Letter of Authorization Application – Addendum to G&G Permit Application

Long Form – Assumes proprietary materials of BOEM G&G application are not provided to NMFS

Requested Period of Effectiveness:
Start date : September 1st, 2023
End date : April 31st, 2024

BOEM permit# : L23-022

A. Type of Survey:

Please indicate which type of survey will be used in the proposed activity
_X_ Deep Penetration Seismic (greater than 1,500 in^3 total airgun array volume) • 2D Seismic-towed Streamer • 2D Seismic-Seafloor Cable or Nodes • 3D Seismic-towed Streamer • 3D Seismic-Seafloor Cable or Nodes • NAZ • WAZ • 4D (Time Lapse) • Vertical Cable • Borehole Seismic (VSP) **___ Shallow Penetration Seismic (less than 1,500 in^3 total airgun array volume)** • Surface Vessel • Surface Vessel and AUV/ROV • Borehole Seismic (VSP) **___ HRG Surveys (no airguns used)** • Surface vessel • AUV/ROV • Both **___ Other** Describe (if Other):

Proxy used : Coil

WesternGeco is applying for an LOA to acquire a long offset sparse OBN survey.

The Coil proxy option has been used in the Exposure Estimation Tool because it most closely resembles sparse OBN. Both Coil and sparse OBN use efficient acquisition methodology to

acquire Full Azimuth (FAZ) and long offset data to enable better imaging of the sub-surface geological structures in both production/development and exploration settings. Both acquisition methods use multiple sources, towed from different vessels to achieve the Full Azimuth and Long Offset data set. Long offsets being 30 Km for sparse OBN and 18-20 Km for Coil. Full Azimuth (FAZ) means each receiver collects data from a full range of azimuths, i.e. 0° - 360°, thereby "illuminating" the sub-surface geological structures from different directions and therefore providing a clearer image of potential drilling prospects.
In contrast, 3D NAZ is narrow azimuth and short offset, typically 8-10 Km, with a source towed by a single vessel, the same vessel that tows the receiver array. Narrow Azimuth means each receiver collects data from a limited range of azimuths, i.e. 150° - 210° relative to the source and therefore there is a limitation on this technology's ability to image the deep geological structures.

B. Survey Area and Operational Plan:

Question:	Response
Location: (Lease Block(s), Facility or Prospect Name, Lat/Lon, etc.)	**Green Canyon and Walker Ridge** Engagement-5
Overall Duration of the Activity (days):	85 days
Areal extent of the survey area: (in OCS lease blocks or km^2) (Attach GIS file(s) of survey lines and/or survey area perimeter)	401 OCS blocks for the node area 795 OCS blocks for the source area Source and node perimeter shape files attached
G&G ITR/PEIS Modeling Zone(s) in which the activity will occur (1-7):	Zones 5 & 7 The proposed survey area is split between zones 5 and 7 with 50% of the survey in each zone
Number of days during the overall activity period on which the sound source(s) listed in Section C will operate: (If the activity will occur in more than one Modeling Zone, provide the number of operating days within each modeling zone.)	65 days The survey is planned to last from mid-September to mid-March. Hence, a 50/50 Summer/Winter split has been used for the modelling.
Water depth range	1,000 m to 3,000 m

C. Sound Sources:

- List all survey-related instruments that emit acoustic energy into the water column, including but not limited to airgun or airgun arrays, sub-bottom profilers, bubble pulsers, sparkers, side scan sonars, multi-beam sonars, single-beam echosounders, ultra-short baseline (USBL) position systems, pressure inverted echosounder (PIES), etc.
- For airgun arrays, please attach a diagram showing the layout (geometry) of the array and list of airgun sizes. See attached source description file: Gundalf_repB_5240_10m_2518.pdf and Gundalf_repC_5240_10m_6610.pdf
- The Gemini enhanced frequency source (EFS) is also under consideration for this project. The source description and modelling can be found in the attached file: Gemini_Source_Modelling_Report.pdf

