

On-Road Emission Results

The largest on-road emission results will occur during the second year and are summarized in Table 5.1.3 in Section 1.5.3. The methodology and calculation result are not affected by the change in marine engine type.

Comparison to De Minimis Levels

The table below compares the total emissions for each criteria pollutant to the de minimis threshold for New Castle County. The total emissions consist of the sum of marine, nonroad and on-road emissions. The calculations performed were based on the assumption that a Tier II engine was used therefore the results are less conservative and the emissions for each year is less than the de minimis threshold.

Table 5.2.2 - Scenario 2 Total Estimated Project Construction Emissions Compared to De Minimis Levels

Summary of Annual Emissions for Criteria Pollutant (tons/year)			
	NO _x	CO	PM
<i>De minimis</i> level	100	100	100
Year 1 Emissions	97	54	5.1
Year 2 Emissions	85	47	4.4
Year 3 Emissions	66	38	3.5

6. General Conformity Assessment

In the case where the Tier 0 marine engines are used, general conformity can be demonstrated by comparison of the estimated emissions to the allowance for such emissions in budget established by the State of Delaware and accepted by EPA. The current budget established by DNREC was provided in the 2014 National Emissions Inventory (NEI) should be utilized in conducting the general conformity analysis. DNREC indicated that the emissions data from the NEI would be a more appropriate comparison than the 2009 EPA approved State Implementation Plan for Delaware.

Due to estimated NO_x emissions being the only group of substances in excess of the *de minimis* threshold, the percentage of the 2014 NEI that would be affected by the total project emissions for NO_x was assessed to demonstrate general conformity. The 2014 NEI budgets for each respective category: commercial marine, nonroad and on-road emissions are provide in Table 6.1 below. The estimated percentages of the categorical budgets that would be used are 3.4% for marine activities, 0.003% for off-road activities, and 0.003% for on-road mobile sources. These numbers indicate that even though the *de minimis* threshold would be breached the first year of construction, the estimated NO_x emissions comprise small parts of the categorical budgets and the total annual NO_x transportation budget for the State.

Table 6.1 - Comparison of Scenario 1 Project Emissions to 2014 NEI

Project Categories	Inventory Categories	DNREC 2014 NEI NO _x Emissions Budget	Project NO _x Emissions					
			First Year		Second Year		Third Year	
		(tpy)	(tpy)	Portion of Budget	(tpy)	Portion of Budget	(tpy)	Portion of Budget
Commercial Marine Activities	Marine Emission Sources	3,189	110	3.4%	92	2.9%	75	2.4%
Land-side Activities	Nonroad Emission Sources	2,756	0.09	0.003%	0.09	0.003%	0.09	0.003%
On-Road Vehicles	On-Road Mobile Sources	8,044	0.23	0.003%	0.23	0.003%	0.23	0.003%
	Heavy Duty On Road	113.16	-	-	3.0	2.65%	-	-
Totals		14,102	110.32	0.78%	95.32	0.67%	75.32	0.53%

7. Best Practices

The general conformity assessment in Section 6 indicates that the estimated project emissions would be within the State of Delaware budget set aside for such emissions and would not lead to a deterioration of air quality. However, the emissions estimated as Scenario 2 suggests that some emissions could be avoided or minimized by using Tier II marine diesel engine equipped vessels on the project. The project marine work (e.g., dredging and pile driving) is expected to be mostly performed outside of the regional ozone season, which extends from May through September, due to restrictions on in water work during the anadromous fish migration period. Additionally, work practices that could be implemented would further reduce engine emissions. Implementation of best practices would be included in contract specifications and bid documents. These measures are expected to be included:

1. Solicitation of commercial marine vessels and equipment to be used in the project that are equipped with controls to meet Tier II emission exhaust standards, by offering a preference in selection of such equipment over older Tier 0 powered equipment.
2. Solicitation of nonroad construction equipment that utilizes Tier III compliant engines and on-road Tier II compliant trucks by offering a preference in selection of such equipment over older Tier 0 powered equipment.
3. Include anti-idling provisions in the contract specifications.

8. Conclusion

On the basis of the analyses described in this report, the construction of the proposed access channel, berth and wharf should not cause a deterioration of air quality or significantly contribute to the continuation of marginal nonattainment of the ozone NAAQS. The general conformity assessment indicates that the estimated construction emissions would be within the State of Delaware NEI budget allowance for transportation related emissions and be minor components of the specific categories for transportation related emissions within the overall NEI budget.

