Appendix I
Construction – Conformity Analysis

Alternative 2

	Staten Island Breakwaters Construction Activity Annual Emissions (ton/yr)				
Year	**PM2.5**	**PM10**	**NOx**	**VOC**	**CO**
2018	0.0	0.0	0.0	0.0	0.0
2019	1.7	1.8	36.3	1.5	4.9
2020	3.1	3.3	66.2	3.0	12.7
2021+	<0.1	<0.1	0.1	<0.1	0.2

Staten Island Breakwaters Non-Road Emissions Factors

Equipment Lookup	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	PM2.5	PM10	NOx	VOC	CO	SO2
AC_10	Air Compresso	AC		Diesel	10	0.150	0.154	1.860	0.241	1.930	0.002
BD_250	Bulldozer	BD		Diesel	250	0.016	0.017	0.614	0.086	0.191	0.002
CC_650	ge Crawler Cra	CC	) T Crane on Ba	Diesel	650	0.013	0.013	0.995	0.071	0.363	0.002
EX_330	Excavator	EX		Diesel	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL_200	ont End Loade	FEL		Diesel	200	0.017	0.018	0.807	0.093	0.270	0.002
FEL_300	ont End Loade	FEL		Diesel	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
DRI_450	Drill Rig	DRI		Diesel	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA_200	Mobile Crane	CRA		Diesel	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP_80	sphalt Laying E	ASP		Diesel	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL_80	Roller	ROL		Diesel	80	0.039	0.040	1.040	0.109	1.020	0.003
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
TB_650	Tug Boat	TB	40' Tug Boat	Diesel	650	0.492	0.537	9.843	0.373	0.820	0.005
TB_1200	Tug Boat	TB	40' Tug Boat	Diesel	1200	0.492	0.537	9.843	0.373	0.820	0.005
TBG_120	Tug Boat	TBG	40' Tug Boat	Diesel	120	0.166	0.179	7.457	0.201	1.268	0.005

			PM2.5	PM10	NOx	VOC	CO	SO2
Tug Boat Emis	Main Engines	g/hp-hr	0.49	0.54	9.84	0.37	0.82	0.01
	Aux Generator	g/hp-hr	0.17	0.18	7.46	0.20	1.27	0.01
		g/hr	610.46	665.76	12706.73	471.58	1136.45	6.64

		Data					
Equipment Code	Size (hp)	Max of PM2.5	Max of PM10	Max of NOx	Max of VOC	Max of CO	Max of SO2
AC	10	0.150	0.154	1.860	0.241	1.930	0.002
CC	650	0.013	0.013	0.995	0.071	0.363	0.002
TB	1200	0.492	0.537	9.843	0.373	0.820	0.005
	650	0.492	0.537	9.843	0.373	0.820	0.005
EX	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL	200	0.017	0.018	0.807	0.093	0.270	0.002
	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN	100	0.029	0.030	1.600	0.179	0.884	0.002
TBG	120	0.166	0.179	7.457	0.201	1.268	0.005
BD	250	0.016	0.017	0.614	0.086	0.191	0.002
DRI	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL	80	0.039	0.040	1.040	0.109	1.020	0.003

	Data				
Year	Sum of CO	Sum of VOC	Sum of NOx	Sum of PM10	Sum of PM2.5
2018	0.000	0.000	0.000	0.000	0.000
2019	1.923	0.549	10.663	0.453	0.419
2020	2.878	0.805	12.032	0.450	0.419
Grand Total	4.800	1.355	22.695	0.904	0.837

single=	7 am to 3 pm
extended=	7 am to 6 pm
double =	7 am to 11 pm

	Hours
single	8
extended	10
double	16

Staten Island Breakwaters - Anticipated Construction Schedule & Equipment Emissions

															Emission Rates (g/hp-hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Shift	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	Quantity	Peak Daily Use	Average Use for Duration	Elevation and other Notes	Expected Annual Energy Use (hp-hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1a	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%		369600	0.015	0.016	0.832	0.086	0.331	0.006	0.006	0.339	0.035	0.135	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%		211200	0.017	0.018	0.807	0.093	0.270	0.004	0.004	0.188	0.022	0.063	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		52800	0.029	0.030	1.600	0.179	0.884	0.002	0.002	0.093	0.010	0.051	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%		5280	0.150	0.154	1.860	0.241	1.930	0.001	0.001	0.011	0.001	0.011	2019
1b	Shoreline Construction	Project Site	1/1/2020	12/31/2020	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%		1467200	0.015	0.016	0.832	0.086	0.331	0.024	0.025	1.346	0.139	0.535	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%		1673600	0.017	0.018	0.807	0.093	0.270	0.032	0.033	1.489	0.172	0.498	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		418400	0.029	0.030	1.600	0.179	0.884	0.013	0.014	0.738	0.083	0.408	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%		41840	0.150	0.154	1.860	0.241	1.930	0.007	0.007	0.086	0.011	0.089	2020
2a	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%		845000	0.013	0.013	0.995	0.071	0.363	0.012	0.012	0.927	0.066	0.338	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%		275357	0.492	0.537	9.843	0.373	0.820	0.149	0.163	2.988	0.113	0.249	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%		390000	0.492	0.537	9.843	0.373	0.820	0.212	0.231	4.232	0.160	0.353	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%		39000	0.166	0.179	7.457	0.201	1.268	0.007	0.008	0.321	0.009	0.054	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%		0	0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%		0	0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2019
2b	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%		715000	0.013	0.013	0.995	0.071	0.363	0.010	0.010	0.784	0.056	0.286	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%		232995	0.492	0.537	9.843	0.373	0.820	0.126	0.138	2.528	0.096	0.211	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%		330000	0.492	0.537	9.843	0.373	0.820	0.179	0.195	3.581	0.136	0.298	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%		33000	0.166	0.179	7.457	0.201	1.268	0.006	0.007	0.271	0.007	0.046	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%		0	0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%		0	0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2020
3a	Water Hub	Project Site	6/1/2019	12/31/2019	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%		547200	0.018	0.018	1.550	0.106	0.454	0.011	0.011	0.935	0.064	0.274	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%		243200	0.010	0.010	0.615	0.068	0.136	0.003	0.003	0.165	0.018	0.036	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%		97280	0.042	0.043	1.300	0.132	1.210	0.004	0.005	0.139	0.014	0.130	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Roller	ROL	Roller	Diesel	80	1	100%	100%		97280	0.039	0.040	1.040	0.109	1.020	0.004	0.004	0.112	0.012	0.109	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		121600	0.029	0.030	1.600	0.179	0.884	0.004	0.004	0.214	0.024	0.118	2019
3b	Water Hub	Project Site	1/1/2020	5/31/2020	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%		388800	0.018	0.018	1.550	0.106	0.454	0.008	0.008	0.664	0.045	0.195	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%		172800	0.010	0.010	0.615	0.068	0.136	0.002	0.002	0.117	0.013	0.026	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%		69120	0.042	0.043	1.300	0.132	1.210	0.003	0.003	0.099	0.010	0.092	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Roller	ROL	Roller	Diesel	80	1	100%	100%		69120	0.039	0.040	1.040	0.109	1.020	0.003	0.003	0.079	0.008	0.078	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		86400	0.029	0.030	1.600	0.179	0.884	0.003	0.003	0.152	0.017	0.084	2020
			1/1/2018	1/1/2018																	0.000	0.000	0.000	0.000	0.000	2018
4	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Bulldozer	BD	Bulldozer	Diesel	250	1	100%	100%		56000	0.016	0.017	0.614	0.086	0.191	0.001	0.001	0.038	0.005	0.012	2020
	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Front End Loader	FEL	Front End Loader	Diesel	300	1	100%	100%		67200	0.017	0.018	0.807	0.093	0.270	0.001	0.001	0.060	0.007	0.020	2020

