4.6 Air Quality

Regulatory Setting

Since it was originally passed in 1955, the Clean Air Act (CAA) had been the primary basis for regulating air pollutant emissions. The Clean Air Act Amendments (CAAA) were passed in 1970, allowing EPA to delegate responsibility to state and local governing bodies. This allowed each state and local government the opportunity to prevent and control air pollution at the source. The CAAA mandated that the EPA establish ceilings for certain pollutants based on the identifiable effects each pollutant may have on public health and welfare. Subsequently, the EPA promulgated the revised regulations, which set National Ambient Air Quality Standards (NAAQS). Current NAAQS are established for carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), lead (Pb), sulfur dioxide (SO2), and inhalable particulate matter smaller than 2.5 micrometers ($PM_{2.5}$).

NAAQS are divided into two types of criterion: primary standards to protect the public health with an adequate margin of safety and secondary standards to protect the public welfare from any known or anticipated adverse effect of a pollutant (e.g. soiling, vegetation damage, material corrosion).

Each criteria pollutant is monitored on a continuous basis throughout the State of New Jersey by NJDEP. Currently, NJDEP maintains 39 air quality monitoring stations, located throughout 16 of the 21 NJ counties. Each air quality monitoring station documents one or more criteria pollutants and not all pollutants are documented within each county. Some NJDEP monitoring stations also document acid deposition, black carbon, measured benzene, toluene, ethyl benzene, Xylenes, mercury, meteorological parameters, total reactive oxides of nitrogen, air toxics, and visibility. Major objectives of monitoring air quality are to provide an early warning system for pollutant concentrations, assess air quality in light of public health and welfare standards, and also track trends or changes in these pollutant levels. Primary and secondary national ambient air quality standards are shown in **Table 4.28**.

Section 176(c)(1) of the CAA requires federal agencies to assure that their actions conform to applicable implementation plans for achieving and maintaining the NAAQS. A federal action must not cause or contribute any new NAAQS violations, increase the frequency or severity of any NAAQS violations, or delay timely attainment of any NAAQS or any required interim emission reductions or other milestones in nonattainment and/or maintenance areas. Since the Project would receive federal funding, it is subject to General Conformity Regulations (GCR). The Project is located within Hudson County, which is designated as O_3 nonattainment, as well as $PM_{2.5}$ and CO maintenance.

Table 4.28 United States Environmental Protection Agency National Ambient Air Quality Standards

POLLUTANT	AVERAGING PERIOD	NATIONAL PRIMARY	NATIONAL SECONDARY
Carbon Monoxide	1 hour 8 hour	35 ppm 9 ppm	- -
Ozone[1]	8 hour	0.070 ppm	0.070 ppm
Nitrogen Dioxide	Annual 1 hour	53 ppb[1] 00 ppb	53 ppb -
Lead	Rolling 3 month Average	0.15 µg/m³	0.15 µg/m³
Sulfur Dioxide[2]	3 hour 1 hour	-75 ppb	0.5 ppm -
FineParticulates (PM2.5)	24 hour Annual	35 µg/m³ 12 µg/m³	35 µg/m³ 15 µg/m³

Notes: 1 -[1] A Final Rule was signed on October 26, 2015 revising primary and secondary O3 standard levels to 0.070 ppm. However, 2008 standards of 0.75 ppm are still in effect.

2 -[2] A Final Rule was signed on June 2, 2010 creating the 1-hour SO2 standard of 75 ppb and revoking the annual and 24-hour standards. However, the annual and 24-hour standards remain in effect until one year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards.

3 -[3]

Source: https://www.epa.gov/criteria-air-pollutants/naaqs-table
Source: USEPA, 2016; https://www.epa.gov/criteria-air-pollutants/naaqs-table

In 1993, the EPA issued general conformity regulations (40 CFR Part 93, Subpart B) pertaining to procedures and criteria for determining federal action conformity. A conformity determination is required for each criteria pollutant or precursors where the total of direct and indirect emissions of the criteria pollutant or precursor in a nonattainment or maintenance area caused by a federal action which would equal or exceed specific emissions per year. Pursuant to 40 CFR 93.153, *de minimis* levels or minimum thresholds have been established for specific pollutants. Applicability analyses performed, which exceed these thresholds, would indicate the need to perform a conformity determination for the Project.