Implementation of the best practices identified in Section 7 have the potential to reduce the project construction emissions to levels below the de minimis thresholds. Project specifications and bid documents will be crafted to encourage or mandate the use of these practices to avoid unnecessary emissions and minimize those that are necessary.

9. References

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APPENDIX A

PROJECT EMISSIONS, FACTORS, AND CALCULATIONS

Table 1. Scenario 1 - Summary of Project Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Summary of Year 1 Emissions for Criteria Pollutant (tons)								
De minimis level (tons/year)	Quantity	100	100	100	-	50	100	100
		NOx	CO	SOx	CO2	VOCs	PM2.5	PM10
Dredge Vessel	1	95	10	0.071	6300	1.1	2.3	2.4
Tugboats	2	6.4	1.2	0.0050	450	0.15	0.16	0.16
Crew boat	1	2.6	0.49	0.0020	180	0.062	0.06	0.065
Crew/Survey Boat (Dredge phase)	1	0.64	0.12	0.00050	45	0.015	0.016	0.016
Bulldozers	3	0.049	0.46	0.0052	1300	0.0050	0.013	-
Excavators	3	0.038	0.36	0.0052	990	0.0050	0.010	-
Crane	1	2.6	0.30	0.0019	170	0.033	0.063	0.065
Diesel Hammer	2	0.51	0.10	0.0004	36	0.012	0.013	0.013
PowerPack	1	2.1	0.39	0.0016	140	0.050	0.051	0.052
Light Duty On-Road	55	0.22	2.8	-	120	0.29	0.0011	0.0012
Total Project (Tons/yr)		110	17	0.093	9700	1.7	2.7	2.7

Summary of Year 2 Emissions for Criteria Pollutant (tons)								
De minimis level (tons/year)	Quantity	100	100	100	-	50	100	100
		NOx	CO	SOx	CO2	VOCs	PM2.5	PM10
Dredge Vessel	1	79	8.7	0.059	5300	0.88	1.9	2.0
Tugboats	2	5.6	1.1	0.0044	390	0.13	0.14	0.14
Crew boat	1	2.2	0.43	0.0018	160	0.054	0.055	0.057
Crew/Survey Boat (Dredge phase)	1	0.56	0.11	0.00044	39	0.013	0.014	0.014
Bulldozers	5	0.081	0.76	0.019	2100	0.018	0.022	-
Excavators	3	0.038	0.36	0.0091	990	0.087	0.010	-
Crane	1	2.3	0.26	0.0017	150	0.029	0.055	0.056
Diesel Hammer	2	0.43	0.082	0.00034	30	0.010	0.011	0.011
PowerPack	1	1.7	0.33	0.0013	120	0.041	0.042	0.044
Heavy Duty On-Road	18	3.0	0.80	-	-	0.15	0.070	0.075
Light Duty On-Road	55	0.23	2.8	-	120	0.29	0.0011	0.0012
Total Project (Tons/yr)		95	16	0.097	9400	1.7	2.3	2.4

Table 1. Scenario 1 - Summary of Project Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Summary of Year 3 Emissions for Criteria Pollutant (tons)								
De minimis level (tons/year)	Quantity	100	100	100	-	50	100	100
		NOx	CO	SOx	CO2	VOCs	PM2.5	PM10
Dredge Vessel	1	63	6.9	0.047	4200	0.71	1.5	1.6
Tugboats	2	4.8	0.92	0.0038	330	0.12	0.12	0.12
Crew boat	1	1.9	0.37	0.0015	130	0.046	0.047	0.049
Crew/Survey Boat (Dredge phase)	1	0.48	0.092	0.00038	33	0.012	0.012	0.012
Bulldozers	3	0.049	0.46	0.011	1300	0.011	0.013	-
Excavators	3	0.038	0.36	0.0090	990	0.087	0.010	-
Crane	1	1.9	0.23	0.0015	130	0.024	0.047	0.048
Diesel Hammer	2	0.43	0.082	0.00034	30	0.010	0.011	0.011
PowerPack	1	1.7	0.33	0.0013	120	0.041	0.042	0.044
Light Duty On-Road	55	0.23	2.8		120	0.29	0.001	0.0012
Total Project (Tons/yr)		75	13	0.077	7400	1.3	1.8	1.9

