Appendix H: Construction Impacts

H-6 Construction Emissions General Conformity Analysis

TAPPAN ZEE HUDSON RIVER CROSSING PROJECT

Construction Emissions
General Conformity Analysis

Prepared for: New York State Department of Transportation
and New York State Thruway Authority

Prepared by: AKRF

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1. Background

The Tappan Zee Hudson River Crossing (TZHRC) project involves the construction of a replacement bridge and ancillary facilities and the removal of the existing Tappan Zee Bridge. A detailed description of the project components and the proposed construction process can be found in the Tappan Zee Hudson River Crossing Draft Environmental Impact Statement (DEIS). This Conformity Analysis applies to emissions associated with the following actions by federal agencies:

1. The U.S. Army Corps of Engineers: Section 404/10 Permit;
2. The U.S. Army Corps of Engineers: Section 103 Joint Ocean Disposal Acceptability Determination; and
3. The U.S. Coast Guard: General Bridge Act of 1946 Permit.

The Clean Air Act, as amended in 1990, defines a non-attainment area as a geographic region that has been designated as not meeting one or more of the National Ambient Air Quality Standards (NAAQS). The project is located in the counties of Rockland and Westchester, which have been designated by the EPA as part of the New York–Northern New Jersey–Long Island, NY–NJ–CT $PM_{2.5}$ non-attainment area and ozone non-attainment area, and are also within an ozone transport region. Both counties are in attainment of the lead, sulfur dioxide (SO_2), carbon monoxide (CO), and annual-average nitrogen dioxide (NO_2) NAAQS. EPA re-designated the New York-N. New Jersey-Long Island, NY-NJ-CT area, which includes Westchester County, as in attainment for CO on April 19, 2002 (67 FR 19337); the Clean Air Act requires that a maintenance plan ensure continued compliance with the CO NAAQS for the former non-attainment area. As is the case for all areas in the U.S., both counties are also designated temporarily as unclassifiable/attainment for the 2010 1-hour average NO_2; this designation will be revisited once additional monitoring data is collected as required by the new standard.

A State Implementation Plan (SIP) is a state's plan on how it will meet the NAAQS under the deadlines established by the Clean Air Act and includes emissions budgets for the applicable pollutants and precursors.

The general conformity requirements in 40 CFR Part 93, Subpart B, apply to those federal actions that are located in a non-attainment area or maintenance area, and that are not subject to transportation conformity requirements at 40 CFR Part 51, Subpart T, or Part 93, Subpart A. Since the project operations are subject to transportation conformity, only emissions associated with construction, which are not addressed via the transportation conformity process, have been reviewed via the general conformity process.

If an applicability analysis determines that the action's direct and indirect emissions have the potential to emit one or more of the six criteria pollutants (or precursors, in the case of ozone and $PM_{2.5}$) at emission rates equal to or exceeding the prescribed emission rates at 40 CFR § 93.153(b), a conformity determination is required. The annual rates applicable to the project are 50 tons of VOCs or 100 tons of NO_x (ozone transport region); 100 tons of CO (maintenance area); and 100 tons of $PM_{2.5}$, SO_2, or NO_x, ($PM_{2.5}$ non-attainment area).

The New York State Department of Transportation (NYSDOT) and the New York State Thruway Authority (NYSTA), as joint lead agencies, have determined that the total annual direct and indirect NO_x and CO emissions are predicted to exceed the prescribed rate of 100 tons per year during construction; accordingly, NYSDOT and NYSTA have concluded that a determination of conformity with the ozone SIP, $PM_{2.5}$ SIP, and CO maintenance plan is required. This report was developed by NYSDOT and NYSTA and will be used by the USCG to support a general conformity determination for the General Bridge Act of 1946 permit. As shown in Table 2 in Appendix B of this report, total direct and indirect emissions associated with the USACE permits for the project are below the general conformity applicability thresholds; thus, the USACE has concluded that a general conformity determination for the USACE permits is not required.

2. Requirements of the Conformity Determination

The purpose of the conformity analysis is to establish that the project would conform to the New York ozone SIP, $PM_{2.5}$ SIP, and CO maintenance plan, thereby demonstrating that total direct and indirect emissions of CO and the ozone precursors, NO_x and VOC, from the project would not:

- cause or contribute to any new violation of any standard in the area;
- interfere with provisions in the applicable SIP for maintenance of any standard;
- increase the frequency or severity of any existing violation of any standard in any area; or
- delay timely attainment of any standard or any required interim emission reductions or other milestones in the SIP for purposes of—
  1. A demonstration of reasonably further progress (RFP);
  2. A demonstration of attainment; or
  3. A maintenance plan.

For the purposes of a general conformity determination, direct and indirect emissions are defined as follows (40 CFR § 93.152):

- *Direct Emissions*: Those emissions of a criteria pollutant or its precursors that are caused or initiated by the federal action and originate in a nonattainment or maintenance area and occur at the same time and place as the action and are reasonably foreseeable;
- *Indirect Emissions*: Those emissions of a criteria pollutant or its precursors:
  1. That are caused or initiated by the federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action;
  2. That are reasonably foreseeable;

3. That the agency can practically control; and
4. For which the agency has continuing program responsibility.

NYSDOT and NYSTA have concluded that the pollutants of concern regarding SIP conformity are CO and the ozone precursors: NO_x and VOCs. These precursors were the basis for the ozone SIP analysis for the ozone non-attainment area, and are therefore used for this general conformity analysis. NYSDOT and NYSTA have determined that the only predicted emissions due to the project would include direct emissions from engines operating on-site during construction, and indirect emissions from construction-related vehicles traveling to and from the site.[1]

3. Determination of Conformity

The air quality analyses conducted for the project are consistent with the requirements of 40 CFR Part 93 Subpart B, ‘‘Determining Conformity of General Federal Actions to State or Federal Implementation Plans (SIP).” A detailed description of the methodology and results of the project emissions inventory analysis and the CO microscale analysis are presented in Appendix B.

The project would be located in an area designated as a CO maintenance area. The direct and indirect emissions during construction of the project were predicted to exceed the prescribed level for CO maintenance areas (100 tons per year of CO).

The project would be located in an area designated as a $PM_{2.5}$ non-attainment area. The direct and indirect emissions during construction of the project were not predicted to exceed the prescribed $PM_{2.5}$ or SO_2 emission rates for $PM_{2.5}$ non-attainment areas (100 tons per year of $PM_{2.5}$ or SO_2, a precursor to $PM_{2.5}$), but were predicted to exceed the prescribed NO_x emission rate for $PM_{2.5}$ non-attainment areas (100 tons per year of NO_x, a precursor to $PM_{2.5}$).

The project would be located in an area designated as a moderate non-attainment area under the 1997 8-hour average ozone NAAQS, a marginal non-attainment area under the 2008 8-hour average ozone NAAQS effective July 20, 2012, and is within an ozone transport region. The direct and indirect emissions during construction of the project were not predicted to exceed the prescribed VOC emission rate for ozone non-attainment areas within an ozone transport region (50 tons per year of VOC), but were predicted to exceed the prescribed NO_x emission rate for ozone non-attainment areas within an ozone transport region (100 tons per year of NO_x).