Crew Boat Distance	3	mi
Average Speed	6.4	knots
RT Time	0.81	hr
	49	min

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.089	0.097	1.808	0.079	0.439
2020	0.794	0.863	16.087	0.699	3.910
Grand Total	0.883	0.959	17.895	0.777	4.349

Staten Island Breakwaters - Truck Cruise Emissions

												Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	# of Workers per day	Monthly Worker Trips	# of Workers	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	15		291	25	1.0112	25.28	7356.48	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	15		279	25	1.0112	25.28	7053.12	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	15		544	25	1.0112	25.28	13752.3	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.04	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	15		1355	25	1.0112	25.28	34254.4	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.10	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	15		1671	25	1.0112	25.28	42242.9	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.13	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2020
2	Breakwater Construction	Breakwater Construction	Project Site	6/1/2019	11/30/2019	11		1207	25	1.0112	25.28	30513	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.09	2019
	Breakwater Construction	Breakwater Construction	Project Site	6/1/2020	10/31/2020	11		1021	25	1.0112	25.28	25810.9	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.08	2020
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	15		1924	25	1.0112	25.28	48638.7	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.15	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	15		1367	25	1.0112	25.28	34557.8	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.11	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	6		223	25	1.0112	25.28	5637.44	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2020

Emissions Rates for Auto Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph
Trucks origin/destination assumed to be within 1 hour travel time from project site

AVO 1.09
Auto Share 92%

Trip Distance: 12.64

**Source: From Transportation Energy Data Book - Edition 34, Table 8.9 (Trip Statistics by Trip Purpose)*
X:\DEPARTMENTS\Air Quality\Resources\Energy\Transportation Energy Data Book (ORNL)

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.089	0.097	1.808	0.079	0.439
2020	0.794	0.863	16.087	0.699	3.910
Grand Total	0.883	0.959	17.895	0.777	4.349

Staten Island Breakwaters - Truck Cruise Emissions

													Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	Truck Type	Truck Code	Daily Trucks	Total Deliveries for Period	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	3	198	25	7.344	184	36352.8	0.56	0.61	11.30	0.49	2.75	0.02	0.02	0.45	0.02	0.11	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	Dump Truck	DT	3	69	25	7.344	184	12668.4	0.56	0.61	11.30	0.49	2.75	0.01	0.01	0.16	0.01	0.04	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	2	44	25	7.344	184	8078.4	0.56	0.61	11.30	0.49	2.75	0.00	0.01	0.10	0.00	0.02	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	Dump Truck	DT	2	86	25	7.344	184	15789.6	0.56	0.61	11.30	0.49	2.75	0.01	0.01	0.20	0.01	0.05	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	15	1605	25	7.344	184	294678	0.56	0.61	11.30	0.49	2.75	0.18	0.20	3.67	0.16	0.89	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	7	462	25	7.344	184	84823.2	0.56	0.61	11.30	0.49	2.75	0.05	0.06	1.06	0.05	0.26	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	19	2508	25	7.344	184	460469	0.56	0.61	11.30	0.49	2.75	0.28	0.31	5.74	0.25	1.39	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	3	198	25	7.344	184	36352.8	0.56	0.61	11.30	0.49	2.75	0.02	0.02	0.45	0.02	0.11	2020
2	Breakwater Construction	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0	25	7.344	184	0	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	2.5	380	25	0.6	15	5700	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.07	0.00	0.02	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	2.5	270	25	0.6	15	4050	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.05	0.00	0.01	2020
	Water Hub	Water Hub	**Project Site**	**6/1/2019**	**12/31/2019**	Tracotr Trailer	TT	**2.5**	380	25	10	250	95000	0.56	0.61	11.30	0.49	2.75	0.06	0.06	1.18	0.05	0.29	2019
	Water Hub	Water Hub	**Project Site**	**1/1/2020**	**5/31/2020**	Tracotr Trailer	TT	**2.5**	270	25	10	250	67500	0.56	0.61	11.30	0.49	2.75	0.04	0.05	0.84	0.04	0.20	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	39	1716	25	7.344	184	315058	0.56	0.61	11.30	0.49	2.75	0.19	0.21	3.92	0.17	0.95	2020

Emissions Rates for Heavy Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph

Trucks origin/destination assumed to be within 1 hour travel time from project site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.002	0.002	0.026	0.003	0.007
2020	0.002	0.003	0.039	0.004	0.011
Grand Total	0.004	0.004	0.066	0.007	0.018

Staten Island Breakwaters - Construction Truck Idle Emissions

										Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	On-Site Vehicle Idle Time (hr)	Total On-Site Idle Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	198	0.05	9.9	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	1/31/2020	Dump Truck	DT	69	0.05	3.45	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	44	0.05	2.2	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	2/29/2020	Dump Truck	DT	86	0.05	4.3	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	1605	0.05	80.25	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	462	0.05	23.1	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	2508	0.05	125.4	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	198	0.05	9.9	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
2	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0.05	0	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	380	1	380	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.02	0.00	0.01	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	270	1	270	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.02	0.00	0.00	2020
	Water Hub	Project Site	6/1/2019	12/31/2019	Tracotr Trailer	TT	380	0.05	19	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Tracotr Trailer	TT	270	0.05	13.5	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
4	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	1716	0.05	85.8	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020

Idle Emissions Rates for Heavy Vehicles

Notes

Concrete Trucks are assumed to idle for 1 hour per trip on site

Dump Truck / Flat Bed Truck are assumed to idle for 3 minutes per trip on site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of CO	Sum of VOC
2019	1.051	1.146	21.871	1.956	0.812
2020	1.051	1.146	21.871	1.956	0.812
Grand Total	2.101	2.292	43.742	3.912	1.623

