

Sunrise Wind Pile Driving Monitoring Plan (WTG Monopile Foundation)

Submitted To:

National Marine Fisheries Service

Office of Protected Resources

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List of Abbreviations and Acronyms

μPa	microPascal(s)
re 1 μPa	referenced to a pressure of 1 microPascal
AMAR	autonomous multichannel acoustic recorder
APC	American Power Conversion
ASL	above sea level
BA	Biological Assessment
BBC	big bubble curtain
DBBC	Double big bubble curtain
BiOp	Biological Opinion
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety and Environmental Enforcement
COP	Construction and Operations Plan
CPA	closest point of approach
dB	decibel(s)
DMON	Acoustic digital monitor
DP	Designated person
DOI	Department of the Interior
ESA	Endangered Species Act
EST	Eastern Standard Time
FAD	free air delivery
FEIS	Final Environmental Impact Assessment
FFT	fast Fourier transform
FLT	flange lifting tool
FOV	Field of view
FR	Federal Register
GARFO	Greater Atlantic Regional Fisheries Office
GPS	global positioning system
HARP	high-frequency acoustic recording package
HSD	Hydro-sound Damper
HSE	Health, Safety and Environment
HTI	Hydroacoustic Technology Inc.
Hz	Hertz
ITR	Incidental Take Regulation
ITS	Incidental Take Statement
ID	identification number
IR	infrared
kHz	kilohertz
kJ	kilojoule(s)
km	kilometer(s)
Lease Area	BOEM-designated Renewable Energy Lease Area OCS-A 0487
LOA	letter of authorization
m	meter(s)
MA-WEA	Massachusetts Wind Energy Area
MARU	marine acoustic recording unit
MCPGF	motion compensated pile gripper frame
MF	mid-frequency
mm	millimeter(s)
min	minute
MMPA	Marine Mammal Protection Act

M/V	motor vessel
MW	megawatt
MWS	Marine Warranty Surveyor
NARW	North Atlantic right whale
NAS	noise abatement systems or noise attenuation systems
NCEI	National Centers for Environmental Information
NMFS	National Marine Fisheries Service
NTL	Notice to Lessees
OCM	Offshore Construction Manager
OCS	Outer Continental Shelf
OCS-DC	offshore converter station
OPR	Office of Protected Resources
Orsted	Orsted Wind Power North America LLC
PAM	passive acoustic monitoring
PDC	project design criteria
PDMP	Pile Driving Monitoring Plan
POC	point of contact
Project	Sunrise Wind Offshore Wind Farm Project
PSO	Protected Species Observer(s)
PTS	permanent threshold shift
Q2	second quarter
Q3	third quarter
QA	quality assurance
QC	quality control
RI-MA-WEA	Rhode Island/Massachusetts Wind Energy Area
rms	root mean square
ROC	Rehearsal of Concept
ROD	Record of Decision
RSA-ORCA	Multi-channel subsea acoustic recorder
RWSAS	Right Whale Sighting Advisory System
SAS	Sightings Advisory System
SEL _{cum}	cumulative sound exposure level
SFV	sound field verification
SNR	Signal to Noise Ratio
SPL	sound pressure level
SPL _{pk}	peak sound pressure level
SPL _{rms}	root-mean-square sound pressure level
SRWF	Sunrise Wind Farm
SZ	Shutdown Zone
TTS	temporary threshold shift
US	United States
USACE	United States Army Core of Engineers
USFWS	United States Fish and Wildlife Service
UTC	Coordinated Universal Time
UXO	unexploded ordnance
VHF	very high frequency
WEA	Wind Energy Area
WM	Works manager
WTG	wind turbine generator

1 Introduction

Sunrise Wind LLC (Sunrise Wind) plans to construct and operate the Sunrise Wind Farm Project (SRWF) Project (hereinafter referred to as the Project). Sunrise Wind has developed this Pile Driving Monitoring Plan (PDMP or Plan) for impact pile driving of the WTG monopile foundations at the SRWF, for review and concurrence by the Department of the Interior (DOI) and the National Marine Fisheries Service (NMFS) prior to commencing installation activities. This Plan is submitted pursuant to Condition 5.5.8 of the Approval of the Construction and Operations Plan (COP) for the Project, the Sunrise Wind Letter of Authorization (89 FR 53589, June 27, 2024), which is consistent with the final rulemaking (89 FR 45292) that was promulgated by the NMFS Office of Protected Resources (OPR) on 22 May 2024 as well as the Endangered Species Act (ESA) Section 7 Consultation Biological Opinion (BiOp) issued by NMFS-Greater Atlantic Fisheries Office (NMFS-GARFO) on 28 September 2023. Additional details on these conditions are included in Table 1. This Plan provides protocols and guidelines for mitigation and monitoring activities to minimize potential impacts on marine mammals and sea turtles.

Table 1. Relevant Conditions from COP Approval, Final ITR, LOA, and BiOp

Condition	Detail
COP Condition 5.5.8	The Lessee must submit a Marine Mammal and Sea Turtle Monitoring Plan for Pile Driving and UXO Detonation to BOEM, BSEE, and NMFS GARFO-PRD at least 180 days before any pile driving or UXO detonation is planned. This may be a single plan or two separate plans. BOEM, BSEE, and NMFS GARFO – PRD will review the plan and provide comments within 45 days of receipt of the plan. The plan may not be implemented, and thus pile driving may not begin until concurrence is reached by BOEM and BSEE. BOEM and BSEE will inform the Lessee if the plan is inconsistent with those requirements. The Lessee must resubmit a modified plan that addresses the identified issues within 30 days of the receipt of the comments but at least 15 days before the start of the associated activity.
COP Condition 5.5.8.1	The Lessee must submit the Reduced Visibility Monitoring/Nighttime Pile Driving Monitoring Plan (or plans if separate plans are submitted) to BOEM, BSEE, and NMFS GARFO – PRD at least 180 days before impact pile driving is planned to begin unless a longer time period is identified in the MMPA Letter of Authorization. BOEM, BSEE, and NMFS GARFO-PRD will review the Reduced Visibility Monitoring Plan/Nighttime Pile Driving Monitoring Plan and provide comments within 45 days of receipt of the plan. The plan may not be implemented, and thus pile driving may not begin, until concurrence is reached by BOEM and BSEE. BOEM and BSEE will inform the Lessee if the plan is inconsistent with those requirements. The Lessee must resubmit a modified plan that addresses the identified issues within 30 days of the receipt of the comments and at least 15 days before the start of the associated activity.
LOA Condition 3(c)(16)	Sunrise Wind must submit a Foundation Installation Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. Sunrise Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving. The plan must detail all plans and procedures for noise attenuation, including procedures for adjusting the noise

	attenuation system(s) and available contingency noise attenuation measures/systems if distances to modeled isopleths of concern are exceeded during SFV. The plan must include a description of all monitoring equipment and PAM operator and PSO protocols (including number and location of PSOs and PAM operators) for all foundation pile driving and an informal guide to aid personnel in identifying species if they are observed in the vicinity of the project area.
Final ITR § 217.314 (c)(16)	Sunrise Wind must submit a Foundation Installation Pile Driving Marine Mammal Monitoring Plan to NMFS Office of Protected Resources for review and approval at least 180 days prior to planned start of foundation pile driving and abide by the Plan if approved. Sunrise Wind must obtain both NMFS Office of Protected Resources and NMFS Greater Atlantic Regional Fisheries Office Protected Resources Division's concurrence with this Plan prior to the start of any pile driving. The Plan must detail all plans and procedures for sound attenuation, including procedures for adjusting the noise attenuation system(s) and available contingency noise attenuation measures/systems if distances to modeled isopleths of concern are exceeded during SFV. The Plan must include a description of all monitoring equipment and PAM operator and PSO protocols (including number and location of PSOs and PAM operators) for all foundation pile driving and an informal guide to aid personnel in identifying species if they are observe in the vicinity of the project area.
BiOp Terms and Condition (T&C) 11 (b):	Marine Mammal and Sea Turtle Monitoring Plan – Pile Driving and UXO Detonation. BOEM, BSEE, and/or Sunrise Wind must submit this Plan to NMFS GARFO at least 180 calendar days before any pile driving for foundation installation is planned. BOEM, BSEE, and/or Sunrise Wind must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of any pile driving for foundation installation.
BiOp T&C 11(c):	Reduced Visibility Monitoring Plan/Nighttime Pile Driving Monitoring Plan. BOEM, BSEE, and/or Sunrise Wind must submit this Plan or Plans (if separate Daytime Reduced Visibility and Nighttime Monitoring Plans are prepared) to NMFS GARFO at least 180 calendar days before impact pile driving is planned to begin. BOEM, BSEE, and Sunrise must obtain NMFS GARFO's concurrence with this Plan(s) prior to the start of pile driving.

¹ The UXO/MEC detonation monitoring plan will be submitted separately from the WTG PDMP given the separate anticipated commencement dates of each individual activity.

1.1 Permits and Agreements

Permits and agreements pertaining to the Project will define the mitigation and monitoring requirements through the various stages of the construction process. The permits and agreements in place for the Project are provided in Table 2. The requirements laid out in the most updated versions of all documents are reflected in the Plan. Any questions arising in the field regarding mitigation and monitoring should directly reference the applicable permits and agreements.

Table 2. Permits and agreements associated with protected species monitoring and mitigation within the Project Area.

Document Title	Issuing Organization	Issue/Revision Date	Acronym Used	Link (if available)
Final Incidental Take Rule (89 FR 45292)	NMFS- OPR	May 22, 2024	ITR	https://www.govinfo.gov/content/pkg/FR-2024-05-22/pdf/2024-09902.pdf
Letter of Authorization (89 FR 53589)	NMFS – OPR	June 27, 2024	LOA	https://www.fisheries.noaa.gov/action/incidental-take-authorization-sunrise-wind-llc-construction-and-operation-sunrise-wind
United States Department of Interior Fish and Wildlife Service Biological Opinion	USFWS	June 29, 2023	BiOp	Not available at this time
Endangered Species Act Section 7 Consultation Biological Opinion	NMFS- GARFO	September 28, 2023	BiOp	https://repository.library.noaa.gov/view/noaa/55726
Sunrise Wind Farm and Sunrise Wind Export Cable Final Environmental Impact Statement	BOEM	December 2023	FEIS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20Final%20Environmental%20Impact%20Statement%20Volume%201.pdf
Sunrise Wind Construction and Operations Plan and Appendices	Sunrise Wind	December 20, 2023	COP	https://www.boem.gov/renewable-energy/state-activities/sunrise-wind-construction-and-operation-plan
Sunrise Wind Farm and Sunrise Wind Export Cable – Development and Operation Biological Assessment	BOEM for USFWS	December 15, 2022	BA – USFWS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20BA%20for%20USFWS.pdf
Sunrise Wind Farm and Sunrise Wind Export Cable – Development and Operation Biological Assessment	BOEM for NMFS-GARFO	December 15, 2022	BA – NMFS	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/Sunrise%20Wind%20Biological%20Assessment%2005JAN2023%20508.pdf
Record of Decision	BOEM	March 26, 2024	ROD	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/05579_Record%20of%20Decision_Sunrise%20Wind_OCS-A%200487.pdf
Sunrise Wind Farm and Sunrise Wind Export Cable– COP Approval	BOEM	June 21, 2024	COP Approval	https://www.boem.gov/sites/default/files/documents/renewable-energy/state-activities/5774_App%20A_Sunrise%20Wind_Conditions%20of%20COP%20Approval_OCS-A%200487_FINAL.pdf
Offshore Wind Site Assessment Programmatic ESA Consultation	NMFS	June 29, 2021	PDC	https://media.fisheries.noaa.gov/2021-12/OSW-surveys-NLAA-programmatic-rev-1-2021-09-30-508-.pdf

1.2 Zone Definitions

Throughout this Plan, zones are described that identify either an impact range or areas within which mitigation and/or monitoring occurs. The size of the zones and the mitigation measures (if necessary) taken within each zone will be activity- and species-specific. Here, protected species includes marine mammals, sea turtles, and fish. The zones applicable during this Project are defined below.

- **Potential Injury Zone** – For marine mammals, the potential injury zone is defined as the distances within which Level A Harassment¹ may occur. The PTS thresholds for marine mammals ((frequency-weighted cumulative sound exposure level (SEL_{cum}) and unweighted peak sound pressure level (SPL_{pk}))) are defined by NMFS (2018). Potential injury thresholds for sea turtles were developed by the US Navy using dual criteria (SEL_{cum} and SPL_{pk}) along with auditory weighting functions in conjunction with SEL thresholds as defined by Finneran et al. (2017). This includes, but is not limited to, the area ensonified by a sound source to an acoustic isopleth defined by the threshold at which onset of PTS in hearing may occur in marine mammals and sea turtles. For fish without swim bladders, fish with swim bladders, fish with swim bladders not involved in hearing, and fish with swim bladders involved in hearing, the physical injury thresholds (SPL_{pk} and SEL_{cum}) are recommended by Popper et al. (2014). For fish equal to or greater than 2 grams and fish less than 2 grams, the physical injury thresholds (SPL_{pk} and SEL_{cum}) are recommended by NMFS GARFO (2020). Marine mammals and ESA-listed species observed within the applicable potential injury zone(s) during impact pile driving may constitute a take².
- **Behavioral Harassment Zone** – The behavioral harassment zone for marine mammals is defined as the distance within which Level B³ harassment may occur. For non-explosive, intermittent sources like impact pile driving, the Level B harassment threshold is defined by NMFS as the unweighted root-mean-square (rms) sound pressure level (SPL_{rms}) of 160 decibels (dB) referenced to (re) 1 microPascal (μPa) (NMFS 2022). The behavioral harassment threshold for sea turtles is defined by NMFS GARFO as a SPL_{rms} of 175 dB re 1 μPa from all non-explosive sound sources (McCauley et al. 2000; Finneran et al. 2017). The behavioral disturbance threshold for ESA-listed fishes was developed by the NMFS GARFO (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011) and set at a SPL_{rms} of ≥ 150 dB re 1 μPa from non-explosive, intermittent sources (Andersson et al. 2007; Wysocki et al. 2007; Mueller-Blenkle et al. 2010; Purser and Radford 2011). Marine mammals within the behavioral harassment zone, or Level B harassment zone, during impact pile driving would constitute a take².
- **Minimum Visibility Zone** – The area within which PSOs must be able to visual detect a marine mammal (the area must be free of visual obstructions such as fog) for a pre-

¹ Level A refers to marine mammal harassment as defined in the Marine Mammal Protection Act (MMPA) that could potentially cause permanent threshold shift (PTS) or auditory injury (marine mammals and sea turtles)/physical injury (fish).

² Take as defined under the ESA means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct”. Take under the MMPA means to “harass, hunt, capture, or kill, or attempt to harass, hunt, capture, or kill any marine mammal.

³ Level B refers to marine mammal harassment as defined in the MMPA that could potentially cause behavioral disturbance.

determined length of time immediately prior to the start of pile driving. The minimum visibility zone for marine mammals is defined as the ER95% distance for NARWs modeled under the applicable construction scenario. Clearance of the minimum visibility zone is intended to ensure that visibility conditions are sufficient enough for PSOs to effectively monitor the clearance zone prior to and during pile driving activity.

- **Clearance Zone** – The area that must be visually and/or acoustically clear of protected species prior to starting pile driving. Protected Species Observers (PSOs) and monitoring technologies such as passive acoustic monitoring (PAM) or infrared systems will be used to visually clear the clearance zone of protected species. Clearance zones may also be implemented prior to restarting the source after a shutdown of sound-producing activities. The size of the clearance zone is dependent on the activity and permit conditions. The clearance zone will be specific to species and/or faunal groups.
- **Shutdown Zone (SZ)** – The area within which a protected species sighting/detection will trigger an equipment shut down, power down, or other active mitigation measures defined in the permit conditions once a source is active. The size of the shutdown zone is dependent on the activity and permit conditions. Shutdown zones will be specific to species and/or faunal groups.

2 WTG Monopile Description and Pile-Driving Summary

2.1 WTG Monopile Description

Sunrise Wind has proposed to construct and operate a 924 megawatts (MW) wind energy facility located on the Outer Continental Shelf (OCS) in the designated Bureau of Ocean Energy Management (BOEM) Renewable Energy Lease Area OCS-A 0487 (Lease Area). The SRWF will consist of installation of 84 wind turbine generators (WTGs) connected by a network of Inter-Array Cables and a single Offshore Converter Station (OCS-DC). The WTGs and OCS-DC will be sited in a uniform east-west/north-south grid with 1.15 mi (1 nm, 1.8 km) by 1.15 mi (1 nm, 1.8 km) spacing that aligns layouts proposed for other projects in the Rhode Island/Massachusetts Wind Energy Area (MA WEA). This Plan includes mitigation measures associated with the sequential installation of WTG monopile (MP) foundations (two or three piles/day), as well as concurrent installation (proximal assumptions⁴) of WTG MP foundations (one vessel installing two MPs per day) and the OCS-DC foundation (one vessel installing four pin piles per day). Concurrent installation (distal assumptions⁵) of WTG MP foundations (one vessel installing two MPs per day) and OCS-DC jacket foundation (one vessel installing four pin piles per day) may occur during OCS-DC foundation installation campaign as well. However, the mitigation measures and associated zone sizes for concurrent installation of WTG MPs and OCS-DC jacket foundation included in this Plan are based on the **proximal** assumptions which result in the most conservative ranges to auditory (marine mammal and sea turtles)/physical (fish) injury and behavioral thresholds.

Each WTG will be installed on MP foundations that will be driven using an impact hammer with a maximum hammer energy of 4,000 kJ. The underwater acoustic analysis and exposure modeling assumed

⁴ The two vessels are assumed to be within the proximal separation distance of 3 nm with two foundation locations between the vessels.

⁵ The two vessels are assumed to be installing at opposite ends of the SRWF (distal separation).

WTG MP foundations supported by a tapered MP foundation that is 7 m on top and 12 m diameter at the mudline (7/12 m). The final engineering design of the MP results in diameters of 10 m for all WTG MPs. Installation of a single MP foundation is expected to require a maximum of 4 hours of active impact hammering, which can occur either in a continuous 4-hour interval or intermittently over a longer period of time. It is anticipated that a maximum of three WTG MP foundations can be driven into the seabed per day using a single installation vessel, assuming 24-hour pile driving operation⁶. Additionally, it is possible that two separate vessels may work simultaneously which would result in installation of up to four total monopiles per day (maximum two per day on each of the two vessels), assuming 24-hour pile driving operations. WTG foundation installation is expected to be completed within a 4 – 5-month period from Q2 – Q4 2025 and Q2 – Q3 2026 (outside of December⁷ through April). A noise abatement system (NAS) consisting of simultaneous use of a double big bubble curtain (DBBC) and a Helmholtz resonator (AdBm) will be deployed during each WTG pile driving event to reduce sounds propagated into the marine environment. Information on components of the NAS are provided in Appendix A.

2.1.1 WTG Monopile Foundations

Figure 1 provides a conceptual example of the WTG support structures (i.e., towers and foundations) which will be designed to withstand 500-year hurricane wind and wave conditions, and the external platform level will be designed above the 1,000-year wave scenario. A WTG MP foundation typically consists of a single steel tubular section, with several sections of rolled steel plate welded together. A transition piece (TP) may be fitted over the top of the MP and secured via a bolted connection. Secondary structures on each WTG MP foundation will include a boat landing or alternative means of safe access (e.g., Get Up Safe – a motion compensated hoist system allowing vessel to foundation personnel transfers without a boat landing), ladders, a crane, and other ancillary components. The TP may either be installed separately following the MP installation or the MP and TP may be fabricated and installed as an integrated single component. If the MP and TP are fabricated and installed as an integrated component, the secondary structures will be installed on the TP subsequently and in separate smaller operations. The TP will be painted yellow and marked according to United States Coast Guard (USCG) requirements.

22 MPs will include installation aids to allow safe installation. Installation aids are internal rings secured to the inner wall of the MPs at the lowest or second lowest can. The aids are designed to break off after the self-weight penetration process, when seabed resistance increases (typically after 10 m of penetration). The remaining MPs will not have any special features for the installation process.

The WTG MPs will be installed to a maximum penetration depth of 50 m (164 ft). Installation of each MP will include a soft start where lower hammer energy is used at the beginning of each pile segment during pile driving activity to provide additional protection to mobile species (e.g., whales,

⁶ 24-hour pile driving operations are subject to NMFS' approval of the *Nighttime Monitoring Plan for Pile Driving*.

⁷ No impact pile driving is planned for the months of December through April; however, installation in December may occur, upon NMFS approval, in the case of unexpected delays. If Sunrise Wind requests NMFS approval for WTG MP installation in December due to unexpected delays, Sunrise Wind will provide an amended WTG PDMP that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 3,000 m and 4,000 m clearance/shutdown zone for sequential and concurrent WTG MP installation in summer, respectively.

dolphins, porpoises) in the vicinity by allowing them to vacate the area prior to the commencement of pile driving activities.

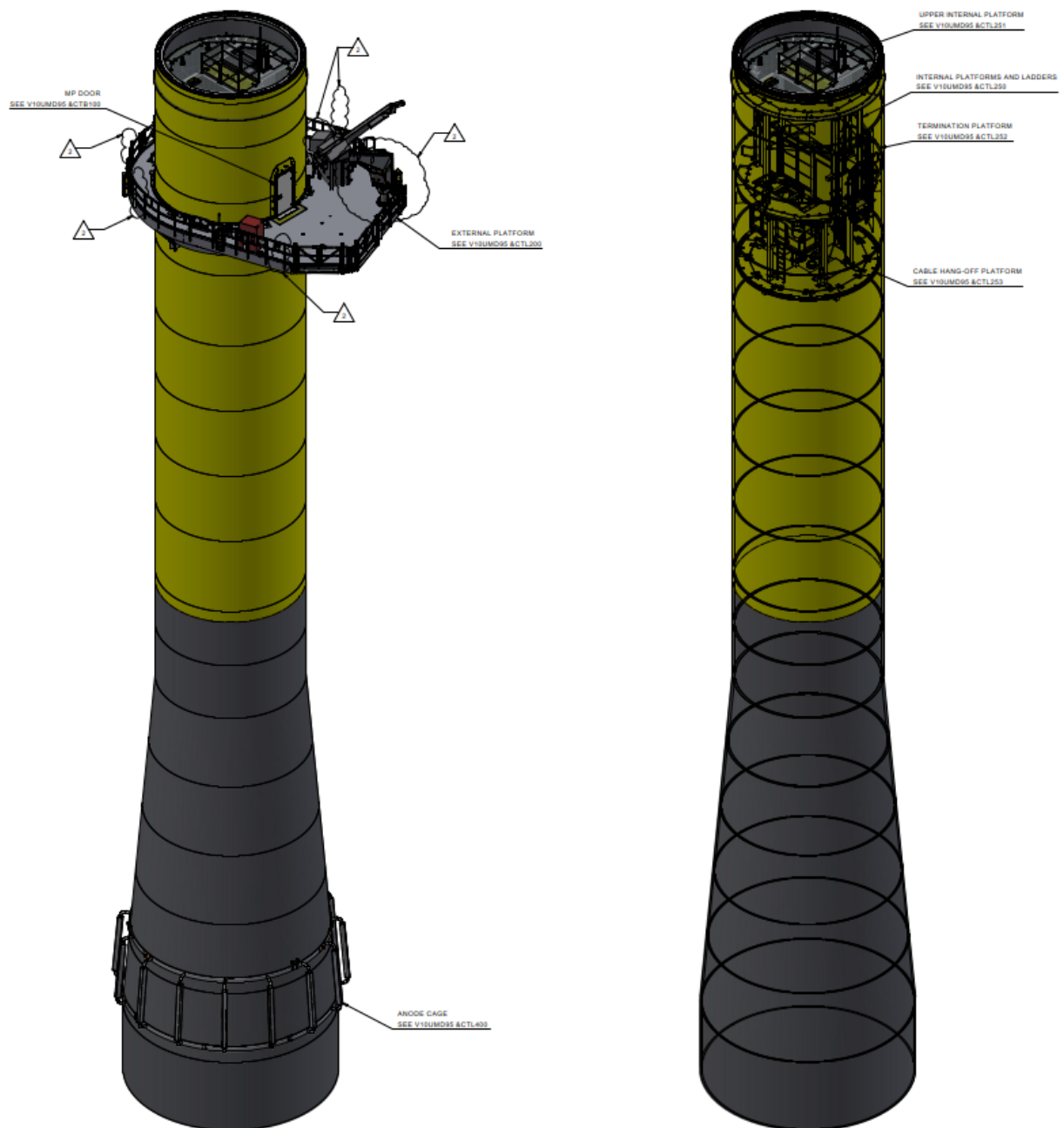


Figure 1. Schematic drawing of a WTG MP foundation

2.1.2 Sequence of Events for Pile Driving

A go/no-go meeting will be held prior to the start of the pile driving installation sequence described in this section. The meeting will include the Offshore Construction Manager (OCM), on-duty Lead PSO, Client representative, and Marine Warranty Surveyor. Several factors are considered during the go / no-go

meeting including the available weather window, weather forecast, offshore measurements, and operational design limits. The main factor considered prior to WTG foundation installation is the crane block movement which is affected by the roll and pitch of the installation vessel. The roll and pitch of the installation vessel are influenced by environmental factors such as swell, wind wave height, wave period, wave and wind direction, and wind speed. A non-PSO related minimum visibility is also assessed, which is defined as >1,000 m or clear visibility to the top of the crane. Additionally, weather forecasts will be taken into account during the go/no-go meeting including forecasted visibility conditions (e.g., fog) and the likelihood of being able to clear the Minimum Visibility Zone (Table 8) as stipulated in LOA Condition 3(c)(13) and COP Condition 5.10.5. Lastly, once pile driving is considered safe to progress, the on-duty Lead PSO will ensure that the entire relevant minimum visibility zone (Table 8) is visually cleared for a full 30-minutes immediately prior to commencing WTG foundation installation activities. The MP will be lifted with the main crane and upended using the Upend Hinge (~1 hour) where it will then be transferred into the Motion Compensated Pile Gripper Frame (MCPGF) (~2 hours). The MCPGF horizontally restrains the pile and ensures installation within the required tolerances. The MP will then be positioned overhead the target installation location and lowered to self-penetration depth (~1 hour). The near field noise mitigation system (AdBm) will be lowered from the MCPGF once the pile is stabbed and engage NAS air compressors and AdBm (~10 minute). After de-coupling the Pile Flange Lifting tool and lowering the MP to self-weight penetration, the hydraulic hammer (Menck 4400S) will be lifted from deck and placed on the MP (~1 hour). Once the MP is stabbed and self-weight penetration is achieved, it is no longer technically feasible to safely reverse operations and the MP must be driven to its final penetration depth. The MPs will be driven into the seabed using a Menck 4400 S hydraulic hammer with a maximum hammer energy of 4,000 kJ (Figure 2) (~1.5 hours). Once the target depth is reached the hammer will be retrieved, placed on deck and disconnected from the main crane. The sequence of events from foundation transport to foundation installation is summarized in Table 3.

Pile driving will only commence after the on-duty Lead PSO has confirmed that that clearance zone has been cleared by the PSOs and PAM operators of all applicable visual or acoustic detections of marine mammals and sea turtles for the required period of time. The hydraulic hammer is used to drive the MP to final penetration, initially with soft starts then with the required energy for installation. The soft start will involve initiating hammer operation at a reduced energy level (relative to full operating capacity) followed by a waiting period. Sunrise Wind will consider final details including site-specific soil properties and other considerations when developing the final protocol. During piling, monitoring will be undertaken to detect marine mammals and sea turtles and if required a shutdown will be initiated (see Section 3.9 for further details). After piling is completed the monitoring systems, near field (AdBm) and far field (DBBC) noise mitigation systems will shut down and retrieved for relocation to the next location, where the cycle will restart.



Figure 2. Menck 4400S hydraulic hammer

Table 3. Sequence of events for each WTG MP installation.

1	Starting points (~3 hours): • BL2 set up at installation location • MP in hinge with FLT connected; • Sufficient weather window determined to be available⁸; • Upend hinge ready for use • Hammer ready for use • MCPG activated and ready for use; • DBBC ready for use • NAS ready for use • Survey equipment ready for use.
2	Go/no-go meeting (~2 minutes): Offshore Construction Manager (OCM), on-duty Lead PSO, Client Rep. and Marine Warranty Surveyor (MWS) must agree that it is considered safe to progress with the installation process. MWS to issue a Certificate of Approval (CoA)
	 Operational Hold Point
3	Upend MP in MP hinge (~1 hour)
4	Bring MP into MCPGF (~2 hours)
5	Lower MP onto seabed (~1 hour)
6	Close MCPGF (~1 hour)
7	Start AdBm air compressors and airflow to DBBC and lower AdBm/NAS (~ 10 minute)
8	Lift hammer and stab on top of MP (~ 1 hour)
9	Confirm DBBC operation and Clearance period completed from Lead PSO (~ 1 minute)
10	Engage AdBm/NAS air compressors (~10 minutes)
	Start hammer energy recording (~20 minutes)
11	Commence pile driving with soft-start protocols including single blows with low energy until automatic setting can be engaged
12	Drive pile to final penetration or refusal depth, whichever may come first (~1.5 hours)
13	Discontinue DBBC and AdBm/NAS operation (~10 minutes)
14	Raise AdBm/NAS (~30 minutes)
15	Open MCPGF (~30 minutes)

⁸ Typically, it is required to have a minimum of 10.5 hours of acceptable conditions to carry forward with a pile installation. This acceptable timeframe is subject to change based on field conditions and is at the discretion of the contractor responsible for pile installation.

3 Mitigation and Monitoring

There are seven primary mitigation and monitoring components associated with impact pile driving for MP foundations:

1. Vessel-based visual PSOs and associated visual monitoring tools stationed on the installation vessel and additional protected species observer (PSO) vessels;
2. Visual monitoring during daylight and reduced visibility conditions;
3. Visual monitoring during nighttime;
4. PAM monitoring;
5. Noise abatement systems (NAS);
6. Acoustic measurement data collection (SFV to validate the modeled ranges to the potential auditory (marine mammals and sea turtles)/physical (fish) injury and behavioral harassment isopleths on which clearance and shutdown zones and take estimate, are based); and
7. Data recording and reporting.

3.1 Mitigation and Monitoring Zones

The mitigation and monitoring zones are based on the results of the underwater sound propagation modeling of potential auditory (marine mammals and sea turtles)/physical (fish) injury and behavioral harassment ranges for modeled scenarios (NMFS 2018). A further description on how these zone sizes were determined is explained within the Sunrise Wind Final Rule (89 FR 45292 2024) and the Sunrise Wind Farm and Sunrise Wind Export Cable Development and Operation Biological Assessment (BOEM 2022). These mitigation and monitoring zones may be modified, with NMFS-OPR, NMFS GARFO – PRD, BSEE, and BOEM approval, based on measurements of the received sound levels during piling operations as described in Section 3 of the *WTG Sound Field Verification Plan*.

Table 4: Threshold ranges and mitigation and monitoring zones during sequential WTG monopile (two or three piles/day) impact pile driving in Summer (May through November).

Species	Level A Zone ¹ (m) (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Monitoring and Mitigation Zones (m)		Minimum Visibility Zone	Vessel Separation Distance (m)
			Level B Harassment Zone ²	Clearance and Shutdown Zone		
Low-frequency Cetaceans						
Fin whale*	3,910	≤10	6,490	4,000	2,700	500
Minke whale	1,980	≤10	6,490	4,000	2,700	100
Sei whale*	2,690	≤10	6,490	4,000	2,700	500
Humpback whale	3,630	≤10	6,490	4,000	2,700	100
North Atlantic right whale*	2,660	≤10	6,490	See Table 8	2,700	500
Blue whale*	3,910	≤10	6,490	4,000	2,700	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,490	4,000	2,700	500
Atlantic spotted dolphin	-	≤10	6,490	200	2,700	50
Atlantic white-sided dolphin	-	≤10	6,490	200	2,700	50
Common dolphin	-	≤10	6,490	200	2,700	50
Risso's dolphin	-	≤10	6,490	200	2,700	50
Bottlenose dolphin	-	≤10	6,490	200	2,700	50
Long-finned pilot whale	-	≤10	6,490	200	2,700	50
High-frequency Cetaceans						
Harbor porpoise	-	200	6,490	200	2,700	50
Phocid Pinnipeds in Water						
Gray seal	-	≤10	6,490	100	2,700	50
Harbor seal	30	≤10	6,490	100	2,700	50
Sea Turtles						
Leatherback sea turtle*	930	-	1,920	500	500	100
Loggerhead sea turtle*	140	-	1,920	500	500	100
Kemp's ridley sea turtle*	430	-	1,920	500	500	100
Green sea turtle*	450	-	1,920	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A ER95% exposure ranges for two sequential monopile scenarios; 2 piles per day (Scenario 1) and 3 piles per day (Scenario 2) in summer and winter. The scenario resulting in the larger distances was used here.

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 5: Threshold ranges and mitigation and monitoring zones during sequential WTG monopile (two or three piles/day) impact pile driving in Winter (December only).

Species	Level A Zone ¹ (m) (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Monitoring and Mitigation Zones (m)		Minimum Visibility Zone	Vessel Separation Distance (m)
			Level B Harassment Zone ²	Clearance and Shutdown Zone		
Low-frequency Cetaceans						
Fin whale*	4,240	≤10	6,970	4,300	3,000	500
Minke whale	2,120	≤10	6,970	4,300	3,000	100
Sei whale*	3,090	≤10	6,970	4,300	3,000	500
Humpback whale	3,820	≤10	6,970	4,300	3,000	100
North Atlantic right whale*	2,900	≤10	6,970	See Table 8	3,000	500
Blue whale*	4,240	≤10	6,970	4,300	3,000	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,970	4,300	3,000	500
Atlantic spotted dolphin	-	≤10	6,970	200	3,000	50
Atlantic white-sided dolphin	-	≤10	6,970	200	3,000	50
Common dolphin	-	≤10	6,970	200	3,000	50
Risso's dolphin	-	≤10	6,970	200	3,000	50
Bottlenose dolphin	-	≤10	6,970	200	3,000	50
Long-finned pilot whale	-	≤10	6,970	200	3,000	50
High-frequency Cetaceans						
Harbor porpoise	-	180	6,970	200	3,000	50
Phocid Pinnipeds in Water						
Gray seal	≤10	≤10	6,970	100	3,000	50
Harbor seal	30	≤10	6,970	100	3,000	50
Sea Turtles						
Leatherback sea turtle*	930	-	2,020	500	500	100
Loggerhead sea turtle*	140	-	2,020	500	500	100
Kemp's ridley sea turtle*	420	-	2,020	500	500	100
Green sea turtle*	450	-	2,020	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A ER95% exposure ranges for two sequential monopile scenarios; 2 piles per day (Scenario 1) and 3 piles per day (Scenario 2) in summer and winter. The schedule resulting in the larger distances was used here.