Notes :

1. Scenario 1 analyzed the use of Tier 0 Commercial Marine Engines, Tier III Non-Road Construction Engines, Heavy Duty and Light Duty On-Road Engines
2. Refer to Table 2. for details of load factors and hours of operation for all equipment used
3. Two additional D10 bulldozers required for bulkhead construction in year 2
4. Heavy Duty On Road emissions required for bulkhead construction in year 2

Table 2. Scenario 1 - Summary of Emission Factors, Load Factors and Hours of Operation
 Air Conformity Analysis
 DSCP Edgemore Facility, DE

Estimated Emission Factors												
Emissions (g/hp-hr)												
Horsepower	Dredge		Crane		Tugboat	Crew boat	Crew/Survey Boat	Diesel Hammer	Power Pack	Excavators	Bulldozer	
	9000	3000	365	100	500	400	100	105	420	472	600	
CAP	Active	Idle	Active	Idle								
NOx	7.9	8.8	7.9	8.8	8.2	8.2	8.2	8.2	8.2	0.021	0.021	
CO	0.78	3.1	0.78	3.1	1.6	1.6	1.6	1.6	1.6	0.19	0.19	
SOx	0.0059	0.0073	0.0059	0.0073	0.0064	0.0064	0.0064	0.0064	0.0064	0.0049	0.0049	
CO2	520	650	520	650	570	570	570	570	570	540	540	
VOCs	0.070	0.56	0.070	0.56	0.20	0.20	0.20	0.20	0.20	0.047	0.0047	
PM2.5	0.19	0.23	0.19	0.23	0.20	0.20	0.20	0.20	0.20	-	-	
PM10	0.20	0.24	0.20	0.24	0.21	0.21	0.21	0.21	0.21	0.0055	0.0055	

Load factors and emission factors for Tier 0 marine engines were determined based on the February, 2000 EPA report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data"
 Excavators and Bulldozers (Tier III) engines are engines based on the 2010 EPA report "Exhaust and Crankcase Emission Factors for Non-road Engine Modeling – Compression-Ignition"

Emission Standards for Non-Diesel Vehicles			
Petroleum	Light Truck	Car	Heavy Duty Truck
CAP	Emissions (g/mi)		
NOx	0.95	0.69	8.6
CO	12	9.4	2.3
SOx	-	-	-
CO2	510	370	-
VOCs	1.2	1.0	0.45
PM2.5	0.0045	0.0041	0.20
PM10	0.0049	0.0044	0.22

Non Diesel Emission Factors are obtained from 2008 EPA Report ' Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks'
 Diesel Emission Factors are obtained from 2008 EPA Report ' Average In-Use Emissions from Heavy Duty Trucks'

Load Factors and Operation Time (g/hp-hr)											
Horsepower	Dredge		Crane		Tugboat	Crew boat	Crew/Survey Boat	Diesel Hammer	Power Pack	Excavators	Bulldozer
	9000	3000	365	100	500	400	100	105	420	472	600
Load Factors	0.8	0.2	0.8	0.2	0.4	0.4	0.4	0.4	0.4	0.59	0.59
Hours/ Day	16	8	8	8	15	15	15	15	15	8	8
Days /Year 1	90		118		118	118	118	90	90	250	250
Days /Year 2	75		103		103	103	103	75	75	251	251
Days /Year 3	60		88		88	88	88	60	60	250	250

Table 3. Scenario 1 - Summary of Commercial Marine Emissions for Tier 0 Engines
Air Conformity Analysis
DSCP Edgemore Facility, DE