Staten Island Breakwaters - Tug Boat Delivery Emissions

												Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	Round Trip Distance (mi)	VMT	Average Speed (knots)	Travel Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
2a	Breakwaters	Project Site	6/1/2019	11/30/2019	Tug Boat/Barge	TB	115	100	11500	6.4	1561.4	610.46	665.76	12706.73	471.58	1136.45	1.05	1.15	21.87	0.81	1.96	2019
2b	Breakwaters	Project Site	6/1/2020	10/31/2020	Tug Boat/Barge	TB	115	100	11500	6.4	1561.4	610.46	665.76	12706.73	471.58	1136.45	1.05	1.15	21.87	0.81	1.96	2020
						Total	230															

Notes

Tugs assumed to travel at an average speed of 6.4 knots

Round Trip Distance measured between site and Tilcon Quarry Sheafe Road New Hamburg, NY 12590

Total Square Footage (gsf)
8,900

2005 Energy Consumption Factor for New York:

	60.3	tho Btu/yr-sqft

Heating Values

Fuel Oil	140,000	Btu/gal
Natural Gas	1,020	Btu/scf

Sulfur Content	15 ppm

	Annual Consumption	
Energy	537	MMBtu/yr
Fuel Oil	3,833	gal/yr
Natural Gas	52,615	scf/yr

Emission Factors (lb/MMBtu)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil	0.0075	0.0075	0.0980	0.0054	0.0824	0.0006
Natural Gas	0.0121	0.0121	0.1286	0.0178	0.0357	0.0015

Emission (lb/yr)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil	4.0	4.0	52.6	2.9	44.2	0.3
Natural Gas	6.5	6.5	69.0	9.6	19.2	0.8

Proposed Event/Activity	Season/Month	Frequency	Approximate Attendance	Likely Travel Method	Annual Attendance	Annual Vehicles: Autos	Annual Vehicles: Bus	
Tree planting events	Spring/Fall	Twice per year	100-300	Auto/bus	600	343	35	Conservatively includes maximum attendance utilizing both auto and bus
Beach cleanups with schools, Boy Scouts, and Girl Scouts	Throughout the year	Ideally three times per week and as scheduled	Groups of 10 to 50	Auto	7800	4,457		
First day of season beach walks	Spring, Summer, Fall, and Winter	Four times per year	5-25	Auto	100	57		
Earth/Arbor Day activities	April	One day or week per year	25-100	Auto/Bus	700	400	41	Conservatively includes maximum attendance utilizing both auto and bus
DEC citizen science Horseshoe crab monitoring	May-June	Once a year	5-15	Auto	15	9		
CHP Dunes, Drawing, and Dendrology "Walk and talk"	May-September	Once per month (Sunday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology EarthART	May-September	Once per month (Wednesday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Chalk and talk"	May-September	Once per month (weekday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Coastal Crafting"	May-September	Once per week (Saturday)	5-25	Auto	300	171		
Shore birding talks and walks	Spring and Fall	Four times per year	5-25	Auto	100	57		
Exhibitions	Throughout the year	Shows generally run for 4-6 weeks	XX	Auto				
Greenbelt Education extension (maritime focus)	July-August (summer came and school field trips during the school year)		Summer Camp 20-25/Field Trips – 10-15	Auto/Bus	3825		225	9 weeks (5 days per week) summer camp; 180 school days; exclusively bus
						6,009	301	
						Annual VMT		
						47,348	2,376	

	Emission Factors (g/mi)				
	PM2.5	PM10	NOx	VOC	CO
Auto	0.008	0.009	0.250	0.066	2.758
Bus	*0.442*	*0.481*	*16.127*	*1.018*	*6.011*

Emissions (ton)				
0.002	0.002	0.055	0.006	0.160

School Bus Occupancy	**17**
Auto Occupancy	**1.75**

CEQR Table 18-7
Average One-Way Taxi Trip Lengths (Miles)

		Manhattan	*Other NYC*	*Unknown Destination*
Origin	***Manhattan***	2	9	2.32
	Other NYC	11	6	7.88
	Unknown Origin	2.32	7.88	N/A

Alternative 3

	Staten Island Breakwaters Construction Activity Annual Emissions (ton/yr)				
Year	**PM2.5**	**PM10**	**NOx**	**VOC**	**CO**
2018	0.0	0.0	0.0	0.0	0.0
2019	1.6	1.7	34.5	1.4	4.4
2020	1.9	2.0	39.9	1.6	5.7
2021+	<0.1	<0.1	0.1	<0.1	0.2

Staten Island Breakwaters Non-Road Emissions Factors

Equipment Lookup	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	PM2.5	PM10	NOx	VOC	CO	SO2
AC_10	Air Compresso	AC		Diesel	10	0.150	0.154	1.860	0.241	1.930	0.002
BD_250	Bulldozer	BD		Diesel	250	0.016	0.017	0.614	0.086	0.191	0.002
CC_650	ge Crawler Cra	CC	) T Crane on Ba	Diesel	650	0.013	0.013	0.995	0.071	0.363	0.002
EX_330	Excavator	EX		Diesel	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL_200	ont End Loade	FEL		Diesel	200	0.017	0.018	0.807	0.093	0.270	0.002
FEL_300	ont End Loade	FEL		Diesel	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
DRI_450	Drill Rig	DRI		Diesel	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA_200	Mobile Crane	CRA		Diesel	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP_80	sphalt Laying E	ASP		Diesel	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL_80	Roller	ROL		Diesel	80	0.039	0.040	1.040	0.109	1.020	0.003
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
TB_650	Tug Boat	TB	40' Tug Boat	Diesel	650	0.492	0.537	9.843	0.373	0.820	0.005
TB_1200	Tug Boat	TB	40' Tug Boat	Diesel	1200	0.492	0.537	9.843	0.373	0.820	0.005
TBG_120	Tug Boat	TBG	40' Tug Boat	Diesel	120	0.166	0.179	7.457	0.201	1.268	0.005

			PM2.5	PM10	NOx	VOC	CO	SO2
Tug Boat Emis	Main Engines	g/hp-hr	0.49	0.54	9.84	0.37	0.82	0.01
	Aux Generator	g/hp-hr	0.17	0.18	7.46	0.20	1.27	0.01
		g/hr	610.46	665.76	12706.73	471.58	1136.45	6.64

		Data					
Equipment Code	Size (hp)	Max of PM2.5	Max of PM10	Max of NOx	Max of VOC	Max of CO	Max of SO2
AC	10	0.150	0.154	1.860	0.241	1.930	0.002
CC	650	0.013	0.013	0.995	0.071	0.363	0.002
TB	1200	0.492	0.537	9.843	0.373	0.820	0.005
	650	0.492	0.537	9.843	0.373	0.820	0.005
EX	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL	200	0.017	0.018	0.807	0.093	0.270	0.002
	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN	100	0.029	0.030	1.600	0.179	0.884	0.002
TBG	120	0.166	0.179	7.457	0.201	1.268	0.005
BD	250	0.016	0.017	0.614	0.086	0.191	0.002
DRI	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL	80	0.039	0.040	1.040	0.109	1.020	0.003