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 6: Threshold ranges and mitigation and monitoring zones during proximal assumptions for concurrent piling of WTG monopiles (one vessel installing two MPs per day) and the OCS-DC foundation (one vessel installing four pin piles per day) in Summer (May through November).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone ¹ (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Level B Harassment Zone ²	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	5,250	≤10	6,490	5,300	3,500	500
Minke whale	2,710	≤10	6,490	5,300	3,500	100
Sei whale*	3,970	≤10	6,490	5,300	3,500	500
Humpback whale	4,830	≤10	6,490	5,300	3,500	100
North Atlantic right whale*	3,490	≤10	6,490	See Table 8	3,500	500
Blue whale*	5,250	≤10	6,490	5,300	3,500	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,490	5,300	3,500	500
Atlantic spotted dolphin	-	≤10	6,490	200	3,500	50
Atlantic white-sided dolphin	-	≤10	6,490	200	3,500	50
Common dolphin	-	≤10	6,490	200	3,500	50
Risso's dolphin	-	≤10	6,490	200	3,500	50
Bottlenose dolphin	-	≤10	6,490	200	3,500	50
Long-finned pilot whale	-	≤10	6,490	200	3,500	50
High-frequency Cetaceans						
Harbor porpoise	610	250	6,490	700	3,500	50
Phocid Pinnipeds in Water						
Gray seal	1,620	≤10	6,490	1,700	3,500	50
Harbor seal	750	≤10	6,490	1,700	3,500	50
Sea Turtles						
Leatherback sea turtle*	2,200	-	1,920	500	500	100
Loggerhead sea turtle*	260	-	1,920	500	500	100
Kemp's ridley sea turtle*	650	-	1,920	500	500	100
Green sea turtle*	1,020	-	1,920	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A harassment ER95% exposure ranges for concurrent installation (proximal assumptions) of monopiles (one vessel installing two monopiles per day) and the OCS-DC foundation (one vessel installing four pin piles per day) (Scenario 5).

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 7: Threshold ranges and mitigation and monitoring zones during proximal assumptions for concurrent piling of WTG monopiles (one vessel installing two MPs per day) and the OCS-DC foundation (one vessel installing four pin piles per day) in Winter (December only).

Species	Monitoring and Mitigation Zones (m)					Vessel Separation Distance (m)
	Level A Zone ¹ (SEL _{cum})	Level A Zone (m) (SPL _{pk})	Level B Harassment Zone ²	Clearance and Shutdown Zone	Minimum Visibility Zone	
Low-frequency Cetaceans						
Fin whale*	6,210	≤10	6,970	6,300	4,000	500
Minke whale	3,070	≤10	6,970	6,300	4,000	100
Sei whale*	4,650	≤10	6,970	6,300	4,000	500
Humpback whale	5,680	≤10	6,970	6,300	4,000	100
North Atlantic right whale*	3,850	≤10	6,970	See Table 8	4,000	500
Blue whale*	6,210	≤10	6,970	6,300	4,000	500
Mid-frequency Cetaceans						
Sperm whale*	-	≤10	6,970	6,300	4,000	500
Atlantic spotted dolphin	-	≤10	6,970	200	4,000	50
Atlantic white-sided dolphin	-	≤10	6,970	200	4,000	50
Common dolphin	-	≤10	6,970	200	4,000	50
Risso's dolphin	-	≤10	6,970	200	4,000	50
Bottlenose dolphin	-	≤10	6,970	200	4,000	50
Long-finned pilot whale	-	≤10	6,970	200	4,000	50
High-frequency Cetaceans						
Harbor porpoise	570	240	6,970	600	4,000	50
Phocid Pinnipeds in Water						
Gray seal	1,740	≤10	6,970	1,800	4,000	50
Harbor seal	780	≤10	6,970	1,800	4,000	50
Sea Turtles						
Leatherback sea turtle*	2,310	-	2,020	500	500	100
Loggerhead sea turtle*	260	-	2,020	500	500	100
Kemp's ridley sea turtle*	700	-	2,020	500	500	100
Green sea turtle*	1,140	-	2,020	500	500	100

* denotes species listed under the Endangered Species Act; dB = decibel; SEL_{cum} = cumulative sound exposure level SPL_{pk} = peak sound pressure level.

NAS (Noise Abatement System) means that the zone is small enough that it will be encompassed by the bubble curtain.

¹ Level A harassment ER95% exposure ranges for concurrent installation (proximal assumptions) of monopiles (one vessel installing two monopiles per day) and the OCS-DC foundation (one vessel installing four pin piles per day) (Scenario 5).

² Level B harassment zone values are based on the modeled single strike SPL acoustic range isopleths to 160 dB re 1 µPa and 175 dB re µPa for behavioral disturbance of marine mammals and sea turtles respectively.

Table 8. Relevant NARW Zones¹ during Impact Piling (May through December).

Season	Minimum Visibility Zone (m)	Visual Clearance Delay and Shutdown (m)	PAM Clearance/Shutdown Zone (km)	PAM Clearance Delay and Shutdown (m)
Sequential Summer WTG	2,700	Any Distance	10	At any distance within the PAM Clearance/Shutdown Zone
Sequential Winter WTG	3,000			
Concurrent Summer WTG	3,500			
Concurrent Winter WTG	4,000			

¹ Sunrise Wind may request modification to zones based on results of sound field verification.

3.2 Personnel

Dedicated personnel will be required to carry out protected species monitoring and mitigation efforts onboard Project vessels. These roles are required to be filled by NMFS-approved and BOEM-accepted PSOs and PAM operators. In addition, all project personnel in the field have a responsibility to support environmental compliance and will receive Environmental Awareness Training so that they are aware of the required monitoring, mitigation, and reporting.

3.2.1 Project Personnel Training

In accordance with LOA Condition 4(a) and 4(c)(1), ITR § 217.315 (a), § 217.315 (c)(1), and all COP Approval Conditions under Section 5.8, Sunrise Wind will ensure that all construction supervisors and crews, PSO and PAM teams, vessel operators and all relevant staff are trained prior to the start of activities. The Sunrise Wind Environmental Awareness Training will include offshore roles/responsibilities, communication procedures, summary of relevant permit conditions, protected species awareness and identification, marine trash and debris awareness training, and reporting procedures. As per LOA Condition 3(a)(2), a description of the training program will be provided to NMFS at least 60 days prior to the initial training before in-water activities commence. All project personnel will complete two separate sessions potentially occurring over the course of two days held with the PSO provider and Project compliance representative(s) prior to the start of in-water activities. Additionally, project briefings will be conducted by Sunrise Wind prior to construction and at each crew change to ensure that personnel have the most current project-specific information and are aware of any changes that have occurred throughout the duration of the Project. This training will be repeated and reported to NMFS OPR for new personnel who join the work during the Project.

Additionally, an online training course provided and required by Sunrise Wind's PSO and PAM contractor for all vessel personnel prior to the start of in-water activities including training on how to use the required monitoring equipment (e.g., thermal cameras) specific to each PSO/PAM operator role. Similar equipment training will be reviewed and repeated during the required in-person training provided by the PSO and PAM contractors during vessel mobilization.

Marine trash and debris awareness training is required of all Sunrise Wind offshore personnel engaged in offshore activities pursuant to approved COP and BiOp Appendix A, BA Table 15, measure "Marine debris awareness and elimination" and must be completed annually. By January 31 of each year, Sunrise Wind will submit an annual report to BSEE describing the marine trash and debris awareness training that was followed and certificates for the previous calendar year. The training process will include the following elements:

1. Viewing a marine trash and debris training video or slide show;
2. Receiving an explanation from management personnel that emphasizes their commitment to the requirements;
3. Attendance measures (initial and annual);

Orsted is planning to conduct Rehearsal of Concept (ROC) drills with their construction, PSO, and PAM contractors well in advance of construction start. The ROC drills include a combination of senior PSOs, PAM operators, PSO/PAM program managers, pile driving operational leads/managers, and Sunrise Wind project leadership. Collaborative monitoring and mitigation drills for all stages of pile driving (including pre- and post-), with emphasis on compliance conditions, decision matrices, communication channels, etc., will take place.

In accordance with LOA Condition 4(c)(1); prior to initiation of Project activities, Sunrise Wind will demonstrate in a report submitted to NMFS-OPR at (pr.itp.monitoringreports@noaa.gov) that all required training for Sunrise Wind personnel, including the vessel crews, vessel captains, PSOs, and PAM operators has been completed. To facilitate this, a training log for all personnel will be maintained and reported to NMFS OPR within 30 days of completed training as per LOA Condition 3(a)(2). As per BiOp Appendix A, BA Table 15, measure “Vessel Crew and Visual Observer Training Requirements”, confirmation of the training and understanding of the requirements will be documented on a training course log sheet and provided to DOI upon request.

In addition to Environmental Awareness Training, and in accordance with LOA and BiOp conditions, additional training will be conducted for project personnel that have specific requirements for the role they will fulfill. All personnel involved with protected species mitigation and monitoring will complete Sunrise Wind training modules applicable to their role prior to deployment. The following list summarizes the training modules for personnel directly involved in protected species monitoring:

Trained Lookout (1 hour)

In accordance with LOA Condition 3(b)(1) and BiOp Appendix B PDC 4, BMP 1(b), the Trained Lookout will receive prior training on protected species detection and identification, detection and observation methods in both good and bad weather conditions, vessel strike minimization procedures, how and when to communicate with the vessel captain, and reporting requirements. The Trained lookout will understand and undergo the training requirements included within the Sunrise Wind *Vessel Strike Avoidance Plan*.

Mysticetus Data Entry and Reporting (2 hours)

All PSO/PAM personnel will receive training in the operation of *Mysticetus* PSO data collection software. Training will include data entry, metadata, Quality Assurance (QA) / Quality Control (QC), reporting, integration with other alternative monitoring technologies, if applicable (i.e., infrared or thermal cameras), detection sharing and situational awareness map, multi-platform data aggregation, and any special features applicable to the Project.

PSO and PAM Compliance (2 to 3 hours)

PSO and PAM operator training and qualifications must be met as defined in Sunrise Wind COP Condition of Approval 5.8.3, LOA condition 4(a), and BiOp Appendix B PDC 7. PSO and PAM operator training and qualification include:

The Lessee must use independent, dedicated, qualified PSOs provided by a third party. The PSOs sole Project-related duty must be to observe, collect and report data, and communicate with and instruct relevant vessel crew regarding the presence of protected species and mitigation requirements (including brief alerts regarding maritime hazards). The Lessee must use NMFS-approved PSOs and PAM operators. The Lessee must provide training certificates for individual PSOs to BOEM or BSEE upon request. PSOs and PAM operators must be approved by NMFS before the start of construction activities. Qualifications to become a NMFS-approved PSO for construction activities are described in LOA Condition 4(a), BiOp Appendix B PDC 7, BMP 4. PSOs and PAM operators must be on watch for no more than a maximum of 4 consecutive hours, followed by a break of at least 2 hours between watches. PSOs and PAM operators will not exceed a combined watch schedule of more than 12 hours in a 24-hour period. The NMFS-approved PSOs and PAM operators will receive additional Sunrise Wind and PAM compliance training that will include detailed permit and operational requirements. Contents will cover minimum visibility

zone, clearance zone, clearance monitoring, soft-starts, shutdown zone monitoring, shutdown assessment by Lead Engineer, re-start/clearance protocols, PSO-PAM operations and communications, mitigation decision matrices, data collection and weekly/monthly reporting, incident reporting, situational reporting, and NARW reporting.

PAM Operator Training

In accordance with LOA Condition 4(a)(11), the PAM operator will demonstrate that they have prior experience with real-time acoustic detection systems and/or have completed specialized training for operating PAM systems, including experience with relevant Project acoustic software and equipment. Sunrise Wind PAM operators will complete the Gardline PAM course which includes:

- Basic theory of Underwater Acoustics;
- Visual Representation of Sound;
- Sound in the Sea;
- Marine Mammals, Sound production & Hearing;
- Acoustic Monitoring;
- PAM Hardware;
- Hardware practical session;
- PAM Software;
- Software Practical session;
- Role as a PAM operator.

Whale Vocalization training (1-2 hours)

In accordance with LOA Condition 4(a)(11), PAM operators will complete specialized training for operating PAM systems and detecting and identifying Atlantic Ocean marine mammal sounds, including North Atlantic right whale (NARW) sounds, humpback whale sounds, and other co-occurring species' sounds in the area including sperm whales; must be able to distinguish between whether a marine mammal or other species sound is detected, possibly detected, or not detected. The PAM operator must be able to review and classify acoustic detections in real-time (prioritizing North Atlantic right whales and noting detection of other cetaceans) during real-time monitoring periods. When localization of sounds or deriving bearings are possible, the PAM operators must demonstrate experience in using this technique. The course module will cover species-specific characteristics of their calls and how to identify them in spectrograms, including visual examples for each species and call type.

PAM Deployment and Recovery

In accordance with LOA Condition 4(a)(11), PAM operators will have the qualifications and relevant experience/training to safely deploy and retrieve equipment and program the software, as necessary and test software and functionality prior to operation. PAM deployment and recovery training will be a mix of onshore and offshore modules that include:

- Mooring design;
- Mooring assembly;
- Antenna feedback/ introduction to software;
- Software troubleshooting;
- Grappling lines;
- Mooring deployment;
- Mooring recovery;
- Recording mooring deployments;
- Health, Safety and Environment (HSE) of mooring deployment;

- Data download;
- PAM recorder configuration;
- Telemetry configuration and testing.

3.2.2 Field Operations Personnel

The field operations team implementing the Plan comprise the visual PSOs, PAM operators, Sunrise Wind personnel, and construction contractors. As per LOA Condition 3(a)(4) and BiOp Appendix A, BA Table 15, measure “Vessel Speed Requirements” and Appendix B PDC 5, BMP 6, Sunrise Wind personnel and contractors will use available sources of information on NARW presence in or near the Project area including daily monitoring of the Right Whale Sighting Advisory System (RWSAS), and monitoring the USCG VHF Channel 16 throughout the day to receive notification of any sightings and/or information associated with any Slow Zones (i.e., Dynamic Management Areas (DMAs) and/or acoustically-triggered slow zones) to provide situational awareness for both vessel operators, PSOs, and PAM operators. These systems will be monitored no less than every 4 hours. The following is a description of the key personnel and their roles within the mitigation and monitoring framework covered under this Plan. Details of measures and communication among personnel are provided in other sections of this document.

Visual PSOs

Sunrise Wind will deploy PSOs with appropriate skills and sufficient numbers to meet all mitigation and monitoring requirements. Individual PSOs seeking NMFS- approval will submit a request via email to nmfs.psoreview@noaa.gov. This request will identify the activity and the role of which they are seeking approval on (PSO or Lead PSO), a resume, and training certificate documenting the requirements stipulated in the Sunrise Wind LOA. Resumes will include the applicant’s education, experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), and training, including dates, duration, location, and description of prior marine mammal monitoring experience, and, if applicable, a description of the project for which previous PSO work was conducted. PSOs and Lead PSOs will be chosen from the applicant pool of available and interested PSOs who have completed training and been granted NMFS-approval. PSOs must have at least 30 days of at-sea experience monitoring for marine mammals, including baleen whales, and recording observational data.

There are two categories of visual PSOs who will be deployed on the Project, PSO and Lead PSO. PSOs are responsible for the detection, identification, localization, and reporting of all protected species observed during watch. PSOs will provide visual monitoring of all minimum visibility, clearance, and shutdown zones prior to, during, and after impact pile driving. Outside of the designated watch periods, PSOs will be responsible for general monitoring for situational awareness and vessel strike avoidance. PSOs (individuals and teams) will record marine species data into data collection software, submitting detection information when applicable, and communicating with the Lead PSO. Visual PSOs will remain in contact with the PAM operator on duty regarding any protected species detection that would be approaching or found within the applicable zones through the use of VHF radios. Should communication using VHF radios fail, mobile phones using WhatsApp, or the Teams Application on a computer will be in place as a backup for communication between PSOs and PAM operators. WhatsApp and Teams messaging communications are instant. If these three methods of communication fail, PSOs will remain in contact with vessel-based PAM operators using the vessel’s radio. All PSO detections will be relayed to the on-duty Lead PSO so that those detections are transmitted across the Project. If a protected species

enters a clearance or shutdown zone, PSOs will immediately notify the on-duty Lead PSO so the appropriate mitigation actions can be implemented.

Lead PSOs carry the same duties as PSOs and also manage the activities associated with the PSO team, PAM team, and SFV field team. Lead PSOs will have a minimum of 90 days at-sea experience in monitoring for marine mammals, including baleen whales, with the conclusion of the most recent relevant experience no more than 18 months previous. Alongside the vessel operator, Lead PSOs will hold onboard briefings prior to the beginning of construction activity. Such briefings will be repeated whenever new relevant personnel join the pile driving activity before work commencement. Lead PSOs will also attend Project meetings, ensuring all PSO and noise monitoring protocols are followed, and conduct general correspondence with dedicated watches and the Client Representative. The on-duty Lead PSO will communicate directly with the Designated Person / Works Manager (DP/WM) and will be responsible for communicating when clearances have been completed and pile driving can commence. Lead PSOs will make decisions regarding visibility and conduct final reviews on all PSO data and reporting. The on-duty Lead PSO will be the main point of contact (POC) for the entire mitigation team.

PAM Operators

Individual PAM and Lead PAM operators seeking NMFS- approval will submit a request via email to nmfs.psoreview@noaa.gov. This request will identify the activity and the role of which they are seeking approval on (PAM Operator or Lead PAM Operator), a resume, and training certificate documenting the requirements stipulated in the Sunrise Wind LOA. Resumes will include the applicant's education, experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), and training, including dates, duration, location, and description of prior marine mammal monitoring experience, and, if applicable, a description of the project for which previous PAM operator work was conducted. There are Lead and Standard PAM operators, and they function in relatively similar roles as PSOs but instead of visual monitoring they will conduct acoustic monitoring. Standard PAM operators must have at least 30-days of experience in identifying and classifying marine mammal acoustic detections by species, including baleen whales, in real-time and demonstrate training or experience using Project-specific PAM hardware and software, including detection systems and localization methods (if applicable). Lead PAM operators must have at least 90-days of experience in identifying and classifying marine mammal acoustic detections by species, including baleen whales, in real-time and demonstrate training or experience using the Project-specific PAM hardware and software, including detection systems and localization methods (if applicable). The Lead PAM operators will be able to troubleshoot the acoustic equipment and assist with making final decisions regarding species identifications, localization and other acoustic monitoring details that will be relayed to the on-duty Lead PSO. The standard PAM operator will be able to access the expertise of the Lead PAM operator as needed.

PAM operators monitoring the RSA – ORCA PAM systems will be located on the installation vessel. All PAM operators monitoring the RSA – ORCA systems will inform the on-duty Lead PSO of any animal detections approaching or within relevant clearance zones through the VHF radio (primary line of communication). Should communication through VHF radio fail, communications will be made through mobile phones using WhatsApp or the Teams Application on a computer. If a detection cannot be confirmed or has originated outside the relevant clearance/shutdown zone, then a conservative approach will be taken and the PAM operator will communicate the detection to the on-duty Lead PSO to request an immediate delay/shutdown of pile driving. Any animal detections approaching or within relevant clearance/shutdown zone will also be entered into *Mysticetus*, the additional data collection software

system. In the unlikely circumstance that *Mysticetus* experiences a temporary disruption, all information will already have been communicated using the VHF radio, WhatsApp, or the Teams Application on a computer. The *Mysticetus* temporary disruption will be communicated by the PSO teams to all Project personnel to ensure use of other communication systems is consistent. The PAM operator(s) monitoring the SeaPicket system(s) will be stationed in the shoreside ThayerMahan Command Center where they will classify and tag detection data using a hierarchy to create contact/ detection reports to ensure potential call detections are not missed (as described in Section 1.3.2 of the *WTG Passive Acoustic Monitoring Plan*). Once detection reports are available, they will be entered or automatically pushed into the *Mysticetus* cloud database which allows them to become visible to the vessel-based PSOs on a map display. If a call detection cannot be confirmed or have originated outside the clearance/shutdown zone, then a conservative approach will be taken and the shore-based PAM operator will request an immediate delay/shutdown of pile driving. If the shore-based PAM operator determines that the location of a call overlaps with an applicable mitigation zone (e.g., PAM clearance/shutdown zone for NARW or clearance/shutdown zone for non-NARW large whales) the PAM operator located in the ThayerMahan Command Center will initiate direct communications with the vessel-based on-duty Lead PSO on the installation vessel (via radio, phone, or other direct communication method). The on-duty Lead PSO will assess the information provided and will take the necessary mitigation actions. All communications regarding PAM detections will go directly to the on-duty Lead PSO. This same procedure of communications will occur if the area of uncertainty around a localized whale call overlaps a relevant mitigation zone even if the call itself is localized outside of the mitigation zone.

Acoustic Reporting Scientist

As part of the SFV team, the Acoustic Reporting Scientist will be responsible for confirming deployment, operation, and retrieval of all SFV equipment and relaying that information to the Lead PSOs. The Acoustic Reporting Scientist will also be responsible for immediate retrieval of acoustic data from the SFV recorders and ensuring its safe transmittal to the onshore acoustic analysts.

Acoustic Deployment Support Member

These are experienced field personnel who will assist the PAM and SFV deployment and recovery. These support personnel will not play a direct role in mitigation and monitoring but will assist in the deployment and recovery as well as troubleshooting or maintenance of all deployed acoustic buoys. Support members will be on both the PAM and SFV vessels.

Designated Person / Works Manager

The designated person (DP)/works manager (WM) will be the Sunrise Wind and construction contractor representative on site that has the role of oversight across the entire Project and will be the POC for maintaining compliance with all regulations for the Project. The key role for the DP/WM will be to maintain communication with the Lead PSOs such that the DP/WM is kept abreast of all clearance activities, detections, and mitigation activities. The DP/WM will initiate the shutdowns requested by the Lead PSOs, communicate with the hammer operator, and consult with engineers for pile stability in the case of any mitigation actions that require pile safety analysis.

3.2.3 PSO Standards and Overall Schedule

The following requirements and roles will be implemented for PSO and PAM personnel. As described in Section 3.2.1, PSOs and PAM operators will all receive project-specific training.

- All PSOs will be chosen from the applicant pool of available and interested PSOs who have been approved by NMFS-OPR prior to the start of the Project. PSOs will meet the qualifications outlined in LOA Condition 4(a) and BiOp Appendix B PDC 7, have completed a NMFS-approved PSO course, and will fulfill the physical/medical requirements, communication skills, and visa requirements.
- Prospective PSO and PAM operators not previously approved, or PSOs and PAM operators whose approval is not current will submit a request to nmfs.psoreview@noaa.gov identifying the activity and the role for which they are seeking approval at least 60 days prior to commencement of in-water construction activities requiring PSOs and PAM operators.
 - Resume's will include information related to their proposed role (i.e., PSO, Lead PSO, PAM operator, or Lead PAM operator), relevant education, training, and experience (academic, commercial, or government sponsored marine mammal surveys or PSO experience), including dates, duration, location and description of prior marine mammal monitoring experience and, if applicable, a description of the project for which previous PSO work was conducted. Resumes will also be accompanied by relevant documentation of successful completion of necessary training.
- For every shift, three visual PSOs per vessel will maintain active watch. The installation vessel will have at least two Lead PSOs onboard. There will be one PAM operator monitoring four acoustic streams from the RSA – ORCA PAM buoys on duty actively monitoring for protected species one hour before, during and 30 minutes after WTG MP foundation installation.
 - The PAM operator will be monitoring the four acoustic data streams from the PAM buoys in real time, each visualized in two spectrograms, in a single window, so that both broadband and low frequency data can be effectively monitored. The PAM operator will use the associated PAMGuard detectors for all PAM data visualization. The broadband spectrogram will display data up to 24 kHz (sampling rate of 48 kHz) to assist in verifying detections for odontocete whistle and click visualization and the low frequency spectrogram will display data up to 3 kHz to allow the PAM operator a “zoomed” in view for more effective monitoring of low frequency baleen whales.
- ThayerMahan PAM operators will monitor one data stream per deployed system. Each data stream consists of 32 hydrophones, which are beamformed into a single display that presents both broadband and spectrogram data. One ThayerMahan PAM operator is able to monitor data streams of up to six deployed systems. All systems will be monitored for the duration of the project, with priority analysis focussed on the data streams from the three closest SeaPicket systems to the pile actively being installed. The PAM operator(s) will be located at the ThayerMahan Command Center to review and analyze incoming data using a web-based interface. A single ThayerMahan PAM operator will monitor the data stream 60 minutes prior to, during, and 30 minutes after each WTG foundation installation.
- Following established BOEM and NMFS standards, the PSO/PAM team(s) will work in designated shifts during protected species monitoring. For PSOs, shifts will be set up such that no individual will work more than 4 consecutive hours without a 2-hour break, or longer than 12 hours during any 24-hour period. The Project will provide each PSO with one 8-hour break per 24-hour period to sleep. An example rotation is provided in Figure 3. Actual rotations will be vessel-specific, and implemented rotations will be documented with the Project's final PSO report. New or inexperienced PSOs will be paired with an experienced PSO qualified to mentor

new PSOs so that the quality of marine mammal observations and data recording is kept consistent.

- PAM monitoring rotations on the installation vessel will comprise a single PAM operator on active duty for 4 hours.
- PAM monitoring rotations at the ThayerMahan shoreside Command Center will be set up such that no individual works more than 4 consecutive hours without a 2-hour break, or longer than 12 hours during any 24-hour period. Two NMFS-approved PAM operators will be assigned each day to cover the duration of pile-driving activities. In addition to the watch rotation requirements, ThayerMahan enhances operator efficiency with automated detection algorithms, which when paired with comfortable shore-based accommodations enable extended monitoring periods without inducing fatigue.
- The PSOs on each of the PSO vessels will communicate directly with the on-duty Lead PSO onboard the installation vessel.
- The on-duty Lead PSO will communicate with each of the PSO vessels and will report directly to onshore project managers. The on-duty Lead PSO will be responsible for calling shutdowns or delays to impact pile driving activity and determining if visibility is adequate to commence or resume pile driving following a delay or shutdown. An indicative crew rotation for the installation vessel and ThayerMahan Command Center, including shift lengths is shown in Figure 3.

Figure 3. Indicative PSO and PAM Operator schedule onboard the installation vessel and ThayerMahan Operations Center.

Day/Night Period	Start Time	End Time	Lead PSO	Lead PSO	PSO	PSO	PSO	PSO	PAM (ashore)	PAM (ashore)	PAM (offshore)	PAM (offshore)
Day (based on example civil sunrise of 04:34 local time)	04:00	05:00	Visual		Visual	Visual			PAM		PAM	
	05:00	06:00	Visual		Visual	Visual			PAM		PAM	
	06:00	07:00	Visual		Visual	Visual			PAM		PAM	
	07:00	08:00	Visual		Visual	Visual			PAM		PAM	
	08:00	09:00		Visual			Visual	Visual		PAM		PAM
	09:00	10:00		Visual			Visual	Visual		PAM		PAM
	10:00	11:00		Visual			Visual	Visual		PAM		PAM
	11:00	12:00		Visual			Visual	Visual		PAM		PAM
	12:00	13:00	Visual		Visual	Visual			PAM		PAM	
	13:00	14:00	Visual		Visual	Visual			PAM		PAM	
	14:00	15:00	Visual		Visual	Visual			PAM		PAM	
	15:00	16:00	Visual		Visual	Visual			PAM		PAM	
	16:00	17:00		Visual			Visual	Visual		PAM		PAM
	17:00	18:00		Visual			Visual	Visual		PAM		PAM
	18:00	19:00	Visual		Visual	Visual			PAM		PAM	
	19:00	20:00	Visual		Visual	Visual			PAM		PAM	
Night (based on example civil sunset of 20:54 local time)	20:00	21:00		Visual			Visual	Visual		PAM		PAM
	21:00	22:00		Visual			Visual	Visual		PAM		PAM
	22:00	23:00		Visual			Visual	Visual		PAM		PAM
	23:00	00:00		Visual			Visual	Visual		PAM		PAM
	00:00	01:00										
	01:00	02:00										
	02:00	03:00										
	03:00	04:00										

3.3 Overall Monitoring Strategy

Visual and acoustic monitoring of the clearance and shutdown zones will be conducted by 3rd party PSOs and PAM operators who will be located on the installation vessel as well as two additional PSO vessels (Figure 4). A team of six qualified PSOs (including two Lead PSOs) and two PAM operators will be on the installation vessel so that three PSOs and one PAM operator can be on duty during all daylight hours. A team of six PSOs will be on board the PSO vessels so that three PSOs can be on duty during all daylight hours. The number of PSOs per vessel may be reduced while still providing a sufficient number of PSOs per vessel such that three may be on duty during the required periods and with sufficient breaks as described in the LOA Condition 4(b)(4). Each day a team of two ThayerMahan PAM operators with experience using the SeaPicket systems will alternate operating and monitoring the incoming data at the shoreside ThayerMahan Command Center. All ThayerMahan PAM operators will be NMFS approved and will work in accordance with the schedule shown in Figure 3. A detailed description of the PAM to be conducted to monitor and mitigate for marine mammals is presented in the separate *WTG Pile Driving Passive Acoustic Monitoring Plan*.

The two dedicated PSO vessels will travel along a circular path around the installation vessel at or near the minimum visibility distance of 2,700 m (3,000 m in winter⁹) during sequential WTG MP installation and 3,500 m (4,000 m in winter) during concurrent WTG MP installation (Figure 4). This will ensure complete coverage of all 360° around the pile being installed. Each vessel will travel at a speed of 7–10 knots during clearance, piling, and post-monitoring. When available and/or necessary, other vessels (PSO vessel #3 and PSO vessel #4) with PSOs and acoustic monitoring personnel will assist with visual monitoring. In these cases, the circle may be split into as many sectors as there are vessels conducting monitoring and each vessel will travel back and forth along the portion of the circular path in its sector at the relevant minimum visibility distance.

PSOs on the installation vessel will use mounted high magnification (25x) binoculars, standard handheld (7x10) reticle binoculars, and the unaided eye to continuously search for protected species within all relevant clearance and shutdown zones. At least two PSOs on the installation vessel will be equipped with Big Eye binoculars (e.g., 25 x 150; 2.7 view angle; individual ocular focus; height control), which will be pedestal mounted on the deck at the best vantage point. The three PSOs stationed on the PSO vessels will each be responsible for monitoring a 120-degree sector of the field of view (FOV) with unaided eye and reticle binoculars (and big eyes periodically) which will provide additional coverage inside the clearance zone towards the installation vessel as well as beyond the clearance zone away from the pile. The efficacy and effectiveness of monitoring methods described in this section will continue to be evaluated during and between seasons to ensure appropriate monitoring methods are used. PSOs will use the described monitoring equipment to confirm the relevant clearance and shutdown zones are clear of marine mammals and not impacted by fog or humidity. If a protected species is sighted during daylight conditions, the on-duty PSOs will radio the detection and location/bearing of the individual(s) to all Project vessels to ensure awareness of the protected species. The PSO that sighted the protected species

⁹ No impact pile driving is planned for the months of December through April; however, installation in December may occur, upon NMFS approval, in the case of unexpected delays. If Sunrise Wind requests NMFS approval for WTG MP installation in December due to unexpected delays, Sunrise Wind will provide an amended PDMP that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 3,000 m and 4,000 m clearance/shutdown zone for sequential and concurrent WTG MP installation, respectively.

will maintain visual contact with the species until they lose visibility, during which one of the other on-duty PSOs will record the sighting in *Mysticetus*, while the third on-duty PSO visually covers the remaining 120-degree sector of the FOV. Photographs and follow-up notes will be downloaded using *Mysticetus* once visual detection has ceased or at the end of the PSO watch.

If mitigation zones are expanded due to regulatory requirements outlined in Section 3 of the approved *Sound Field Verification Plan* the distance at which the PSO vessels circle or the pattern that they travel around the pile being installed may be adjusted based on the size of the modified zones. This framework of vessel activity is the basis of the monitoring plan; however, positioning of vessels is dynamic based on the measured zone sizes, therefore, a single, static, solution is not provided here as such a solution is impracticable and does not serve the purpose of establishing the best monitoring protocols possible. Rather, in the case of modified zone sizes, all vessel positions and activities would be designed in consultation with field PSOs and the agencies to develop the most comprehensive visual monitoring protocols.

In addition to the dedicated PSO vessels (PSO vessel #1 and PSO vessel #2), PSO vessel #3, and PSO vessel #4 will be used for supporting monitoring operations by deploying PAM and SFV equipment in the field when available and/or necessary. Two deployment/acoustic specialists and six PSOs (three on watch) will be on each of these vessels for the duration of all piling. When not actively deploying or retrieving acoustic equipment, these two PSO vessels (PSO vessel #3 and PSO vessel #4) are expected to be available to assist in conducting visual PSO observations and increase awareness of marine mammals near the pile driving site. In addition to deploying or retrieving acoustic equipment, one of the two PSO vessels (PSO vessel #3 and PSO vessel #4) may be required for port calls/crew changes or other duties at which time they would not be available to assist in conducting PSO monitoring. Additionally, if zones are modified based on SFV results and the resulting monitoring plan stipulates additional PSO vessels are necessary to clear the mitigation zones, these additional vessels would be available to become fully dedicated to PSO surveys during clearance, piling, or post-piling periods and would not be removed for any other duties during those times. All PAM and SFV deployment and associated pre- and post- watches for the Project will be conducted outside of pile driving activities allowing PSOs to fulfill the required duties on the PSO vessel without any deployment interruptions. Other than the four vessels described within this section, no additional vessels will have the capabilities or resources for mitigation and/or deployment requirements.

Table 9 provides a summary of equipment and personnel that will be deployed for all piling operations. Figure 4 shows indicative positions of the PSO and PAM vessels relative to the installation vessel as well as relevant monitoring and shutdown zones (sequential and concurrent) for summer WTG MP foundation installation. Based on the acoustic modeling results, relevant monitoring and shutdown zones will be larger during winter foundation installation, should that be necessary and approved (not depicted in Figure 4). As per LOA Condition 3(c)(1), foundation installation must not be planned in December; however, it may only occur if necessary to complete the Project within a given year with prior approval by NMFS. Sunrise Wind will notify NMFS in writing by September 1 of that year that pile driving cannot be avoided, and that circumstances are expected to require December piling. Should these circumstances arise, Sunrise Wind will also provide an amended WTG PDMP that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 3,000 m and 4,000 m minimum visibility zone assuming sequential and concurrent foundation installation, respectively.

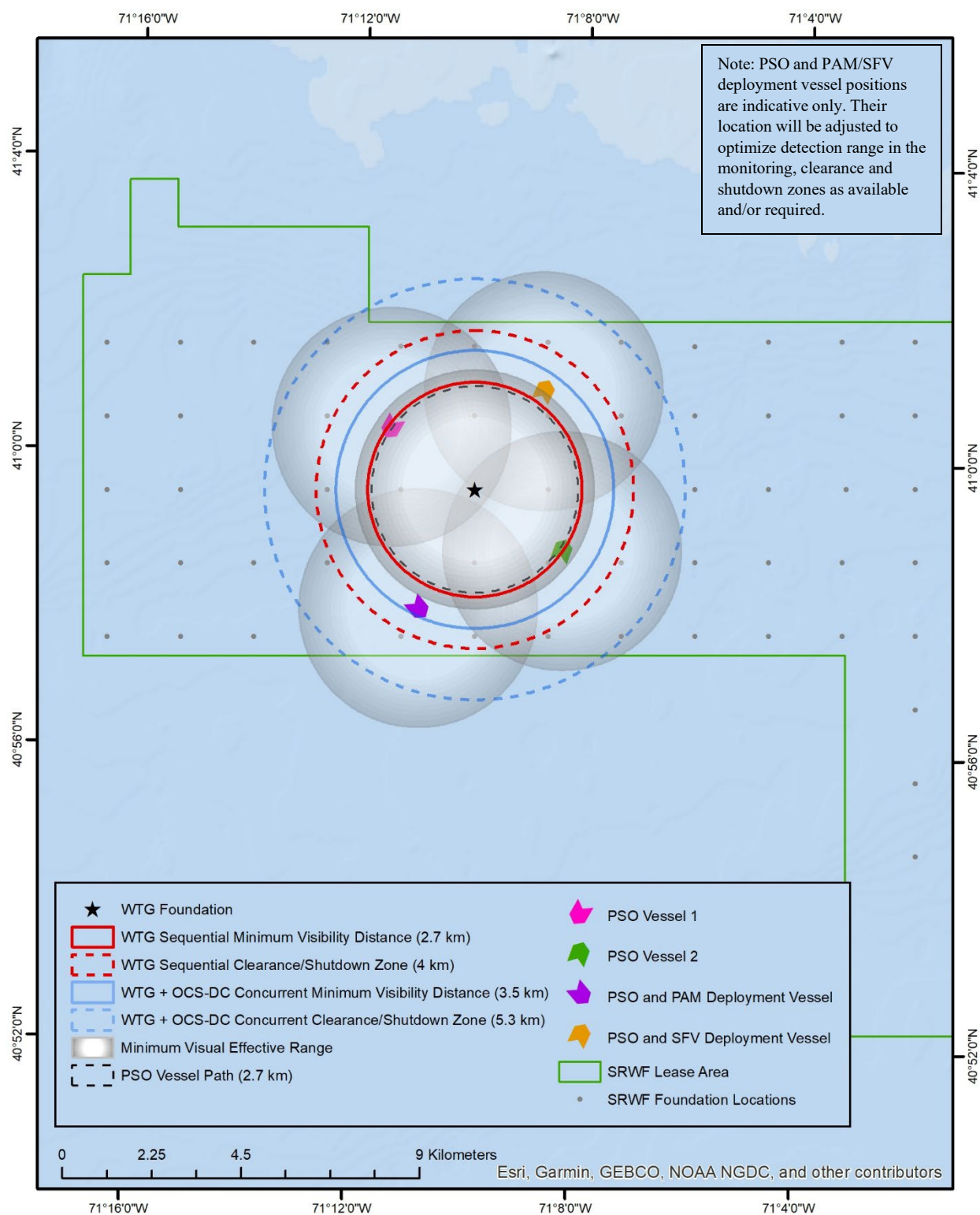


Figure 4. Indicative locations of personnel and equipment during WTG sequential pile driving event and potential WTG and OCS-DC concurrent pile driving occurring in summer.

