Attachment E GARFO Pile Driving Acoustic Tool Results for the Blue Economy Support Docks & Vessel Launch Ramp



30" Steel Piles - Impact Pile Driving

		_		
IMPACT PILE DRIVING	Use check boxes for Taxa present	✓ Fishes	Sea Turtles	Phocid
VERSION 1.2-Multi-Species: 2022	Lv LF Cet.	MF Cet.	HF Cet.	Otariid
KEY				
	User Provided Information Defau	It values are in bold, italics t	urquoise (can be changed by us	er if project-specific information is available).
	Preset NMFS Provided Informatio	n (cannot be altered by user)	. NMFS thresholds/default weig	hting value are in bold red.
	OUTPUT: Resultant Isopleth/rang	e to effects (cannot be altere	d by user); Note: isopleths are p	presented in meters and feet
	Automatically Calculated Values I	Based on User Provided Info	rmation (only weighting adjustm	nent (-dB) can be altered by user, Row 67, if spectrum is availab
	-			
STEP 1: GENERAL PROJECT INFORM				
	Blue Economy Support Docks & Vessel Launch Ramp			
	Vessei Launch Ramp			
PROJECT TITLE and CONTACT				
			Notes (Please include all assur	motione)
			rotes (Flease include all assur	I I I I I I I I I I I I I I I I I I I
PROJECT/SOURCE INFORMATION (size,				
material, number, pile strikes, etc.)				
STED 2: OHANTITATIVE DOOLECT SE	ECIEIC INEODMATION			

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

TEL 2. QUANTIANVET ROSECT-OF		METRICS		_		
	Peak	SELss	RMS		WEIGHTING	(WFA in kHz)
Unattenuated Single strike level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas)	204	151	161	Effective Quiet (Fish Only)	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA (kHz)
Attenuated Single strike level (dB)* (calculation done automatically)	204	151	161	150	0.16	2
Distance associated with single strike level/Measurement distance from pile (meters); Typically, 10-m but please double check data being used	10	10	10		WFA: Weighting Factor Adjustmen	ı
Transmission loss constant (NMFS recommends: 15 if unknown)	15					
Number of piles per day (best estimate based on previous experience)	12	Attenuation assumed (e.g., bubble curtain) (enter positive number)	0			
Number of strikes per pile (best estimate based on previous experience)	20		NMFS recommends 5 dB as default, If attenuation used			
Number of strikes per day	240					
Cumulative SEL at measured distance	175					

RESULTANT ISOPLETHS[†]

Impulsive sounds have dual metric thresholds for injury (SEL, um & PK).

Metric producing largest isopleth should be used.

(Range to Effects)

	FISHES			
Fishes present	ONSET OF	PHYSICAL	INJURY	BEHAVIOR
	Peak (PK)	SEL _{cum}	Threshold (dB)**	RMS
	Threshold (dB)	Fish ≥ 2 g	Fish < 2 g	Threshold (dB)
	206	187	183	150
Isopleths (meters)	7.4	1.5	2.8	54.1
Isopleth (feet)	24.1	5.0	9.3	177.5

^{**}This calculation accounts for single strike SEL < 150 dB do not accumulate to cause injury (Effective Quiet)

	SEA TURTLES		
Sea Turtles present	PTS ONSET		BEHAVIOR
	Peak (PK) Threshold (dB)	SEL _{cum} Threshold (dB)	RMS Threshold (dB)
	232	204	175
Isopleths (meters)	0.1	0.1	1.2
Isopleth (feet)	0.4	0.4	3.8

	MARINE MAMMALS				
			PTS ONSET		
Hearing Grou	LF Cetacean PTS Peak (PK)	MF Cetacean Peak (PK)		PW Pinniped PTS Peak (PK)	
. Hearing Grou	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)
	219	230	202	218	232
Isopleths (meters	1.0	0.2	13.6	1.2	0.1
Isopleth (fee		0.6	44.6	3.8	0.4
	LF Cetacean PTS SEL _{cum}	MF Cetacean PTS SEL _{cum}	HF Cetacean PTS SEL _{cum}	PW Pinniped PTS SEL _{cum}	OW Pinniped PTS SEL _{cum}
	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)
	183	185	155	185	203
Isopleths (meters	2.8	0.1	3.4	1.5	0.1
Isopleth (fee	9.3	0.3	11.1	5.0	0.4
ALL MARINE MAMMAL	S BEHAVIOR	LF Cet. present	Low-frequency (LF)	mal Hearing Group cetaceans: baleen whales	
1	RMS Threshold (dB)	MF Cet. present	Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales		
	160	HF Cet. present	High-frequency (HF) cetaceans: trite		
			porpoises, Kogia, river dolphius, cephalorhynchid,		
Isopleths (meters	11.7	Phocids present			
Isopleth (fee	38.3	NO OTABUBE	Phocid pinnipeds (F		
isopietii (iee	30.3	NO OTARIIDS	Otariid pinnipeds (C	OW):sea lions and fur seals	