	Data				
Year	Sum of CO	Sum of VOC	Sum of NOx	Sum of PM10	Sum of PM2.5
2018	0.000	0.000	0.000	0.000	0.000
2019	1.662	0.481	10.032	0.440	0.406
2020	1.348	0.401	8.374	0.371	0.342
Grand Total	3.010	0.881	18.406	0.812	0.748

single=	7 am to 3 pm
extended=	7 am to 6 pm
double =	7 am to 11 pm

	Hours
single	8
extended	10
double	16

Staten Island Breakwaters - Anticipated Construction Schedule & Equipment Emissions

														Expected Annual Energy Use (hp-hr)	Emission Rates (g/hp-hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Shift	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	Quantity	Peak Daily Use	Average Use for Duration	Elevation and other Notes		PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1a	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%			0.015	0.016	0.832	0.086	0.331	0.000	0.000	0.000	0.000	0.000	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%			0.017	0.018	0.807	0.093	0.270	0.000	0.000	0.000	0.000	0.000	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%			0.029	0.030	1.600	0.179	0.884	0.000	0.000	0.000	0.000	0.000	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%			0.150	0.154	1.860	0.241	1.930	0.000	0.000	0.000	0.000	0.000	2019
1b	Shoreline Construction	Project Site	1/1/2020	12/31/2020	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%			0.015	0.016	0.832	0.086	0.331	0.000	0.000	0.000	0.000	0.000	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%			0.017	0.018	0.807	0.093	0.270	0.000	0.000	0.000	0.000	0.000	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%			0.029	0.030	1.600	0.179	0.884	0.000	0.000	0.000	0.000	0.000	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%			0.150	0.154	1.860	0.241	1.930	0.000	0.000	0.000	0.000	0.000	2020
2a	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%		845000	0.013	0.013	0.995	0.071	0.363	0.012	0.012	0.927	0.066	0.338	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%		275357	0.492	0.537	9.843	0.373	0.820	0.149	0.163	2.988	0.113	0.249	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%		390000	0.492	0.537	9.843	0.373	0.820	0.212	0.231	4.232	0.160	0.353	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%		39000	0.166	0.179	7.457	0.201	1.268	0.007	0.008	0.321	0.009	0.054	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%		0	0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%		0	0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2019
2b	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%		715000	0.013	0.013	0.995	0.071	0.363	0.010	0.010	0.784	0.056	0.286	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%		232995	0.492	0.537	9.843	0.373	0.820	0.126	0.138	2.528	0.096	0.211	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%		330000	0.492	0.537	9.843	0.373	0.820	0.179	0.195	3.581	0.136	0.298	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%		33000	0.166	0.179	7.457	0.201	1.268	0.006	0.007	0.271	0.007	0.046	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%		0	0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%		0	0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2020
3	Water Hub	Project Site	6/1/2019	12/31/2019	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%		547200	0.018	0.018	1.550	0.106	0.454	0.011	0.011	0.935	0.064	0.274	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%		243200	0.010	0.010	0.615	0.068	0.136	0.003	0.003	0.165	0.018	0.036	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%		97280	0.042	0.043	1.300	0.132	1.210	0.004	0.005	0.139	0.014	0.130	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Roller	ROL	Roller	Diesel	80	1	100%	100%		97280	0.039	0.040	1.040	0.109	1.020	0.004	0.004	0.112	0.012	0.109	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		121600	0.029	0.030	1.600	0.179	0.884	0.004	0.004	0.214	0.024	0.118	2019
3b	Water Hub	Project Site	1/1/2020	5/31/2020	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%		388800	0.018	0.018	1.550	0.106	0.454	0.008	0.008	0.664	0.045	0.195	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%		172800	0.010	0.010	0.615	0.068	0.136	0.002	0.002	0.117	0.013	0.026	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%		69120	0.042	0.043	1.300	0.132	1.210	0.003	0.003	0.099	0.010	0.092	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Roller	ROL	Roller	Diesel	80	1	100%	100%		69120	0.039	0.040	1.040	0.109	1.020	0.003	0.003	0.079	0.008	0.078	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		86400	0.029	0.030	1.600	0.179	0.884	0.003	0.003	0.152	0.017	0.084	2020
			1/1/2018	1/1/2018																	0.000	0.000	0.000	0.000	0.000	2018
4	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Bulldozer	BD	Bulldozer	Diesel	250	1	100%	100%		56000	0.016	0.017	0.614	0.086	0.191	0.001	0.001	0.038	0.005	0.012	2020
	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Front End Loader	FEL	Front End Loader	Diesel	300	1	100%	100%		67200	0.017	0.018	0.807	0.093	0.270	0.001	0.001	0.060	0.007	0.020	2020

Crew Boat Distance	3	mi
Average Speed	6.4	knots
RT Time	0.81	hr
	49	min

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.062	0.067	1.254	0.054	0.305
2020	0.238	0.258	4.816	0.209	1.170
Grand Total	0.299	0.325	6.070	0.264	1.475

Staten Island Breakwaters - Truck Cruise Emissions

												Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	# of Workers per day	Monthly Worker Trips	# of Workers	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	15		836	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	15		291	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	15		279	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	15		544	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	15		1355	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	15		1671	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
2	Breakwater Construction	Breakwater Construction	Project Site	6/1/2019	11/30/2019	11		1207	25	1.0112	25.28	30513	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.09	2019
	Breakwater Construction	Breakwater Construction	Project Site	6/1/2020	10/31/2020	11		1021	25	1.0112	25.28	25810.9	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.08	2020
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	15		1924	25	1.0112	25.28	48638.7	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.15	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	15		1367	25	1.0112	25.28	34557.8	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.11	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	6		223	25	1.0112	25.28	5637.44	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2020

Emissions Rates for Auto Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph
Trucks origin/destination assumed to be within 1 hour travel time from project site

AVO 1.09
Auto Share 92%

Trip Distance: 12.64

**Source: From Transportation Energy Data Book - Edition 34, Table 8.9 (Trip Statistics by Trip Purpose)*
X:\DEPARTMENTS\Air Quality\Resources\Energy\Transportation Energy Data Book (ORNL)

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.062	0.067	1.254	0.054	0.305
2020	0.238	0.258	4.816	0.209	1.170
Grand Total	0.299	0.325	6.070	0.264	1.475