Dredge Vessel Emission Summary																	
Days/Year	Year 1					Annual Total	Year 2					Annual Total	Year 3				
	90						75						60				
	Dredging		Idling				Dredging		Idling				Dredging		Idling		
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)			
NOx	1.0	91	0.047	4.2	95	1.0	75	0.047	3.5	79	1.0	60	0.047	2.8	63		
CO	0.10	8.9	0.017	1.49	10	0.10	7.4	0.017	1.24	8.7	0.10	5.9	0.017	0.99	6.9		
SOx	0.00075	0.067	0.000039	0.0035	0.071	0.001	0.056	0.000039	0.0029	0.06	0.00075	0.045	0.000039	0.0023	0.047		
CO ₂	67	6,000	3.4	310	6,300	67	5,000	3.5	260	5,300	67	4,000	3.5	210	4,200		
VOC	0.0088	0.79	0.0029	0.26	1.1	0.009	0.66	0.0029	0.22	0.88	0.009	0.53	0.0029	0.18	0.71		
PM2.5	0.024	2.2	0.0012	0.11	2.3	0.024	1.8	0.0012	0.09	1.9	0.024	1.5	0.0012	0.074	1.5		
PM10	0.025	2.2	0.0013	0.11	2.4	0.025	1.9	0.0013	0.10	2.0	0.025	1.5	0.0013	0.076	1.6		

Crane Emission Summary																	
Days/Year	Year 1					Annual Total	Year 2					Annual Total	Year 3				
	118						103						88				
	Crane in operation		Idling				Crane in operation		Idling				Dredging		Idling		
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)			
NOx	0.020	2.41	0.0016	0.18	2.6	0.020	2.10	0.0016	0.16	2.3	0.020	1.8	0.0016	0.14	1.9		
CO	0.0020	0.24	0.00055	0.065	0.30	0.0020	0.21	0.00055	0.057	0.26	0.0020	0.18	0.00055	0.048	0.23		
SOx	0.000015	0.0018	0.0000013	0.00015	0.0019	0.000015	0.0016	0.0000013	0.00013	0.0017	0.000015	0.0013	0.0000013	0.00011	0.0015		
CO ₂	1.4	159	0.11	13	170	1.4	139	0.11	12	150	1.4	119	0.11	10	130		
VOC	0.00018	0.021	0.00010	0.012	0.033	0.00018	0.018	0.00010	0.010	0.029	0.00018	0.016	0.00010	0.0086	0.024		
PM2.5	0.00049	0.058	0.000041	0.0048	0.063	0.00049	0.051	0.000041	0.0042	0.055	0.00049	0.043	0.000041	0.0036	0.047		
PM10	0.00051	0.060	0.000042	0.0050	0.065	0.00051	0.052	0.000042	0.0043	0.056	0.00051	0.045	0.000042	0.0037	0.048		

Diesel Hammer Emission Summary						
Days/Year	Year 1		Year 2		Year 3	
	90		75		60	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.0057	0.51	0.0057	0.43	0.0057	0.34
CO	0.0011	0.10	0.0011	0.082	0.0011	0.066
SOx	0.0000045	0.00040	0.0000045	0.00034	0.0000045	0.00027
CO ₂	0.40	35.65	0.40	30	0.40	24
VOC	0.00014	0.012	0.00014	0.010	0.00014	0.0083
PM2.5	0.00014	0.013	0.00014	0.011	0.00014	0.0085
PM10	0.00015	0.013	0.00015	0.011	0.00015	0.0087

Table 3. Scenario 1 - Summary of Commercial Marine Emissions for Tier 0 Engines
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

2 x Tugboat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	90		75		60	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.054	6.4	0.054	5.6	0.054	4.8
CO	0.010	1.2	0.010	1.1	0.010	0.92
SOx	0.000043	0.0050	0.000043	0.004	0.000043	0.0038
CO ₂	3.8	450	3.8	390	3.8	330
VOC	0.0013	0.15	0.0013	0.135	0.0013	0.12
PM2.5	0.0013	0.16	0.0013	0.138	0.0013	0.12
PM10	0.0014	0.16	0.0014	0.142	0.0014	0.12

Crew Boat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	118		103		88	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.022	2.6	0.022	2.2	0.022	1.9
CO	0.0042	0.49	0.0042	0.43	0.0042	0.37
SOx	0.000017	0.0020	0.000017	0.002	0.000017	0.0015
CO ₂	1.5	180	1.5	160	1.5	130
VOC	0.00052	0.062	0.00052	0.054	0.00052	0.046
PM2.5	0.00054	0.063	0.00054	0.055	0.000537	0.047
PM10	0.00055	0.065	0.00055	0.057	0.00055	0.049