WEIGHTING FUNCTION CALCULATIONS (Sea Turtles and Marine Mammals Only)

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds	Sea Turtles
а	1	1.6	1.8	1	2	1.4
b	2	2	2	2	2	2
f ₁	0.2	8.8	12	1.9	0.94	0.077
f ₂	19	110	140	30	25	0.44
С	0.13	1.2	1.36	0.75	0.64	2.35
Adjustment (-dB)†	-0.01	-19.74	-26.87	-2.08	-1.15	0.00





IMPACT PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

Blue Economy Support Docks & Vessel Launch Ramp

PROJECT INFORMATION	PEAK	SELss	RMS	
Single strike level (dB)	204	151	161	OTHER INFO 0
Distance associated with single strike level (meters)	10	10	10	
Transmission loss constant	15		-	_
Number of piles per day	12			NOTES 0
Number of strikes per pile	20			
Number of strikes per day	240	1		Attenuation 0
Cumulative SEL at measured distance	175			

ISOPLETHS (meters)	NSET OF eak pleth 7.4 4.1 URTLES		INJURY Isopleth Fish < 2 g 2.8 9.3	BEHAVIOR RMS Isopleth 54.1	Fishes present
ISOPLETHS (meters)	pleth 7.4 4.1 JRTLES	Fish ≥ 2 g 1.5	Fish < 2 g 2.8	Isopleth 54.1	Fishes present
ISOPLETHS (meters)	7.4 4.1 JRTLES	1.5	2.8	54.1	Fishes present
(JRTLES				Fishes present
lsopleth (feet)	JRTLES	5.0	9.3	177.5	
				111.0	
SEA TU					•
	PTS	ONSET	BEHAVIOR		
Peak I	Isopleth	SEL _{cum} Isopleth	RMS Isopleth		
ISOPLETHS (meters)	0.1	0.1	1.2	Sea Turtles present	
Isopleth (feet)	0.4	0.4	3.8		
MARIN	E MAMMA	LS			
LF Ce	etacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	1.0	0.2	13.6	1.2	0.1
PTS ONSET (Peak isopleth, feet)	3.3	0.6	44.6	3.8	0.4
PTS ONSET (SEL _{cum} isopleth, meters)	2.8	0.1	3.4	1.5	0.1
PTS ONSET (SEL _{cum} isopleth, feet)	9.3	0.3	11.1	5.0	0.4
ALI	LMM	MF Cet. present	HF Cet. present	Phocids present	NO OTARIIDS
	1.7	LF Cet. present			
Behavior (RMS isopleth, <mark>feet</mark>)	8.3				

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30" Steel Piles - Vibratory Pile Driving

Vibratory Pile Driving	Use check boxes for Taxa present	Fishes	Sea Turtles	Phocid		
VERSION 1.2-Multi-Species: 2022 KEY	LF Cet.	MF Cet.	HF Cet.	Otariid		
	User Provided Information Defaul	t values are in bold	, italics turquoise (can be changed	I by user if project-specific inforn	nation is available).	
	Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red. OUTPUT: Resultant Isopieth/Range to Effects (cannot be altered by user); Note: isopieths are presented in meters and feet Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user; Row 64, if spectrum is availa					

STEP 1: GENERAL PROJECT INFORMATION					
PROJECT TITLE and CONTACT	Blue Economy Support Docks & Vessel Launch Ramp				
PROJECT/SOURCE INFORMATION (size, material, number, duration to drive pile, etc.)					



STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

STEF 2. QUANTITATIVE PROJECT-SF	LOII TO THE ORBITATION	-	
	METRIC		
1 sec SEL = RMS	RMS (NOT Peak)	WEIGHTING	(WFA in kHz)
Unattenuated Sound Pressure Level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas)	153	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA
Attenuated Sound Pressure Level (dB)* (calculation done automatically)	153	0.16	2.5
Distance associated with sound pressure level measurement/Measurement distance from pile (meters); Typically, 10-m but please double check data being used	10		
Transmission loss constant (NMFS recommends: 15 if unknown)	15		
Number of piles per day (best estimate based on previous experience)	12	Attenuation (e.g., bubble curtain) (enter positive number)	
Duration to drive a single pile (minutes) (best estimate based on previous experience)	20		
Duration of Sound Production within a day (seconds)	14400	Cumulative SEL at measured distance (dB)	194.58
10 Log (duration of sound production)	41.58		·

^{*}If sound pressure level provided includes attenuation methods (e.g., bubble curtain), please note this in Project/Source Information in Step 1

RESULTANT ISOPLETHS (Range to Effects)

For vibratory pile driving, only behavioral thresholds exist for fishes

Fishes present

RMS Threshold (dB)

150

Isopleth (meters)
Isopleth (feet)

52.0

	SEA TURTLES				
Sea Turtles present	PTS ONSET	BEHAVIOR			
	PTS SEL _{cum} Threshold (dB)	RMS Threshold (dB)			
	220	175			
Isopleth (meters)	0.2	0.3			
Isopleth (feet)	0.7	1.1			

1	MARINE MAMMALS				
			PTS ONSET		
Hearing Group	LF Cetacean PTS SEL _{cum} Threshold (dB)	MF Cetacean PTS SEL _{cum} Threshold (dB)	HF Cetacean PTS SEL _{cum} Threshold (dB)	PW Pinniped PTS SEL _{cum} Threshold (dB)	OW Pinniped PTS SEL _{cum} Threshold (dB)
	199	198	173	201	219
Isopleth (meters)	5.0	0.4	7.5	3.1	0.2
Isopleth (feet)	16.5	1.5	24.4	10.1	0.7

ALL MARINE MAMMALS	BEHAVIOR	LF Cet. pres
	RMS Threshold (dB)	MF Cet. pres
	120	HF Cet. pres
Isopleth (meters)	1,584.9	Phocids pres
Isopleth (feet)	5,199.8	NO OTARI

١	Marine Mammal Hearing Group
ľ	Low-frequency (LF) cetaceans: baleen whales
	Mid-frequency (MF) cetaceans: dolphins, toothed whales, beaked whales, bottlenose whales
	High-frequency (HF) cetaceans: true porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorbynchus trueiger & L. australis
	Phocid pinnipeds (PW):true seals
Г	Otariid pinnipeds (OW) sea hons and fur seals

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds	Sea Turtles	
a	1	1.6	1.8	1	2	1.4	
b	2	2	2	2	2	2	
f ₁	0.2	8.8	12	1.9	0.94	0.077	
f ₂	19	110	140	30	25	0.44	
С	0.13	1.2	1.36	0.75	0.64	2.35	
Adjustment (-dB)†	-0.05	-16.83	-23.50	-1.29	-0.60	0.00	





VIBRATORY PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

Blue Economy Support Docks & Vessel Launch Ramp

PROJECT INFORMATION RMS

Sound pressure level (dB)	153
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	12
Duration to drive pile (minutes)	20
Duration of sound production in day	14400
Cumulative SEL at measured distance	195

OTHER INFO 0	
NOTES	0

Attenuation

RESULTANT ISOPLETHS						
(Range to Effects)	FISHES	_	SEA TURTLES	TLES		
	BEHAVIOR]		PTS ONSET	BEHAVIOR	
Fishes present	RMS Isopleth		Sea Turtles prese	SEL _{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	15.8	ISC	PLETHS (meters)	0.2	0.3	
ISOPLETHS (feet)	52.0	1	ISOPLETHS (feet)	0.7	1.1	
MARINE MAMMALS						
			_			
	MARINE MAMM. LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds	
PTS ONSET (SELcum isopleth, meters)	LF Cetacean		HF Cetaceans 7.5	PW Pinniped 3.1	OW Pinnipeds 0.2	
PTS ONSET (SELcum isopleth, meters) PTS ONSET (SELcum isopleth, feet)	LF Cetacean 5.0	MF Cetaceans		-	•	
,	LF Cetacean 5.0	MF Cetaceans 0.4 1.5	7.5 24.4	3.1	0.2	
	LF Cetacean 5.0 16.5 ALL MM	MF Cetaceans 0.4 1.5	7.5 24.4 HF Cet. present	3.1 10.1	0.2	