Staten Island Breakwaters - Truck Cruise Emissions

													Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	Truck Type	Truck Code	Daily Trucks	Total Deliveries for Period	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	3	198	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	Dump Truck	DT	3	69	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	2	44	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	Dump Truck	DT	2	86	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	15	1605	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	7	462	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	19	2508	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	3	198	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
2	Breakwater Construction	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0	25	7.344	184	0	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	2.5	380	25	0.6	15	5700	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.07	0.00	0.02	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	2.5	270	25	0.6	15	4050	0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.05	0.00	0.01	2020
	Water Hub	Water Hub	**Project Site**	**6/1/2019**	**12/31/2019**	Tracotr Trailer	TT	**2.5**	380	25	10	250	95000	0.56	0.61	11.30	0.49	2.75	0.06	0.06	1.18	0.05	0.29	2019
	Water Hub	Water Hub	**Project Site**	**1/1/2020**	**5/31/2020**	Tracotr Trailer	TT	**2.5**	270	25	10	250	67500	0.56	0.61	11.30	0.49	2.75	0.04	0.05	0.84	0.04	0.20	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	39	1716	25	7.344	184	315058	0.56	0.61	11.30	0.49	2.75	0.19	0.21	3.92	0.17	0.95	2020

Emissions Rates for Heavy Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph

Trucks origin/destination assumed to be within 1 hour travel time from project site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.002	0.002	0.025	0.003	0.007
2020	0.001	0.002	0.024	0.003	0.006
Grand Total	0.003	0.003	0.049	0.005	0.013

Staten Island Breakwaters - Construction Truck Idle Emissions

										Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	On-Site Vehicle Idle Time (hr)	Total On-Site Idle Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	198	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	1/31/2020	Dump Truck	DT	69	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	44	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	2/29/2020	Dump Truck	DT	86	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	1605	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	462	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	2508	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	198	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
2	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0.05	0	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	380	1	380	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.02	0.00	0.01	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	270	1	270	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.02	0.00	0.00	2020
	Water Hub	Project Site	6/1/2019	12/31/2019	Tracotr Trailer	TT	380	0.05	19	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Tracotr Trailer	TT	270	0.05	13.5	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
4	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	1716	0.05	85.8	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020

Idle Emissions Rates for Heavy Vehicles

Notes

Concrete Trucks are assumed to idle for 1 hour per trip on site

Dump Truck / Flat Bed Truck are assumed to idle for 3 minutes per trip on site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of CO	Sum of VOC
2019	1.051	1.146	21.871	1.956	0.812
2020	1.051	1.146	21.871	1.956	0.812
Grand Total	2.101	2.292	43.742	3.912	1.623

Staten Island Breakwaters - Tug Boat Delivery Emissions

												Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	Round Trip Distance (mi)	VMT	Average Speed (knots)	Travel Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
2a	Breakwaters	Project Site	6/1/2019	11/30/2019	Tug Boat/Barge	TB	115	100	11500	6.4	1561.4	610.46	665.76	12706.73	471.58	1136.45	1.05	1.15	21.87	0.81	1.96	2019
2b	Breakwaters	Project Site	6/1/2020	10/31/2020	Tug Boat/Barge	TB	115	100	11500	6.4	1561.4	610.46	665.76	12706.73	471.58	1136.45	1.05	1.15	21.87	0.81	1.96	2020
						Total	230															

Notes

Tugs assumed to travel at an average speed of 6.4 knots

Round Trip Distance measured between site and Tilcon Quarry Sheafe Road New Hamburg, NY 12590

Total Square Footage (gsf)
8,900

2005 Energy Consumption Factor for New York:

	60.3	tho Btu/yr-sqft

Heating Values

Fuel Oil	140,000	Btu/gal
Natural Gas	1,020	Btu/scf

Sulfur Content	15 ppm

	Annual Consumption	
Energy	537	MMBtu/yr
Fuel Oil	3,833	gal/yr
Natural Gas	52,615	scf/yr

Emission Factors (lb/MMBtu)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil	0.0075	0.0075	0.0980	0.0054	0.0824	0.0006
Natural Gas	0.0121	0.0121	0.1286	0.0178	0.0357	0.0015

Emission (lb/yr)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil	4.0	4.0	52.6	2.9	44.2	0.3
Natural Gas	6.5	6.5	69.0	9.6	19.2	0.8

Proposed Event/Activity	Season/Month	Frequency	Approximate Attendance	Likely Travel Method	Annual Attendance	Annual Vehicles: Autos	Annual Vehicles: Bus	
Tree planting events	Spring/Fall	Twice per year	100-300	Auto/bus	600	343	35	Conservatively includes maximum attendance utilizing both auto and bus
Beach cleanups with schools, Boy Scouts, and Girl Scouts	Throughout the year	Ideally three times per week and as scheduled	Groups of 10 to 50	Auto	7800	4,457		
First day of season beach walks	Spring, Summer, Fall, and Winter	Four times per year	5-25	Auto	100	57		
Earth/Arbor Day activities	April	One day or week per year	25-100	Auto/Bus	700	400	41	Conservatively includes maximum attendance utilizing both auto and bus
DEC citizen science Horseshoe crab monitoring	May-June	Once a year	5-15	Auto	15	9		
CHP Dunes, Drawing, and Dendrology "Walk and talk"	May-September	Once per month (Sunday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology EarthART	May-September	Once per month (Wednesday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Chalk and talk"	May-September	Once per month (weekday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Coastal Crafting"	May-September	Once per week (Saturday)	5-25	Auto	300	171		
Shore birding talks and walks	Spring and Fall	Four times per year	5-25	Auto	100	57		
Exhibitions	Throughout the year	Shows generally run for 4-6 weeks	XX	Auto				
Greenbelt Education extension (maritime focus)	July-August (summer came and school field trips during the school year)		Summer Camp 20-25/Field Trips – 10-15	Auto/Bus	3825		225	9 weeks (5 days per week) summer camp; 180 school days; exclusively bus
						6,009	301	
						Annual VMT		
						47,348	2,376	

	Emission Factors (g/mi)				
	PM2.5	PM10	NOx	VOC	CO
Auto	0.008	0.009	0.250	0.066	2.758
Bus	*0.442*	*0.481*	*16.127*	*1.018*	*6.011*

Emissions (ton)				
0.002	0.002	0.055	0.006	0.160

School Bus Occupancy	**17**
Auto Occupancy	**1.75**

CEQR Table 18-7
Average One-Way Taxi Trip Lengths (Miles)

		Manhattan	*Other NYC*	*Unknown Destination*
Origin	***Manhattan***	2	9	2.32
	Other NYC	11	6	7.88
	Unknown Origin	2.32	7.88	N/A

Alternative 4

	Staten Island Breakwaters Construction Activity Annual Emissions (ton/yr)				
Year	**PM2.5**	**PM10**	**NOx**	**VOC**	**CO**
2018	<0.1	<0.1	<0.1	<0.1	<0.1
2019	0.1	0.1	1.7	0.1	0.5
2020	1.2	1.3	26.2	1.4	7.0
2021+	0.0	0.0	0.0	0.0	0.0