Table 9. PSO and PAM personnel and equipment on installation, monitoring vessels, and ThayerMahan Operations Center

Vessel Name		Installation Vessel	PSO Vessel #1	PSO Vessel #2	PSO Vessel #3	PSO Vessel #4	ThayerMahan Command Center
Vessel Role		Pile Driving	PSO Monitoring	PSO Monitoring	PSO + PAM Deployment	PSO + SFV Deployment	PAM Monitoring
Personnel							
Visual PSOs		6	6	6	6	6	N/A
# PSOs on active watch		3	3	3	3	3	N/A
PAM Operators		2	0	0	0	0	2
# PAM operators on duty ¹		1	0	0	0	0	1
Acoustic Reporting Scientist		0	0	0	0	2	N/A
Deployment/Acoustic support Personnel on Duty		0	0	0	2	2	N/A
Equipment							
Binoculars (7x – 10x, reticle)	Varied	3	3	3	3	3	N/A
Big Eye Binoculars	Fujinon 25 x 150 MT-SX	2	2	2	2	2	N/A
Digital cameras ³	single-lens reflex camera equipped with 300-mm lens	2	2	2	2	2	N/A
PSO dedicated VHF Radios	Varied	3	3	3	3	3	N/A
Mounted Thermal/IR Camera System	Current Scientific (Cooled – NN 3050; Uncooled – NN 3025)	2 (1 – cooled and 1 – uncooled)	1 – uncooled	1 – uncooled	1 – uncooled	1 – uncooled	N/A
Night Vision Device (NVDs)	Rongland GNVY-3 Night Vision (290 m range)	1	1	1	1	1	N/A
Monitoring station for real-time PAM ²	Varied	1	0	0	0	0	1
RSA- ORCA PAM Buoys	RSA – ORCA- 750-a1	0	0	0	4	0	N/A
RSA-ORCA PAM Hydrophone Mooring	TR-FLOAT	0	0	0	4	0	N/A
SeaPicket PAM System	SeaPicket	0	0	0	0	0	5
SeaPicket PAM Hydrophone Mooring	MAPCORP 605S	0	0	0	0	0	5
Mysticetus Data Collection System	Mysticetus	1	1	1	1	1	1

IR = infrared; PSO = Protected Species observer; VHF=very high frequency.

¹ PAM operators monitoring the RSA-ORCA system(s) will be stationed on the installation vessel and PAM operators monitoring the ThayerMahan SeaPicket system(s) will be stationed in the shoreside ThayerMahan Operations Center.

² The selected PAM systems will transmit real time data to PAM monitoring stations from the vessels and the shoreside Command Center.

³ There will be two digital cameras provided on each vessel for use by the three PSOs on duty. Each PSO team will share a single digital camera. This digital camera will be located on the bridge of the vessel to ensure easy accessibility for any PSOs use. A second digital camera will be located on board as a backup (total of two digital cameras).

3.4 Visual Monitoring Distances

Visual monitoring by PSOs will be conducted from the installation vessel and two dedicated PSO vessels. Daytime visual monitoring is defined by the period between nautical twilight rise and set for the region. The PSOs will conduct the visual monitoring from the bridge and bridge-wings located at a height of 6.2 m above the sea level (ASL) on the secondary PSO vessel(s) and at a height of 25.83 m on the installation vessel (Table 10). They will monitor with the unaided eye, 7 x 50 magnification reticle binoculars, and a set of 25x magnification ‘Bigeye’ binoculars (one on the port and one on the starboard bridgewings, on each vessel). PSO’s eye height will be recorded on each vessel and input into the recording template prior to observations so more accurate height can be used during operations.

The longest distance able to be observed by PSOs, which is the distance to the horizon, can be calculated using the following equation: $3.6\sqrt{h}$, where “h” is eye height ASL. To calculate the minimum distance to the horizon observable by a PSOs based on this equation, the minimum eye height of a PSO can be used. Assuming the deck of the vessel is 4.47 m above sea level and the minimum eye height of a PSO is 1.53 m (5 ft), then the minimum eye height ASL would be 6 m. Using the equation above, the minimum distance to the horizon visible by PSOs would be approximately 8.8 km (Table 10). The calculated visibility ranges for representative vessels are shown below in Table 10.

While the detection of large whales at or near the calculated visibility ranges (8–10 km) is possible, it is less likely for single individuals or small groups compared to larger groups, especially if larger groups are engaged in certain behaviors such as feeding or social activity. Depending on the environmental conditions and available detection cues of marine mammals, PSOs on a vessel have a minimum effective range of 2–3 km, meaning they can reliably detect individual large whales and/or small groups within that distance. To increase the probability of detecting whales within and beyond the 2–3 km effective range from the piling vessel, two dedicated PSO vessels will circle the installation vessel as described in Section 3.3, providing additional coverage within the minimum visibility zone and effective coverage out to a distance of 4–6 km.

PSOs will routinely use available targets at known distances, primarily other project vessels, to quantify the distances at which they can reliably monitor for marine mammals and sea turtles. Each of the two dedicated PSO monitoring vessels will be located 2,700 meters or 3,500 m from the BL2 at the edge of the 2.7-kilometer or 3.5- kilometer Minimum Visibility Zone(s) for sequential and concurrent foundation installation, respectively. Three-person PSO team teams aboard each monitoring vessel and the BL2 will work collaboratively to monitor the entirety of the relevant Minimum Visibility Zone and adjacent waters beyond this zone. Other project vessels in the area will serve as additional reference points for PSOs to confirm effective monitoring distances and distances to potential sightings. If PSO teams conclude the entirety of the relevant Minimum Visibility Zone cannot be reliably monitored, a determination will be made by the on-duty Lead PSO on the installation vessel and pile driving will be delayed or shut down.

Table 10. PSO eye height above sea level in meters (m) for each vessel and the distance to horizon in kilometers (km), assuming average PSO eye height is 1.53 m

	Installation Vessel	PSO Vessel #1	PSO Vessel #2	PSO Vessel #3	PSO Vessel #4
	Pile Driving	PSO Monitoring	PSO Monitoring	PSO + PAM Deployment	PSO + SFV Deployment
Average PSO eye height	1.53	1.53	1.53	1.53	1.53
Eye Height Above Sea Level (unaided eye, 7-10 x magnification binoculars, 25 x magnification binoculars)	25.83	6	5.65	5.78	7.63
Thermal cameras	27.3	8.3	8.7	8.33	10.31
Visible distance to horizon (km)	18.3	8.8	8.6	8.7	9.9

Using the below formula, and currently known obstructions aboard the installation and PSO monitoring vessels, we have estimated the available FOV at each location as a percentage of a full 360° FOV around the vessel. The available FOV values represent how much of the full 360° FOV around the installation site is available to a given person (PSO using binoculars) or visual monitoring equipment (IR cameras) based on where they are positioned or mounted on the installation vessel (Table 11) or PSO vessels (Table 12). These values do not represent the FOV being monitored instantaneously from these locations, but rather how much of the area around the vessel is available to be monitored from each observation location as PSOs using binoculars or the Current Corporation IR camera panning back and forth over that area.

$$(1) \quad ((360^\circ - \text{°obscured}) / 360^\circ) \times 100\% = \text{Available FOV (\%)}$$

Table 11. Available FOV by each PSO and/or visual monitoring equipment on the installation vessel.

	PSO (handheld binoculars)	25 x magnification binoculars – port	25 x magnification binoculars – starboard	NN3025 Thermal Cameras – Helideck	NN3050 Thermal Cameras – Boom-rest
Installation Vessel	79.17%	62.50%	49.44%	50.00%	37.50%

Note: Fields of view takes into account vessel-based obstructions at the anticipated position of equipment use. However, through collective monitoring across the piling and PSO vessels using the monitoring tools determined

to be appropriate on a given day taking into account the environmental conditions during daytime, the full 100% FOV will be achieved with the available FOV.

Table 12. Available FOV by each PSO and/or visual monitoring equipment location on the PSO vessels.

	PSO Vessel #1	PSO Vessel #2	PSO Vessel #3	PSO Vessel #4
PSO (handheld binoculars)	75%	75%	66.67%	79.17%
25 x magnification binoculars	59.72%	65.28%	62.50%	74.44%
NN3025 Thermal Camera	70.83%	50.56%	66.67%	76.39%

Note: Fields of view takes into account vessel-based obstructions at the anticipated position of equipment use. However, through collective monitoring across the piling and PSO vessels using the monitoring tools determined to be appropriate on a given day taking into account the environmental conditions during daytime, the full 100% FOV will be achieved with the available FOV.

3.5 Mitigation and Monitoring Measures

The monitoring and mitigation protocols that will be followed during daylight conditions are indicated below.

3.5.1 General Measures

- 1) A minimum of three PSOs on each PSO vessel will simultaneously monitor the relevant clearance/shutdown zones using standard handheld binoculars (7x), high magnification (25x) binoculars, and the unaided eye to search continuously for protected species.
- 2) PSOs stationed on the dedicated PSO vessel(s) will ensure the outer portion of the clearance/shutdown zones are visually monitored.
- 3) PSOs on all vessels will immediately communicate sightings within or near the clearance/shutdown zones to the on-duty Lead PSO aboard the installation vessel so that appropriate mitigation measures can be implemented.
 - a) PSOs and PAM operators will record all detections of marine mammals and sea turtles from periods of active watch, regardless of distance from the pile site or pile driving activity status.
 - b) All PSO and PAM detection data will be shared across PSO teams in real time to inform situational awareness and assessment of potential mitigation.

3.5.2 Clearance Protocols

- 1) Visual and acoustic monitoring will begin at least 60 minutes prior to the start of pile driving activity.
- 2) During the 60-minute clearance monitoring period, there must be no visual or acoustic detections of NARW for 60 minutes immediately prior to pile driving and no detections of other marine mammals or sea turtles in their applicable Clearance Zones for 30 minutes prior to pile driving.
- 3) At least one PAM operator from ThayerMahan monitoring the SeaPicket system(s) will review data from at least 24 hours prior to pile driving as described in Section 1.5 of the *WTG PAM Plan* as per LOA Condition 4(b)(6).
- 4) At least one PAM operator monitoring the RSA-ORCA systems(s) and one PAM operator monitoring SeaPicket system(s) will actively monitor hydrophones for 60 minutes prior to pile driving, at all times during pile driving, and for 30 minutes after pile driving as per LOA Condition 3(c)(11).

- 5) PSOs will visually clear (i.e., confirm no observations of marine mammals) the entire minimum visibility zone (as shown in Table 4 through Table 8) for a full 60 minutes immediately prior to commencing WTG foundation installation activities.
- 6) In recognition of brief periods of reduced visibility, the on-duty Lead PSO will determine sufficient visibility conditions through communication between Project vessels. The configuration of PSOs and vessels will ensure that the area out to the relevant minimum visibility distance is visually monitored during the required monitoring periods; this includes the area comprising the sea turtle clearance/shutdown zone of 500 m (BiOp Table 3.17).
- 7) If PSOs cannot visually monitor the minimum visibility zone prior to impact pile driving, pile driving operations will not commence.
 - a) If the minimum visibility zone cannot be adequately monitored due to reduced visibility during daylight, an immediate delay to the commencement of pile driving will be called for. The clearance zone will only be declared clear when the entire Minimum Visibility Zone is visible for 60 minutes prior to the commencement of pile driving activity. Additional details are described in Section 3.6.
- 8) Monitoring and mitigation during nighttime pile driving will be required as described within the *Nighttime Monitoring Plan for Pile Driving*, if approved.
- 9) If nighttime pile driving is not approved, pile driving will not be initiated earlier than 1 hour after civil sunrise or 1.5 hours prior to civil sunset. Additionally, if pile driving has begun prior to/after the civil sunset/sunrise, pile driving may only continue after dark only when the minimum visibility zone for impact pile driving is fully visible and if stopping operations represents a risk to human health, safety, and/or pile stability.
 - a) If these circumstances arise, PSOs will utilize alternative technology (i.e., IR and/or Thermal camera) to monitor the clearance and shutdown zones (as shown above in measure 3) as approved by NMFS if impact pile driving continues past civil sunset.
- 10) The on-duty Lead PSOs will receive confirmation from the DP/WM that the bubble curtain is fully operational and configured correctly.
- 11) If a marine mammal (other than a NARW) or sea turtle is observed within the applicable clearance zone during the clearance period, impact pile driving will be delayed until the animal(s) has voluntarily left the specific clearance zone and has been visually or acoustically confirmed beyond that clearance zone, or when specific time period has elapsed with no further sightings: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales and sea turtles.
 - a) Sea turtles observed within a clearance zone prior to the commencement of pile driving will be allowed to remain in the clearance zone (i.e., must leave on their own volition), and their behavior will be monitored and documented. If a sea turtle is observed entering or within the 500 m clearance zone after pile driving has begun, the PSO will request a temporary cessation of pile driving.
 - b) In cases where these criteria are not met, pile driving may restart only if necessary to maintain pile stability at which time Sunrise Wind will use the lowest hammer energy practicable to maintain stability.

- 12) In the event that any large whale is sighted or acoustically detected at any distance that cannot be confirmed as a non-NARW, it will be treated as if it were a NARW for purposes of mitigation.
 - a) For NARW/unidentified large whale, any visual observation by PSOs at any distance or acoustic detection within the PAM clearance/shutdown zone for NARWs (10 km) will trigger a delay to the commencement of pile driving. The clearance zone will only be declared clear if no NARW visual detections at any distance or acoustic detections within the PAM clearance/shutdown zone for NARWs have occurred during the 60-minute clearance zone monitoring period of which 30 consecutive minutes will be determined to be clear of all marine mammals (as per LOA Condition 3(c)(13)) directly prior to commencing these activities.
- 13) If a marine mammal vocalization is detected on at least two RSA–ORCA PAM buoys during pile driving and the detection is able to be localized or if the SeaPicket operator determines the location of a call overlaps with an applicable mitigation zone, the appropriate mitigation will be called for:
 - a) Immediate shutdown and/or delay to pile driving commencement for any confirmed NARW/unidentified large whale localized at any distance within the 10 km PAM clearance/shutdown zone for NARW.
 - b) Immediate shutdown and/or delay to pile driving commencement for any confirmed non-NARW large whale localized within the 4,000 m [4,300 m in winter] clearance/shutdown zone for sequential installation and 5,300 m [6,300 m in winter] clearance/shutdown zone for concurrent installation.
 - c) Continued pile driving if the vocalization is identified to be a delphinid species given that the clearance/shutdown zone for delphinids is 200 m and any delphinid detected by an RSA–ORCA PAM buoy located 5 km from the pile would not be within 200 m of the pile .
 - d) Continued pile driving if a NARW/unidentified large whale is localized **outside** the 10 km NARW PAM clearance/shutdown zone (accounting for +/- 11 m localization error, assuming position closest to the pile once error is considered) or if an identified non-NARW call is localized **outside** the 4,000 m (4,300 m in winter) or 5,300 m [6,300 m in winter] non-NARW large whale clearance/shutdown zone for sequential and concurrent installation, respectively.
- 14) If a marine mammal is detected on a single RSA – ORCA PAM buoy and therefore cannot be localized and confirmed outside the applicable clearance/shutdown zone, a conservative approach will be taken, and the PAM operator will call for an immediate delay/shutdown of piling. The delay/shutdown of piling will remain in effect until the animal is able to be localized and confirmed to be outside the clearance/shutdown zone or until a specific time period has elapsed with no further sighting or detection: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (other than NARW) and sea turtles.
 - a) This protocol applies to any single marine mammal calls detected on the RSA-ORCA PAM buoy(s) which are unable to be localized outside of the clearance/shutdown zone.
 - b) Any additional QA/QC to support mitigation requirements will occur after mitigation has been requested/implemented. One on-duty PSO will record the sighting into *Mysticetus*, while the other two PSOs will remain on watch from the bridge wings of the vessel.
- 15) If impact pile driving is delayed due to the presence of a NARW/unidentified large whale, impact pile driving will not begin until the NARW/unidentified large whale has neither been visually nor acoustically detected for 60 minutes.

3.5.3 Soft-start Protocols

- 1) Soft start of pile driving will not begin until the clearance zone has been determined clear including no NARW visual detections at any distance or PAM detections within the 10 km PAM Clearance/Shutdown Zone for NARW for 60 minutes, no other marine mammals or sea turtles in the applicable clearance zone for 30 minutes, and the entire Minimum Visibility Zone must be visible for 60 minutes, as determined by the on-duty Lead PSO, visual PSOs and PAM operators.
- 2) Soft start is required at the start of all pile driving events and at any time following cessation of piling for 30 minutes or longer, unless not technically feasible to do so (as described below).
- 3) The pile driving soft-start will involve initiating hammer operation at a reduced energy level (relative to full operating capacity) followed by a waiting period. Sunrise Wind will consider final design details including site-specific soil properties and other considerations when developing the final protocol.
- 4) If a marine mammal or sea turtle is observed within or about to enter the applicable clearance zone during the soft start period, impact pile driving will be stopped until the animal has been visually observed exiting the clearance zone or until a specific time period has elapsed with no further sightings: 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including the NARW) and sea turtles.
- 5) Upon re-starting pile driving on a pile that has been partially installed, soft start protocols will be followed unless not technically feasible to do so, in which case pile driving will restart using hammer energies no more than the minimum amount of hammer energy that Sunrise Wind determines necessary to advance the pile without causing damage to the hammer.

3.5.4 Shutdown Protocols

- 1) If a marine mammal or sea turtle is detected (visually or acoustically) entering or within the applicable shutdown zone after pile driving has begun, the PSO or PAM operator will call for a shutdown of pile driving and the vessel operator will stop pile driving immediately, unless shutdown is not practicable due to imminent risk of injury or loss of life to an individual or risk of damage to a vessel that creates risk of injury or loss of life for individuals, or the DP/WM determines there is risk of pile refusal or instability.
- 2) The hammer energy selected to drive the pile will be the minimum effective hammer energy (no greater than the maximum 4,000 kJ hammer energy) necessary to effectively and safely install and achieve the necessary penetration progress based on the driveability assessment. The most efficient driving energy may not be equal to the minimum effective energy needed to drive the pile with correct penetration progress. The difference between most efficient and minimum effective energy may be small; however, a difference would be recordable in the hammer logs. Therefore, if a shutdown is called for and the pile is not stable enough for a shutdown; mitigation will be requested and, if technically feasible, a lower hammer energy (i.e., change from most efficient to minimum effective) or reduced strike rate, if practicable, would be implemented¹⁰.

¹⁰ The hammer energy and strike rate are inversely related. By reducing the hammer energy, the strike rate will increase and to reduce the strike rate, the hammer energy will need to be increased. Therefore, by reducing the hammer energy, the amount of blows per meter will increase thus resulting in an increase in the total exposure period.

- a) If pile driving is not shutdown when a marine mammal has been detected within the applicable shutdown zone, the hammer energy will be reduced to the lowest level practicable and the reason(s) for not shutting down will be document and reported to NMFS-OPR in the applicable monitoring reports (e.g., weekly, monthly) as described below in Section 5.7 and 5.11.
- 3) Bubble curtain and AdBm compressor sensor monitoring will take place throughout the piling process. If bubble curtain sensors indicate that pressure or flow rates have changed and are not sufficient to maintain the 10 dB attenuation levels, the DP/WM will be notified and a shutdown in piling operations will be implemented, if it is safe to do so (see above). Similarly, the compressor equipped with the AdBm system provides a continuous air flow rate of 5.5 m³/minute at the nozzle outlets on the hose in the bottom frame to ensure the pockets in the AdBm resonator are always sufficiently filled with air. If the sensor indicates that pressure or flow rates have changed and are not sufficient to maintain the 10 dB attenuation levels, the DP/WM will be notified and a shutdown in piling operations will be implemented if safe to do so. Pile driving will not restart until the bubble curtain and/or the AdBm NAS or its compressor(s) are repaired and full functionality verified.
 - a) Bubble curtain performance will be monitored by confirming that the compressors are delivering the minimum required air flow rate of 0.5 m³/(min*m) at the compressors outlet. With this minimum air flow rate, the bubble curtain's noise attenuation capability of 10 dB will be achievable. This flow rate will be logged and included within a DBBC daily report.
- 4) After a shutdown, impact pile driving may restart when:
 - a) The animal (other than a NARW) has been observed voluntarily departing and outside the relevant clearance zone;
 - b) There have been no visual or acoustic detections for 15 minutes for odontocetes (excluding sperm whales) and pinnipeds, and 30 minutes for sperm and baleen whales (including the NARW), and sea turtles;
 - c) Visibility improves such that the relevant Clearance Zones are fully visible and clear of marine mammals and sea turtles for at least 60 minutes immediately prior to restart of impact pile driving.
- 5) If pile driving is shut down for less than 30 minutes and all visual and acoustic monitoring has been maintained continuously throughout the shutdown period, pile driving may begin immediately without clearance watch and soft start procedures.
- 6) If pile driving is shut down for a period longer than 30 minutes, all soft start procedures will be followed, unless not technically feasible to do so.
 - a) If this is the case, pile driving will restart using hammer energies no more than the minimum amount of hammer energy than Sunrise Wind determines necessary to advance the pile without causing damage to the hammer.
- 7) As per LOA Condition 3(c)(4), initiation of a pile may occur no earlier than one hour after civil sunrise. However, if pile driving is shut down for darkness (nighttime), Sunrise Wind will assess the weather conditions for the rest of the night and the following daylight period. If weather conditions are forecast to worsen before daylight and cause a risk to pile stability and vessel/human safety, Sunrise Wind will initiate soft-start procedures and conduct pile installation overnight to maintain feasibility for complete pile installation. Monitoring during clearance and piling would be conducted as described in Section 3.6.

- 8) Any disagreements between the on-duty Lead PSO, PAM operator, and the activity operator regarding delays or shutdowns will only be discussed after the mitigative actions (as described above) have occurred.

3.5.5 Pauses and Silent Periods

- 1) The visual clearance and shutdown zones will be continuously monitored by PSOs and PAM during any pauses in pile driving.
- 2) If an animal is sighted within the applicable visual clearance zone or a NARW is visually sighted at any distance or acoustically detected on any PAM buoy within the 10 km PAM Clearance/Shutdown Zone during a pause in piling, activities will be delayed until the animal(s) has moved outside the clearance zone (other than NARW) and no animals have been detected within their respective clearance zones for a period of 15 minutes for odontocetes (excluding sperm whales) and pinnipeds and 30 minutes for sperm and baleen whales (including NARW), and sea turtles.

3.5.6 Post-Piling Monitoring

- 1) PSOs will continue to monitor using visual and acoustic protocols throughout the pile installation and for a minimum of 30 minutes after piling has been completed.

3.6 Daytime Reduced Visibility Monitoring Plan

Pile driving may not be initiated at any time during daytime when the relevant minimum visibility zone is not fully visible (e.g., due to, rain, fog etc.). As per LOA Condition 3(c)(4), initiation of a pile may occur no earlier than one hour after civil sunrise and no later than 1.5 hours before civil sunset, unless NMFS approves a *Nighttime Monitoring Plan for Pile Driving* that demonstrates the efficacy of night vision devices to effectively monitor the mitigation zones. This Daytime Reduced Visibility Monitoring Plan is not intended to be used when the minimum visibility zone cannot be collectively cleared by PSOs for at least 30 minutes immediately prior to piling (e.g., at night). As per COP Condition 10.5.2, if daylight is insufficient, the on-duty Lead PSO will call for a delay in pile driving until the relevant minimum visibility distance can be monitored in all directions.

This Daytime Reduced Visibility Monitoring Plan will be used to monitor the relevant shutdown zone(s) in cases where piling has begun during suitable daytime visual conditions, soft start has been completed, but then visibility conditions become reduced to less than the minimum visibility distance and stopping operations represents a risk to human health, safety, and/or pile stability. Under such circumstances, all visual monitoring protocols described in Section 3.5 and PAM monitoring as described in the *WTG PAM Plan* will be implemented with the additional utilization of alternative monitoring technology (e.g., infrared cameras [IR]) to monitor for marine mammals and sea turtles (described in the following paragraphs). A map showing the large whale (non-NARW) shutdown zone as well as the PSO vessels path at a representative WTG location is shown in Figure 4. The visual effective range applicable during periods of reduced visibility will vary based on the environmental conditions as well as which tools the PSOs determine to be most reliable for monitoring marine mammals and sea turtles in those conditions. Therefore, the effective range shown in Figure 4 may not be representative of the effective range during periods of reduced visibility. The shutdown zone distance for a WTG MP foundation installation in the summer is 4 km and 5.3 km assuming sequential and concurrent foundation installation, respectively (Table 4 and Table 6). Recording of marine mammal sightings and notifications to other PSOs during reduced visibility conditions will occur in the same manner as described for daytime periods

in Section 3.9. Any detections within or near the shutdown zone will be communicated directly to the on-duty PSOs on the piling vessel through VHF radio. Should communication fail using the VHF radio, other forms of communication method such as mobile phone via WhatsApp or computer via Teams will be used so that any necessary mitigation actions can be implemented in a timely manner.

During daylight pile driving operations, there will be a minimum of one vessel-mounted thermal camera on every vessel, supplied by Current Corporation. Two cameras will be outfitted on the BL2, a Current NN3050 cooled system, with 100% redundancy and a Current NN3025 uncooled system. All other PSO vessels will have a single Current NN3025 uncooled mounted system. The technical specifications of the cameras are provided in Table 13. Additional estimates on the available FOV as a percentage of a full 360° FOV (not what is being monitored instantaneously) for the IR cameras on the installation vessel and other PSO vessels are provided in Table 11 and Table 12 respectively. Both types of cameras were tested in the field during two separate trials in 2022. The field study results from ThayerMayhan (2023) present effective ranges for two camera systems included in shoreside testing where cameras were mounted 11 m above sea level (ASL) and for offshore testing from a vessel where the three IR cameras were mounted 13-14 m ASL. The results of these tests showed the thermal IR cameras to be capable of effective detection of large whale blows out to distances of 1–2 km at night in good visibility conditions (little to no fog, Beaufort Sea state less than 4) (ThayerMahan 2023). Based on comments received from agencies regarding the results in ThayerMahan (2023), the effectiveness of the IR systems were accepted to be 1 km for uncooled cameras and 1.5 km for cooled cameras. The two dedicated PSO vessels will each travel along a circular path around the installation vessel at a distance of 2.5 km from the WTG MP foundation. The cooled camera system located on the installation vessel will be able to detect out to 1.5 km towards the 2.7 km and 3.5 km minimum visibility zone for sequential and concurrent foundation installation respectively, while the uncooled camera system located on the PSO monitoring vessels will be able to detect 1 km both towards the WTG foundation being installed and outwards towards the 2.7 km and 3.5 km minimum visibility zone for sequential and concurrent foundation installation, respectively. Through the combined use of the cooled and uncooled camera systems located on the BL2 and PSO monitoring vessels, respectively, effective monitoring of the entire relevant minimum visibility zone for summer piling installation assuming sequential and concurrent foundation installation respectively (2.7 and 3.5 km) will be achieved. Therefore, Sunrise Wind expects coverage beyond the indicated 180° coverage for each of the two cameras given the overlap between the two IR cameras on the installation vessel as well as the NN3025 onboard the PSO monitoring vessels.

Thermal IR cameras are not expected to be as effective in detecting whale blows at the same distances during moderate to dense fog or in high sea states. Therefore, the first priority during periods of moderate to dense fog or in high sea states will be to implement a shutdown of pile driving activities. However, in rare cases where pile driving must continue during reduced visibility conditions the on-duty Lead PSO on duty will determine whether or not the amount of fog or elevated sea states is affecting their ability to detect whale blows using the IR cameras. Should this determination be made, the on-duty Lead PSO will then decide which method (unaided eye or IR) provides the most effective observations under the current conditions and PSOs will use that method during continued periods of observation. The most effective monitoring method will continue to be evaluated as visibility conditions change.

As described in section 3.3, no impact pile driving is planned for the month of December through April, however, installation in December may only occur upon NMFS approval, in the case of unexpected delays. If Sunrise Wind requests NMFS approval for WTG MP installation in December due to

unexpected delays, Sunrise Wind will provide an amended PDMP that covers winter pile driving, including further detail surrounding the PSO vessel configuration to monitor the 3,000 m and 4,000 m minimum visibility zone assuming sequential and concurrent foundation installation, respectively.

Table 13. Specifications of the Current Corporation, Inc. thermal cameras.

Key factors	NN3025	NN3050 (Bokalift 2 only)
Type of sensor	LWIR Uncooled Thermal Imager	Cooled Mid Wave Infrared (MWIR), 3-5 μ m
Sensor Resolution	1920x 1080 HD	640x512 pixels, 30fps
Wavelength	8-14 μ m	3-5 μ m
Optics Field of View (FOV)	25° (wide) to 6° (narrow)	28° (wide) to 2° (narrow)
Zoom	30x optical zoom	30x optical zoom
360° visual scan	Yes	Yes
Testing standard	(Military standard) MIL-STD 810 & MIL-STD-461	(Military standard) MIL-STD 810 & MIL-STD-461
Stabilization	3 axis gyro stabilization ² c./w. enhanced video stabilization	3 axis gyro stabilization ² c./w. enhanced video stabilization

Each PSO vessel will have a minimum of one NN3025 vessel mounted thermal camera, which will be monitored by a PSO if piling activity occurs during daylight periods of reduced visibility. The NN3025 thermal camera will be mounted at approximately 14 m ASL on PSO vessels. The installation vessel will have two thermal cameras installed. One on the base of the helideck (NN3025) and one on the Boom-rest platform overlooking the pile installation (NN3050). The cooled camera installed on the boom rest will be installed on the piling side of the vessel, with the least number of obstructions covering the largest FOV with higher specification. Both thermal cameras will be mounted at a height of approximately 27 m. The helideck mounted camera will cover the area over the bow of the vessel and will be used primarily for vessel strike avoidance whenever the vessel is in transit, while the cooled camera on the Boom-rest will be the primary camera used to cover piling operations.

The standard monitoring procedure for the cameras on the installation vessel will be for the cooled camera to be monitored by one PSO while the other two PSOs continue monitoring from the bridge wings. The two PSOs monitoring from the bridge wings will use the unaided eye (or NVDs [Rongland gnv-3], as appropriate based on the amount of vessel lighting present) to monitor for sea turtles since they are less likely to be detected by the IR camera. Given the mounted position and expected use of the uncooled camera (vessel strike avoidance), it was determined that the PSO's FOV on the bridge wings resulted in more effective monitoring during piling operations than the FOV afforded by the uncooled camera. However, when the on-duty Lead PSO determines that the bridge wing observers are no longer effective, one bridge wing PSO will move to the uncooled thermal camera while the other continues to monitor for sea turtles using whichever monitoring method is determined to be the most effective under the current conditions.

The standard monitoring procedure for the uncooled camera on the PSO monitoring vessels will be for two PSOs to monitor from the bridge wings. Both PSOs monitoring from the bridge wings will be using the unaided eye (or NVDs [Rongland GNVY-3], as appropriate based on the amount of vessel

lighting present) to monitor for sea turtles since they are less likely to be detected by the IR camera. The third PSO will monitor the uncooled IR camera. If the on-duty Lead PSO determines that the bridge wing observers are no longer effective due to reduced visibility conditions, one PSO will continue monitoring for sea turtles using whichever monitoring method they determine to be most effective under the current conditions, while the other PSO assists in monitoring and/or data entry for the PSO monitoring the uncooled camera system.

While using a combination of one cooled (NN3050) and one uncooled (NN3025) IR camera on the installation vessel and a single uncooled IR camera on the PSO monitoring vessels, the PSO monitoring each camera (cooled and uncooled) will manually control the pan rate such that it moves steadily back and forth across the 180° sector at a slow enough rate to avoid blurring the image. As described above, Sunrise Wind expects coverage beyond the indicated 180° FOV for each of the two cameras given the overlap between the two IR cameras as well as the NN3025 onboard the PSO monitoring vessels. This overlap will provide coverage of the 2.7 km and 3.5 km clearance zone(s) as described above. Additionally, the three PSOs stationed on the PSO vessels will each be responsible for monitoring a 120-degree sector of the FOV with unaided eye and reticle binoculars (and big eyes periodically) which will provide additional coverage inside the clearance zone towards the installation vessel as well as beyond the clearance zone away from the pile.

The pan rate of the IR cameras (both NN3025 and NN3050) is designed at 30f panning speed to avoid motion blur (Table 13). The FOV for the NN3025 25° (wide) to 6° (narrow) and 63° to 2.3° for the NN3050 thermal camera (Table 13). The NN3025 uncooled camera will have a sensor resolution of 1920x 1080 HD while the NN3050 cooled camera will have a sensor resolution of 640x512 pixels (Table 13). Current Corporation IR camera data is collected in combination with H.264 Codec image compression software. This is a low-loss-high-resolution data compression package for monitoring of camera imagery by PSOs viewing a large HD monitor. Motion blur will be continually assessed by PSOs throughout periods of monitoring and the pan rate will be adjusted as necessary to maximize coverage based on environmental conditions at that time, location of additional PSO monitoring effort on other vessels, and any ongoing protected species detection events. Additionally, both camera systems (NN3025 and NN3050) include a mechanical stabilizing mechanism (Gyro stabilization) which increases the reliability of the footage in offshore conditions when movement is inevitable (helping to reduce motion blur).

If a potential detection is made, the PSO will stop panning and, if possible, zoom in on the potential detection to improve detection and classification of the object. If the object is determined to be a protected species, the ranging tool in the camera display will be used to inform the approximate distance to the animal(s) and whether they are inside or outside of the relevant mitigation zone. If the PSO is unable to confirm the animal(s) are outside of the relevant mitigation zone, a conservative approach to calling for mitigation (delay or shutdown) will be used by the PSO. The PSO training emphasizes the importance of taking such a conservative approach to calling for mitigation (delay or shutdown) if an animal's estimated range is close to the mitigation zone boundary. Once the appropriate mitigation is called for, the PSO will then follow the same data recording and sighting communications protocols for daytime monitoring described in sections 3.8 and 3.9. If the object is determined not to be a protected species, then the PSO will return the camera to the systematic panning method previously described. The planned IR cameras do not include automated detection software for highlighting potential objects of interest to PSOs so they will continuously monitor the video feed from their camera while on duty, except for brief periods of time required to record effort and sighting data. If a PAM localization is made, PSOs conducting IR

monitoring will use *Mysticetus* to determine in which sector the protected species may be located. The PSO responsible for monitoring that sector will focus their monitoring in the area indicated by the PAM localization. As the vessel continues the circular path around the installation site and the sector where the PAM localization was made the PSO will pass responsibility for monitoring in the area of the PAM localization to the next PSO responsible for that area via VHF radio. Should communication using VHF radios fail, mobile phones using WhatsApp, or the Teams Application on a computer will be in place as a backup for communication between PSOs and PAM operators. WhatsApp and Teams messaging communications are instant. If these three methods of communication fail, PSOs will remain in contact with vessel-based PAM operators using the vessel's radio.

