

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

LF Cet.

MF Cet.

HF Cet.

Otariid

KEY

User Provided Information Default values are in bold, italics turquoise (can be changed by user if project-specific information is available).
Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.
OUTPUT: Resultant isopleth/range to effects (cannot be altered by user); Note: isopleths are presented in meters and feet
Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user, Row 67, if spectrum is available)

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE and CONTACT

PROJECT/SOURCE INFORMATION (size, material, number, pile strikes, etc.)

Notes (Please include all assumptions)

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

	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 Adjustment		
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†
(Range to Effects)

*Impulsive sounds have dual metric thresholds for injury (SEL_{cum} & PK).
Metric producing largest isopleth should be used.

Fishes present

FISHES			
ONSET OF Peak (PK) Threshold (dB)	PHYSICAL INJURY SEL _{cum} Threshold (dB)**		BEHAVIOR RMS Threshold (dB)
	Fish ≥ 2 g	Fish < 2 g	
206	187	183	150
Isopleths (meters)	7.4	1.5	2.8
Isopleth (feet)	24.1	5.9	9.3

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

Sea Turtles present

SEA TURTLES		
PTS ONSET		BEHAVIOR
Peak (PK) Threshold (dB)	SEL _{cum} Threshold (dB)	RMS Threshold (dB)
232	204	175
Isopleths (meters)	0.1	1.2
Isopleth (feet)	0.4	3.9

Marine Mammals

MARINE MAMMALS				
Hearing Group	PTS ONSET		PTS ONSET	
	LF Cetacean PTS Peak (PK) Threshold (dB)	MF Cetacean Peak (PK) Threshold (dB)	HF Cetacean PTS Peak (PK) Threshold (dB)	PW Pinniped PTS Peak (PK) Threshold (dB)
	219	230	202	218
Isopleths (meters)	1.0	0.2	13.6	1.2
Isopleth (feet)	3.3	0.6	44.6	3.9
	PTS ONSET		PTS ONSET	
	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)
	183	165	155	185
Isopleths (meters)	2.8	0.1	3.4	1.5
Isopleth (feet)	9.3	0.3	11.1	5.0
BEHAVIOR				
RMS Threshold (dB)				
	160			
Isopleths (meters)	11.7			
Isopleth (feet)	38.3			

LF Cet. present
MF Cet. present
HF Cet. present
Phocids present
NO OTARIIDS

Marine Mammal Hearing Group
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, cephaloscyllid, *Lagenorhynchus croceus* & *L. australis*
Phocid pinnipeds (PW): true seals
Otariid pinnipeds (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
C	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

$$W(f) = C + 10 \log_{10} \left(\frac{(f/f_1)^b}{1 + (f/f_1)^b + 1 + (f/f_2)^b} \right)$$

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COASTAL RESOURCES
MANAGEMENT COUNCIL

30" Steel Piles - Impact Pile Driving

IMPACT PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

Blue Economy Support Docks & Vessel Launch Ramp

PROJECT INFORMATION

	PEAK	SEL _{ss}	RMS
Single strike level (dB)	204	151	161
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	12		
Number of strikes per pile	20		
Number of strikes per day	240		
Cumulative SEL at measured distance	175		

OTHER INFO 0

NOTES 0

Attenuation 0

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF		PHYSICAL INJURY	BEHAVIOR	
	Peak	SEL _{cum} Isopleth		RMS	
	Isopleth	Fish ≥ 2 g	Fish < 2 g	Isopleth	
ISOPLETHS (meters)	7.4	1.5	2.8	54.1	Fishes present
Isopleth (feet)	24.1	5.0	9.3	177.5	

SEA TURTLES

	PTS ONSET		BEHAVIOR	
	Peak 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	

MARINE MAMMALS

	LF Cetacean	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
	ALL MM	MF Cet. present HF Cet. present Phocids present NO OTARIIDS			
Behavior (RMS isopleth, meters)	11.7	LF Cet. present			
Behavior (RMS isopleth, feet)	38.3				

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COASTAL RESOURCES
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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

☒ LF Cet.

☒ MF Cet.

☒ HF Cet.

☐ Otariid

KEY

	User Provided Information <i>Default values are in bold, italics turquoise (can be changed by user if project-specific information is available).</i>
	Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.
	OUTPUT: Resultant Isopleth/Range to Effects (cannot be altered by user); Note: isopleths are presented in meters and <i>feet</i>
	Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user; Row 64, if spectrum is available)

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.)	