Therefore, NYSDOT and NYSTA, in consultation with the New York State Department of Environmental Conservation (NYSDEC) (as described in NYSDEC’s written SIP commitment letter, Appendix A), have reviewed the CO, $PM_{2.5}$, NO_x, and VOC emissions modeling and the CO microscale analyses for the project and have determined the following:

- The methods for estimating direct and indirect emissions from the project and the local CO modeling presented in the project’s DEIS (summarized in Appendix B)

[1] The operational phase of the TZHRC will be included in the transportation air quality conformity determination for the New York Metropolitan Transportation Council 2011-2015 TIP and Regional Transportation Plan prior to the completion of the TZHRC FEIS. The TZHRC DEIS demonstrated that the local CO and PM “hot-spot” air quality impacts were fully considered and meet the transportation air quality conformity requirements per 40 CFR Part 93 Subpart A.

meet the requirements of 40 CFR § 93.159. The emissions scenario used in the air quality analysis is expected to produce the greatest off-site impacts on a daily and annual basis. Non-road engine emissions were predicted using the NONROAD model—the latest EPA model for determining emissions from non-road engines. On-road emissions were predicted using the MOBILE6.2 model—an EPA approved model for predicting emissions from on-road vehicles. Resuspension of road dust, as appropriate, was estimated using the latest EPA guidance set forth in "AP-42—Compilation of Emission Factors." Local (microscale) CO dispersion analyses were prepared using EPA's AERMOD models—an EPA preferred model for dispersion analysis. All of the above modeling procedures were conducted based on the latest EPA guidance and in a manner consistent with the procedures used by the New York State Department of Environmental Conservation in preparation of the SIPs.[2]

- NYSDEC has determined that an area-wide modeling analysis of CO concentrations is not required, as per 40 CFR Part 93.158(a)(4)(i).
- The project was predicted to result in the following NO_x emissions in the New York State portion of the non-attainment areas (total tons per year):

Year:[3]	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Dredging and Armoring:	69.6	44.9	0.0	40.2	40.2	0.0
Bridge:	4.4	4.5	4.6	3.6	1.6	1.0
Plaza, landings, approaches:	383.0	377.2	390.1	334.6	241.3	173.1
Total:	*457.0*	*426.6*	*394.8*	*378.4*	*283.1*	*174.1*

Note that the emissions presented in the table above are lower than those disclosed in NYSDEC's written SIP commitment (Appendix A). The analysis was refined to include a 68 percent engine load factor for tug boats based on Port Authority of New York and New Jersey emissions inventory data from 2008; this inventory was developed in a manner consistent with EPA's methodologies and is the accepted inventory for marine emissions in the New York region. The preliminary analysis presented to NYSDEC conservatively modeled tug boats operating at full load (100 percent). In addition, as discussed further in Appendix B, project changes may potentially result in slightly lower total emissions than presented here.

- Pursuant to 40 CFR § 93.158(a)(5)(i)(B), NYSDEC has documented in a written commitment to EPA—

[2] New York is in the process of transitioning to the use of the new Motor Vehicle Emission Simulator (MOVES) model for SIP analyses. USEPA defined a grace period ending March 2, 2013 for transitioning from MOBILE model to the MOVES model, which is applicable to general conformity (EPA, "Policy Guidance on the Use of MOVES2010 and Subsequent Minor Revisions for State Implementation Plan Development, Transportation Conformity, and Other Purposes", EPA-420-B-12-010, April 2012.)

[3] The exact start date of construction is unknown at this time. The first year of construction is assumed to be 2013. Since the most intense emissions would occur in the first year, should the construction-year not coincide with the calendar-year, the maximum calendar-year emissions would be lower.

1. A specific schedule for adoption and submittal of a revision to the ozone and $PM_{2.5}$ SIP which would achieve the needed emission reductions prior to the time emissions from the project would occur;
2. Identification of specific measures for incorporation into the SIPs which would result in a level of emissions which, together with all other emissions in the non-attainment or maintenance area, would not exceed any emissions budget specified in the applicable SIPs;
3. A demonstration that all existing applicable SIP requirements are being implemented in the area for NO_x, and that local authority to implement additional requirements has been fully pursued;
4. A determination that NYSDOT and NYSTA have required all reasonable mitigation measures associated with their action; and
5. Written documentation including all air quality analyses supporting the conformity determination;

- The project does not cause or contribute to any new violation, or increase the frequency or severity of any existing violation, of the standards for the pollutants addressed in 40 CFR § 93.158.
- The project does not violate any requirements or milestones in the ozone or $PM_{2.5}$ SIPs or the CO maintenance plan.

Based on these determinations, the project would conform to the applicable SIPs for the project area. The activities that would conform include construction–related activities of the project.

Appendix A

New York State
Department of Environmental
Conservation Written SIP Commitment

ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

MAY 2 4 2012

Ms. Judith Enck
Regional Administrator
United States Environmental
Protection Agency - Region 2
290 Broadway, 26th Floor
New York, New York 10007-1866

Dear Ms. Enck:

The Department of Environmental Conservation (DEC) has been actively participating in the review of the Draft Environmental Impact Statement (DEIS) for the Tappan Zee Hudson River Crossing (TZHRC) project. As part of that process, DEC is in agreement with the United States Army Corps of Engineers (USACE) and the United States Coast Guard (USCG) determination that general conformity applies to the emissions associated with the TZHRC construction. These emissions include those associated with bridge construction, demolition of the existing bridge, dredging activities and transport of dredged materials to the Historic Area Remediation Site (HARS). In addition to the inclusion of these emissions in the Final Environmental Impact Statement (FEIS) by the project sponsors, please let this serve as DEC's commitment to adopt and submit the necessary state implementation plan (SIP) revisions to include construction emissions from the TZHRC project.

In particular, the FEIS for the TZHRC will demonstrate that the emissions of carbon monoxide (CO) and oxides of nitrogen (NO_X) exceed the *de minimis* thresholds in 40 CFR Part 93.153(b)(1). Specifically, peak construction emissions are estimated to be 106.5 tons per year of CO in the New York State portion of the New York-New Jersey-Connecticut CO maintenance area and 560.5 tons per year of NO_X in the New York State portion of the New York-New Jersey-Connecticut ozone and $PM_{2.5}$ nonattainment areas.

For CO, DEC has reviewed the hot-spot analysis in the DEIS and agrees that the FEIS will include a demonstration that emissions from construction and operation of the TZHRC will not cause or contribute to any new CO violations, increase the frequency or severity of any existing CO violations, or delay timely attainment of the CO standard or any required CO emissions milestones in the SIP. DEC believes that the analysis to support this conclusion meets all applicable United States Environmental Protection Agency (USEPA) modeling criteria and the general conformity criteria for CO emissions in 40 CFR Parts 93.158(a)(4)(i), 93.158(b), and 93.159.

To address the general conformity NO_X *de minimis* exceedance, DEC is committing, per 40 CFR Part 93.158(a)(5)(i)(B), to include the 560.5 tons per year of NO_X in the $PM_{2.5}$ maintenance plan currently under development for submission to EPA by the fall of 2012. DEC will include an analysis demonstrating that all SIP requirements and milestones will continue to be met with the inclusion of the NO_X emissions from the TZHRC. This submission will include the identification of specific measures that have been incorporated into the plan as well as a demonstration that all existing applicable SIP requirements are being implemented in the area for the pollutants affected by the Federal action. In addition, DEC has determined, based on a review of the DEIS, that the responsible Federal agencies are requiring all reasonable mitigation measures associated with their actions (Clean Fuels, Best Available Tailpipe Reduction Technologies, Utilization of Newer Equipment, Tug Boat Emissions Reduction, Concrete Batch Plant Controls, and Idling Restrictions as described in Chapter 18 of the DEIS) and that they have included a detailed air quality analysis supporting their conformity determination. In addition, DEC is committing to submit a SIP revision for ozone within 18 months that will document the Department's plan to include NO_X emissions from TZHRC construction in the ozone SIP.

Please call me at (518) 402-8540 if you have any questions.

