



**US Army Corps
of Engineers** ®
Wilmington District

**General Re-evaluation Report and Environmental Assessment
Surf City, Onslow and Pender Counties, North Carolina
Coastal Storm Risk Management Project**



**Appendix O:
Greenhouse Gas Emissions
Final
April 2025**

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1.0 Overview

The U.S. Council on Environmental Quality's, on January 9, 2023, issued interim guidance (policy CEQ-2022-0005) on Greenhouse Gases (GHG) emissions and how Federal agencies can determine GHG emissions predicted to occur with each construction alternative.

The total GHG emissions for the project were calculated using the type, quantity, horsepower, total hours, and other associated emission factors of the equipment (e.g., tugboats, pilot boats and heavy equipment needed to position the pipeline and regrade the newly placed sand) for the entire project (i.e., 50 years).

Initial baseline calculations were determined using a tool developed by the State of California's Sacramento Metro Air Quality Management District (SMAQMD). This spreadsheet calculates GHG emissions associated with harbor-related activities. The initial data was input to develop baseline emissions related to vessel/equipment type, size and predicted runtime. This raw data is then developed further to determine total construction and nourishment (i.e., O&M) emissions for each build alternative. Mobilization and demobilization emissions are included in these two totals (Tables 1-3). The next step is to use the NEAT v1.1 model. Outputs from Tables 1-3 are then used to determine total emissions for each alternative, in grams and metric tons. Table 4 presents the final results table from this model.

2.0 Action Alternative Descriptions

The scope of the action alternatives for this project are discussed in Section 3.5 of the main report. Generally, all include the construction of sand berm and dune system measuring approximately 33,300 feet long, or approximately six miles of shoreline, with the dune peak constructed to an elevation of 14 feet North Atlantic Vertical Datum 1988 (NAVD 88) and fronted by a 6-foot (NAVD 88) by 50-foot-wide beach berm. All construction alternatives include a 1,000-foot transition berm in northern end of the project that would go into the town limits of North Topsail Beach. Other features of the alternative would include dune vegetation and 500 walkover structures.

After initial construction, the sand berm and dune system would be renourished (i.e., nourishment event) seven times over the 50-year project, at fixed six-year intervals. Sand for placement would be taken from several borrow sites that are located between one and six miles off the coast of Topsail Island. Each construction alternative would require at least eight mobilization and demobilization efforts for initial construction and renourishment events.

In addition, construction activities for the action alternatives are distinguished in this analysis by the use or removal of construction/environmental windows. These periods provide a specific date range for in-water dredging and placement activities to occur as to minimize potential impacts to threatened and endangered species and their habitats. Alternative 2a and 2b are proposed with such windows.

Alternative 2a would include a construction/environmental window between December 1 and March 31 (120 days) for initial construction and renourishment events. The initial

construction activities would span approximately four dredging seasons and require four disturbance events resulting from all equipment use in water and on the beach.

Alternative 2b would include expanded environmental window between November 16-April 30 (165 days) for initial construction and renourishment events. The initial construction activities would span approximately three dredging seasons and require three disturbance events resulting from all equipment use in water and on the beach.

Alternative 2c would include no environmental window for initial construction and an expanded environmental window between November 16-April 30 (165 days) for renourishment events. Only one disturbance event, both in water and on beach, would be required lasting approximately 16 months.

Given this, the following factors were used to estimate total greenhouse gases by project and construction alternative:

Alternative 2a

- Initial construction would occur over a four-season period.
- Four mobilization and demobilization events (Six days per mobilization and six days per demobilization per season).

Alternative 2b

- Initial construction would occur over a three-season period.
- Three mobilization and demobilization events. (Six days per mobilization and six days per demobilization per season).

Alternative 2c

- Initial construction would occur over one 16-month continuous period.
- One mobilization and demobilization event (Six days per mobilization and six days per demobilization per season).

3.0 Assumptions

The following assumptions were also considered for this analysis:

All Alternatives

- Seven nourishment events during the 50-year project.
- Each nourishment event would be conducted in 165-days (November 16 – April 30).
- Two dredgers would be used simultaneously for the initial construction and all seven nourishment events.
- Two pilot boats
- Three tugboats would be needed.
- In the standardized GHG emissions calculation spreadsheet (SMAQMD_HC) horsepower (hp) values for bulldozers are not available. Emissions calculations were determined for bulldozers by using the surrogate standard emissions for tow boats/push boat generators (79 hp) and other generators (29 hp) from the

Auxiliary Engine Type worksheet to calculate bulldozer emission. The total of 108 hp captures hp for all 15,000 lb. dozers and many 20,000 lb. models.