Energy Source	**Manu-facturer**	**Model**	**Total Array Volume & Number of Elements** (cubic inches or Liters.)	**Source Level (SL) in dB re 1µPa@1m in water** (RMS)	**Source Level (SL) in dB re 1µPa@1m in water** (Peak to Peak)	**Operating Frequency** (Hz, kHz, range)	**Pulse Duration** (seconds, milli-seconds)	**Pulse Rate (or Cycle)** (Pulses per second or minute)	**Towing Depth of the Source** (ft or m)	**Towing Depth of the Receiver(s)** (ft or m)	**Duration of Use** (Number of Days or Percent of Active Sound Source Days)
Air gun array	Bolt	Long Life	5230 cu. in.	234	259	0-128 Hz	100 msecs	8 seconds	10 m	OBN receivers on Seabed	65
Pressure Inverted Echo Sounder	Sonardyne	8036	NA	188-200 dB	190-200 dB	14-19 KHz	NA	1 pulse every 15 seconds	Placed on seabed	Placed on seabed	85
Single beam echosounder One per vessel	Simrad	EA600	NA			38 Khz					85
USBL system	Kongsberg	HiPAP 501	NA			21-31 Khz					85
Gemini Enhanced frequency source (EFS)	Sercel	Gemini	8000	220	243	0-128 Hz	100 msecs	8 seconds	10 m	OBN receivers on Seabed	65

Note: the source will be either the standard air gun array or the Gemini EFS – both sources will not be utilized.

D. Take Estimate:

[*Insert the "Summary for NOAA" table here after completing all required inputs on the "Applicant Data Entry" spreadsheet in the Take Calculator Excel file or alternative tool developed with/by NMFS*]

Zone 5

Parameters	
Survey Type	*COIL*
Zone Number	*5*

Schedule	
Season	# days
Summer	16
Winter	16

Exposures by Metric				Total take, including Level B Scaling (where appropriate)		
	Summer	Winter	Total	Summer	Winter	Total
Level A						
Low-Frequency Hearing Group						
Bryde's whale	0.15	0.16	0.31			
High-Frequency Hearing Group						
Kogia (dwarf, pygmy sperm whale)	8.55	8.55	17.09			
Level B						
Low-Frequency Hearing Group						
Bryde's whale	6.99	7.01	14.01	1.4689211	1.48668722	2.96
Mid-Frequency Functional Hearing Group						
Beaked whales (Cuvier/Blainville/Gervais)	1,832.22	1,886.49	3,718.71	185.05	190.54	375.59
Bottlenose dolphin	1,444.78	1,536.94	2,981.71	414.65	441.10	855.75
Short-finned pilot whale	170.97	173.46	344.44	50.44	51.17	101.61
Sperm whale	427.42	423.56	850.98	180.80	179.17	359.96
Atlantic spotted dolphin	594.77	613.91	1,208.68	170.70	176.19	346.89
Clymene dolphin	866.67	912.75	1,779.42	248.73	261.96	510.69
False killer whale	217.80	224.53	442.33	64.25	66.24	130.49
Fraser's dolphin	101.03	102.50	203.53	28.99	29.42	58.41
Killer whale	5.81	6.05	11.85	1.71	1.78	3.50
Melon-headed whale	591.07	599.69	1,190.76	174.37	176.91	351.27
Pantropical spotted dolphin	3,932.85	4,141.97	8,074.82	1128.73	1188.74	2317.47
Pygmy killer whale	136.90	141.13	278.03	40.39	41.63	82.02
Risso's dolphin	254.27	268.17	522.44	75.01	79.11	154.12
Rough-toothed dolphin	314.64	324.36	639.00	90.30	93.09	183.39
Spinner dolphin	1,053.82	1,109.85	2,163.67	302.45	318.53	620.97
Striped dolphin	338.50	356.50	694.99	97.15	102.31	199.46
High-Frequency Hearing Group						
Kogia (dwarf, pygmy sperm whale)	145.68	153.00	298.68	55.31	57.66	112.97

