Gorgon Gas Development and Jansz Feed Gas Pipeline

Environmental Performance Report 2022

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1 Introduction

1.1 Proponent

Chevron Australia Pty Ltd (CAPL) is the Proponent and the person taking the action for the Gorgon Gas Development and Jansz Feed Gas Pipeline (collectively referred to hereafter as the Gorgon Gas Development [the ‘Project’]) on behalf of these companies (collectively known as the Gorgon Joint Venture Participants):

- Chevron Australia Pty Ltd
- Shell Australia Pty Ltd
- Mobil Australia Resources Company Pty Ltd
- Osaka Gas Gorgon Pty Ltd
- Tokyo Gas Gorgon Pty Ltd
- JERA Gorgon Pty Ltd.

1.2 Purpose of this Environmental Performance Report

CAPL, as the Proponent, is required to prepare an Environmental Performance Report (EPR) in accordance with:

- Condition 5 and Schedule 3 of Ministerial Statement (MS) 800 (and Condition 2 of MS 965)
- Condition 5 and Schedule 3 of MS 769
- Condition 4 and Schedule 3 of EPBC 2003/1294
- Condition 4 and Schedule 3 of EPBC 2008/4178
- relevant systems, programs, and plans as amended or replaced from time to time approved under MS 800, MS 769, MS 965, and EPBC 2003/1294 and 2008/4178.

1.3 Contents of this EPR

This EPR covers the period from 10 August 2021 to 9 August 2022 (the ‘Reporting Period’) unless otherwise stated. Table 1-1 lists the State and Commonwealth Condition requirements of this EPR and the sections in this EPR that fulfil them. This includes the EPR requirements under Schedule 3 of MS 800, MS 769, EPBC 2003/1294, and EPBC 2008/4178 and any additional EPR commitments contained in relevant systems, programs, and plans.

Table 1-1: Environmental Performance Reporting Requirements Addressed in this EPR

Environmental Aspect	MS 800	MS 769	EPBC 2003/1294	EPBC 2008/4178	EMP Commitment	Section in this EPR
Terrestrial and Subterranean Environment State	✓	✓	✓	✓	✓	2
Terrestrial and Marine Quarantine (including weed management)	✓		✓	✓		3
Marine Turtles (including light and noise management)	✓		✓	✓		4
Short-range Endemics and Subterranean Fauna	✓		✓	✓		5
Fire Management	✓	✓	✓	✓		6
Carbon Dioxide Injection Project			✓	✓		7
Air Quality	✓					8
Coastal Stability	✓		✓	✓		9
Terrestrial Rehabilitation	✓				✓	10
Spill Management		✓				11

1.4 Project

CAPL is developing the gas reserves of the Greater Gorgon Area. The gas is processed in a Gas Treatment Plant (GTP) on Barrow Island, which is located off the Pilbara coast 85 km north-north-east (NNE) of Onslow in Western Australia (WA) (Figure 1-1).

Subsea gathering systems and pipelines deliver feed gas from the Gorgon and Jansz–Io gas fields to the west coast of Barrow Island. The underground feed gas pipeline system then traverses Barrow Island to the GTP on the east coast. The GTP includes natural gas trains that produce liquefied natural gas (LNG), condensate and domestic gas (DomGas). Carbon dioxide (CO_2), which occurs naturally in the feed gas, is separated during the production process, and injected into deep rock formations below Barrow Island. The LNG and condensate are loaded onto tankers from a jetty, and then transported to international markets. Gas for domestic use is exported by pipeline from Barrow Island to the DomGas collection and distribution network on the WA mainland.

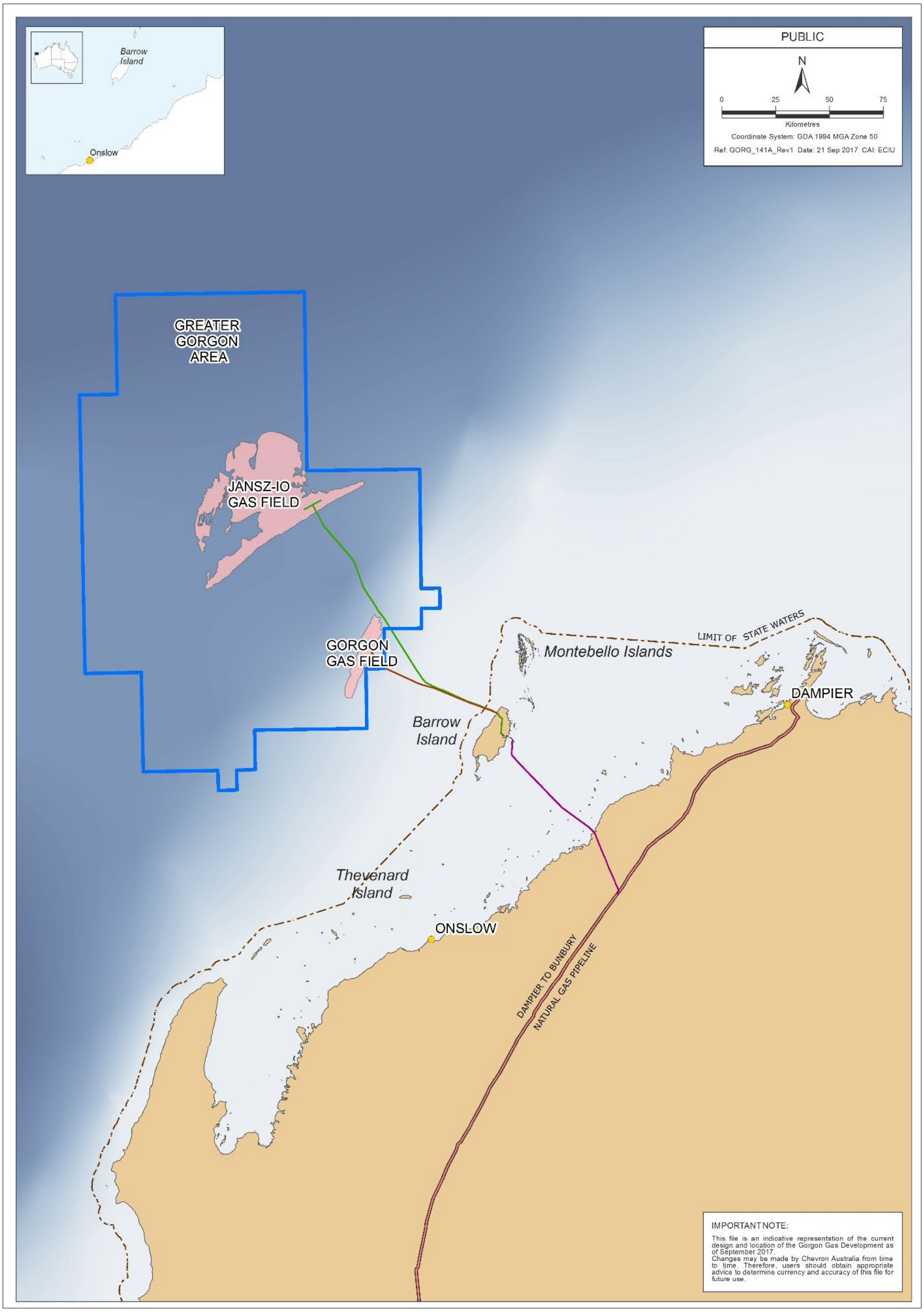

Figure 1-1: Location of Gorgon Gas Development and Greater Gorgon Area

1.4.1 Status of Implementation

Construction of the Gorgon Gas Development commenced in December 2009 and three train LNG operations began in July 2018. In the last 12 months:

- Scheduled major maintenance ‘turnarounds’ have been completed on all three LNG trains. Turnarounds are routine major maintenance shutdowns, which involve numerous inspections, repairs, and equipment changeouts.
- The Gorgon Joint Venture announced it will proceed with the Jansz–Io Compression Project.
- As of October 2022, almost 7 million tonnes of greenhouse gas (GHG) (carbon dioxide equivalent [CO_2e]) have been injected since safely starting the CO_2 injection system in 2019.
- The Gorgon DomGas facilities have delivered natural gas to WA since 2016. The DomGas Plant can produce up to 300 TJ/day of domestic gas.

2 Terrestrial and Subterranean Environment State

Table 2-1: EPR Requirements for Terrestrial and Subterranean Environment

Item	Source	Section in this EPR
Results of monitoring and any measurable impacts from the Project, including any changes from the baseline	MS 800, Schedule 3(1i) MS 769, Schedule 3(1i) EPBC 2003/1294 and 2008/4178, Schedule 3(1i)	2.1
Conclusions as to the Project stressors (if any) causing the impacts identified	MS 800, Schedule 3(1ii) MS 769, Schedule 3(1ii) EPBC 2003/1294 and 2008/4178, Schedule 3(1ii)	Not applicable (N/A)[1]
Any mitigation measures applied during the Reporting Period, and results of that mitigation	MS 800, Schedule 3(1iii) MS 769, Schedule 3(1iii) EPBC 2003/1294 and 2008/4178, Schedule 3(1iii)	N/A[2]
Any changes to monitoring sites	MS 800, Schedule 3(1iv) MS 769, Schedule 3(1iv) EPBC 2003/1294 and 2008/4178, Schedule 3(1iv)	2.1
Any changes to monitoring sites below the minimum number required	Terrestrial and Subterranean Environment Monitoring Program (TSEMP) (Ref. 1), Section 3.4	N/A[3]
Any changes to ecological elements	TSEMP (Ref. 1), Section 5	2.1
Threatened or listed fauna cared for, injured, or killed within the Terrestrial Disturbance Footprint (TDF)	Terrestrial and Subterranean Environment Protection Plan (Ref. 2), Section 7.2	2.2

1 *No Project-related adverse impacts to ecological elements (as listed in Condition 6.1 of MS 800 and MS 769, and Condition 5.1 EPBC 2003/1294 and 2008/4178) were identified outside the TDF during the Reporting Period; therefore, reporting is not applicable at this time.*

2 *No mitigation measures were implemented in response to Project-related adverse impacts outside the TDF during the Reporting Period; therefore, reporting is not applicable at this time.*

3 *No changes were made to the TSEMP monitoring sites during the Reporting Period.*

2.1 Monitoring Results

The objective of the Terrestrial and Subterranean Environment Management Plan (TSEMP; Ref. 1), as defined by Ministerial Conditions, is to establish a statistically valid ecological monitoring program to detect any Material or Serious Environmental Harm to the ecological elements outside the TDF.

The ecological elements considered at risk from the Gorgon Gas Development that require monitoring on Barrow Island are listed in the TSEMP (Ref. 1).

At Risk zones (located within the relevant TDF—a zone where potential impacts are predicted to occur) and Reference zones (located in comparable areas beyond the TDF) were established for each monitoring program to detect changes attributable to Gorgon Gas Development activities.

Where applicable, monitoring data are presented in time-series control charts, which are used to diagnose trends in population abundance. Trends identified in control charts act as early-warning signals to guide a tiered management approach. A management response is triggered if a parameter demonstrates a trend towards or changes beyond statistical deviations (± 1, ± 2, or ± 3 statistical deviations [e.g. standard deviation (SD)]) from baseline conditions or other reference point (e.g. the zero centre-line of a ratio).

Since 2016, annual differences between the standardised At Risk and Reference zone population density metric (standardised density difference ratio) have been applied to control charts for mammals and birds to improve the diagnosis of trends. Alternative analyses are applied to groundwater and surface water landform monitoring data, where control charting is inappropriate for comparing trends over time.

Vegetation monitoring is undertaken every two years—it was last completed in 2021 and reported on that same year; therefore, conducting vegetation monitoring and reporting on it was not required during this Reporting Period.

The 2021–2022 monitoring results for the ecological elements listed in the TSEMP (Ref. 1) are summarised in the following tables.

Ecological Element: White-winged Fairy-wren (Barrow Island)
Objective
Detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time
Changes to Monitoring Sites
There were no substantial changes to monitoring sites in 2021.
Methodology
• Survey method: Diurnal distance sampling across 26 transects (each up to 12.9 km long and orientated east–west at 500 m spacing across Barrow Island) to compare the densities of White-winged Fairy-wrens (WWFWs) within the At Risk and Reference zones during September 2021. The combined total length of the transects was 219 km (129 km in the Reference zone; 90 km in the At-Risk zone). The locations of observed WWFWs along the transects were recorded by taking a GPS fix at the location of the animal. • Analysis method: WWFW observations were converted to density estimates using distance sampling software, with a truncation distance of 52 m applied. Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time.
Results
• In 2021, the estimated density of WWFWs within the Reference zone was 0.07 (± 0.03) individuals per hectare (ind/ha) and the estimated density within the At-Risk zone was 0.30 (± 0.07) ind/ha. • In 2021, the estimated abundance of WWFWs within the Reference zone was 1,109 ± 475 individuals and the estimated abundance within the At-Risk zone was 3,156 ± 720 individuals. • The Barrow Island-wide density estimate slightly decreased from 0.20 (± 0.04) ind/ha in 2020 to 0.17 (± 0.04) in 2021, with an overall population estimate of 4,265 (± 597) WWFWs, similar to that recorded in 2019. • The ratio between the estimated At Risk and Reference zone densities increased from 2.68 in 2020 to 4.30 in 2021 because of a larger decrease in the density within the Reference zone relative to the At-Risk zone. This was the highest At Risk to Reference ratio since annual monitoring began in 2009. As a result, the exponentially weighted moving average (EWMA) metric exceeded the +1 SD alert (Figure 2-1).
Conclusions
• The density of WWFWs within the At-Risk zone has always been greater than that within the Reference zone (Figure 2-2) due to a highly correlated association with their preferred habitat, *Melaleuca cardiophylla*, which is more prominent within the At-Risk zone. • An overall declining trend in density and abundance estimates of WWFWs has been observed over time within both zones. Because the slope of the declines did not differ significantly between the 2 zones, this trend is more likely due to broad environmental conditions rather than any Project-related effects. Rainfall and other natural events may partially explain the declining trends in estimated densities and overall population abundance over time. • More recently, density and abundance estimates have decreased in the Reference zone compared to a general increase in the At-Risk zone; island-wide estimates have remained relatively stable. Although the reason for this is difficult to determine, it may be related to the movement of individuals between zones, possibly due to localised habitat preferences and/or food resources and availability. • There appear to be no impacts on WWFWs that were attributable to the Gorgon Gas Development during the Reporting Period.

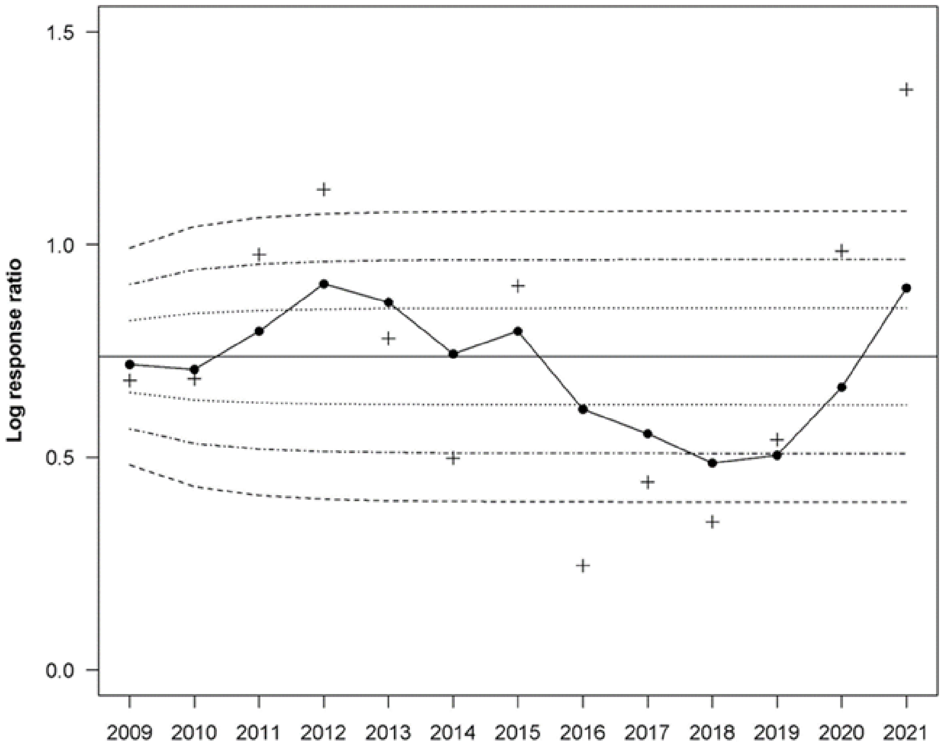

Figure 2-1: EWMA Control Chart for White-winged Fairy-wren Density at Barrow Island

The response variable is the log of the At Risk: Reference zone density estimate ratio.

EWMA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD

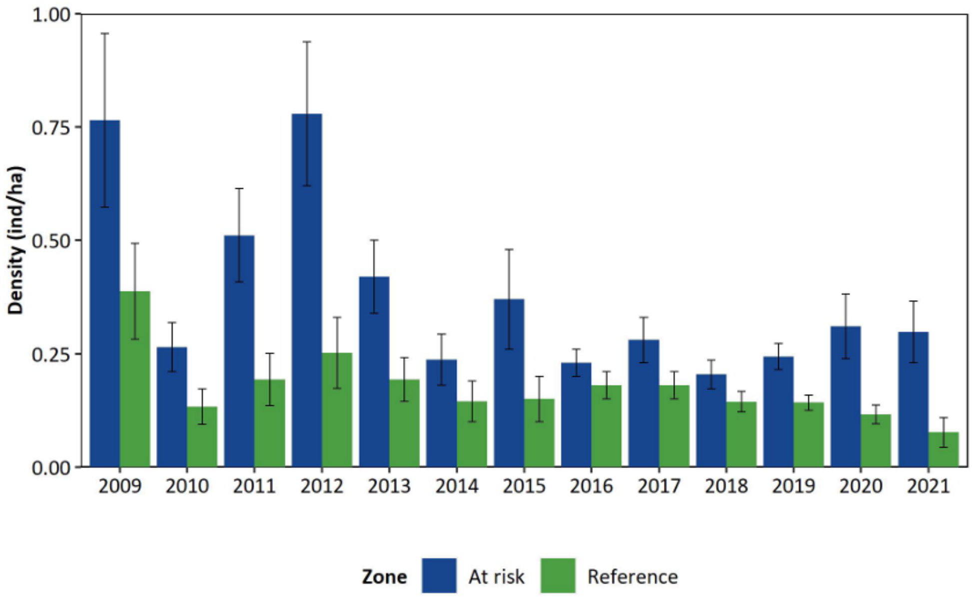

Figure 2-2: Annual Estimates of White-winged Fairy-wren Densities within the At Risk and Reference Zones

Monitoring Program: Euro (Barrow Island)
Objective
Detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
• Monitoring of Barrow Island Euros was conducted over two survey periods in 2021 —one diurnal and one nocturnal. Despite the 2020 surveys using nocturnal data, in 2021 the data from nocturnal observations exhibited poor model fit due to a U-shaped pattern in observations, with highest number of observations recorded on the transect and some distance from the transect (~45 m). In contrast, the diurnal data exhibited the desirable distribution with numbers of observations declining with distance from the transect. Therefore, analysis was performed only using the diurnal records.
Methodology
• Survey method: Diurnal distance sampling across 26 transects (each up to 12.9 km long and orientated east–west at 500 m spacing across Barrow Island) to compare the densities of Barrow Island Euro within the At Risk and Reference zones during September 2021. The combined total length of the transects was 219 km (90 km in the Reference zone; 129 km in the At-Risk zone). The locations of observed Barrow Island Euros along the transects were recorded by taking a distance and bearing from the observer to the animal to minimise any disturbance to the animal. • Analysis method: Barrow Island Euro observations were converted to density estimates using distance sampling software, with a truncation distance of 40 m applied. Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time. • An aerial survey technique utilising an unmanned aircraft coupled with a thermal camera was trialled in the Reporting Period to improve detections of Barrow Island Euros. Data was analysed using the same distance sampling software and results compared with the existing on-ground survey method.
Results
• In 2021, the estimated density of Barrow Island Euros within the Reference zone was 0.09 (± 0.01) ind/ha and the estimated density within the At-Risk zone was 0.06 (± 0.03) ind/ha. • The Barrow Island-wide density estimate decreased from 0.14 (± 0.03) ind/ha in 2020 to 0.08 (± 0.02) in 2021, with an overall population estimate of 1,985 (± 415.3) Barrow Island Euros. • The EWMA metric exceeded the −1 SD trigger level for the ratio of At Risk and Reference population density for the second consecutive year because of a larger proportional decrease in the Reference density (47% decrease) compared to the At Risk density (33% decrease) from 2020 to 2021 (Figure 2-3).
Conclusions
• In the initial monitoring years (2010–2012), the At-Risk zone supported a greater density of Barrow Island Euros. Since 2013 this relationship has reversed and stabilised, representing a potential shift in relative distribution of Barrow Island Euro from the At Risk zone to Reference zone where they are found in higher abundance (Figure 2-4). • The island-wide population estimate for Barrow Island Euros has been relatively stable over time, with 2020 being unusually high, and 2021 recording the second highest population estimate since monitoring began. • The EWMA control chart metric exceeded the −1 SD alert trigger for the second consecutive year because of the proportionally larger Barrow Island Euro abundance decrease within the Reference zone relative to the At-Risk zone, and the weighting in the EWMA metric from previous values. • The trial of a new survey technique utilising unmanned aircraft and thermal imagery proved successful and will be the preferred survey method in 2022. • Monitoring has not detected an adverse variation in abundance (attributable to the Gorgon Gas Development) to the Barrow Island Euro population during the Reporting Period.

Figure 2-3: EWMA Control Chart for Barrow Island Euro Density at Barrow Island

The response variable is the log of the At Risk: Reference zone density estimate ratio.

EWMA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

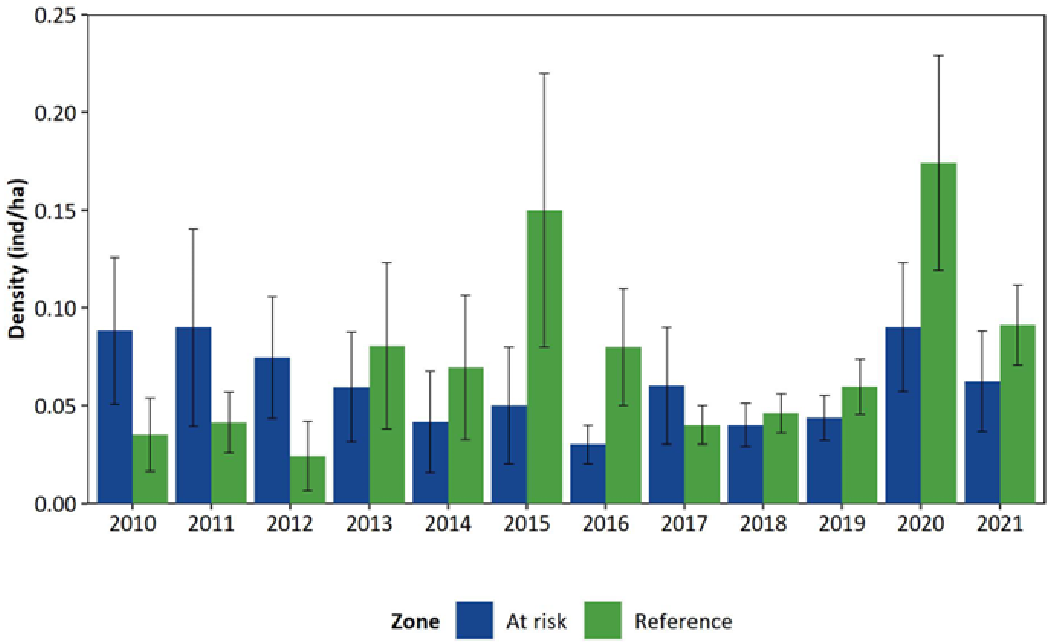

Figure 2-4: Annual Estimates of Barrow Island Euro Densities within the At Risk and Reference Zones

Monitoring Program: Spectacled Hare-wallaby (Barrow Island)
Objective
Detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
There were no substantial changes to monitoring sites in 2021.
Methodology
• Survey method: Nocturnal distance sampling across 24 transects (each up to 12 km long and orientated east–west at 500 m spacing across Barrow Island) to compare the densities of Spectacled Hare-wallaby within the At Risk and Reference zones during June 2021. The combined total length of the transects was 182 km (109 km in the Reference zone; 73 km in the At-Risk zone). The locations of observed wallabies along the transects were recorded by taking a distance and bearing from the observer to the animal to minimise any disturbance to the animal. • Analysis method: Spectacled Hare-wallaby observations were converted to density estimates using distance sampling software, with a truncation distance of 31 m applied. Changes in relative density were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time. • An aerial survey technique utilising an unmanned aircraft coupled with a thermal camera was trialled in the Reporting Period to improve detections of Spectacled Hare-wallabies. Data was analysed using the same distance sampling software and results compared with the existing on-ground survey method.
Results
• The estimated density of Spectacled Hare-wallaby was greater within the Reference zone at 0.48 (± 0.18) ind/ha compared to 0.37 (± 0.13) ind/ha within the At Risk zone (Figure 2-5, Figure 2-6). • The Barrow Island-wide density estimate decreased from 0.60 (± 0.09) ind/ha in 2020 to 0.44 (± 0.07) in 2021, with an overall population estimate of 10,967 (± 1,562) individuals. • The ratio between the estimated At Risk and Reference zone densities has increased for the fourth consecutive year to a value of 0.77 because of a larger relative decrease in the density within the Reference zone relative to the At-Risk zone. Therefore, the EWMA metric has remained within control limits (Figure 2-5).
Conclusions
• The 2021 monitoring indicated that the measured parameter for Spectacled Hare-wallabies is within control limits. A slight decrease in the density of Spectacled Hare-wallabies occurred across Barrow Island and within both the At Risk and Reference zones when compared to the 2020 monitoring data. • Rainfall and other natural events partially explain the trends in estimated densities and overall population abundance over time. Lower densities in the overall population may be the result of a lag effect of 3 years of below average rainfall from 2018–2020. • The trial of a new survey technique utilising unmanned aircraft and thermal imagery proved successful and will be the preferred survey method in 2022. • Monitoring has not detected an adverse variation in abundance (attributable to the Gorgon Gas Development) to the Barrow Island Spectacled Hare-wallaby population during the Reporting Period.

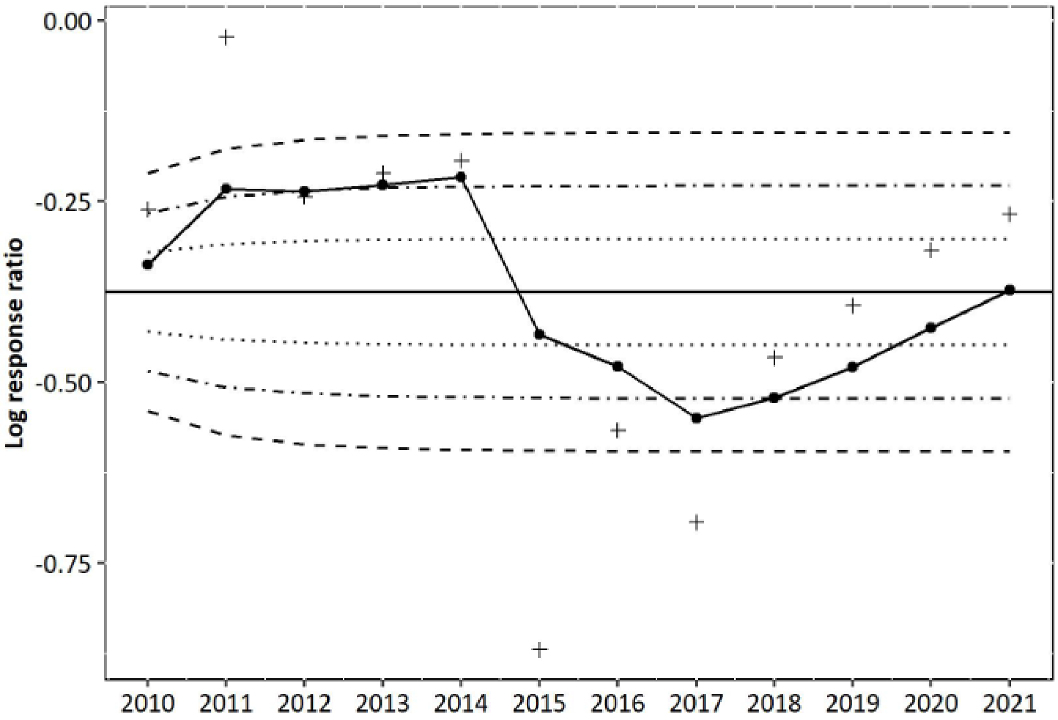

Figure 2-5: EWMA Control Chart for Spectacled Hare-wallaby Density at Barrow Island

The response variable is the log of the At Risk: Reference zone density estimate ratio.