- Seven nourishment events result in 6,720 hours of engine runtime per piece of equipment. (8 hours x 120 days x 7 events apply to all Alternatives = total individual engine runtime).
- GHG emissions calculations have been considered regarding the potential to retrofit 40 existing dune walkovers. These structures may need to be retrofit if dune nourishment efforts increase dune width adjacent and under each structure, which would increase the walkover structure length. Walkover extensions are not currently proposed for any specific existing structure, but there is a possibility that at least one structure would need to be retrofit. Conversely, USACE has determined that it is extremely unlikely that all 40 walkover structures will receive a retrofit. Considering this, a conservative estimate of the emissions produced from retrofitting 40 structures would be a substantial overestimate, due to not knowing how many structures would be retrofitted. If any retrofitting occurs, the potential GHG emissions would be *de minimus*. Therefore, those calculations are not included in this analysis.

4.0 Calculations

The estimated greenhouse gas raw data and emissions amount for the Action Alternatives and are presented in **Tables 1 through 5**.

5.0 Conclusions

Section 5.10 of the Environment Assessment document contains a discussion of the results for GHG emissions. The USACE has concluded that both Alternative 2b and Alternative 2c are viable approaches, with Alternative 2b producing the least emissions and cost. Conversely, Alternative 2a producing significant far more emissions and cost than the other two alternatives.

Table 1. Raw Data Calculations for NEAT v1.1 Model (Alternative 2a).

SPECIES ANNUALIZED EMISSIONS BY ACTION ALTERNATIVE ¹ : ALTERNATIVE 2a (grams except CO ₂ e)										
Species	Construction (One Season)				O&M (One Event)				Total Emissions by Species	CO ₂ Equivalency (CO ₂ e) (metric tons)
	Initial Construction	Mobilize and Demobilize	Total Construction Emissions	Annualized Initial Constriction	O&M Event	Mobilize and Demobilize Per Each Event	Total O&M Emissions	Annualized O&M Emissions ²		
Carbon Dioxide (CO ₂)	8,944,097,234	887,017,481.280	9,831,114,715.440	N/A	8,944,092,936.240	887,017,481.280	9,831,110,417.520	1,376,355,458.453	11,207,470,173.893	11,207.470
Methane (CH ₄)	216,706.160	21,491.520	238,197.680	N/A	216,706.160	21,491.520	238,197.680	33,347.675	271,545.355	6.789
Nitrous Oxide (N ₂ O)	43,337	4,297.920	47,635.280	N/A	43,337.360	4,297.920	47,635.280	6,668.939	54,304.219	16.183
TOTALS			9,831,400,548.400				9,831,396,250.480	1,376,395,475.067	11,207,796,023.467	11,230.441

¹Values represent only one construction season and one O&M event (of 7 total). NEAT v1.1 model will address number of construction seasons and O&M events.

² Determined by multiplying total O&M species emissions by 7 nourishment events divided by 50 years of period of Federal participation.

Table 2. Raw Data Calculations for NEAT v1.1 Model (Alternative 2b).

SPECIES ANNUALIZED EMISSIONS BY ACTION ALTERNATIVE ¹ : ALTERNATIVE 2b (grams except CO ₂ e)										
Species	Construction (One Season)				O&M (One Event)				Total Emissions by Species	CO ₂ Equivalency (CO ₂ e) (metric tons)
	Initial Construction	Mobilize and Demobilize	Total Construction Emissions	Annualized Initial Constriction	O&M Event	Mobilize and Demobilize Per Each Event	Total O&M Emissions	Annualized O&M Emissions ²		
Carbon Dioxide (CO ₂)	12,196,490,367.600	887,017,481.280	13,083,507,848.880	N/A	1,524,561,295.950	887,017,481.280	2,411,578,777.230	337,621,028.812	13,421,128,877.692	13,421.129
Methane (CH ₄)	295,508.400	21,491.520	316,999.920	N/A	36,938.550	21,491.520	58,430.070	8,180.210	325,180.130	8.130
Nitrous Oxide (N ₂ O)	59,096.400	4,297.920	63,394.320	N/A	7,387.050	4,297.920	11,684.970	1,635.896	65,030.216	19.379
TOTALS			13,083,888,243.120				2,411,648,892.270	337,630,844.918	13,421,519,088.038	13,448.637

¹Values represent only one construction season and one O&M event (of 7 total). NEAT v1.1 model will address number of construction seasons and O&M events.