Level A Color Legend:	
	Level A SEL
	Level A Peak

*If no color highlight, both level A peak and SEL are <0.01

Zone 7

Parameters	
Survey Type	*COIL*
Zone Number	*7*

Schedule	
Season	# days
Summer	16
Winter	16

Exposures by Metric			
	Summer	Winter	Total
Level A			
Low-Frequency Hearing Group			
Bryde's whale	< 0.01	< 0.01	< 0.01
High-Frequency Hearing Group			
Kogia (dwarf, pygmy sperm whale)	4.05	4.05	8.10
Level B			
Low-Frequency Hearing Group			
Bryde's whale	< 0.01	< 0.01	< 0.01
Mid-Frequency Functional Hearing Group			
Beaked whales (Cuvier/Blainville/Gervais)	705.04	759.92	1,464.96
Bottlenose dolphin	3.20	3.75	6.94
Short-finned pilot whale	16.61	19.04	35.65
Sperm whale	77.49	86.06	163.55
Atlantic spotted dolphin	< 0.01	< 0.01	< 0.01
Clymene dolphin	311.71	372.77	684.49
False killer whale	113.43	132.27	245.70
Fraser's dolphin	53.13	60.90	114.03
Killer whale	11.40	13.35	24.75
Melon-headed whale	209.59	240.24	449.83
Pantropical spotted dolphin	3,094.68	3,700.90	6,795.58
Pygmy killer whale	100.23	116.88	217.12
Risso's dolphin	51.78	60.10	111.87
Rough-toothed dolphin	121.11	141.23	262.34
Spinner dolphin	72.62	86.84	159.46
Striped dolphin	161.93	193.65	355.57
High-Frequency Hearing Group			
Kogia (dwarf, pygmy sperm whale)	38.55	44.39	82.93

Level A Color Legend:	
	Level A SEL
	Level A Peak

*If no color highlight, both level A peak and SEL are <0.01

Total take, including Level B Scaling (where appropriate)		
Summer	Winter	Total
< 0.01	< 0.01	< 0.01
71.21	76.75	147.96
0.92	1.08	1.99
4.90	5.62	10.52
32.78	36.40	69.18
< 0.01	< 0.01	< 0.01
89.46	106.99	196.45
33.46	39.02	72.48
15.25	17.48	32.73
3.36	3.94	7.30
61.83	70.87	132.70
888.17	1062.16	1950.33
29.57	34.48	64.05
15.27	17.73	33.00
34.76	40.53	75.29
20.84	24.92	45.76
46.47	55.58	102.05
16.42	18.30	34.72

Zone 5 + 7 Combined

Zone	5	7	5+7
Season	Summer / Winter	Summer / Winter	Summer / Winter
# days	32.5	32.5	65
Survey Type	Coil	Coil	Coil

Level B			
Low-Frequency Hearing Group			
Bryde's whale	14.01	< 0.01	14.01
Mid-Frequency Functional Hearing Group			
Beaked whales (Cuvier/Blainville/Gervais)	3,718.71	1,464.96	5,183.67
Bottlenose dolphin	2,981.71	6.94	2,988.66
Short-finned pilot whale	344.44	35.65	380.09
Sperm whale	850.98	163.55	1,014.52
Atlantic spotted dolphin	1,208.68	< 0.01	1,208.68
Clymene dolphin	1,779.42	684.49	2,463.91
False killer whale	442.33	245.70	688.03
Fraser's dolphin	203.53	114.03	317.56
Killer whale	11.85	24.75	36.60
Melon-headed whale	1,190.76	449.83	1,640.58
Pantropical spotted dolphin	8,074.82	6,795.58	14,870.41
Pygmy killer whale	278.03	217.12	495.15
Risso's dolphin	522.44	111.87	634.32
Rough-toothed dolphin	639.00	262.34	901.34
Spinner dolphin	2,163.67	159.46	2,323.13
Striped dolphin	694.99	355.57	1,050.57
High-Frequency Hearing Group			
Kogia (dwarf, pygmy sperm whale)	298.68	82.93	381.61

E. Mitigation and Monitoring Efforts:

Question:	Response:
Please indicate which set of monitoring and mitigation measures from the ITR's apply to the planned activity:	All monitoring and mitigation measures in the ITRs applicable to Airgun Surveys with a total volume >1500 cu in will be followed. See attached file "Mitigation Measures.pdf" for a list of applicable monitoring and mitigation measures. Additionally, to avoid potential taking of killer whales, the airgun array will be shut down if killer whales are observed at any distance from the array while in operation.
Confirm that you will apply this set of monitoring and mitigation measures during the activity:	Yes, we will apply these measures during the 3D OBN survey.

F. Map of Survey Area and Transit Route

[*Insert map here or attach as a separate file*]