EWMA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

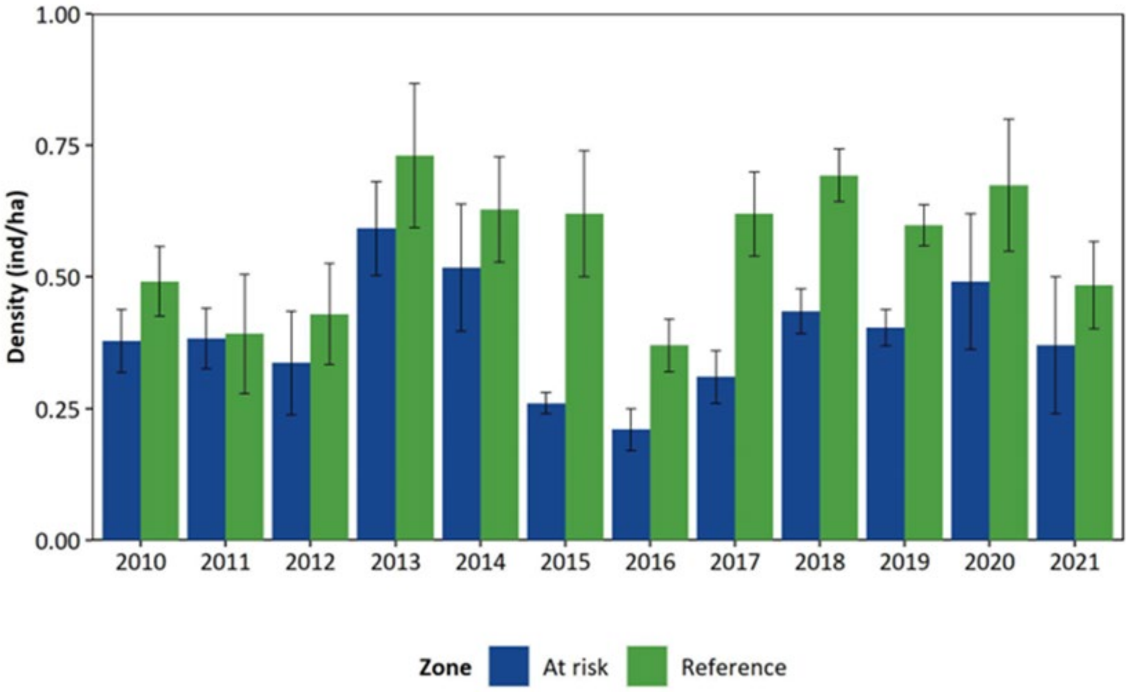

Figure 2-6: Annual Estimates of Spectacled Hare-wallaby Densities within the At Risk and Reference Zones

Monitoring Program: Burrowing Bettong (Boodie) (Barrow Island)
Objective
Detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
• There were no substantial changes to monitoring sites in 2021. All warrens sampled have a trapping history and represent a subsample of known Burrowing Bettong warrens.
Methodology
• Survey method: Annual capture-mark-recapture sampling using baited cage traps at 25 active Burrowing Bettong warrens (ten in the Reference zone, 15 in the At-Risk zone) for three consecutive nights in August 2021. • Analysis method: The capture-mark-recapture analyses included all capture histories from available data for the 25 sampled warrens using a robust Huggins model design, which included a closed population component (across nights) and open population component (across years) to derive 'at warren' abundance estimates. Changes in relative abundance were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time. • Note: The analyses included capture histories from 2012 and 2015–2021. Data from 2013 and 2014 was unavailable at the time of analysis and was treated as missing data for this analysis. To account for differences in number of traps and number of trapping nights across years, all historical data from warrens that were not monitored in 2021 were excluded from the analysis, and only data from the first 3 nights of trapping for each warren were retained to align with the most recent sampling design.
Results
• The EWMA control chart for Burrowing Bettong abundance at monitored warrens remained in control for the 2021 monitoring period (Figure 2-7). • From 2018 to 2020 a decline was observed in the abundance estimates at warrens in both zones, followed by an increase at both zones in 2021. However, the rate of increase was greater within the Reference zones, resulting in a decrease in the At Risk to Reference ratio shown in Figure 2-7. • A slight increase was observed in the abundance estimates at monitored warrens during the 2021 monitoring period in both the At Risk and Reference zones (Figure 2-8). • When considering the total (raw) number of Burrowing Bettongs captured, the At-Risk zone warrens have shown a decline since 2014, with a slight recovery in 2018 before a decline in recent years. The decline in 2020 and 2021 is largely a reflection of a reduced number (approximately half) of warrens previously sampled. When the total raw number of Burrowing Bettongs was converted to a density of Burrowing Bettongs per warren to account for the different number of warrens monitored each year, it followed a similar trend to the raw numbers. A general declining trend has occurred at both At Risk and Reference warrens since 2012, with a slight increase in 2018 within both zones and then again in 2020 for At Risk warrens and 2021 for Reference warrens. Further standardising the data for trapping effort (to be expressed as number per trap night), the declining trend was also evident from 2012 to 2019 within both zones, before a sharp increase in 2020. The apparent large increase in capture rate in recent years is unlikely to correspond to such a large increase in the overall abundance, although it is an indication of an increasing number of Burrowing Bettongs, particularly in 2021. • Some Burrowing Bettong warrens within the At-Risk zone have recorded continued declines over the ten years of monitoring (e.g. B016, B034, B035, B101 and B128), independent of any overall increases over the years. Similarly, some warrens within the Reference zone have experienced declines in individuals (e.g. B001, B007 and B063). Conversely, other Burrowing Bettong warrens close to roads and infrastructure within the At-Risk zone (e.g. B012 and B038) recorded increased numbers of individuals, with the highest number of individuals (17 and 21 respectively) recorded at these warrens in 2021. • In 2021, 12 warrens recorded an increase in the number of individuals from 2020 to 2021—six Reference warrens (B001, B061, B062, B064, B069 and B070) and six At Risk warrens (B009, B012, B013, B035, B038 and B071). Conversely, eight warrens recorded a decrease in the number of individuals from 2020 to 2021—four Reference warrens (B002, B005, B006 and B063) and four At Risk warrens (B016, B039, B101 and B128). When adjusted for trap nights, the lowest numbers of Burrowing Bettongs since monitoring began were recorded in 2021 at three At Risk warrens (B016, B034 and B101). No Burrowing Bettongs were recorded at two Reference warrens (B006 and B063)—this is not unusual because both warrens had little activity in recent years.

Monitoring Program: Burrowing Bettong (Boodie) (Barrow Island)
Conclusions
• Rainfall and other events partially explain the trends in abundance and survivorship estimates over time. Recent declines in abundance (2018–2020) within both zones are likely due to three consecutive years of well below average rainfall. An increase in abundance estimates in 2021, with the highest survivorship estimates since monitoring began, is likely due to significant amounts of summer rainfall. Similarly, historical changes in abundance estimates can be partly explained by rainfall but may also be due to other more localised events, although such events could not be determined. Using the supplied data, there appears to be no detectable impact to individual warrens from vehicle strikes additional to the decline in abundance observed that was attributed to broad environmental conditions. • No impacts on Burrowing Bettongs appear to be attributable to the Gorgon Gas Development in 2021; the At Risk to Reference abundance ratio is within control limits. Despite this, the number of individuals caught at each warren varied, which has also been observed in other studies of Burrowing Bettongs on Barrow Island. Interpretation of this variation is difficult because individuals may move between warrens, not all warrens are monitored or known, population changes can be influenced by broad environmental conditions but also may be highly localised to a warren, and there may be other unknown factors (including natural movements) affecting these warrens.

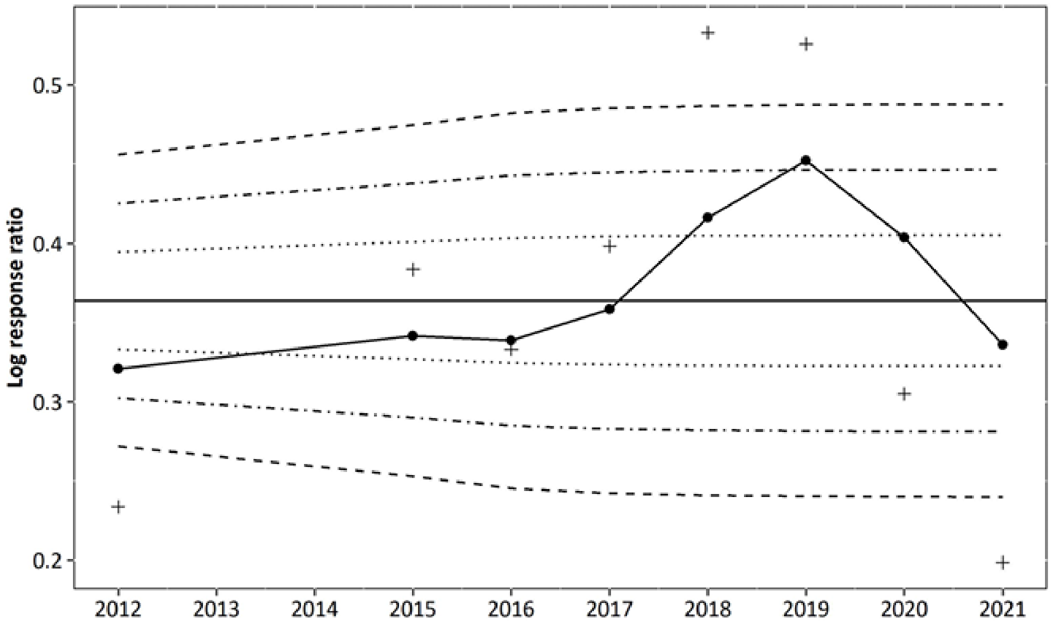

Figure 2-7: EWMA Control Chart for Burrowing Bettong (Boodie) Abundance at Monitored Warrens

The response variable is the log of the At Risk: Reference zone abundance estimate ratio.

EWMA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

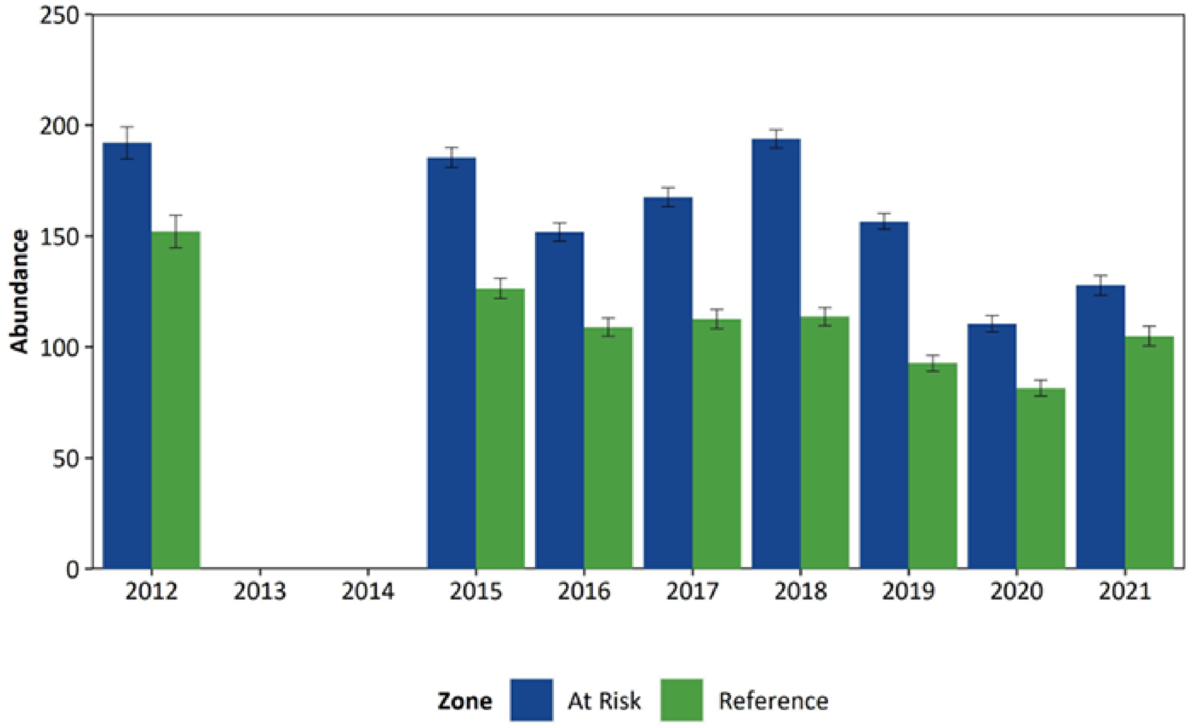

Figure 2-8: Annual Estimates of Burrowing Bettong Abundance at Monitored Warrens within the At Risk and Reference Zones

Note: See Methodology section for details on the missing 2013 and 2014 data.

Ecological Element: Golden Bandicoots
Objective
Detect variation in abundance—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
• Methods largely followed those of the most recent Golden Bandicoot monitoring survey in 2017 with a slight variation in the number of Reference zone trapping grids (nine in 2021 compared to 12 in 2017).
Methodology
• Monitoring of the Barrow Island Golden Bandicoot is required 'At least every five years or in response to three consecutive years of above or below average annual rainfall.' Barrow Island experienced three consecutive years of below average rainfall (2018, 2019 and 2020), therefore triggering the Golden Bandicoot Monitoring Program in 2021. • Survey method: Spatially explicit capture-recapture using baited Elliott traps at 21 trapping grids (12 in the At-Risk zone; nine in the Reference zone) for five consecutive nights in July 2021. • Analysis method: The spatially explicit capture-recapture analyses included all available capture history data (2016, 2017 and 2021 capture histories). Densities were estimated using the 'secr' package in R statistical software. Changes in relative abundance were determined by the degree of variation observed between At Risk and Reference zones and were plotted using time-series control charts to understand trends in abundance between zones over time.
Results
• The estimated density of Golden Bandicoots was similar within the Reference zone at 4.24 (± 0.31) ind/ha compared to 4.63 (± 0.27) ind/ha within the At Risk zone ((Figure 2-9, Figure 2-10). • The Barrow Island-wide density estimate increased significantly from 2.58 (± 0.54) ind/ha in 2017 to 4.17 (± 0.213) ind/ha in 2021, with an overall population estimate of 97,369 (± 4,974) Golden Bandicoots, the highest recorded since monitoring began in 2012. • The ratio between the estimated At Risk and Reference zone densities was relatively similar (1.09 At Risk: Reference), and as a result the EWMA metric has returned to within control limits following −1 SD exceedances in 2016 and 2017 (Figure 2-9).
Conclusions
• The 2021 monitoring indicated that the measured parameter for Golden Bandicoots is in control, with the ratio of population densities in the At Risk to Reference zone within control limits. A marked increase occurred in the estimated density and population size of Golden Bandicoots across Barrow Island and within both the At Risk and Reference zones when compared to all previous monitoring data. • Rainfall and other natural events are strong influencers in density estimates and overall population abundance over time. In this instance, increased densities in the overall population are likely to be the result of greater than average rainfall in the preceding six to seven months, despite the three years of below average annual rainfall from 2018–2020. • There appear to be no impacts attributable to the Gorgon Gas Development on Golden Bandicoots in 2021 as the At Risk to Reference density ratio is within control limits.

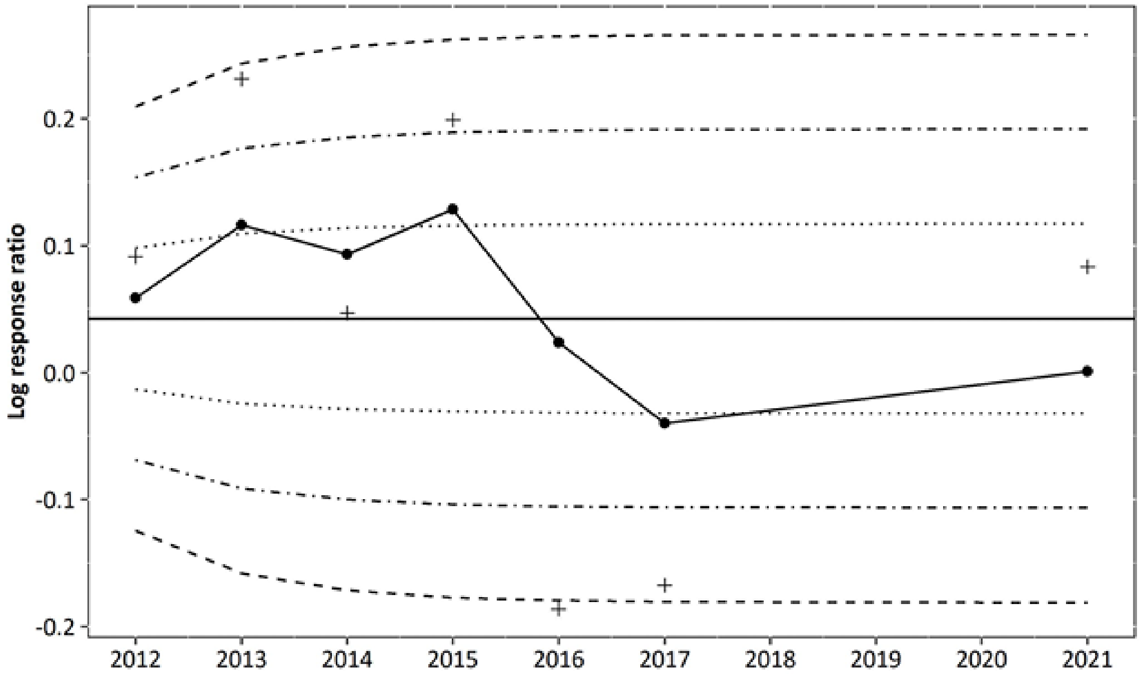

Figure 2-9: EWMA Control Chart for Golden Bandicoots

The response variable is the log of the At Risk: Reference zone abundance estimate ratio.

EWMA Chart: + = log ratio of observed data; • = smoothed standardised difference metric based on exponentially weighted 3-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

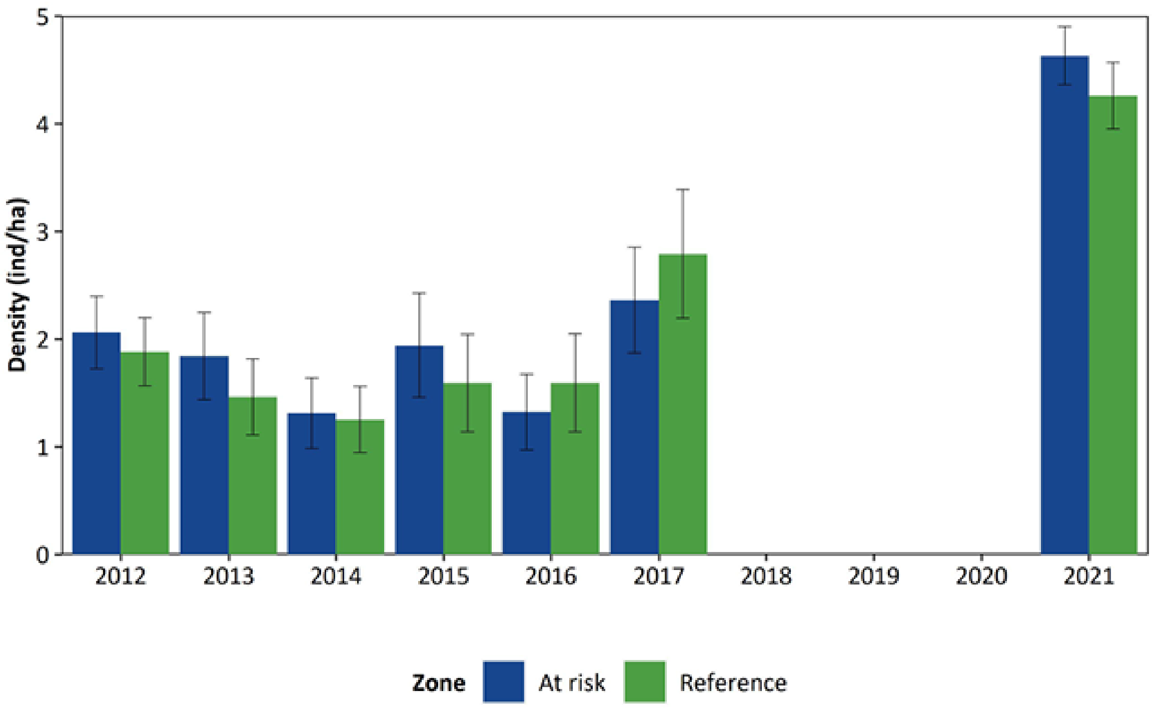

Figure 2-10: Annual Estimates of Golden Bandicoot Densities within the At Risk and Reference Zones

Note: See Methodology section for details on the missing 2018, 2019 and 2020 data.

Monitoring Program: Wedge-tailed Shearwater

Objective

Detect variation in abundance and demographics—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.

Changes to Monitoring Sites

There were no changes to monitoring sites in 2021. However, the fledging success survey was undertaken earlier than usual in 2021–2022 because of site-access restrictions resulting from the COVID-19 pandemic. Conducted in late February/early March 2022, the survey may have overestimated the breeding success for Wedge-tailed Shearwaters because the birds were predicted to remain within the nesting colony and potentially exposed to perturbations until fledging in early to mid-April.

Methodology

- Survey method: Three fixed long-term transects (100 m × 10 m) on each of Double Island North (DIN), Double Island South (DIS) (At Risk islands), and Ah Chong Island (AHC) (Reference island) were surveyed twice during the summer breeding season. For each survey, all burrows within transects were counted and their contents identified using a purpose-built burrow scope to determine breeding status. The first survey was undertaken during the early egg incubation period (November 2021) to derive breeding participation estimates. The second survey was undertaken during late chick provision and just before fledging (February to March 2022) to determine fledging success estimates (burrows that contained live, well-developed fledglings were considered fledged).
- Analysis method: The breeding performance metrics used for control charting were:
  - Burrow Density (per 100 m^2) = total number of burrows (active and inactive) within the transects
  - Breeding Participation (%) = number of breeding attempts / total number of burrows (active and inactive)
  - Fledging Success (%) = number of developed chicks / number of breeding attempts derived from the first field visit.
- Changes were determined by the degree of variation observed between At Risk and Reference islands, and were plotted using time-series control charts to understand trends over time.

Results

- Wedge-tailed Shearwater burrow density was similar between the Reference island AHC (10.4 ± 2.4) and At-Risk island DIS (10.1 ± 2.8), both of which were double that reported from DIN (4.8 ± 1.6) where the nesting habitat and substrate differs. Burrow density at all three monitoring locations increased slightly from 2020, and this metric remains within control limits for both At Risk locations (DIS and DIN) (Figure 2-11).
- Wedge-tailed Shearwater breeding participation was highest at DIN (55.0 ± 8.4%) in 2021–2022, which was lower than that reported during the 2020–2021 monitoring period (62.2 ± 5.1%). Breeding participation was also lower at AHC (43.1 ± 1.0%) and DIS (41.9 ± 11.7%), which both exhibited a slight decrease from 2020–2021 levels (51.2 ± 4.0% and 45.4 ± 11.8%, respectively). This metric remains within control limits for both At Risk locations (Figure 2-11).
- Wedge-tailed Shearwater fledging success was lower at DIS (55.0 ± 7.4%) when compared to 2020–2021 (62.0 ± 5.4%) and higher at DIN (61.8 ± 15.5%, up from 39.6 ± 13.7%) and AHC (61.8 ± 6.1%, up from 53.9 ± 1.7%). This metric remains within control limits for both At Risk locations (Figure 2-11).

Conclusions

- All three breeding performance metrics were within management control limits in 2021–2022.
- The 2021–2022 breeding season appeared favourable for recruitment to the population, as indicated by the large proportion of new burrows (53 in total) excavated across monitoring transects. Recruitment to the population is consistent across both DIS and AHC; however, the rocky terrain at DIN limits the capacity for new burrows to be excavated.
- Significant rainfall events throughout North West Shelf region in late March also posed a higher risk of burrow collapse; however, most damage that was observed in open sandy areas resulted in partial mouth collapse, indicating that the rainfall was not heavy enough to affect most burrows. Similarly, Barrow Island experienced ~60 mm of rainfall between 30 March and 2 April (after the field survey), and this may have affected fledgling survivorship by reducing the integrity of some sandy burrows.
- Monitoring has not detected an adverse variation to the abundance and demographics of Wedge-tailed Shearwaters that is attributable to the Gorgon Gas Development during the Reporting Period.

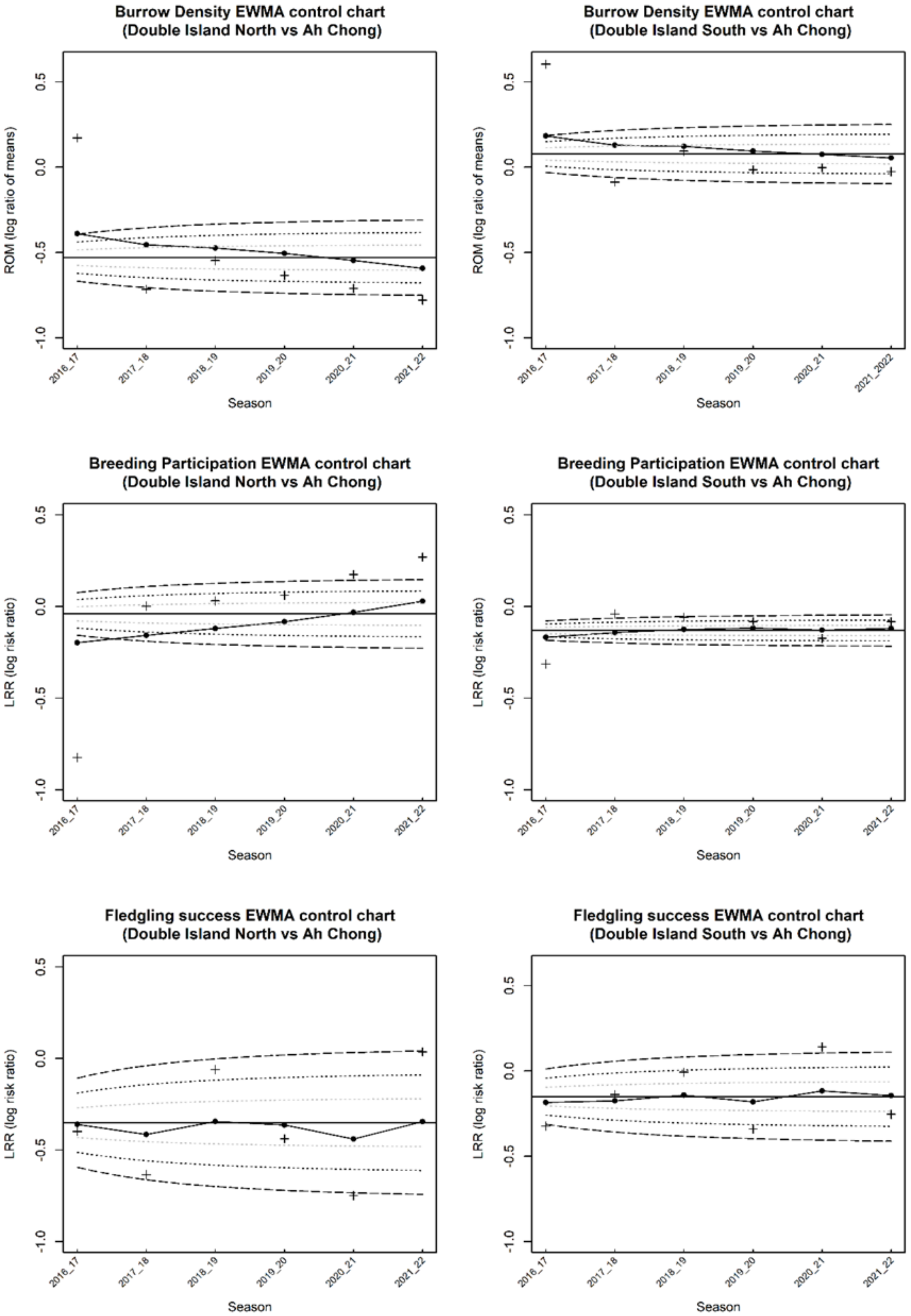

Figure 2-11: Wedge-tailed Shearwater EWMA Control Charts for Nest Density (top), Breeding Participation (middle), and Fledging Success (bottom) between At Risk Islands (Double Island North and South) and Reference Island (Ah Chong)

+ = standardised difference metric; • = smoothed standardised difference metric based on exponentially weighted three-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

Monitoring Program: Bridled Tern
Objective
Detect variation in abundance and demographics—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
There were no changes to monitoring sites in 2021. However, the fledging success survey was undertaken earlier than usual in 2021–2022 due to site-access restrictions resulting from the COVID-19 pandemic.
Methodology
• Survey method: Three fixed long-term transects (100 m × 10 m) on each of DIN, DIS (At Risk islands), and Parakeelya Island (PAR) (Reference island) were surveyed twice during the summer breeding season. For each survey, all nest sites within transects were counted and their contents identified to determine breeding status. The first survey was undertaken during the early egg incubation period (January 2022) to derive breeding participation and nest density estimates. The second survey was undertaken during late chick provision and just before fledging (February to March 2022) to determine fledging success estimates (either through direct sighting of a chick, or other indicators such as guano [sign of chick presence but no actual chick observed] in the nest scrape). • Analysis method: The breeding performance metrics used for control charting were: – Nest Density (per 100 m^2) = total number of nests (active and inactive) within the transects – Breeding Participation (%) = number of breeding attempts / total number of nests (active and inactive) – Fledging Success (%) = number of fledglings evident / number of breeding attempts derived from the first field visit. • Changes were determined by the degree of variation observed between At Risk and Reference islands, and were plotted using time-series control charts to understand trends over time.
Results
• Bridled Tern nest density was marginally lower at At Risk islands (DIN 9.0 ± 3.0; DIS 9.7 ± 2.7) and marginally higher at the Reference island (PAR 8.5 ± 0.6) when compared to 2020–2021. Control chart values indicate a trend of increasing nest density at DIN and DIS, relative to PAR, which has been observed since 2017–2018. In the 2021–2022 season, control chart values at both DIN and DIS were within management control limits for nest density (Figure 2-12). • Bridled Tern breeding participation increased at all islands. Control charts indicate that increases in breeding participation have been greater at At Risk islands (DIN 41.0 ± 6.9; DIS 49.6 ± 5.4) relative to PAR (39.9 ± 6.5), particularly in the last 2 years of monitoring (2020–2021 and 2021–2022). The relative breeding participation metric on both DIN and DIS were within management control limits (Figure 2-12). • Bridled Tern fledging success decreased at all islands in 2021–2022 when compared to 2020–2021. Control charts for this metric indicate fledging success at At Risk islands was lower than at PAR; however, fledging success remained within management control limits for the 2021–2022 season (Figure 2-12).
Conclusions
• All three breeding performance metrics were within management control limits in 2021–2022. • The 2021–2022 breeding season was unusual because it was the second consecutive year under La Niña climatic conditions. The first Bridled Tern eggs would typically be expected in late December each year; however, some eggs were present in mid-November (i.e., laid before the first Wedge-tailed Shearwater survey on 18 November 2021). This led to earlier than expected fledging times in late January and through February for some Bridled Terns, compared to the usual late February/early March fledging period. A second wave of laying also occurred, reflected by the number of Bridled Tern eggs still present during the January field survey. Despite the earlier onset of laying, the proportion of nest sites recorded with chick guano in January were not significantly different between years (2020–2021 = 0.21, 2021–2022 = 0.26, Kruskal–Wallis = 1.42, P = 0.23). • Monitoring has not detected an adverse variation to the abundance and demographics of Bridled Terns attributable to the Gorgon Gas Development during the Reporting Period.