² Determined by multiplying total O&M species emissions by 7 nourishment events divided by 50 years of period of Federal participation

Table 3. Raw Data Calculations for NEAT v1.1 Model (Alternative 2c)

SPECIES ANNUALIZED EMISSIONS BY ACTION ALTERNATIVE ¹ : ALTERNATIVE 2c (grams except CO ₂ e)										
Species	Construction (One Season)				O&M (One Event)				Total Emissions by Species	CO ₂ Equivalency (CO ₂ e) (metric tons)
	Initial Construction	Mobilize and Demobilize	Total Construction Emissions	Annualized Initial Constriction	O&M Event	Mobilize and Demobilize Per Each Event	Total O&M Emissions	Annualized O&M Emissions ²		
Carbon Dioxide (CO ₂)	35,480,699,251.200	887,017,481.280	36,367,716,732.480	17,740,349,625.000	1,524,561,295.950	887,017,481.28	2,411,578,777.230	337,621,028.812	18,077,970,653.812	18,077.971
Methane (CH ₄)	859,660.800	21,491.520	881,152.320	429,830.000	36,938.550	21,491.52	58,430.070	8,180.210	438,010.210	10.950
Nitrous Oxide (N ₂ O)	171,916.800	4,297.920	176,214.720	85,958.000	7,387.050	4,297.92	11,684.970	1,635.896	87,593.896	26.103
TOTALS			36,368,774,099.520	17,740,865,413.000			2,411,648,892.270	337,630,844.918	18,078,496,257.918	18,115.024

¹Values represent only one construction season and one O&M event (of 7 total). NEAT v1.1 model will address number of construction seasons and O&M events.

² Determined by multiplying total O&M species emissions by 7 nourishment events divided by 50 years of period of Federal participation.

Table 4. Total Emissions Results by Alternative (NEAT v1.1 Model).

Include O&M Air Pollutant Emissions In Net Calculations						YES
	Gross Emissions			Net Emissions		
No Action Alternative						
Pollutant Emissions (Clean Air Act)	Grams	Pounds	Metric Tons	Grams	Pounds	Metric Tons
Greenhouse Gas Emissions (NEPA)						
Carbon Dioxide (CO ₂)	0	0	0	0	0	0
Methane (CH ₄)	0	0	0	0	0	0
Nitrous Oxide (N ₂ O)	0	0	0	0	0	0
Carbon Dioxide Equivalents (CO ₂ e)	0	0	0	0	0	0
Alternative 2a						
Pollutant Emissions (Clean Air Act)	Grams	Pounds	Metric Tons	Grams	Pounds	Metric Tons
Greenhouse Gas Emissions (NEPA)						
Carbon Dioxide (CO ₂)	78,648,883,340	173,391,249	78,649	78,648,883,340	173,391,249	78,649
Methane (CH ₄)	1,905,581	4,201	2	1,905,581	4,201	2
Nitrous Oxide (N ₂ O)	381,082	840	0	381,082	840	0
Carbon Dioxide Equivalents (CO ₂ e)	78,810,085,384	173,746,639	78,810	78,810,085,384	173,746,639	78,810
Alternative 2b						
Pollutant Emissions (Clean Air Act)	Grams	Pounds	Metric Tons	Grams	Pounds	Metric Tons
Greenhouse Gas Emissions (NEPA)						
Carbon Dioxide (CO ₂)	29,964,559,289	66,060,599	29,965	29,964,559,289	66,060,599	29,965
Methane (CH ₄)	726,010	1,601	1	726,010	1,601	1
Nitrous Oxide (N ₂ O)	145,189	320	0	145,189	320	0
Carbon Dioxide Equivalents (CO ₂ e)	30,025,975,905	66,196,000	30,026	30,025,975,905	66,196,000	30,026
Alternative 2c						
Pollutant Emissions (Clean Air Act)	Grams	Pounds	Metric Tons	Grams	Pounds	Metric Tons
Greenhouse Gas Emissions (NEPA)						
Carbon Dioxide (CO ₂)	34,621,401,066	76,327,186	34,621	34,621,401,066	76,327,186	34,621
Methane (CH ₄)	838,840	1,849	1	838,840	1,849	1
Nitrous Oxide (N ₂ O)	167,753	370	0	167,753	370	0
Carbon Dioxide Equivalents (CO ₂ e)	34,692,362,409	76,483,629	34,692	34,692,362,409	76,483,629	34,692
0						