Sincerely,

Joseph J. Martens

cc: M. Toni, FHWA-NY
J. Burns, FHWA
J. Rich, FHWA-NY
L. Knutsen, USEPA
M. Zeman, USEPA
M. Laurita, USEPA
R. Tomer, USACE
G. Kassof, USCG
D. Hitt, NYSDOT
P. Lentlie, NYSDOT
M. Anderson, NYSDOT
E. Novak, NYSTA

Appendix B

Project Construction Activity
Emissions Inventory
and
Microscale CO Analysis

1. Introduction

This Appendix summarizes the air quality analyses prepared for the Tappan Zee Hudson River Crossing relevant to this general conformity determination. The analysis represents the reasonable worst-case scenario of the two construction options identified, i.e. the Short Span Option and Long Span Option. The Short Span Option would result in higher emissions.

As noted in the main body of this report, the emissions estimates presented here are lower than those stated in NYSDEC's written SIP commitment (Appendix A). This difference occurred because the preliminary draft analysis provided to NYSDEC to initiate the SIP revision process conservatively modeled tug boats to be operating at full load (100 percent). The analysis presented in this report was refined to include a tug boat engine load factor of 68 percent based on the Port Authority of New York and New Jersey's emissions inventory data.[1] The 68 percent load factor is also consistent with load factors assumed in the construction CO and PM microscale analyses presented in the DEIS and anticipated to be presented in the FEIS.

In addition, subsequent to preparation of this analysis, the design of the Rockland County landing was modified to reduce the profile of the highway between South Broadway and the bridge abutment at River Road. As a result, the project will no longer include the reconstruction of the South Broadway Bridge. The lower profile applies to both the Short and Long Span Options. The modified Rockland County landing will be formally incorporated into the Replacement Bridge Alternative in the Final Environmental Impact Statement (FEIS). The associated change in construction air pollutant emissions will be relatively minor, and would reduce emissions as compared to the existing analysis presented below.

For a detailed description of the construction, the regulatory context, and other analyses, see "Draft Environmental Impact Statement for Tappan Zee Hudson River Crossing Project", FHWA, 2012.

2. Emission Reduction Measures

Per the DEIS, the construction contracts will require the following Environmental Performance Commitments to reduce PM and NO_x emissions:

- *Clean Fuel.* All diesel fuel used for the project will contain 15 parts per million (ppm) or less sulfur by weight. This includes on-road, nonroad, and tug boats operating on-site.
- *Best Available Tailpipe Reduction Technologies.* All land-based nonroad diesel engines with a power rating of 50 horsepower (hp) or greater and controlled truck fleets (i.e., truck fleets under long-term contract) including but not limited to concrete mixing and pumping trucks, would utilize the best available tailpipe (BAT) technology for reducing diesel PM emissions. Diesel particle filters (DPFs) have been identified as being the tailpipe technology currently proven to have the highest PM reduction capability. Construction contracts would specify that all diesel land-

[1] PANYNJ, 2008 Multi-Facility Emissions Inventory, pp 140, December 2010. This inventory was developed in a manner consistent with EPA's methodologies and is the accepted inventory for marine emissions in the New York region.

based nonroad engines rated at 50 hp or greater would utilize DPFs, either installed on the engine by the original equipment manufacturer (OEM) or retrofit with a DPF verified by the United States Environmental Protection Agency (USEPA) or the California Air Resources Board, and may include active DPFs,[2] if necessary; or other technology proven to reduce diesel PM by at least 90 percent.

- *Utilization of Newer Equipment.* All nonroad construction equipment (excluding tug boat engines) rated at 50 hp or greater would meet at least the Tier 3 emissions standard; all nonroad construction equipment rated at less than 50 hp would meet at least the Tier 2 emissions standard.
- *Tug Boat Emissions Reduction.* The total combined PM emission rate from all tug boats used for the project will be limited to 3,700 grams per hour at peak power, including auxiliary engine emissions.[3] This limit may be achieved by installing retrofits, using new engines, repowering or engine replacement, or various combinations of these measures, along with limitations on the engine size and number of tug boats on site.[4]
- *Concrete Batch Plant Controls.* The concrete batch plant would vent the cement weigh hopper, gathering hopper, and mixing loading operations to a baghouse or filter sock. Storage silo chutes would be vented to a baghouse. Baghouses should have a PM control efficiency of at least 99.9 percent. Roadways and all unloading and loading material handling operations at the concrete batch plant would have a dust control plan providing at least a 50 percent reduction in PM_{10} and $PM_{2.5}$ emissions from fugitive dust through wet suppression.
- *Idling Restrictions.* All efforts will be made to address heavy duty vehicle idling at the project site in order to reduce fuel usage (and associated costs) and emissions. On-road diesel fueled trucks are subject to New York's heavy duty vehicle idling prohibition. These vehicles may not idle for more than five consecutive minutes except under certain specific conditions as described in Subpart 217-3. In addition to enforcing the on-road idling prohibition, all reasonable efforts will be made to reduce non-productive idling of nonroad diesel powered equipment.

3. Methodology

On-Site Construction Activity Assessment

The construction schedule is presented in **Figure 1**, presenting an overview of the construction phasing. The construction periods with activities closest to sensitive receptors (i.e., residences, institutional buildings, and open spaces) and with the most

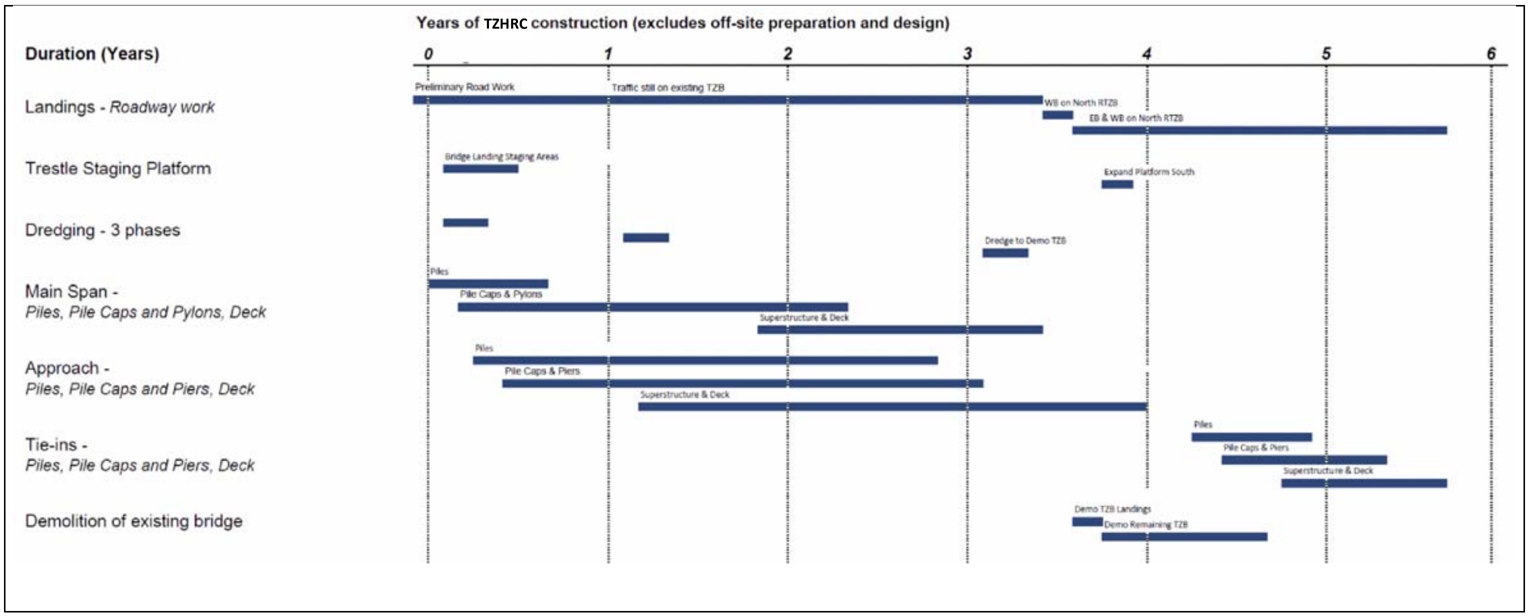
[2] There are two types of DPFs currently in use: passive and active. Most DPFs currently in use are the "passive" type, which means that the heat from the exhaust is used to regenerate (burn off) the PM to eliminate the buildup of PM in the filter. Some engines do not maintain temperatures high enough for passive regeneration. In such cases, "active" DPFs can be used (i.e., DPFs that are heated either by an electrical connection from the engine, by plugging in during periods of inactivity, or by removal of the filter for external regeneration).