For each detection made, Sunrise Wind will document the range to target, FOV, mounting height, environmental conditions including BSS, and degree of fog/humidity/inclement weather. Sunrise Wind will use all available data to summarize the distances of detections made using the IR cameras and, to the extent feasible based on the available sample size, will produce a detection function. The summary and analysis will be provided to NMFS within the annual report (as described in Section 5.13).

3.7 Nighttime Monitoring Plan for Pile Driving

In accordance with a NMFS-approved *Nighttime Monitoring Plan for Pile Driving*, Sunrise Wind may initiate impact pile driving later than 1.5 hours prior to civil sunset through 1 hour after civil sunrise between June 1 to October 31, annually. As per BiOp Appendix B Section (c)(1)(iii) and LOA Condition 3(c)(4), the *Nighttime Monitoring Plan for Pile Driving*, submitted to NMFS, includes a complete description of how Sunrise Wind will monitor pile driving activities during nighttime piling and reliably demonstrates the efficacy of the nighttime monitoring equipment (e.g., mounted thermal/infrared camera systems, hand-held or wearable night vision devices (NVDs, spotlights) at detecting marine mammals and sea turtles in the relevant clearance and shutdown zones under all various conditions anticipated during construction including varying weather conditions, sea states, and in the consideration of the use of artificial lighting. The *Nighttime Monitoring Plan for Pile Driving* will also include a demonstration that the full extent of the minimum visibility zones can be effectively and reliably monitored. As per COP Condition 5.5.8.2, the *Nighttime Monitoring Plan for Pile Driving* will include a full description of the proposed technology, monitoring methodology, and data demonstrating that marine mammals and sea turtles can reliably and effectively be detected within the clearance and shutdown zones for WTG MPs before, during, and after impact pile driving at night. Further details regarding the measures to be implemented during pile driving intentionally initiated during periods of darkness can be found in the *Nighttime Monitoring Plan for Pile Driving* submitted to NMFS in December 2023.

3.8 Data Collection

3.8.1 Visual PSOs

3.8.1.1 Monitoring Effort, Sightings, and Operations

For all visual monitoring efforts and protected species sightings, the following information will be collected by PSOs. A sequential identification number (ID) unique to each vessel will be assigned to each new marine mammal sighting with multiple sightings of the same animal or group given the same ID. The following information will be collected for each sighting as soon as possible:

- Date and time the monitored activity begins or ends;

- Construction activities occurring during each observation period;
- Watch status (i.e., sighting made by PSO on/off effort, opportunistic, crew, alternate vessel/platform);
- PSO who sighted the animal (last, first) and number of PSOs on watch;
- Date and Time of start and end of sighting (YYYY-MM-DD, hh:mm:ss (UTC)) and duration of observation;
- Weather parameters (e.g., wind speed (knots), wind direction, percent cloud cover, visibility (km), precipitation, glare);
- Water conditions (Beaufort Sea state, tidal state including swell height (m), swell height (meters), water depth (m));
- Identification of the animal(s) with degree of certainty (i.e., genus/species, lowest possible taxonomic level, or unidentified); also note the composition of the group if there is a mix of species;
- Pace of the animal(s);
- Estimated number of animals (minimum/maximum/high/low/best);
- Estimated number of animals by cohort (e.g., adults, yearlings, juveniles, calves, group composition);
- Description (i.e., as many distinguishing features as possible of each individual seen, including length, shape, color, pattern, scars or markings, shape and size of dorsal fin, shape of head, and blow characteristics);
- Whether or not there was a corresponding PAM detection;
- Description of behavior (e.g., such as feeding or traveling), including an assessment of behavioral responses thought to have resulted from the activity (e.g., no response or changes in behavioral state such as ceasing feeding, changing direction, or breaching). If the animal is bow-riding, record duration;
- Animal's closest distance (reticle distance in meters) from the pile being driven and estimated time spent (time entering and leaving (UTC HH:MM) and seconds duration) within the potential injury zone, behavioral harassment zone, and/or shutdown zone (specify radius in m) as well as closest distance from observation vessel if different (reticle distance in meters) and times when these closest approaches occurred (UTC HH:MM);
- Distance (meters) and bearing (relative to ship heading or "clock face") to each animal observed and the animal's direction of travel (relative to vessel as well as initial and final heading in degrees);
- Construction activity at time of sighting (i.e., impact pile driving), use of any NAS, and specific phase of activity (e.g., soft start, active pile driving, etc.). If observed during soft start, record first, closest and last distance as well as behavior at final detection;
- Use of any noise attenuation device(s);
- Specific phase of activity (soft-start for pile driving, active pile driving);
- Description of any mitigation-related actions implemented, or mitigation-related actions called for but not implemented, in response to the sighting (e.g., delay, shutdown, etc.) and time and location of the action;
- Location of observer (latitude and longitude in decimal degrees) and compass heading of vessel (degrees);
- Animal occurrence within potential injury or behavioral harassment zones;
- Other human activity in the area;

- Other applicable information as required in the LOA.

3.8.1.2 NARW Observations (visual and acoustic)

If a NARW is sighted with no visible injuries or entanglements by PSO, the following information will be recorded (in addition to the information described in section 3.8.1.1) and the sighting will be reported immediately as described in Section 5.4:

- Time (UTC, EST), date (MM/DD/YYYY), and location (latitude/longitude in decimal degrees, coordinate system used) of the observation;
- number of whales;
- animal description/certainty of sighting (provide photos/video if taken);
- Lease Area/project name;
- PSO/personnel name who made the observation;
- PSO provider company (if applicable); and;
- Reporter's contact information;
- Confirmation the sighting was reported to the respective hotline;
- The vessel/platform from which the sighting was made;
- Activity the vessel/platform was engaged in at time of sighting;
- Project construction and/or survey activity at the time of sighting;
- Distance from vessel/platform to sighting at time of detection;
- Closest point of approach of whale to vessel/platform;
- Vessel speed; and,
- Any mitigation actions taken in response to the sighting.

If a NARW is acoustically detected, all NARW detections within a 24-hour period will be reported into a single spreadsheet (<https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual>) and reported to NMFS within 24-hours as described in Section 5.4.

3.8.1.3 Large Whale Detection during Vessel Transit

If an observation of a non-NARW large whale occurs during vessel transit, Sunrise Wind will collect and report the time, date, and location of the sighting through the WhaleAlert app as soon as possible but within 24 hours as described in 5.3.

3.8.1.4 Injured or Dead Protected Species

In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead protected species, Sunrise Wind will collect the following data and report the sighting as described in Section 5.5:

- Contact (name, phone number, etc.);
- Time, date, and location (latitude/longitude in decimal degrees) of the first discovery (updated location information if known and applicable);
- Species identification (if known) or description of the animal(s) involved;
- Condition of the animal(s) (including carcass condition if the animal is dead);
- Observed behavior of the animal(s), if alive;
- If available, photographs or video footage of the animal(s); and,
- General circumstances under which the animal was discovered.

In the event that a protected species is injured (non-auditory injury) or killed as a result of Project activities, Sunrise Wind will collect the following information and report the event as described in Section 5.5:

- Time, date, and location (latitude/longitude in decimal degrees) of the incident;
- Species identification (if known) or description of the animal(s) involved;
- Vessel size and motor configuration (inboard, outboard, jet propulsion);
- Vessel's speed leading up to and during the incident;
- Vessel's course/heading and what operations were being conducted (if applicable);
- Status of all sound sources in use (if applicable);
- Description of avoidance measures/requirements that were in place at the time of the incident and what additional measures were taken, if any, to avoid the incident;
- Environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, visibility) immediately preceding the incident;
- Estimate size and length of the animal that was injured or killed;
- Description of the behavior of the animal immediately preceding and following the strike;
- Estimated fate of the animal (e.g., dead, injured but alive, injured and moving, blood or tissue observed in the water, status unknown, disappeared); and,
- To the extent practicable, photographs or video footage of the animal(s).

3.8.1.5 Data Collection Software

Mysticetus software will be used by all PSO and PAM Operators aboard Project vessels to collect and share operational, monitoring effort, and species detection data. In addition to the data summarized above, the following project information will be captured in *Mysticetus*:

- Project Name;
- Lease number;
- State coastal zones;
- PSO contractors;
- Vessel Names;
- Reporting dates (YYYY-MM-DD);
- Visual monitoring equipment used (e.g., bionics, magnification, IR cameras etc.);
- Distance finding method used;
- PSO names (Last, First) and training;
- Observation height above sea surface (m).

The following operational information will also be captured in *Mysticetus*:

- Date (YYYY-MM-DD);
- Hammer type used (make and model);
- Greatest hammer power used for each pile (kJ);
- Pile identified and pile number for the day (e.g., pile 2 and 3 for the day);
- Pile diameters (m);
- Pile length (m);
- Total number of strikes used to install each pile;
- Total hammer energy used to install each pile;
- Pile locations (latitude and longitude);

- Number of vessel transits;
- Types of vessels used;
- Vessel routes used.

The following monitoring effort information will also be captured in *Mysticetus*:

- Date (YYYY-MM-DD);
- Noise source (ON = Hammer on; OFF = Hammer off);
- PSO name(s) (Last, first);
- If visual, how many PSOs on watch at one time;
- Time pre-clearance visual monitoring began and ended (UTC, HH:MM);
- Time pre-clearance PAM monitoring began and ended (UTC, HH:MM);
- Duration of pre-clearance PAM and visual monitoring (MM:SS);
- Time power-up/ramp-up began and reached full power or ended (UTC, HH:MM);
- Duration of power-up/ramp-up (MM:SS);
- Time pile driving began (hammer on) and ended (hammer off) (UTC, HH:MM);
- Duration of hammer activity (MM:SS);
- Duration of visual detection;
- Wind speed (kts), from direction
- Environmental conditions such as: swell height (m), water depth (m), visibility (m), glare severity;
- Latitude (decimal degrees), longitude (decimal degrees);
- Compass heading of vessel (degrees);
- Beaufort scale;
- Precipitation;
- Cloud cover (%);
- Whether a shutdown or power-down occurred;
- Time shutdown was called for (UTC);
- Time equipment was shut down (UTC);
- Habitat or prey observations.

3.9 PSO Communication Plan

Communications are of utmost importance when conducting multi-vessel operations and monitoring. As such, Sunrise Wind will ensure communication channels between the PSOs, the DP/WM, and vessel masters on all applicable vessels are established and maintained prior to and during all vessel movements and pile driving events. Communication and decision tree flowcharts are provided below for specific protected species observations from any project vessels (Figure 5), pile driving clearance (Figure 6), and during pile driving (Figure 7).

The on-duty Lead PSO who will act as the main point of contact for the DP/WM, who will be situated on the Bridge of the installation vessel. The Lead PSO(s) will be on the same vessel with the DP/WM and will have direct contact with the DP/WM throughout the piling process. All project personnel (e.g., PSOs, PAM operators, vessel captains, DP/WM) will have radios and will use a dedicated channel outside the standard marine communications channels. As back up, PSOs will use vessel radios,

instant messaging, Teams App, and/or cell phones should communication via the radio fail. Additionally, all detections will be reported on *Mysticetus* and all PSO and non-PSO vessel with displays will receive the location of each detection. All PSO alerts, including visual and acoustic detections, will be transmitted via the radio channel for situational awareness and preparation for any mitigation activities.

For detections that trigger mitigation actions, only the on-duty Lead PSO will recommend to the DP/WM what mitigation action should be taken. The DP/WM will be responsible for deciding if a shutdown or delay in operations is safe and technically feasible. All PSOs/PAM Operators will communicate directly with the on-duty Lead PSO for discussion with the DP/WM. The DP/WM will verbally confirm and authorize the shutdown or delay and the on-duty Lead PSO will record the interaction.

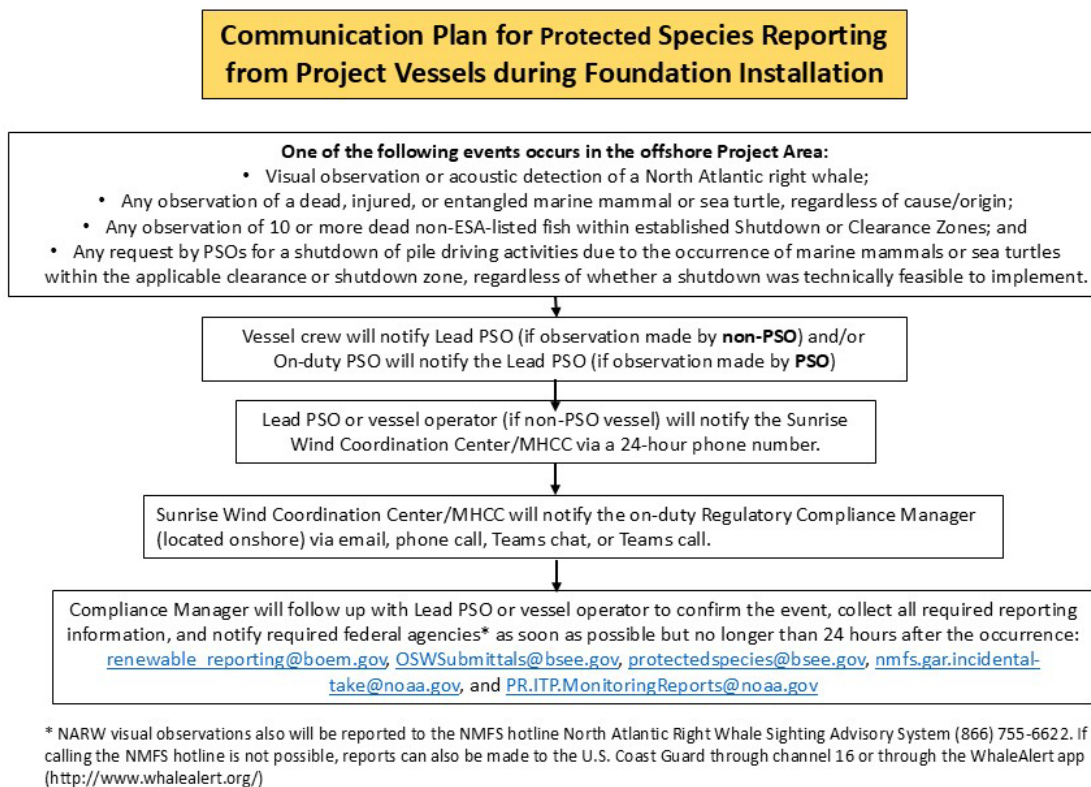


Figure 5. Communication flowchart for detection of certain protected species and mitigation events from Project vessels.

In the event that a shutdown is called for, the DP/WM will consult the Boskalis Offshore Construction Manager who must evaluate the penetration depth of the pile in relation to the known soil data and the pile's hammer/progress logs to determine pile stability and shutdown/reduction feasibility. If a mitigation action requested by the on-duty Lead PSO is not implemented due to safety or other allowable circumstances or a reduction in hammer energy is implemented, the general information will be relayed from the DP/WM to the on-duty Lead PSO who will note the information in their report. A

separate report will be produced by the DP/WM and offshore construction staff detailing the reasoning behind the inability to shutdown.

In the event that a reduced hammer energy is called for, the DP/WM will consult the Boskalis Offshore Construction Manager who must evaluate the penetration depth of the pile in relation to the known soil data and the pile's hammer/progress logs to determine pile stability and shutdown/reduction feasibility. If a mitigation action requested by the on-duty Lead PSO is not implemented due to safety or other allowable circumstances or a reduction in hammer energy is implemented, the general information will be relayed from the DP/WM to the on-duty Lead PSO who will note the information in their report. A separate report will be produced by the DP/WM and offshore construction staff detailing the reasoning behind the inability to reduce hammer energy.

Each PSO vessel will be outfitted with Starlink broadband internet with dedicated networks for the PSOs/PAM operators and acoustic reporters to provide reports efficiently. Additionally, each vessel will be provided a dedicated PSO laptop with access to a shared mailbox and Microsoft Teams channel. The PSOs and PAM operators will also be provided a VHF radio and mobile phone for onshore and offshore connections should the internet go down. All sightings and mitigation data will also be input into *Mysticetus* by dedicated watch, PSOs and PAM Operators on all Project vessels. The PAM buoys will be on their own network to a monitoring station and will use the Rajant system¹¹ to communicate with the base station; therefore, they will not be reliant on any offshore internet availability.

Each SeaPicket system detects acoustic signals using a 32-channel linear acoustic array. The received signals undergo onboard processing with relevant data then transmitted every five minutes or less to the shoreside ThayerMahan Command Center via Starlink satellite communication. In the event Starlink communication fails, a secondary broadband global area network (BGAN) antenna will transmit relevant data back to the operations center. The onboard processing will include classifiers specifically developed to identify the NARW upcall and humpback whale calls. Autodetection classifiers for other additional species are in development and will be used as they become available. Using a web-based interface, ThayerMahan PAM operator(s) will be on duty shoreside in the ThayerMahan Command Center to review and analyze incoming data. The SeaPicket operator(s) will classify and tag detection data using a hierarchy to create contact/detection reports and discuss any uncertainties with the on-duty PAM Operator to ensure potential call detects are not missed as described in Section 1.3.2 of the *WTG Passive Acoustic Monitoring (PAM) Plan*. As soon as a detection report for a marine mammal is available it will be entered or automatically pushed into the *Mysticetus* cloud database. The vessel-based computers running *Mysticetus* automatically sync to the cloud resulting in the acoustic detections becoming visible to the vessel-based PSOs on a map display. The NMFS-approved PAM operator will review potential detections and conduct data recording, mitigation and monitoring decision making and direct communications to the on-duty Lead PSO (located on the installation vessel) required of PAM operators via radio, phone, or other direct communication method. The on-duty Lead PSO will assess the information provided and will take the necessary mitigation actions. No direct communication will be made between the PAM operator monitoring the RSA – ORCA PAM systems and the PAM operator(s) located in the Command Center monitoring the SeaPicket system(s).

The duration of time from when a call is received by the SeaPicket system to when it can be reviewed by a PAM operator is less than 10 minutes and typically 4 – 7 minutes. Additional details

¹¹ The Rajant system has a tested range out to 8 km; therefore, the system will not have any issues maintaining a stable connection out to the Project's 5 km distance from shore.

describing the time required for potential marine mammal calls to be transmitted, reviewed, and communicated to the on-duty Lead PSO (via radio, phone, or other direct communication method) are provided in Appendix D to the *WTG Passive Acoustic Monitoring Plan*.

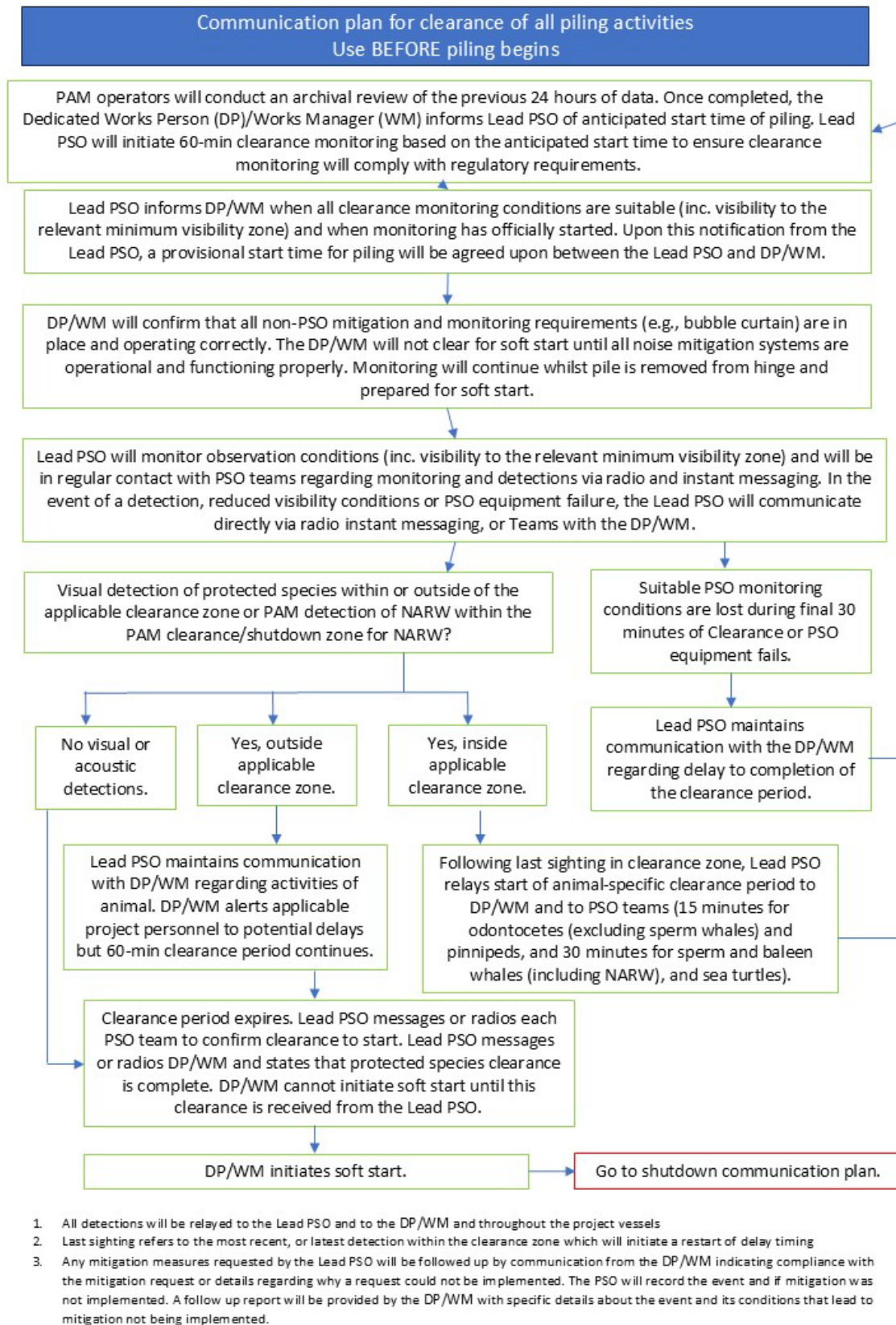


Figure 6. Clearance communication flowchart and decision tree.

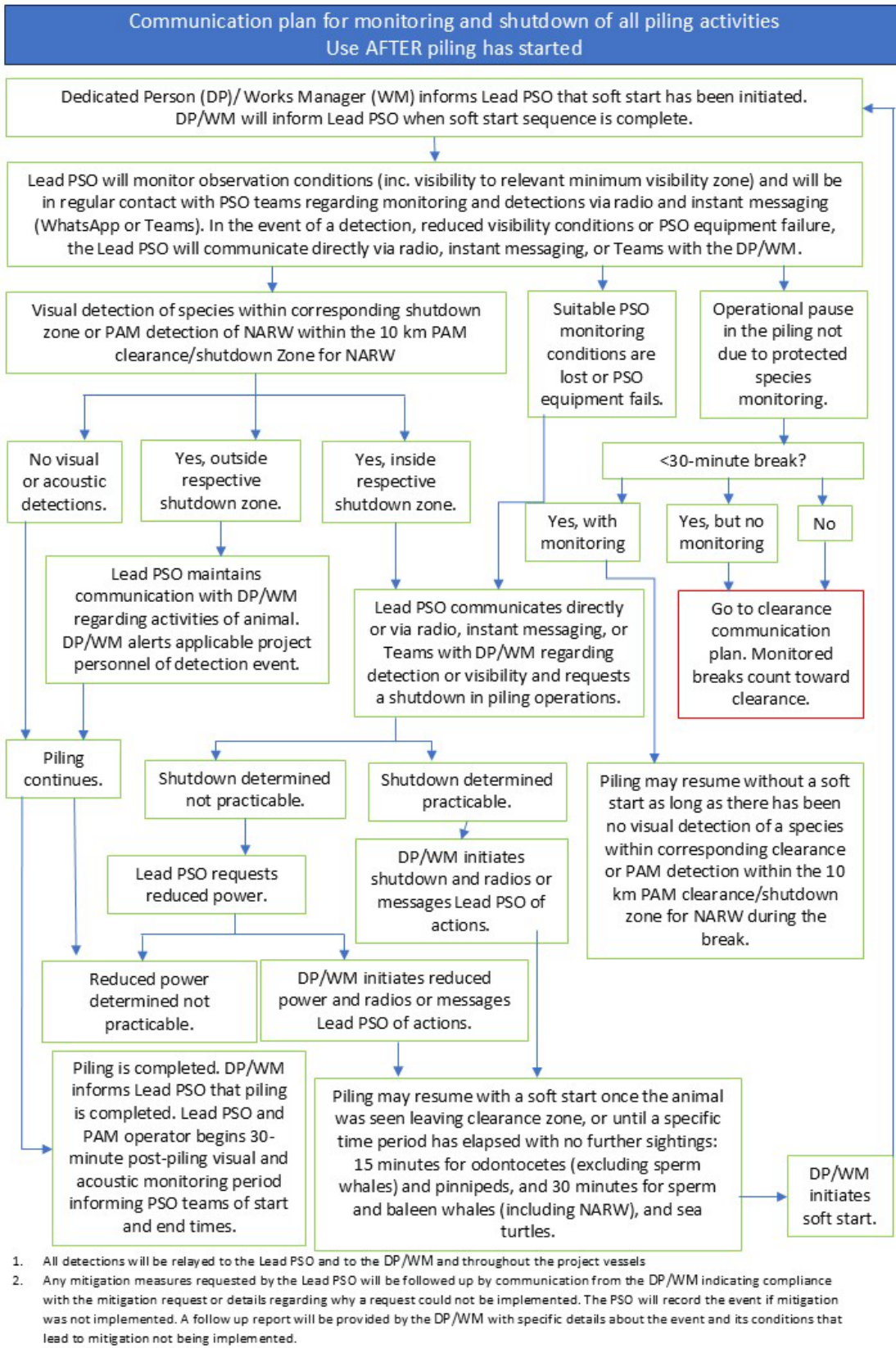


Figure 7. Communication flowchart and decision tree during pile driving

4 Noise Abatement System (NAS)

As per LOA condition 3(c)(6), Sunrise Wind will deploy at a minimum, a double big bubble curtain and AdBm that reduce noise levels to the modeled harassment isopleths, assuming 10 dB attenuation during all MP foundation pile driving activities. A DBBC and AdBm, together will be employed during each piling event. The hoses will be flushed out prior to informing the BL2 that the DBBC are operational. Once the MP has been upended and placed on the seabed, the AdBm “curtain” is suspended under water around the MP and remains in place throughout the entire piling event.

The DBBC consists of 2 big bubble curtains (BBCs) comprising nozzle hoses with lengths of:

- BBC 1: 377 m (Inner ring) set at 55 m from the pile, and
- BBC 2: 628 m (Outer ring) set at 110 m from the pile.

The inner and outer BBCs will be deployed as a set on every installation location by the nozzle hose deployment vessel (NHDV) per MP location and will be supplied with compressed air to maintain a 2-layer bubble curtain around the MP. The DBBC will be pre-installed before MP installation and during piling, the DBBC will be pressurized from the vessel at a level designed to reduce, to the maximum extent practicable, hammering noise that propagates through the water column. The Free Air Delivery (FAD) supplied on the DBBC during piling operations is greater than $0.5 \text{ m}^3/(\text{min} \times \text{m})$. Therefore, the total air supplied to the DBBC would be greater than $510 \text{ m}^3/\text{min}$. If the DBBC is installed without use for 72 hours, the system will be fully pressurized. During this time the bubble rings will be monitored at the surface to verify correct layout and positions and to observe a uniform and constant flow. Should any gaps or irregularities be observed, the hoses will be retrieved, thoroughly inspected, and re-deployed. Similarly, if the DBBC is installed without use for 96 hours, the hoses will be retrieved, thoroughly inspected, and re-deployed.

There will be three sets of DBBC hoses (one set = inner and outer hose) onboard the noise mitigation vessel; two sets will be operational, and one will be available as a spare. Each set of DBBC hoses onboard the vessel will be given a unique identifier (#1, #2, and #3), which will be reported in the bubble curtain performance reports submitted to the agencies as described in Section 5.10. Usage and tracking of which hose set is used for each foundation installation will be a part of the daily tasks conducted by the DBBC operations team. There will also be ten compressors onboard the noise mitigation vessel used to pressurize the combined DBBC including eight operational compressors and two spares. To account for varying water depths, the DBBC operating pressures will be modified to optimize performance at increasing water depths as follows:

1. Water depths <40 m – target pressure will be 8 bars to maintain a flow rate of $510 \text{ m}^3/\text{min}$
2. Water depths >40 m – target pressure will be increased above 8 bars and flow rate will be increased to $570 \text{ m}^3/\text{min}$ if the back pressure allows for it.

There will also be two separate compressors, one operational and one back up, on board the installation vessel that will be used to “fill” the AdBm NAS component. The AdBm system is equipped with an electric compressor that will be installed on the deck of the BL2 which will have the air supply controlled by the depth of the AdBm system bottom frame. From the bottom frame, the air will travel vertically through the AdBm system to fill up the cups of the resonators. The air in the resonators will then compress during the descent of the AdBm system to the operational depth due to increased hydrostatic pressure. Sufficient spares for different components of the AdBm system will be onboard the DBBC vessel to assist in repairs as needed. A big bubble curtain is often described as 'far-field NAS' in

the context of offshore impact pile driving and not necessarily from a strict acoustic propagation standpoint. The reason is it is placed at a distance from the source (foundation) that is often considered 'far field' in acoustics terminology. As stated in https://www.itap.de/media/experience_report_underwater_era-report.pdf page 30: 'The boundary between near and far field for underwater noise (hydro sound) is not exactly defined, but depends on the wavelength λ . In airborne sound, a value of $\geq 2\lambda$ is assumed. For underwater noise, values of up to $\geq 5\lambda$ can be found.' The AdBm (Helmholtz resonator) will be the near-field portion of the NAS and given that this device is typically deployed within 10 m of the pile, may be considered a near-field system, although, as noted in the far field discussion, it not an exact definition. In accordance with LOA Condition 3(c)(6), construction contractors will train personnel to collect relevant data regarding the operation or maintenance of the deployed NAS (e.g., proper balancing of airflow to the bubble curtain ring, deployment accuracy of hose nozzles, maintenance record, etc.). Such data will be recorded by the Chief engineer on board the NAS deployment vessel. The Chief Engineer for the NAS will provide the works manager with verbal confirmation that the NAS is correctly operational so that the PSOs can begin watch. The reported data will be submitted to the works manager and the on-duty Lead PSO. The NAS report will be included in the daily construction report and will be included in the daily PSO reports. A full description of the NAS deployment, including equipment configurations that ensure connection to the seafloor, is provided in the Far Field Noise Mitigation Manual (Appendix A).

In accordance with LOA Condition 3(c)(6)(iv), the construction contractor will use a highly experienced NAS contractor with personnel who have deployed and managed NAS(s) on similar projects; all personnel from the NAS contractor will receive Sunrise Wind Environmental Awareness Training as required. The construction contractor will submit an inspection/performance report for approval by Sunrise Wind within 48 hours following an initial performance test conducted shortly after the NAS is fully operational and has been operating for at least 10 minutes; and any corrections to the NAS to meet the performance standards will occur prior to pile driving. The initial performance test will be performed once, at the start of the offshore campaign at field. Subsequently, prior to each DBBC deployment at the foundation location, the DBBC spread will be inspected. The bubble curtain sensors will indicate if there are any problems with the bubble curtain deployment. Performance reports for the AdBm system will be compiled in the same manner as described for the DBBC. Sunrise Wind will provide NMFS-OPR, BOEM, and BSEE with a bubble curtain and AdBm performance test and maintenance report to review within 48 hours after each pile using a bubble curtain and AdBm is installed. For piles for which Complete SFV is carried out, the performance test and maintenance report will be submitted as soon as it is available, but no later than when the interim SFV report is submitted for the respective pile. Additionally, a full maintenance check (e.g., manually clearing holes) will occur prior to each pile being installed. Any corrections to the bubble ring(s) to meet the performance standards as described in LOA Condition (c)(6)(iv) will occur prior to impact pile driving of MPs. Any repairs or alterations will be included in the daily report and sent to NMFS-OPR, NMFS GARFO – PRD, BOEM and BSEE as described in Section 5.10. Prior to DBBC operations at each location a number of quality checks will be performed to verify operational performance. This includes installation positions, air supply and pressure checks, and flushing out hoses. Additional details surrounding steps taken to ensure the DBBCs are operating at peak efficiency for each use are provided in Appendix A.

If any of the SFV measurements indicate distances to the isopleths corresponding to potential auditory injury (marine mammals and sea turtles)/physical injury (fish) and/or behavioral harassment thresholds are greater than the distances predicted by the modeling assuming 10 dB attenuation, Sunrise

Wind will notify NMFS GARFO Protected Resources Division (NMFS GARFO – PRD), NMFS Office of Protected Resources (OPR), Bureau of Ocean and Energy Management (BOEM), and Bureau of Safety and Environmental Enforcement (BSEE) through TIMSWeb and at protectedspecies@bsee.gov via email. In this same email, Sunrise Wind will communicate and confirm the noise mitigation adjustments that will be employed for installation of the next pile prior to beginning installation to ensure future piles do not exceed modeled distances to thresholds (assuming 10 dB attenuation). Additional measures may include improving the efficacy of the implemented noise attenuation technology through inspection and amendment of the DBBC layout, inspection of the nozzle hose and redrilling if needed, adjustment/increase of the air supply to the DBBC/ adjustment of air supply to the AdBm “filling small curtain” and/or modifying the piling schedule to reduce the sound source.

As per BiOp RPM 2(a)(ii) and LOA Condition 3(c)(18)(iii), if any of the measured piles indicate that the distances to potential auditory injury thresholds for marine mammals and sea turtles or physical injury thresholds for fish are larger than the modeled distances (assuming 10 dB attenuation), Sunrise Wind will coordinate with NMFS to expand the relevant clearance and shutdown zones for the subsequent piles so that they are at least the size of the distances to those thresholds as indicated by the SFV measurements. Pile installation will continue with implementation of the previously determined enhanced noise attenuation measures and any expanded clearance and shutdown zone sizes until SFV results for at least three additional foundations demonstrate that measured ranges to potential auditory injury (marine mammals and sea turtles/ physical injury (fish) or behavioral harassment isopleths meet or are less than those modeled assuming 10 dB of attenuation. For every 1,500 m that a protected species clearance or shutdown zone is expanded, additional PSOs will be deployed from additional PSO vessels to ensure adequate coverage of the expanded clearance and/or shutdown zones with each observer responsible for maintaining watch in no more than 120° and an area with a radius no greater than 1,500 m. Once the SFV results for at least three additional foundations indicate distances to isopleths corresponding to potential auditory injury (marine mammals and sea turtles)/ physical injury (fish) and behavioral harassment thresholds are within the distances predicted by modeling assuming 10 dB attenuation, Sunrise Wind will continue to implement the additional mitigation measures until NMFS grants approval to revert to the original clearance and shutdown zones or continue with the expanded clearance and shutdown zones with additional PSOs.