Since the project location is designated as O_3 nonattainment, pollutant precursors (NOx and VOCs) were estimated. In addition, CO and $PM_{2.5}$ emissions were estimated due to Hudson County's maintenance designation for these pollutants. SO2

Table 4.29 Project-Related *De Minimis* Air Pollutant Thresholds

POLLUTANT	ALLOWABLE TONS/YEAR
CO	100
NOx	100
VOC	50
$PM_{2.5}$	100

Note: Proposed project is not expected to cause indirect emissions. All *de minimis* thresholds listed above would therefore apply to direct emissions only.

Source: https://www.epa.gov/general-conformity/de-minimis-emission-levels is also a precursor pollutant to the formation of $PM_{2.5}$, however a detailed analysis of SO2 emissions was not required for general conformity purposes because SO2 emissions from construction equipment and emergency generators would be a small fraction of the direct $PM_{2.5}$ emissions. **Table 4.29** presents *de minimis* levels for pollutants assessed relevant to this project.

4.6.1 Methodology

Construction of the proposed project is expected to occur over approximately 3.5 years. The Study Area is densely populated with sensitive receptors such as residential dwellings, schools, senior housing developments, and a hospital. Activities related to long-term construction (i.e. generally more than two years) adjacent to sensitive receptors may have the potential to impact air quality. In addition, localized areas of congestion and elevated emissions may result from truck deliveries and contractor vehicles within the Study Area roadway network.

While construction deliveries are expected to begin in December of 2018, construction activity is expected to commence in January 2019 and be complete in July 2022. Anticipated construction activities were separated into work areas, equipment quantities, and number of crews for each alternative. Construction-related emissions were calculated for pollutants of concern (CO, NOx, VOC, and $PM_{2.5}$) for each year of construction over the course of the Project by alternative.

EPA's NONROAD2008a Emission Model (NONROAD), incorporated within the most updated motor vehicle emission simulator (MOVES2014a), was utilized to develop emission rates for various sizes and types of construction equipment. The model included temperature profiles for Hudson County provided by NJDEP. Fuel supply and fuel formulation data assumed ultra-low sulfur fuel (ULSF). Emission factors for CO, NOx (NO and NO_2), VOC, and $PM_{2.5}$ were obtained for each month related to on-site construction equipment necessary to construct the Project during CY 2019, 2020, 2021, and 2022.

NONROAD provides a limited equipment database. Preliminary equipment necessary to construct Resist features was identified by the project team. Emission factors provided by NONROAD for the most representative equipment type were utilized and presented within the analysis. Since equipment sizes were not identified for all equipment types, a conservative analysis was performed utilizing the highest emission rate per equipment type for each analysis year. Preliminary equipment list identified by the project team and most representative NONROAD equipment category utilized for the analysis is presented in **Table 4.30**.

Excavators, dump trucks, backhoes, pile driving rigs, sheet pile driving rigs, cranes, cement mixer trucks, and concrete pump trucks necessary to construct Resist structures were assumed to be diesel-powered equipment. Worst-case emission factors obtained from NONROAD in grams/brake-horsepower-hour were converted to grams per second for each piece of non-road equipment, assuming continuous operation. Estimates assumed construction activities would be performed five days a week (weekdays). To adjust for actual utilization and obtain hourly emissions, emission rates were subsequently multiplied by the reasonable horsepower engine sizes, number of pieces of equipment, as well as a usage factor accounting for the percentage of time that the equipment is in operation during an 8-hour work shift.

Pile driving and sheet pile driving rigs (bore/drill rigs) necessary to construct Resist features were preliminarily scheduled to be in operation anywhere from three to six months a year for the duration of construction (approximately 3.5 years), depending on the year and alternative (See construction schedule provided in Appendix B). Emission factors were obtained for each month of every year for all construction equipment. Since actual months of construction activities associated with pile driving and sheet pile driving are subject to change, an average emission factor associated with bore/drill rigs for each calendar year was utilized within air pollutant emission calculations.