[3] This level of emissions would occur with available retrofit technology and the number and size of tug boats currently estimated to be necessary to perform the construction work. Subsequently, later in this section, this level of emissions was found to achieve the air quality goals of the project.

[4] For example, the analysis in this section assumed eight 1,500 hp tug boats with EPA Tier 2 rating each with an 80 kw auxiliary engine, with all engines retrofit with a diesel oxidation catalyst.

Figure 1

Short-Span Global Schedule



intense activities and highest emissions were selected as the worst-case periods for microscale analysis. Construction-related emissions were estimated for all subtasks of construction, based on the construction schedule and engine emissions factors described below.

Detailed analyses were performed for the following construction periods:

- *Rockland Landing—Reconstruction of the South Broadway Bridge*: The Rockland landing is defined as the portion of the corridor that extends from the abutment of the bridge to just west of the South Broadway Bridge. During this period of construction, the South Broadway Bridge would be replaced and heavy diesel equipment such as cranes, excavators and loaders would be used. The peak construction activities during this period would occur near sensitive residential receptors and would last for several months. Due to project design modifications, the reconstruction of the South Broadway Bridge is no longer included in the project. However, the mesoscale emissions estimates presented in this report reflect the project as initially proposed which included the reconstruction of the South Broadway Bridge. Therefore, the emissions estimates presented in this report are conservative.
- *Rockland Landing—Approach Roadway Construction*: The side slopes south of existing Interstate 87/287 from South Broadway to the river would be removed, the retaining walls would be constructed and temporary pavement would be placed. Heavy diesel equipment such as cranes, excavators and loaders would be used. The peak construction activities during this period would occur near sensitive residential receptors and would last for several months. Due to project design modifications, the construction work in this area may be less intense or of shorter duration due to the lower roadway elevation. However, the mesoscale emissions estimates presented in this report reflect the project as initially proposed. Therefore, the emissions estimates presented in this report are conservative.
- *Rockland Inland Staging Area*: A staging area would be required for a concrete batch plant and miscellaneous construction vehicle storage. The precise location of this area is unknown at this time, and therefore this analysis was performed for a generic plant meeting the needs of the project. The concrete batch plant would be a source of particulate matter emissions. Fugitive sources associated with a concrete batch plant include the transfer of sand and aggregate, truck loading, mixer loading, vehicle traffic, and wind erosion from sand and aggregate storage piles. Estimates of air emissions from these activities were derived based on EPA procedures delineated in AP-42 Section 11.12.
- *Bridge Construction—Rockland Approach and Main Span*: There would be 3 principal in-river work areas, including the main span, Rockland approach, and Westchester approach. Tug boats and barges would be used during in-river construction activities. The substructure construction at each area would include dredging, cofferdam construction, assembly work, pile driving, construction of the pile cap, construction of the columns and deck erection. Pile driving was identified as the substructure construction activity with the highest air quality emissions due to the high amount of heavy equipment employed during this task, including pile drivers and large generators. The period when pile driving would occur at spans that are closest to the Rockland shoreline and therefore closest to sensitive receptors

was selected for analysis. Pile driving at spans near the shoreline would last for approximately two months for the north structures and another two months for the south structures at a later period. Similar pile driving work would occur at spans further away from the shoreline at an earlier time. Construction activities at the Main Span that would overlap with the Rockland Approach during this peak period were also included in the analysis, as well as roadway and earthworks at the Rockland Landing.

- *Westchester Landing*: This period of construction would include the relocation of the NYSTA Tappan Zee Bridge Maintenance Facility and New York State Police (NYSP) facilities directly north of the Interstate 87/287 near the Toll Plaza. In addition, a temporary bridge would be constructed to connect the temporary access road west of the railroad tracks and the existing bridge area east of the railroad tracks. Heavy diesel equipment such as cranes, excavators and loaders would be used. The peak construction activities during this period would occur near sensitive residential receptors and would last for several months.
- *Bridge Construction—Westchester Approach and Main Span*: Tug boats and barges would be used during in-river construction activities for the Westchester Approach. Pile driving was identified as the substructure construction activity with the highest air quality emissions due to the high amount of heavy equipment employed during this task, including pile drivers and large generators. The period when pile driving would occur at spans that are closest to the Westchester shoreline and therefore closest to sensitive receptors was selected for analysis. Pile driving at spans near the shoreline would last for approximately two months for the north structures and another two months for the south structures at a later period. Similar pile driving work would occur at spans further away from the shoreline at an earlier time. Construction activities at the main span that would overlap with the Westchester approach during this peak period were also included in the analysis, as well as roadway and earthworks at the Westchester landing.

Engine Exhaust Emissions

The projected usage factors, sizes, types, and number of construction equipment were estimated based on detailed construction activities. Emission factors for NO_x, CO, and $PM_{2.5}$ from on-site construction engines were developed using the EPA's NONROAD2008 Emission Model (NONROAD). Since emission factors for truck-mounted concrete pumps are not available from either the EPA MOBILE6.2 emission model or NONROAD, emission factors specifically developed for this type of application were used.[5] With respect to trucks, emission rates for VOC, NO_X, CO, and $PM_{2.5}$ for truck engines were developed using MOBILE6.2. A maximum of 5-minute idle time was employed for the heavy trucks. For analysis purposes, it was assumed that each concrete truck would operate on-site for 45 minutes per delivery. Tugboat emissions were estimated according to the latest emission factors and methodologies delineated

[5] Concrete pumps are usually truck mounted and use the truck engine to power pumps at high load. This application of truck engines is not addressed by the MOBILE6 model, and since it is not a nonroad engine, it is not included in the NONROAD model. Emission factors were obtained from a study which developed factors specifically for this type of activity. Source: *FEIS for the Proposed Manhattanville in West Harlem Rezoning and Academic Mixed-Use Development*, CPC–NYCDCP, November 16, 2007.

by US. Environmental Protection Agency (EPA) as applied in the PANYNJ emissions inventory.[6]

Engine size, quantity, usage, and emission factors data are presented in Attachment 1.

Fugitive Emission Sources

Particulate matter emissions would be generated by material handling activities (i.e., loading/drop operations for fill materials and excavate), truck transports, and concrete batching at the Inland Staging Area. Estimates of air emissions from these activities were developed based on EPA procedures delineated in AP-42 Table 13.2.3-1.

Dispersion Modeling

Projected pollutant concentration increments resulting from the construction of the project were predicted using the EPA/AMS AERMOD dispersion model.[7] AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources.

For the short-term model scenarios, all stationary sources that idle in a single location while unloading, were simulated as point sources. Other engines, which would move around the site on any given day, were simulated as area sources. In the annual analyses, all sources would move around the site throughout the year and were therefore simulated as area sources.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at LaGuardia Airport (2006–2010) and concurrent upper air data collected at Brookhaven, New York.

Receptor Locations

Thousands of receptors (locations in the model where concentrations are predicted) were placed along the sidewalks closest to the construction sites that would be publicly accessible, at residential and other sensitive uses at both ground-level and elevated locations (e.g., residential windows), and at open spaces. In addition, a ground-level receptor grid of approximately two thousand receptors was also included in the dispersion modeling to assist in the analysis of potential impacts.