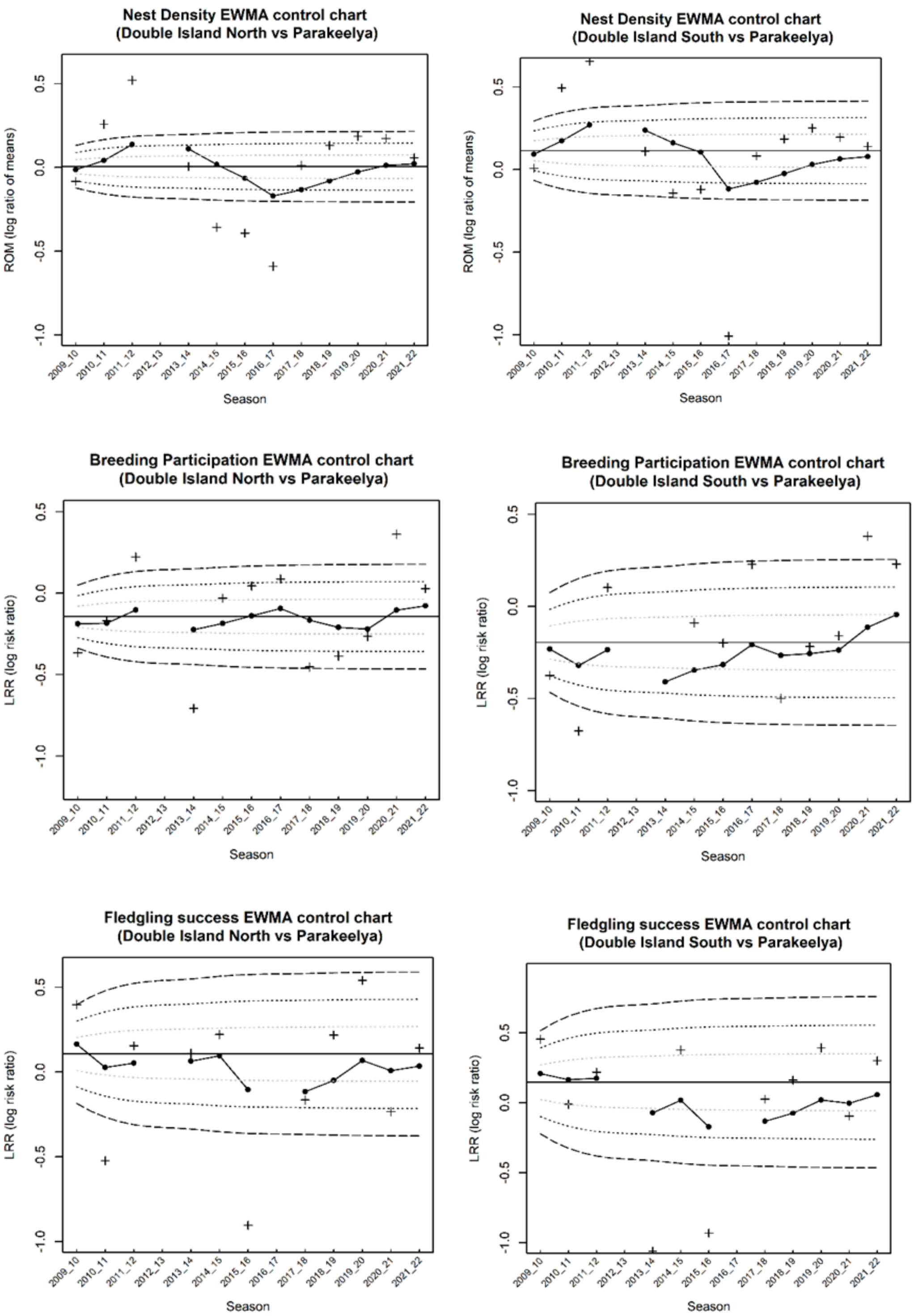

Figure 2-12: Bridled Tern Control Charts for Nest Density (top), Breeding Participation (middle), and Fledging Success (bottom), between the At Risk Islands (Double Island South and North) and Reference Island (Parakeelya)

+ = standardised difference metric; • = smoothed standardised difference metric based on exponentially weighted three-year moving average; dotted curves represent ±1 SD, ±2 SD, and ±3 SD.

Note: No Bridled Tern monitoring occurred in 2012–2013 and fledging success could not be estimated in 2016.

Monitoring Program: Groundwater
Objective
Collect information on groundwater levels and the physicochemical parameters of the groundwater to diagnose observed changes—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
No deviation from the Operational Sampling and Analysis Quality Plan (SAQP) (Ref. 3) except adopting individual monitoring well pre-operations baseline values for the assessment.
Methodology
Monitoring frequency • Since November 2016 biannual sampling has been undertaken in accordance with the Operational SAQP (Ref. 3). During the Reporting Period, two biannual groundwater monitoring events (GMEs) were undertaken (August 2021 and March 2022). **Sampling method** • Groundwater samples were collected from 14 monitoring wells within the GTP, two monitoring wells near the Permanent Wastewater Disposal (PWD) wells on Road 5, and two monitoring wells near the Temporary Wastewater Injection Plant (TWIP) wells. Samples were collected using low-flow and passive sampling techniques. • Physical parameters (including water level, pH, electrical conductivity, redox potential [ORP], dissolved oxygen [DO], and temperature) were recorded in the field. • Samples were also sent to a National Association of Testing Authorities accredited laboratory for further analysis. **Sample Analysis** *GTP Monitoring Wells – Shallow* • Laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, monoethylene glycol (MEG), activated methyldiethanolamine (aMDEA), benzene, toluene, ethylbenzene, and xylenes (BTEX), total recoverable hydrocarbons (TRH), and dissolved organic carbon (DOC). *GTP Monitoring Wells – Deep* • Laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, MEG, aMDEA, and DOC. *Monitoring Wells near PWD Wells* • Laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, MEG, aMDEA, BTEX, TRH, DOC, and nutrients. • Based on the primary analytical results, some wells were analysed for additional analytes such as an additional dissolved metals suite. *Monitoring Wells near TWIP Wells* • Laboratory analysis was conducted for physical parameters, major cations, major anions, mercury, BTEX, TRH, DOC, and nutrients. • Based on the primary analytical results, some wells were analysed for additional analytes such as TRH silica gel clean-up (SGC), polycyclic aromatic hydrocarbons (PAH), monocyclic aromatic hydrocarbons (MAH), or an additional dissolved metals suite. Field and laboratory results were compared against baseline values and published water quality criteria guidelines or limits of reporting (LORs) where applicable. Changes in selected groundwater parameters are used as an indirect habitat indicator for stygofauna.
Results
GTP Monitoring Wells Analysis of results for the GTP monitoring wells indicated that parameters were generally within the range of baseline results, were not detected above the LOR, or were below assessment criteria (as outlined in the Operational SAQP [Ref. 3]), except for: • Physical parameters: Some pH, DO, salinity, and ORP values were recorded outside the baseline values at GTP wells during the August 2021 and March 2022 GMEs.

Monitoring Program: Groundwater

- The groundwater at GW-GTP-01A and GW-GTP-03A remains high in DO content from low levels during pre-operations, in line with previous monitoring periods. Additionally, groundwater at GW-GTP-15A reported a high DO level in comparison to the levels reported during pre-operations.
- Generally, a trend towards an oxidising redox state was observed at most well locations during the March 2022 GME, with results at most wells exceeding baseline values. The groundwater at GW-05-B and GW-05-E was reported as mildly reducing to mildly oxidising during the baseline; however, the redox state of the March 2022 GME was reported as oxidising. The groundwater at GW-GTP-01B, GW-GTP-02A, GW-GTP-04A, and GW-05B was reported as mildly reducing to mildly oxidising during the baseline; however, the redox state of the August 2021 GME was reported as oxidising. A similar trend was observed at GW-GTP-02B and GW-GTP-15A, which reported as reducing to mildly reducing during the baseline; however, the redox state of the August 2021 GME was reported as oxidising. GW-GTP-03A and GW-GTP-04A reported an oxidising redox state in August 2021, compared to a mildly oxidising redox state recorded during the baseline.
- Mercury, TRH, BTEX, naphthalene, aMDEA, and MEG were not detected above the LOR in the GTP wells that are part of the routine monitoring plan (as outlined in the Operational SAQP [Ref. 3]) in August 2021 and March 2022.
- Additional groundwater monitoring was completed within and near the GTP, which is outside the scope of the Operational SAQP (Ref. 3). Results of this monitoring have been reported to the WA Department of Water, Environment and Regulation (DWER) under the *Environmental Protection Act 1986* - Section 72 (Ref. 24, Ref. 25, Ref. 26); the *Contaminated Sites Act 2003* - Section 11 (Ref. 27); and in the L9102/2017/1 Annual Audit Compliance Report 2022 (Ref. 28).

Monitoring wells near TWIP Wells

Analysis of results for the monitoring wells in proximity to the TWIP wells indicated that parameters were generally within the range of baseline results, were not detected above the LOR, or were below assessment criteria (as outlined in the Operational SAQP [Ref. 3]), except for:

- In the March 2022 GME, the concentration of nitrate (as N) reported at DWDB1-MW2 (4.78 mg/L) and DWDB2-MW3 (4.95 mg/L) exceeded the assessment criterion of 1.70 mg/L, but it did not exceed the pre-operations baseline values. The concentration of nitrate has not decreased during previous GMEs and was within the same order of magnitude as previous monitoring events.
- The TRH > C_{16}–C_{34} F3 fraction at DWDB1-MW2 exceeded the assessment criterion of 0.1 mg/L in August 2021 (0.20 mg/L) and March 2022 (0.14 mg/L). TPH > C_{15}–C_{28} also exceeded the assessment criteria of 0.1 mg/L at DWDB1-MW2 in August 2021 (0.11 mg/L). TRH was detected above the LOR in previous monitoring rounds. Additional analysis of PAH, MAH, and TRH SGC were conducted for the DWDB1-MW2 sample as a result of the TRH detection. No MAH, PAH, or SGC results were recorded above the laboratory LOR. BTEX and naphthalene were not detected above the LOR.

Monitoring Wells near the PWD Wells

Analysis of results for the monitoring wells in proximity to the PWD wells indicated that parameters were generally within the range of baseline results, were not detected above the LOR, or were below assessment criteria (as outlined in the Operational SAQP [Ref. 3]), except for:

- Physical parameters: Groundwater conditions at GW-RD5-02 and GW-RD5-03 have shown a trend of decreasing salinity since operations commenced. In the March 2022 GME, the groundwater salinity at both wells was reported as ‘fresh’ with current concentrations of total dissolved salts of 992 mg/L at GW-RD5-02 and 622 mg/L at GW-RD5-03.
- An elevated level of nitrate (as N) was reported at GW-RD5-02 in the August 2021 GME (1.95 mg/L) and March 2022 GME (0.92 mg/L), with the concentration exceeding the baseline values but not the assessment criterion of 1.70 mg/L in March 2022. Nitrate concentrations were within the same order of magnitude as previous GMEs and the baseline values.
- Both monitoring wells recorded lower concentrations than the baseline values for calcium, chloride, sodium, potassium, magnesium, and sulfate (as SO_4).
- All other metal concentrations were not detected or were within or below baseline concentrations.
- The pH at GW-RD5-02 (7.74) exceeded the baseline pH of 7.047 but was within the assessment criterion range (6.5–8.5) in the August 2021 GME; it was reported as neutral in the March 2022 GME.
- The redox state of GW-RD5-02 was reported as mildly reducing during the baseline; however, in the August 2021 GME was reported as oxidising.
- Mercury, TRH, BTEX, naphthalene, aMDEA, and MEG were not detected above the LOR in the monitoring wells in the August 2021 and March 2022 GMEs, consistent with previous monitoring results.

Conclusions

Monitoring Program: Groundwater
• Groundwater monitoring during the Reporting Period is considered to have been completed in accordance with the TSEMP (Ref. 1). Monitoring was undertaken in accordance with the Operational SAQP (Ref. 3). • The results from the groundwater monitoring program, as per the Operational SAQP, have generally indicated that no significant observable changes to relevant groundwater parameters were attributable to the Gorgon Gas Development during the Reporting Period.

Monitoring Program: Surface Water Landforms
Objective
To detect impacts to surface water landforms—attributable to the Gorgon Gas Development and Jansz Feed Gas Pipeline—over time.
Changes to Monitoring Sites
No changes to monitoring sites. All 14 sites were transitioned to direct field inspection in 2020 after two or more years had elapsed since clearing or earthworks, and remote sensing had not identified any Project-related impact.
Methodology
• Detecting changes to surface water landforms at risk of erosion or sedimentation is undertaken annually using remote sensing and/or direct field inspection of Reference Sites (upstream of the disturbance, e.g. road, pipeline right-of-way) and At-Risk Sites (downstream of the disturbance) or by direct field inspection following heavy or cyclonic rainfall. • A review of aerial imagery was undertaken in October 2021 comparing imagery from October 2020. A site field inspection was also undertaken in October 2021.
Results
Above average rainfall occurred on Barrow Island in December 2020 (39.9 mm) and March, April, and May 2021 (85.8 mm, 105 mm, 131 mm, respectively). Following this rainfall, no significant erosion or sedimentation was observed at any of the 14 monitoring sites via aerial imagery or direct field inspection in October 2021.
Conclusions
Monitoring to date has not detected an adverse impact (attributable to the Gorgon Gas Development) to surface water landforms.

2.2 Event Data

The Threatened or Listed fauna reporting undertaken during the Reporting Period is summarised in the following table.

Event Data: Threatened or Listed Fauna Reporting
Reporting Requirement
Threatened or Listed fauna cared for, injured, or killed within the TDF.
Results
Table 2-2 lists the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Threatened or Listed fauna injured or killed within the TDF during the Reporting Period. In the deceased fauna records, the Barrow Island Golden Bandicoot represents 47.9% of the records, followed by the Barrow Island Spectacled Hare-wallaby (24.4%), Barrow Island Boodie (10%), Silver Gull (7.6%), Barrow Island Euro (5%), Wedge-tailed Shearwater (3.4%) and Reef Egret (1.7%) (Table 2-2). The predominant cause of death for these species was vehicle strike (77%). The mortality counts for these species represent only a small proportion (~≤1%) of estimated Barrow Island abundance for these species.

Table 2-2: EPBC Act Threatened or Listed Fauna Recorded as Injured or Deceased within the TDF

Common Name	Species Name	No. Injured[1]	No. Deceased[2]
Barrow Island Burrowing Bettong (Boodie)	*Bettongia lesueur*	0	12
Barrow Island Euro	*Macropus robustus isabellinus*	0	6
Barrow Island Golden Bandicoot	*Isoodon auratus barrowensis*	0	57
Barrow Island Spectacled Hare-wallaby	*Lagorchestes conspicillatus*	0	29
Eastern Reef Egret	*Ardea (Egretta) sacra*	0	2
Silver Gull	*Chroicocephalus novaehollandiae*	1	9
Wedge-tailed Shearwater	*Ardenna pacifica*	0	4

1 *Includes injured fauna where the cause of injury is attributed to the Gorgon Gas Development or where the cause of injury is unknown; does not include fauna where the injury was from natural causes.*

2 *Includes fauna deaths where the cause of death is attributed to the Gorgon Gas Development, and sick or injured fauna that were cared for and subsequently euthanised; does not include fauna where the death was from natural causes.*

3 Terrestrial and Marine Quarantine

Table 3-1: EPR Requirements for Terrestrial and Marine Quarantine

Item	Source	Section in this EPR
Results of the audit and monitoring programs	MS 800, Schedule 3(2i) EPBC 2003/1294 and 2008/4178, Schedule 3(2i)	3.1, 3.2
Detected introduction(s) of non-indigenous terrestrial flora or fauna (NIS) and marine pest species, including procedure breaches and 'near misses'[1] including special reference to weeds	MS 800, Schedule 3(2ii) EPBC 2003/1294 and 2008/4178, Schedule 3(2ii)	3.2, 0
Consequences of the introduction	MS 800, Schedule 3(2iii) EPBC 2003/1294 and 2008/4178, Schedule 3(2iii)	3.2
Modification, if any, to the Quarantine Management System (QMS) because of: • audits and monitoring • detected introductions • 'best practice' improvements.	MS 800, Schedule 3(2iv) EPBC 2003/1294 and 2008/4178, Schedule 3(2iv)	3.4
Eradication actions if any taken; reasons for any action or non-action; changes to improve procedures and outcomes and progress	MS 800, Schedule 3(2v) EPBC 2003/1294 and 2008/4178, Schedule 3(2v)	3.2
Mitigation actions	MS 800, Schedule 3(2vi) EPBC 2003/1294 and 2008/4178, Schedule 3(2vi)	3.2
Results of any QMS-related studies, where conducted, to improve performance	MS 800, Schedule 3(2vii) EPBC 2003/1294 and 2008/4178, Schedule 3(2vii)	N/A[2]
Weed management incidents: • new infestations • proliferations	MS 800, Schedule 3(2viii) EPBC 2003/1294 and 2008/4178, Schedule 3(2viii)	N/A[3]
Weed eradication performance and • areas treated • results against measurable indicators and limits	MS 800, Schedule 3(2xi) EPBC 2003/1294 and 2008/4178, Schedule 3(2ix)	N/A[3]
Targets proposed for the next year	MS 800, Schedule 3(2x) EPBC 2003/1294 and 2008/4178, Schedule 3(2x)	3.2

1. *Although MS 800 refers to 'near misses', 'intercept' is the appropriate term, and therefore is used below. The term 'intercept' is used throughout the QMS (Ref. 4).*
2. *No QMS-related studies were implemented during the Reporting Period; therefore, reporting is not applicable at this time.*
3. *No proliferations of existing weeds or new weed establishments, were recorded during the Reporting Period; therefore, reporting is not applicable at this time.*

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3.1 Audits

CAPL audits of the quarantine management measures described in the QMS (Ref. 4) are conducted at least every two years during operations. CAPL conducted a QMS audit in July/August 2022, which resulted in three findings, five recommendations, three observations and one good practice. Corrective actions are currently underway.

No regulator audits were carried out on the QMS during the Reporting Period. The Commonwealth Department of Agriculture, Water and the Environment (DAWE, now the Department of Agriculture, Fisheries and Forestry from 1 July 2022) undertook a verification site visit in November 2021 to confirm the LNG trading vessel inspection and clearance process and associated training and accreditation program is implemented consistent with their requirements. One opportunity for improvement was identified and implemented relating to the challenges associated with access to vessels for verifying ballast water management due to COVID-19 restrictions.

3.2 Monitoring Results

A quarantine surveillance program determines the presence or absence of NIS (plants, invertebrates, and vertebrates) on Barrow Island and Marine Pests in the waters surrounding Barrow Island.

The results of surveillance programs implemented during the Reporting Period are summarised in the following tables.

Surveillance Program: Plant NIS
Objective
Detect the presence and/or proliferation of plant NIS (weeds) on Barrow Island attributable to Gorgon Gas Development activities.
Methodology
• Repeated weed surveillance at identified risk localities within the Gorgon Gas Development tenure and surrounding areas. • Repeated weed inspections of areas where weeds were previously recorded as a follow-up measure to ensure any further weed detections are controlled immediately.
Results
• Weed species detected and controlled within the Gorgon Gas Development tenure or surrounding areas under weed surveillance during the Reporting Period: – Buffel Grass (*Cenchrus ciliaris*)* – Blackberry Nightshade (*Solanum nigrum*)* – Common Sowthistle (*Sonchus oleraceus*)* – Whorled Pigeon Grass (*Setaria verticillata*)* – Bulrush (*Typha* sp). plants were detected in drains in the GTP area – Tomato (*Solanum lycopersicum*). • Surveillance associated with Kapok (*Aerva javanica*) detected in the 2016–2017 Reporting Period continued. There were nine kapok bush seedlings detected during the Reporting Period (detected around the same location as those noted in the 2016–2017 Reporting Period). • No new Weed Hygiene Zones were required to be established during the Reporting Period. ** includes seeded individuals*
Conclusions
No introduction or proliferation of weed species (attributable to the Gorgon Gas Development) was recorded during the Reporting Period.

Surveillance Program: Invertebrate NIS
Objective
Detect the presence and/or proliferation of invertebrate NIS on Barrow Island, attributable to Gorgon Gas Development activities.
Methodology
• Surveillance effort focused on identified risk localities and used multiple surveillance system components (SSCs). • The SSCs used for the Reporting Period included: light traps, baited traps (including sticky traps), biologist structured and unstructured surveys, suction sampling, and workforce observations/reporting.
Results
• The following NIS invertebrates were recorded during the Reporting Period: – 116 jumping spiders (*Menemerus nigli*) were detected associated with infrastructure including the Materials Offloading Facility (MOF), Butler Park, the airport and the GTP (see below). – 213 Maritime Earwigs (*Anisolabis maritima*) were detected in sticky traps at the MOF. These were detected as part of an ongoing quarantine response (NIS detected in the previous reporting period). – Nine Longicorn Beetles (*Coleocoptus senio*) were detected (one at WA Oil base, one at Production Village and seven along the coastline). These were detected as part of an ongoing Quarantine Response (NIS detected in the previous reporting period) surveillance activities. – 165 Indian House Crickets (*Gryllodes sigillatus*) were detected within sticky traps on the MOF. These were detected as part of an ongoing Quarantine Response (NIS detected in the previous reporting period). There have been no detections since 31 December 2021. – Targeted surveillance for the Maritime Earwig, Longicorn Beetle and Indian House Cricket remains in place. • During this Reporting Period, CAPL consulted with the Quarantine Expert Panel (QEP) and relevant subject matter experts (SMEs) regarding the presence of the jumping spider, *M. nigli*, on Barrow Island. – It was determined that *M. nigli* is an NIS that has been introduced to Barrow Island as a result of and after the Gorgon Gas Development commenced. – In accordance with MS 800 Condition 9.2 and Condition 10.3, the QEP wrote to the Minister for Environment on 16 September 2021 to notify them of this establishment. CAPL will continue to engage with the Minister, the QEP and other SMEs on this matter. – The consequences of introduction are yet to be determined, however, initial advice from SMEs is that it is anticipated that *M. nigli* will have a low to negligible impact on the biodiversity of Barrow Island. – Eradication or mitigation measures are yet to be determined following further advice from the Minister. – Targets are developed in response to introductions of NIS. Delineation surveillance continues to be undertaken and following further advice from the Minister, this will determine the response or management program and targets accordingly. • Identification of some specimens from the 2021–2022 surveillance program is still pending, and any NIS detections will be included in the 2023 EPR.
Conclusions
It was determined that *M. nigli* is an NIS that has been introduced to Barrow Island as a result of and after the Gorgon Gas Development commenced. All other NIS detected during the Reporting Period were controlled immediately or are under an ongoing Quarantine Response.

Surveillance Program: Vertebrate NIS
Objective
Detect the presence and/or proliferation of vertebrate NIS on Barrow Island attributable to Gorgon Gas Development activities.
Methodology
• Surveillance effort focused on identified risk localities and used several SSCs. • The SSCs used for the Reporting Period included: biologist unstructured surveys, biologist structured surveys (night and day), scat searches, Elliot traps, environmental acoustic recognition sensors, print acquisition for wildlife sensors, and workforce observations/reporting.
Results
One Asian House Gecko (*Hemidactylus frenatus*) was detected within Area 3 of the GTP on Barrow Island (April 2022). A quarantine response was completed, and no further geckos were detected.
Conclusions
No introductions of vertebrate NIS, attributable to Gorgon Gas Development activities, were recorded during the Reporting Period.

Surveillance Program: Marine Pests
Objective
Detect the presence of Marine Pests that might be the result of Gorgon Gas Development activities.
Methodology
• The Marine Pest Surveillance Program conducted at Barrow Island during the Reporting Period included these components: – intertidal surveillance, using visual surveillance transects – visual examination of settlement arrays – analysis of environmental deoxyribonucleic acid (eDNA) from additional settlement arrays and water samples. DNA present on settlement arrays and in water samples is analysed using next-generation sequencing methodology, or real-time polymerase chain reaction testing, and the results are compared against a reference database of targeted Marine Pests. • Surveillance and sampling locations focused on high-risk localities around operational areas.
Results
• Two intertidal surveys and visual examination of two settlement arrays, which had been immersed for six months, were completed (September 2021 and March 2022). No Marine Pests were detected from visual examinations. • Six sampling events from 12 settlement arrays were completed for eDNA analysis (in September and November 2021, and January, March, May, and July 2022). No Marine Pests were detected[1].
Conclusions
No introduction of Marine Pests, attributable to Gorgon Gas Development activities, was recorded during the Reporting Period.

1 *eDNA analysis of settlement plate arrays and water samples from the Reporting Period is still pending. Any introduced Marine Pest detections will be included in the 2023 EPR.*

3.3 Event Data

The quarantine detections recorded during the Reporting Period are summarised in the following table.

Event Data: Quarantine Detections
Reporting Requirement
Detected introduction(s) of NIS and Marine Pest species, procedure breaches, and intercepts, with special reference to weeds.
Results
• During the Reporting Period, one quarantine introduction (jumping spider, *Menemerus nigli;* see invertebrate NIS surveillance results above for further detail), one Quarantine Incident, 15 Quarantine Intercepts, and 10 Quarantine Procedural Deviations were recorded (see Section 12 for quarantine event terminology). • One Level 3 incident was associated with an NIS vertebrate – one Asian House Gecko (*Hemidactylus frenatus*) was detected by Quarantine during surveillance activity for the Indian House Cricket: • Most Quarantine Intercepts were associated with NIS invertebrates (46%) and seed material (40%). • During this Reporting Period, one historical quarantine record was reclassified from a non-event (not Project-attributable) to a Level 1 incident, following a review by the QEP. This event was associated with a Racing Pigeon (*Columbia livia*) on an LNG tanker.
Conclusions
• One NIS, *M. nigli*, has been declared as introduced to Barrow Island, as a result of and after the Gorgon Gas Development commenced. • All other NIS detected during the Reporting Period were responded to and controlled immediately following detection. Targeted surveillance remains in place for detecting the Maritime Earwig, Longicorn Beetle, and Indian House Cricket. • Quarantine first-response and eradication activities for the Indian House Cricket (*Gryllodes sigillatus*)[1] continued during the Reporting Period. Activities included monitoring and treatments. There have been no detections of this species on Barrow Island since 31 December 2021. More than 3,000 monitoring stations were deployed around the GTP, MOF, the surrounding native vegetation, and targeted satellite sites. • Quarantine surveillance activities for the jumping spider (*Menemerus nigli*)[1] continued during the Reporting Period. • Quarantine first-response activities for the Longicorn Beetle (*Coleocoptus senio*)[1] continued during the Reporting Period. • Surveillance will continue for Buffel Grass (*Cenchrus ciliaris*) and Kapok Bush (*Aerva javanica*) until CAPL is confident no residual seed banks remain. • Following the Quarantine Incidents, Intercepts, and Procedural Breaches recorded, actions were taken to reinforce quarantine training, procedures, and Gorgon Gas Development quarantine requirements.