5 Reporting

Sunrise Wind will use a standardized reporting system during the effective period of the Letter of Authorization (LOA). All data will be recorded using industry-standard software that is installed on field laptops and/or tablets (see Section 3.8). All reporting will comply with COP approval, ITR, LOA and BiOp conditions. Sunrise Wind has the responsibility to meet all permit conditions. Contractor responsibilities are contractual commitments to Sunrise Wind that will allow compliance with permit conditions. Measures related to specific reporting circumstances are outlined in the following sub-sections below.

5.1 Training

5.1.1 Sunrise Wind Responsibilities

- Prior to initiation of WTG MP foundation installation, Sunrise Wind will demonstrate in a report submitted to NMFS-OPR (pr.itp.monitoringreports@noaa.gov) that all required training

for Sunrise Wind personnel (including vessel crew, vessel captains, PSOs, and PAM operators) has been completed (ITR § 217.314 (c)(1) and LOA Condition 4(c)(1)).

5.1.2 Contractor Responsibilities

- The contractor will provide documentation of all personal training conducted by the contractor within 24 hours of training completion (Excel, word, or PDF format).
- Training certificates for the PSO and PAM personnel will be provided at least 90 days prior to the start of WTG MP foundation installation activity.
- Contractors will provide copies of PSO training documents to NMFS-OPR upon request.

5.2 Vessel Strike Reporting

Required reporting protocols surrounding vessel strike can be found within the stand-alone *Vessel Strike Avoidance Plan* originally submitted to NMFS-OPR for review on September 27, 2023 (revised August 20, 2024) and approved by NMFS OPR on September 10th, 2024.

5.3 Large Whale during Vessel Transit Reporting

If a non-NARW large whale is observed during vessel transit, the following reporting actions will be taken as described in LOA Condition (LOA Condition 4 (c)(17)(iii)).

5.3.1 Sunrise Wind Responsibilities

If a non-NARW large whale is observed during vessel transit, the following actions will be taken:

- Sunrise Wind will report the time, date, and location of the sighting through the WhaleAlert app (www.whalealert.org) as soon as possible but within 24 hours.

5.4 North Atlantic Right Whale Reporting

If a NARW is visually or acoustically detected by the PSOs or PAM operator on watch, the following reporting actions will be taken as described within LOA Condition 4(c)(17)(ii) and BiOp T&C 7 (b).

5.4.1 Sunrise Wind Responsibilities

If a NARW is sighted with no visible injuries or entanglement or is acoustically detected at any time by PSOs, PAM operators, or project personnel, the observation will be reported immediately (if not feasible, as soon as possible) and no longer than 24 hours after the initial sighting or acoustic detection. The visual sighting report will include the information described in Section 3.8.1.1 and 3.8.1.2. Reporting protocols will include the following steps:

- Download and complete the Real-Time North Atlantic Right Whale Reporting Template spreadsheet (<https://www.fisheries.noaa.gov/resource/document/template-datasheet-real-time-north-atlantic-right-whale-acoustic-and-visual>) for both visual sightings and acoustic detections. Save the spreadsheet as a .csv file and email it to NMFS NEFSC-PSD (ne.rw.survey@noaa.gov), NMFS GARFO-PRD (nmfs.gar.incidental-take@noaa.gov), and NMFS OPR (PR.ITPMonitoringReports@noaa.gov), BOEM (at renewable_reporting@BOEM.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B).

- All NARW acoustic detections within a 24-hour period will be collated into one Real-Time North Atlantic Right Whale Reporting Template spreadsheet.
- If the sighting occurs within the Southeast (North Carolina through Florida) report via the Real-Time North Atlantic Right Whale Reporting Template and to the Southeast regional Hotline 877-WHALE-HELP (877-942-5343) with the information described in Sections 3.8.1.1 and 3.8.1.2
- If unable to report a sighting through the spreadsheet within 24 hours, call the relevant regional Hotline (Greater Atlantic Region [Maine through Virginia] Hotline (866-755-6622); Southeast Hotline (877-WHALE-HELP), with the observational information described in Section 3.8.1.1 and 3.8.1.2
 - PAM detections are not reported to the Hotline.
- If unable to report via the template or the Regional NMFS Hotline, reports can be made through the WhaleAlert App (<http://www.whalealert.org/>). If this is not possible, reports can be made to the USCG through channel 16. The report to the USCG will include the same information as would be reported to the Hotline and described in Section 3.8.1.1 and 3.8.1.2. PAM detections are not reported to WhaleAlert or the U.S.C.G.
- Sunrise Wind will submit a summary report to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) and NMFS-GARFO (nmfs.gar.incidental-take@noaa.gov), and NMFS Northeast Fisheries Science Center ([NEFSC](mailto:ne.rw.survey@noaa.gov)) (ne.rw.survey@noaa.gov) within 24 hours including the data collection details described in Section 3.8.1.2.

5.4.2 Contractor Responsibilities

- The on-duty Lead PSO will be notified of any visual or acoustic NARW detection(s);
 - Lead PSO will directly contact and notify the Sunrise Wind WM (located on the same vessel as the lead PSO) of the detection. As back up, the Lead PSO will contact the Sunrise Wind WM using a vessel radio, instant messaging, and/or a cell phone.
- The sighting information will be recorded as described in Section 3.8.1.1 as well as the following information recorded in *Mysticetus*:
 - Date, time (in ISO8601 units)
 - location in decimal degrees;
 - recording platform; and,
 - all required data prompted by *Mysticetus* (as shown in Section 3.8.1.5).
- The contractor will complete monthly NARW reporting using the NMFS Excel template (<https://www.ncei.noaa.gov/products/passive-acoustic-data> and <https://www.fisheries.noaa.gov/resource/document/passive-acoustic-reporting-system-templates>)
 - Monthly detection and reporting data for NARW on the NMFS NARW PAM reporting system website will be submitted to Sunrise Wind on the 12th of each month to allow review and submittal by Sunrise Wind by the 15th of each month (as required per LOA Condition 4(c)(7)).

5.5 Injured or Dead Protected Species Reporting

5.5.1 Sunrise Wind Responsibilities

- In the event that personnel involved in the Project discover a stranded, entangled, injured, or dead protected species (including sea turtle or sturgeon), the sighting will be reported immediately to the NMFS SAS hotline (marine mammals and sea turtles only) (866-755-6622). If in the Greater Atlantic Region (Maine through Virginia), call the NMFS Greater Atlantic Stranding Hotline (866-755-6622) and if in the Southeast Stranding Region (North Carolina through Florida) call the NMFS Southeast Stranding Hotline (877-WHALE-HELP (877-942-5343)). The stranding hotline may request the report be sent to the local stranding network response team. Or an alternative electronic reporting system as approved by NMFS stranding program, as well as the USCG. Staff responding to the hotline call will provide any instructions for handling or disposing of any injured or dead animals, which may include coordination of transport to shore, particularly for injured sea turtles.
 - Separately, Sunrise Wind will report the incident to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours, and if in the Greater Atlantic Region (Maine – Virginia) to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) (by phone (marine mammals and sea turtles only) and email (marine mammals, sea turtle, and listed fish) (nmfs.gar.incidental-take@noaa.gov) as soon as feasible and if in the Southeast Region (North Carolina through Florida) call the NMFS Southeast Stranding Hotline (877-WHALE-HELP (877-942-5343)) and email the Southeast Regional Office (SERO) (secmammalreports@noaa.gov) as soon as feasible.
 - The report will include the information described in LOA Condition 4(c)(17)(iv) and Section 3.8.1.4 of this Plan.
 - BOEM (renewable_reporting@boem.gov), and BSEE (via TIMSWeb and notification email to protectedspecies@bsee.gov).
- If a protected species (including a sea turtle or sturgeon) is injured (non-auditory injury) or killed as a result of Project activities, the vessel captain or PSO on board will immediately report the incident to NMFS-OPR and GARFO, no later than within 24 hours.
 - If in the Greater Atlantic Region (Maine through Virginia), call the NMFS Greater Atlantic Stranding Hotline (866-755-6622), and if in the Southeast Region (North Carolina through Florida) call the NMFS Southeast Stranding Hotline (877-WHALE-HELP (877-942-5343)).
 - Separately, Sunrise Wind will report the incident to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours, and if in the Greater Atlantic Region (Maine – Virginia) to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) (by phone (marine mammals and sea turtles only) and email (marine mammals, sea turtle, and listed fish) (nmfs.gar.incidental-take@noaa.gov) or if in the Southeast Region (North Carolina through Florida) to the NMFS Southeast Regional Fisheries Office (SERO; secmammalreports@noaa.gov) as soon as feasible.
 - The report will include the information described in LOA Condition 4(c)(17)(v) and Section 3.8.1.4 of this plan.
 - Activity operations will cease until NMFS-OPR is able to review the circumstances of the incident and determine what, if any, additional measures are appropriate before

continuing operations. Additional measures may be imposed by NMFS – OPR to minimize the likelihood of further prohibited take.

5.5.2 Contractor responsibilities

- The on-duty Lead PSO will be notified of any injured or dead protected species;
 - Lead PSO will directly contact and notify the Sunrise Wind WM (located on the same vessel as the Lead PSO) of the detection. As back up, the Lead PSO will contact the Sunrise Wind WM using a vessel radio, instant messaging, and/or a cell phone.
- Contractor will submit a report (within a word document) with the information/details described in LOA Condition 4(c)(17)(v) and Section 3.8.1.4 of this Plan.

5.6 Shutdown Reporting

5.6.1 Sunrise Wind Responsibilities

- Within 24 hours of detection resulting in a shutdown of piling activity, Sunrise Wind will report to BOEM (renewable_reporting@boem.gov) and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023-N01 Appendix B) the sighting of any marine mammal or sea turtle in the relevant shutdown zone.
- Within 48 hours of any ESA-listed species observed within the identified shutdown zone during active pile driving, Sunrise Wind will report to NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) and BSEE (protectedspecies@bsee.gov). The report will include the following:
 - During of pile driving prior to the detection of the animal(s);
 - Location of PSOs and any factors that impaired visibility or detection ability;
 - Time of first and last detection of the animal(s);
 - Distance of animal at first detection;
 - Closest point of approach of animal to pile;
 - Behavioral observations of the animal(s);
 - Time the PSO called for shutdown;
 - Hammer log (number of strikes, hammer energy);
 - Time the pile driving began and stopped;
 - Any measures implemented (e.g., reduced hammer energy) prior to shutdown;
 - If shutdown was determined not to be feasible, the report will include an explanation for that determination and measures that were implemented.

5.6.2 Contractor Responsibilities

- Within 12 hours of a detection resulting in a shutdown the contractor will provide the raw data collected in the field and daily report forms including:
 - Date;
 - Time (in ISO8601);
 - Species (in standard species code);

- Pile identification number;
 - Latitude and longitude in decimal degrees;
 - Time and distance (m) of the animal when sighted;
 - Time when the shutdown or power-down occurred;
 - Behavior of the animal;
 - Direction of travel in degrees;
 - Time the animal left the shutdown zone;
 - Time the piling restarted or powered back up;
 - Any photographs.
- Data will be recorded using Excel/Mysticetus (as shown in Section 3.8.1.5):/.FFT & .WAV files when protected species is acoustically detected.

5.7 Shutdown Refusal Reporting

5.7.1 Sunrise Wind Responsibilities

- Sunrise Wind will report any decision not to shut down pile-driving due to pile refusal to BOEM (renewable_reporting@boem.gov) and NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov) within 24 hours of the decision.
 - Report will include an explanation of the safety risk presented by pile refusal and the animals potentially impacted.

5.7.2 Contractor Responsibilities

- Contractors will collect hammer/piling logs, summary of PSO-engineer conversations, engineering report (if applicable), and a debrief of events; and,
- All data will be collected in Word and copies of piling logs as needed.

5.8 Detected or Impacted Dead Non-ESA Listed Fish

5.8.1 Sunrise Wind Responsibilities

- An occurrence of at least 10 dead non-ESA-listed fish within any visual clearance or shutdown zone will be reported to BOEM (renewable_reporting@boem.gov) and BSEE (via TIMSWeb and notification to protectedspecies@bsee.gov) as soon as practicable (taking into account crew and vessel safety), but no later than 24 hours after the sighting. BOEM and BSEE will notify NMFS GARFO – PRD via NMFS.GAR.HESDoffshorewind@noaa.gov. Sunrise Wind will confirm the relevant POC prior to reporting and confirm the reporting was received.

5.8.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind, a non-ESA listed fish impact report, within 12 hours of the occurrence. The report will identify the occurrence of 10 or more dead non-ESA listed fish species within any shutdown zone or anywhere within the areas being monitored by PSOs. All data will be recorded using *Mysticetus* (as shown in 3.8.1.5).
- The report will include:
 - Time of occurrence (in ISO8601 units);

- Details surrounding the occurrence;
- Phase of pile driving and monitoring;
- Species or guild to the best estimate;
- Condition and number of fish observed.

5.9 Take Threshold Reporting

5.9.1 Sunrise Wind Responsibilities

- If the Project estimates that it has reached 80% of the allowable number of takes under the LOA for a given species across all activities, Sunrise Wind will alert NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B), and BOEM (renewable_reporting@boem.gov).

5.10 Bubble Curtain Reporting

As per LOA Condition 3(c)(6)(iv) and BiOp T&C 2(d), Sunrise Wind will submit a NAS inspection/performance report as described below.

5.10.1 Sunrise Wind Responsibilities

- Construction contractors will submit a NAS inspection/performance report for approval by Sunrise Wind, which Sunrise Wind will then report to NMFF-OPR (PR.ITP.MonitoringReports@noaa.gov) and NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B) within 48 hours following the performance test, which will occur to the first pile installation as well as any additional piles for which SFV is conducted as described within the SFV Plan. As per LOA Condition 3(c)(6)(iv), this report will be submitted as soon as it is available, but no later than when the interim SFV report is submitted for the respective pile. This report will also be submitted with the SFV report as described in the *WTG SFV Plan*. Performance reports for all subsequent piles will be submitted with the weekly pile driving reports as described in Section 5.11.
 - Any modifications to attenuation device to meet the performance standards will occur before impact pile driving occurs and maintenance or modifications completed will be included in the report.

5.10.2 Contractor Responsibilities

- The contractor will provide the results of a performance test within 48 hours following the test. All data will be recorded using Word and any additional necessary data files;
 - Any modifications to the attenuation device to meet the performance standards will occur before impact pile driving occurs and maintenance or modifications completed will be included in the report.
- NAS contractor will be required to provide this report.

5.11 Weekly Reports

5.11.1 Sunrise Wind Responsibilities

- Sunrise Wind will compile and provide weekly PSO and PAM reports during WTG MP and OCS-DC piled jacket foundation installation to NMFS-OPR (PR.ITP.monitoringreports@noaa.gov) and NMFS-GARFO – PRD (nmfs.gar.incidental-take@noaa.gov) as described in LOA Condition 4(c)(6) and BiOp T&C 7 (e). Weekly reports will also be provided to BOEM (renewable_reporting@boem.gov) and (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B).
- Weekly reports will be due on Wednesday for activities occurring the previous week (Sunday – Saturday, local time)
- Once all foundation installation is completed, weekly reporting is no longer required.

5.11.2 Contractor Responsibilities

- Contractors will compile and submit weekly PSO and PAM reports to Sunrise Wind documenting the information described in LOA Condition 4(c)(6) and BiOp T&C 7(e);
- Weekly reports are due on Wednesday for the previous week (Sunday – Saturday);
- Weekly reports will include:
 - SFV results
 - Pile ID;
 - Type of pile;
 - Pile diameter;
 - Start and finish time of each pile driving event;
 - Hammer log (number of strikes, max hammer energy, duration of piling);
 - Any changes to NAS and/or hammer schedule;
 - The start and stop of associated observation periods by PSOs;
 - Details on the deployment of PSOs;
 - Vessel operations (including vessel name, port departures, number of vessels, type of vessel(s), and route
 - Record of all detections of marine mammals (acoustic and visual) as described in 3.8.1.1;
 - Sightings during pile driving activities (clearance, active pile driving, post-pile driving);
 - Any mitigation actions (or if mitigation actions could not be taken, why that was the case);
 - Details on the NAS(s) used and their performance;
 - Any mitigation actions (or if mitigation actions could not be taken, why) including equipment shutdowns, delays, etc.;
 - Takes that may have occurred; and,
 - Identify which turbines become operational and when (a map will be provided).
- All reports will be compiled using *Mysticetus* (as shown in Section 3.8.1.5).

5.12 Monthly Reports

5.12.1 Sunrise Wind Responsibilities

- Sunrise Wind will compile and submit monthly reports to NMFS-OPR during WTG MP and OCS-DC piled jacket foundation installation on the 15th of the month for the previous month via PR.ITP.monitoringreports@noaa.gov. Monthly reports will also be provided to BOEM (renewable_reporting@boem.gov), BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 -N01 Appendix B), and NMFS GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)
 - Reports will be compiled using contract or weekly data to develop monthly reports for the agencies.
- The monthly report will include information described in described in LOA Condition 4(c)(7) and BiOp T&C 7 (f).
- Sunrise Wind will also contribute all recorded sea turtle sightings, as reported, to an agency-approved centralized database in coordination with the monthly reports.

5.12.2 Contractor Responsibilities

- PSOs will collect data in accordance with standard reporting in standard forms, software tools, or electronic data forms authorized by BOEM for pile driving activity
- As described in LOA Condition 4(c)(7) and BiOp T&C 7 (f), monthly reports will include:
 - Project activities carried out in the previous month including dates and location of any fisheries surveys carried out;
 - Vessel transits (name, number of transits, type of vessel, vessel activity, Mobile Service Identity (MMSI) number, and route (this includes transits from all ports, foreign and domestic));
 - Number of piles installed and pile IDs;
 - All detections of marine mammals, sea turtles, and sturgeon as described in 3.8.1.1;
 - Species ID;
 - Time;
 - Date;
 - Initial detection distance
 - Vessel/platform name
 - Vessel activity
 - Vessel speed
 - Bearing to animal
 - Project Activity
 - Any mitigative action taken or if mitigation actions could not be taken including the reasons why; and,
 - Identify which turbines become operational and when (a map will be provided).

- PSOs will collect data in accordance with standard reporting in standard forms, software tools, or electronic data forms authorized by BOEM for pile driving activity;
- PSOs will fill out report forms for each vessel with PSOs aboard. Unfilled cells will not be left empty and must contain “NA”. The reports will be compiled using *Mysticetus* (as shown in 3.8.1.5), Excel, and Word.
- A new entry will be created on the Effort form each time a pile segment changes, or weather conditions change, and at least once an hour as a minimum. Contractors will review and revise all forms for completeness and resolve incomplete data fields before submittal.
 - The file name will follow this format: Lease#_ ProjectName_ PSOData_ YearMonthDay to YearMonthDay.xls.
 - Data fields will be reported in Excel format.
 - Data categories will include Project, Operations, Monitoring Effort, and Detection.
 - PSO data will be generated through software applications or otherwise recorded electronically by PSOs.
- Applications developed to record PSO data are encouraged, as long as the data fields listed below can be recorded and exported into Excel.

5.13 Draft Annual Marine Mammal Monitoring Report

5.13.1 Sunrise Wind Responsibilities

- Sunrise Wind will submit a draft annual marine mammal monitoring report on all visual and acoustic monitoring conducted under the LOA and COP Approval no later than March 31, annually. Sunrise Wind will submit a draft annual SFV report to NMFS no later than 90 days after SFV is completed for the year as per LOA Condition 4(c)(8) and BiOp T&C 7 (g).
- The final annual report will be submitted within 30 calendar days following receipt of any comments received from NMFS on the draft report as per LOA Condition 4(c)(8).
- All draft and final monitoring reports will be submitted to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 - N01 Appendix B) and NMFS-GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)

5.13.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind a final report (Word format) containing all information in the Orsted Reporting Template within 30 days of completion of all PSO activities (described in LOA Condition 4(c)(8) and BiOp T&C 7 (g)).
- The draft and final report will include:
 - The total number of marine mammals of each species/stock detected and how many were within the designated potential injury and behavioral harassment zone(s) with comparison to authorized take of marine mammals for the associated activity;
 - The number of sea turtles exposed above the 175 dB harassment threshold and the number of marine mammals exposed above the Level A and Level B harassment thresholds will be determined based on the number actually observed within the relevant distances during pile driving. For comparison, alternative

estimates of the number of individuals potentially exposed may be made based on sightings recorded during periods without pile driving and/or by using availability bias corrections available in the literature.

- Marine mammal detections and behavioral observations before, during, and after each activity;
- What mitigation measures were implemented (i.e., number of shutdowns or clearance zone delays etc.) or, if no mitigative actions were taken, why not;
- Operational details (i.e., days and duration of impact pile driving, days and amount of HRG survey effort);
- HRG survey tracklines;
- Any PAM systems used;
- Results, effectiveness, and which NAS(s) were used during relevant activities;
- Summarized information related to situational reporting;
- Any other important information relevant to the Project;
- All raw data will be transferred in data packages following the Orsted data submittal folder structure
 - Raw data will be submitted as appropriate to the NCEL.

5.14 Draft Final 5-Year Report

5.14.1 Sunrise Wind Responsibilities

- Sunrise Wind will submit a draft final 5-year report on all visual and acoustic monitoring, including SFV, conducted within 90 days after completion of the specified activities as per LOA Condition 4(c)(9).
- Sunrise Wind will provide a final report within 30 days following receipt of any NMFS' comments on the draft report. If no comments are received from NMFS within 30 days of NMFS' receipt of the draft report, the report will be considered final.
- All draft and final 5-year reports will be submitted to NMFS-OPR (PR.ITP.MonitoringReports@noaa.gov), BOEM (renewable_reporting@boem.gov), and BSEE (Submittal requirements to BSEE will follow reporting requirements under JOINT NTL 2023 - N01 Appendix B) and NMFS-GARFO – PRD (nmfs.gar.incidental-take@noaa.gov)

5.14.2 Contractor Responsibilities

- The contractor will provide Sunrise Wind a final report (Word format) containing all information in the Orsted Reporting Template within 30 days of completion of all PSO activities (described in LOA Condition 4(c)(9) and BiOp T&C 7 (g)).
- The draft and final 5-year report will include:
 - The total number (annually and across all five years) of marine mammals of each species/stock detected and how many were within the designated potential injury and behavioral harassment zone(s) with comparison to authorized take of marine mammals for the associated activity;

- The number of sea turtles exposed above the 175 dB harassment threshold and the number of marine mammals exposed above the Level A and Level B harassment thresholds will be determined based on the number actually observed within the relevant distances during pile driving. For comparison, alternative estimates of the number of individuals potentially exposed may be made based on sightings recorded during periods without pile driving and/or by using availability bias corrections available in the literature.
- Summary table indicating the amount of each activity (e.g., pile installation, HRG) completed in each of the five years and total;
- GIS shapefiles(s) of the final location of all piles, cable routes, and other permanent structures including an indication of what year installed and began operation;
- GIS shapefile of all North Atlantic right whale sightings, including dates and group sizes; 5-year summary and evaluation of marine mammal detections and behavioral observations;
- 5-year summary and evaluation of mitigation and monitoring implementation and effectiveness;
- HRG survey tracklines;
- Five year summary and evaluation of all PAM and SFV data collected;
- List of recommendations to inform environmental compliance assessments for future offshore wind actions.

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Appendix A – Far Field Noise Mitigation

Document Title: Far Field Noise Mitigation Manual	
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Ørsted Document Number:	08168954
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Far Field Noise Mitigation Manual

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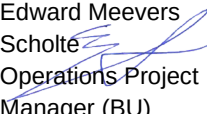
PROJECT NAME: Sunrise Wind 01 – Offshore Wind Farm (SRW01)

PROJECT NUMBER: P0050247

CLIENT NAME: Sunrise Wind LLC

CLIENT REFERENCE: 08168954



Rev.	Stat.	Revision date	Prepared by	Reviewed by	Interdisciplinary Check	Approved by
Rev. 02	IFC	17-Jan-2025	Ismail Nor Akmal Project Engineer 	Diogo Mereiles Lead Project Engineer 	Edward Meevers Scholte Operations Project Manager (BU) 	Iman den Haan Project Manager

DOCUMENT CONTROL

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Project Number:	P0050247
Client Name:	Sunrise Wind LLC
Client Reference:	08168954
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Change log		
Revision	Section	Change
Rev. 00	All	Issued for Construction Written based on 0040135-BOS-OPS-MA-0104-01 Far Field Noise Mitigation Manual – REV01 with updates: All reference to REV01 replaced by SRW01
Rev. 01	All	Document updated to align with 0040135-BOS-OPS-MA-0104-01 (07822480) Far Field Noise Mitigation Manual - Revolution, revision D (approved) Chapter on environmental limit included.
Rev. 02	All	Updated to include references and information on REV01 Incorporated SRW01 permits, inserted DBBC Quality Check Interim Report template and DBBC Operation Report template in Attachments Included additional DBBC performance measures as employed on REV01 as requested in ORSTD-CMN-003715 Updated inner and outer DBBC ring radius to 55m and 110m

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1. INTRODUCTION

The scope executed under this manual is also applicable for Revolution Wind (REV01) 2025 campaign.

1.1. Project Description

Sunrise Wind LLC, hereafter referenced as Employer, is developing the US wind farm project Sunrise Wind (SRW01). Together with South Fork Wind (SFW01) and Revolution Wind (REV01) these projects are referred to as the Northeast Program (NEP). The project executed under this scope is Sunrise Wind (SRW01).

The SRW01 wind farm will cover an area of approximately 445 km².



Figure 1-1 Location of the Project

1.2. Contractor's scope of work

The Contractor's scope of work for Sunrise Wind is scheduled to be executed in 2025 and 2026 and consists of the transport and installation (T&I) of the Installation Items, each including monopile, anode cage, external platform and internal platform.

The Installation Items components will be designed and supplied by the Employer.

1.3. Scope of Document

The purpose of this document is to provide the instructions for the NHDV (Nozzle Hose Deployment Vessel) crew for the work to be performed during the Deployment, Operation & Retrieval of the DBBC. This manual describes the marine operations in the field and the step-by-step procedure including contingency procedures. All activities are performed by the NHDV.

The scope of this document comprises the following descriptions, including but not limited to:

- General operations in the field;
- Deployment of DBBC (Double Big Bubble Curtain);
- Operation of DBBC;
- Retrieval of DBBC;
- Contingency procedures.

The operation starts with the NHDV in the field and ready to enter the field to deploy the DBBC on the installation location, and, ends with the retrieval of the DBBC after the HLV has completed the MP installation operations and is re-located to the next installation location.

This manual in relation to the other manuals within the Boskalis Scope of Work is illustrated in Figure 1-2.

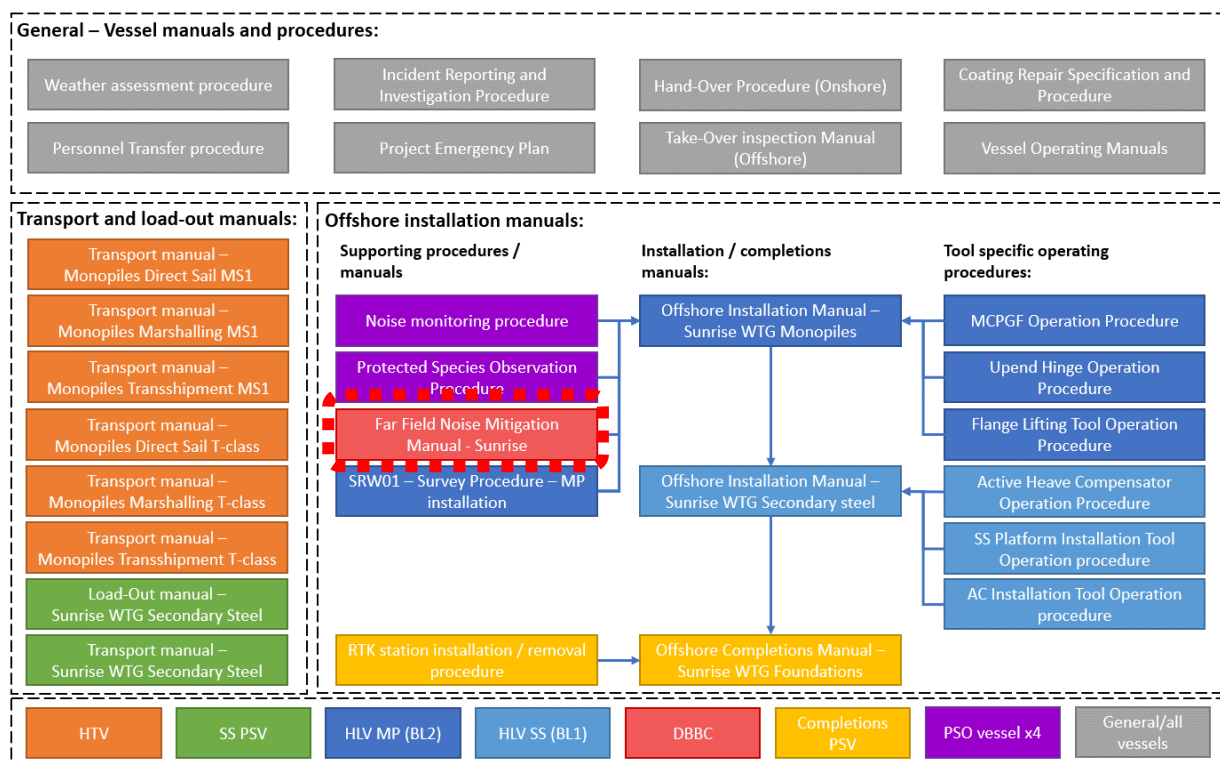
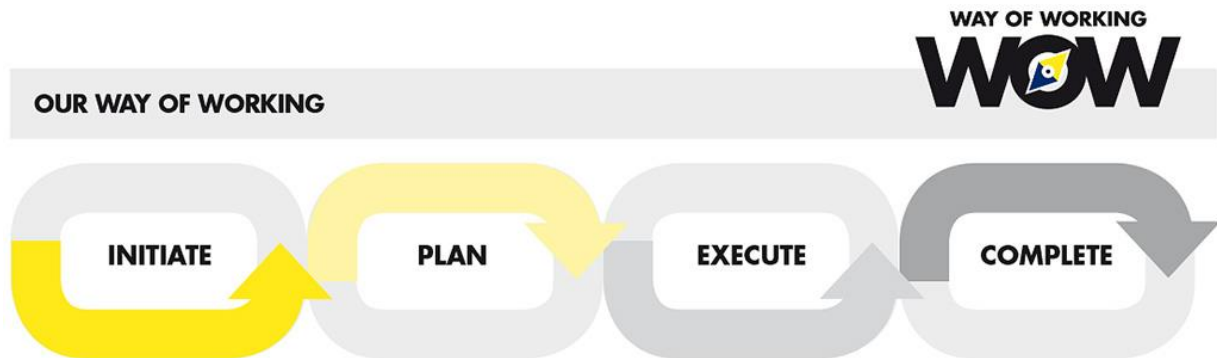


Figure 1-2 Manual Overview SRW

This document forms part of the Boskalis Way of Working, the integrated quality management system applicable to all operations in Boskalis. The Boskalis Way of Working is structured around four Phases as pictured below. This Far Field Noise Mitigation Manual is typically prepared in the **Plan** Phase, where

the main implementation is taking place in the [Execute](#) Phase.



2. REFERENCES, ABBREVIATIONS, DEFINITIONS

2.1. References

Client Documents

No.	Document No.	Document Title
[1]	07774033 Rev. B	H.13.COM Permitting Conditions (SRW01)
[2]	06914236	H.13.COM - Permitting Conditions (REV01)
[3]	SRW01_365	Sunrise Wind layout 191
[4]	07270120 Rev. B	Geotechnical Interpretative Report for Wind Turbine Generator Foundations
[5]	08129864	SRW01 WTG Foundation Primary Structure Fabrication incl. Welded Attachments
[6]	AAC471_JM5621_WTG_C68_V2.0	Munitions and Explosives of Concern ALARP Certification – WTG Location C68
[7]	AAC409_JM5621_WTG_**No._V2.0	Munitions and Explosives of Concern ALARP Certification – WTG Locations **No. ¹

Standards

No.	Document No.	Document Title
[8]	DNV-ST-N001	Marine Operations and Marine Warranty

Boskalis Documents

No.	Boskalis Document No.	Ørsted Document No.	Document Title
[9]	0050247-BOS-OPS-DG-0004-00	08168909	Binder - Bubble Curtain Layouts
[10]	0050247-BOS-OPS-MA-0001-01	08168948	Offshore Installation Manual - Sunrise WTG Monopiles
[11]	0050247-BOS-ENG-RP-0046-01	08272884	DP Capability Analysis - DBBC Vessel
[12]	0050247-BOS-OPS-DG-0003-00	08168908	Binder - Deck layout of DBBC Vessel
[13]	0050247-BOS-PMT-PL-0001-01	08168967	Project Management Plan (PMP)
[14]	0050247-BOS-OPS-PR-0009-01	08168996	Personnel Transfer Procedure
[15]	0050247-BOS-RIS-PL-0001-01	08168981	Project Risk Management Plan

¹ **No. is referring to the ID of the monopile location (i.e. C03, C04, ... D25 etc.)

Boskalis Documents			
No.	Boskalis Document No.	Ørsted Document No.	Document Title
[16]	0040135-BOS-ENG-MS-0007-01	07701694	Method Statement – Scour Protection Installation
[17]	0040135-BOS-ENG-MS-0016-01	07755024	Scope of Works – Scour Protection Installation
[18]	0050247-BOS-PMT-PL-0002-01	08168968	Logistic Plan
[19]	0040135-BOS-OPS-PR-0068-01	08416223	Vessel Importation + Clearance Procedure – US
[20]	BOHL-BL2-OPS 0001		BOKALIFT 2 – Operations Manual
[21]	0050247-BOS-OPS-MA-0021-01		Mobilization and Demobilization Manual – BBC Vessel
[22]	0050247-BOS-ENG-RP-0027-01	08169050	Operational Design Limit
[23]	0050247-BOS-SHE-PL-0003-01	08168984	Project Emergency Response Plan
[24]	0040135-BOS-DES-DG-1131-01		Field Layout REV01
[25]	0040135-BOS-DES-DG-1111-00	08291759	Binder – Bubble Curtain Layout – REV01
[26]	0040135-BOS-OPS-MA-0093-01	07883874	Offshore Installation Manual – Revolution Monopiles

2.2. Abbreviations

Abbreviation	Full meaning
AHT	Anchor Handling Tug
DBBC	Double Big Bubble Curtain
DP	Dynamic Positioning
HLV	Heavy Lift Vessel
FAD	Free Air Delivery
FOU	Foundation
MEC	Munitions and Explosives of Concern
MP	Monopile
MHC	Marine and Helicopter Coordinator
MWS	Marine Warranty Surveyor
NHDV	Nozzle Hose Deployment Vessel

Abbreviation	Full meaning
PtW	Permit to Work
SS	Secondary Steel
T _C	Operational Contingency Period
T _{POP}	Planned Operational Duration
T _R	Operational Reference Period
UXO	Unexploded Ordnance
VMT	Vessel Management Team
WAD	Work Authorization Document
WTG	Wind Turbine Generator
WoW	Way of Working

2.3. Definitions

Definition	Full meaning
Employer	Sunrise Wind LLC
Contractor	Boskalis Offshore Contracting LLC
Employer's Design	Drawings of foundation installation items including scour protection.
Limiting Operational Conditions / Workability Limits	Set of climatic conditions (wind speed, wave height, swell wave height, current speed, temperature etc.) defined for each phase of execution of the works. All works shall be effectively and safely operable in all weather conditions up to and including the limiting operational conditions
Marine Installation	MP and SS installation with the HLV. Station keeping and mooring engineering are included.
Contrator's Equipment	All apparatus, machinery, vehicles, vessels and other things required for the execution and completion of the Works and the remedying of any Defects.
Lifting	Includes all lifting and rigging engineering
Mobilization Port	Port where the contractor mobilizes the NHDV in preparation of the works.
Offshore Site	Offshore place where the works are to be executed and the installation items incl. scour protection are to be installed
Operational Design Limits	The weather limits of any piece of Contractors Equipment with its corresponding weather windows.
Supply Port	Port at which the contractor takes delivery of the Installation Items from either the Employer or another contractor of the Employer. From the supply port the installation items are transported to either a feeder port or directly to the Offshore Site

3. GENERAL INFORMATION

3.1. High level Scope of Work DBBC operations

The scope of work covered in this manual:

- General operations in the field;
- NHDV outfitting & preparation;
- Set-up vessel in field;
- NHDV operations in the field
- Contingency scenarios.