Emission factors for vehicles traveling within the work site, as well as to and from the site, such as delivery trucks, cement mixer trucks, and cement pump trucks, were estimated utilizing MOVES2014a and Hudson County database files provided by NJDEP. Emission rates, in units of grams-per-vehicle-mile (g/veh-mi) were estimated for each month of the analysis year for the speed bin (testing method), accounting for average speeds equal to or greater than 2.5 mph and less than 7.5 mph (speed bin 2) for on-site trucks and average speeds equal to or greater than 27.5 and less than 32.5 mph (speed bin 7) for on-road trucks. Delivery trucks, cement mixer trucks, and cement pump trucks were assumed to be single unit short-haul trucks (source type 52) traveling 0.5 miles within the site and an average travel route of 75 miles each way to the site, or 150 miles round trip.

In addition, contractor vehicles commuting to and from the work site were estimated utilizing MOVES2014a and Hudson County database files provided by NJDEP. Emission rates, in units of g/veh-mi, were

Table 4.30 Construction Equipment Categories

PRELIMINARY EQUIPMENT LIST	NONROAD EQUIVALENT EQUIPMENT
Excavators	Excavators
Dump Trucks	Dumpers/Tenders
Backhoes	Tractors/Loaders/Backhoes
Pile Driving Rigs	Bore/Drill Rigs
Sheet Pile Driving Rigs	Bore/Drill Rigs
Cranes	Cranes
Hydraulic Hoe Ram	N/A*
Concrete Mixer Trucks	Cement & Mortar Mixers
Concrete Pump Trucks	Pumps

Note: 1 –* Since hydraulic hoe ram is mounted to excavator, backhoe, or driving rig and receives power from the mounted equipment, no additional emissions were assumed for the hoe ram attachment.
Source: Paul Carpenter Associates, Inc. 2016

estimated for each month of the analysis year for the speed bin, accounting for average speeds equal to or greater than 27.5 mph and less than 32.5 mph (speed bin 7). Of the potential passenger vehicles, passenger trucks resulted in higher emissions than passenger cars. Therefore, the analysis was performed assuming passenger trucks (source type 30) commuting an average of 75 miles each way to the site, or 150 miles round trip. The number of on-site crews per month for each alternative is included in the construction schedule. The number of contractors per crew was assumed to be 4.31 workers.

All vehicular traveling emissions were estimated without assessing start, evaporative, refueling, extended idle, well-to-pump, or auxiliary power exhaust. Conservatively, the highest emission rate within operating hours (7:00 AM to 3:00 PM) for this vehicle type was analyzed for each month and each analysis year.

As part of the DSD element of the Project, three pump stations would be constructed throughout Hoboken. Emergency generators associated with pump stations were assumed to be diesel-powered. Specific generator manufacturers and models have not been designated for each of the pump stations at this time. Based on conceptual review of equipment needs, it can be stated that the NJ TRANSIT site pump station is estimated to require a 50 to 60 kilowatt (kW) emergency generator, while BASF and Clinton Street pump stations are estimated to require a 160 to 175 kW generator at each site. A General Permit (GP-005A) would need to be acquired for each of the emergency generators through the NJDEP Air Quality Permitting Program.

EPA's NONROAD2008a Emission Model (NONROAD), incorporated within the most updated motor vehicle emission simulator (MOVES2014a) was utilized to obtain emission rates for generator sets corresponding with 60 kW (approximately 93 horsepower) and 175 kW (approximately 267 horsepower) generators. The model included temperature profiles for Hudson County provided by NJDEP. Fuel supply and fuel formulation data assumed ultra-low sulfur fuel (ULSF). Emission factors for CO, NOx (NO and NO_2), VOC, and $PM_{2.5}$ were obtained for each month related to each emergency generator size for the "Build" 2022 calendar year. Air emissions were estimated assuming each generator would undergo a weekly test, each for one hour duration.