Notes (please include all assumptions)

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

1 sec SEL = RMS	METRIC	WEIGHTING (WFA in kHz)	
	RMS (NOT Peak)	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA (kHz)
Unattenuated Sound Pressure Level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas)	153		
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)	0
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

Isopleth (meters)

Isopleth (feet)

Sea Turtles present

Isopleth (meters)

Isopleth (feet)

ALL MARINE MAMMALS

Isopleth (meters)

Isopleth (feet)

LF Cet. present

MF Cet. present

HF Cet. present

Phocids present

NO OTARIIDS

Marine Mammal Hearing Group	
Low-frequency (LF) cetaceans:	baleen whales
Mid-frequency (MF) cetaceans:	dolphins, toothed whales, beaked whales, bottlenose whales
High-frequency (HF) cetaceans:	true porpoises, <i>Kogia</i> , river dolphins, cephaloscyllid, <i>Lagenorhynchus cracrer</i> & <i>L. australis</i>
Phocid pinnipeds (PW):	true 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
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
c	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

$$W(f) = C + 10 \log_{10} \left\{ \frac{(f/f_1)^a}{[1 + (f/f_1)^2]^b [1 + (f/f_2)^2]^b} \right\}$$

30" Steel Piles - Vibratory Pile Driving

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 0

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

BEHAVIOR
RMS Isopleth
ISOPLETHS (meters)
ISOPLETHS (feet)

Fishes present

ISOPLETHS (meters)

ISOPLETHS (feet)

SEA TURTLES

PTS ONSET	BEHAVIOR
SEL _{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	ISOPLETHS (meters)
ISOPLETHS (feet)	ISOPLETHS (feet)

Sea Turtles present

ISOPLETHS (meters)

ISOPLETHS (feet)

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
PTS ONSET (SEL _{cum} isopleth, meters)	5.0	0.4	7.5	3.1	0.2
PTS ONSET (SEL _{cum} isopleth, feet)	16.5	1.5	24.4	10.1	0.7
	ALL MM	MF Cet. present HF Cet. present Phocids present NO OTARIIDS			
Behavior (RMS isopleth, meters)	1,584.9	LF Cet. present			
Behavior (RMS isopleth, feet)	5,199.8				

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COASTAL RESOURCES
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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.

Otariid

KEY

User Provided Information Default values are in bold, italics turquoise (can be changed by user if project-specific information is available).
Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.
OUTPUT: Resultant isopleth/range to effects (cannot be altered by user); Note: isopleths are presented in meters and feet
Automatically Calculated Values Based on User Provided Information (only weighting adjustment (-dB) can be altered by user, Row 67, if spectrum is available)

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE and CONTACT

PROJECT/SOURCE INFORMATION (size, material, number, pile strikes, etc.)

Notes (Please include all assumptions)

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

	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)	210	177	190	Effective Quiet (Fish Only)	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA (kHz)
Attenuated Single strike level (dB)* (calculation done automatically)	210	177	190	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 Adjustment		
Transmission loss constant (NMFS recommends: 15 if unknown)	15					
Number of piles per day (best estimate based on previous experience)	8	Attenuation assumed (e.g., bubble curtain) (enter positive number)		0		
Number of strikes per pile (best estimate based on previous experience)	36	NMFS recommends 5 dB as default, if attenuation used				
Number of strikes per day	288					
Cumulative SEL at measured distance	202					

RESULTANT ISOPLETHS[†]
(Range to Effects)

[†]Impulsive sounds have dual metric thresholds for injury (SEL_{cum} & PK).
Metric producing largest isopleth should be used.

Fishes present

FISHES			
ONSET OF Peak (PK) Threshold (dB)	PHYSICAL INJURY		BEHAVIOR RMS Threshold (dB)
	SEL _{cum} Threshold (dB)**		
	Fish ≥ 2 g	Fish < 2 g	
206	187	183	150
18.5	94.0	173.6	4,641.6
60.6	308.3	569.6	15,228.3

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

Sea Turtles present

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

Marine Mammals

MARINE MAMMALS				
Hearing Group	PTS ONSET			
	LF Cetacean PTS Peak (PK) Threshold (dB)	MF Cetacean Peak (PK) Threshold (dB)	HF Cetacean PTS Peak (PK) Threshold (dB)	PW Pinniped PTS Peak (PK) Threshold (dB)
	219	230	202	218
Isopleths (meters)	2.5	0.5	34.1	2.9
Isopleth (feet)	8.2	1.5	112.0	9.6
	PTS ONSET			
	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)
	183	165	155	185
Isopleths (meters)	173.4	6.2	206.5	92.8
Isopleth (feet)	568.8	20.2	677.6	304.4

ALL MARINE MAMMALS

BEHAVIOR	
RMS Threshold (dB)	
160	
Isopleths (meters)	1,000.0
Isopleth (feet)	3,280.8