18" Steel Piles - Impact Pile Driving

	-	_				
IMPACT PILE DRIVING	Use check boxes for Taxa present	✓ Fishes	Sea Turtles	Phocid		
VERSION 1.2-Multi-Species: 2022	LF Cet.	MF Cet.	HF Cet.	Otarlid		
KEY						
	User Provided Information Defau				on is available).	
	Preset NMFS Provided Information OUTPUT: Resultant Isopleth/range					
	Automatically Calculated Values I	•		•	er. Row 67. if spectrum is availa	able)
	•		. ,	•		
STEP 1: GENERAL PROJECT INFORM	MATION Blue Economy Wave Attenuation					
	Structure					
PROJECT TITLE and CONTACT						
			Notes (Please include all assu	mptions)		
PROJECT/SOURCE INFORMATION (size, material, number, pile strikes, etc.)						
, , , , , , , , , , , , , , , , , , , ,						
		_		-		
STEP 2: QUANTITATIVE PROJECT-SF	PECIFIC INFORMATION	METRICS				
	Peak	SELSS	RMS	7	WEIGHTING	/WEA in kH
Unattenuated Single strike level (dB) (see		JELSS	RWG		WEIGHTING	(WEATH KIT
Proxy Level Tab for surrogate values; Copy,	210	177	190			Marine Mam
ONLY Paste Values (123), not formulas)				Effective Quiet (Fish Only)	Sea Turtle Default WFA (kHz)	(
Attenuated Single strike level (dB)*	210	177	190	150	0.16	
(calculation done automatically)					WFA: Weighting Factor Adjustmen	
Distance associated with single strike level/Measurement distance from pile					rroighting i actor Adjustmen	
(meters); Typically, 10-m but please double	10	10	10			
check data being used						
Transmission loss constant (NMFS	15					

NMFS recommends 5 dB as default, If attenuation used

RESULTANT ISOPLETHS[†]

Number of piles per day (best estimate based on previous experience)

Number of strikes per pile (best estimate based on previous experience)

ative SEL at measured dist

*Impulsive sounds have dual metric thresholds for injury (SEL_{oum} & PK).

(Range to Effects)

| FISHES | STEAM | SEL_com Threshold (dB)** | RMS | Threshold (dB) | Fish ≥ 2 | Fish < 2 | Threshold (dB) | SEL_com Threshold (dB)* | Threshold (dB) | SEL_com Threshold (dB)* | Threshold (dB) | Selection | Sel

^{**}This calculation accounts for single strike SEL < 150 dB do not accumulate to cause injury (Effective Quiet)

	SEA TURTLES			
Sea Turtles present	PTS ONSET	BEHAVIOR		
	Peak (PK) Threshold (dB) SEL _{cum} Threshold (dB)		RMS Threshold (dB)	
	232	204	175	
Isopleths (meters)	0.3	6.9	100.0	
Isopleth (feet)	1.1	22.7	328.1	

	MARINE MAMMALS				
			PTS ONSET		
Hearing Group	LF Cetacean PTS Peak (PK)	MF Cetacean Peak (PK)		PW Pinniped PTS Peak (PK)	
ricaring Group	Tilleshold (db)	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)
	219	230	202	218	232
Isopleths (meters)	2.5	0.5	34.1	2.9	0.3
Isopleth (feet)		1.5	112.0	9.6	1.1
l	LF Cetacean PTS SEL _{cum}	MF Cetacean PTS SEL _{cum}	HF Cetacean PTS SEL _{cum}	PW Pinniped PTS SEL _{cum}	OW Pinniped PTS SEL _{cum}
	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)	Threshold (dB)
	183	185	155	185	203
Isopleths (meters)	173.4	6.2	206.5	92.8	6.8
Isopleth (feet)	568.8	20.2	677.6	304.4	22.2
ALL MARINE MAMMALS	BEHAVIOR	LF Cet. present		nal Hearing Group cetaceans: baleen whales	
	D10 71	•	341 4 4		1
	RMS Threshold (dB)	MF Cet. present	toothed whales, beake	d whales, bottlenose whales	
	160	HF Cet. present	High-frequency (HI	f) cetaceans: trite	1
			porpoises, Kogia, river	dolphius, cephalorhynchid,	
Isopleths (meters)	1,000.0	Phocids present	Lagenorbynchus cruciger		1
In a whath (for a)	3,280,8		Phocid pinnipeds (F	W) true seals	1
Isopleth (feet)	3,200.8	NO OTARIIDS	Otariid pinnipeds (C	OW):sea lions and fur seals]