4.6.2 Affected Environment

Section 107 of the 1970 CAAA requires EPA and states throughout the country to identify areas not meeting the NAAQS. An area that does not meet a standard is designated as nonattainment. The Project is located within Hudson County, which is designated as attainment for NO_2, Pb, SO_2, and PM10; nonattainment for O_3 (the entire state of New Jersey is classified as in O_3); and maintenance for $PM_{2.5}$ and CO (area was previously in nonattainment but now meets standards).

Regarding O_3, New Jersey is located within the "New York - N. New Jersey - Long Island, NY-NJ-CT" Eight-Hour (2008) Moderate Non-Attainment area. Naturally occurring O_3 in the upper atmosphere protects the population from harmful ultraviolet rays. Ground-level O_3 is formed when nitrogen oxides (NOx) and volatile organic compounds (VOC) react in the presence of sunlight and heat. Ground-level O_3 can cause serious adverse health effects by damaging cells that line our airways. Therefore, O_3 can aggravate respiratory diseases and cause the public to be more susceptible to respiratory infections. The incomplete combustion of fossil fuels, power plants, and other sources of combustion emit the primary source of NOx. In recent years, documented O_3 levels in New Jersey have been decreasing. Effective December 28, 2015, the EPA created a more stringent ambient O_3 standard, and precursors (NOx and VOCs) are monitored very carefully.

To determine compliance with O_3 standards and assess progress towards meeting the NAAQS, a design value is calculated by EPA based on actual air quality monitoring data over the most recent three-year period (2013-2015). The Hudson County O_3 design value, based on fourth highest eight-hour annual concentrations, and respective standard is 0.071 parts per million (ppm), which exceeds the standard of 0.070 ppm.

In 2013, EPA re-designated Hudson County along with twelve other New Jersey counties to $PM_{2.5}$ attainment. Hudson County is therefore in $PM_{2.5}$ maintenance and is subject to the same requirements as a $PM_{2.5}$ nonattainment area. These requirements include being held to a maintenance plan.

Particulate matter includes very small liquid and solid particles suspended within the lower atmosphere. Particulate matter irritates the membranes of the respiratory system and may affect sensitive groups including the elderly, individuals with cardiopulmonary disease such as asthma, and children. EPA is concerned with inhalable particulate matter, which is not filtered by the nose and throat like larger particulates and can reach deep in the lungs causing lung disease, emphysema, or lung cancer. Fine particulate matter smaller than 2.5 micrometers in diameter is created from chemical reactions in the atmosphere and through fuel combustion by sources such as motor vehicles and power generation. The NAAQS was revised in 2012 to provide a more stringent annual $PM_{2.5}$ standard.

NJDEP began monitoring $PM_{2.5}$ levels in 1999. To determine compliance with $PM_{2.5}$ standards, a design value is calculated by EPA based on actual monitoring data over the most recent three-year period (2013-2015). The 24-hour and annual mean design values at a Hudson County monitoring station (355 Newark Avenue, Jersey City) are 27 micrograms per cubic meter (µg/m3) and 10.8 µg/m3, respectively. Both $PM_{2.5}$ design values meet standards at this Hudson County representative monitoring location.

After many years of demonstrating CO attainment, Hudson County was re-designated to attainment status in 2004. Therefore, Hudson County is in CO maintenance and, in accord with the Clean Air Act, is subject to the same requirements as a CO nonattainment area. A CO maintenance area must maintain the NAAQS for 20 years by following two sequential 10-year plans.

The incomplete combustion of fossil fuel creates a spectrum of pollutant by-products. CO by volume is the most prominent when compared to other mobile-source pollutants for typical passenger vehicles. CO is a colorless/odorless poisonous gas that is generally found adjacent to intersections or congested roadways. Acceleration/deceleration and idling vehicles emit higher emissions than steady-state speed vehicles.

To determine compliance with CO standards, a design value is calculated by EPA based on actual air quality monitoring data over the most recent three-year period (2013-2015). CO design values at a Hudson County monitoring station are 2.1 ppm and 1.6 ppm, respectively. Both one-hour and eight-hour CO design values meet concentration standards within Hudson County.