Crew-Survey Boat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	118		103		88	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.0054	0.64	0.0054	0.56	0.0054	0.48
CO	0.0010	0.12	0.0010	0.11	0.0010	0.092
SOx	0.0000043	0.00	0.0000043	0.00044	0.0000043	0.00038
CO ₂	0.38	45	0.38	39	0.38	33
VOC	0.00013	0.015	0.00013	0.013	0.00013	0.012
PM2.5	0.00013	0.016	0.00013	0.014	0.00013	0.012
PM10	0.00014	0.016	0.00014	0.014	0.00014	0.012

Table 3. Scenario 1 - Summary of Commercial Marine Emissions for Tier 0 Engines
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Power Pack Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	90		75		60	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.023	2.06	0.023	1.714	0.023	1.4
CO	0.0068	0.61	0.0044	0.328	0.0044	0.26
SOx	0.000028	0.0025	0.000018	0.0013	0.000018	0.0011
CO ₂	2.5	220	1.6	120	1.6	95
VOC	0.00086	0.077	0.00055	0.041	0.00055	0.033
PM2.5	0.00088	0.079	0.00056	0.042	0.000564	0.034
PM10	0.00090	0.081	0.00058	0.044	0.00058	0.035

Notes:

1. Load factors and emission factors were determined based on the February, 2000 EPA report "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data"
2. Emissions factors conservatively reflect a fleet of Tier 0 marine engines, lacking NOx emissions control technology
3. Assumes a 0.0015% sulfur concentration in fuel oil, which is the maximum allowable amount of sulfur in non-road diesel fuel according to the EPA Office of Transportation
4. The EPA NONROAD 2008a emission factor model assumes that all diesel particulate matter is PM10 and 97% of diesel PM10 is PM2.5. This ratio was used to estimate
5. 2 Tugboats are required for the project
6. Support Vessels (Crew Boat, Crew - Survey Boat, Tugboat and Crane) Operate for an additional 2 weeks before and after standard project schedule

Table 4. Scenario 2 - Summary of Project Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Summary of Year 1 Emissions for Criteria Pollutant (tons/year)				
De minimis level (tons/year)	Quantity	100	100	100
		NOx	CO	PM
Dredge Vessel	1	87	44	4.4
Tugboats	2	4.6	2.9	0.29
Crew boat	1	1.8	1.2	0.12
Crew/Survey Boat (Dredge phase)	1	0.46	0.29	0.029
Bulldozers	3	0.049	0.46	0.013
Excavators	3	0.038	0.36	0.010
Crane	1	1.9	1.2	0.12
Diesel Hammer	2	0.37	0.23	0.023
PowerPack	1	1.5	0.93	0.093
Light Duty On-Road	55	0.22	2.8	0.0012
Total Project (Tons/yr)		97	54	5.1

Summary of Year 2 Emissions for Criteria Pollutant (tons/year)				
De minimis level (tons/year)	Quantity	100	100	100
		NOx	CO	PM
Dredge Vessel	1	72	37	3.7
Tugboats	2	4.0	2.5	0.25
Crew boat	1	1.6	1.0	0.10
Crew/Survey Boat (Dredge phase)	1	0.40	0.25	0.025
Bulldozers	5	0.049	0.46	0.000
Excavators	3	0.038	0.36	0.0091
Crane	1	1.6	1.0	0.10
Diesel Hammer	2	0.30	0.19	0.019
PowerPack	1	1.2	0.78	0.078
Heavy Duty -On-Road	18	3.0	0.80	0.075
Light Duty On-Road	55	0.23	2.8	0.0012
Total Project (Tons/yr)		85	47	4.3

Table 4. Scenario 2 - Summary of Project Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Summary of Year 3 Emissions for Criteria Pollutant (tons/year)				
De minimis level (tons/year)	Quantity	100	100	100
		NO _x	CO	PM
Dredge Vessel	1	58	29	2.9
Tugboats	2	3.4	2.2	0.22
Crew boat	1	1.4	0.87	0.087
Crew/Survey Boat (Dredge phase)	1	0.34	0.22	0.022
Bulldozers	3	0.049	0.46	0.0058
Excavators	3	0.04	0.36	0.0057
Crane	1	1.4	0.90	0.090
Diesel Hammer	2	0.30	0.19	0.019
PowerPack	1	1.2	0.78	0.078
Light Duty On-Road	55	0.23	2.8	0.0012
Total Project (Tons/yr)		66	38	3.5

Notes :