1 *Detected in a previous reporting period.*

3.4 Review of the Quarantine Management System

A review of the QMS was completed during the Reporting Period. The 2022 revision builds on the maturity of the QMS as the Gorgon Gas Development continues through operations. The minor changes made in this version of the QMS strengthen the system and/or clarify certain areas. The updated QMS was reviewed and endorsed by the QEP in December 2021 and was submitted to the DWER for approval in February 2022 and Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW) in October 2022.

4 Marine Turtles

Table 4-1: EPR Requirements for Marine Turtles

Item	Source	Section in this EPR
Results of all marine turtle monitoring carried out by the Proponent, including any detected changes to the Flatback Turtle population	MS 800, Schedule 3(3i) EPBC 2003/1294 and 2008/4178, Schedule 3(3i)	4.1, 4.5
Reportable incidents involving harm to marine turtles	MS 800, Schedule 3(3ii) EPBC 2003/1294 and 2008/4178, Schedule 3(3ii)	4.2
Changes to the marine turtle monitoring program	MS 800, Schedule 3(3iii) EPBC 2003/1294 and 2008/4178, Schedule 3(3iii)	4.1
Conclusions about the status of Flatback and other marine turtle populations on Barrow Island	MS 800, Schedule 3(3iv) EPBC 2003/1294 and 2008/4178, Schedule 3(3iv)	4.1, 4.4
Changes (if any) to the Long-term Marine Turtle Management Plan	MS 800, Schedule 3(3v) EPBC 2003/1294 and 2008/4178, Schedule 3(3v)	4.4
Findings of the annual audit and review on the effectiveness of lighting design features, management measures, and operating controls including details of light management initiatives and activities undertaken during the year	MS 800, Schedule 3(3vi) EPBC 2003/1294 and 2008/4178, Schedule 3(3vi)	1
Results of studies undertaken	MS 800, Schedule 3(3vii) EPBC 2003/1294 and 2008/4178, Schedule 3(3vii)	4.1
Noise monitoring results and a discussion on the success (or otherwise) in meeting noise emission targets	MS 800, Schedule 3(3viii) EPBC 2003/1294 and 2008/4178, Schedule 3(3viii)	N/A[1]

1. *No specific noise emission targets for the Gorgon Gas Development apply to environmental receptors; noise monitoring is considered in relation to monitoring results for the Flatback Turtle population. As reported in the 2010–2015 Five-year EPR (Ref. 5): 'Given the results to date, the difficulty in detecting any onshore noise or vibration effects from Project activities on the beaches, and endorsement from the Marine Turtle Expert Panel (and subsequent regulatory approval), the noise and vibration monitoring program was suspended after the 2011–2012 season.' Therefore, reporting for this item is not applicable.*

4.1 Monitoring Results

An objective of the Long-term Marine Turtle Management Plan (LTMTMP) (Ref. 6), as defined by Ministerial Conditions, is to establish a statistically valid monitoring program to measure and detect changes to the Flatback Turtle population on Barrow Island.

Key demographic parameters were identified as necessary for understanding the population dynamics and population viability of the Flatback Turtle rookery on Barrow Island. A mainland Reference site (Mundabullangana [MDA]) was also established. Where relevant, data related to these key parameters are also captured at MDA for comparison with the Barrow Island Flatback Turtle data (Ref. 6).

Changes in key demographic parameters are measured using time-series control charts. Trends identified in control charts act as early-warning signals to guide a tiered management approach. A management response is triggered if a demographic parameter demonstrates a trend towards, or changes beyond statistical deviations (± 1, ± 2, or ±3 SD, standard error [SE], mean or median absolute deviation [MAD]) from baseline conditions (Ref. 6).

The 2021–2022 results (Ref. 7) for the monitoring programs listed in the LTMTMP, including any changes detected to the Barrow Island Flatback Turtle population, are summarised in the following tables.

Monitoring Program: Flatback Turtle Abundance and Distribution
Objective
To measure and detect changes to the abundance, distribution, and nesting behaviour of adult Flatback Turtles.
Changes to Program
• To align with the updated WA Department of Biodiversity, Conservation and Attractions tagging protocol for Flatback Turtles, all new untagged Flatback Turtles received a single flipper tag and 2 Passive Integrated Transponder or “PIT” tags, where possible. If there was a clear sign that the turtle had been previously flipper tagged (i.e. via an existing tag or presence of tag scars), the turtle did not receive an additional flipper tag. • The number of completed survey nights each season that are presented in this report differs to those of previous years. This difference is due to a review, and subsequent exclusion, of data for those nights where any form of training by field personnel was conducted on a beach. This change is considered an improvement to the data analysis output because it removes any potential bias when comparing distribution and use between seasons. There is no indication that the exclusion of this data significantly altered the output of any analysis. • The Adult Survival Probability Control Chart is no longer presented as this parameter has been modelled and plotted as a constant mean value over all seasons and does not have the potential to exceed the control limits. • Four monitoring nights at MDA were interrupted due to the presence of lightning.
Methodology
• Capture-recapture sampling of nesting adult female Flatback Turtles was used to estimate these demographic parameters: – annual nester abundance – adult female survival probability – adult female breeding omission probability – nesting activity – clutch frequency – internesting interval. • Only key demographic parameters are control-charted—including annual nester abundance, adult female breeding omission probability and clutch frequency. • Variation in modelled estimates can occur when models are re-run each year with additional data. Therefore, minor variations from year to year might occur in historical control-charted parameter estimates presented in this EPR.
Results
Annual Nester Abundance • Population size modelling using a capture-mark-recapture multi-state open robust design (MSORD) estimated an annual nester abundance of 2,074 female turtles at Barrow Island (95% confidence interval [CI]: 2,014–2,134) and 1,686 female turtles at MDA (95% CI: 1,573–1,799) as shown in Figure 4-1. • The abundance estimates for Barrow Island and MDA both remained within the EWMA control limits (Figure 4-2a), with the abundance estimate increasing at both locations when compared to the previous season (see Figure 4-1). • The annual nester abundance at Barrow Island alone has exceeded the +3 SD control limit (Figure 4-2b). The parameter shows an increasing, but not significant, linear trend.

Monitoring Program: Flatback Turtle Abundance and Distribution
Adult Female Survival Probability • The estimated annual survival probability for nesting Flatback Turtles on Barrow Island was 0.939 (95% CI: 0.936–0.942) and at MDA was 0.948 (95% CI: 0.944–0.953). *Adult Female Breeding Omission Probability* • The breeding omission probability of a Flatback Turtle nesting at Barrow Island in a season, given that the turtle nested the previous season, was estimated as 0.73 (95% CI: 0.70–0.75), an increasing, but not significant, linear trend. This parameter exceeded the +1 SD control limit and has returned from a +3 SD exceedance in 2020–2021 (Figure 4-2c). The breeding omission probability at MDA was 0.49 (95% CI: 0.43–0.56), indicating that there was a lower probability of a turtle that nested in the previous season skipping the next nesting season at MDA compared to Barrow Island. The breeding omission probability at MDA shows a decreasing, but not significant, linear trend. *Clutch Frequency* • The estimated clutch frequency at Barrow Island was 3.9 clutches per female per season (95% CI: 3.8–4.1), is within control limits (Figure 4-2d) and shows an increasing, but not significant linear trend. At MDA, the estimated mean clutch frequency was 3.1 clutches per female per season (95% CI: 2.9–3.3). *Internesting Interval* • The mean internesting interval for Flatback Turtles at Barrow Island was 13.2 ± 1.9 days and showed no significant trend. At MDA, the mean internesting interval for Flatback Turtles was 13.2 ± 3.4 days and showed no significant trend. *Nesting Activity (spatial and temporal distribution)* • When compared to baseline, the nesting population has demonstrated temporal and spatial variation in how they use certain beaches at Barrow Island. The nesting population's use of certain beaches has likely varied due to changes in coastal processes caused by Project-related activities, notably at Inga, Bivalve, and Terminal beaches, which have recorded a reduction and redistribution of nesting habitat (see Section 9 on Coastal Stability). Concurrently, the same beaches have recorded a shift in the location and change in the pattern of their nesting activities and, in the case of Inga and Bivalve beaches, significant reductions in percentage use of the beach.

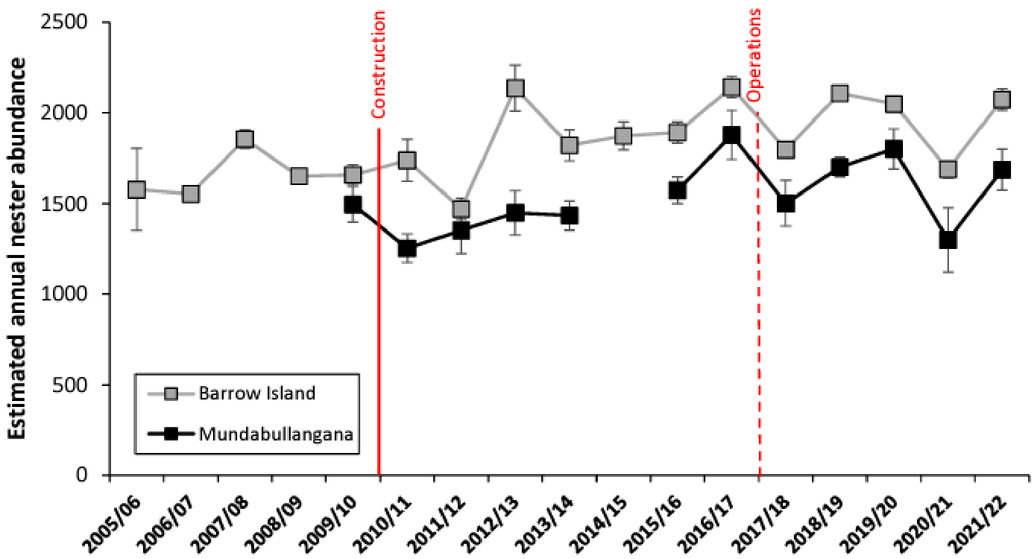

Figure 4-1: Annual Abundance Estimates at Barrow Island and Mundabullangana between 2005–2006 and 2020–2021[1]

Error bars indicate 95% confidence intervals. Red line indicates commencement of construction. Red dash line indicates commencement of operations. There is no estimate for 2014–2015 at MDA due to the limited sampling in that season.

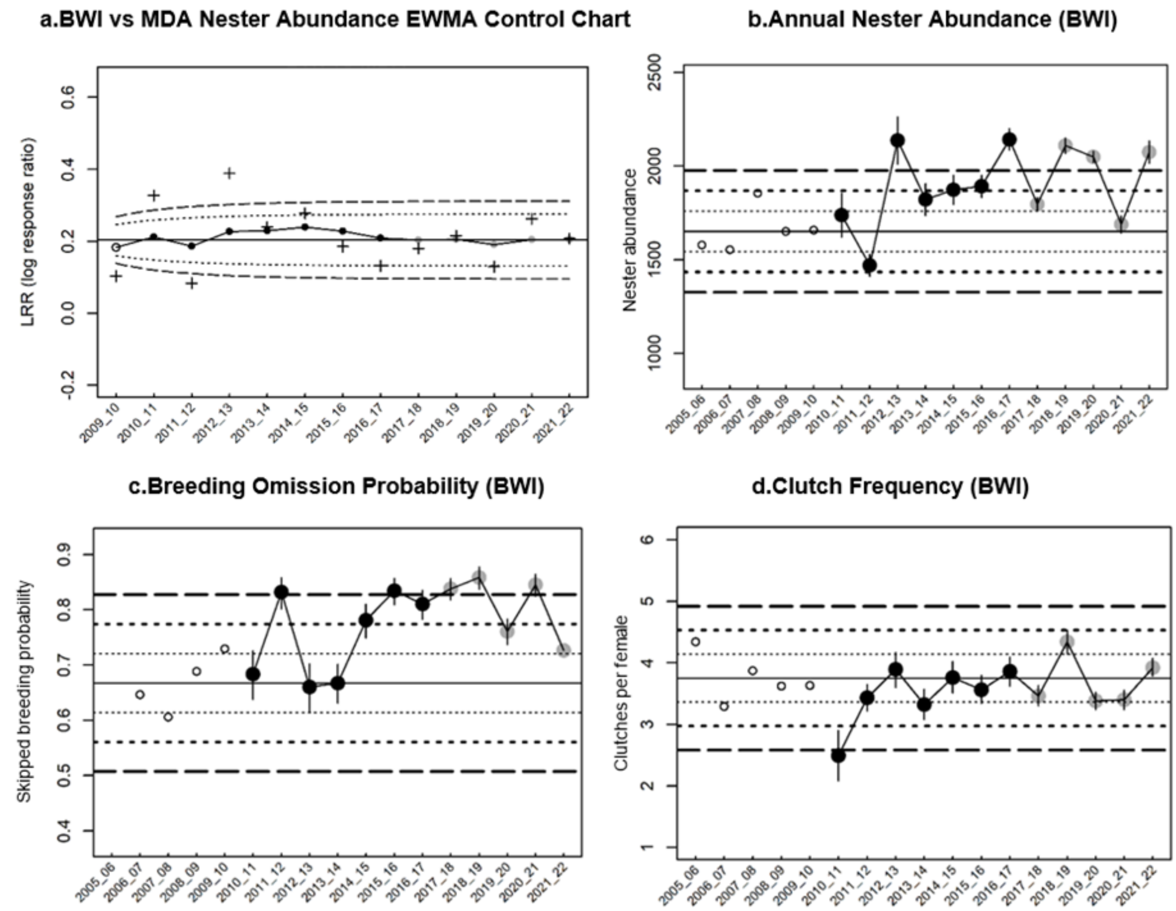

Figure 4-2: Control Charts for Flatback Turtle Population Demographic Metrics at Barrow Island (BWI) including (a) Annual Nester Abundance for BWI vs MDA, (b) Annual Nester Abundance at BWI, (c) Breeding Omission Probability at BWI, and (d) Clutch Frequency at BWI[1]

1 *Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal line = long-term expected estimate derived from baseline estimates (mean or median), dotted lines = ±1 SE (or 1 MAD for annual nester abundance), small dashed lines = ±2 SE (or 2 MAD), long dashed lines = ±3 SE (or 3 MAD). Error bars indicate 95% CI.* ***Note****: There is no annual abundance estimate for MDA in 2014–2015 due to the limited sampling in that season.*

Monitoring Program: Flatback Turtle Incubation Success
Objective
To measure and detect changes to Flatback Turtle incubation success.
Changes to Program
No changes were made to the Flatback Turtle incubation success monitoring program during the Reporting Period.
Methodology
• Routine monitoring at Inga, Bivalve, Terminal, and Mushroom beaches. • Monitoring marked nests to estimate these parameters: – egg hatching probability – hatchling emergence probability – incubation duration – incubation temperature – clutch fate – clutch size. • Only key demographic parameters for Barrow Island are control-charted; these include median egg hatching probability and median hatchling emergence probability for complete clutches. Mean values for both complete and incomplete clutches are presented for comparison. Incomplete clutches are those disturbed by other turtles or predators, lost during incubation, mixed with another clutch, or inundated.
Incubation Success Results
Egg Hatching Probability • The mean egg hatching probability at Barrow Island (for all clutches, complete and incomplete), was 72.0 ± 30.0% and was similar to all clutches at MDA (77.1 ± 28.6%). The parameter remained within management control limits (Figure 4-3a). *Hatchling Emergence Probability* • The mean hatchling emergence probability at Barrow Island was 83.1 ± 18.1% and was similar to MDA (82.6 ± 21.0%). The parameter remained within management control limits (Figure 4-3b). *Incubation Duration* • The mean incubation duration at Barrow Island and MDA was 47.2 ± 2.7 and 48.3 ± 2.3 days, respectively. *Incubation Temperature* • The mean daily clutch temperature during incubation at Barrow Island and MDA was 31.4 ± 1.8 °C and 31.3 ± 1.9 °C, respectively. *Clutch Fate* • Of the 166 marked clutches, 125 (75%) were considered complete. The remaining 41 incomplete clutches were either disturbed by another turtle or predator (n = 29), lost during incubation (n = 6), or mixed with another clutch (n = 6). All disturbance events occurred during incubation (as indicated by the temperature logger data). The percentage of marked clutches that were categorised as incomplete at Barrow Island (all beaches combined) in each season since 2010–2011 does not show a significant increasing or decreasing trend. *Clutch Size* • The mean clutch size at excavation was 49.1 ± 7.7 eggs at Barrow Island and 48.6 ± 7.4 eggs at MDA.

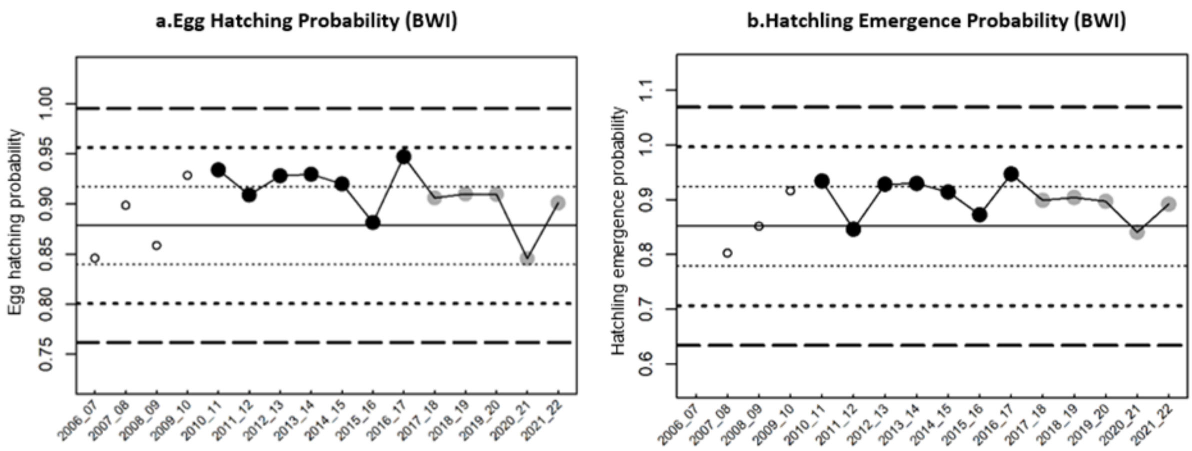

Figure 4-3: Control Chart for (a) Egg Hatching Probability and (b) Hatchling Emergence Probability for Complete Clutches[1]

1 Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal line = long-term expected estimate derived from baseline estimates (mean or median), dotted lines = ±1 SE (or 1 MAD), small dashed lines = ±2 SE (or 2 MAD), long dashed lines = ±3 SE (or 3 MAD).

Monitoring Program: Hatchling Orientation

Objective

To measure and detect variation in dispersal patterns of Flatback Turtle hatchlings following emergence from the nest.

Changes to Program

No changes were made to the hatchling orientation monitoring program during the Reporting Period.

Methodology

- Measures of artificial light (magnitude and bearing) on marine turtle nesting beaches using specialised light-measurement cameras.
- Measures of the orientation (fan spread angle [disorientation] and fan offset angle [from most direct line to the ocean—misorientation]) of marine turtle hatchling tracks on beaches. These parameters are control-charted for Bivalve and Terminal beaches.

Light Results

- Sources of night-time light emissions included the GTP, ground flare, offshore infrastructure including the MOF, LNG Jetty head, LNG tanker (when present) and Butler Park. No drill centres were detected as a source of light emissions.
- The level of brightness at each monitoring site demonstrated a spatial relationship with the distance from the GTP; i.e. brighter values were recorded at closer sites and darker values at more distant sites.
- Night-time light emissions (whole-of-sky) were brightest at Bivalve Beach followed by (in order of descending magnitude) Inga, Terminal, Yacht Club North (YCN), Yacht Club South (YCS), and Mushroom beaches.
- No major flaring events were observed during the survey; however, sky brightness varied substantially each night due to differing levels of cloud coverage.

Hatchling Orientation Results

- No exceedances in the modelled hatchling post-emergence spread (disorientation) occurred at Bivalve or Terminal beaches during the Reporting Period (Figure 4-4a and Figure 4-4c.)
- An exceedance in the modelled hatchling post-emergence offset (misorientation) occurred at Bivalve (+3 SD) and at Terminal (+1 SD) beaches, as shown in Figure 4-4b and Figure 4-4d.

Monitoring Program: Hatchling Orientation

- In addition to the modelled control chart estimates for Bivalve and Terminal beaches, measures of orientation on these and other Barrow Island beaches (i.e. YCS, YCN, Inga, and Mushroom) indicated:
  - The smallest mean fan spread angle was at Mushroom and largest at YCS. This was the second consecutive season that YCS has recorded the largest fan spread angle.
  - Fan spread angle was significantly larger on YCS compared to the baseline. There was no significant difference in the fan spread angle at YCN, Bivalve, or Mushroom beaches when compared to the baseline. Comparison of the fan spread angle at Inga was not possible due to the limited number of samples recorded at that beach in 2021–2022.
  - The smallest mean fan offset angle was at Mushroom and the largest was at Bivalve.
  - There was no significant difference in the fan offset angle at YCS, YCN, or Mushroom beaches when compared to the baseline. Comparison of the fan offset angle at Inga was not possible due to the limited number of samples recorded at that beach in 2021–2022.
- Hatchlings generally oriented in a seaward direction and, similar to 2020–2021, a larger proportion of hatchling fan spread and offset angles were in a southerly direction compared to the baseline, across all beaches. The largest shift in hatchling fan orientation occurred at YCS. Lighting from the Main Camp has been completely switched off; however, a small, low-intensity source of sky glow remains in the same direction (this may be light from the Ashburton region on the mainland). No other new light sources were detected that may explain the southerly shift in hatchling spread and offset angles.
- No observations were made of hatchlings orienting directly inland towards the LNG site, other than one outlier on Bivalve Beach.

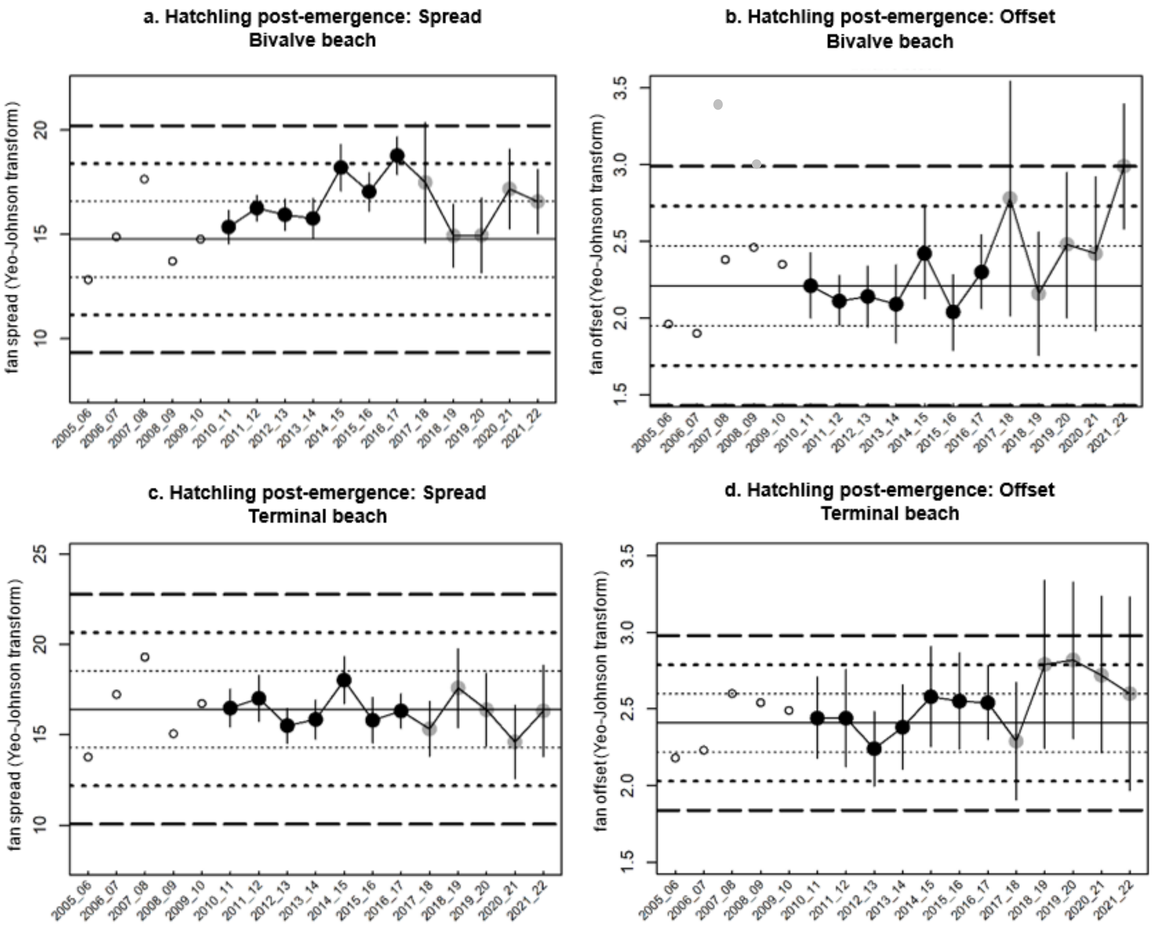

Figure 4-4: Control Charts for Hatchling Post-emergence Dispersion: Fan Spread and Offset Estimates at Terminal and Bivalve Beaches[1]

1 *Open dots = baseline estimate derived from empirical data, black dots = construction parameter estimate, grey dots = operations parameter estimate, solid horizontal line = long-term expected estimate derived from baseline*

estimates (mean or median), dotted lines = ±1 SE (or 1 MAD), small dashed lines = ±2 SE (or 2 MAD), long dashed lines = ±3 SE (or 3 MAD). Error bars indicate 95% CI.

4.1.1 Flatback Turtle Tagging – A07 and Junction Beaches

A study was initiated during 2017–2018 to better understand the spatial and temporal variation in nesting beach usage and beach fidelity for those turtles encountered at A07, Junction, and Camp beaches, which are not monitored during the routine Flatback Turtle Abundance and Distribution Monitoring Program. This study was continued during the Reporting Period, with additional tagging effort at two of the study beaches—A07 and Junction.

The additional monitoring effort at A07 and Junction beaches identified 411 turtles that were not encountered on the routine beaches (Mushroom, Terminal, Bivalve, Inga, Yacht Club North, and Yacht Club South) during the season, and hence excluded from the population size MSORD modelling. This was 22% of all individual turtles encountered at all Barrow Island beaches this season, which was consistent with previous seasons (seasonal monitoring commenced at these beaches in 2017–2018). The 411 turtles at A07 and Junction beaches included 380 remigrant turtles (92%) and 31 new turtles (8%).

4.1.2 Incubation Success – A07, Junction, YCS, and YCN Beaches

To better understand the hatch/emergence success and incubation environment of Flatback Turtles clutches on A07, Junction, YCS, and YCN beaches, CAPL continued a study during the Reporting Period that had been started at Inga Beach in 2016–2017. The study used the same methodology as the routine Incubation Success Program.

With the exception of Junction Beach, the egg hatching probability (all clutches) at these individual beaches was high, and the rate of clutch disturbance was low and consistent with previous seasons. However, Junction Beach experienced the lowest mean egg hatching probability for complete clutches (67.4 ± 33.6%) and all clutches (42.2 ± 39.7%). The higher rate of clutch disturbance at Junction Beach was likely linked to the high density of nesting activity at the beach and may be an artefact of a higher nester abundance at Barrow Island during the Reporting Period or an increased use of the beach by Flatback Turtles. The incubation environment at Junction Beach may also have negatively influenced egg hatching probability, with the beach recording the highest mean percentage of the incubation duration (35 ± 7 %) spent above the thermal tolerance range for Flatback Turtles (33 °C) out of all beaches. The incubation success parameters of Junction, and other beaches, vary year to year and the 2021–2022 results are no indication of lesser quality nesting habitat at Junction Beach. For example, in previous seasons of this study, the incubation environment at Junction Beach has recorded an egg hatching probability as high as 89.3 ± 14.9% (complete clutches in 2019–2020) and 73.9 ± 33.9% (all clutches 2017–2018).

The egg hatching probability at those beaches where Flatback Turtles have demonstrated a change in their spatial distribution of nesting activity (i.e. Inga, Bivalve, and Terminal) was similar to the other monitored beaches this season (i.e. A07, Junction, YCS, YCN, and Mushroom) combined.

4.1.3 Population Modelling

The development of a mathematical age-structured model for the Barrow Island Flatback Turtle population continued throughout the Reporting Period. This model helps inform ongoing studies into the distribution and incubation success of

Flatback Turtles on Barrow Island, and the dispersal and survivorship of Flatback Turtle hatchlings. The current model is being developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) and the University of Tasmania, and tracks the age-distribution of turtles distributed among a finite number of sites (beaches) within the Barrow Island Flatback Turtle rookery. The model will aim to demonstrate population trajectories based on a range of scenarios and risks, and parametrised with data for Flatback Turtles collected as part of Flatback Turtle and coastal stability monitoring programs and other published data.

4.2 Event Data

Incidents involving harm to marine turtles reported during the Reporting Period are summarised in the following table.

Event Data: Harm to Marine Turtles
Reporting Requirement
Reportable incidents[1] involving harm to marine turtles.
Results
There were no reportable incidents during the Reporting Period involving harm to marine turtles as a result of the Gorgon Gas Development.