WEIGHTING FUNCTION CALCULATIONS (Sea Turtles and Marine Mammals Only)

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds	Sea Turtles
a	1	1.6	1.8	1	2	1.4
b	2	2	2	2	2	2
f ₁	0.2	8.8	12	1.9	0.94	0.077
f ₂	19	110	140	30	25	0.44
С	0.13	1.2	1.36	0.75	0.64	2.35
Adjustment (-dB)†	-0.01	-19.74	-26.87	-2.08	-1.15	0.00





IMPACT PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

PROJECT INFORMATION

Single strike level (dB)

Blue Economy Wave Attenuation Structure

g					
Distance associated with single strike level (meters)	10	10	10		
Transmission loss constant	15		-	•	
Number of piles per day	8			NOTES	
Number of strikes per pile	36				_
Number of strikes per day	288			Attenuation	0
Cumulative SEL at measured distance	202				
RESULTANT ISOPLETHS	FISHES				
(Range to Effects)	ONSET OF	PHYSICAL	INJURY	BEHAVIOR	
	Peak	SEL _{cum}	Isopleth	RMS	
	Isopleth	Fish ≥ 2 g	Fish < 2 g	Isopleth	
ISOPLETHS (meters)	18.5	94.0	173.6	4,641.6	Fishes present
Isopleth (feet)	60.6	308.3	569.6	15,228.3	
•	SEA TURTLES				-
	PTS	ONSET	BEHAVIOR		
	Peak Isopleth	SEL _{cum} Isopleth	RMS Isopleth		
ISOPLETHS (meters)	0.3	6.9	100.0	Sea Turtles pres	ent
Isopleth (feet)	1.1	22.7	328.1		
	MARINE MAMMA	ALS			
	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (Peak isopleth, meters)	2.5	0.5	34.1	2.9	0.3
PTS ONSET (Peak isopleth, feet)	8.2	1.5	112.0	9.6	1.1
PTS ONSET (SEL $_{cum}$ isopleth, meters)	173.4	6.2	206.5	92.8	6.8
PTS ONSET (SEL _{cum} isopleth, feet)	568.8	20.2	677.6	304.4	22.2
	ALL MM	MF Cet. present	HF Cet. present	Phocids present	NO OTARIIDS
Behavior (RMS isopleth, meters)	1,000.0	LF Cet. present			
Behavior (RMS isopleth, feet)	3,280.8				

SELss

177

RMS

190

OTHER INFO 0

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PEAK

210

18" Steel Piles - Vibratory Pile Driving

Vibratory Pile Driving	Use check boxes for Taxa present	∠ Fishes	Sea Turtles	Phocid
VERSION 1.2-Multi-Species: 2022	<u></u> LF Cet.	MF Cet.	HF Cet.	Otariid
KEY				
	User Provided Information Defau	It values are in bold, italics tur	quoise (can be changed by us	er if project-specific information is available).
	Preset NMFS Provided Informatio OUTPUT: Resultant Isopleth/Rang			
	Automatically Calculated Values I	Based on User Provided Inforn	nation (only weighting adjustm	ent (-dB) can be altered by user; Row 64, if spectrum is a
	•			
STEP 1: GENERAL PROJECT INFORM	IATION			
	Blue Economy Wave Altenuation Structure		Notes (please include all assum	totional
				,
PROJECT/SOURCE INFORMATION (size, material, number, duration to drive pile, etc.)				

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

STEP 2: QUANTITATIVE PROJECT-SP	ECIFIC INFORMATION	-	
	METRIC		
1 sec SEL = RMS	RMS (NOT Peak)	WEIGHTING	(WFA in kHz)
Unattenuated Sound Pressure Level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas)	153	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA (kHz)
Attenuated Sound Pressure Level (dB)* (calculation done automatically)	153	0.16	2.5
Distance associated with sound pressure level measurement/Measurement distance from pile (meters); Typically, 10-m but please double check data being used	10		
Transmission loss constant (NMFS recommends: 15 if unknown)	15		
Number of piles per day (best estimate based on previous experience)	8	Attenuation (e.g., bubble curtain) (enter positive number)	
Duration to drive a single pile (minutes) (best estimate based on previous experience)	20		
Duration of Sound Production within a day (seconds)	9600	Cumulative SEL at measured distance (dB)	192.82
10 Log (duration of sound production)	39.82		