Microscale Mobile Source Assessment

Traffic flow on Interstate 87/287 would be maintained throughout the construction period while roadway work is performed. During those times, traffic would be diverted to temporary roadway segments and remain in the temporary location for an extended period before being shifted again. A shift in the roadway would reduce the distance between the heavily traveled Interstate 87/287 and residences located near the temporary segment, potentially increasing pollutant concentrations at those locations. In

6 PANYNJ, 2008 Multi-Facility Emissions Inventory, pp 140, December 2010.

7 EPA, AERMOD: Description Of Model Formulation, 454/R-03-004, September 2004; and EPA, User's Guide for the AMS/EPA Regulatory Model AERMOD, 454/B-03-001, September 2004 and Addendum December 2006.

addition, construction vehicles would be added to the projected traffic volumes in some locations. Microscale analyses were performed for both the Rockland and the Westchester sides to assess the effect of these temporary roadway shifts on air quality. Since the project does not exceed the prescribed emission thresholds for $PM_{2.5}$, the $PM_{2.5}$ microscale analyses presented in the DEIS were not required for the purposes of general conformity and are not included in this general conformity report.

Vehicle Emissions

Vehicular exhaust emission factors, which were computed by NYSDOT using the USEPA Mobile Source Emissions Model, MOBILE6.2,[8] and presented in NYSDOT's *The Environmental Manual (TEM)*,[9] were used for the CO microscale analyses. The database includes emission factors by county, vehicle class, roadway functional class, and speed. MOBILE6.2 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.

Dispersion Model for Microscale Analyses

Maximum CO concentrations resulting from vehicle emissions at the bridge landing site in Rockland County were predicted using USEPA's CAL3QHC model version 2.0.[10] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC is used to conservatively predict the dispersion from idling and moving vehicles based on peak traffic and meteorological conditions.

A different modeling approach was used to analyze impacts around the bridge landing area in Westchester County, including the bridge's toll plaza. The toll plaza operates as a series of many line sources including queues, and is, therefore, better represented as an area source. Area sources are better simulated by the USEPA-approved model AERMOD. AERMOD is a steady-state plume dispersion model and simulates dispersion from multiple point, area, or volume sources. Dispersion characteristics may be selected to model rural or urban conditions, and terrain effects can be modeled to reflect simple or complex terrain. The model employs hourly sequential preprocessed meteorological data to estimate concentrations for selected averaging times from one hour to one year.

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 direction in which pollutants are

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8 EPA, User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, EPA420-R-03-010, August 2003.

9 NYSDOT, The Environmental Manual, January 2001.

10 USEPA, User's guide to CAL3QHC—A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, September 1995.

dispersed from a given source, and wind speed and atmospheric stability affect the extent of mixing in the atmosphere.

Following the *TEM* and USEPA guidelines,[11] CAL3QHC computations were performed using a wind speed of 1 meter per second, and the neutral stability class, D (for urban environments). The wind angle was varied to determine the maximum concentrations at each receptor under all wind conditions, regardless of frequency of occurrence. 8-hour average CO concentrations were estimated by multiplying the predicted 1-hour average CO concentrations by a factor of 0.70 to account for persistence of meteorological conditions. A surface roughness of 1.08 meters was chosen. These assumptions ensured that worst-case meteorology was used to estimate impacts.

The latest available five years of hourly meteorological data were employed in the AERMOD model: surface data collected at LaGuardia Airport and concurrent upper air data collected at Brookhaven, Suffolk County, New York from 2005 through 2009. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

Traffic Data

Traffic data for the air quality analysis were modeled based on existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the project (see Chapter 4 of the DEIS, “Transportation”). Traffic data for the construction period with and without the project were employed in the respective air quality modeling scenarios. Peak hour periods were used for microscale CO analysis around the bridge landing site in Rockland County (using CAL3QHC), producing the maximum anticipated project-generated traffic and the greatest potential for air pollutant emissions. This assumption results in conservatively high concentrations since the peak hour traffic is used for all hours. The modeling of bridge traffic at the landing area in Westchester County (using AERMOD) applied hourly traffic distribution.

Background Concentrations

Background concentrations are pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions within 1,000 feet and in the line of sight of the analysis site. Background concentrations are added to modeling results to obtain total pollutant concentrations at an analysis site.

Background concentrations were assumed to be the same as those monitored in the existing condition.

Receptor Locations

Concentrations were modeled at multiple receptors at both analysis sites. The receptors were placed at spaced intervals along sidewalk or roadside locations with continuous public access, and at residential locations. The receptors placed on sidewalks were located at least 3 meters from each of the traveled roadways. Concentrations were

[11] USEPA, Guidelines for Modeling Carbon Monoxide from Roadway Intersections, USEPA Office of Air Quality Planning and Standards, EPA-454/R-92-005, 1992.

calculated at receptors placed at 25-meter intervals along the sidewalk. Ground-level receptors were placed at a height of 1.8 meters, and elevated residential windows were included as well.

Combined Microscale Impact

Since emissions from on-site construction equipment and mobile sources may contribute to concentration increments concurrently, the combined effect was assessed. Total concentrations were estimated by combining the results from the on-site construction analysis with the construction-related mobile source increments at the same location. The combined total is a conservatively high estimate of potential impacts, since it is likely that the highest results from different sources would occur under different meteorological conditions (e.g., different wind direction and speed), and would not necessarily occur when the highest background concentrations are present.

Area-Wide (Mesoscale) Emissions

Total emissions within the non-attainment areas were summed based on the emissions analyses methods described above for on-site and on-road emissions. In addition to the on-site emissions, the mesoscale emissions include all on-road emissions and tug boat emissions associated with marine transport of materials within the non-attainment areas.

4. Results

Local (Microscale) Construction Activity Assessment

Total maximum combined concentration increments were estimated by combining the results from the on-site construction analysis with the construction-related mobile source increments from the mobile source receptor closest to the location of the on-site increment. The overall combined CO concentrations, including background concentrations, are presented in **Table 1** below, and do not exceed the NAAQS.

Table 1
Maximum Total Combined CO Concentrations (ppm)

Period	Westchester	Rockland	NAAQS
1-hour Average	14.5	10.7	35
8-hour Average	7.5	6.1	9

Area-Wide (Mesoscale) Emissions

Annual construction activity and transport emissions associated with the dredging activity and armoring are presented in **Table 2**. Dredging, armoring, and transport of dredged material are under the jurisdiction of the USACE Section 404/10 and Section 103 Permits.

Annual construction activity and on-road emissions associated with bridge construction only (abutment to abutment) are presented in **Table 3**, including temporary and permanent platform construction, bridge construction, and demolition of the existing bridge. This activity is under the jurisdiction of the USCG General Bridge Act of 1946 Permit.

Annual construction activity and on-road emissions associated with all aspects of project construction included in the NYSDEC SIP revision commitment letter in Appendix A are presented in **Table 4**. More detailed results by year are presented in Attachment 2.

Table 2
Emissions from Dredging and Armoring Only (ton/yr)

	$PM_{2.5}$	NO_x	VOC	CO	SO_2
Year 1	2.1	69.6	2.8	3.8	0.05
Year 2	1.3	44.9	1.8	2.4	0.03
Year 3	0.0	0.0	0.0	0.0	0.00
Year 4	1.2	40.2	1.6	2.1	0.02
Year 5	1.2	40.2	1.6	2.1	0.02
Year 6*	none	none	none	none	none

Note: * The last year of construction includes only 8 months of activity, and no dredging activity.
Includes all transportation associated with this activity, including transport to the Historic Area Remediation Site.