1. *Reportable incidents as defined in the LTMTMP (Ref. 6) "Harm or mortality to listed marine turtles attributable to the Gorgon Gas Development, and significant impacts detected by the monitoring program on matters of NES relevant to this Plan"*

4.3 Audit and Review

Findings of the annual audit and review of lighting design features, management measures, and operating controls, including details of light management initiatives and activities undertaken during the Reporting Period, are summarised in the following table.

Stressor: Light
Audit Results
• An internal annual audit of lighting design features, management measures, and operating controls commenced in April 2022, immediately after the peak Flatback Turtle nesting season (Ref. 8). The audit started with a review of 38 site lighting inspections undertaken between 11 September 2021 and 24 March 2022. The audit recommenced on 5 August 2022 at the end of the Reporting Period, focusing on: – permanent lighting – temporary onshore lighting – LNG and condensate vessel lighting – vessel lighting (other than LNG ships and condensate vessels) – marine turtle studies. • 14 actions were identified in the 38 site lighting inspections, all of which were closed out within a satisfactory timeframe. • The August 2022 audit reported no Findings, one Recommendation, one Observation and one assessment of Good Practice. All other audit items were assessed as Satisfactory. • Two recommendations made in the 2020–2021 annual lighting audit and effectiveness review (Ref. 8) were actioned in January 2022—these pertained to an additional lighting inspection being undertaken by CAPL's Marine Turtle Monitoring Program managers and a trial of continuous light monitoring technology to complement the annual Light Monitoring Program sky photography undertaken at Flatback Turtle nesting beaches.

Stressor: Light
Light Management Initiatives, Activities, and Reasonably Practicable Lighting Improvements
• Site planning sessions continued for activities with the potential to affect marine turtle behaviour before and during the marine turtle nesting season. • Marine turtle awareness communications were sent to staff and contractors at the start of and throughout the turtle season, highlighting the relationships between lighting management and impacts to marine turtles. These were incorporated into routine prestart and contractor meetings and site notices. • Marine turtle awareness information was made available to ships entering the Port of Barrow Island via a Turtle Season Marine Notice accessible via the CAPL website, in addition to routine information contained within the Port of Barrow Island Information Manual (all available from https://australia.chevron.com/our-businesses/barrow-island/barrow-island-port). • Personnel engagement continued via the marine turtle nesting and turtle hatchling tours to raise awareness of the environmental commitments associated with marine turtles. Additional information on the marine turtle nesting season, monitoring programs, and lighting management was also disseminated through the accommodation TVs. • Lighting along the LNG Jetty and MOF was switched off, except where required for work and safety reasons. • An additional 30 solar bollards (customised for directional light, LEDs with blue wavelength removed) were installed on walkways around Butler Park. Adjacent street and building lighting was removed or switched off. • Mobile solar-powered lighting towers are gradually replacing traditional diesel-powered lighting towers. These towers have been programmed to meet optimal turtle lighting requirements for wavelength and light intensity. • WA Oil Production Camp was closed in July 2020—all personnel are now accommodated at Butler Park. This action has reduced the light spill near east coast beaches, as only minimal safety and security lights are left in place.
Conclusions on the Effectiveness of Lighting Design Features, Management Measures, and Operating Controls
• CAPL considers lighting design features, management measures, and operating controls are ‘effective’ if the environmental objectives of the LTMTMP are met, and if they reduce potential adverse impacts to Barrow Island marine turtle populations. • The brightness of artificial light at Barrow Island varied across survey nights due to the presence of cloud and an LNG/condensate tanker. The sea-finding behaviour of emerged hatchlings demonstrated an exceedance of control limits for their fan offset angle at both Bivalve and Terminal beaches and shows a significantly increasing trend in both spread and offset angles (Bivalve and Terminal combined). This may be partially attributed to the variation in artificial light or to the different distribution of hatchling emergence points on the beach due to the spatial shift in beach use at these beaches since baseline. • Overall, analysis of hatchling sea-finding parameters on monitored beaches demonstrated that Gorgon Gas Development lighting did not adversely affect the sea-finding ability of hatchlings during the Reporting Period, and emergent Flatback Turtle hatchlings continued to orientate successfully towards the ocean. • Given the above, no changes to lighting design features, management measures, and operating controls were required during the Reporting Period, beyond the improvements and initiatives undertaken to reduce artificial lighting.

4.4 Changes to the Long-term Marine Turtle Management Plan

No amendments to the LTMTMP were proposed and/or approved during the Reporting Period.

4.5 Conclusion

The Flatback Turtle nester abundance recorded at Barrow Island during the Reporting Period was higher than baseline and continues to show an increasing, but not significant, linear trend, which aligns with results at MDA. Breeding omission for the Barrow Island population also remained high and for an eighth consecutive season, exceeding a control chart limit. The nesting population’s use of certain beaches has also likely varied due to changes in coastal processes caused by Project-related activities, notably at Terminal, Bivalve and Inga beaches, which have recorded a reduction and redistribution of nesting habitat. Concurrently, the same beaches have recorded a shift in the location and change in the pattern of their nesting activities and, in the case of Inga and Bivalve, significant reductions in percentage use of the beach. Additional investigation into the fate of marked clutches and density-dependent effects attributed to temporal and spatial variation in the nesting population's use of beaches at Barrow Island, found a localised reduction in egg hatching probability at Inga and Mushroom beaches this season. However, despite this localised reduction, the control-charted parameters for incubation success at Barrow Island as a whole (i.e. egg hatching and hatchling emergence probability of complete clutches) remained within control limits.

The brightness of artificial light at Barrow Island varied across survey nights due to the presence of cloud and an LNG/condensate tanker. The sea-finding behaviour of emerged hatchlings demonstrated an exceedance of control limits for their fan offset angle at both Bivalve and Terminal beaches and shows a significantly increasing trend in both spread and offset angles (Bivalve and Terminal combined). This may be partially attributed to the variation in artificial light or to the different distribution of hatchling emergence points on the beach due to the spatial shift in use at these beaches since baseline.

Outcomes of the monitoring programs, investigations into observed deviations in demographic parameters, and nesting behaviour, indicate that the Flatback Turtle population nesting on Barrow Island remains stable and demographically healthy, with consistently high survival rates observed for nesting females.

5 Short-range Endemics and Subterranean Fauna

Table 5-1: EPR Requirements for Short-range Endemics and Subterranean Fauna

Item	Source	Section in this EPR
Results of survey and studies to locate outside the GTP footprint and Additional Support Area (ASA) those remaining short-range endemics (SRE) and subterranean fauna species previously found only within the GTP footprint and ASA	MS 800, Schedule 3(4i)	5.1

5.1 Monitoring Results

The Short-Range Endemics and Subterranean Fauna Monitoring Plan (SRESFMP) (Ref. 9) focuses on surveys to locate and identify those SRE and subterranean fauna species that had only previously been located within the GTP footprint and the ASA. Several of these species were confirmed outside the GTP footprint and ASA before construction commenced, and a further two subterranean fauna species were identified during construction (Ref. 9). Therefore, the ongoing focus of the SRESFMP is to locate these four taxa:

- terrestrial SRE fauna: *Idiommata* sp.
- subterranean stygofauna SRE fauna: *Oniscidea* sp. nov. 1. and *Pilbaracandona* sp. nov. 1.
- subterranean troglofauna SRE fauna: *Symphyla* sp.

The SRESFMP was amended in 2019, in consultation with relevant regulatory agencies, to reduce the monitoring frequency for subterranean fauna and terrestrial SRE fauna from yearly to five-yearly. Targeted subterranean fauna sampling was last undertaken on Barrow Island in February, April, and June 2018. Therefore, no subterranean fauna monitoring results are presented in this EPR. Similarly, targeted monitoring of terrestrial SRE fauna was last undertaken in May 2016 and was not completed in subsequent years due to low rainfall.

The 2021–2022 results for monitoring of terrestrial SRE fauna species are summarised in the following table.

Monitoring Program: Terrestrial Short-range Endemics
Objective
Locate *Idiommata* sp. outside GTP site and Additional Support Area
Changes to Program
There were no changes to the program in 2021–2022.
Methodology
• Targeted monitoring every five years using burrow searches and excavation, and night searches using torches to scan the bare ground and vegetation for wandering individuals. No burrow searches or excavations were undertaken during the Reporting Period. • A total of 379 hours of night visual surveillance searches were carried out during the Reporting Period.
Results
Idiommata sp. was not detected outside the GTP footprint or ASA during the NIS surveillance program.
Conclusions
Idiommata sp. was not detected outside the GTP footprint or ASA during the Reporting Period.

6 Fire Management

Table 6-1: EPR Requirements for Fire Management

Item	Source	Section in this EPR
Incidence of fires caused by the Proposal, and fires that impact on the Proponent's facilities, including details of cause, lessons learnt, and recommended actions	MS 800, Schedule 3(5i) MS 769, Schedule 3(2i) EPBC 2003/1294 and 2008/4178, Schedule 3(4i)	6.1
Material or Serious Environmental Harm caused by fire directly attributable to the Proposal	MS 800, Schedule 3(5ii) MS 769, Schedule 3(2ii) EPBC 2003/1294 and 2008/4178, Schedule 3(4ii)	N/A[1]
Any changes to the Gorgon Gas Development Fire Management Plan (Ref. 10) including: • management responses to address Material or Serious Environmental Harm caused by fire directly attributable to the Proposal improvement to fire management practices.	MS 800, Schedule 3(5iii) MS 769, Schedule 3(2iii) EPBC 2003/1294 and 2008/4178, Schedule 3(4iii)	6.2

1 No Material or Serious Environmental Harm caused by fire was recorded during the Reporting Period.

6.1 Event Data

Incidences of fire caused by the Gorgon Gas Development, or fires that impacted on Project facilities during the Reporting Period, including details of cause, lessons learnt, and recommended actions, are provided in the following table.

Event Data: Fires
Results
• No fire events occurred during the Reporting Period that caused Material or Serious Environmental Harm outside the TDF. • No fire events impacted the Gorgon Gas Development facilities.

6.2 Changes to the Fire Management Plan

No changes or revisions were made to the Gorgon Gas Development Fire Management Plan (Ref. 10) during the Reporting Period.

7 Carbon Dioxide Injection Project

The Gorgon Carbon Dioxide Injection Project is the largest of its kind in the world and represents the largest greenhouse gas (GHG) abatement project undertaken by industry to date.

To date, the Gorgon Joint Venture Participants have invested more than AU$3.2 billion in the Carbon Dioxide Injection Project and remain committed to safely reducing the Gorgon Gas Development's GHG emissions.

Since CO_2 injection started in August 2019, more than 7 million tonnes of GHG have been injected.

Table 7-1 lists the matters related to the Carbon Dioxide Injection Project to be reported on in this EPR.

Table 7-1: EPR Requirements for the Carbon Dioxide Injection Project

Item	Source[1]	Section in this EPR
Volume of reservoir carbon dioxide and other acid gases removed from the incoming natural gas stream and available for injection	EPBC 2003/1294 and 2008/4178, Schedule 3(5i)	7.1
Volume of reservoir carbon dioxide and other acid gases injected	EPBC 2003/1294 and 2008/4178, Schedule 3(5ii)	7.2
Results of environmental monitoring and identified Material or Serious Environmental Harm, if any, resulting from the seepage of injected carbon dioxide to the surface or near-surface environments including those which may support subterranean fauna (including the Blind Gudgeon [*Milyeringa veritas*])	EPBC 2003/1294 and 2008/4178, Schedule 3(5iii)	N/A[2]
Reasons for shortfall between the volume of reservoir carbon dioxide extracted and injected	EPBC 2003/1294 and 2008/4178, Schedule 3(5iv)	7.3
If the amount of carbon dioxide injected falls significantly below the target levels, CAPL must report on: • measures that could be implemented that would ensure the target level is met or, if injection is not considered feasible for all or some of the gas, measures to otherwise offset • which if any of these measures the Proponent intents to implement	EPBC 2003/1294 and 2008/4178, Schedule 3(5v)	7.4
If monitoring shows there is an elevated risk of Material or Serious Environmental Harm and/or risk to human health associated with the injection of reservoir carbon dioxide, the Proponent must report to the Minister on the efficacy of continuing to geosequester and alternative offsets considered instead of continuing injection of reservoir carbon dioxide	EPBC 2003/1294 and 2008/4178, Schedule 3(5vi)	N/A[2]

1 *Reporting of these parameters are no longer required under MS 800 as amended by MS 1198, published 20 October 2022.*

2 *Environmental monitoring was not required during the Reporting Period as there was no detection of seepage of injected carbon dioxide to the surface or near-surface environments. Therefore, no elevated risk of Material or Serious Environmental Harm and/or risk to human health was identified.*

7.1 Volume of Reservoir Carbon Dioxide Removed

The Commonwealth *National Greenhouse and Energy Reporting Act 2007* (NGER Act) contains provisions on the reporting of emissions from the transport, injection, and underground storage of GHGs. To comply with NGER Act reporting requirements, CAPL is required to determine the volume of reservoir carbon dioxide removed from the incoming natural gas stream that is available for injection. This EPR includes data on the volumes of reservoir carbon dioxide extracted for the most recent financial year (1 July to 30 June), which aligns with CAPL's NGER Act reporting obligations. This enables the processes and procedures (including quality assurance, audit, and sign-off checks) developed for NGER Act compliance to be applied to these data.

Volume of Reservoir Carbon Dioxide Removed
2,565,171 × 10^3 standard cubic metres of reservoir carbon dioxide was removed from the incoming natural gas stream during the 2021–2022 financial year. This equates to 5,044,308 tonnes of carbon dioxide equivalent (tCO_2e).

7.2 Volume of Reservoir Carbon Dioxide Injected

This EPR includes data on the volumes of reservoir carbon dioxide injected for the most recent financial year, which align with CAPL's NGER Act reporting obligations.

Volume of Reservoir Carbon Dioxide Injected
824,599 × 10^3 standard cubic metres of reservoir carbon dioxide was injected during the 2021–2022 financial year. This equates to 1,646,150 tCO_2e.

7.3 Reasons for Shortfall Between Volume Extracted and Injected

The key reasons for the shortfall between the volume of reservoir carbon dioxide extracted and injected for the 2021–2022 financial year are:

- the regulatory limitations on injection rates in place until late 2021; and
- the careful management of reservoir carbon dioxide injection rates to appropriately manage Dupuy Formation reservoir pressures as a result of reduced water production rates from the pressure management system.

Early reservoir performance and modelling has indicated that additional pressure management capacity is required to manage reservoir pressures. CAPL is progressing plans to optimise the current pressure management system to increase water production rates.

7.4 Measures Being Implemented

18 July 2016 to 17 July 2021 Compliance Period

As reported in the 2021 EPR, as a result of the time needed to address the technical issues to ensure the safe operation of the Carbon Dioxide Injection Project over the life of the Gorgon Project it was not possible to meet the target level set in Condition 26.2 of MS 1136 for the period from 18 July 2016 to 17 July 2021.

In the 2021 Gorgon EPR, CAPL committed to acquiring and surrendering credible GHG offsets recognised by the WA Government to otherwise offset the shortfall and to using reasonable endeavours to acquire and surrender 5.23 million offsets by 17 July 2022.

The acquisition and surrender of 5.23 million offsets was completed on 20 June 2022.

The offsets acquired and surrendered were:

- Australian Carbon Credit Units (ACCUs) issued under the Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011*
- Verified Emission Reductions (VERs) issued under the Gold Standard program
- Verified Carbon Units (VCUs) issued under the Verified Carbon Standard program.

VERs and VCUs were the dominant type of offsets acquired and surrendered with the volumes of ACCUs influenced by the timeframe for acquisition and surrender of the offsets, availability and the potential impact on the ACCU market. Offsets were generated from various projects (renewables, energy efficiency, waste, and power, landfill gas, human-induced regeneration and savanna burning) and from various regions.

In addition to offsetting the shortfall through acquiring and surrendering GHG offsets, CAPL will also invest AU$40 million in lower-carbon projects in WA. CAPL continues to work with the WA Government on arrangements relating to the lower-carbon investment.

18 July 2017 to 17 July 2022 Compliance Period

As with the 18 July 2016 to 17 July 2021 compliance period, as a result of the time needed to address the technical issues to ensure the safe operation of the Carbon Dioxide Injection Project over the life of the Gorgon Project, it was not possible to meet the target level set in Condition 26.2 of MS 1136 for the period from 18 July 2017 to 17 July 2022.

The shortfall from the target level set in Condition 26.2 for the period 18 July 2017 and 17 July 2022 is approximately 2.4 million tCO_2e.

CAPL is committed to acquiring and surrendering offsets to fully offset the shortfall. At the time of writing, the acquisition and surrender of over 2.3 million offsets had been completed.

The offsets acquired and surrendered were:

- ACCUs issued under the Commonwealth *Carbon Credits (Carbon Farming Initiative) Act 2011*
- VERs issued under the Gold Standard program
- VCUs issued under the Verified Carbon Standard program.

VERs and VCUs were the dominant type of offsets acquired and surrendered with the volumes of ACCUs influenced by the timeframe for acquisition and surrender of the offsets, availability, and the potential impact on the ACCU market. Offsets were generated from various projects (renewables, energy efficiency, landfill gas and human-induced regeneration) and from various regions.

8 Air Quality

Table 8-1: EPR Requirements for Air Quality

Item	Source	Section in this EPR
Air quality monitoring results, with a discussion on the success (or otherwise) in meeting emissions targets	MS 800, Schedule 3(7i)	8.1

8.1 Monitoring Results

The objectives of the Gorgon Gas Development Air Quality Management Plan (AQMP) (Ref. 11), as defined by Ministerial Conditions, are to:

- ensure air quality meets the appropriate standards for human health in the workplace
- ensure air emissions from GTP operations do not pose a risk of Material or Serious Environmental Harm to the flora, vegetation communities, terrestrial fauna, and subterranean fauna of Barrow Island.

The Ambient Air Quality Monitoring Program measures air quality for selected atmospheric pollutants and air toxics emissions associated with the operation of the GTP, and then compares these data against the applicable assessment criteria defined in the AQMP (Ref. 11). The Occupational Hygiene monitoring plan is implemented within the GTP to evaluate workplace exposure standards for airborne contaminants (Ref. 12).

The AQMP also specifies emission targets for selected atmospheric pollutants and air toxics emitted from major GTP emission sources (Frame 9 Gas Turbine Generators [GTGs] and Frame 7 Liquefaction Compressor Gas Turbines [LCGTs]) (Ref. 11). Emissions from these major sources are monitored via sampling at the point of discharge (the stacks) to the environment.

The 2021–2022 air quality monitoring results, including assessment of exceedances, are summarised in the tables below.

Monitoring Program: Ambient Air Quality
Results
As part of the Ambient Air Quality Monitoring Program there were no recorded exceedances for nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), hydrogen sulfide (H_2S), or aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene) against the relevant National Environmental Protection Measure (NEPM) (Table 8-2) and National Occupational Health Exposure Standards (NOHES) guidelines. The annual occupational hygiene monitoring plan was implemented within the GTP including evaluation of mercury (Hg), H_2S, and aromatic hydrocarbons (benzene, toluene, ethylbenzene, xylene) against relevant workplace exposure standards for airborne contaminants. Results met appropriate standards for human health in the workplace. • In total, there were 14 exceedances of the NEPM guideline for PM_{10} at the Communications Tower (CT) location and two exceedances at Butler Park during the reporting period (Table 8-2). – The PM_{10} exceedances at the Communications Tower (CT) location were interpreted as localised sources, with dust lift-off caused by vehicle movements periodically impacting data collected at the AQMS due to its proximity to an unsealed road. Given typically low PM contribution from point source emissions (e.g. clean-burning turbines) within the GTP site, the most likely cause for the observed exceedances is local, transport-related dust from vehicle movements. – While localised dust may also influence the Butler Park monitoring location, the two PM_{10} exceedances against the 1-day NEPM guideline at the Butler Park Air Quality Monitoring Station (AQMS) during the Reporting Period were inferred to be regional events given concurrent

Monitoring Program: Ambient Air Quality
exceedances observed at the CT on both occasions, and wind direction being from the south-south-west and west respectively. • As a result of limitations on the reservoir carbon dioxide injection rate, Acid Gas Removal Units (AGRU) venting rates were higher in the reporting period compared to the prior period. Air toxics and H_2S concentrations have generally increased relative to the last reporting period. There were detections of H_2S at the CT above nuisance levels but below NOHES guidelines. During periods of elevated H_2S, winds were typically light (<5 m/s) and south-westerly to westerly. Under light winds, sources are most likely localised. The AGRU vents continue to be the most likely source of the H_2S, given the prevailing wind direction and that H_2S is known to be present in the acid gas being vented (Ref. 13). • Measured ambient air quality results were evaluated against modelling predictions relevant for current operating conditions involving higher venting rates. Measured ambient air quality results were generally within modelled predictions for atmospheric pollutants and air toxics. • Measured ambient air quality results and modelled predictions were compared against the applicable assessment criteria. Measured results did not exceed the applicable assessment criteria, and modelled predictions also indicated these criteria were met for areas outside of the specific monitoring locations described in the ambient air quality monitoring program.
Conclusions
• There were no recorded exceedances for parameters against NEPM and NOHES guidelines associated with the Ambient Air Quality Monitoring Program. Results from the occupational hygiene monitoring plan met relevant workplace exposure standards for human health in the workplace. • Exceedances for PM_{10} were inferred to have originated from both localised unsealed road dust lift-off, and regional events. The exceedances of PM_{10} are not considered attributable to GTP emission sources. • Measured ambient air quality results were within model predictions, and both modelled and measured results do not exceed applicable assessment criteria outlined in the AQMP. • Overall, results of the ambient air quality monitoring program demonstrated that air quality was below the relevant NEPM and NOHES guidelines during the Reporting Period. Consequently, during the Reporting Period the air quality was assessed to have met appropriate standards for human health in the workplace, and GTP operations did not pose a risk of Material or Serious Environmental Harm to the flora, vegetation communities, terrestrial fauna, and subterranean fauna of Barrow Island.

Table 8-2: Summary of Exceedances against Guideline Values during the Reporting Period

Guideline Value			No. of Exceedances	
Parameter[1]	Concentration	Averaging Period	CT	Butler Park
PM_{10}	50 µg/m^3	1 day	13	2
	25 µg/m^3	1 year[2]	1	0
NO_2	0.12 ppm	1 hour	0	0
	0.03 ppm	1 year[2]	0	0
O_3	0.10 ppm	1 hour	0	0
	0.08 ppm	4 hours	0	0
SO_2	0.20 ppm	1 hour	0	0
	0.08 ppm	1 day	0	0
	0.02 ppm	1 year[2]	0	0
CO	9.0 ppm	8 hours	0	0
Benzene	0.003 ppm	1 year[2]	0	0
Toluene	1 ppm	1 day[3]	0	0
	0.1 ppm	1 year[2]	0	0
Xylene	0.25 ppm	1 day[3]	0	0

Guideline Value			No. of Exceedances	
Parameter[1]	Concentration	Averaging Period	CT	Butler Park
	0.2 ppm	1 year[2]	0	0

1 Due to logistical and resource constraints during the COVID-19 pandemic, some monitoring equipment was unable to be serviced in accordance with relevant Australian Standards (AS) between February 2022 and June 2022. During this period, continuity of data capture was maintained but data has been treated as indicative. Indicative data was below the relevant NEPM guidelines.

2 In NEPM, the annual averaging period is based on a calendar year. For the purposes of this report, the period 10 August 2021 to 9 August 2022 is used as the yearly averaging period.

3 This is based on a conservative estimate where it is assumed that the pollutant concentration measured over the sampling period (nominally 14 days) was due to a single event lasting one day.

Monitoring Program: Stack Air Quality (Major Emission Sources)
Results
All air quality parameters, except nitrogen oxides (NO_X), were below the relevant emission targets in the Reporting Period for the emission sources considered (Table 8-3) (Ref. 13).
Conclusions
• Overall, results of the stack air quality monitoring demonstrated that all measured parameters remained within emission targets during the Reporting Period, except for some exceedances for NO_X. • The NO_X exceedances on the GTGs occurred during periods when GTGs were operating under low loads (typically <30% capacity). The NO_X target only applies when the GTGs are running at >55% load (Ref. 14). Optimisation of GTGs is ongoing to improve performance.

Table 8-3: Summary of Exceedances against Stationary Source Emissions Targets during the Reporting Period

Emission Source	Emission Targets[1]		No. of Exceedances[2]
	Parameter	Concentration (mg/m^3)	
GTG 1	NO_x	70	2
	CO	125	0
GTG 2	NO_x	70	1
	CO	125	0
GTG 3	NO_x	70	1
	CO	125	0
GTG 4	NO_x	70	0
	CO	125	0
GTG 5	NO_x	70	0
	CO	125	0
LCGTs	NO_x	70	0
	CO	125	0

1 Emission targets apply at the point of discharge to the environment.

2 Target does not apply when GTGs are operating under low loads (<30% capacity).

9 Coastal Stability

Table 9-1: EPR Requirements for Coastal Stability

Item	Source	Section in this EPR
Results of beach and sediment monitoring	MS 800, Schedule 3(8i) EPBC 2003/1294 and 2008/4178, Schedule 3(6i)	9.1, 9.2
Any mitigation measures applied in response to action-related impacts of beach profile	MS 800, Schedule 3(8ii) EPBC 2003/1294 and 2008/4178, Schedule 3(6ii)	N/A[1]
All exceedances of management triggers	Approval letter from the former WA Department of Environment and Conservation to CAPL (Ref. 15)	9.1, 9.2

1 *No mitigation measures as required under Condition 25.6(iii) of MS 800 and Condition 18.6(iii) of EPBC 2003/1294 and 2008/4178 were implemented during the Reporting Period; therefore, reporting is not applicable at this time.*

9.1 Monitoring Results

The objectives of the Gorgon Gas Development Coastal Stability Management and Monitoring Plan (CSMMP) (Ref. 16), as defined by Ministerial Conditions, are to:

- ensure that the MOF and LNG Jetty do not cause significant adverse impacts to the beaches adjacent to those facilities
- establish a monitoring program to detect adverse changes to the beach structure and beach sediments that could have implications for marine turtles nesting on the beaches adjacent to the MOF and LNG Jetty.

The monitoring program detects changes to the beach morphology (beach structure and beach sediments) that could have potential implications for coastal stability and/or marine turtle nesting (Ref. 16). Monitoring is carried out on two Potential Impact beaches (Terminal and Bivalve Beaches) and three Reference beaches (Inga, Yacht Club North, and Yacht Club South Beaches).

Coastal stability management triggers have been established for beach volume, beach slope, and sediment particle size at Potential Impact beaches, and data from each monitoring event are compared against these management triggers. The actions required if a management trigger exceedance occurs are set out in the CSMMP Supplement: Management Triggers (Ref. 17) and includes assessment of defined Performance Standards. Management triggers specific to changes in turtle nesting habitat, based on the quantification of marine turtle nesting areas through habitat mapping, have been defined. These marine turtle nesting habitat management triggers apply to the Potential Impact beaches (i.e. Terminal and Bivalve beaches, immediately adjacent to the MOF), and to data collected at the end of dry season monitoring event (Ref. 16; Ref. 17).

The 2021–2022 monitoring results, including any detected exceedances and major event monitoring[1], are summarised in the following tables.