1. Scenario 1 analyzed the use of Tier II Commercial Marine Engines, Tier III Non-Road Construction Engines, Heavy Duty and Light Duty On-Road Engines
2. Refer to Table 5. for details of load factors and hours of operation for all equipment used.
3. Two additional D10 bulldozers required for bulkhead construction in year 2
4. Heavy Duty On Road emissions required for bulkhead construction in year 2

Table 5. Scenario 2 - Summary of Emission Factors, Load Factors and Hours of Operation
 Air Conformity Analysis
 DSCP Edgemore Facility, DE

Estimated Emission Factors											
Emissions (g/hp-hr)											
Horsepower	Dredge		Crane		Tugboat	Crew boat	Crew/Survey Boat	Diesel Hammer	Power Pack	Excavators	Bulldozer
	9000	3000	365	100	500	400	100	105	420	472	600
CAP	Active	Idle	Active	Idle							
NOx	7.3	6.5	5.8	5.8	5.8	5.8	5.8	5.8	5.8	0.021	0.021
CO	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	0.19	0.19
PM10	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.0055	0.0055

Note:
 Tier II Marine emission factors are based on 40 CFR §94.8
 Excavators and Bulldozers (Tier III) engines are based on the 2010 EPA report "Exhaust and Crankcase Emission Factors for Non-road Engine Modeling – Compression-Ignition"

Emission Standards for Non-Diesel Vehicles			
Petroleum	Light Truck	Car	Heavy Duty Truck
CAP	Emissions (g/mi)		
NOx	0.95	0.69	8.6
CO	12	9.4	2.3
SOx	-	-	-
CO2	510	370	-
VOCs	1.2	1.0	0.45
PM2.5	0.0045	0.0041	0.20
PM10	0.0049	0.0044	0.22

Non Diesel Emission Factors are obtained from 2008 EPA Report ' Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks'
 Diesel Emission Factors are obtained from 2008 EPA Report ' Average In-Use Emissions from Heavy Duty Trucks'

EPA Tier II Engine Emission Standards and Dates											
Category	Power (kW)	Power (hp)	Displacement (liters/cylinder)	Displacement (in ³ /cylinder)	Model year	Nox+HC (g/kW-hr)	Nox+HC (g/hp-hr)	CO (g/kW-hr)	CO (g/hp-hr)	PM (g/kW-hr)	PM (g/hp-hr)
1	>37	>50	< 0.9	< 54.9	2005	7.5	5.6	5	3.7	0.40	0.30
			0.9 - < 1.2	54.9 - < 73.2	2004	7.2	5.4	5	3.7	0.30	0.22
			1.2 - < 2.5	73.2 - < 152.6	2004	7.2	5.4	5	3.7	0.20	0.15
			2.5 - < 5.0	152.6 - < 305	2007	7.2	5.4	5	3.7	0.20	0.15
2	>37	>50	5.0 - < 15	305 - < 915	2007	7.8	5.8	5	3.7	0.27	0.20
			15 - < 20	915 - < 1,220	2007	8.7	6.5	5	3.7	0.50	0.37
	<3,300	<4,425	15 - < 20	915 - < 1,220	2007	9.8	7.3	5	3.7	0.50	0.37
			20 - < 25	1,220 - < 1,525	2007	9.8	7.3	5	3.7	0.50	0.37
	>3,300	>4,425	25 - < 30	1,525 - < 1,830	2007	11	8.2	5	3.7	0.50	0.37

Tabled Referenced from Moffat & Nichol - Delaware River Main Channel Deepening Project, General Conformity Analysis and Mitigation Report, 2004

Load Factors and Operation Time (g/hp-hr)											
Horsepower	Dredge		Crane		Tugboat	Crew boat	Crew/Survey Boat	Diesel Hammer	Power Pack	Excavators	Bulldozer
	9000	3000	365	100	500	400	100	105	420	472	600
Load Factors	0.8	0.2	0.8	0.2	0.4	0.4	0.4	0.4	0.4	0.59	0.59
Hours/ Day	16	8	8	8	15	15	15	15	15	8	8
Days /Year 1	90		118		118	118	118	90	90	250	250
Days /Year 2	75		103		103	103	103	75	75	251	251
Days /Year 3	60		88		88	88	88	60	60	250	250

Table 6. Scenario 2 - Summary of Commercial Marine Emissions for Tier II Engines
Air Conformity Analysis
DSCP Edgemore Facility, DE