4.6.3 Environmental Consequences

Alternative 1

Alternative 1 requires 15,500 equipment days for either Option 1 or Option 2 to construct Resist features. This number of equipment days is the highest among the alternatives. Pursuant to 40 CFR 93.153, *de minimis* levels or minimum thresholds have been established for specific pollutants. Applicability analyses performed that exceed these thresholds would indicate the need to perform a conformity determination for the Project. Based on the construction-related air emissions analysis performed for Alternative 1, Option 1 and Alternative 1, Option 2, emissions estimated for each construction calendar year do not exceed *de minimis* thresholds. Based on the assessment performed for Alternative 1, the Project would not create any new violations, nor increase the frequency or severity of any existing violations of the NAAQS. Therefore, Alternative 1 would be in compliance with the Clean Air Act. Construction-related air emission worksheets are included in Appendix C of the Air Quality Technical Environmental Study (2017). **Table 4.31** details predicted CO, NOx, VOC, and $PM_{2.5}$ levels by year, as a result of Alternative 1, Options 1 and 2.

Based on the operational-related air emissions analysis performed for DSD elements of the Project, emissions estimated for all three generators under 2022 “Build” condition do not exceed *de minimis* thresholds. **Table 4.32** details predicted “Build” CO, NOx, VOC, and $PM_{2.5}$ levels for 2022.

Alternative 2

Alternative 2 requires less equipment days than Alternative 1 to construct Resist features. Option 1 requires 13,480 equipment days while Option 2 requires 13,120 equipment days. Pursuant to 40 CFR 93.153, *de minimis* levels or minimum thresholds have been established for specific pollutants. Applicability analyses performed that exceed these thresholds would indicate the need to perform a conformity determination for the Project. Based on the construction-related air emissions analysis performed for Alternative 2, Option 1 and Alternative 2, Option 2, emissions estimated for each construction calendar year do not exceed *de minimis* thresholds. Based on the assessment performed for Alternative 2, the Project would not create any new violations, nor increase the frequency or severity of any existing violations of the NAAQS. Therefore, Alternative 2 would be in compliance with the Clean Air Act. **Table 4.33** details predicted CO, NOx, VOC, and $PM_{2.5}$ levels by year as a result of Alternative 2, Options 1 and 2.

Regarding DSD, emergency generator air emissions would be the same as described under Alternative 1.

Alternative 3

Alternative 3 requires the least number of equipment days to construct Resist features compared to the other alternatives with 9,300 equipment days for Option 1 and 10,300 equipment days for Option 2. Pursuant to 40 CFR 93.153, *de minimis* levels or minimum thresholds have been established for specific pollutants. Applicability analyses performed

Table 4.31 Predicted Emissions Compared to *De Minimis* Thresholds - Alternative 1, Option 1 / Option 2 (tons/year)

	CO	NOx	VOC	$PM_{2.5}$
2019	34.2 / 34.2	26.3 / 26.3	5.0 / 5.0	3.1 / 3.1
2020	30.2 / 30.2	23.1 / 23.2	4.2 / 4.2	2.5 / 2.5
2021	25.4 / 25.4	19.3 / 19.3	3.6 / 3.6	2.2 / 2.2
2022	7.8 / 7.8	6.2 / 6.2	1.0 / 1.0	0.6 / 0.6
Allowable (tons/yr)	100	100	50	100

Source: Paul Carpenter Associates, Inc. 2016

Table 4.32 Predicted 2022 Emergency Generator Emissions Compared to *De Minimis* Thresholds (tons/year)

	CO	NOx	VOC	$PM_{2.5}$
2022	0.03	0.09	0.01	0.01
Allowable (tons/yr)	100	100	50	100

Source: Paul Carpenter Associates, Inc. 2016

Table 4.33 Predicted Emissions Compared to *De Minimis* Thresholds - Alternative 2, Option 1 / Option 2 (tons/year)