3.2. DBBC layout

The DBBC consists of two nozzle hoses with lengths of:

- Inner DBBC ring: 346 [m] (Radius 55 [m] from centre of MP)
- Outer DBBC ring: 691 [m] (Radius 110 [m] from centre of MP).
- Total perforated hose length 1037 [m]

The inner and outer BBCs are deployed as a set on every installation location by the NHDV and will be supplied with compressed air to maintain a 2 x layer bubble curtain around the MP. Details on the dimensions and layout on each location can be found in the DBBC layout drawings [9]. The DBBC layout drawings for REV01 is referenced to [25].

The bubble curtains must distribute air bubbles using an air flow rate of at least $0.5 \text{ [m}^3/(\text{min} \times \text{m})]$ at the compressor outlet as per Permitting Conditions [1] [2]. Considering the total perforated hose length, the minimum flow rate to satisfy the Permitting Conditions equals to $519 \text{ [m}^3/\text{min}]$.

The updated flow requirements stipulated by Orsted during REV01 2024 campaign is taken into consideration for 2025 campaign. For water depth larger than 40 [m], the flow rate to be increased to $570 \text{ [m}^3/\text{min}]$. Important to note that based on discussion with Orsted, only the increased flow rate requirement will be considered when applicable.

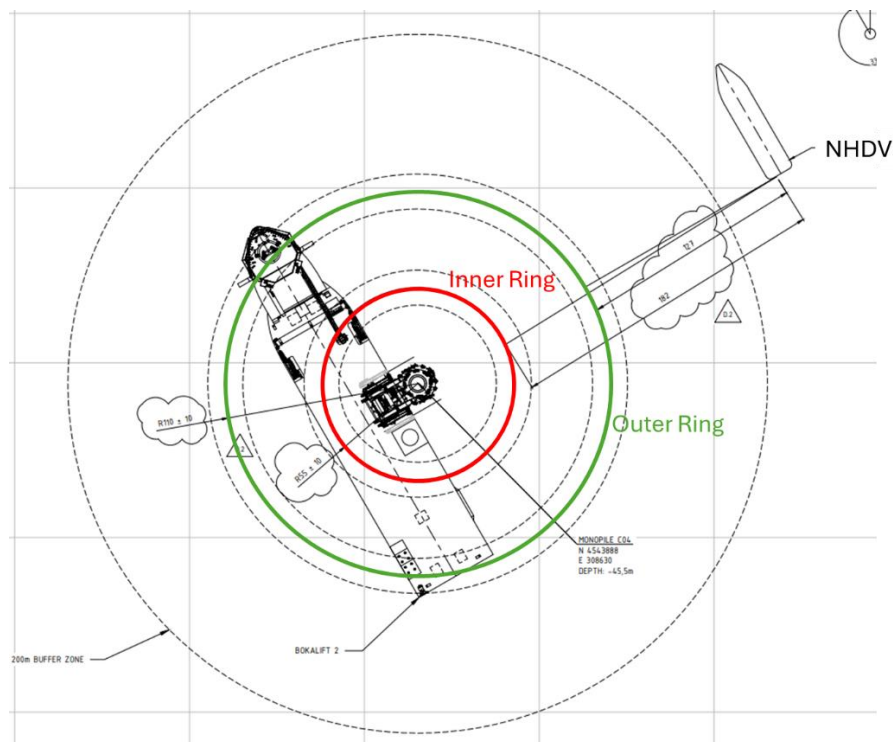


Figure 3-1 Example of Typical DBBC Layout (NHDV Heading Indicative Only)

3.3. Sunrise Wind Field components and Key Locations

3.3.1. Existing Field Components

An overview of the Sunrise Wind field layout [3] and bathymetry overview [4] are shown in Figure 3-2 and Figure 3-3. There is a confirmed MEC (or UXO) at location C68 [6] within the 200m radius installation area, as shown in Figure 3-4. In addition, potential MEC (or UXO) per MP location can be found in [7] which is also presented in the BBC layout drawing [9]. In case of uninspected potential UXOs in vicinity, it is allowed to place bubble curtain in an ellipse configuration to stay clear from the object.

An overview of the Revolution Wind field layout [24] is shown in Figure 3-5.

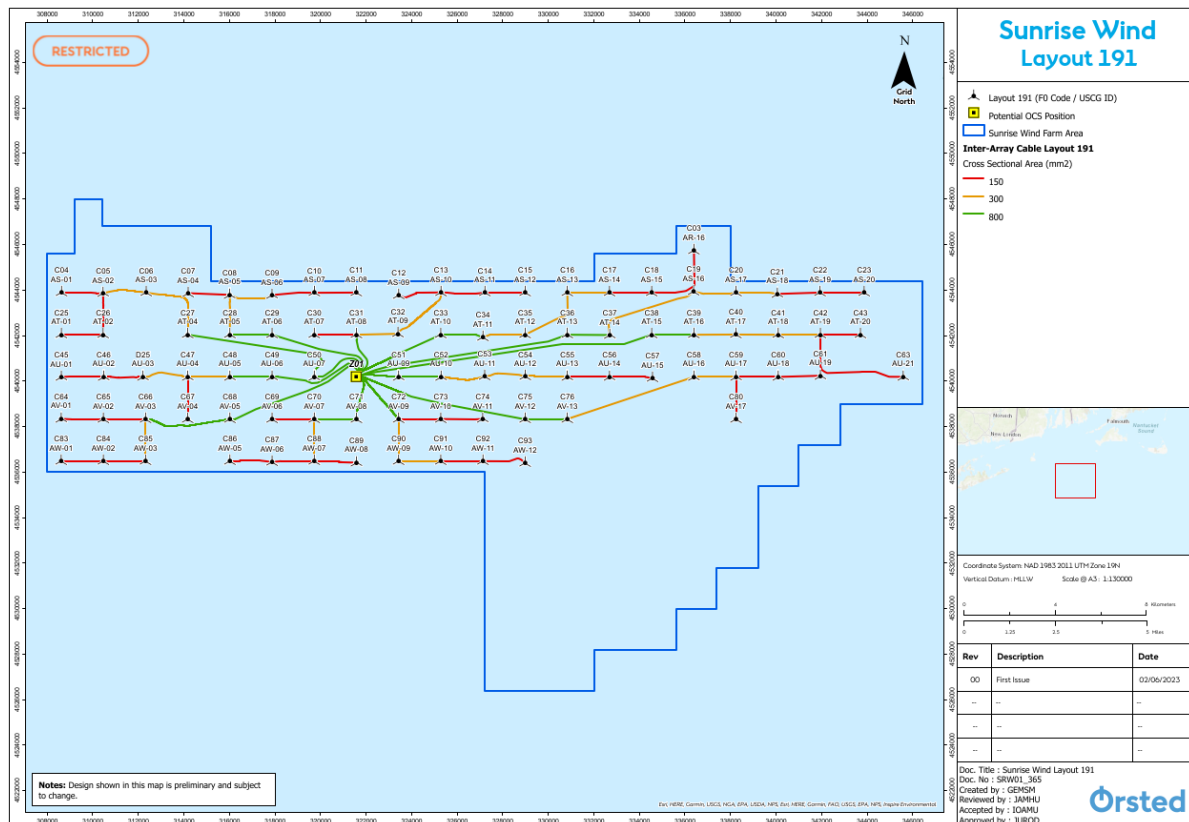


Figure 3-2 Field Layout SRW01

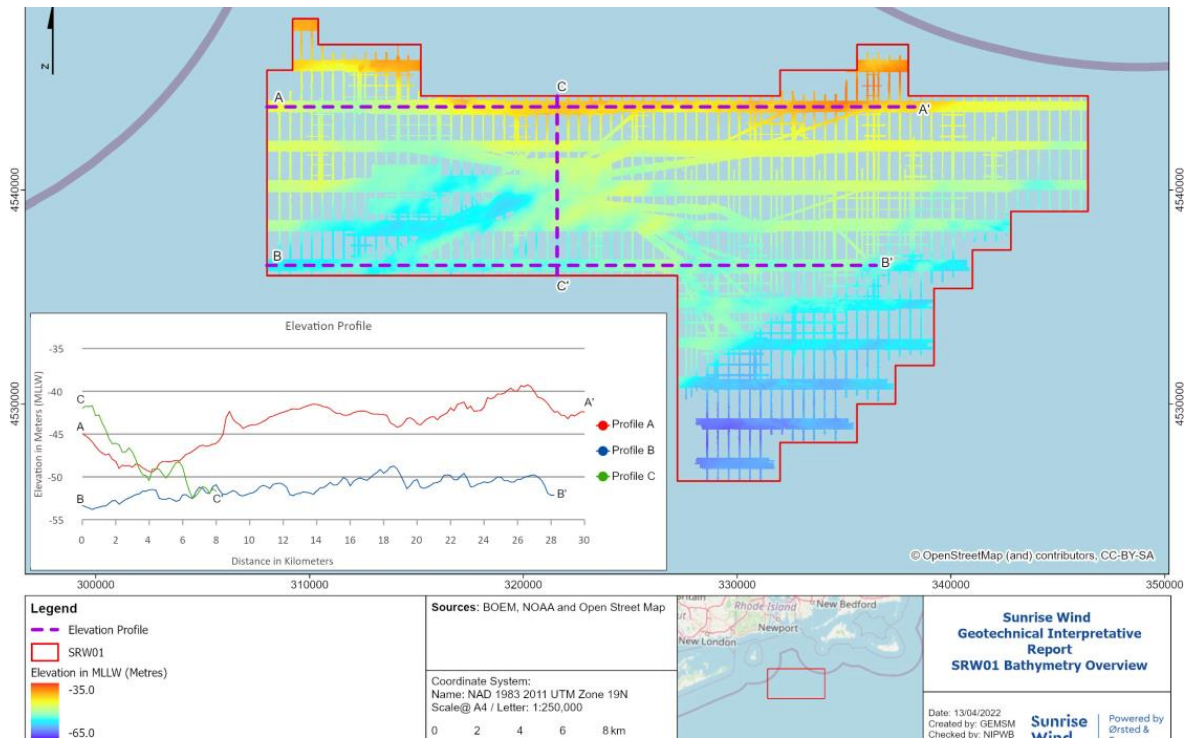


Figure 3-3 Bathymetry Overview of SRW01

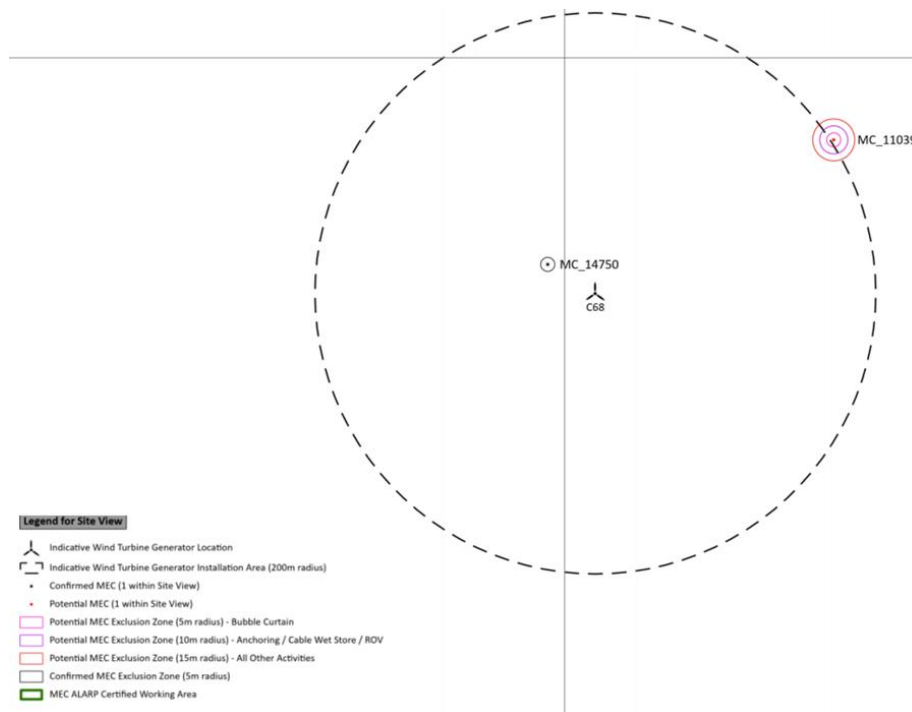


Figure 3-4 Confirmed MEC (or UXO), MC_14750 at Location C68

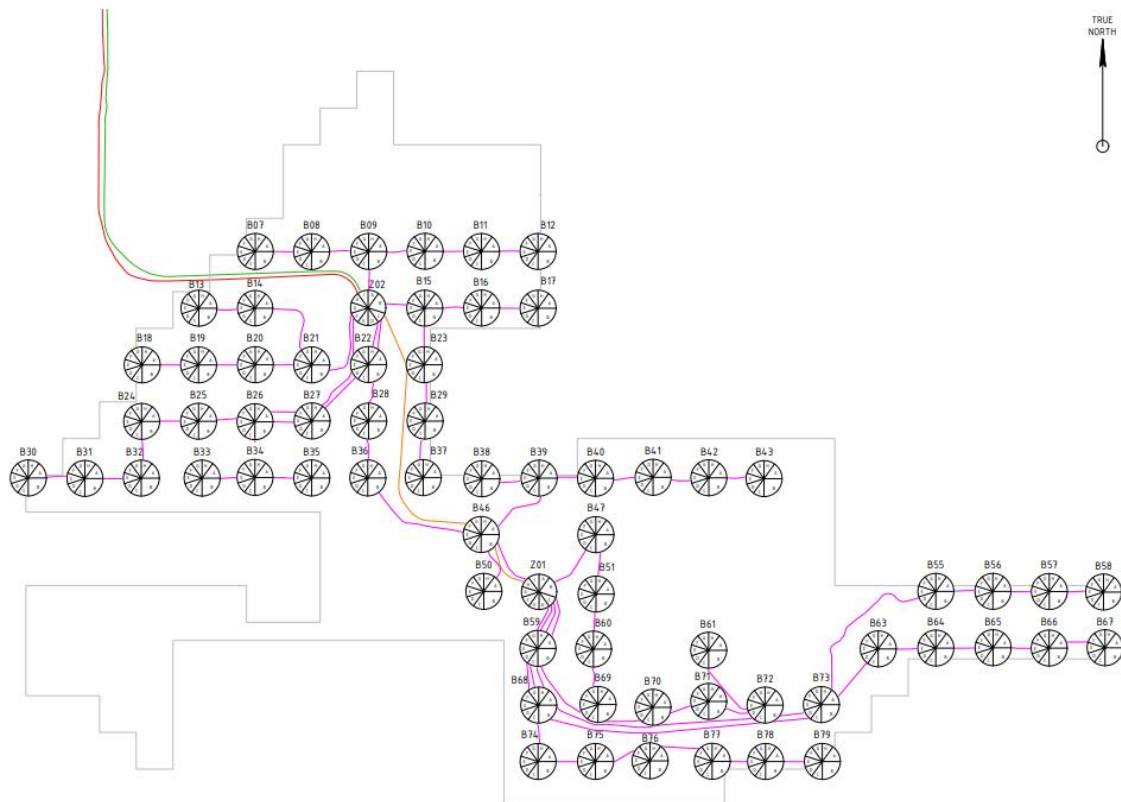


Figure 3-5 Field Layout REV01

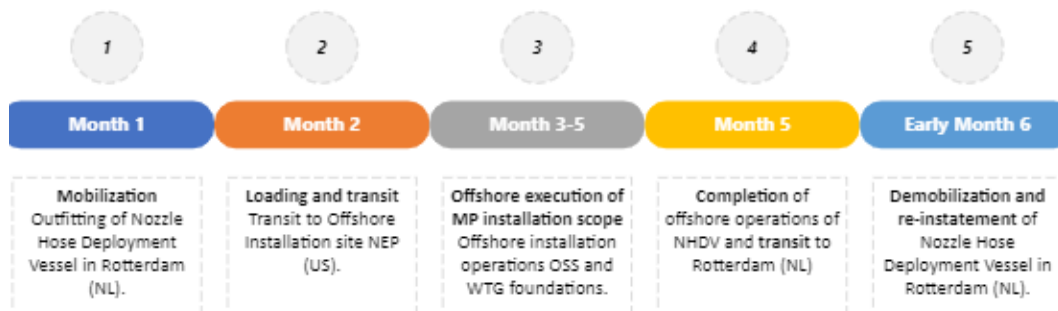
In principle, the scour protection will be installed ahead of the MP installation sequence [16]. The maximum outer radius of the scour protection on seabed relative to MP centre is 16.8m [17], while the minimum radius of the Inner DBBC ring is 45[m] (inner R = 55[m] – 10[m] tolerance). Therefore, there are no clashes expected during hose deployment at MP locations.

3.4. WTG Foundation

The WTG foundation consists of a monopile and secondary steel (anode cage, external platform, and internal platform). In Figure 3-6 [5], the foundation is shown without the inclusion of secondary steel, providing a preview of its appearance during the DBBC operation. For installation details, such as coordinates, reference is made to [10]. General detail on the SRW01 WTG MP can be found in below Table 3-1. The installation and MP details for REV01 can be found in [26].

3.5. Offshore Execution Schedule

Below figure shows an indication of the timeline. Note that subsequent conditions such as weather can increase the duration of the offshore operations.



3.6. Coordinate System

The following coordinate system is applicable:

- The X-axis is defined as positive from the stern to the bow of the vessel;
- The Y-axis is defined as positive from the Center Line to Port Side;
- The Z-axis is defined as positive from the Base Line upwards.

The environmental angles of attack with respect to the vessel are shown in Figure 3-7.

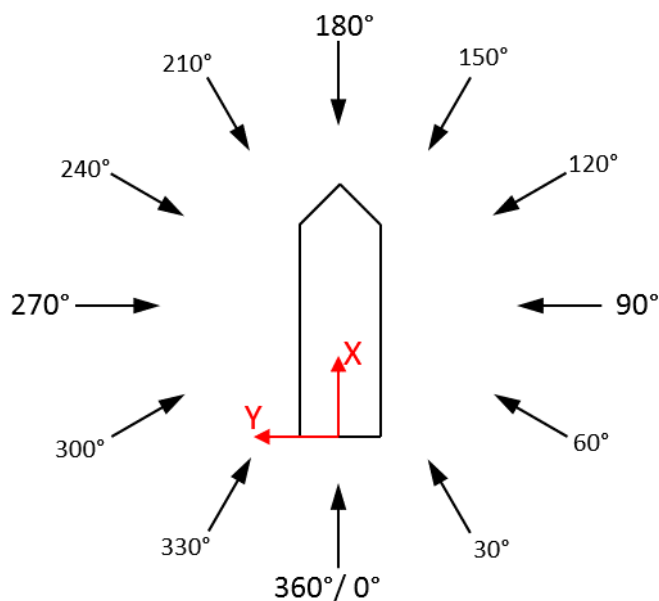


Figure 3-7 Environmental Forces Direction Convention

3.7. Weather Reporting and Monitoring

During the offshore operations, the following will be available for the weather assessment:

- Two (2) independent (bespoke) weather reports (StormGeo; Employer provided, Infoplaza; Contractor provided);
- Wave data from weather buoy (supplied by Employer);
- Vessel wind sensor;
- Guidance from onshore meteorologist consultant.

This information will be available to the Offshore Construction Managers (OCM's), Field Engineers (FE's), and Vessel Masters.

3.8. Daily Progress Reporting

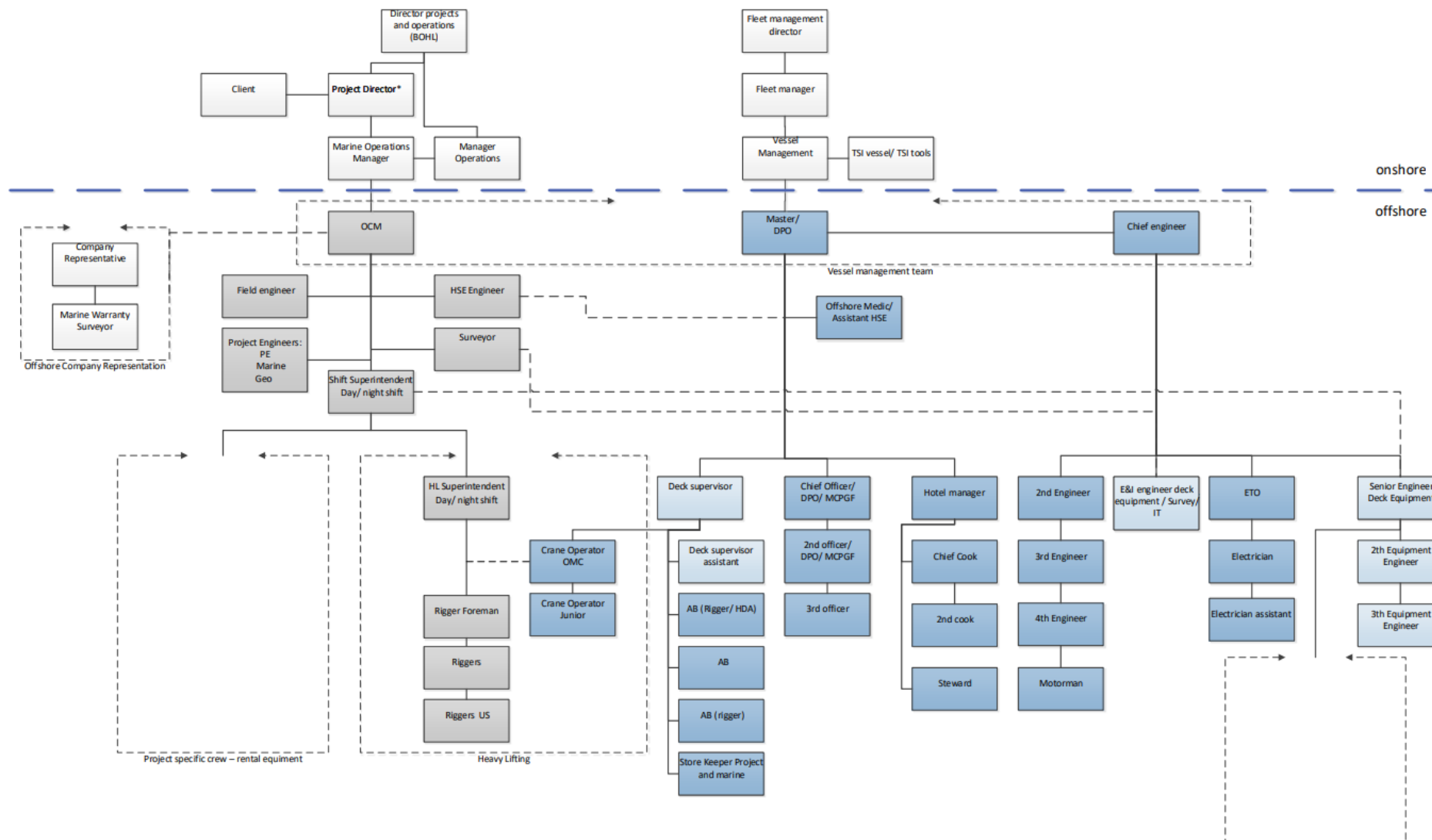
Reporting is required on a daily basis for the period midnight to midnight (at worksite's local time). A web based DPR filling and approval system will be used, which will contain the following information as a minimum:

- Date of report and report number;
- Current vessel operation and position;
- Current and forecasted weather;
- Personnel movements (quantity);
- Active marine spreads;
- Consumables;
- Mechanical breakdowns;
- HSE statistics;
- Breakdown of activities past 24 hours;
- Waiting on weather (time);
- As installed data of DBBC;
- Planned activities for next 24 hours.

Output of the DPR system is a signed .pdf file that will be distributed on a daily basis.

3.9. Organization and Communication

All communication shall follow the guidelines as identified in the Vessel's Operations Manual, as referenced in [20]. The organizational chart during offshore construction can be seen in Figure 3-8 (HLV) and Figure 3-9 (NHDV).



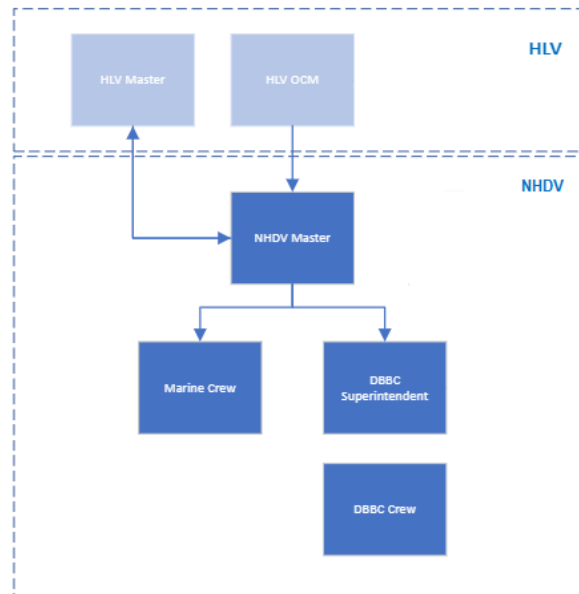


Figure 3-9 Organization Chart Onboard of the Nozzle Hose Deployment Vessel (NHDV)

For the communication between the NHDV Bridge and NHDV DBBC Superintendent on deck, UHF/VHF radios will be used. A dedicated UHF/VHF channel including backup channel has to be agreed prior any operation.

3.10. Project Management Plan

All activities shall adhere to the processes, procedures and Boskalis' Way of Working (WoW) as stipulated in the Project Management Plan [13].

4. OPERATIONS IN THE FIELD

4.1. General

Operations and SIMOPS in the field are controlled by the Employer through the Marine & Helicopter Coordination Centre (MHCC). Contractor will request authorization to work in the field on a daily basis.

Supporting processes for the field operations are listed here:

- Equipment and Material Logistics Procedure – US [18];
- Vessel Importation + Clearance Procedure – US [19];

4.2. Roles and Responsibilities

4.2.1. Marine Operations Manager

The Marine Operations Manager is overall responsible for the marine spread. In close consultation with the OCM's and Vessel Masters he directs field operations including (but not limited to) material logistics, crew movements, port calls, bunkering, provisions, mobilization, demobilization, vessel clearance, permits etc. This role is based onshore.

4.2.2. Offshore Construction Manager BL2 & BL1

In addition to the job description in BL2 Operations [20], the Offshore Construction Manager (OCM) BL2 is responsible for the efficient daily operations of the BL2 and the following vessels, when positioned inside the Sunrise Offshore Wind Farm.

- HMT vessels / MP transport vessels;
- NHDV vessel;
- PAM vessel;
- SFV vessel;
- PSO vessel;
- Bokalift 1, see below.

OCM BL1 is responsible for the efficient daily operations of the BL1 and the following vessels, when positioned inside the Sunrise Offshore Wind Farm.

- SS Transport PSV1, and SS Transport PSV2.

OCMs will work closely with the BL1 and BL2 Masters and the bridge teams to guide the supporting fleet accordingly. This role is based offshore.

4.2.3. Roles and Responsibilities onboard NHDV

On the NHDV, the Master is in charge of the vessel and marine crew, and the DBBC Superintendent onboard is steering project crew on deck and is in close contact with OCM BL2 on sequencing and moving in. During hose deployment, the NHDV Master is in close (radio) contact with DBBC Operator for accurate hose positioning.

Position onboard	Responsibilities
NHDV Master	Responsible for overall NHDV operations: • Overriding authority regarding vessel safety • Responsible for the overall safety onboard • Maneuver the vessel according to the planned deployment track • Communicate with the Marine Helicopter Coordination Centre (MHCC) • Communicate with project crew on deck • Communicate with HLV Master & OCM BL2
DBBC Superintendent	Responsible for: • Communication between all parties onboard and external • Maintenance/operation of the full DBBC spread • Prepare documentation for DBBC operation • Hold daily meeting • Coordination of all offshore DBBC operations on deck of NHDV • Responsible for supervision on deck during any kind of operation • Communicate with NHDV Master and DBBC Operators to coordinate vessel movements during deployment and recovering of equipment • Inform about remaining hose length and remaining track length • Responsible for safe execution of works on deck • Responsible for maintenance of DBBC equipment
DBBC Technician/Operator	Responsible for operation of nozzle hose deployment winches spread • Operate the winch • Control speed of hose deployment/retrieval • Conduct checks on DBBC system • Connect and disconnect buoys and supply hose • Test systems as necessary

Position onboard	Responsibilities
Air Compressor Technician/Operator	Responsible for operations, maintenance and performance of the entire compressor spread • Operate compressors • Refueling of compressors • Maintain operational condition of compressors • Liaise with DBBC Superintendent • Operate air supply manifold • Record performance of compressor spread and report to NHDV Superintendent
Able-bodied Seamen (Vessel Marine Crew)	Responsible for assisting during DBBC operation • Deploying / recovery of buoys • Bringing the buoys safely onboard • Connect and disconnect buoy and supply hose • Assisting during re-fueling operations of compressors/HPU's • Assisting in any deck handling activities

4.3. Intra Ship Communications

All intra ship project alignment communications shall be done through internet phone link. All near field instructions and operations shall be communicated through VHF radio channel #8 and #10.

4.4. Personnel Transfer

The transfer of Project or Marine crew from and to the NHDV will be done either in Base Port (Port of Providence) or offshore. Reference is made to the Personnel Transfer Procedure [14]

4.5. Permit to Work (PtW)

All vessels will use their own Permit to Work (PtW) system as per their Vessel Management System unless stated otherwise.

Onboard the BL2 the permit to work system is according to the BL2 Operations Manual, reference is made to [20].

4.6. Marine Mammal Observation

For the marine mammal observation procedure reference is made to the employer's Protected Species Mitigation Measures Plan section on Permitting conditions document [1]. As part of the requirements, all vessel need to exercise strike avoidance surveillance with the protected species during transit and in-field. The NHDV is fitted with thermal camera at top of the wheelhouse for this purpose. Any sighting will be reported in the Mysticetus software to communicate the sightings between vessels.

4.7. Noise Monitoring

For Noise Monitoring, reference is made to the Employer's Sound Field Verification Plan. Noise monitoring activity will be carried out by sound field verification (SFV) vessel which is equipped with noise monitoring equipment.

5. MARINE & HELICOPTER COORDINATION CENTRE (MHCC)

Employer has an established MHCC set up for this project. Including a software system for applying for Work Authorization Document (WAD).

5.1. Marine Helicopter Coordinator

The Marine and Helicopter Coordinator (MHC) is the person responsible for the overall Offshore Site (field). The MHC is employed by the Employer.

5.2. Daily Planning Meetings

The Contractor must attend Daily Planning Meetings throughout the execution phase of the project. This will be the forum whereby any access conflicts and activity scheduling will be discussed and agreed between all relevant parties. The Daily Planning Meetings will be chaired by the MHC.

The Contractor must submit their planning for the next 24, 48 and 72 hours, 2 hours prior to the Daily Planning Meeting. In case of conflicts, work will be prioritized in best interest of the project.

5.3. Field Entry Requirements

NHDV to enter the field as per vessel field entry checklist. DP functional test will be performed as per vessel standard protocol at arrival at the field. Permission to enter the field is granted by the MHCC.

The Bokalift 2 OCM and/or Master are responsible for applying the applicable permits for the vessel to operate in the SRW01 lease area. Planned SIMOPS need to be risk assessed. If required, priorities can be determined based on the risk assessment.

5.3.1. Field Entry Checklist

All vessels to perform the field entry checklist as per their Vessel Management System [VMS].

5.3.2. Training, Next of Kin and ID cards

Prior to being allowed to work in the field, personnel have to complete and upload the following documentation:

- All training in line with the Training Matrix;
- Next of Kin [NOK] forms;
- Photograph.

Personnel receive their own personal ID card prior to Offshore Site access.

Contractor plans to use 'crew management software' to automatically connect and complete this compliance check for the offshore personnel.

5.3.3. Work Authorization

The vessels are only allowed to start work in the field with a Work Authorization Document [WAD].

The Marine Operations Manager [or his delegate] is responsible for applying for the applicable WAD for the vessel to operate in the SRW01 lease area. This Work Authorization Request is done via a software system provided by Employer.

6. VESSEL PREPARATION AND EQUIPMENT

6.1. General

The NHDV (Nozzle Hose Deployment Vessel) is a multi-purpose DP-2 offshore Anchor Handling Tug Supply vessel, fitted with a stern roller open aft deck which allows for hose deployment & retrieval of the nozzle hoses from the aft. The vessel is fitted with the BBC equipment for deployment, operation and retrieval of the DBBC. A detailed description of the equipment can be referred in Section 6.3.

Vessel specifications for the NHDV and the HLV can be seen in below Table 6-1 and Table 6-2.

Table 6-1 Nozzle Hose Deployment Vessel (NHDV) particulars

Name	Bear	
Length	73.50 [m]	
Beam	16.40 [m]	
Depth	8.00 [m]	
Speed	10 [kn]	
Owner	Boskalis	

Table 6-2 Monopile Installation Heavy Lift Vessel (HLV) particulars

Name	Bokalift 2	
Length	231 [m]	
Beam	49 [m]	
Depth	17.8 [m]	
Speed	10 [kn]	
Owner	Boskalis	

The latest version of the planned deck layout of the NHDV Bear can be found in [12]. Further explanation on hose deployment is explained in Section 8. Figure 6-1 shows the deck layout of the NHDV during the operations.



6.3. Key Equipment

For the SRW01 development, key mission equipment has been identified and procured. The following sections provide a brief description on the equipment and their utilization. All key equipment shall be made ready for use prior to the commencement of the MP installation campaign according to the individual operation manuals and procedures. Inspections and function tests of individual key mission equipment and assembled spread are part of the preparations before sending the equipment to the mobilization port.

The main DBBC spread consists of :

Table 6-3 DBBC Spread Particulars

1	Air compressors	Air-compressors type ST3100 with a sufficient combined operational Free Air Delivery (FAD) 0.5 m³/(min x m) as per Permitting Conditions [1] [2]. Spare air compressor(s) are placed onboard to keep the DBBC functional in the instance of compressor failure. Technical information and specifications for the compressors can be found in Attachment 3. There are total 10 units of air compressors onboard the Bear. It is expected that 8 units will be online during the operation while 2 units on stand-by / as spares. Additionally, there will be 1 unit of spare compressor at base port (Port of Providence) for exchange if really required.
2	Nozzle hoses	DBBC nozzle hoses fitted with ballast chains. The hoses are drilled for the site conditions of the project to allow for uniformly distribution of air around the DBBC. Technical information and specifications can be found in Attachment 1. Spare parts are available onboard to carry out repair on the hose. Small damages (cuts, twists etc.) can be repaired with clips. For blockage of the nozzles, a redrilling and flushing procedure is to be followed. Reference is made to contingency procedures in Section 10.
3	Nozzle hose deployment winches	Nozzle hose deployment winches fitted in offshore frames. Technical information and specifications can be found in Attachment 2. The winch consists of two parts. The hydraulic power pack and the winch frame with hoses reel. There will be 3 set of DBBC hose deployment winches: 1 set comprises of 1 winch for Inner DBBC ring and 1 winch for Outer DBBC ring. 2 set will be operational and used throughout the campaign while another 1 set will be kept as spare. To have redundancy onboard, the vessel is equipped with three (3) complete sets of winches and power packs. In case there is a failure on one hydraulic power pack it can be interconnected between the winches. In case two hydraulic power packs fail, two winches can operate with only one hydraulic power pack at 70% of the total speed. The 3rd winch is permanently installed and ready to operate. Hoses on the 3rd winch is made for sacrificial spare should any hose section on 1st and 2nd winch needing replacement. For the remote control there are spare batteries available. In case of a general failure of the remote control, the winch can be operated from a local control inside the power pack.