Dredge Vessel Emission Summary															
Days/Year	Year 1				Annual Total	Year 2				Annual Total	Year 3				Annual Total
	90		75			60									
Pollutants	Dredging		Idling		Annual Total	Dredging		Idling		Annual Total	Dredging		Idling		Annual Total
	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	
NOx	0.93	83	0.034	3.1	87	0.93	70	0.034	2.58	72	0.93	56	0.034	2.1	58
CO	0.47	42	0.020	1.8	44	0.47	35	0.020	1.47	37	0.47	28	0.020	1.2	29
PM	0.047	4.2	0.0020	0.18	4.4	0.047	3.5	0.0020	0.15	3.67	0.047	2.8	0.0020	0.12	3

Crane Emission Emission Summary															
Days/Year	Year 1				Annual Total	Year 2				Annual Total	Year 3				Annual Total
	118		103			88									
Pollutants	Crane in operation		Idling		Annual Total	Crane in operation		Idling		Annual Total	Dredging		Idling		Annual Total
	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)		Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	
NOx	0.025	2.2	0.0015	0.14	2.4	0.026	1.9	0.0016	0.12	2.1	0.028	1.7	0.0017	0.10	1.8
CO	0.012	1.1	0.00086	0.077	1.2	0.013	0.98	0.00090	0.067	1.0	0.014	0.84	0.0010	0.057	0.9
PM	0.0012	0.11	0.000086	0.0077	0.12	0.0013	0.10	0.000090	0.0067	0.10	0.0014	0.084	0.000096	0.0057	0.090

Diesel Hammer Emission Summary						
Days/Year	Year 1		Year 2		Year 3	
	90		75		60	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
	NOx	0.0041	0.37	0.0041	0.30	0.0041
CO	0.0026	0.23	0.0026	0.19	0.0026	0.16
PM	0.00026	0.023	0.00026	0.019	0.00026	0.016

Table 6. Scenario 2 - Summary of Commercial Marine Emissions for Tier II Engines
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

2 x Tugboat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	118		103		88	
	Tugboats (2)		Tugboats (2)		Tugboats (2)	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.039	4.6	0.039	4.0	0.039	3.4
CO	0.025	2.9	0.025	2.5	0.025	2.2
PM	0.0025	0.29	0.0025	0.25	0.0025	0.22

Crew Boat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	118		103		88	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.015	1.8	0.015	1.6	0.015	1.4
CO	0.010	1.2	0.010	1.0	0.010	0.87
PM	0.0010	0.12	0.0010	0.10	0.0010	0.087

Crew-Survey Boat Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	118		103		88	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.0039	0.46	0.0039	0.40	0.0039	0.34
CO	0.0025	0.29	0.0025	0.25	0.0025	0.22
PM	0.00025	0.029	0.00025	0.025	0.00025	0.022

Power Pack Emission Summary						
	Year 1		Year 2		Year 3	
Days/Year	90		75		60	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.016	1.5	0.016	1.2	0.016	0.97
CO	0.016	1.5	0.010	0.78	0.010	0.62
PM	0.0016	0.15	0.0010	0.078	0.0010	0.062

Notes

1. Emissions factors reflect a fleet of Tier II marine engines, referenced from 40 CFR § 94.8
2. Assumes a 0.0015% sulfur concentration in fuel oil, which is the maximum allowable amount of sulfur in non-road diesel fuel according to the EPA Office of Transportation and Air Quality
3. Support Vessels (Crew Boat, Crew - Survey Boat, Tugboat and Crane) Operate for an additional 2 weeks before and after standard project schedule
4. 2 Tugboats are required for the project

Table 7. Summary of Non Road Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

D10 Bulldozer Emission Summary						
	3 Bulldozers		5 Bulldozers		3 Bulldozers	
	Year 1		Year 2		Year 3	
Days/Year	250		251		250	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.000065	0.049	0.000065	0.081	0.000065	0.049
CO	0.00061	0.46	0.00061	0.46	0.00061	0.46
SOx	0.000021	0.0052	0.000015	0.019	0.000015	0.011
CO ₂	1.7	1300	1.7	2,100	1.7	1300
VOC	0.000020	0.0050	0.000015	0.018	0.000015	0.011
PM2.5	0.000017	0.013	0.000017	0.022	0.000017	0.013