If sound pressure level provided includes attenuation methods (e.g., bubble curtain), please note this in Project/Source Information in Step 1

RESULTANT ISOPLETHS (Range to Effects)

For vibratory pile driving, only behavioral thresholds exist for fishes

Fishes present

RMS Threshold (dB)

150

Isopleth (meters)
Isopleth (feet)

52.0

	SEA TURTLES	
Sea Turtles present	PTS ONSET	BEHAVIOR
	PTS SEL _{cum} Threshold (dB)	RMS Threshold (dB)
	220	175
Isopleth (meters)	0.2	0.3
Isopleth (feet)	0.5	1.1

	MARINE MAMMALS				
			PTS ONSET		
Hearing Group	LF Cetacean PTS SEL _{cum} Threshold (dB)	MF Cetacean PTS SEL _{cum} Threshold (dB)	HF Cetacean PTS SEL _{cum} Threshold (dB)	PW Pinniped PTS SEL _{cum} Threshold (dB)	OW Pinniped PTS SEL _{cum} Threshold (dB)
	199	198	173	201	219
Isopleth (meters)	3.8	0.3	5.7	2.3	0.2
Isopleth (feet)	12.6	1.1	18.7	7.7	0.5

ALL MARINE MAMMALS	BEHAVIOR	LF Cet. present	Marine Mammal Hearing Group
	RMS Threshold (dB)		Low-frequency (LF) cetaceans: baleen whales Mid-frequency (MF) cetaceans: dolphins,
	120		toothed whales, beaked whales, bottlenose whales
	120	Til Oet. present	High-frequency (HF) cetaceans: trite
Isopleth (meters)	1,584.9	Phocids present	porpoises, Kogia, river dolphins, cephalorhynchid, Lagenorhynchus cruciger & L. australis
Isopleth (feet)	5,199.8	NO OTARIIDS	Phocid pinnipeds (PW):rue seals
			Otariid pinnipeds (OW):sea lions and fur seals

WEIGHTING FUNCTION CALCULATIONS

Weighting Function Parameters	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds	Sea Turtles
а	1	1.6	1.8	1	2	1.4
b	2	2	2	2	2	2
f ₁	0.2	8.8	12	1.9	0.94	0.077
f ₂	19	110	140	30	25	0.44
С	0.13	1.2	1.36	0.75	0.64	2.35
Adjustment (-dB)†	-0.05	-16.83	-23.50	-1.29	-0.60	0.00





VIBRATORY PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

Blue Economy Wave Attenuation Structure

PROJECT INFORMATION RMS

Sound pressure level (dB)	153
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	8
Duration to drive pile (minutes)	20
Duration of sound production in day	9600
Cumulative SEL at measured distance	193

OTHER INFO 0	
NOTES	(

Attenuation

RESULTANT ISOPLETHS					
(Range to Effects)	FISHES	_		SEA TURTLES	
	BEHAVIOR			PTS ONSET	BEHAVIOR
Fishes present	RMS Isopleth		Sea Turtles prese	SEL _{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	15.8	ISC	PLETHS (meters)	0.2	0.3
			IOODI ETUO /f4\		
ISOPLETHS (feet)	52.0		ISOPLETHS (feet)	0.5	1.1
ISOPLETHS (feet)	MARINE MAMM			3.0	
ISOPLETHS (feet)	02.0	ALS MF Cetaceans		0.5 PW Pinniped	0W Pinnipeds
PTS ONSET (SELcum isopleth, meters)	MARINE MAMM LF Cetacean 3.8			3.0	
	MARINE MAMM LF Cetacean 3.8	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SELcum isopleth, meters)	MARINE MAMM LF Cetacean 3.8	MF Cetaceans 0.3 1.1	HF Cetaceans 5.7 18.7	PW Pinniped 2.3	OW Pinnipeds 0.2
PTS ONSET (SELcum isopleth, meters)	MARINE MAMM LF Cetacean 3.8 12.6 ALL MM	MF Cetaceans 0.3 1.1	HF Cetaceans 5.7 18.7 HF Cet. present	PW Pinniped 2.3 7.7	OW Pinnipeds 0.2 0.5