Staten Island Breakwaters Non-Road Emissions Factors

Equipment Lookup	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	PM2.5	PM10	NOx	VOC	CO	SO2
AC_10	Air Compresso	AC		Diesel	10	0.150	0.154	1.860	0.241	1.930	0.002
BD_250	Bulldozer	BD		Diesel	250	0.016	0.017	0.614	0.086	0.191	0.002
CC_650	ge Crawler Cra	CC	) T Crane on Ba	Diesel	650	0.013	0.013	0.995	0.071	0.363	0.002
EX_330	Excavator	EX		Diesel	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL_200	ont End Loade	FEL		Diesel	200	0.017	0.018	0.807	0.093	0.270	0.002
FEL_300	ont End Loade	FEL		Diesel	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
DRI_450	Drill Rig	DRI		Diesel	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA_200	Mobile Crane	CRA		Diesel	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP_80	sphalt Laying E	ASP		Diesel	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL_80	Roller	ROL		Diesel	80	0.039	0.040	1.040	0.109	1.020	0.003
GEN_100	Generator	GEN		Diesel	100	0.029	0.030	1.600	0.179	0.884	0.002
TB_650	Tug Boat	TB	40' Tug Boat	Diesel	650	0.492	0.537	9.843	0.373	0.820	0.005
TB_1200	Tug Boat	TB	40' Tug Boat	Diesel	1200	0.492	0.537	9.843	0.373	0.820	0.005
TBG_120	Tug Boat	TBG	40' Tug Boat	Diesel	120	0.166	0.179	7.457	0.201	1.268	0.005

			PM2.5	PM10	NOx	VOC	CO	SO2
Tug Boat Emis	Main Engines	g/hp-hr	0.49	0.54	9.84	0.37	0.82	0.01
	Aux Generator	g/hp-hr	0.17	0.18	7.46	0.20	1.27	0.01
		g/hr	610.46	665.76	12706.73	471.58	1136.45	6.64

		Data					
Equipment Code	Size (hp)	Max of PM2.5	Max of PM10	Max of NOx	Max of VOC	Max of CO	Max of SO2
AC	10	0.150	0.154	1.860	0.241	1.930	0.002
CC	650	0.013	0.013	0.995	0.071	0.363	0.002
TB	1200	0.492	0.537	9.843	0.373	0.820	0.005
	650	0.492	0.537	9.843	0.373	0.820	0.005
EX	350	0.015	0.016	0.832	0.086	0.331	0.002
FEL	200	0.017	0.018	0.807	0.093	0.270	0.002
	300	0.017	0.018	0.807	0.093	0.270	0.002
GEN	100	0.029	0.030	1.600	0.179	0.884	0.002
TBG	120	0.166	0.179	7.457	0.201	1.268	0.005
BD	250	0.016	0.017	0.614	0.086	0.191	0.002
DRI	450	0.018	0.018	1.550	0.106	0.454	0.002
CRA	200	0.010	0.010	0.615	0.068	0.136	0.002
ASP	80	0.042	0.043	1.300	0.132	1.210	0.003
ROL	80	0.039	0.040	1.040	0.109	1.020	0.003

	Data				
Year	Sum of CO	Sum of VOC	Sum of NOx	Sum of PM10	Sum of PM2.5
2018	0.000	0.000	0.000	0.000	0.000
2019	0.260	0.068	0.631	0.013	0.013
2020	1.530	0.405	3.658	0.079	0.077
Grand Total	1.791	0.473	4.289	0.092	0.089

single=	7 am to 3 pm
extended=	7 am to 6 pm
double =	7 am to 11 pm

	Hours
single	8
extended	10
double	16

Staten Island Breakwaters - Anticipated Construction Schedule & Equipment Emissions

														Expected Annual Energy Use (hp-hr)	Emission Rates (g/hp-hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Shift	Equipment Type	Equipment Code	Details	Engine type	Size (hp)	Quantity	Peak Daily Use	Average Use for Duration	Elevation and other Notes		PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1a	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%		369600	0.015	0.016	0.832	0.086	0.331	0.006	0.006	0.339	0.035	0.135	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%		211200	0.017	0.018	0.807	0.093	0.270	0.004	0.004	0.188	0.022	0.063	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		52800	0.029	0.030	1.600	0.179	0.884	0.002	0.002	0.093	0.010	0.051	2019
	Shoreline Construction	Project Site	10/1/2019	12/31/2019	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%		5280	0.150	0.154	1.860	0.241	1.930	0.001	0.001	0.011	0.001	0.011	2019
1b	Shoreline Construction	Project Site	1/1/2020	12/31/2020	single	Excavator	EX	Excavator	Diesel	350	2	100%	100%		1467200	0.015	0.016	0.832	0.086	0.331	0.024	0.025	1.346	0.139	0.535	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Front End Loaders	FEL	Front End Loaders	Diesel	200	2	100%	100%		1673600	0.017	0.018	0.807	0.093	0.270	0.032	0.033	1.489	0.172	0.498	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%		418400	0.029	0.030	1.600	0.179	0.884	0.013	0.014	0.738	0.083	0.408	2020
	Shoreline Construction	Project Site	1/1/2019	12/31/2020	single	Compressor	AC	Compressor	Diesel	10	1	100%	100%		41840	0.150	0.154	1.860	0.241	1.930	0.007	0.007	0.086	0.011	0.089	2020
2a	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%			0.013	0.013	0.995	0.071	0.363	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%			0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2019
	Breakwaters Construction	Project Site	6/1/2019	11/30/2019	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%			0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2019
2b	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Crane	CC	Crane Barge	Diesel	650	1	100%	100%			0.013	0.013	0.995	0.071	0.363	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Crew Boat	TB	Crew Boat	Diesel	650	1	33%	100%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TB	Tugboat-Engine	Diesel	1200	1	25%	100%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	On-Site Tugboat	TBG	Tugboat-Generator	Diesel	120	1	25%	100%			0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TB	Tugboat-Engine	Diesel	1200	1	0%	0%			0.492	0.537	9.843	0.373	0.820	0.000	0.000	0.000	0.000	0.000	2020
	Breakwaters Construction	Project Site	6/1/2020	10/31/2020	extended	Transport Barge Tgboat	TBG	Tugboat-Generator	Diesel	120	1	0%	0%			0.166	0.179	7.457	0.201	1.268	0.000	0.000	0.000	0.000	0.000	2020
3a	Water Hub	Project Site	6/1/2019	12/31/2019	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%			0.018	0.018	1.550	0.106	0.454	0.000	0.000	0.000	0.000	0.000	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%			0.010	0.010	0.615	0.068	0.136	0.000	0.000	0.000	0.000	0.000	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%			0.042	0.043	1.300	0.132	1.210	0.000	0.000	0.000	0.000	0.000	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Roller	ROL	Roller	Diesel	80	1	100%	100%			0.039	0.040	1.040	0.109	1.020	0.000	0.000	0.000	0.000	0.000	2019
	Water Hub	Project Site	6/1/2019	12/31/2019	single	Generator	GEN	Generator	Diesel	100	1	100%	100%			0.029	0.030	1.600	0.179	0.884	0.000	0.000	0.000	0.000	0.000	2019
3b	Water Hub	Project Site	1/1/2020	5/31/2020	single	Drill Rig	DRI	Drill Rig	Diesel	450	1	100%	100%			0.018	0.018	1.550	0.106	0.454	0.000	0.000	0.000	0.000	0.000	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Mobile Crane	CRA	Mobile Crane	Diesel	200	1	100%	100%			0.010	0.010	0.615	0.068	0.136	0.000	0.000	0.000	0.000	0.000	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Asphalt Laying Eqp	ASP	Asphalt Laying Eqp	Diesel	80	1	100%	100%			0.042	0.043	1.300	0.132	1.210	0.000	0.000	0.000	0.000	0.000	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Roller	ROL	Roller	Diesel	80	1	100%	100%			0.039	0.040	1.040	0.109	1.020	0.000	0.000	0.000	0.000	0.000	2020
	Water Hub	Project Site	1/1/2020	5/31/2020	single	Generator	GEN	Generator	Diesel	100	1	100%	100%			0.029	0.030	1.600	0.179	0.884	0.000	0.000	0.000	0.000	0.000	2020
			1/1/2018	1/1/2018																	0.000	0.000	0.000	0.000	0.000	2018
4	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Bulldozer	BD	Bulldozer	Diesel	250	1	100%	100%			0.016	0.017	0.614	0.086	0.191	0.000	0.000	0.000	0.000	0.000	2020
	Beach Fill	Project Site	6/17/2020	7/26/2020	single	Front End Loader	FEL	Front End Loader	Diesel	300	1	100%	100%			0.017	0.018	0.807	0.093	0.270	0.000	0.000	0.000	0.000	0.000	2020