[1] Major event: a sustained period (4 days or more) of winds with an easterly component (NNE to SSE), during which the total duration of winds >18 knots is ≥96 hours recorded at Barrow Island. (Ref. 16)

Monitoring Program: Beach Structure
Objective
Detect changes to the beaches adjacent to the MOF and LNG Jetty that may affect the stability of those beaches by measuring beach profile, beach volume, and quantifying the extent of any erosion or accretion of sediment over time.
Methodology
• Remote sensing surveys are completed twice each year (at the end of the dry and wet seasons where practicable, typically October and April) or after a major weather event. These surveys capture horizontal (x,y-plane) and vertical (z-plane) data to generate digital surface elevation models over the entire beach (landward of the primary dune to the waterline) at Potential Impact beaches (Terminal and Bivalve Beaches) and Reference beaches (Inga, YCN, and YCS Beaches). • Topographic surveys (using remote sensing or real-time kinematic GPS methods) to record beach morphology are also undertaken, where practicable, after a major weather event.
Survey Timing
• End of dry season routine monitoring event: – on-ground survey 5–8 October 2021 – topographic survey 20 October 2021 • End of wet season routine monitoring event: – on-ground survey 22–25 April 2022 – topographic survey 18 May 2022
Results
Surface Elevation – Patterns of Erosion and Accretion • Measurements of surface elevation are presented in the context of change since baseline condition (October 2009 to May 2022), and most recent annual (May 2021 to May 2022) and seasonal change (October 2021 to May 2022). Changes to each beach are described with reference to the 2009 sparse vegetation line (SVL), which separated the foredune area (FA) (landward of the SVL) from the active zone of the beach (seaward of the SVL) in October 2009. *Terminal Beach* • Between October 2009 and May 2022, Terminal Beach (immediately north of the MOF) eroded at the northern end of the beach and accreted at the southern end of the beach, with some accretion also evident in the creek bed at the centre of the beach (Figure 9-1). Changes were greatest in the active zone of the beach; however, changes have also occurred at the FA, which includes building out the foredune at the southern end of the beach and eroding the edge of the FA at the northern end of the beach, leading to some minor loss of sparse foredune vegetation (Ref. 18). • Between May 2021 and May 2022, changes to surface elevation were minimal, with any change occurring within the limit of detection (±0.25 m; Figure 9-1). • Between October 2021 and May 2022 accretion occurred over the active zone of the beach at the southern end of Terminal Beach, with small patches of erosion occurring near to the 2009 SVL, indicating possible storm-induced beach profile adjustment (Figure 9-1). *Bivalve Beach* • Between October 2009 and May 2022, Bivalve Beach (immediately south of the MOF) exhibited the opposite trend to Terminal Beach, eroding at the southern end of the beach and accreting at the northern end (Figure 9-2). Erosion is also evident in the creek bed at the southern end of the beach. Erosion has encroached on the seaward edge of the FA, along approximately two-thirds of the beach, which has resulted in some minor loss of sparse foredune vegetation (Ref. 18). • Changes occurring between May 2021 and May 2022 were minor, with a small localised area of accretion recorded over the active zone of the beach at the most northern end of the beach, and erosion recorded at the southern extent of the area of long-term accretion (Figure 9-2). • Between October 2021 and May 2022 accretion occurred over the active zone of the beach at the most northern end of the beach, and both minor erosion and accretion occurred near the southern extent of long-term accretion (Figure 9-2). *Inga Beach* • Between October 2009 and May 2022, Inga Beach exhibited a similar trend to Bivalve Beach, accreting at the northern end and eroding along southern sections (Figure 9-3). Changes occurred predominantly over

Monitoring Program: Beach Structure
the active zone of the beach, with some erosion encroaching onto the seaward edge of the FA along the central third of the beach. Erosion at Inga Beach has resulted in the progressive exposure of bedrock, as well as a veneer of loose rock rubble at the northern extent of bedrock exposure (Ref. 18). Accretion at the northern end of the beach has resulted in sparse coastal vegetation establishing in areas that were previously bare (i.e. before construction of the MOF) (Ref. 18). There is evidence of sediments in the area of accretion being transported around the rock headland at the northern end of the beach (Ref. 18). • Very little change occurred from May 2021 to May 2022 at Inga Beach (Figure 9-3), with minor patchy erosion and accretion occurring at the northern end of the beach. • Between October 2021 and May 2022 small areas of both erosion and accretion were evident at the very northern end of the beach (Figure 9-3). *YCN Beach* • Between October 2009 and May 2022, YCN Beach accreted at the beach face over the northern third of the beach, and at the base on the FA along the length of the beach (Figure 9-4). Beach face erosion has occurred over the southern half of the beach, and in a localised area on the lower beach face at the very northern extent. Changes at YCN Beach are strongly linked to changes occurring at YCS Beach to the south and to the mouth area of Terminal Creek to the north, which periodically changes due to creek flow events. • Between May 2021 and May 2022, and October 2021 to May 2022, changes to surface elevation were minimal, with any change occurring within the limit of detection (±0.25 m; Figure 9-4). *YCS Beach* • Between October 2009 and May 2022, erosion occurred at the beach face along the length of YCS Beach, which is an extension of the erosion over the southern half of YCN Beach (Figure 9-5). Similar to YCN Beach, accretion was detected at the base of the FA along the length of the beach. • Between May 2021 and May 2022, patches of erosion were evident over the active zone of the beach, particularly in the centre of the beach, where a persistent rock outcrop occurs (Figure 9-5). • Between October 2021 and May 2022 patches of both erosion and accretion were detected near the persistent rock outcrop in the centre of the beach, as well as minor accretion at the southern end of the beach (Figure 9-5).

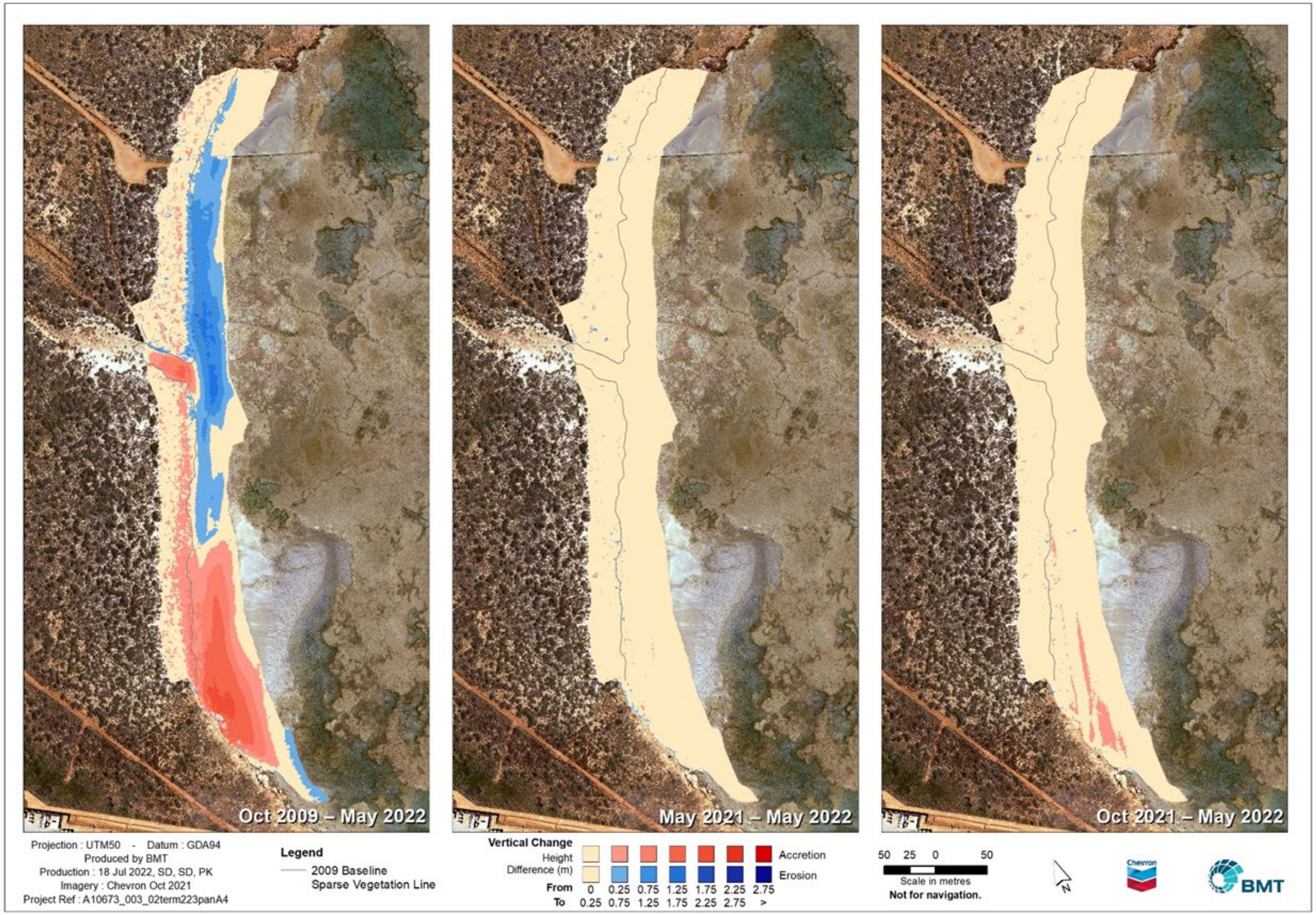

Figure 9-1: Surface Elevation Changes at Terminal Beach

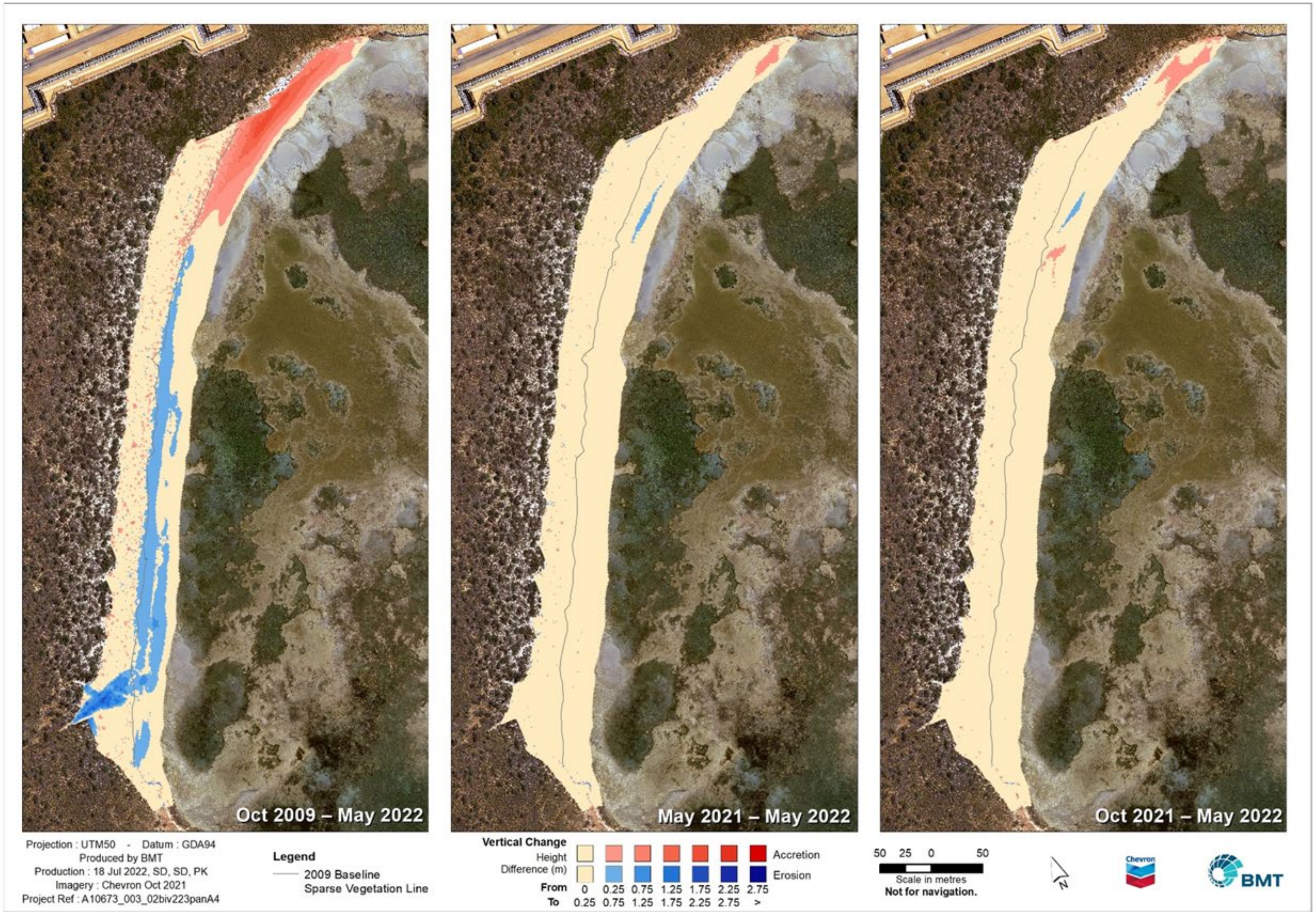

Figure 9-2: Surface Elevation Changes at Bivalve Beach

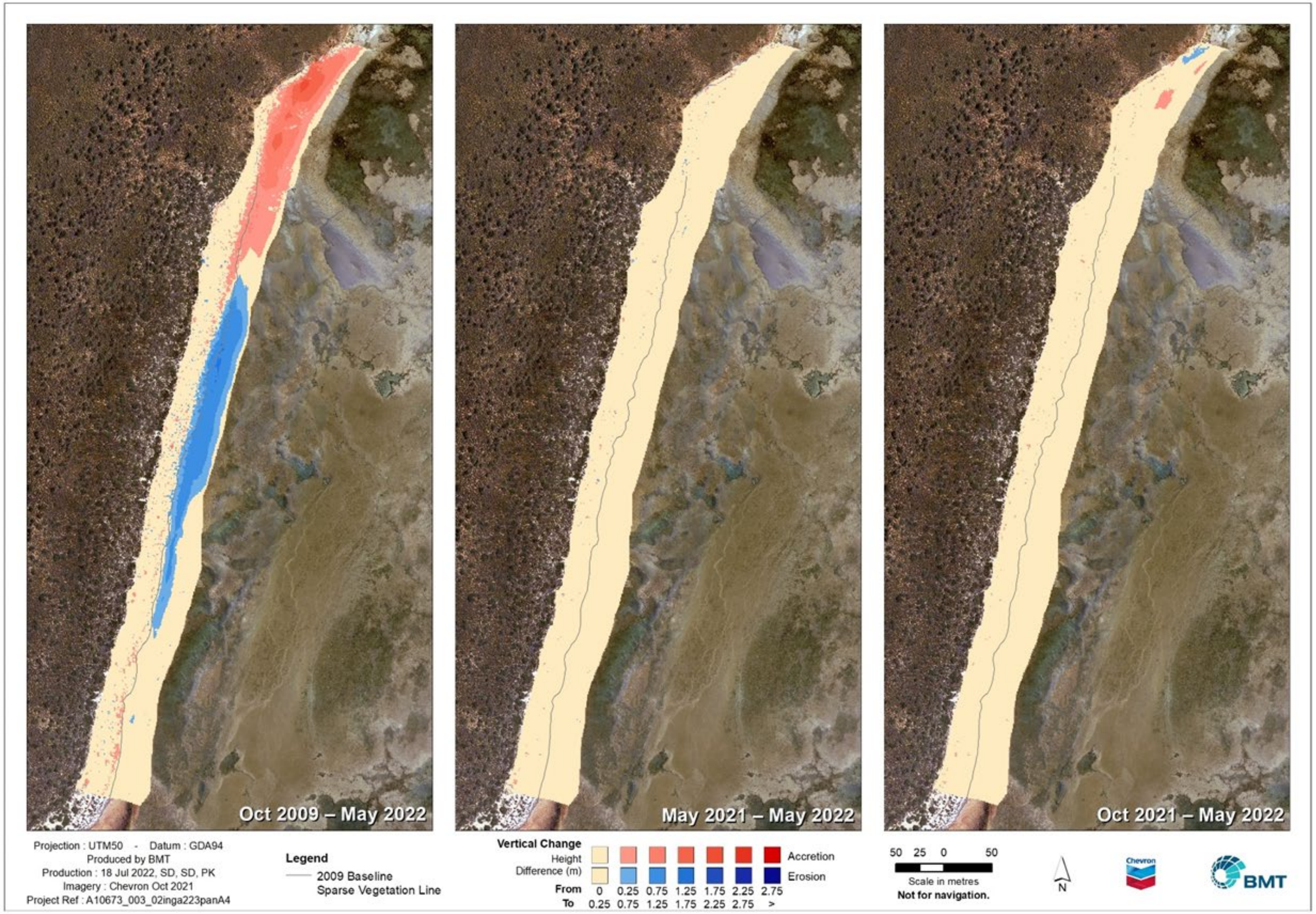

Figure 9-3: Surface Elevation Changes at Inga Beach

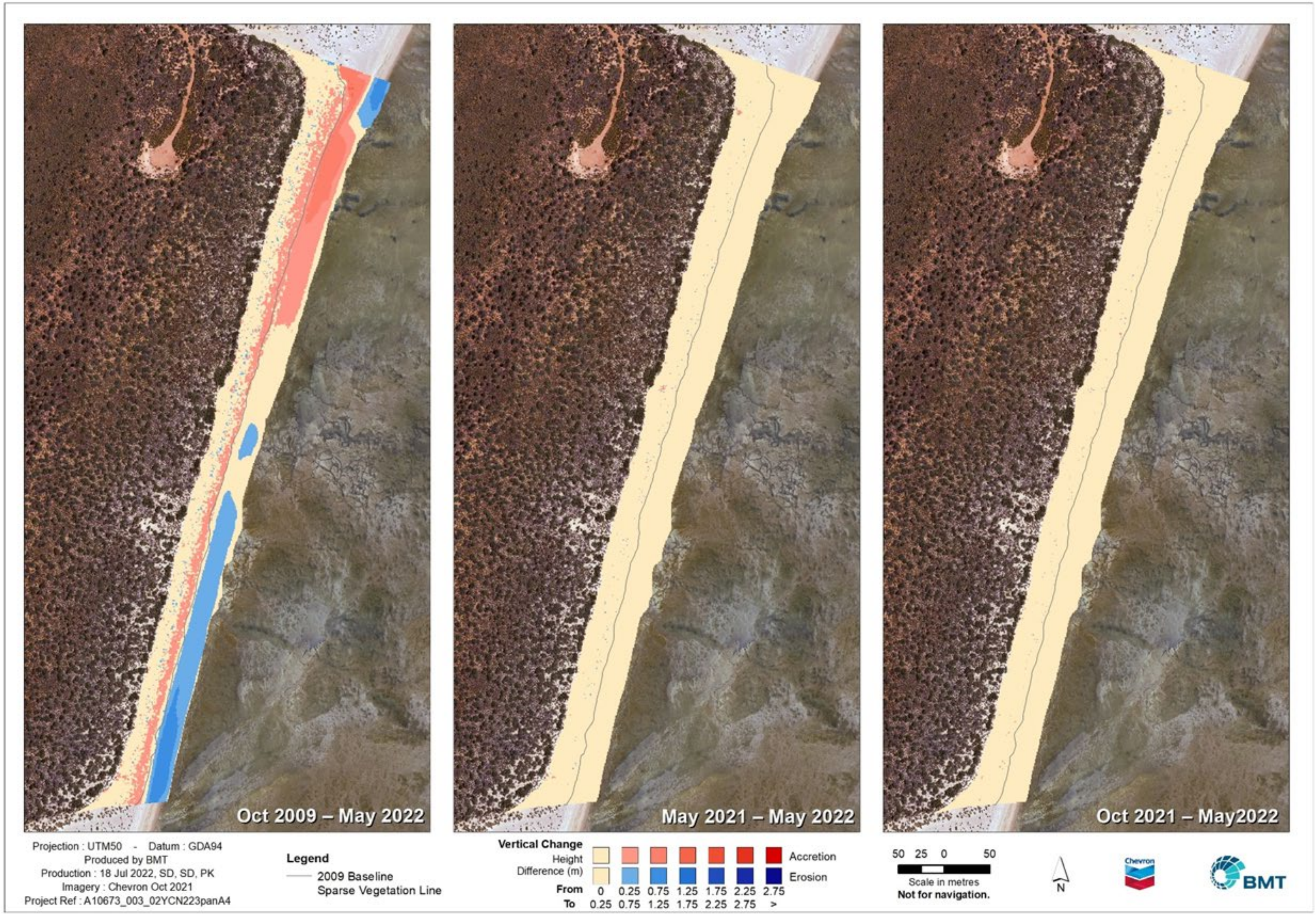

Figure 9-4: Surface Elevation Changes at Yacht Club North Beach

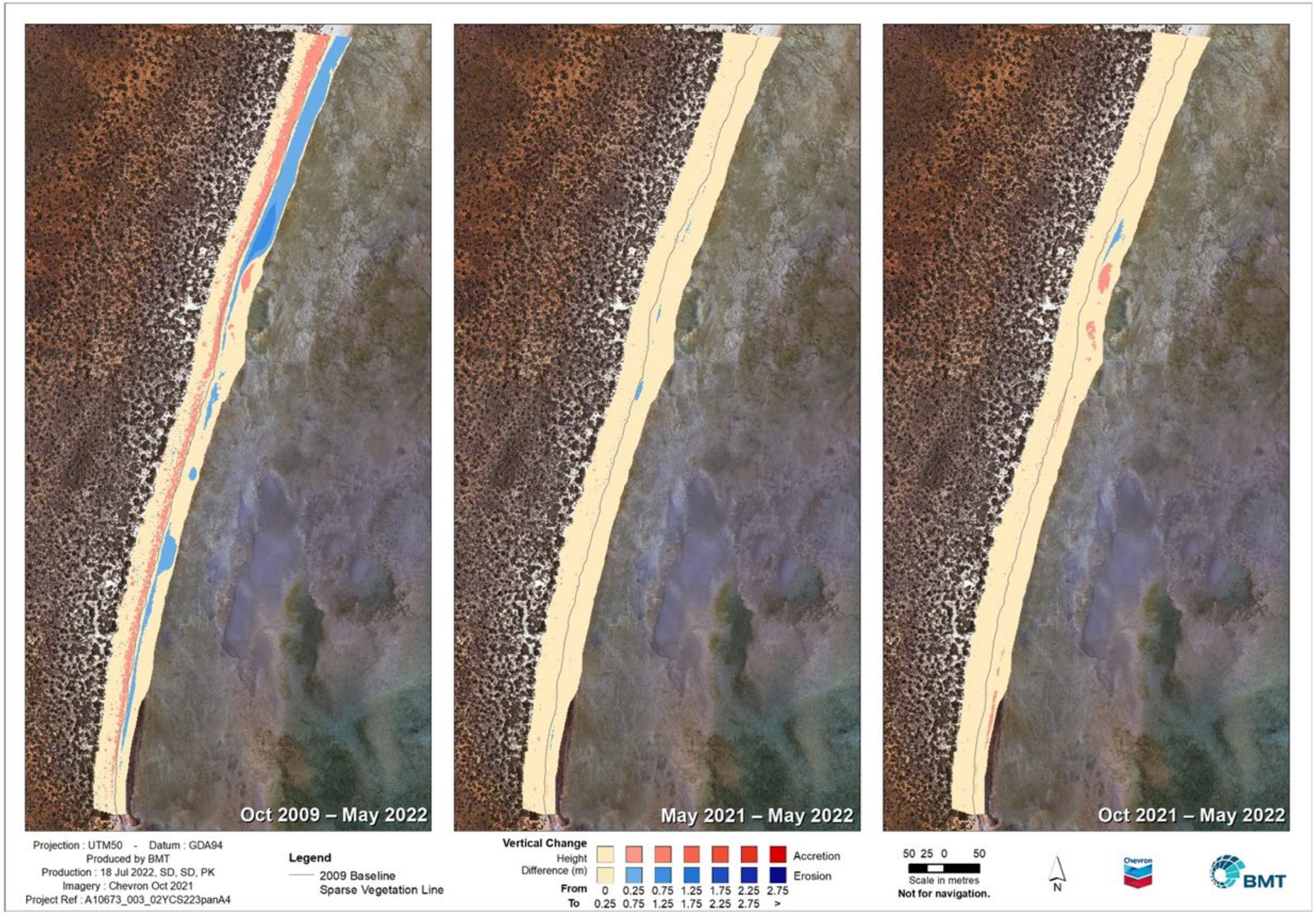

Figure 9-5: Surface Elevation Changes at Yacht Club South Beach

Monitoring Program: Beach Structure

Results (continued)

Net Volume Change

- Net sand volume on the beaches fluctuates as a result of seasonal and regional interannual cycles, or specific events such as tropical cyclones (Figure 9-6). Seasonal changes are linked to wind patterns and the resulting incident wave climate. Interannual changes can be linked to regional influences, such as water-level fluctuations (e.g. caused by the El Niño Southern Oscillation) and other metocean variability or anomalies.
- Since baseline (October 2009 to May 2022), a net reduction of sediment from the beach face has occurred on YCS and YCN, and a net gain has occurred on Terminal Beach (net gain 3,484 m^3), Bivalve Beach (net gain 1,594 m^3) and Inga Beach (net gain 219 m^3) (Figure 9-2).
- Over the dry season (May to October 2021), a net reduction of sediment occurred on all monitored beaches. In contrast, a net gain occurred on all beaches over the wet season (October 2021 to May 2022), which was greater than the magnitude of net loss (Table 9-2, Figure 9-7). Therefore, a net sediment gain for the annual period May 2021 to May 2022 was recorded for all beaches, with the greatest gains occurring on the Reference beaches (Table 9-2).

Major Event Monitoring

- During the Reporting Period no weather events exceeded the CSMMP post-major event monitoring trigger at Barrow Island. Similarly, no storms or tropical cyclones generated conditions warranting further investigation. Therefore, no major event monitoring was undertaken during the Reporting Period.

Management Trigger Exceedances

- Management trigger exceedances were recorded for these sites and parameters during the Reporting Period:
  - Terminal Beach: beach volume at the crest of beach face (CBF) at Transects 11 and 22, beach volume and slope at the FA at Transects 11 and 22.
  - Bivalve Beach: beach volume at the CBF at Transect 11 and beach volume and slope at Transect 22; beach slope at the FA at Transect 11 and Transect 22 (Table 9-3).
- Exceedances of management triggers at Terminal and Bivalve beaches have been detected since post-construction monitoring began in July 2010. The cause of these exceedances has been attributed both to natural variability and to the presence of the MOF, which has caused the realignment of Terminal and Bivalve beaches. Because most FAs on Terminal and Bivalve beaches have accreted or remained the same, with the changes typically restricted to the area seaward of the CBF, investigations conclude that the shoreline changes occurring on Terminal and Bivalve beaches are not having significant adverse impacts on the stability of these beaches.

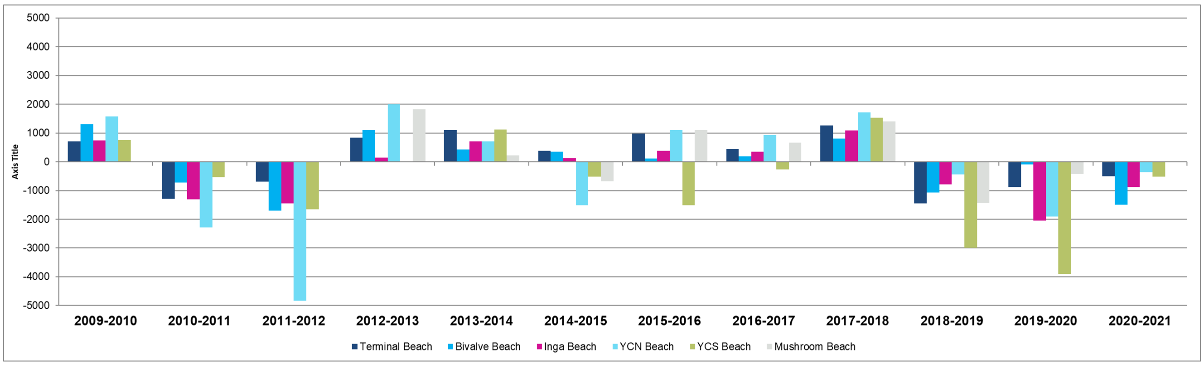

Figure 9-6: Annual Net Volume Change of the Active Zone of the Beach (below the SVL) at Monitored Beaches, October to October, 2009–2021

Table 9-2: Net Volume Changes (m^3) across the Active Zone[1] of the Beach at Monitored Beaches

Beach	Length (m)	Change since Baseline		Annual change		Seasonal change	
		Oct 09–Oct 21	Oct 09–May 22	Oct 20–Oct 21	May 21–May 22	May 21–Oct 21	Oct 21–May 22
Terminal	700	653	3,484	−498	1,236	−1,595	2,831
Bivalve	785	-798	1,594	−1,493	834	−1,557	2,392
Inga	818	−2,932	219	−882	1,495	−1,655	3,151
YCN	832	−3,300	−492	−363	1,891	−917	2,808
YCS	1,175	−8,474	−5,158	−521	2,065	−1,251	3,316

1 Active Zone = the beach face, defined as the area below the 2009 SVL.

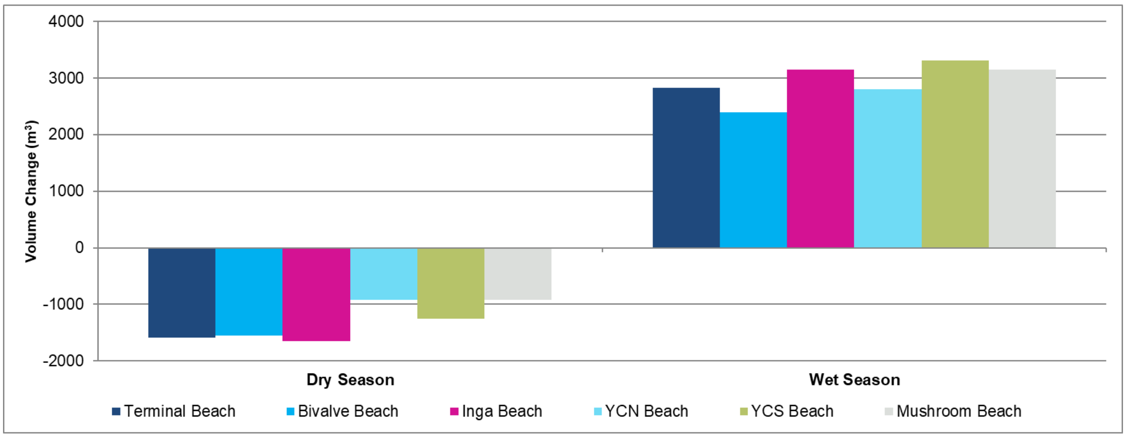

Figure 9-7: Seasonal Net Volume Change of the Active Zone of the Beach (below the SVL) at Monitored Beaches

Note: Dry season: May–October 2021; Wet season: October 2021–May 2022

Table 9-3: Management Trigger Exceedances at Terminal and Bivalve Beaches during the Reporting Period

Location	Transect	Survey Date	Volume Trigger[1,2]				Slope Trigger[1,2]				Change from Baseline Mean
			1	2	3	4	1	2	3	4	
Terminal (CBF)	11	Oct 2021	x	x	x	x	-	-	-	-	Increase volume, no change slope
		May 2022	x	x	x	x	-	-	-	-	Increase volume, no change slope
	22	Oct 2021	x	x	x	x	-	-	-	-	Decrease volume no change slope
		May 2022	x	x	x	x	-	-	-	-	Decrease volume, no change slope
Bivalve (CBF)	11	Oct 2021	x	x	x	x	-	-	-	-	Increase volume, no change slope
		May 2022	x	x	x	x	-	-	-	-	Increase volume, no change slope
	22	Oct 2021	x	x	x	x	-	-	-	x	Decrease volume, increase slope
		May 2022	x	x	x	x	-	-	-	x	Decrease volume, increase slope
Terminal (FA)	11	Oct 2021	x	x	x	x	x	x	x	x	Increase volume, decrease slope
		May 2022	x	x	x	x	x	x	x	x	Increase volume, decrease slope
	22	Oct 2021	-	-	-	x	-	x	x	x	Increase volume, increase slope
		May 2022	-	-	-	x	x	x	x	x	Decrease volume, increase slope

Location	Transect	Survey Date	Volume Trigger[1,2]				Slope Trigger[1,2]				Change from Baseline Mean
			1	2	3	4	1	2	3	4	
Bivalve (FA)	11	Oct 2021	-	-	-	-	-	x	-	-	No change volume, decrease slope
		May 2022	-	-	-	-	-	x	-	-	No change volume, decrease slope
	22	Oct 2021	-	-	-	-	x	x	x	-	No change volume, increase slope
		May 2022	-	-	-	-	x	x	x	-	No change volume, increase slope

1 *Trigger 1 = single point ±3 SD from the baseline mean; Trigger 2 = 2 out of 3 consecutive points ±2 SD from the baseline mean; Trigger 3 = 4 out of 5 consecutive points ±1 SD from the baseline mean; Trigger 4 = 8 consecutive points on the same side of the baseline mean.*

2 *'x' = exceedance; '-' = no exceedance.*

Monitoring Program: Beach Sediments

Objective

Detect changes to beach sediments as a result of the presence of the MOF and LNG Jetty.