Table 3
Emissions from Bridge Construction and Demolition Only Abutment to Abutment (ton/yr)

	$PM_{2.5}$	NO_x	VOC	CO	SO_2
Year 1	10.1	383.0	21.4	96.1	0.44
Year 2	10.1	377.2	20.6	56.9	0.41
Year 3	10.9	390.1	19.1	41.7	0.37
Year 4	9.7	334.6	14.5	27.7	0.28
Year 5	6.9	241.3	11.7	30.8	0.25
Year 6*	5.1	173.1	7.5	13.5	0.16

Note: * The last year of construction includes only 8 months of activity, and no dredging activity.
Includes all transportation associated with this activity.

Table 4
Total Emissions from All Construction Activities (ton/yr)

	$PM_{2.5}$	NO_x	VOC	CO	SO_2
Year 1	12.2	457.0	24.6	101.7	0.5
Year 2	11.5	426.6	22.8	62.0	0.4
Year 3	10.9	394.8	19.7	45.3	0.4
Year 4	11.0	378.4	16.5	31.9	0.3
Year 5	8.1	283.1	13.5	33.4	0.3
Year 6*	5.1	174.1	7.7	14.1	0.2

Notes: * The last year of construction includes only 8 months of activity.
Total emissions include emissions listed above in Tables 2 and 3, as well as approaches, landings, toll plaza, and other items. Includes all transportation associated with this activity.

Attachment 1: Engine and Emissions Data

Rockland Landing-Reconstruction of the South Broadway Bridge
Nonroad Emissions

Equipment	Engine Size (hp)	Quantity	Shifts / Day	Hours / Shift	BAT: Pollutant Load after Control (%)		Peak Trucks per Day	Average Trucks per Day	$PM_{2.5}$ Emission Factor (g/hp-hr)	PM_{10} Emission Factor (g/hp-hr)	NOx Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)
Compressors - surface tools	275	2	1	8	10%				0.043	0.045	1.107	0.263
Concrete pump - general	250	2	1	8	10%				0.042	0.042	1.546	0.552
Crane - all-terrain (80t)	175	1	1	8	10%				0.079	0.081	1.237	0.351
Crane - crawler (100t)	603	1	1	8	10%				0.044	0.045	1.174	0.479
Excavator - long reach, tracked	203	1	1	8	10%				0.096	0.099	1.434	0.540
Excavator - mini-excavator	84	2	1	8	10%				0.233	0.240	1.980	1.974
Front-end loader - wheeled, large	349	1	1	8	10%				0.051	0.053	0.640	0.328
Front-end loader - wheeled, mid	197	1	1	8	10%				0.051	0.053	0.640	0.328
Generator - large	426	1	1	8	10%				0.040	0.041	1.250	0.300
Generator - mid	110	1	1	8	10%				0.068	0.071	1.251	0.340
Pump - general, water	8	1	1	8	100%				0.075	0.081	1.731	211.073
Telescopic boom - self-propelled	75	1	1	8	10%				0.062	0.064	0.818	0.807
Telescopic forklift handler	101	1	1	8	10%				0.169	0.175	1.451	0.703
Paver	224	1	1	8	10%				0.095	0.098	1.527	0.556
Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211	2.612	1.523
Truck - concrete	405	2	1	8	10%		2	1	0.003	0.003	0.062	0.053
Truck - delivery & haul-away	310	1	1	8	100%		1	1	0.003	0.003	0.081	0.069
Truck - muck-away	300	4	1	8	100%		4	2	0.003	0.004	0.084	0.072

Rockland Landing-Approach Roadway Construction

Nonroad Emissions

Equipment	Engine Size (hp)	Quantity	Shifts / Day	Hours / Shift	BAT: Pollutant Load after Control (%)		Peak Trucks per Day	Average Trucks per Day	$PM_{2.5}$ Emission Factor (g/hp-hr)	PM_{10} Emission Factor (g/hp-hr)	NOx Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)
Compressors - surface tools	275	2	1	8	10%				0.043	0.045	1.107	0.263
Concrete pump - general	250	2	1	8	10%				0.042	0.042	1.546	0.552
Crane - all-terrain (80t)	175	1	1	8	10%				0.079	0.081	1.237	0.351
Crane - crawler (100t)	603	1	1	8	10%				0.044	0.045	1.174	0.479
Excavator - long reach, tracked	203	1	1	8	10%				0.096	0.099	1.434	0.540
Excavator - mini-excavator	84	2	1	8	10%				0.233	0.240	1.980	1.974
Front-end loader - wheeled, large	349	1	1	8	10%				0.051	0.053	0.640	0.328
Front-end loader - wheeled, mid	197	1	1	8	10%				0.051	0.053	0.640	0.328
Generator - large	426	1	1	8	10%				0.040	0.041	1.250	0.300
Generator - mid	110	1	1	8	10%				0.068	0.071	1.251	0.340
Pump - general, water	8	1	1	8	100%				0.075	0.081	1.731	211.073
Telescopic boom - self-propelled	75	1	1	8	10%				0.062	0.064	0.818	0.807
Telescopic forklift handler	101	1	1	8	10%				0.169	0.175	1.451	0.703
Paver	224	1	1	8	10%				0.095	0.098	1.527	0.556
Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211	2.612	1.523
Truck - concrete	405	2	1	8	10%		2	1	0.003	0.003	0.062	0.053
Truck - delivery & haul-away	310	1	1	8	100%		1	1	0.003	0.003	0.081	0.069
Truck - muck-away	300	4	1	8	100%		4	2	0.003	0.004	0.084	0.072

Tappan Zee Hudson River Crossing Project

Rockland Inland Staging Area- Concrete Batching Plant

Emission Rates	PM_{10} Short-Term Emissions (g/s)	$PM_{2.5}$ Short-Term Emissions (g/s)	$PM_{2.5}$ Annual Emissions (g/s)	CO Emissions (g/s)	NOx Emissions (g/s)
Unloading to Elevated Storage Silo (C&CS)	2.20E-03	3.96E-04	1.59E-04	--	--
Mixer Loading into Concrete Trucks	1.30E-02	2.34E-03	9.38E-04	--	--
Weigh Hopper Loading	3.87E-05	5.87E-06	2.35E-06	--	--
Delivery to Ground Storage (S&A)	1.59E-02	2.41E-03	9.63E-04	--	--
Transfer to Conveyor (S&A)	1.59E-02	2.41E-03	9.63E-04	--	--
Transfer to Elevated Storage (S&A)	3.18E-05	4.81E-06	1.93E-06	--	--
Storage Piles	7.42E-03	1.04E-03	4.16E-04	--	--
Equipment (Engine Emissions + Road Dust)	6.27E-04	3.57E-04	1.38E-04	7.95E-06	1.30E-05
Crawler Crane	1.89E-04	1.83E-04	9.15E-05	1.43E-02	4.47E-03