Crew Boat Distance	3	mi
Average Speed	6.4	knots
RT Time	0.81	hr
	49	min

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.027	0.030	0.553	0.024	0.135
2020	0.556	0.604	11.271	0.490	2.739
Grand Total	0.583	0.634	11.824	0.514	2.874

Staten Island Breakwaters - Truck Cruise Emissions

												Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	# of Workers per day	Monthly Worker Trips	# of Workers	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	15		291	25	1.0112	25.28	7356.48	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	15		279	25	1.0112	25.28	7053.12	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.02	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	15		544	25	1.0112	25.28	13752.3	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.04	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	15		1355	25	1.0112	25.28	34254.4	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.10	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	15		1671	25	1.0112	25.28	42242.9	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.13	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	15		836	25	1.0112	25.28	21134.1	0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.01	0.00	0.06	2020
2	Breakwater Construction	Breakwater Construction	Project Site	6/1/2019	11/30/2019	11		1207	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2019
	Breakwater Construction	Breakwater Construction	Project Site	6/1/2020	10/31/2020	11		1021	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	15		1924	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	15		1367	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	6		223	25	1.0112	25.28		0.01	0.01	0.25	0.07	2.76	0.00	0.00	0.00	0.00	0.00	2020

Emissions Rates for Auto Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph
Trucks origin/destination assumed to be within 1 hour travel time from project site

AVO	1.09
Auto Share	92%

Trip Distance: 12.64

**Source: From Transportation Energy Data Book - Edition 34, Table 8.9 (Trip Statistics by Trip Purpose)*
X:\DEPARTMENTS\Air Quality\Resources\Energy\Transportation Energy Data Book (ORNL)

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.027	0.030	0.553	0.024	0.135
2020	0.556	0.604	11.271	0.490	2.739
Grand Total	0.583	0.634	11.824	0.514	2.874

Staten Island Breakwaters - Truck Cruise Emissions

													Emission Rates (g/mi)					Emissions (ton)					
#	Work task	Stage	Location	Start Date	End Date	Truck Type	Truck Code	Daily Trucks	Total Deliveries for Period	Average Speed (mph)	Travel Time (hr)	Round Trip Distance (mi)	VMT	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Earthen Berm	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	3	198	25	7.344	184	36352.8	0.56	0.61	11.30	0.49	2.75	0.02	0.02	0.45	0.02	0.11	2019
	Shoreline Project		Project Site	1/1/2020	1/31/2020	Dump Truck	DT	3	69	25	7.344	184	12668.4	0.56	0.61	11.30	0.49	2.75	0.01	0.01	0.16	0.01	0.04	2020
	Shoreline Project	Eco-Revetment (between Brighton Street and Manhattan Street)	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	2	44	25	7.344	184	8078.4	0.56	0.61	11.30	0.49	2.75	0.00	0.01	0.10	0.00	0.02	2019
	Shoreline Project		Project Site	1/1/2020	2/29/2020	Dump Truck	DT	2	86	25	7.344	184	15789.6	0.56	0.61	11.30	0.49	2.75	0.01	0.01	0.20	0.01	0.05	2020
	Shoreline Project	Hybrid Dune/Revetment	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	15	1605	25	7.344	184	294678	0.56	0.61	11.30	0.49	2.75	0.18	0.20	3.67	0.16	0.89	2020
	Shoreline Project	Eco-Revetment (between Loretto Street and Sprague Avenue)	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	7	462	25	7.344	184	84823.2	0.56	0.61	11.30	0.49	2.75	0.05	0.06	1.06	0.05	0.26	2020
	Shoreline Project	Raised Edge (Revetment with Trail)	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	19	2508	25	7.344	184	460469	0.56	0.61	11.30	0.49	2.75	0.28	0.31	5.74	0.25	1.39	2020
	Shoreline Project	Transition Nodes	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	3	198	25	7.344	184	36352.8	0.56	0.61	11.30	0.49	2.75	0.02	0.02	0.45	0.02	0.11	2020
2	Breakwater Construction	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	2.5	380	25	0.6	15		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	2.5	270	25	0.6	15		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
	Water Hub	Water Hub	Project Site	6/1/2019	12/31/2019	Tracotr Trailer	TT	2.5	380	25	10	250		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Water Hub	Project Site	1/1/2020	5/31/2020	Tracotr Trailer	TT	2.5	270	25	10	250		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020
4	Beach Fill Delivery	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	39	1716	25	7.344	184		0.56	0.61	11.30	0.49	2.75	0.00	0.00	0.00	0.00	0.00	2020

Emissions Rates for Heavy Vehicles Traveling at 25 mph

Notes

Trucks assumed to travel at an average speed (including delays associated with congestion and red lights) of 25 mph