Table 6-3 DBBC Spread Particulars

4	Seasentry	The Seasentry bundles the supplied air from the compressors (8 active 2 spare) and filters the air. From the Seasentry, the air will be supplied to a manifold. Technical information and specifications can be found in Attachment 4.
5	Manifold	The manifold bundles the two 6" lines coming from the Seasentry and distributes the air into the four 4" lines going to the DBBC. Additionally, it has two three-way-valves that can be used to bleed or to flush the nozzle hoses.
6	Spare parts	All spare parts related to the equipment are identified in the spare parts list, reference is made to Attachment 5.
7	Buoy recovery winch	Small 12T pulling winch for buoy & hose end retrieval. Technical specification for this equipment is included in Attachment 6.
8	Fuel tank	A 20.000ltr. fuel tank is used to store and circulate the fuel for all 10 compressors.
9	Fuel line	From the vessel tank a fuel line is laid to the middle of the NHDV. A pistol fuel dispenser can be used to fill up the HPU fuel tanks and a quick connect system is used to fill up the 20.000ltr. fuel tank.

6.4. Mobilization of NHDV

The outfitting and mobilization of the NHDV will include the following activities as a minimum:

- Removal of the vessel spare towing winch on B-deck and placement and hook-up of additional accommodation units;
- Preparation of the main deck on the NHDV. Seafastening grillages are installed on main deck prior to DBBC equipment mobilization;
- Loading Nozzle Hose Winches, Compressors, Seasentry, Manifold, Fuel tank, Spare parts container;
- Sea fastening of equipment on custom built grillages;
- All connections between the DBBC equipment are fitted after every piece of the DBBC spread is in the final position on deck;
- Air compressors and manifolds are pressurized to operational pressure and all connections are checked for leaks and test run of all winches to check for hydraulic leaks and proper functioning.

The detailed process for the mobilization of the NHDV can be found in the vessel's mobilization manual in reference [21].

6.5. Site Testing of DBBC Deployment and Operation

Contractor must submit an inspection and performance report for approval by Employer within 12 hours following the performance test. Any modifications to attenuation device to meet the performance standards must occur before impact driving starts and maintenance or modifications completed must be included in the report. Procedure of the agreed test proposal (adoption from SFW01) can be found in Attachment 7. The DBBC Quality Check Interim Report template and DBBC Operational Report template can be found in Attachment 8 and Attachment 9.

7. ENVIRONMENTAL LIMITATIONS

For DBBC deployment, operation and retrieval, the environmental limitations are listed in Table 7-1. This limitation is based on operational feedback and the empirical review of the bubble curtain operational as defined in the Operational Design Limit [22]. It is at the discretion of the Vessel Master, vessel OCM and Site Supervisor to commence the operations based on the actual weather conditions.

Table 7-1 Environmental Limitations [22]

<i>Description</i>	<i>H_s</i> [m]	<i>U₁₀</i> [m/s]	<i>U_c</i> [m/s]
DBBC Deployment, Operation and Retrieval	1.2	9.0	0.5

For the NHDV DP capability, reference is made to [11].

7.1. Weather Window

Based on Operational Design Limit [22], the corresponding required weather window for DBBC operations is summarized in table below.

Table 7-2 Required Weather Window for DBBC Operations [22]

<i>Description</i>	<i>T_{POP}</i> [h:min]	<i>T_C</i> [h:min]	<i>T_R</i> [h:min]
Deployment	8:00	4:00	12:00
Retrieval	7:30	4:00	11:30

8. DBBC OFFSHORE OPERATIONAL SEQUENCE

8.1. General

The Far Field Noise Mitigation System consists of a Double Big Bubble Curtain (DBBC) and is pre-laid at the MP installation location to allow the HLV to operate without interruption of laying or retrieval of the DBBC hose. The DBBC hoses shall be laid in a round shape at the installation location. If the lay route is blocked by potential UXO, an oval shape can be used to avoid the ordnance. For details of the hose layout per location, reference is made to the Bubble curtain layout drawings for SRW01 [9]. The bubble curtain layout drawings for REV01 is referenced to [25].

To allow for an uninterrupted installation campaign, the DBBC hoses will "leapfrog" from one installation location to the next location. This means that once the 1st MP installation location is prepared with the DBBC hoses, this location will be marked and abandoned by the NHDV. On the 2nd MP installation location, the DBBC hose will be deployed, where in parallel, the HLV will position on the 1st MP installation location. Once the latter has been completed and the DBBC hose is successfully deployed on the 2nd location, the NHDV will return to the first location to operate the DBBC hose. To mitigate any potential sand buildup and clogging the holes, flushing of the hoses will be implemented prior commencing each piling operation.

In the unlikely event that the hoses are on the sea floor for a period of 72 hours without use, the hoses will be flushed and monitored at surface to verify correct layout and positioning of the hoses, as well as to confirm that it is capable of delivering a uniform and constant flow. If the DBBC is installed without use for 96 hours, the hose will be retrieved for further inspection provided that there would be no critical path delay on the installation spread.

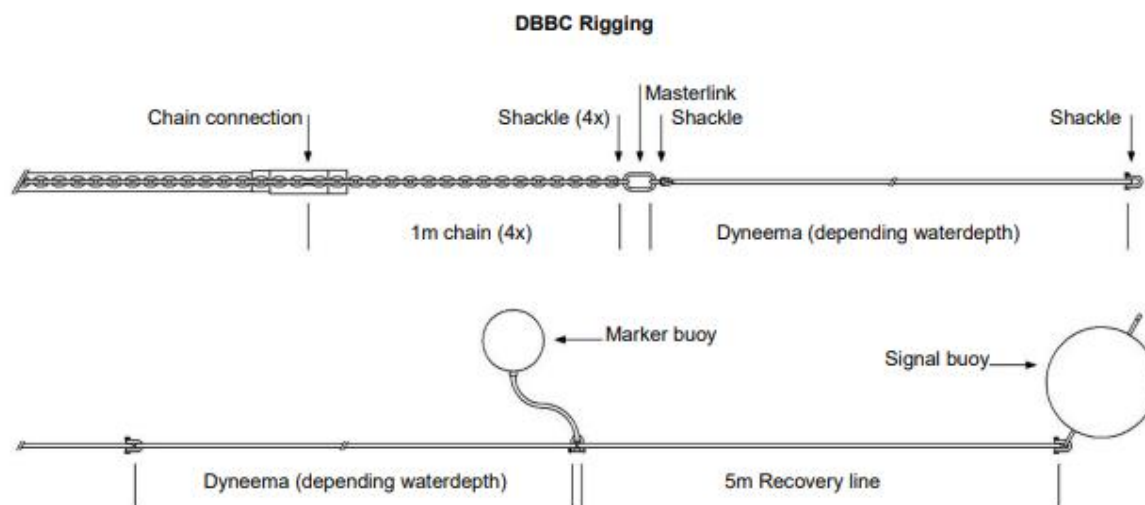
Upon completion of the installation at the 1st location and repositioning of the HLV to the 2nd location, the NHDV will retrieve the DBBC hose and deploy this set on the 3rd MP installation location. This cycle will be applied until all foundations have been installed and all BBC hoses are retrieved onboard the NHDV.

The DBBCs will be deployed around the future foundation locations, whereby the track serves as a guideline for the NHDV (actual position of the NHDV may deviate from this track). With the Tug Management System (TMS), the surface position of the stern roller is recorded. The HLV working position will be over the DBBC.

The DBBC will consist of 2 layer of Big Bubble Curtains, namely inner and outer ring/curtain. The inner DBBC ring has a nominal hose length of 346 [m]. The outer DBBC ring has a nominal hose length of 691 [m]. The BBC hose will be sequentially deployed by the NHDV. The base case is to lay first the inner and second the outer. This order is selected to avoid entanglement in the alley.

The DBBC hoses will be rigged in accordance with below guidelines.

Hoses: The ends of each of BBC ring are connected to marker and signal buoy via a set of riggings as shown in Figure 8-1. The signal buoy is equipped with light and radar reflector.



Hoses tied together



Deploying the hoses



Connecting the Marker buoy



Connecting the Signal buoy



Disconnecting from the winch



Deploying the buoys

Figure 8-1 DBBC Retrieval Buoys

To retrieve the buoys and hose ends during the different DBBC phases a small pulling winch is used situated on the aft deck in front of the large middle spare winch for nozzle hoses. During operations on the stern work deck with unprotected stern roller, staff shall be connected to the dedicated safety work line.

The following (repetitive) outline sequence will be followed:

Table 8.1 Outline DBBC Deployment Sequence		
Item	Task	Responsible Person
1.	Deploy DBBC on 1 st MP installation location, prior to arrival of HLV. Including function test	DBBC Superintendent
2.	Deploy DBBC on 2 nd MP installation location, prior to arrival of HLV	DBBC Superintendent
3.	NHDV to return to 1 st MP installation location	NHDV Master
4.	Upon successful positioning of HLV, NHDV to approach to standby position. Pick-up DBBC hoses	NHDV Master
5.	NHDV to perform noise mitigation activities	NHDV Master / DBBC Superintendent
6.	NHDV to move out of HLV DP positioning area	NHDV Master
7.	Upon relocation of HLV, NHDV to retrieve DBBC from 1 st MP installation location	DBBC Superintendent
8.	NHDV to sail to 3 rd MP installation location	NHDV Master
9.	NHDV to deploy DBBC on 3 rd MP installation location	DBBC Superintendent
10.	NHDV to sail to 2 nd MP installation location and upon successful DP positioning of HLV, NHDV to approach to standby position	NHDV Master
11.	Repeat steps 5-10 for all following MP installation location	NHDV Master / DBBC Superintendent

8.2. DBBC Deployment

The DBBC inner and outer layout are installed in a plotted track in the survey system. The aft of the vessel is the center point of hose deployment therefore it will be used as tracking point. Once the equipment is installed, function test will be executed and the outcome recorded.

The start and end of each nozzle hose (inner & outer) are marked with buoys. The position of the nozzle hose shall be recorded during deployment by the NHDV positioning system with the aft of the vessel as reference point.

The following steps will be taken for the deployment of the DBBC:

Table 8.2 DBBC Deployment Activity list		
Item	Task	Responsible person
1.	Perform communication check, additional required checks according to project specific offshore installation guidelines, confirm mobilization is accepted and toolbox talk for upcoming works has been held	NHDV Master
2.	DP function test to be executed according to NHDV DP checklist.	NHDV Master
3.	Manoeuvre vessel towards 500m Zone	NHDV Master
4.	Before entering 500m Zone: Set vessel in DP-2 Auto position	NHDV Master
5.	Entering 500m Zone	NHDV Master

Table 8.2 DBBC Deployment Activity list

Item	Task	Responsible person
6.	Start hydraulics for winch and compressors for minimum pressure on hose	DBBC Superintendent
7.	Deck to report towards the Master readiness for operation	DBBC Superintendent
8.	DBBC Superintendent to instruct DBBC operators about start of deployment. During deployment of hoses the holes will be checked and (re)drilled where needed for sufficient airflow.	DBBC Superintendent
9.	Weighted end of hose with the connected surface buoy to be brought into water, keep track of length paid out	DBBC Superintendent
10.	Pay out hose, until hose has landed on the seabed	DBBC Superintendent
11.	Move vessel ahead slightly whilst paying out, ensure sufficient slack is on the seabed. Departure angle to be 5~10deg from vertical. Hose angle to be continuously monitored by the DBBC Superintendent and communicated to the bridge.	DBBC Superintendent
12.	Constant communication between Master and DBBC Superintendent during deploying of DBBC, bridge to confirm DBBC Superintendent about required AC's, as they follow provided track	DBBC Superintendent
13.	After 100m of hose is laid on the seabed, a stronger catenary can be created allowing departure angle to be increased until 25~30deg from vertical	DBBC Superintendent
14.	If the circle is closed, this is to be communicated from the bridge towards the deck. Speed to be reduced. DBBC Superintendent has visual over the vessel aft deck and communicates to Master	DBBC Superintendent
15.	Manoeuvre close to the DBBC retrieval buoy connected to first end of the hose	NHDV Master
16.	NOTE: Maintain sufficient distance between NHDV and buoy in blow off, to avoid surface buoy with rope to be caught in thrusters of NHDV	NHDV Master / DBBC Superintendent
17.	The buoy will be caught with a hand grapnel; from predefined position, to minimize chance of entanglement	DBBC Superintendent
18.	Buoy to be lifted onboard and disconnected	DBBC Superintendent
19.	Connect riggings from the buoy assembly to 12t winch	DBBC Superintendent
20.	First end of hose to be lifted on deck with winch, second end still connected to winch	DBBC Superintendent
21.	Both ends to be connected to buoy assembly	DBBC Superintendent
22.	Both ends of BBC 1 to be deployed with no pressure (wet store)	DBBC Superintendent
23.	Repeat task #6 - #22 for BBC 2	DBBC Superintendent
24.	Upon successful DP positioning of HLV, NHDV to pickup buoys onboard and disconnect	DBBC Superintendent
25.	BBC hose to be connected to the supply coupling	DBBC Superintendent
26.	Supply valve to be opened. Start the flushing operations until there is no sand and uninterrupted flow can be confirmed	DBBC Superintendent
27.	NHDV heading within the environment to be adjusted to minimum thrust	NHDV Master
28.	Provide notice to HLV confirming the DBBC has been successfully deployed within the positioning limits. Operational readiness to be reported towards HLV.	NHDV Master

8.3. DBBC Operation

The following steps will be taken during piling operations and when the DBBC is at operational pressure:

Table 8.3 DBBC Operation Activity List		
Item	Task	Responsible Person
1.	Quality check via an Interim test report to be provided prior to stabbing of the pile	DBBC Superintendent
2.	Positioning of the NHDV, start air supply, flushing of BBCs, standby pressure, operational pressure (prior to stabbing of the pile). RPM and associated air supply (from compressor technical specifications) during piling operations for each compressor will be documented. Note: In the unlikely event that the hoses are on the sea floor for a period of more than 72 hours without use, hose to be flushed and monitored at surface to verify the correct layout and positioning of the hoses, as well as to confirm that it is capable of delivering a uniform and constant flow. If DBBC hoses is installed without use for 96 hours, the hose will be retrieved for further inspection provided that there would be no critical path delay on the installation spread.	DBBC Superintendent
3.	After piling operations are finished, stop air supply, retrieve wire, air supply hoses, and disconnect the air supply hoses from feeder hoses.	DBBC Superintendent
4.	If piling works are interrupted for less than 30mins the NHDV sets pressure to standby pressure to avoid ingress of foreign material in the DBBC hose. When the works on HLV are interrupted this will be communicated to the NHDV as per Table 9-1.	DBBC Superintendent
5.	In case of interruption longer than 30mins, NHDV ends DBBC operation to start again when operations continue. When the works on HLV are interrupted this will be communicated to the NHDV as per Table 9-1.	NHDV Master

8.4. DBBC Retrieval

After the end of piling operations, the NHDV will wait for the HLV to finalize installation works on the location. Once HLV confirms that the location is clear, NHDV can approach to start the DBBC retrieval works.

The following steps will be taken for the retrieval of the DBBC:

Table 8.4 DBBC Retrieval Activity list		
Item	Task	Responsible person
1.	Receive information that piling operations is completed	NHDV Master
2.	Toolbox talk held with all involved personnel	DBBC Superintendent
3.	Reduce the air pressure from the compressors for economic operation	Deck Supervisor
4.	Confirm that HLV is clear from location and NHDV can access for recovery of DBBC (on discretion of both vessels for start recovery process).	NHDV Master

Table 8.4 DBBC Retrieval Activity list

Item	Task	Responsible person
5.	When confirmed, DBBC can be recovered. Start hydraulics and prepare all systems for recovery	DBBC Superintendent
6.	Master to inform HLV that recovery operation starts	NHDV Master
7.	Close one side of the manifold to stop double side air supply	DBBC Superintendent
8.	DBBC hose will be slowly lowered to the seabed	DBBC Superintendent
9.	Buoy will be lowered to the water	DBBC Superintendent
10.	Vessel to move away from buoy	DBBC Superintendent
11.	Based on weather situation, vessel either to be turned or hose to be recovered going sternways	NHDV Master
12.	After being on the opposite track the vessel will be manoeuvred along this track and hose per hose will be recovered	NHDV Master
13.	Once cycle is completed, the buoy will be brought on deck and secured. Switch off compressors	DBBC Superintendent
14.	Bridge will inform HLV that operation is completed	NHDV Master
15.	NHDV will leave from location and relocate to continue with pre-laying activities on next location (as per communicated sequence)	NHDV Master
16.	Once the cycle is completed, the compressors will be re-fuelled for the next cycle. DBBC superintendent to request permit from the Master for refuelling operations on deck	DBBC Superintendent

9. VESSEL COMMUNICATION PLAN

In the process of DBBC operations in relation to MP Installation cycle (as described in Section 8), communication between HLV and NHDV is decisive on the next step(s) of the operation. The Offshore Construction Manager (OCM) of the HLV or his delegate will be responsible person to communicate the operations planning and direct the vessels in the field. The NHDV plan will be directed from the HLV plan and follow any changes on the installation sequence that may occur. The minimum notifications between HLV and NHDV prior, during and post piling on each location can be seen in Table 8-1 below on each MP installation location. Reference is also made in MP Offshore Installation Manual [10].

Table 9-1 HLV / NHDV Communication Plan on Each MP Installation Location

	Communication	Vessel	Radio	Vessel	Communication
1		HLV	←	NHDV	Notification to HLV Confirm DBBC deployed on next FOU location
2	Notification to NHDV Prior moving to next FOU location	HLV	→	NHDV	
3	Notification to NHDV 3 hr. before start piling	HLV	→	NHDV	
4		HLV	←	NHDV	Notification to HLV Confirm connection DBBC + Confirm compressor start up
5	Notification to NHDV 1 hr. before start piling	HLV	→	NHDV	
6		HLV	←	NHDV	Notification to HLV DBBC On operational Pressure
7	Final notification to NHDV 15 mins before start piling	HLV	→	NHDV	
8a	Notification to NHDV (If occurs) Piling Interrupted	HLV	→	NHDV	
8b	Notification to NHDV 15 mins before re-start piling	HLV	→	NHDV	
9	Notification to NHDV Piling Finished	HLV	→	NHDV	
10		HLV	←	NHDV	Notification to HLV DBBC Retrieval

10. CONTINGENCIES

10.1. General

In the event of a deviation from the approved procedures due to an equipment malfunction or due to unforeseen circumstances, the course of action to be followed upon will be agreed between all parties concerned. This section solutions are given for certain contingencies applicable to the operations.

10.2. Deteriorating Weather

In the event of deteriorating weather conditions, the HLV Master and Superintendent shall agree their intended course of action and advise the NHDV Master and DBBC Superintendent. When deteriorating weather occurs and the NHDV can remain in the field, the DBBC spread will be wet stored and upon recommencement of operations, the hoses are to be flushed.

If circumstance so dictate (i.e. storm) the DBBC is to be recovered to the NHDV when reasonably practicable.

10.3. Missing Buoy

In the event of a buoy being lost, the Employer shall be advised immediately.

In case of a missing buoy, other than small plastic buoys, the relevant coast guard authority shall be informed immediately, giving the following details:

- Size, colour and marking of the buoy;
- Time buoy was last sighted;
- Probable speed and direction in which buoy is drifting;
- Action being taken to locate and recover;
- Wind direction, sea and swell and prevailing current.

In view of the potential hazard to shipping, a seabed search to ascertain whether the buoy has sunk, and a vessel search of the area shall be performed.

The results shall be communicated to the relevant coast guard authority by the NHDV Master. Working class ROV may be used for retrieval of the DBBC equipment and buoy.

10.4. NHDV Blackout while Maneuvering

During the stay inside the 500m Zone of the HLV, all main engines and generators will be running.

The NHDV is a DP-2 class vessel, and as such in cases of black-out the vessel can rely on its back-up / secondary system. In case the black-out cannot be remedied within a reasonable time frame, the operation must be ceased for subsequent repairs of the NHDV and become fully operational.

If needed the BBC hose to be wet stored (deployed without bringing any tension onto the hose). DBBC winch drivers must be ready for emergency abandonment upon NHDV Master's decision (disconnecting the hoses).

For the emergency abandonment and before the hoses can be disconnected, the pressure is to be released from the hoses on the seafloor for safety reasons. For this a manifold with bleeding valves is introduced on deck of the NHDV between the compressors and the hose winches. The bleeding valves can be quickly opened in case of emergency and all 4 feeding lines individually closed with a turning wheel valve. Figure 10-1 shows the manifold and working principle.

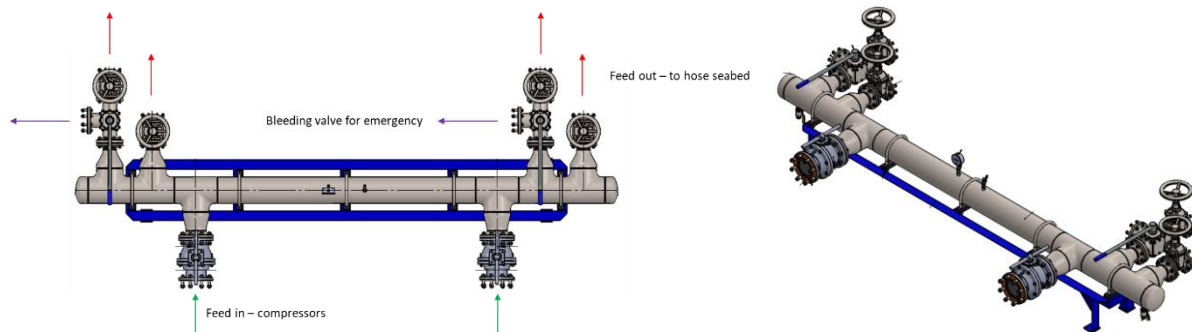


Figure 10-1 Air Manifold for DBBC Hoses on Deck

Outlined below are the steps for emergency disconnect of the DBBC hose in the case of NHDV blackout while maneuvering:

Table 9-1 Emergency Disconnect of DBBC Hoses

Item	Task	Responsible person
1.	NHDV Captain to inform DBBC Superintendent to initiate emergency disconnect of hose	NHDV Captain
2.	Reduce the feed-in pressure from compressors	DBBC Superintendent
3.	Depressurize the system by opening the bleed valve on manifold	DBBC Superintendent
4.	Identify the hose section on deck to be cut	DBBC Superintendent
5.	Use stopper rope for securing the hose onto deck prior cutting the hose and chain	DBBC Superintendent
6.	Connect ROV recovery rigging (dyneema rope) to the hose end that will be left on seabed	DBBC Superintendent
7.	Cut the hose and chain connection	DBBC Superintendent
8.	Cut the stopper rope and release the hose into the water	DBBC Superintendent
9.	For recovery of the hose, connect the ROV hook to the recovery rigging and recover back to deck using winch	DBBC Superintendent

10.5. Loss of Thruster while Maneuvering in Proximity of the HLV and/or Fixed Structure

In case of any failure on either thruster, the NHDV will be maneuvered away from the HLV and the operation will be ceased for subsequent repairs of the NHDV and become fully operational.

If needed the BBC hose to be wet stored (deployed without bringing any tension onto the hose). DBBC winch drivers must be ready for emergency abandonment upon NHDV Master's decision (disconnecting the hoses).

10.6. Hose/Chain in Propeller

In the case that the hose/chains come into one of the propellers, the propeller should be clutched out or stopped, and the hoses will be cut off. The NHDV will leave the site with the remaining propeller for subsequent repairs and become fully operational.

10.7. Failure to Hose Winch during Deployment/Recovery

In case of a failure on the winch during deployment or recovery the vessel will be stopped and hold in position. It is possible to interconnect the hydraulic from one hydraulic power pack to another. The speed of the winch will be reduced to 70%.

For the remote control there are spare batteries available. In case of a general failure, the system can be operated manually.

10.8. Clogging of Hose

If clogging of the hose is observed, the nature of the clog and affected hose section is to be identified and de-clogged. If this is not practical, the clogged hose section will be replaced.

10.9. Failure to the DBBC Spread

Trouble shooting is to be carried out ASAP by Contractor. Based on the outcome, e.g., extent of possible damages and repair time, Employer will be informed of the way forward.

10.10. Compressor Failure

Identify cause of failure. Substitute malfunctioning compressor with one of the spare contingency compressors. Spare compressors are connected permanently to the manifolds and can instantly supply air when needed, so the DBBC operation is uninterrupted.

10.11. Spills Onboard

In case of spills or (hydraulic) leaks onboard the readily available SOPEP kits shall be used to contain and clear the spill. Should there is potential of the spills leakage to the sea, the required action to be taken is referred in [23].

10.12. Shutdown

In case the sensors indicated that pressure or flow rates are not sufficient, the DBBC Superintendent/NHDV Master will notify BL2 OCM and a shutdown in piling operations will be implemented if possible/safe. The piling will not recommence until the bubble curtain is repaired and specifications verified. A restart will follow all pre-start clearance protocols.

11. ATTACHMENTS

- | | |
|----------------------|---|
| Attachment 1. | Technical Description – Bubble Curtain Nozzle Hose |
| Attachment 2. | Technical Description – Nozzle Hose Deployment Winch |
| Attachment 3. | Technical Description – Air Compressor |
| Attachment 4. | Technical Description – Air Filtration |
| Attachment 5. | Technical Description – Spare Part List |
| Attachment 6. | Technical Description – 12t Pull-in Winch |
| Attachment 7. | Noise Mitigation Performance Test Proposal Memo |
| Attachment 8. | DBBC Quality Check Interim Report Template |
| Attachment 9. | DBBC Operation Report Template |

ATTACHMENT 1. TECHNICAL DESCRIPTION – BUBBLE CURTAIN NOZZLE HOSE

Technical-Description-DBBC Hoses

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SUBC. NAME: Bernhard Weyres GmbH
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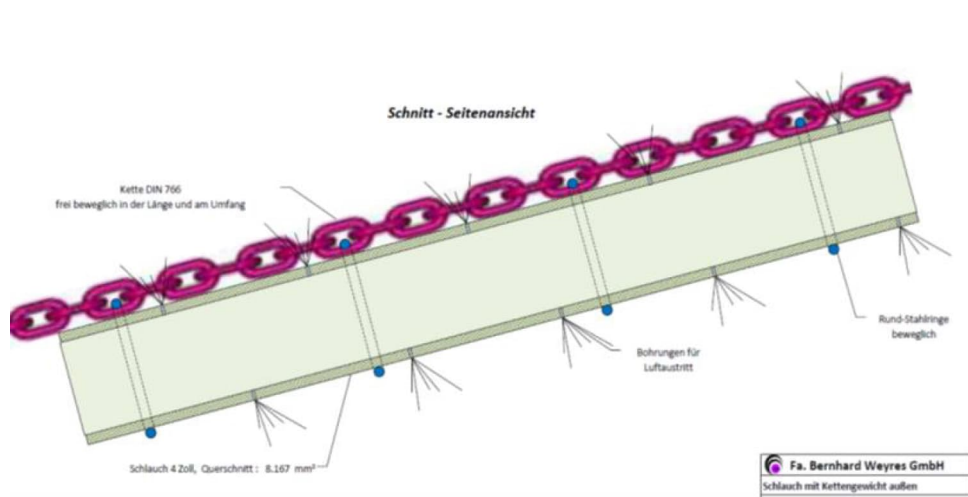
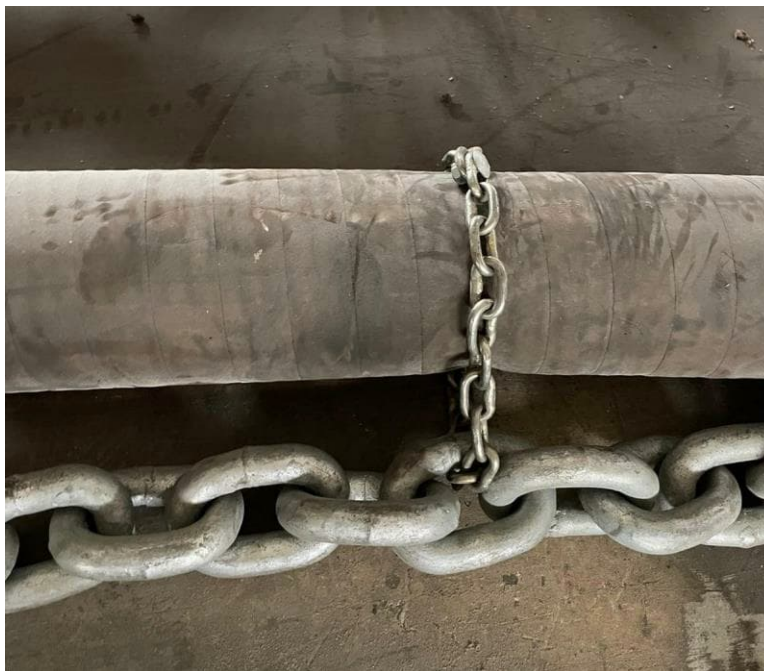
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1. BUBBLE CURTAIN

- Tubing - system with external chain.
- Hose length up to 1040 meter per winch possible.

Figure 2: Hose with a fixed chain outside



2. SPECIFICATIONS: HOSE

2.1. New specification: 2022

T-130 AK
COMPRESSED AIR 40 BAR (600 PSI) - STEEL REINFORCED



TUBE : BLACK SBR/NBR - OIL MIST RESISTANT
REINFORCEMENT : HIGH TENSILE STEEL CORDS
COVER : YELLOW SBR - ABRASION AND OZONE RESISTANT - PIN PRICKED
APPLICATION : HIGH PRESSURE COMPRESSED AIR DESIGNED FOR HEAVY DUTY MINE AND QUARRY APPLICATIONS WHERE LONG SERVICE LIFE AND MAXIMUM SAFETY IS REQUIRED.
SAFETY FACTOR : 4:1
TEMPERATURE : -30°C +80°C (-22°F +176°F)
BRAND TEXT : ALFAGOMMA -ITALY- T-130 STEEL AIR
BRAND TYPE : EMBOSSED

APPROVALS :

NOTE :

Code	ID mm	ID inch	OD mm	Wall mm	Weight g/m	WP bar	WP psi	Vac. %	BR mm	Available Length m	Stock Length m
130AK019311X03	19	3/4	31	6	810	40	600		95	30,5	30,5
130AK025371X03	25	1"	37	6	1010	40	600		125	30,5	30,5
130AK032441X03	32	1" 1/4	44	6	1240	40	600		160	30,5	
130AK038521X03	38	1" 1/2	52	7	1660	40	600		190	15,25 / 30,5	30,5
130AK051651X03	51	2"	65	7	2350	40	600		255	15,25 / 30,5	30,5
130AK063831X03	63	2" 1/2	83	10	3570	30	450		315	15,25 / 30,5	30,5
130AK076961X03	76	3"	96	10	5000	30	450		380	30,5	30,5
130AK102221X03	102	4"	122	10	8000	30	450		510	15,25 / 30,5	30,5

The total weight for 1m fitted hose length:

for the hoses: 6,15 kg/m now

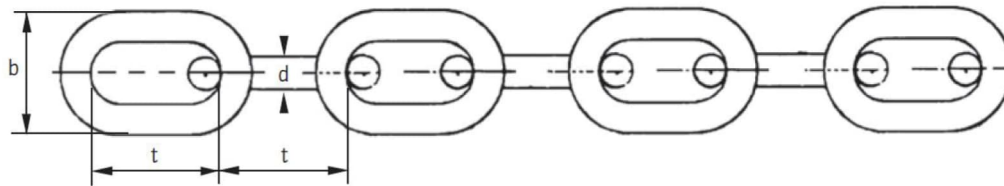
for the chain: 9,00 kg/m

connections: 0,50 kg/m

15,65 kg/m fitted hose length

Bending radius min: 510 mm

2.2. Specifications: main chain



Bezeichnung Type	Maße mm Dimensions mm			Gewicht Weight	Belastbarkeit* Capacity*
	d	t	b	ca./appr. kg	kg/max.
DIN 5685, kurzgl.2056	20	56	64	8Kg/m	18000

Table 1: Main chain

2.3. Connection chains:

Rundstahlkette nach DIN 5685 | C-Glieder (langgliedrig) | gerade | ungeprüft
 Langgliedrige Kette für nicht sicherheitsrelevante Arbeitseinsätze, z. B. als Absperrkette oder zur Abhängung von Schildern | lieferbar in 3 verschiedenen Ausführungen (blank, galv. verzinkt oder feuerverzinkt).



Maße (mm) d x t x b2	Oberfläche	Länge je Bund m	Belastbarkeit kg	Gewicht (ca.) kg / 100 m
2 x 22 x 8	feuerverzinkt	30	20	6
2 x 22 x 8	galvanisch verzinkt	30	20	6
2 x 22 x 8	blank	30	20	6
3 x 26 x 12	feuerverzinkt	30	45	14
3 x 26 x 12	galvanisch verzinkt	30	45	14
3 x 26 x 12	blank	30	45	14
4 x 32 x 16	feuerverzinkt	30	80	26
4 x 32 x 16	galvanisch verzinkt	30	80	26
4 x 32 x 16	blank	30	80	26
5 x 35 x 20	feuerverzinkt	30	125	42
5 x 35 x 20	galvanisch verzinkt	30	125	42
5 x 35 x 20	blank	30	125	42

Table 2: Connection chain

ATTACHMENT 2. TECHNICAL DESCRIPTION – NOZZLE HOSE DEPLOYMENT WINCH

Winches and Power Packs

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4.	Safety systems	8

1. WINCH



- 2x Hose reels as per picture above
- Hose reels: Steel drums with side rotary joint for permanent compressed air supply and an axial drive consisting of a hydraulic motor, planetary gears and an internal disc brake
- 1 x Hydraulic power pack stored in 10" container
- Hydraulically operated (in/out and spooling device)
- Operated by remote control. One for 2 winches with manual switch over
- Max. 1.040m/hose per winch
- Hoses fitted with an outside chain for negative buoyancies. 7kg/m in water
- Minimum breaking load for the chain: 18t
- Hoses: Alfagomma T-130AK 40bar steel reinforced, Ø 122mm with a minimum breaking load of 9 metric tons
- Minimum bending radius is 510 mm
- Total weight: (Frame, Drum with hoses and HPU): approx. 29 tons
- Pulling force: approx. 5 tons on first (lowest) layer
- Air supply connector at winch: project specific (see sub. 5.)
- Length: approx. 6.900mm; Height: approx. 3.300mm; Width: approx. 3.400mm with air inlet valve connection (project specific)

1.1 Winch Remote Controls

The remote control comes with a spare battery and a charging station. Changing the battery takes less than a minute (<1m).

All remote controls are equipped with an Emergency Stop at the side. Additionally, there is one emergency stop inside the hydraulic container.