Methodology

- Sediment sampling is completed once a year, at the end of the dry season (typically October) where practicable. Sediments are sampled at two locations (CBF and FA), and up to three depths (0.0 m, 0.3 m, 0.6 m) along selected transects (seven on Terminal; six on Bivalve; and two each on Inga, YCN, and YCS beaches), then analysed to measure changes in particle size distribution (PSD) over time.
- Beach sediment sampling is also undertaken after a major (weather) event, where practicable.

Results

Terminal and Bivalve beaches

- At Terminal Beach, sediment coverage has decreased and sediment size has coarsened within CBF sediments at the northern end of the beach since the baseline survey. In October 2021, CBF sediment samples were not collected from transects T16, T19, or T22 due to insufficient sediment at these sites. At the southern end of the beach, a greater proportion of fine sediments has been observed at the CBF. Changes in sediments at the FA have been less pronounced; however, a reduction in the gravel component in FA sediments at the northern end of the beach has been observed (Ref. 19).
- At Bivalve Beach, sediment coverage has decreased since the baseline survey at the southern end of the beach at both CBF and FA sites, noting some interannual variation (Ref. 18). In October 2021, CBF samples were not collected from transects B16, B21, B22 or B24, and FA samples were not collected at B24, due to insufficient sediment coverage. At the northern end of the beach, there has been a decrease in the gravel fraction in CBF sediments since baseline (Ref. 19).

Inga, YCN, and YCS beaches

- Sediments sampled at Inga, YCN, and YCS beaches in 2021 generally comprised similar PSDs to samples from the previous sampling event (October 2020) and from baseline (Ref. 19). However, the Inga Beach CBF samples indicated a decreased gravel component relative to baseline.

Management Trigger Exceedances

- The beach sediment management trigger is qualitative and based on a change from baseline sediment characteristics. At some sites, the management trigger can no longer be assessed due to erosion. Due to this, and the qualitative nature of the management trigger, no exceedances of management triggers for sediment PSD were identified during the Reporting Period.

Monitoring Program: Marine Turtle Nesting Habitat
Objective
Detect adverse changes to the beach structure and beach sediments (as a result of the presence of the MOF and LNG Jetty) that could have implications for marine turtle nesting on the beaches adjacent to these marine facilities.
Methodology
• Multiple physical characteristics of the beaches are used to categorise and map the suitability of areas on each beach for marine turtle nesting. Areas were categorised as one of three zones: – Optimal Nesting Zone: characteristics of the measured physical parameters within the study area are considered ideal for marine turtle nesting – Suboptimal Nesting Zone: characteristics of the measured physical parameters within the study area are considered less than ideal but may still allow successful marine turtle nesting – Unsuitable Nesting Zone: characteristics of the measured physical parameters within the study area are unlikely to allow successful marine turtle nesting. • Physical characteristics used to classify the nesting habitat zones include: landward and seaward boundaries, presence of rock (e.g. intertidal rock, subaerial rock), sediment composition, sand depth, and other (e.g. presence of infrastructure, discontinuous nesting areas within otherwise unsuitable area).
Results
• The total available (defined as optimal + suboptimal) Flatback Turtle nesting area for the mapped Barrow Island beaches in October 2009 was 14.7 ha, with 89% of this area defined as optimal nesting habitat. In October 2021, the total available nesting area was 11.4 ha, with 76% of this defined as optimal nesting habitat (Figure 9-10). • Changes in the size of nesting areas since baseline (October 2009) have varied between individual beaches, with the greatest changes observed on beaches closest to the MOF (Terminal, Bivalve, and Inga beaches). Changes are primarily attributable to increases in the amount of intertidal rock exposed on the beach face over time, resulting in optimal nesting habitat being reclassified as either suboptimal or unsuitable as sandy access pathways to the FA area are eroded. • Progressive exposure of intertidal rock since baseline is due to the ongoing realignment of Terminal, Bivalve, and Inga beaches towards the MOF via longshore sediment redistribution. Realignment has resulted in a gain in optimal nesting area on each beach at the end closest to the MOF (northern end for Bivalve and Inga beaches, southern end for Terminal Beach), and a reduction in optimal nesting area at the end furthest from the MOF. *Terminal Beach* • The area of mapped optimal nesting habitat at Terminal Beach progressively reduced between 2009 and 2012, from 2.25 ha in October 2009 to 0.81 ha in October 2012. Since 2012, optimal nesting habitat has averaged 0.84 ha (0.87 ha in October 2021). The greatest change has occurred in the northern two-thirds of the beach, where intertidal rock has been gradually exposed. In the southern third of the beach, optimal habitat has been created further south of the baseline nesting area on the accreted sections of beach (Figure 9-8, Figure 9-9).- • In October 2021, the southern third of Terminal Beach was classified as optimal nesting habitat (with some small areas classified as unsuitable and suboptimal due to shallow sand), and the remaining two-thirds were classified as unsuitable (Figure 9-9). • Between October 2020 and October 2021, the area of optimal nesting habitat increased from 13.6% of the study area in 2020 (0.83 ha) to 14.3% in 2021 (0.87 ha). However, the area of suboptimal nesting habitat decreased from 11% in 2020 (0.67 ha) to 0.5% in 2021 (0.03 ha) (Figure 9-8). The optimal area increased as a result of continued accretion in the lee of the southern rock headland, which increased the sand depth in this area. Changes in the exposure of bedrock in the central third of the beach led to the decrease in suboptimal nesting area, with rock exposed marginally above the mean high water springs (MHWS) tide mark (Figure 9-9). *Bivalve Beach* • At Bivalve Beach, the area of optimal nesting habitat progressively reduced between 2009 and 2015e, from 2.10 ha in October 2009 to 0.779 ha in October 2015. Since 2015, optimal nesting habitat has averaged 0.77 ha (0.79 ha in October 2021). Optimal nesting habitat has been reclassified to suboptimal or unsuitable along the southern two-thirds of the beach where intertidal rock has been exposed. In the northern third of the beach, optimal habitat has been created further north of the baseline nesting area on the accreted section of beach (Figure 9-8, Figure 9-10).

Monitoring Program: Marine Turtle Nesting Habitat
• In October 2021, the southern two-thirds of Bivalve Beach were predominantly classified as unsuitable habitat, with small areas of suboptimal habitat. The northern third was largely classified as optimal habitat, with some unsuitable areas of shallow sand adjacent to the rock headland (Figure 9-10). • Between October 2020 and October 2021, the optimal nesting area decreased slightly, from 14.8% of the study area in 2020 (0.82 ha) to 14.3% in 2021 (0.79 ha). The area of suboptimal nesting habitat also decreased, from 17.6% in 2020 (0.97 ha) to 7.14% in 2021 (0.39 ha). Changes in the suboptimal nesting zone were predominantly associated with changes in sediment distribution, which increased the exposure of intertidal rock above the MHWS tide line in the middle section of the beach (Figure 9-10). *Inga Beach* • Optimal nesting area at Inga Beach has decreased over time from 1.86 ha in October 2009 to 0.26 ha in October 2021. Optimal nesting habitat has been replaced with either suboptimal or unsuitable habitat along the southern two-thirds of the beach, due to the exposure of intertidal rock or loose rock rubble. At the northern end of the beach, optimal habitat has been created further north of the baseline nesting area on the accreted section of beach (Figure 9-11). • In October 2021, the northern quarter of Inga Beach was classified as optimal nesting habitat, with the remainder being suboptimal in the middle section and unsuitable in the southern section. • Between October 2020 and October 2021, optimal nesting area on Inga Beach decreased from 7.6% of the study area in 2020 (0.49 ha) to 4.1% in 2021 (0.26 ha). This was accompanied by an increase in suboptimal nesting area, from 13.0% in 2020 (0.83 ha) to 15.5% in 2021 (0.99 ha). These changes correspond to an increase in exposure of rock, cobbles, and pebbles, encroaching north over the lower beach face. *YCN Beach* • YCN Beach has undergone minor changes in turtle nesting habitat since baseline, with changes relating to the annual position of the MHWS line, which is influenced by patterns of erosion and accretion. No intertidal rock has been exposed at YCN Beach since baseline, and there have been no areas of suboptimal or unsuitable nesting habitat since baseline (Figure 9-12). In October 2009, 3.49 ha of optimal nesting area was recorded. This had increased to 3.68 ha in October 2021. • Between October 2020 and October 2021, optimal nesting area on YCN Beach increased slightly, from 56.8% of the study area in 2020 (3.67 ha) to 56.9% in 2021 (3.68 ha) (Figure 9-8). *YCS Beach* • YCS Beach has seen a minor decrease in optimal nesting area and a minor increase in suboptimal nesting area since baseline. In October 2009, 3.44 ha of optimal nesting area was recorded, which had reduced to 3.04 ha by October 2021. Changes in the size of nesting areas relate to exposure of intertidal rock, particularly in the central section of beach (Figure 9-13). • Between October 2020 and October 2021, optimal nesting area on YCS Beach decreased slightly, from 33.9% of the study area in 2020 (3.20 ha) to 32.2% in 2021 (3.04 ha) (Figure 9-8).
Management Trigger Exceedances
No exceedances of the interim marine turtle nesting habitat management triggers occurred during the Reporting Period at Terminal or Bivalve beaches.

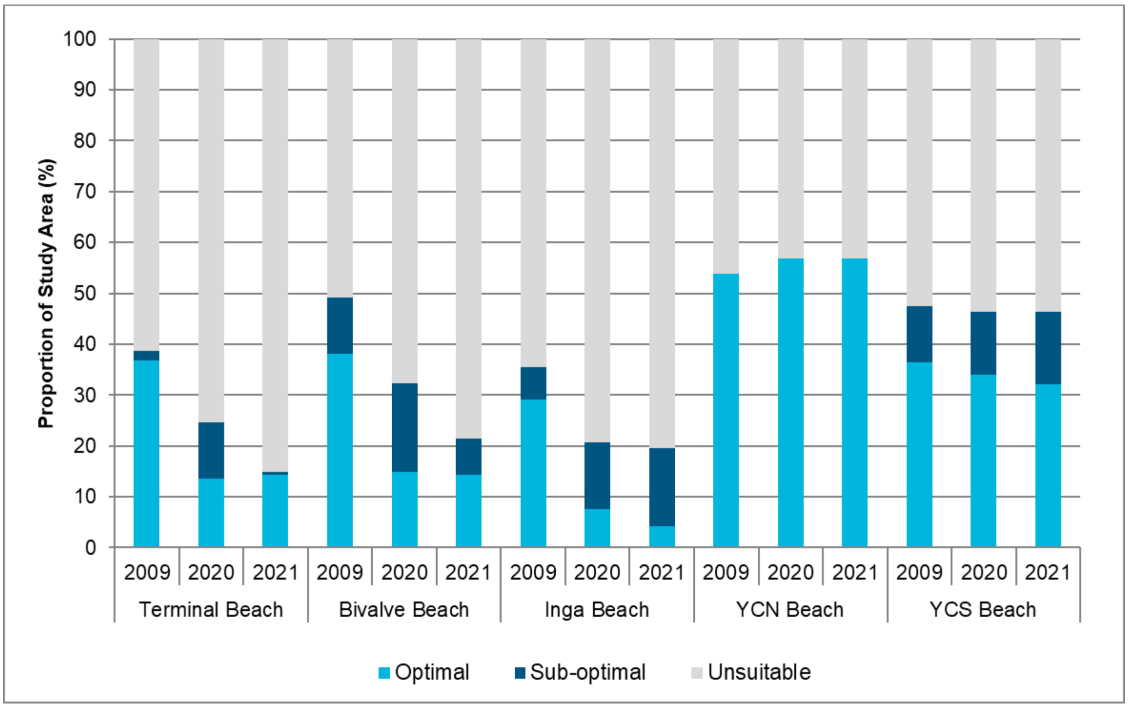

Figure 9-8: Proportions (%) of Marine Turtle Nesting Habitat Zones for Monitored Beaches in October 2009 (Baseline), October 2020, and October 2021

Figure 9-9: Marine Turtle Nesting Habitat Zones for Terminal Beach

Figure 9-10: Marine Turtle Nesting Habitat Zones for Bivalve Beach

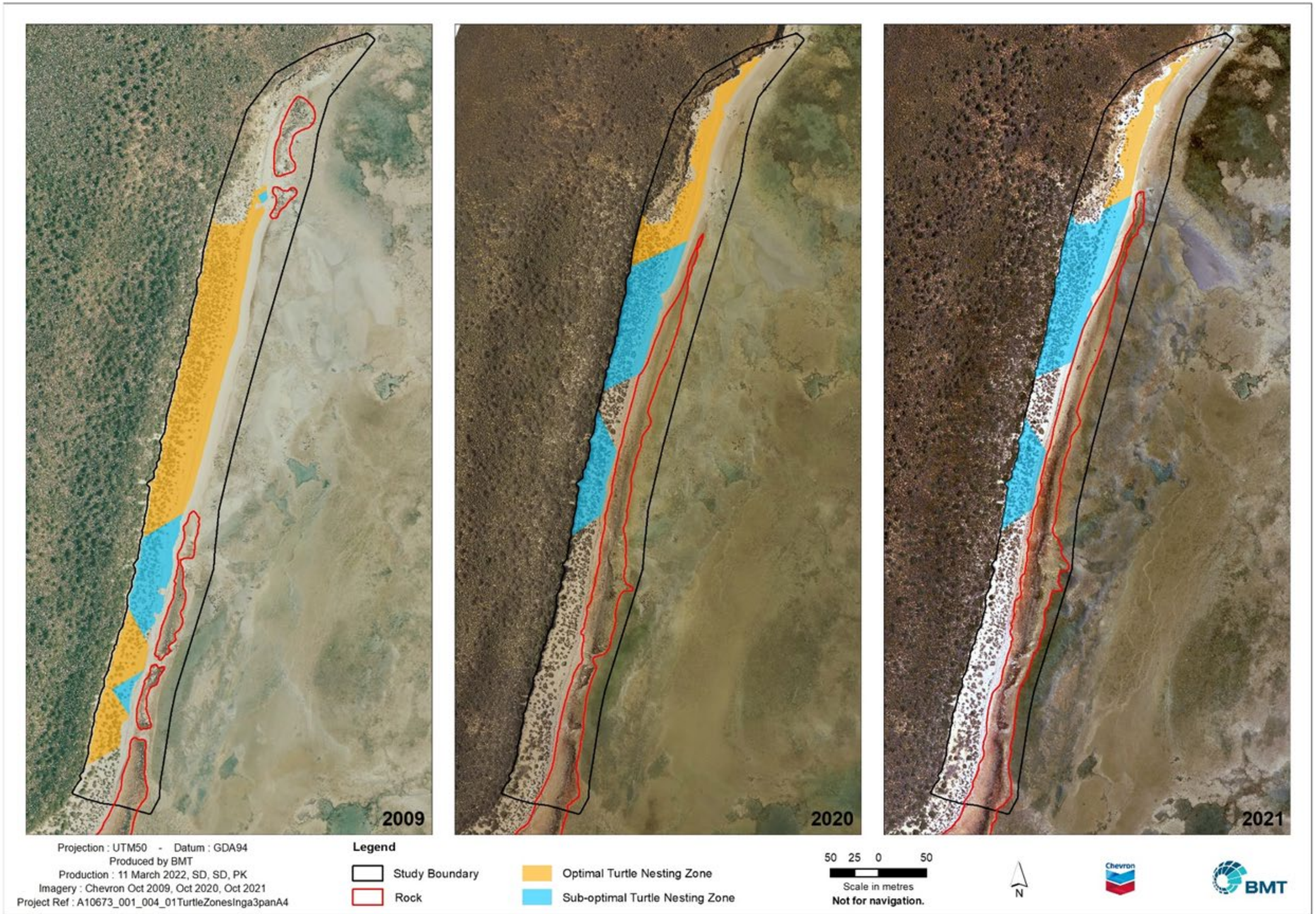

Figure 9-11: Marine Turtle Nesting Habitat Zones for Inga Beach

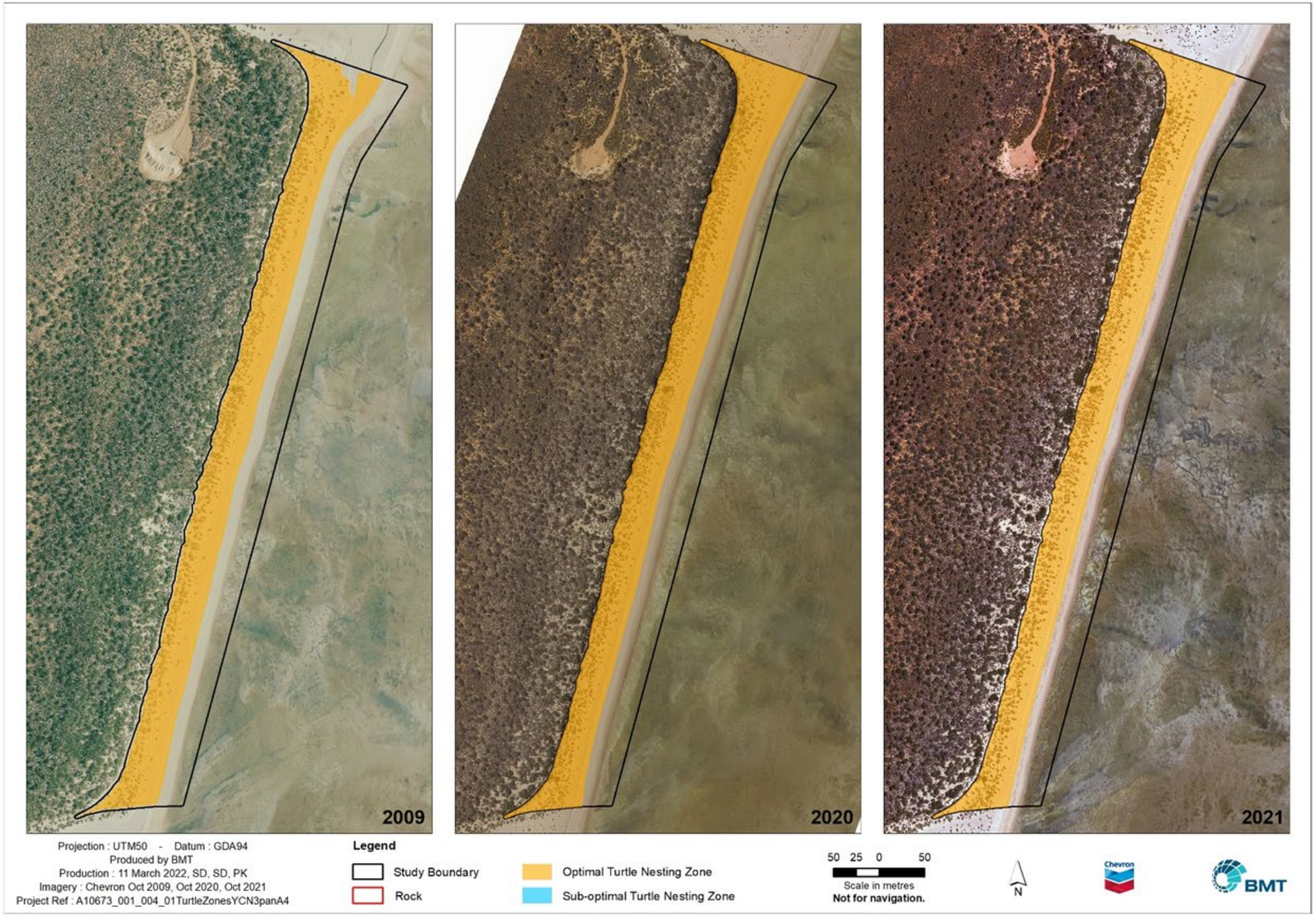

Figure 9-12: Marine Turtle Nesting Habitat Zones for YCN Beach

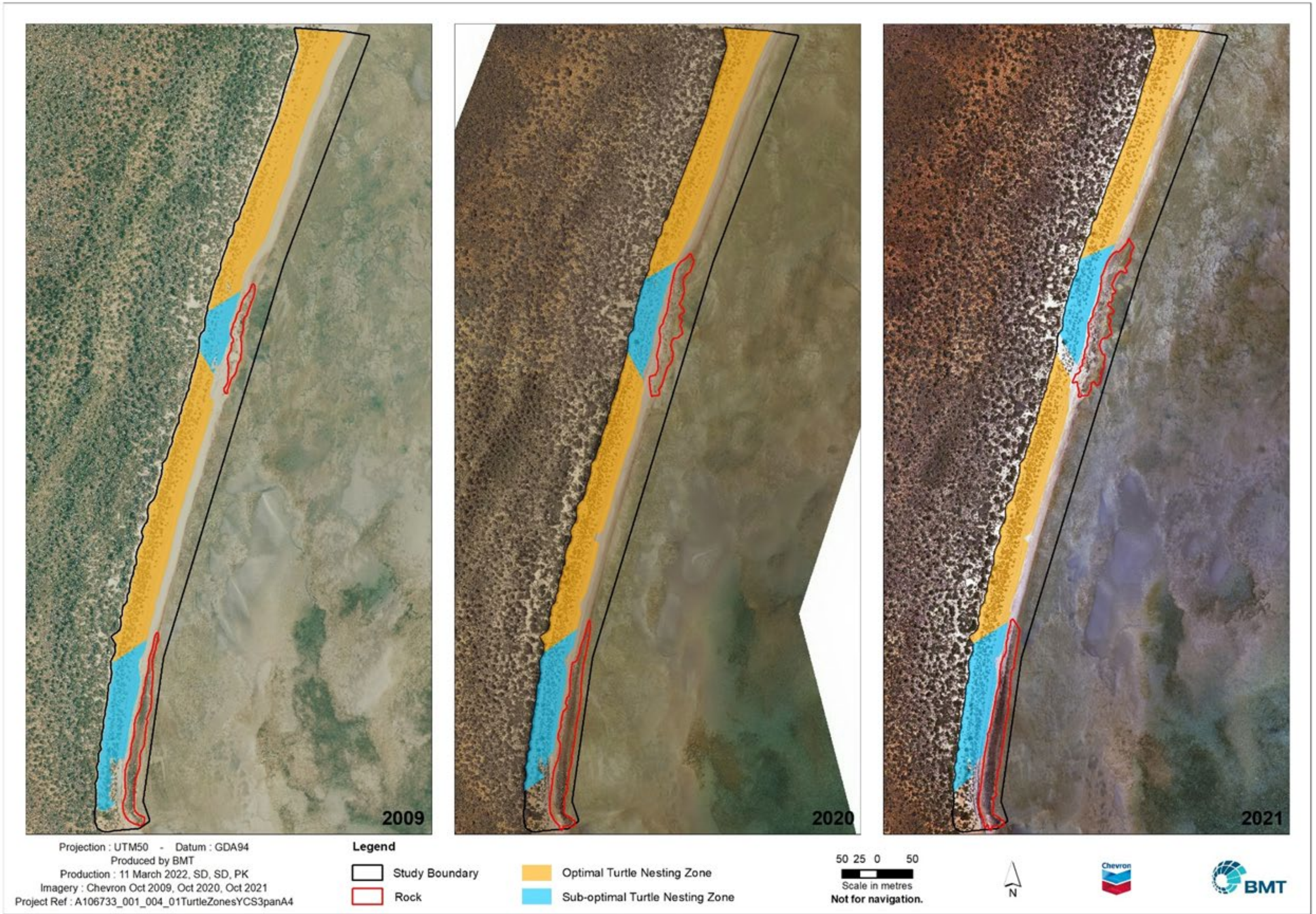

Figure 9-13: Marine Turtle Nesting Habitat Zones for YCS Beach

9.2 Conclusion

During the Reporting Period, exceedances of volume management triggers were detected for all CBF sites at monitoring transects on Terminal and Bivalve beaches, and for the FA sites on Terminal Beach. Slope exceedances were detected at B22 CBF and at all FA sites. These exceedances correspond to a trend of sand redistribution towards the MOF on Terminal and Bivalve beaches since baseline (October 2009). Terminal Beach has eroded in the north and accreted in the south, while Bivalve Beach has eroded in the south and accreted in the north. Changes on these beaches have predominantly occurred over the active beach face; however, erosion has encroached onto the seaward edge of the FA at some locations on Potential Impact beaches and has resulted in some vegetation loss.

Coastal instability is caused by erosion of the beach face and berm, allowing wave action to influence the backshore and sand dunes. Typically, a stable beach changes in the active zone (i.e. the beach face) but should remain relatively static in the backshore and sand dunes.

Terminal and Bivalve beaches are inherently stable through geological control; i.e. they are underpinned by rock and bounded at each end by rock headlands. Although erosion has generally occurred over the beach face since baseline, the presence of rock in the active zone may help prevent further encroachment of waves into the foredune and primary dune areas. Therefore, Terminal and Bivalve beaches are currently considered relatively stable, and it is unlikely the MOF has had a significant adverse impact on coastal stability—as a result, Performance Standards have not been exceeded. However, changes occurring on these beaches may increase the vulnerability of the FA and primary dunes to extreme metocean conditions, and the presence of the MOF will likely restrict the capacity for natural recovery after such events.

Inga, YCN, and YCS beaches are bounded by rock headlands (northern end of Inga Beach and southern end of YCS Beach) and are intersected by subaerial and intertidal rock outcrops and creeks. These features have a greater capacity for sediment exchange into and out of the study area boundaries, which results in lower capacity for trapping sediments than on Terminal and Bivalve beaches. Since baseline, Inga Beach has exhibited a similar trend to Bivalve Beach, eroding in the south and accreting in the north. YCN and YCS beaches, when examined as a single sediment transport cell, have also exhibited this trend.

Alongshore sand redistribution at the beach face since construction of the MOF has exposed large sections of the underlying rock platform on Terminal, Bivalve, and Inga beaches. Rock exposure has reduced the availability of sandy access pathways preferred by Flatback Turtles to access nesting habitat in the FA of each beach. Therefore, the largest reductions in optimal nesting habitat have occurred on Terminal, Bivalve, and Inga beaches, and this habitat has been replaced by suboptimal and unsuitable nesting habitat. In general, decreases in optimal nesting area have occurred on sections of beach furthest from the MOF (southern ends of Bivalve and Inga, northern end of Terminal) and increases have occurred closest to the MOF. No interim management triggers for marine turtle nesting habitat (which apply to Terminal and Bivalve beaches only) were exceeded during the Reporting Period. The reduction in optimal nesting habitat may represent an adverse change that could have implications for marine turtles.

Results of the CSMMP monitoring program since construction of the MOF have indicated that changes to Terminal, Bivalve, and Inga beaches have been greater than predicted. In response to these findings, a new revision (Revision 0.3) of the CSMMP was developed and submitted to DWER and DAWE in March 2019. The revision proposed new management triggers for coastal stability and marine turtle nesting habitat. Further improvements were proposed in Revision 0.4, submitted to DWER and DAWE in June 2020. At the time of this annual EPR, these CSMMP revisions were still awaiting approval.

As required by the CSMMP, CAPL will continue to monitor changes in beach morphology to detect and evaluate potential implications for marine turtle nesting and coastal stability. If exceedances of the CSMMP management triggers or Performance Standards are detected, they will be assessed in accordance with the requirements identified in the current approved CSMMP and relevant Ministerial Conditions.