	CO	NOx	VOC	$PM_{2.5}$
2019	31.1 / 28.7	24.5 / 22.0	4.8 / 4.3	2.9 / 2.6
2020	26.9 / 26.8	21.0 / 21.0	3.9 / 3.9	2.4 / 2.3
2021	24.6 / 22.8	18.9 / 17.8	3.6 / 3.3	2.2 / 2.0
2022	6.9 / 7.4	5.8 / 6.3	1.0 / 1.0	0.6 / 0.6
Allowable (tons/yr)	100	100	50	100

Source: Paul Carpenter Associates, Inc. 2016

Table 4.34 Predicted Emissions Compared to *De Minimis* Thresholds - Alternative 3, Option 1 / Option 2 (tons/year)

	CO	NOx	VOC	$PM_{2.5}$
2019	21.0 / 22.9	15.3 / 17.2	3.2 / 3.4	1.9 / 2.1
2020	18.7 / 23.4	13.8 / 18.0	2.6 / 3.3	1.5 / 2.0
2021	18.2 / 20.0	13.3 / 15.1	2.5 / 2.8	1.5 / 1.7
2022	5.0 / 6.4	4.0 / 5.4	0.7 / 0.9	0.4 / 0.5
Allowable (tons/yr)	100	100	50	100

Source: Paul Carpenter Associates, Inc. 2016

that exceed these thresholds would indicate the need to perform a conformity determination for the Project. Based on the construction-related air emissions analysis performed for Alternative 3, Option 1 and Alternative 3, Option 2, emissions estimated for each construction calendar year do not exceed *de minimis* thresholds. Based on the assessment performed for Alternative 3, the Project would not create any new violations, nor increase the frequency or severity of any existing violations of the NAAQS. Therefore, Alternative 3 would be in compliance with the Clean Air Act. **Table 4.34** details predicted CO, NOx, VOC, and $PM_{2.5}$ levels by year as a result of Alternative 3, Options 1 and 2.

Regarding DSD, emergency generator air emissions would be same as described under Alternative 1.

No Action Alternative

The No Action Alternative would result in no change to ambient air quality within the Study Area.

4.6.3.1 Mitigation Measures and BMPs in Alternatives 1, 2 And 3

Construction management of the Project would include general environmental measures imposed on contractors. Construction work would be planned and executed in a manner that would minimize air emissions and would be mindful of the site's proximity to users of the surrounding environment. Air quality control measures for both Resist and DSD would include:

- Use of low-sulfur diesel fuel to power construction equipment;
- Limiting idling times to less than three minutes on diesel and gasoline powered engines pursuant to N.J.A.C. 7:27-14 and N.J.A.C. 7:27-15;
- Locating diesel-powered exhausts away from local residential or building air intakes;
- Limiting on-site equipment to operating speeds of five mph to reduce dust and particulate pollutants from tires and brakes;
- Spraying suppressing agent on any dust pile;
- Utilizing water or appropriate liquids for dust control during demolition, land clearing, grading, and on materials stockpile or surface;
- Covering open-body trucks when transporting materials;
- Removing surface materials promptly;
- Diesel construction equipment powered by Tier 1 or newer non-road engines (> 100 horsepower) and used at the site for more than ten days are required to meet EPA Tier 4 non-road emission standards or be retrofitted with the best available emission control technology that is technologically feasible and verified by the EPA or the California Air Resources Board (CARB) to reduce particulate matter emissions by at least 90 percent; and
- Truck haul routes would be determined to minimize impact to sensitive receptors such as residential areas, hospitals, schools, daycare facilities, senior citizen housing, and convalescent facilities.

4.6.4 Greenhouse Gas Assessment

Three primary tracked greenhouses gases (GHG) produced by fossil fuel combustion include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). As stated earlier, construction of the Project is expected to occur over 3.5 years and would involve fossil fuel combustion due to on-road and off-road mobile sources, as well as construction equipment. The only direct source of GHG emissions expected to result from the Project's operation is three diesel-powered emergency generators associated with pump stations, which require weekly testing.