Trucks origin/destination assumed to be within 1 hour travel time from project site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of VOC	Sum of CO
2018	0.000	0.000	0.000	0.000	0.000
2019	0.000	0.000	0.001	0.000	0.000
2020	0.001	0.001	0.016	0.002	0.004
Grand Total	0.001	0.001	0.017	0.002	0.005

Staten Island Breakwaters - Construction Truck Idle Emissions

										Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	On-Site Vehicle Idle Time (hr)	Total On-Site Idle Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
1	Shoreline Project	Project Site	10/1/2019	12/31/2019	Dump Truck	DT	198	0.05	9.9	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	1/31/2020	Dump Truck	DT	69	0.05	3.45	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	12/1/2019	12/31/2019	Dump Truck	DT	44	0.05	2.2	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Shoreline Project	Project Site	1/1/2020	2/29/2020	Dump Truck	DT	86	0.05	4.3	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	2/1/2020	6/30/2020	Dump Truck	DT	1605	0.05	80.25	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	462	0.05	23.1	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Shoreline Project	Project Site	7/1/2020	12/31/2020	Dump Truck	DT	2508	0.05	125.4	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.01	0.00	0.00	2020
	Shoreline Project	Project Site	6/1/2020	8/31/2020	Dump Truck	DT	198	0.05	9.9	3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
2	Breakwater Construction	Project Site	7/16/2018	1/31/2019				0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2018
3	Water Hub	Project Site	6/1/2019	12/31/2019	Concrete Truck	CT	380	1		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Concrete Truck	CT	270	1		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
	Water Hub	Project Site	6/1/2019	12/31/2019	Tracotr Trailer	TT	380	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2019
	Water Hub	Project Site	1/1/2020	5/31/2020	Tracotr Trailer	TT	270	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020
4	Beach Fill Delivery	Project Site	7/1/2020	8/31/2020	Dump Truck	DT	1716	0.05		3.55	3.86	57.91	6.20	15.91	0.00	0.00	0.00	0.00	0.00	2020

Idle Emissions Rates for Heavy Vehicles

Notes

Concrete Trucks are assumed to idle for 1 hour per trip on site

Dump Truck / Flat Bed Truck are assumed to idle for 3 minutes per trip on site

	Data				
Year	Sum of PM2.5	Sum of PM10	Sum of NOx	Sum of CO	Sum of VOC
2019	0.000	0.000	0.000	0.000	0.000
2020	0.000	0.000	0.000	0.000	0.000
Grand Total	0.000	0.000	0.000	0.000	0.000

Staten Island Breakwaters - Tug Boat Delivery Emissions

												Emission Rates (g/hr)					Emissions (ton)					
Phase	Work task	Location	Start Date	End Date	Truck Type	Truck Code	Total Deliveries for Period	Round Trip Distance (mi)	VMT	Average Speed (knots)	Travel Time (hr)	PM2.5	PM10	NOx	VOC	CO	PM2.5	PM10	NOx	VOC	CO	Year
2a	Breakwaters	Project Site	6/1/2019	11/30/2019	Tug Boat/Barge	TB	115	100		6.4	0.0	610.46	665.76	12706.73	471.58	1136.45	0.00	0.00	0.00	0.00	0.00	2019
2b	Breakwaters	Project Site	6/1/2020	10/31/2020	Tug Boat/Barge	TB	115	100		6.4	0.0	610.46	665.76	12706.73	471.58	1136.45	0.00	0.00	0.00	0.00	0.00	2020
						Total	230															

Notes

Tugs assumed to travel at an average speed of 6.4 knots

Round Trip Distance measured between site and Tilcon Quarry Sheafe Road New Hamburg, NY 12590

Total Square Footage (gsf)
8,900

2005 Energy Consumption Factor for New York:

	60.3	tho Btu/yr-sqft

Heating Values

Fuel Oil	140,000	Btu/gal
Natural Gas	1,020	Btu/scf

Sulfur Content	15 ppm

	Annual Consumption	
Energy	537	MMBtu/yr
Fuel Oil	3,833	gal/yr
Natural Gas	52,615	scf/yr

Emission Factors (lb/MMBtu)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil	0.0075	0.0075	0.0980	0.0054	0.0824	0.0006
Natural Gas	0.0121	0.0121	0.1286	0.0178	0.0357	0.0015

Emission (lb/yr)

	PM2.5	PM10	NOx	VOC	CO	SO2
Fuel Oil						
Natural Gas						

Proposed Event/Activity	Season/Month	Frequency	Approximate Attendance	Likely Travel Method	Annual Attendance	Annual Vehicles: Autos	Annual Vehicles: Bus	
Tree planting events	Spring/Fall	Twice per year	100-300	Auto/bus	600	343	35	Conservatively includes maximum attendance utilizing both auto and bus
Beach cleanups with schools, Boy Scouts, and Girl Scouts	Throughout the year	Ideally three times per week and as scheduled	Groups of 10 to 50	Auto	7800	4,457		
First day of season beach walks	Spring, Summer, Fall, and Winter	Four times per year	5-25	Auto	100	57		
Earth/Arbor Day activities	April	One day or week per year	25-100	Auto/Bus	700	400	41	Conservatively includes maximum attendance utilizing both auto and bus
DEC citizen science Horseshoe crab monitoring	May-June	Once a year	5-15	Auto	15	9		
CHP Dunes, Drawing, and Dendrology "Walk and talk"	May-September	Once per month (Sunday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology EarthART	May-September	Once per month (Wednesday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Chalk and talk"	May-September	Once per month (weekday)	5-25	Auto	300	171		
CHP Dunes, Drawing, and Dendrology "Coastal Crafting"	May-September	Once per week (Saturday)	5-25	Auto	300	171		
Shore birding talks and walks	Spring and Fall	Four times per year	5-25	Auto	100	57		
Exhibitions	Throughout the year	Shows generally run for 4-6 weeks	XX	Auto				
Greenbelt Education extension (maritime focus)	July-August (summer came and school field trips during the school year)		Summer Camp 20-25/Field Trips – 10-15	Auto/Bus	3825		225	9 weeks (5 days per week) summer camp; 180 school days; exclusively bus
						6,009	301	
						Annual VMT		
						47,348	2,376	

	Emission Factors (g/mi)				
	PM2.5	PM10	NOx	VOC	CO
Auto	0.008	0.009	0.250	0.066	2.758
Bus	*0.442*	*0.481*	*16.127*	*1.018*	*6.011*

Emissions (ton)				

School Bus Occupancy	**17**
Auto Occupancy	**1.75**

CEQR Table 18-7
Average One-Way Taxi Trip Lengths (Miles)

		Manhattan	*Other NYC*	*Unknown Destination*
Origin	***Manhattan***	2	9	2.32
	Other NYC	11	6	7.88
	Unknown Origin	2.32	7.88	N/A