Bridge Construction- Rockland Approach and Main Span
Nonroad Emissions

Equipment	Engine Size (hp)	Quantity	Shifts / Day	Hours / Shift	BAT: Pollutant Load after Control (%)		Peak Trucks per Day	Average Trucks per Day	$PM_{2.5}$ Emission Factor (g/hp-hr)	PM_{10} Emission Factor (g/hp-hr)	NOx Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)
Eastbound approach near River road												
Paver	224	1	1	8	10%				0.095	0.098	1.527	0.556
Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211	2.612	1.523
Truck - delivery & haul-away	310	1	1	8	100%		1	1	0.003	0.003		0.069
Truck - muck-away	300	4	1	8	100%		4	2	0.003	0.004		0.072
Bridge work												
Sheetpile vibratory hammer	300	2	1	8	10%				0.045	0.047	1.105	0.266
Barge mounted 500 Ton Ringer Crane	450	1	1	8	10%				0.046	0.047	1.247	0.309
Barge mounted 200 Ton Crane	340	2	1	8	10%				0.046	0.047	1.247	0.309
Barge mounted 100 Ton Crane	230	4	1	8	10%				0.045	0.047	1.105	0.266
Pile vibratory hammer	300	1	1	8	10%				0.045	0.047	1.105	0.266
Pile driving hammer – 500 kJ	1000	1	1	8	10%				0.048	0.050	1.513	0.335
Pile driving hammer – 800 kJ	1500	1	1	8	10%				0.048	0.050	1.513	0.335
Welding huts (supporting up to 10 welders)	35											
Rock Socket Drilling Rig	209	4	1	8	10%				0.040	0.041	1.122	0.261
Tugboats (1500 HP)- Main Engine	1500	8	1	8	60%				0.492	0.537	9.843	0.820
Tugboats Auxiliary Engine	107	8	1	8	60%				0.276	0.298	7.457	1.268
Flat deck barges (materials transport)												
Concrete delivery barges												
Concrete pumping barges												
Pile delivery barges												
Segment delivery barges												
Truss delivery barges												
Deck segment erection gantry	194	2	1	8	10%				0.045	0.047	1.105	0.266
Truss Lifting winches												
Jacking T-Cranes (pylons)	194	8	1	8	10%				0.045	0.047	1.105	0.266
Compressors - surface tools	275	20	1	8	10%				0.043	0.045	1.107	0.263
Concrete pump - general	250	3	1	8	10%				0.042	0.092	1.546	0.552
Excavator - long reach, tracked	203	1	1	8	10%				0.096	0.099	1.434	0.540
Freeze pipe rotary drilling rig	200	1	1	8	10%				0.040	0.041	1.122	0.261
Freezing plant (construction)	550											
Generator - large	426	8	1	8	10%				0.040	0.041	1.250	0.300
Generator - mid	110	15	1	8	10%				0.068	0.071	1.251	0.340
Pump - general, water	8	20	1	8	100%				0.075	0.081	1.731	211.073
Telescopic boom - self-propelled	75	8	1	8	10%				0.062	0.064	0.818	0.807
Telescopic forklift handler	101	8	1	8	10%				0.169	0.175	1.451	0.703
Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211	2.612	1.523
Truck - concrete	405	60	1	8	10%		60	30	0.003	0.003	0.062	0.053
Truck - delivery & haul-away	310	20	1	8	100%		20	10	0.003	0.003	0.081	0.069
Truck - muck-away	300	20	1	8	100%		20	10	0.003	0.004	0.084	0.072

Westchester Landing
Nonroad Emissions

Equipment	Engine Size (hp)	Quantity	Shifts / Day	Hours / Shift	BAT: Pollutant Load after Control (%)		Peak Trucks per Day	Average Trucks per Day	$PM_{2.5}$ Emission Factor (g/hp-hr)	PM_{10} Emission Factor (g/hp-hr)	NOx Emission Factor (g/hp-hr)	CO Emission Factor (g/hp-hr)
Compressors - surface tools	275	2	1	8	10%				0.043	0.045	1.107	0.263
Concrete pump - general	250	2	1	8	10%				0.042	0.042	1.546	0.552
Crane - all-terrain (80t)	175	1	1	8	10%				0.079	0.081	1.237	0.351
Crane - crawler (100t)	603	1	1	8	10%				0.044	0.045	1.174	0.479
Excavator - long reach, tracked	203	1	1	8	10%				0.096	0.099	1.434	0.540
Excavator - mini-excavator	84	2	1	8	10%				0.233	0.240	1.980	1.974
Front-end loader - wheeled, large	349	1	1	8	10%				0.051	0.053	0.640	0.328
Front-end loader - wheeled, mid	197	1	1	8	10%				0.051	0.053	0.640	0.328
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Truck - delivery & haul-away	310	1	1	8	100%		1	1	0.003	0.003	0.081	0.069
Truck - muck-away	300	4	1	8	100%		4	2	0.003	0.004	0.084	0.072

Bridge Construction - Westchester Approach and Main Span
Nonroad Emissions

Equipment	Engine Size (hp)	Quantity	Shifts / Day	Hours / Shift	BAT: Pollutant Load after Control (%)		Peak Trucks per Day	Average Trucks per Day	$PM_{2.5}$ EF (g/hp-hr)	PM_{10} EF (g/hp-hr)	NOx EF (g/hp-hr)	CO EF (g/hp-hr)
Landing- Road work												
Paver	224	1	1	8	10%				0.095	0.098		0.556
Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211		1.523
Generator - mid	110	1	1	8	10%				0.068	0.071	1.251	0.340
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Pile driving hammer – 500 kJ	1000	1	1	8	10%				0.048	0.050	1.513	0.335
Pile driving hammer – 800 kJ	1500	1	1	8	10%				0.048	0.050	1.513	0.335
Welding huts (supporting up to 10 welders)	35											
Rock Socket Drilling Rig	209	4	1	8	10%				0.040	0.041	1.122	0.261
Tugboats (1500 HP)- Main Engine	1500	8	1	8	60%				0.492	0.537	9.843	0.820
Tugboats Auxiliary Engine	107	8	1	8	60%				0.276	0.298	7.457	1.268
Flat deck barges (materials transport)												
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Freezing plant (construction)	550											
Generator - large	426	8	1	8	10%				0.040	0.041	1.250	0.300
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Vibratory Compactor Roller	18	1	1	8	100%				0.204	0.211	2.612	1.523
Truck - concrete	405	60	1	8	10%		60	30	0.003	0.003	0.062	0.053
Truck - delivery & haul-away	310	20	1	8	100%		20	10	0.003	0.003	0.081	0.069
Truck - muck-away	300	20	1	8	100%		20	10	0.003	0.004	0.084	0.072

Attachment 2: Construction Emissions by Year and Task

Year 1

		PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.002*	*0.002*	*0.345*	*0.026*	*0.047*	*0.047*	*0.001*
	Other Use Equipment	*0.558*	*0.572*	*63.218*	*6.502*	*20.500*	*55.091*	*0.215*
	Sub Total Land-Based Nonroad	0.56	0.57	63.56	6.53	20.55	55.14	0.22
	Marine							
	Dredge On-Site Tugboats	*0.866*	*0.944*	*29.107*	*1.092*	*1.255*	*1.255*	*0.015*
	Other Use On-Site Tugboats	*6.235*	*6.800*	*209.635*	*7.865*	*9.036*	*9.036*	*0.108*
	Dregde Removal Tugboats	*1.068*	*1.165*	*35.850*	*1.347*	*1.537*	*1.537*	*0.018*
	Material Delivery Tugboats	*2.932*	*3.198*	*98.585*	*3.699*	*4.249*	*4.249*	*0.051*
	Sub Total Marine	11.10	12.11	373.18	14.00	16.08	16.08	0.19
	On-Road							
	Westchester	*0.243*	*0.349*	*8.581*	*1.935*	---	*30.485*	*0.042*
	Rockland	*0.330*	*0.462*	*11.673*	*2.176*	*31.494*	---	*0.050*
	Sub Total On-Road	0.57	0.81	20.25	4.11	31.49	30.48	0.09
	NY Total	**12.23**	**13.49**	**456.99**	**24.64**	**68.12**	**101.70**	**0.50**
NJ	On-Road	0.01	0.01	0.34	0.03		0.11	0.00
	Rail	0.14	0.14	1.97	0.00		0.42	0.13
	NJ Total	**0.15**	**0.15**	**2.31**	**0.03**		**0.54**	**0.13**