LF Cet. present
MF Cet. present
HF Cet. present
Phocids present
NO OTARIIDS

Marine Mammal Hearing Group
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, cephaloscyllid, *Lagenorhynchus croceus* & *L. australis*
Phocid pinnipeds (PW): true seals
Otariid pinnipeds (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
C	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

$$W(f) = C + 10 \log_{10} \left(\frac{(f/f_1)^b}{1 + (f/f_1)^b + (f/f_2)^b} \right)$$

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18" Steel Piles - Impact Pile Driving

IMPACT PILE DRIVING REPORT

VERSION 1.2-Multi-Species: 2022

Blue Economy Wave Attenuation Structure

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	210	177	190
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	8		
Number of strikes per pile	36		
Number of strikes per day	288		
Cumulative SEL at measured distance	202		

OTHER INFO 0

NOTES 0

Attenuation 0

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	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 present
Isopleth (feet)	1.1	22.7	328.1	

MARINE MAMMALS

	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				

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COASTAL RESOURCES
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18" Steel Piles - Vibratory Pile Driving

Vibratory Pile Driving

Use check boxes for Taxa present

☒ Fishes

☒ Sea Turtles

☐ Phocid

☒ MF Cet.

☐ HF Cet.

☐ Otariid

VERSION 1.2-Multi-Species: 2022

☐ LF Cet.

KEY

User Provided Information

Default values are in bold, italics turquoise (can be changed by user if project-specific information is available).

Preset NMFS Provided Information (cannot be altered by user). NMFS thresholds/default weighting value are in bold red.

OUTPUT: Resultant Isopleth/Range to Effects (cannot be altered by user); Note: isopleths 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 available)

STEP 1: GENERAL PROJECT INFORMATION

PROJECT TITLE and CONTACT	Blue Economy Wave Attenuation Structure	Notes (please include all assumptions)
PROJECT/SOURCE INFORMATION (size, material, number, duration to drive pile, etc.)		

STEP 2: QUANTITATIVE PROJECT-SPECIFIC INFORMATION

1 sec SEL = RMS	METRIC	WEIGHTING (WFA in kHz)	
	RMS (NOT Peak)	Sea Turtle Default WFA (kHz)	Marine Mammal Default WFA (kHz)
Unattenuated Sound Pressure Level (dB) (see Proxy Level Tab for surrogate values; Copy, ONLY Paste Values (123), not formulas)	153		
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)	0
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

	FISHES
	BEHAVIOR
	RMS Threshold (dB)
	150
Isopleth (meters)	15.8
Isopleth (feet)	52.0

Sea Turtles present

	SEA TURTLES	
	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

	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
	RMS Threshold (dB)
	120
Isopleth (meters)	1,584.9
Isopleth (feet)	5,199.8

LF Cet. present

MF Cet. present

HF Cet. present

Phocids present

NO OTARIIDS

Marine Mammal Hearing Group

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, cephaloscyrid, Lagenorhynchus crozieri & L. australis

Phocid pinnipeds (PW): true 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
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
C	0.13	1.2	1.36	0.75	0.64	2.35
Adjustment (-dB)	-0.05	-18.83	-23.50	-1.29	-0.60	0.00

$$W(f) = C + 10 \log_{10} \left(\frac{(f/f_1)^{2b}}{1 + (f/f_1)^{2b}} + \frac{(f/f_2)^{2b}}{1 + (f/f_2)^{2b}} \right)$$

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COASTAL RESOURCES
MANAGEMENT COUNCIL

18" Steel Piles - Vibratory Pile Driving

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

0

Attenuation

0

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

BEHAVIOR

RMS Isopleth

Fishes present

ISOPLETHS (meters)

ISOPLETHS (feet)

15.8

52.0

SEA TURTLES

PTS ONSET

BEHAVIOR

SEL_{cum} Isopleth

RMS Isopleth

Sea Turtles present

ISOPLETHS (meters)

ISOPLETHS (feet)

0.2

0.5

0.3

1.1

MARINE MAMMALS

PTS ONSET (SEL_{cum} isopleth, meters)

PTS ONSET (SEL_{cum} isopleth, feet)

3.8

12.6

0.3

1.1

5.7

18.7

2.3

7.7

0.2

0.5

ALL MM

Behavior (RMS isopleth, meters)

Behavior (RMS isopleth, feet)

1,584.9

5,199.8

MF Cet. present HF Cet. present Phocids present NO OTARIIDS

LF Cet. present

RECEIVED

3/12/2024

COASTAL RESOURCES
MANAGEMENT COUNCIL