On August 1, 2016, CEQ released the "Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in National Environmental Policy Act Reviews." Pursuant to this

Table 4.35 CO_2e Emission Estimates[1]

ALTERNATIVE	2019	2020	2021	2022
Alternative 1, Option 1	4,146	3,833	3,112	4,164
Alternative 1, Option 2	4,146	3,845	3,112	4,164
Alternative 2, Option 1	3,669	3,356	2,938	3,687
Alternative 2, Option 2	3,307	3,354	2,853	3,325
Alternative 3, Option 1	2,360	2,396	2,310	2,378
Alternative 3, Option 2	2,599	2,933	2,546	2,617

Note: 1 – [1] Emissions reported in metric tons

Source: Paul Carpenter Associates, Inc. 2016

guidance, quantification of both direct and indirect GHG emissions by alternative is required in NEPA documents to ensure the public and all agencies involved possess the information necessary to make informed decisions.

Therefore, a GHG assessment was performed related to construction of each alternative, as well as the emergency generator assumed to be operational by 2022. It is important to note that the GHG assessment estimated emissions associated with project activities up to and including 2022, but not full life cycle emissions of the Project.

According to the EPA, each GHG has a different effect on the earth's atmosphere because they absorb energy differently and have differing lifetimes (i.e. some stay in the atmosphere longer than others). In order to compare global warming impacts of different gases and quantify total GHG emissions, a factor called Global Warming Potential (GWP) was created. The GWP is a measure of how much energy the emissions of one ton of a gas would absorb over a given period of time, relative to the emissions of one ton of CO_2. By definition, CO_2 has a GWP of one because it is the reference gas. Multiplying each pollutant by its GWP factor yields the CO_2 equivalent (CO_2e).

The EPA's most updated motor vehicle emission simulator (MOVES2014a) directly calculates CO_2e for on-road vehicles utilizing GWP values of one, 21, and 310 for CO_2, CH_4, and N_2O, respectively. These on-road construction vehicles include vehicles traveling within the work site, as well as to and from the site such as delivery trucks, cement mixer trucks, and cement pump trucks. In addition, contractor vehicles commuting to and from the work site were included in on-road CO_2e emissions.

NONROAD2008, which is incorporated into the MOVES2014a model and utilized to calculate emissions from non-road sources (i.e. stationary on-site construction equipment), does not directly compute CO_2e. Therefore, post-processing was performed for all non-road equipment whereby CO_2, CH_4, and N_2O emissions were scaled by the appropriate GWP factors.

NONROAD2008 provides emission factors in grams/horsepower per hour for CO_2 and CH_4 for a range of equipment sizes. Conservatively, the highest emission factors yielded by the model were utilized to calculate CO_2 and CH_4 emissions in metric tons (mt) per year. Generally, construction activities were assumed to occur on weekdays only for an eight-hour day. These assumptions were utilized to compute monthly emissions, which were subsequently converted to emissions in mt per year.

Since NONROAD2008 does not calculate emissions factors for N_2O, additional calculations were necessary to estimate N_2O emissions. Emissions for N_2O are based on the volume of fuel combusted. Since fuel usage information is unknown, an EPA default diesel fuel emission factor for CO_2 of 10.21 kg CO_2 per gallon was utilized to estimate fuel combustion. Subsequently, gallons of diesel fuel were multiplied by an N_2O emission factor developed by EPA for non-road diesel construction equipment, which is based on mass of emissions per gallon of fuel. Finally, N_2O emissions are estimated in mt per year by applying the appropriate GWP.

Emergency generators associated with three pump stations would require weekly testing of equipment operations. GHG emissions associated with weekly testing were estimated for 2022, assuming pump stations would be constructed and operational in 2022. GHG emissions associated with the operational phase of RBD-HR were calculated to be 18 mtCO_2e per year, associated with the use of generators for pumps. **Table 4.35** presents CO_2e emissions estimates based on each Build Alternative.

4.6.4.1 Mitigation Measures and BMPs in Alternatives 1, 2 And 3

Based on the project emission level of greenhouse gas under any alternative, no mitigation measures or further alternatives are proposed.