374 Excavator Emission Summary						
	3 Excavators		3 Excavators		3 Excavators	
	Year 1		Year 2		Year 3	
Days/Year	250		251		250	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.00015	0.038	0.00015	0.038	0.00015	0.038
CO	0.0014	0.36	0.0014	0.36	0.0014	0.36
SOx	0.000036	0.0090	0.000036	0.0091	0.000036	0.0090
CO ₂	4.0	990	3.9	990	4.0	990
VOC	0.000020	0.0050	0.00035	0.087	0.00035	0.087
PM2.5	0.000041	0.010	0.000041	0.010	0.000041	0.010

Table 7. Summary of Non Road Emissions
Air Conformity Analysis
DSCP Edgemoore Facility, DE

Notes:

1. Machines run for 8 hours per day for 250 days during years 1 and 3, and 251 days during year 2
2. 3 bulldozers and 3 excavators required throughout the project, plus 2 additional bulldozers required in year 2
3. Emission factors were referenced from the 2010 EPA report "Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling - Compression-Ignition" NR-009d, which summarizes the EPA NONROAD 2008a emission inventory model
4. Assuming Tier III diesel engine
5. Assumes a 0.0015% sulfur concentration in fuel oil, which is the maximum allowable amount of sulfur in non-road diesel fuel according to the EPA Office of Transportation and Air Quality. The modeled default fuel sulfur content is 2000 ppm for Tier III diesel engines 175 < hp 750
6. All PM emissions are assumed to be smaller than 10 microns (PM10) and 97% of the PM is assumed to be smaller than 2.5 microns (PM2.5)
7. Load Factor of 0.59 referenced from 2002 EPA Report 'Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling'

Table 8. Summary of On Road Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

55 Commuter On Road Emission Summary						
	Year 1		Year 2		Year 3	
Working Days/Year	250		251		250	
Pollutants	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)	Daily Emissions (Tons/Day)	Annual Emissions (Tons/Year)
NOx	0.00090	0.22	0.00090	0.23	0.00090	0.22
CO	0.011	2.8	0.011	2.8	0.011	2.8
SOx	-	-	-	-	-	-
CO ₂	0.49	120	0.49	120	0.49	120
VOC	0.0012	0.29	0.0012	0.29	0.0012	0.29
PM2.5	0.0000043	0.0011	0.0000043	0.0011	0.0000043	0.0011
PM10	0.0000046	0.0012	0.0012	0.0012	0.0012	0.0012

Notes:

1. Non Diesel Emission Factors are obtained from 2008 EPA Report ' Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Cars and Light Trucks'
2. Passengers are assumed to travel in ' Light Trucks'
3. The average commuting distance is 7.8 miles, one way
4. Commuting Distance is referenced from 2015 Brookings Report ' The growing distance between people and jobs in metropolitan America'
5. Duration of work is assumed to be the entire working year

Table 8. Summary of On Road Emissions
 Air Conformity Analysis
 DSCP Edgemoore Facility, DE

Tier 0 - Heavy Duty Diesel On Road Emission Summary			
Year 2			
Working Days/Year	251		
Pollutants	Daily Emissions per Truck (Tons/Day)	Annual Emissions per Truck (Tons/Year)	Total Annual Emissions from a fleet of Trucks (Tons/Year)
NOx	0.012	0.16	3.0
CO	0.0032	0.044	0.80
PM	0.00030	0.0042	0.075

Notes:

1. Diesel Emission Factors are obtained from 2008 EPA Report ' Average In-Use Emissions from Heavy Duty Trucks'
2. Machines run for 8 hours per day for 251 days
3. Assumes a 0.0015% sulfur concentration in fuel oil, which is the maximum allowable amount of sulfur in non-road diesel fuel according to the EPA Office of Transportation and Air Quality. The modeled default fuel sulfur content is 2000 ppm for tier 3 diesel engines 175 <hp 750
4. All PM emissions are assumed to be smaller than 10 microns (PM10) and 97% of the PM is assumed to be smaller than 2.5 microns (PM2.5)
5. Load Factor of 0.59 referenced from 2002 EPA Report 'Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modelii
6. The average truck capacity is assumed to be 14 CY
7. The total volume of fill required is estimated to be 145,893 CY, therefore a fleet of 18 trucks provides a realistic representation of the project requirements, based on the assumptions made above