Year 2

		PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.002*	*0.002*	*0.362*	*0.027*	*0.049*	*0.049*	*0.001*
	Other Use Equipment	*0.440*	*0.453*	*53.993*	*5.269*	*34.000*	*13.139*	*0.175*
	Sub Total Land-Based Nonroad	0.44	0.45	54.35	5.30	34.05	13.19	0.18
	Marine							
	Dredge On-Site Tugboats	*0.905*	*0.987*	*30.415*	*1.141*	*1.311*	*1.311*	*0.016*
	Other Use On-Site Tugboats	*6.332*	*6.906*	*212.905*	*7.988*	*9.177*	*9.177*	*0.110*
	Dregde Removal Tugboats	*0.375*	*0.409*	*12.586*	*0.473*	*0.540*	*0.540*	*0.006*
	Material Delivery Tugboats	*2.932*	*3.198*	*98.585*	*3.699*	*4.249*	*4.249*	*0.051*
	Sub Total Marine	10.54	11.50	354.49	13.30	15.28	15.28	0.18
	On-Road							
	Westchester	*0.209*	*0.307*	*7.325*	*1.995*	---	*33.511*	*0.040*
	Rockland	*0.295*	*0.420*	*10.417*	*2.235*	*34.520*	---	*0.049*
	Sub Total On-Road	0.50	0.73	17.74	4.23	34.52	33.51	0.09
	NY Total	**11.49**	**12.68**	**426.59**	**22.83**	**83.84**	**61.98**	**0.45**
NJ	On-Road	0.01	0.01	0.34	0.03		0.11	0.00
	Rail	0.14	0.14	1.97	0.00		0.42	0.13
	NJ Total	**0.15**	**0.15**	**2.31**	**0.03**		**0.54**	**0.13**

Year 3

		PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Other Use Equipment	*0.324*	*0.333*	*37.184*	*3.453*	*22.619*	*4.515*	*0.131*
	Sub Total Land-Based Nonroad	0.32	0.33	37.18	3.45	22.62	4.52	0.13
	Marine							
	Dredge On-Site Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Other Use On-Site Tugboats	*7.237*	*7.893*	*243.320*	*9.129*	*10.488*	*10.488*	*0.126*
	Dregde Removal Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Material Delivery Tugboats	*2.932*	*3.198*	*98.585*	*3.699*	*4.249*	*4.249*	*0.051*
	Sub Total Marine	10.17	11.09	341.91	12.83	14.74	14.74	0.18
	On-Road							
	Westchester	*0.179*	*0.260*	*6.285*	*1.588*	---	*26.050*	*0.033*
	Rockland	*0.265*	*0.373*	*9.377*	*1.828*	*27.059*	---	*0.042*
	Sub Total On-Road	0.44	0.63	15.66	3.42	27.06	26.05	0.07
	NY Total	**10.94**	**12.06**	**394.75**	**19.70**	**64.41**	**45.30**	**0.38**
NJ	On-Road	0.01	0.01	0.34	0.03		0.11	0.00
	Rail	0.14	0.14	1.97	0.00		0.42	0.13
	NJ Total	**0.15**	**0.15**	**2.31**	**0.03**		**0.54**	**0.13**

Year 4

State	Source	PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.002*	*0.002*	*0.357*	*0.027*	*0.048*	*0.048*	*0.001*
	Other Use Equipment	*0.130*	*0.134*	*11.993*	*1.003*	*3.803*	*2.548*	*0.071*
	Sub Total Land-Based Nonroad	0.13	0.14	12.35	1.03	3.85	2.60	0.07
	Marine							
	Dredge On-Site Tugboats	*0.905*	*0.987*	*30.415*	*1.141*	*1.311*	*1.311*	*0.016*
	Other Use On-Site Tugboats	*6.332*	*6.906*	*212.905*	*7.988*	*9.177*	*9.177*	*0.110*
	Dregde Removal Tugboats	*0.250*	*0.273*	*8.390*	*0.315*	*0.360*	*0.360*	*0.004*
	Material Delivery Tugboats	*2.932*	*3.198*	*98.585*	*3.699*	*4.249*	*4.249*	*0.051*
	Sub Total Marine	10.42	11.36	350.30	13.14	15.10	15.10	0.18
	On-Road							
	Westchester	*0.178*	*0.246*	*6.312*	*1.049*	---	*14.241*	*0.026*
	Rockland	*0.264*	*0.360*	*9.404*	*1.289*	*15.250*	---	*0.034*
	Sub Total On-Road	0.44	0.61	15.72	2.34	15.25	14.24	0.06
	NY Total	**10.99**	**12.11**	**378.36**	**16.51**	**34.20**	**31.93**	**0.31**
NJ	On-Road	0.01	0.01	0.34	0.03		0.11	0.00
	Rail	0.14	0.14	1.97	0.00		0.42	0.13
	NJ Total	**0.15**	**0.15**	**2.31**	**0.03**		**0.54**	**0.13**

Year 5

State	Source	PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.002*	*0.002*	*0.362*	*0.027*	*0.049*	*0.049*	*0.001*
	Other Use Equipment	*0.144*	*0.148*	*15.153*	*1.428*	*7.575*	*5.819*	*0.080*
	Sub Total Land-Based Nonroad	0.15	0.15	15.51	1.46	7.62	5.87	0.08
	Marine							
	Dredge On-Site Tugboats	*0.905*	*0.987*	*30.415*	*1.141*	*1.311*	*1.311*	*0.016*
	Other Use On-Site Tugboats	*6.332*	*6.906*	*212.905*	*7.988*	*9.177*	*9.177*	*0.110*
	Dregde Removal Tugboats	*0.250*	*0.273*	*8.390*	*0.315*	*0.360*	*0.360*	*0.004*
	Material Delivery Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Sub Total Marine	7.49	8.17	251.71	9.44	10.85	10.85	0.13
	On-Road							
	Westchester	*0.181*	*0.253*	*6.409*	*1.166*	---	*16.677*	*0.027*
	Rockland	*0.267*	*0.366*	*9.501*	*1.407*	*17.686*	---	*0.036*
	Sub Total On-Road	0.45	0.62	15.91	2.57	17.69	16.68	0.06
	NY Total	**8.08**	**8.93**	**283.14**	**13.47**	**36.16**	**33.39**	**0.27**
NJ	On-Road	0.00	0.00	0.00	0.00		0.00	0.00
	Rail	0.00	0.00	0.00	0.00		0.00	0.00
	NJ Total	**-**	**-**	**-**	**-**		**-**	**-**

Year 6

State	Source	PM2.5	PM10	NOx	VOC	CO (Rockland)	CO (Westchester)	SO2
NY	Land-Based Nonroad							
	Dredge Equipment	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Other Use Equipment	*0.032*	*0.033*	*3.032*	*0.250*	*0.251*	*0.842*	*0.033*
	Sub Total Land-Based Nonroad	0.03	0.03	3.03	0.25	0.25	0.84	0.03
	Marine							
	Dredge On-Site Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Other Use On-Site Tugboats	*4.669*	*5.092*	*156.981*	*5.890*	*6.766*	*6.766*	*0.081*
	Dregde Removal Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Material Delivery Tugboats	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
	Sub Total Marine	4.67	5.09	156.98	5.89	6.77	6.77	0.08
	On-Road							
	Westchester	*0.155*	*0.208*	*5.508*	*0.644*	---	*6.494*	*0.019*
	Rockland	*0.241*	*0.321*	*8.601*	*0.884*	*7.503*	---	*0.028*
	Sub Total On-Road	0.40	0.53	14.11	1.53	7.50	6.49	0.05
	NY Total	**5.10**	**5.65**	**174.12**	**7.67**	**14.52**	**14.10**	**0.16**
NJ	On-Road	0.00	0.00	0.00	0.00		0.00	0.00
	Rail	0.00	0.00	0.00	0.00		0.00	0.00
	NJ Total	**-**	**-**	**-**	**-**		**-**	**-**

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