Before the operation start:

- Remote control battery fully charged
- Fully charged spare battery charging slot inside the powerpack

2. HYDRAULIC POWER UNIT

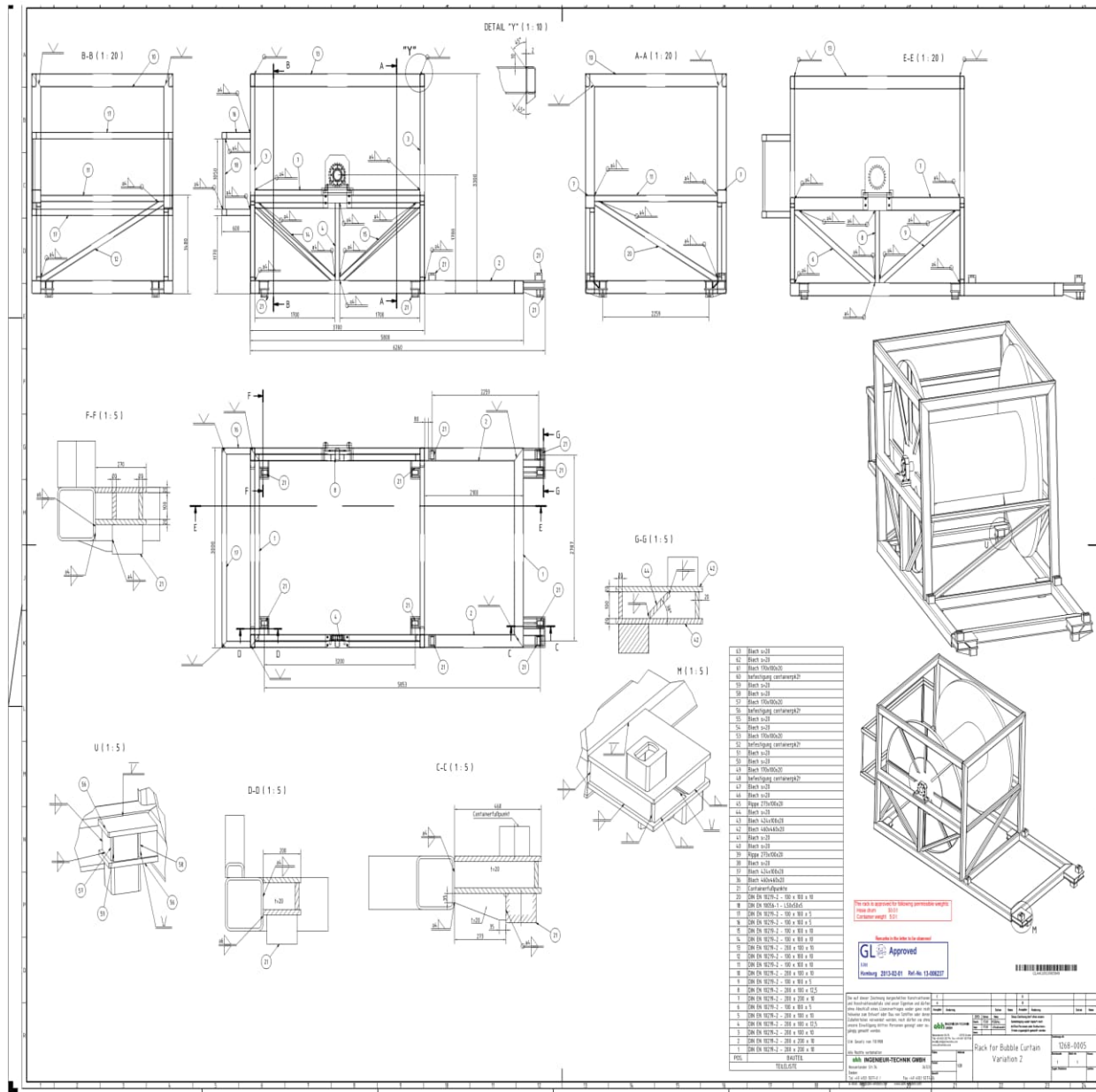
The Hydraulic Power Unit that is used to drive the winch(s) is a container solution (10ft container) that is attached to the frame of the winch. In this/these container(s) are built the following modules:

- diesel engine, Perkins 1200 series
- hydraulic pump connected to diesel engine
- Fuel tank with a capacity of approx. 100 litres
- Hydraulic Oil tank, capacity: approx. 80 litres
- Remote control with a battery charging station
- Spare parts intended for the project (e.g., joints, screws and more)
- 220 Volt supply for lights, battery chargers and plug(s) for the use of the tools (e.g., grinder, drill, etc.)
- Fire extinguisher

Example of hydraulic power unit container



3. DRAWINGS WINCH FRAME



4. SAFETY SYSTEMS

4.1 Fire extinguisher:

6 kg powder, for A, B, C class fires

4.2 HPU unit:

The HPU unit (engine and pump) is controlled by a Perkins BU Power Unit system with permanent monitoring of key engine data. Emergency shutdown when key values are exceeded.

Remote control: Emergency call buttons on the remote control itself and inside the HPU container, immediately accessible from the front door (see image page 4).

ATTACHMENT 3. TECHNICAL DESCRIPTION – AIR COMPRESSOR

Big Bubble Curtain Air Compressor

ST3100



Stage V complaint air compressor designed to support large scale bubble curtain projects. High volume / medium pressure provides optimal FAD for projects even in deep waters (~60metres).

Stackable design allowing clients to optimise available deck space.

For more information on how ScanTech Offshore can add value to your offshore operations, please visit www.scantechoffshore.com or contact our business development team at sales@scantechoffshore.com or call +44 (0) 1493 443300.

Benefits

- Stackable Design (Both CSC & DNV 2.7-1 Compliant)
- Best In Class Emissions
- Unique Patented Cooling Matrix (suitable for placement on vessels with High Sides)

All equipment offered is subject to availability at point of order confirmation.

Technical Information

Model	ST3100
Delivered Flow @ 12 Bar	3100cfm / 87.5m3/min
Delivered Flow @ 14 Bar	2700cfm / 76.4m3/min
Stackable	Yes
Sound Level	Power (Lwa) >90dBA
Fuel Consumption	200 litre per hour
Fuel Tank Capacity	700 litres (designed for auto refuelling set up)
Compressed Air Outlet	4" Fig 206 'Weco Wing'
Compressor Start Up	Electric Start (Standalone)
Ambient Operating Range	-10°C to + 50°C
Emission Compliance	EU Stage V & US EPA Tier 4 Final
Air Quality	Class Zero (ISO8573-1:2010) when operated via ScanTech SeaSentry™

Weight & Dimensions

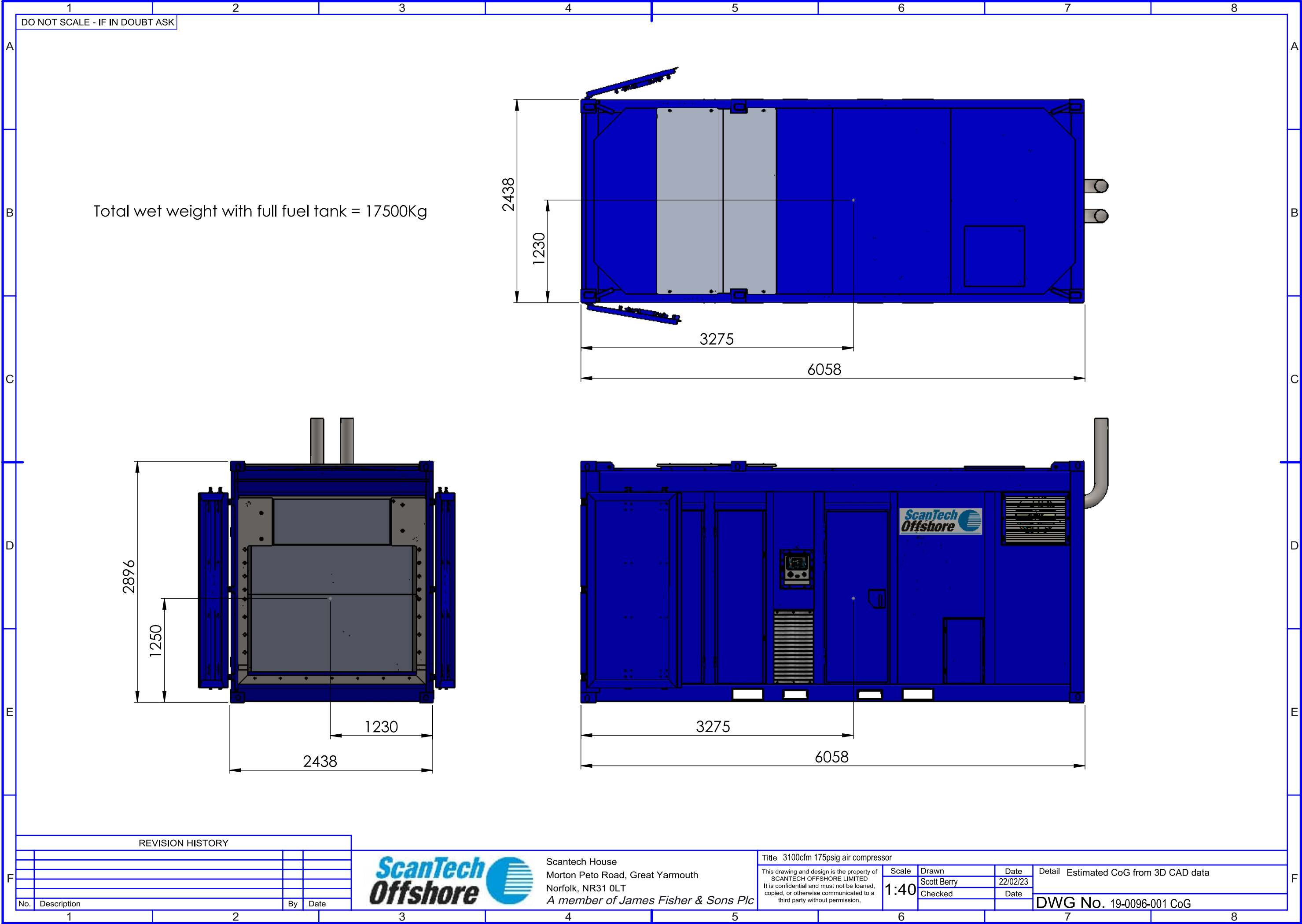
Length	6090mm
Width	2440mm
Height	2896mm
Weight	Gross 16,500kgs
Container Rating	CSC / DNV 2.7-1



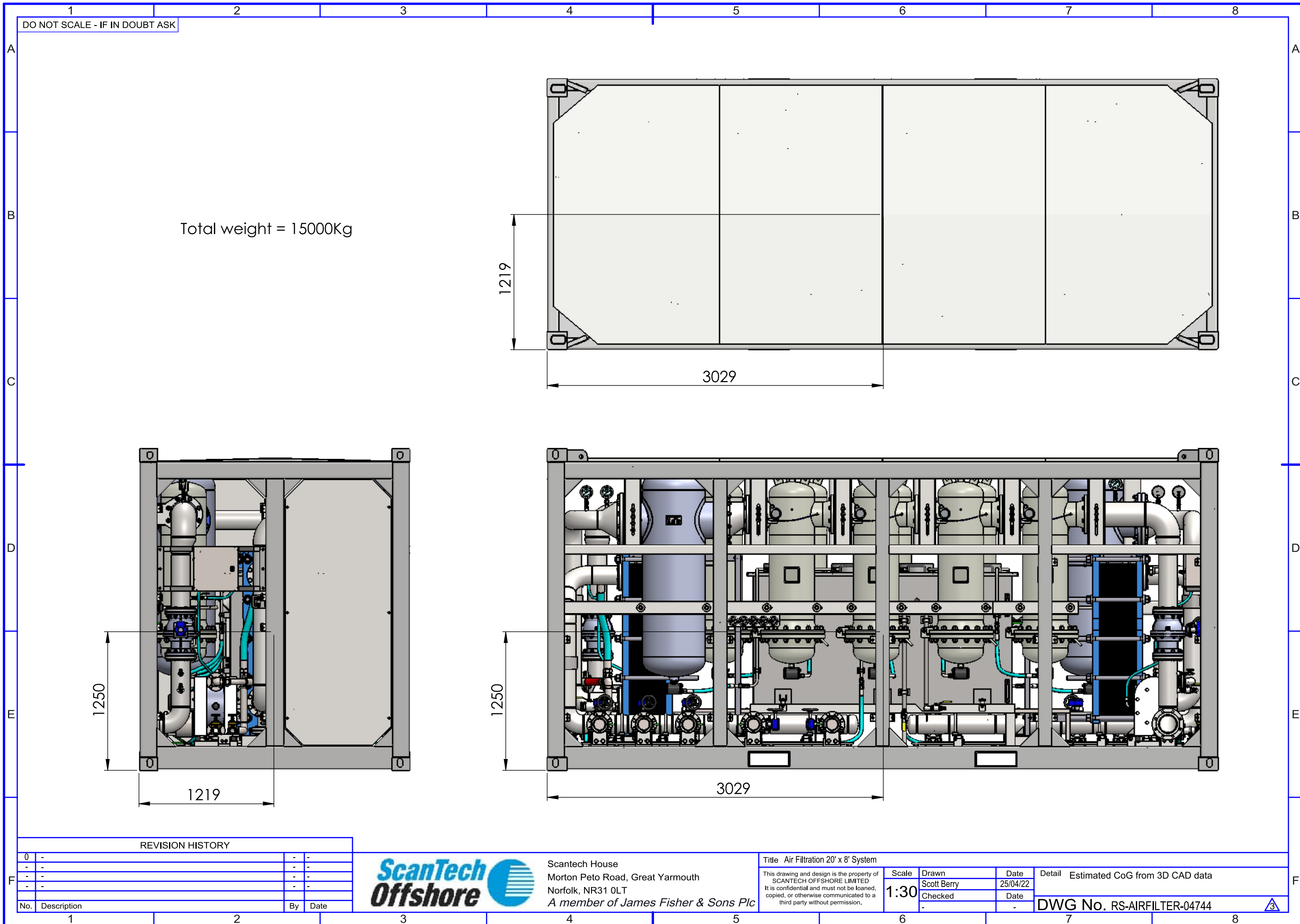
ScanTech Offshore
ScanTech House, Morton Peto Road
Great Yarmouth, NR31 0LT

A part of
James Fisher and Sons plc
Marine Services Worldwide





ATTACHMENT 4. TECHNICAL DESCRIPTION – AIR FILTRATION



ATTACHMENT 5. TECHNICAL DESCRIPTION – SPARE PART LIST

Bernhard Weyres
BEKA-Schallschutzsysteme

check per date

01.12.2022

[illegible]

Spare Parts _Boskalis USA_Winches_Power Packs

14	M10 x 80 screw	20	USA	BBC vessel		v													
15	M10 x 40 screw	300	USA	BBC vessel		v													
16	Nuts M10	300	USA	BBC vessel		v													
17	Nuts M16	50	USA	BBC vessel		v													
18	M16 screws	50	USA	BBC vessel		v													
19	Small grinder discs	20	USA	BBC vessel		open													
20	Big grinder discs	20	USA	BBC vessel		v													
21	Manometer (small and big)	1 + 1	USA	BBC vessel		v													
22	Multi purpose grease	10	USA	BBC vessel		open 7pcs													
23	Chainblock	1	USA	BBC vessel		v													
24	Measure tape	1	USA	BBC vessel		v													
25	Safety harness set	4	USA	BBC vessel		open													
26	Sling 2 m 3 T	2	USA	BBC vessel		v													
27	Sling 3 m 2 T	2	USA	BBC vessel		v													
28	Sling 3 m 5 T	2	USA	BBC vessel		v													

Spare Parts _Boskalis USA_Winches_Power Packs

29	Sling 2 m 1 T	1		USA	BBC vessel		v										
30	Sling 1 m 2 T	1		USA	BBC vessel		v										
31	Cargo strap 5,6 m + racket	4		USA	BBC vessel		v										
32	Cargo strap 7,5 m	2		USA	BBC vessel		v										
33	Cargo strap 9,6 m	1		USA	BBC vessel		v										
34	Cargo strap 8 m	1		USA	BBC vessel		v										
35	Cargo strap 19,5 m	1		USA	BBC vessel		v										
36	Lashing ratchet	4		USA	BBC vessel		v										
37	Spool with wire	200 pcs a 53 cm		USA	BBC vessel		v										
38	Pipe thread sealant	2		USA	BBC vessel		v										
39	Contact spray	1		USA	BBC vessel		v										
40	Electro cleaner	1		USA	BBC vessel		v										
41	Color spray	14		USA	BBC vessel		v										
42	Rostloser	2		USA	BBC vessel		v										
43	WD40	1		USA	BBC vessel		open										

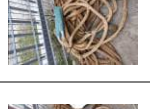
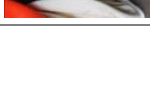
Spare Parts _Boskalis USA_Winches_Power Packs

44	Grease gun	1		USA	BBC vessel		v										
45	Life vest clasp	4		USA	BBC vessel		open										
46	O-ring	1		USA	BBC vessel		v										
47	Seals	7		USA	BBC vessel		v										
48	Spare cable with socket	1		USA	BBC vessel		open										
49	Cable tie	250 pcs		USA	BBC vessel		v										
50	Spare valve handles	2		USA	BBC vessel		v										
51	Extension cord	1		USA	BBC vessel		open										
52	Brushes	3		USA	BBC vessel		v										
53	Securing chain	11		USA	BBC vessel		v										
54	Oil spillage mats	1 box		USA	BBC vessel		v										
55	Oil Absorbent	1		USA	BBC vessel		v										
56	Spare batteries for impact hammer	6		USA	BBC vessel		v										
57	Pneumatic hose	1		USA	BBC vessel		v										
58	Hawsack	1		USA	BBC vessel		v										

Spare Parts _Boskalis USA_Winches_Power Packs

59	Big grinder	1		USA	BBC vessel		v										
60	Small grinder	1		USA	BBC vessel		v										
61	Impact wrench	2		USA	BBC vessel		v										
62	Crimper	2		USA	BBC vessel		v										
63	Cordless screwdriver	2		USA	BBC vessel		v										
64	Crowbar	1		USA	BBC vessel		v										
65	Hose fork	2		USA	BBC vessel		v										
66	Anchor with heaving line	2		USA	BBC vessel		v										
67	Hose connections	15		USA	BBC vessel		v										
68	Shells set	120		USA	BBC vessel		v										
69	Rubber hammer	2		USA	BBC vessel		v										
70	Hammer 5 kg	1		USA	BBC vessel		v										
71	Hammer 1 kg	2		USA	BBC vessel		v										
72	Sprocket	1		USA	BBC vessel		v										
73	Shackles 4,75 t	8		USA	BBC vessel		v										

Spare Parts _Boskalis USA_Winches_Power Packs

74	Shackles 8,5 t	2		USA	BBC vessel		v										
75	Shackles 3,25 t	8		USA	BBC vessel		v										
76	Shackles 2 t	8		USA	BBC vessel		v										
77	Swivel (small and big)	2		USA	BBC vessel		v										
78	Rope 30 m	2		USA	BBC vessel		v										
79	Rope 15 m	1		USA	BBC vessel		v										
80	Rope 10 m	1		USA	BBC vessel		v										
81	Rope 45 m	2		USA	BBC vessel		v										
82	Rope 60 m	1		USA	BBC vessel		v										
83	Spare torpedo	3		USA	BBC vessel		v										
84	Spare shere valve	1		USA	BBC vessel		v										
85	Life vest	5		USA	BBC vessel		open										
86	Polypropylene rope	270 m		USA	BBC vessel		v										
87	Big buoy	3		USA	BBC vessel		v										
88	Small buoy	7		USA	BBC vessel		v										

Spare Parts _Boskalis USA_Winches_Power Packs

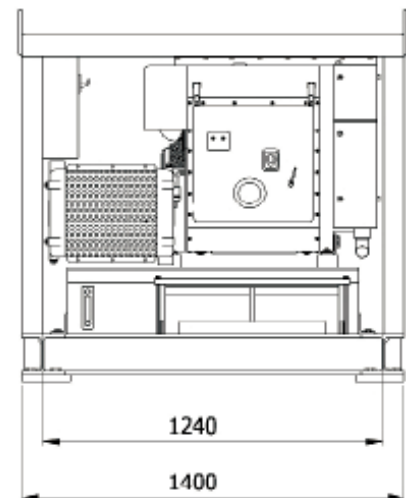
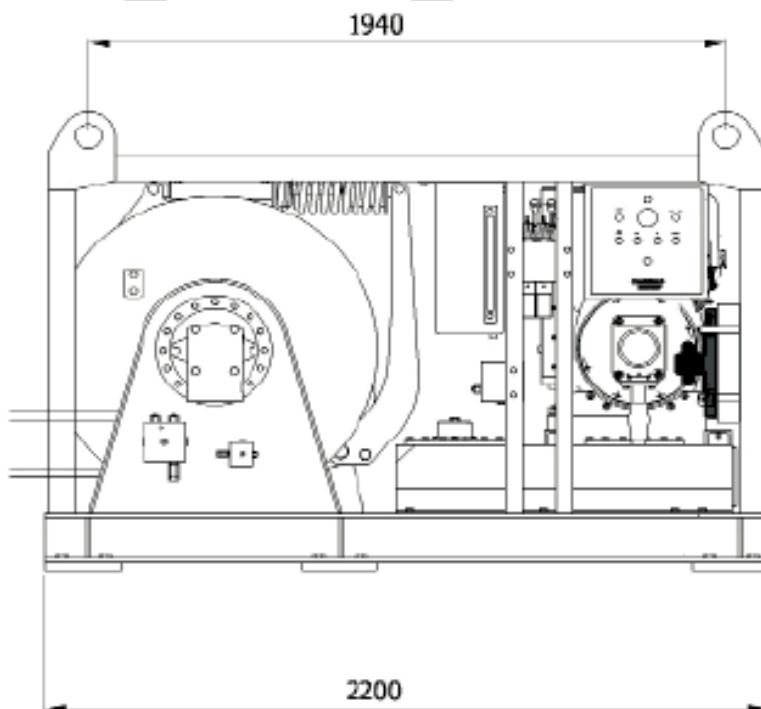
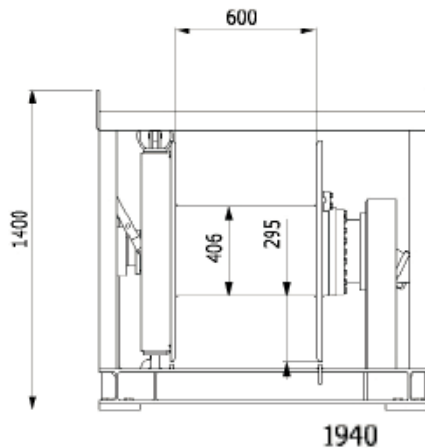
89	Screwdriver	10		USA	BBC vessel		✓												
90	Ladder	1		USA	BBC vessel		✓												
91	Pincers 70 cm	2		USA	BBC vessel		✓												
92	Cuting Pincers	1		USA	BBC vessel		✓												
93	Tool Box	1		USA	BBC vessel		✓												
94	Electrical Tool Box	1		USA	BBC vessel		✓												
95	Chain Conectors	40		USA	BBC vessel		✓												
96	Hydraulic Oil	20 L		USA	BBC vessel		✓												
97	Engine Oil	5 L		USA	BBC vessel		✓												
98	Coolant	10 L		USA	BBC vessel		✓												
99	Battery 12V	1		USA	BBC vessel		✓												
100	Spare Chain 1 M	12		USA	BBC vessel		✓												
101	Wrench Box	1		USA	BBC vessel		✓												
102	Spanner (32, 17, 13, 27, 13, 24,24)	1		USA	BBC vessel		✓												
103	winch bearing	1		USA	BBC vessel		✓												

ATTACHMENT 6. TECHNICAL DESCRIPTION – 12T PULL-IN WINCH

EQUIPMENT BOOK

12 TONNES WINCH EQUIPMENT

Capacity	12 tonnes
Pull	12 tonnes
Brake force	18 tonnes
Brake	Hydraulic release
Wire capacity	400 m of 24 mm steel wire
Speed	10 m per minute on first layer
Drive	Diesel hydraulic
Clutch	Manual
Winch control	Manual and wireless
Number of units	6



Winch mass approx. (excl. wire)	: 2750kg
Pulling force on the 1 st layer	: 12ton
Holding force on the 1 st layer	: 18ton
Wire speed on 1 st layer	: 10m/min
Total wire capacity on winch	: 400m
Wire diameter	: Ø24mm
Controls	: Remote and manual

ATTACHMENT 7. NOISE MITIGATION PERFORMANCE TEST PROPOSAL MEMO

To
ORSTED

From
BOSKALIS

Copy
T. Nagtegaal
R. Groeneveld
K. van Koten
B. Czech
E. van Sloten

Date
11 May 2023

Reference
-

Page
1 | 4

MEMO

Noise Mitigation Performance Test

This memo has been written in order to provide a description of performance testing procedure of Near and Far field noise mitigation systems in the field of SFW as per Employer requirements H13. 3.7.2 M

The noise mitigation systems used during pile driving are the following:

- 1) Near field: Noise Mitigation Screen (NMS) installed on the Motion Compensation Pile Gripper (MCPG) on board the Heavy Lift vessel (HLV). This contains ADBM resonators with additional air supply which are closed around the Mono Pile (MP) and lowered above seabed.

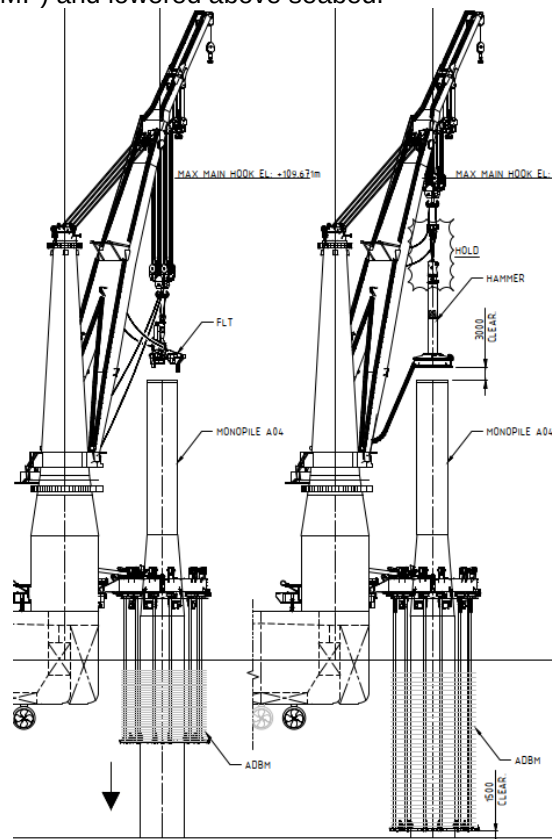


Figure1: NMS screen deployed

- 2) Far field: Double Big Bubble Curtain (DBBC) laid at approx. 60m and 100m radius around the Monopile by a Noise Hose Deployment Vessel (NHDV).

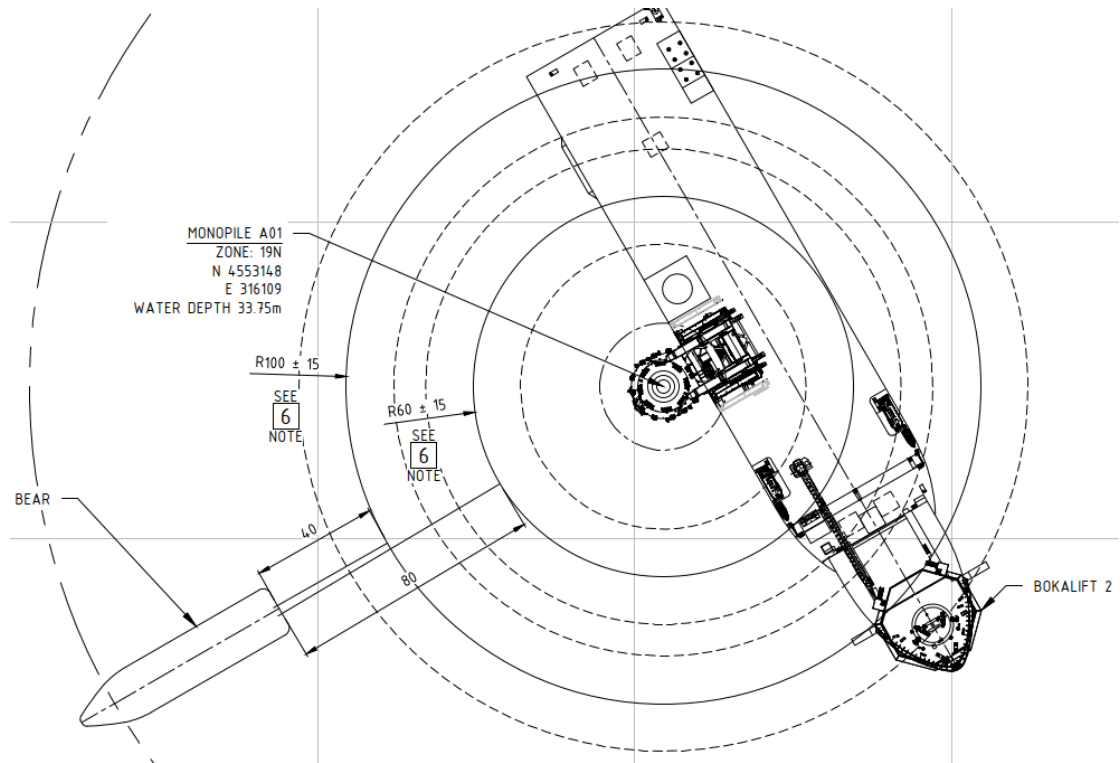


Figure2: DBBC deployed around MP

References:

Boskalis Documents

No.	Document No.	Document Title
1.	0040135-BOS-OPS-MA-0016-01	0040135-BOS-OPS-MA-0016-01 - Offshore Installation Manual - South Fork WTG Monopiles
2.	0040135-BOS-OPS-MA-0103-01	0040135-BOS-OPS-MA-0103-01 - Far Field Noise Mitigation Manual - SFW01

Pre-deployment function test steps and criteria for the Near Field noise mitigation system (final operational steps as per the relevant section of [Boskalis Document Number]). The original intent was to do the test without any MP, however after agreement between Employer and Contractor this will be done during MP installation.

Step:	Description:
1.	Move HLV to installation location
2.	Confirm start-up checklist is completed and MCPG/NMS is operational.
3.	Confirm weather forecast is within acceptable limits
4.	Start-up compressors for NMS. RPM and air-supply of the compressor(s) will be monitored and documented. No flow meter is used for document this.
5.	Start-up MCPG and lower it from transport position into installation position
6.	MCPG lowers NMS screen until the bottom frame is hovering ~ 1m above seabed. During lowering air is supplied (by the compressors on step 4) from bottom frame to the resonators on all upper levels until the splash-zone. Flush hoses prior start pile driving.
7.	Run compressors for 20 minutes.
8.	Turn off NMS compressors and raise the NMS screen.
9.	Receive verbal confirmation from ORSTED that test is successfully completed, and record in HLV DPR
10.	Turn off NMS compressors and raise the NMS screen.
11.	If required raise MCPG to sailing position
12.	Report performance test of NMS system to ORSTED within 12hrs.

Performance test steps and criteria for the Far Field noise mitigation system (final operational steps as per the relevant section of [Boskalis Document Number]). The test as described below will only be performed once, during the performance test, and not for each piling operation.

Step:	Description:
1.	Move Nozzle Hose Deployment Vessel to first installation location
2.	Confirm all vessel systems are operational. RPM and associated air supply will be documented (flow meter will be used). Hoses will be new for the project.
3.	Nozzle Hose Deployment Vessel starts with pre-laying the inner ring. Laying of the inner ring starts and finishes on the same position when the riser hoses are connected to a buoy. A plot from the survey system will be documented to log the sailed track. For detailed steps please Section 7 of 0040135-BOS-OPS-MA-0103-01 - Far Field Noise Mitigation Manual.
4.	NHDV starts with pre-laying the outer ring. Laying of the outer ring starts and finishes on the same position when the riser hoses are connected to a buoy. A plot from the survey system will be documented to log the sailed track. For detailed steps please Section 7 of 0040135-BOS-OPS-MA-0103-01 - Far Field Noise Mitigation Manual in ref. 2.
5.	NHDV retrieves the buoys of the inner & outer riser hoses and connects to the air supply by the compressors.
6.	Start air supply. Flush DBBCs and increase to operational pressure . For detailed steps please Section 7 of 0040135-BOS-OPS-MA-0103-01 - Far Field Noise Mitigation Manual in ref. 2.
7.	Run compressors for trial period from min 20min to max 60min which is considered sufficient for performance testing purposes.
8.	Stop air delivery.
9.	Report delivered air pressure and volume
10.	Receive verbal confirmation from ORSTED that test is successfully completed, and record in HLV DPR
11.	Stop air delivery.
12.	Disconnect air hoses from deck and re-connect them to the buoy.
13.	Report performance test of DBBC system to ORSTED within 12hrs

ATTACHMENT 8. DBBC QUALITY CHECK INTERIM REPORT TEMPLATE

DBBC Quality Check Interim Report (MP Location: xx) – SRW01

PROJECT NAME: Ørsted US Projects
PROJECT NUMBER: P0050247

CLIENT NAME: Ørsted Offshore Wind Power North America LLC



	<i>Stat.</i>	<i>Revision date</i>	<i>Prepared by</i>	<i>Reviewed by</i>		
Rev. 00	IFI	DD-MM-YY	DOCM DBBC	OCM DBBC		

Sunrise Wind 01 (REV01)			
MP Location			
HLV	Bokalift 2	NHDV	Bear

Water Depth & Sea States *at start of operation	Water depth (m)	
	Current speed (knots) *	
	Current direction (deg) *	
	Wave height (m) *	

DBBC	Deployment				Retrieval	
	Inner Ring		Outer Ring			
Date						
Time						
Total Length (m)						
Inspection	Yes ☐	No ☐	Yes ☐	No ☐	Yes ☐	No ☐
Flushing						
Any modification?						
DP Plot of NHDV	As attached		As attached		N/A	

DBBC Operation		
DBBC Operation Start	Date	
	Time	
Piling Operation Start	Date	
	Time	
No. of Compressors Online		
No. of Compressors on Stand-by		
Modifications to compressor spread? (compared to last operation)		
Total Flowrate at Seasentry Outlet (m ³ /min) *min. 519 m ³ /min		
Compressor RPM Reading		

Flowmeter documentation during DBBC Operation

ATTACHMENT 9. DBBC OPERATION REPORT TEMPLATE

DBBC Operation Report (MP Location: xx) – SRW01

PROJECT NAME: Ørsted US Projects
PROJECT NUMBER: P0050247

CLIENT NAME: Ørsted Offshore Wind Power North America LLC



	<i>Stat.</i>	<i>Revision date</i>	<i>Prepared by</i>	<i>Reviewed by</i>		
Rev. 00	IFI	DD-MM-YY	DOCM DBBC	OCM DBBC		

Sunrise Wind 01 (REV01)			
MP Location			
HLV	Bokalift 2	NHDV	Bear

Water Depth & Sea States *at start of operation	Water depth (m)	
	Current speed (knots) *	
	Current direction (deg) *	
	Wave height (m) *	

DBBC	Deployment				Retrieval	
	Inner Ring		Outer Ring			
Date						
Time						
Air Supply Hose Length (m) / Total Length (m)						
Hole diameter (mm)						
Hole spacing (mm)						
Inspection	Yes ☐	No ☐	Yes ☐	No ☐	Yes ☐	No ☐
Flushing						
Any modification?						
DP Plot of NHDV	As attached		As attached		N/A	

DBBC Operation		
DBBC Operation Start	Date	
	Time	
Piling Operation Start	Date	
	Time	
No. of Compressors Online		
No. of Compressors on Stand-by		
Modifications to compressor spread? (compared to last operation)		
Total Flowrate at Seasentry Outlet (m ³ /min) *min. 519 m ³ /min		
Compressor RPM Reading		

Winches and Hoses Spread Inspection and Maintenance Report

Compressor Spread Inspection and Maintenance Report

Flowmeter documentation during DBBC Operation

Compressors RPM Reading during DBBC Operation

DP Plot of NHDV upon Hoses Deployment