10 Terrestrial Rehabilitation

Table 10-1: EPR Requirements for Terrestrial Rehabilitation

Item	Source	Section in this EPR
A description of any rehabilitation activities undertaken	MS 800, Schedule 3(9i)	10.2
Results of the rehabilitation monitoring program including performance against completion criteria targets	MS 800, Schedule 3(9ii)	10.3
Results of any studies to address knowledge gaps as referenced in Condition 32.5(x) and proposals for further studies (if any)	MS 800, Schedule 3(9iii)	N/A[1]
Recommended changes, if any, to the Gorgon Gas Development Post-Construction Rehabilitation Plan (PCRP) (Ref. 20)	MS 800, Schedule 3(9iv)	10.1
A figure identifying areas rehabilitated, areas planned to be rehabilitated, and disturbed areas to be retained for ongoing construction and operational needs	PCRP (Ref. 20), Section 7.2.2	10.2
Topsoil usage and topsoil balances	Gorgon Gas Development Topsoil Management Plan (TMP) (Ref. 21), Section 3.3	10.4
Changes to volume of soil stockpiled as a result of rehabilitation or clearing activities	TMP (Ref. 21), Section 3.3	10.4
Results of the topsoil monitoring program, topsoil performance reviews, and topsoil volume reconciliation	TMP (Ref. 21), Section 5.0	10.5
Progress against rehabilitation objectives in Table 5–2 of the PCRP (Ref. 20)	PCRP (Ref. 20), Table 5–2	10.2, 10.3, 10.4, 10.5

1 *No ongoing studies to address knowledge gaps were undertaken during the Reporting Period; therefore, reporting is not applicable at this time.*

10.1 Changes to the Post-Construction Rehabilitation Plan

No changes were made to the to the PCRP (Ref. 20) during the Reporting Period.

10.2 Rehabilitation Activities

Rehabilitation activities undertaken during the Reporting Period are summarised in the following table.

Rehabilitation Activities
• No new rehabilitation scopes were completed during the Reporting Period. • Areas rehabilitated for the Gorgon Gas Development are shown in Figure 10-1.

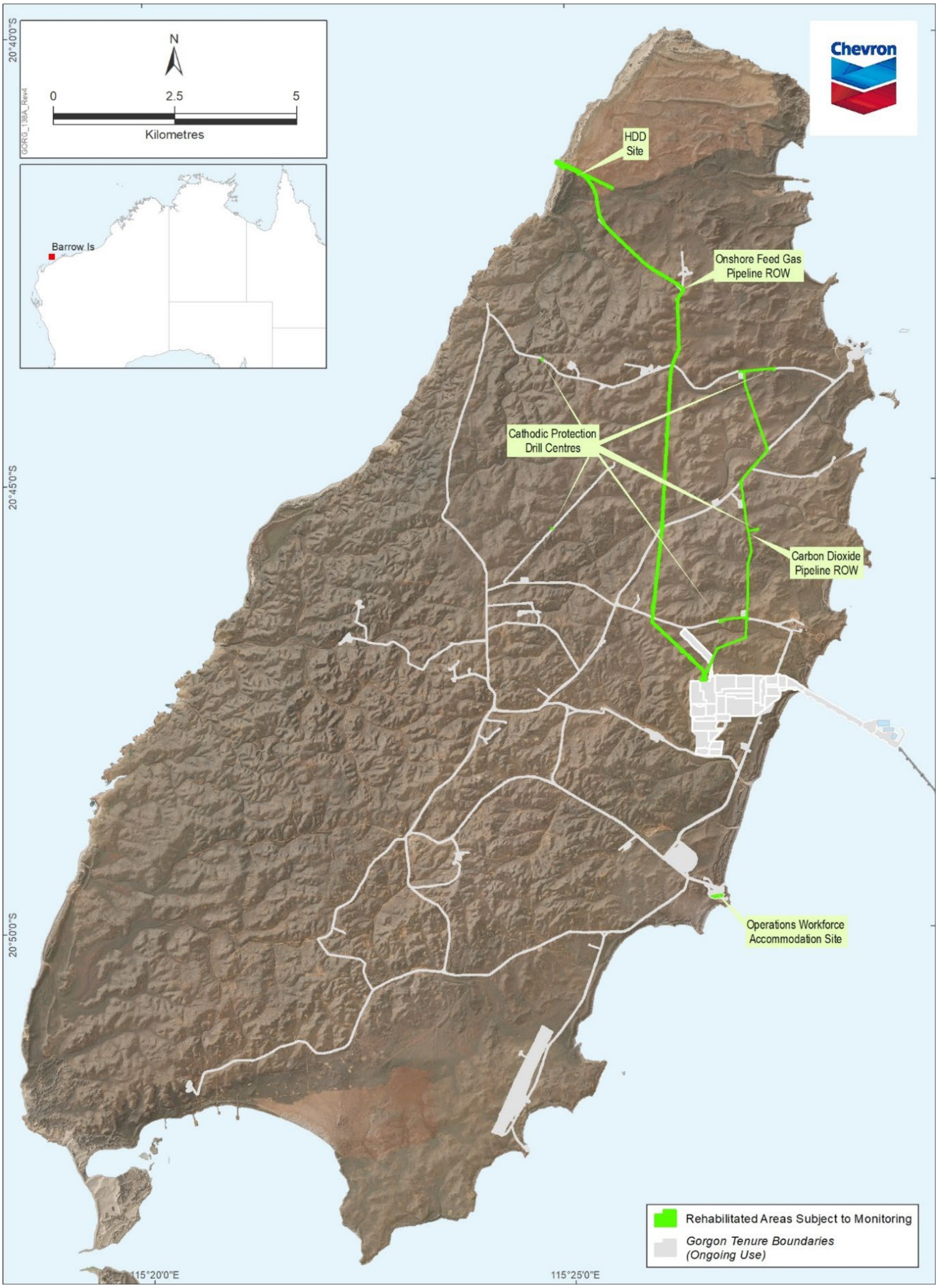

Figure 10-1: Areas Rehabilitated for the Gorgon Gas Development

10.3 Rehabilitation Monitoring

The PCRP (Ref. 20) details the rehabilitation methodology and completion criteria for rehabilitating lands temporarily disturbed by the Gorgon Gas Development. The rehabilitation monitoring methodology is Ecosystem Function Analysis (EFA), a method that has been used on Barrow Island since 2004.

The rehabilitation monitoring methodology and results are summarised in the following table.

Monitoring Program: Rehabilitation
Objectives
To meet the intent of the Ministerial objectives for rehabilitated areas, the PCRP (Table 5-2, in Ref. 20) further defines specific objectives for the rehabilitation of temporarily disturbed areas: • The rehabilitated land surface and soil properties are appropriate to support the target ecosystem • Vegetation in rehabilitated areas will have equivalent values as surrounding natural ecosystems • The rehabilitated ecosystem has equivalent functions and resilience as the target ecosystem • Rehabilitated sites provide appropriate habitat for fauna and fauna recruitment including EPBC Act (Commonwealth) listed species • The rehabilitated site should be able to be managed in the same way as surrounding land.
Methodology

• EFA is based on a methodology developed by the CSIRO, originally described as Landscape Function Analysis (LFA), which uses indicators that assess and determine functional status of the landscape. EFA differs from LFA in that ecosystem components such as vegetation composition, cover, and habitat complexity are also recorded and assessed to provide a quantitative measure of the ecological functionality of the site. LFA is a core component of EFA, and primarily focuses on stability, water infiltration, and nutrient indices. For arid environments, permanent EFA transects are set up to follow a line of resource flow, typically up to 50 m long.
• In total 23 rehabilitation sites were monitored—20 sites in the CO_2 and feed gas pipeline corridors, respectively, and three non-pipeline transects.
• Two reference quadrats adjacent to the horizontal directional drilling (HDD) site were also monitored. Ten reference sites (corresponding to limestone, drainage, or plain habitats) were also monitored to allow assessment against the completion criteria in the PCRP. Broadly, the monitoring gathered data on:
  – landscape function (stability, infiltration, and nutrient cycling)
  – vegetation (*Triodia* cover, species diversity, density, cover and height, floristic composition, and functional structure)
  – erosion and visual amenity.

Results
• None of the monitored rehabilitation sites met all the completion criteria in the PCRP, but this outcome was expected at this relatively early stage of vegetation re-establishment. Criteria that were consistently not met for all sites were *Triodia* cover and total plant cover/height—these criteria require time to reach completion. • Criteria that were frequently met were erosion, species provenance and landform consistency with surrounding areas (Ref. 22), indicating that the rehabilitation sites are fundamentally sound. Species diversity in rehabilitated sites was generally higher than in reference sites (where sufficient topsoil was added/exists), as is characteristic of disturbed landscapes transitioning from primary to late succession. It is expected that species diversity will continue to decline and become similar to reference sites as rehabilitation progresses. • Landscape function indices increased at most rehabilitation and analogue transects between 2020 and 2021, particularly the limestone ridges landscape type within the pipeline right of way. Transect FGP_LT10 was the only rehabilitation transect to achieve the target for all LFA indices. • Compared with 2020, the 2021 results showed an overall improvement in rehabilitation performance with more transects achieving targets for the stability index (two transects), infiltration index (six transects), nutrient cycling index (four transects), total plant cover (six transects) and total plant density (four transects).

Monitoring Program: Rehabilitation
• The arthropod diversity (abundance and richness) recorded from the 2021 monitoring of the Feed Gas pipeline right of way rehabilitated and reference sites was much greater than found in 2020. The 2021 results demonstrated that the rehabilitated sites hosted comparable levels of diversity to the reference sites. The reference sites' traps collected a higher trophic level and parasitic Hymenoptera diversity than at rehabilitated sites, although the difference was not statistically significant. • The HDD area was stable with no wind or water erosion of concern, but vegetation development remained slow.
Conclusions
• During the Reporting Period, the rehabilitation monitoring program was completed in accordance with the requirements of the PCRP (Ref. 20). • Completion criteria addressing key rehabilitation aspects such as erosion and landform consistency were met at all rehabilitation sites, indicating that the rehabilitation sites are fundamentally sound. • *Triodia* densities were generally below the levels considered likely to achieve adequate cover at maturity. However, increases in Triodia cover were noted at CO_2 pipeline right of way limestone rehabilitation transects, LT20 and LT22, as well as the Triangle Gravel Pit rehabilitation area, which indicates that adequate *Triodia* cover may be achieved with more time across these rehabilitation areas. *Triodia* species were detected on all but one transect. • It is expected that other completion criteria will be met by an increasing number of sites as rehabilitation continues to progress. Overall, rehabilitation performance is indicative of rehabilitation sites becoming more resilient.

10.4 Topsoil Activities

Topsoil activities undertaken during the Reporting Period and topsoil stockpile volumes are summarised in Table 10-2.

Table 10-2: Monitored Topsoil Stockpile Volume Summary (2021–2022)

Topsoil Stockpile	Original Topsoil Source Location	Changes to Volume Stockpiled During the Reporting Period (m^3)	Total Volume Stockpiled (m^3)
A28	GTP Site	None	7,483
Q31	GTP Site	None	7,984
X62J	GTP Site	None	17,655[1]
R Station	GTP Site	None	3,481
P13	CO_2 pipeline right-of-way	None	9,453[1]
ASA Stage 3	ASA Stages 3 and 4	None	2,272
ASA Stage 2	ASA Stages 1 and 2	None	3,550
Perentie II	GTP Site and ASA	None	8,884

1 *The total volume stockpiled for X62J was updated after the stockpile survey was completed in November 2015. The total volume stockpiled for P13 was updated to include topsoil activities conducted after the stockpile survey was completed in October 2017.*

10.5 Monitoring Results

The TMP (Ref. 21) complements the PCRP (Ref. 20), and describes the stripping, transport, and re-use of recovered topsoil. The TMP also includes a monitoring program to measure topsoil viability. The monitoring program was amended in 2020 to accommodate assessment using object-based image analysis (OBIA), with performance criteria developed that aligned with current criteria for Gorgon rehabilitation areas. The assessment used 2020 aerial imagery.

The topsoil monitoring results are summarised in the following table.

Monitoring Program: Topsoil
Objectives
• Measure and record the physical, chemical, and biological attributes, and the overall integrity, of the stored topsoil from the Gorgon Gas Development. • Provide assurance that the topsoil remains viable and stable.
Results
• An on-ground integrity assessment found that vegetation on the topsoil stockpiles was in healthy condition with no major erosion issues. No weed populations were observed. These findings were consistent with topsoil stockpile observations made in previous integrity assessments. • OBIA of October 2020 aerial imagery was conducted for 16 stockpiles. The dominant vegetation cover classes on the stockpiles were *Triodia* and shrubs. Cover had increased at one stockpile due to an increase in *Triodia* cover. About half the stockpiles had slightly less cover than when assessed 12 months earlier—the decreases in percentage cover ranged from 5% to 15%. • The level of germinable seed in the topsoil stockpiles was assessed six months later than the vegetation, after substantial favourable rain that had led to a *Triodia* flowering event. As a result, the number of monocot germinants in stockpiled topsoil, consisting predominantly of *Triodia*, had increased around 20-fold, to the equivalent of ~400 seedlings/m^2 (at 2 cm soil depth). Dicot germinant numbers were about one-third of that of monocots. Successful flowering and seed production by *Triodia* in 2021 supports observations that substantial favourable rainfall events are critical for continued vegetation establishment.
Conclusion
Topsoil stockpiles are stable and remain a viable resource for future topsoil harvesting requirements.

11 Spill Management

Table 11-1: EPR Requirements for Spill Management

Item	Source	Section in this EPR
Incidence of spills caused by the Proposal, and spills that impact on the Proponent's facilities including details of cause and recommended actions	MS 769, Schedule 3(3i)	11.1

11.1 Event Data

No spills caused by the Jansz Feed Gas Pipeline, or spills that impacted on Jansz Feed Gas Pipeline facilities, occurred during the Reporting Period.

12 Terminology

Table 12-1 defines the acronyms, abbreviations, and terminology used in this document.

Table 12-1: Terminology

Term	Definition
~	Approximately
°C	Degrees Celsius
µg	Microgram
ABU	Australian Business Unit
ACCU	Australian Carbon Credit Unit
Adult female breeding omission probability	Annual probability estimate of skipped breeding for adult female marine turtle nesters in a nesting population
Adult female survival probability	Annual estimated survival rate for adult female marine turtle nesters in a nesting population
AHC	Ah Chong Island
Alert trigger	Measured parameter deviates towards (but remains within) 1 SD for 2 consecutive years, or deviates outside a 1 SD limit
aMDEA	Activated methyldiethanolamine
Annual nester abundance	Estimate of total female marine turtle nesters per season at a rookery
AQMP	Air Quality Management Plan
AQMS	Air Quality Monitoring Station
ASA	Additional Support Area
At Risk	Being at risk of Material Environmental Harm or Serious Environmental Harm and/or, for the purposes of the EPBC Act relevant listed threatened species, threatened ecological communities, and listed migratory species, at risk of Material Environmental Harm or Serious Environmental Harm
At Risk zone/site/island	An area where potential impacts are predicted to occur
AU$	Australian dollar
Backshore	An upper shore zone above high tide
Baseline	The original status of the environment in the area before the development work of the project is started
BTEX	Benzene, toluene, ethylbenzene, and xylene compounds
Butler Park	Barrow Island accommodation village
BWI	Barrow Island
CAPL	Chevron Australia Pty Ltd
CBF	Crest of Beach Face; sampling site located at the change in slope at the transition between the beach face and foredune area
CI	Confidence Interval; an interval that is likely to contain the true value of a population parameter, but reflects the inherent uncertainty in estimating this parameter from a sample. The level of confidence reflects the likelihood that the constructed interval contains the true parameter value, so a 95% Confidence Interval is an interval that will include the true parameter value 95% of the time. By convention, 95% Confidence Intervals are usually used to define reasonably upper and lower bounds for parameter estimates.

Term	Definition
Clutch fate	The recorded fate of a Flatback Turtle nest. Fate is determined based on set criteria including discrepancies between egg counts at laying versus egg counts at excavation, and evidence of disturbance from other nesting turtles or predation.
Clutch frequency	The mean number of clutches laid per female marine turtle nester per season
Clutch size	The mean number of eggs in a Flatback Turtle nest
cm	Centimetre
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSMMP	Coastal Stability Management and Monitoring Plan
CT	Communications Tower
DAWE	Former Commonwealth Department of Agriculture, Water and the Environment (dates: 1 Feb 2020 to 30 Jun 2022; split into Department of Climate Change, Energy, the Environment and Water and Department of Agriculture, Fisheries and Forestry on 1 Jul 2022)
DIN	Double Island North
DIS	Double Island South
DNA	Deoxyribonucleic Acid
DO	Dissolved oxygen
DOC	Dissolved organic carbon
DomGas	Domestic Gas
DWER	Western Australian Department of Water and Environmental Regulation
e.g.	For example
eDNA	Environmental DNA; DNA that can be extracted from environmental samples
EFA	Ecosystem Function Analysis
Egg hatching probability	The median hatching success of eggs within complete clutches. Complete clutches refer to clutches not disturbed by other turtles, predated or lost.
EMP	Environmental Management Plan
Environmental Harm	Has the meaning given by Part 3A of the *Environmental Protection Act 1986* (WA)
EPBC 2003/1294	Commonwealth Ministerial Approval (for the Gorgon Gas Development) as amended or replaced from time to time
EPBC 2008/4178	Commonwealth Ministerial Approval (for the Revised Gorgon Gas Development) as amended or replaced from time to time
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPR	Environmental Performance Report
EWMA	Exponentially Weighted Moving Average
F3	Total Recoverable Hydrocarbons Fraction 3, which corresponds the carbon number range C_{16}–C_{34} as specified in the National Environmental Protection Measure guidelines
FA	Foredune Area; area between the beach face and the primary dune, which is populated by scattered vegetative hummocks and marine turtle body holes
First Response	Quarantine activities that occur immediately after the detection of a suspect NIS or Marine Pest. The aim is to contain, control, and eliminate.

Term	Definition
GHG	Greenhouse Gas
GME	Groundwater Monitoring Event
Gorgon Gas Development	Gorgon Gas Development and Jansz Feed Gas Pipeline
GPS	Global Positioning System
GTG	Gas Turbine Generator
GTP	Gas Treatment Plant
H_2S	Hydrogen sulfide
ha	Hectare
Hatchling	Newly hatched marine turtle
Hatchling disorientation	The range of dispersion (nest fan spread angle) of marine turtle hatchling tracks from the emergence point
Hatchling emergence probability	The median emergence success of hatchlings from clutches
Hatchling misorientation	The degree of deflection (nest fan offset angle) of marine turtle hatchling tracks from the most direct line to the ocean
HDD	Horizontal Directional Drilling
HSE	Health, Safety, and Environment
i.e.	That is
Incubation duration	The mean incubation time period of a Flatback Turtle nest
Incubation temperature	The mean incubation temperature of a Flatback Turtle nest
Incursion response	Coordinated quarantine activities that aim to delineate, delimit, and eliminate positively identified NIS and Marine Pests
ind/ha	Individuals per hectare
Internesting interval	Period between a successful nest and subsequent nest or nesting attempt in a single breeding season. The females move to offshore internesting grounds while they form the next clutch of eggs. Internesting grounds may be close to or remote from the nesting beach.
km	Kilometre
L	Litre
LED	Light-emitting Diode
LFA	Landscape Function Analysis
LNG	Liquefied Natural Gas
LOR	Limit of Reporting (also known as the detection limit)
LRR	Log Response Ratio
LTMTMP	Long-term Marine Turtle Management Plan
m	Metre
m/s	Metres per second
m^2	Square metre
m^3	Cubic metre
MAD	Median Absolute Deviation
MAH	Monocyclic Aromatic Hydrocarbon

Term	Definition
Management trigger	Quantitative, or where this is demonstrated to be not practicable, qualitative matters above or below which relevant additional management measures must be considered
Marine Pest	Species other than the native species known or those likely to occur in the waters of the Indo–West Pacific region and the Pilbara Offshore marine bioregion
Material Environmental Harm	Environmental Harm that is neither trivial nor negligible
MDA	Mundabullangana (Reference site on the WA mainland)
MEG	Monoethylene glycol; used as a hydrate inhibitor
mg	Milligram
MHWS	Mean High Water Springs (tide)
MOF	Materials Offloading Facility
MS	(Western Australian) Ministerial Statement
MS 769	Western Australian Ministerial Statement 769 (for the Jansz Feed Gas Pipeline) as amended from time to time
MS 800	Western Australian Ministerial Statement 800 (for the Gorgon Gas Development) as amended from time to time
MS 965	Western Australian Ministerial Statement 965, issued for the Additional Support Area, as amended from time to time
MS 1198	Western Australian Ministerial Statement 1198, (for the Gorgon Gas Development), as amended from time to time
MSORD	Multi-state open robust design
N	Nitrogen
N/A	Not Applicable
NEPM	National Environmental Protection Measure
Nesting activity	The spatial and temporal nesting distribution of adult female Flatback Turtles
NGER Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NIS	Non-indigenous Terrestrial Species; any species of plant, animal, or microorganism not native to Barrow Island
NNE	North-north-east (compass direction)
NO_2	Nitrogen dioxide
NOHES	National Occupational Health Exposure Standards
NO_x	Nitrogen oxides (NO and NO_2)
O_3	Ozone
OBIA	Object-based Image Analysis
ORP	Oxidation-reduction Potential (also known as redox)
PAH	Polycyclic Aromatic Hydrocarbon
PAR	Parakeelya Island
PCRP	Post-Construction Rehabilitation Plan
pH	Measure of acidity or basicity of a solution
PM_{10}	Particulate matter less than 10 microns
ppm	Parts per million

Term	Definition
Project	Gorgon Gas Development
Proposal	Gorgon Gas Development, as expanded and revised by the Revised and Expanded Gorgon Gas Development
Proliferation	Increase of a species, attributable to the Gorgon Gas Development, by frequent and repeated reproduction: • NIS plant (excluding those considered to be naturalised) proliferation: an increase in the distribution of NIS plants producing propagules outside existing Weed Hygiene Zones. • NIS animal proliferation: an increase in reproductively capable offspring dispersing outside the known distribution. • Marine Pest proliferation: an increase in reproductively capable offspring dispersing outside the known distribution in the waters surrounding Barrow Island.
PSD	Particle Size Distribution
QEP	Quarantine Expert Panel
QMS	Quarantine Management System
Quadrat	A rectangular or square measuring area used to sample living things in a given site; can vary in size
Quarantine Incident	A quarantine incident is declared (declaration is subject to positive identification*) by the CAPL Quarantine Manager following: • a detection of NIS or Marine Pest on Barrow Island after Final Quarantine Clearance, or • the proliferation of a NIS population on Barrow Island or Marine Pest in the waters surrounding Barrow Island. **Level 1 Quarantine Incident** • A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where the risk of the species to the biodiversity of Barrow Island is considered by CAPL, on advice of the QEP, to be low, or • A proliferation of existing NIS on Barrow Island as a consequence of Gorgon Gas Development activities. **Level 2 Quarantine Incident** A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where: • uncertainty exists (as determined by CAPL on advice of the QEP) as to the risk of the species to the biodiversity of Barrow Island due to a range of factors (e.g. the ability of the species to survive on Barrow Island, availability of suitable habitats), or • the risk to the biodiversity of Barrow Island is considered to be high (as determined by CAPL, on advice of the QEP), but the ability to detect and eradicate is considered readily achievable (due to factors such as visibility, fecundity, slow dispersal etc.). **Level 3 Quarantine Incident** **Terrestrial NIS**: A confirmed detection of NIS on Barrow Island, after Final Quarantine Clearance, where: • the risk to the biodiversity of Barrow Island is considered to be high and the ability to detect and eradicate is difficult (as determined by CAPL, on advice of the QEP), and/or • the consequence of eradication/control actions on the biodiversity of Barrow Island is considered to be high (as determined by CAPL, on advice of the QEP). **Marine Pests**: A confirmed detection of a Marine Pest on marine infrastructure or in the waters surrounding Barrow Island. Note: A Marine Pest that has only been detected on the wetsides of a vessel and not on marine infrastructure and/or in the

Term	Definition
	waters surrounding Barrow Island is not considered an incident (see Quarantine Intercept). ** Positive identification is taxonomic (morphologic or molecular) confirmation in every instance except where there is high certainty of species identification in the expert judgement of the CAPL Quarantine Manager.* **Note**: An introduction of a Marine Pest is classified as a Level 3 Incident only.
Quarantine Intercept	**Terrestrial NIS**: The detection, containment, and removal of suspected NIS prior to Final Clearance. **Marine Pest**: The detection, containment, and removal of a Marine Pest on a vessel's (including barges etc.) wetsides after Final Quarantine Clearance is granted and when the vessel is within the limited access zone or controlled access zone.
Quarantine Introduction	The presence of viable NIS on Barrow Island, or of a Marine Pest in the waters surrounding Barrow Island (excluding on vessel wetsides—see Quarantine Intercept). In both instances, the species will be considered introduced if the species has survived First Response and Incursion Response.
Quarantine Procedural Breach	Any case where a quarantine observation, inspection, or audit detects a failure to comply with Barrow Island quarantine procedures, standards, or concessions. **Level 1 Quarantine Procedural Deviation** • Upon arrival of a vessel or material at Barrow Island, it is determined that a quarantine procedure, or part thereof, has not been followed and the potential impact of the deviation has low risk to the biodiversity of Barrow Island and surrounding waters. **Level 2 Quarantine Procedural Deviation** • Upon arrival of a vessel or material at Barrow Island, it is determined that a quarantine procedure, or part thereof, has not been followed and the potential impact of the deviation has high risk to the biodiversity of Barrow Island and surrounding waters.
Redox	*See* ORP
Reference zone/site/island	Specific areas of the environment that are not at risk of being affected by the Project or existing developments, that can be used to determine the natural state, including natural variability, of environmental attributes
Remigrant turtle	A tagged Flatback turtle returning and 'recaptured', as opposed to a new (untagged) turtle that is tagged for the first time.
Reporting Period	The period from 10 August 2021 to 9 August 2022 covered by this EPR
Reservoir Carbon Dioxide	GHG Emissions that are separated (from natural gas or the products produced from extracted hydrocarbons) in the acid gas removal units and expected to be subsequently injected underground (as per MS 1198).
ROM	(log) Ratio of Means
SAQP	Sampling and Analysis Quality Plan
Scope 1	Defined under the Greenhouse Gas Protocol (a Corporate Accounting and Reporting Standard) as 'all direct GHG emissions, where direct GHG emissions are emissions from sources that are owned or controlled by the reporting entity'
SD	Standard deviation (statistical variation); a measure used to quantify the amount of variation or dispersion of a set of data values
SE	Standard error (statistical variation); a measure used to quantify the accuracy with which a sample mean represents a population mean
Serious Environmental Harm	Environmental harm that is: a) irreversible, of a high impact or on a wide scale; or

Term	Definition
	b) significant or in an area of high conservation value or special significance and is neither trivial nor negligible
SGC	Silica Gel Clean-up
SO_2	Sulfur dioxide
SO_4	Sulfate ion
SRE	Short-range Endemics; taxonomic group of invertebrates that are unique to an area, found nowhere else, and have naturally small distributions (i.e. <10,000 km^2).
SRESFMP	Short-range Endemics and Subterranean Fauna Monitoring Plan
SSC	Surveillance System Components
SSE	South-south-east (compass direction)
Stressor	An environmental condition or influence that stresses an organism
SVL	Sparse Vegetation Line
tCO_2e	Tonnes of carbon dioxide equivalent
TDF	Terrestrial Disturbance Footprint The area to be disturbed by construction or operations activities associated with the Terrestrial Facilities listed in Condition 6.3 of MS 800, Condition 6.3 of MS 769, and Condition 5.2 of EPBC 2003/1294 and 2008/4178, and set out in the Terrestrial and Subterranean Baseline State and Environmental Impact Report required under Condition 6.1 of MS 800, Condition 6.1 of MS 769, and Condition 5.1 of EPBC 2003/1294 and 2008/4178.
Threatened Species	Species listed as extinct, extinct in the wild, critically endangered, endangered, vulnerable or conservation dependent under section 178 of the Commonwealth EPBC Act
TJ	Terajoule
TMP	Topsoil Management Plan
Topsoil	The top layer of soil that stores seed and acts as the growth medium in which vegetation can establish itself
Transect	The path along which a researcher moves, counts, and records observations
TRH	Total Recoverable Hydrocarbons
TSEMP	Terrestrial and Subterranean Environment Monitoring Program
TV	Television
UAV	Uncrewed Aerial Vehicle (e.g. drone)
VCU	Verified Carbon Unit
VER	Verified Emission Reduction
WA	Western Australia
Waters surrounding Barrow Island	Refers to the waters of the Barrow Island Marine Park and Barrow Island Marine Management Area (~4,169 ha and 114,693 ha respectively), as well as the Port of Barrow Island representing the Pilbara Offshore Marine Bioregion
Weed	Non-indigenous plant species; a plant that establishes in natural ecosystems, subsequently adversely affecting natural processes and ultimately resulting in the decline of the native vegetation community
Weed Hygiene Zone	An area within which non-indigenous plant species, assessed to be high-risk species, have established populations and/or where a seedbank of a high-risk species is present
YCN	Yacht Club North (beach)

Term	Definition
YCS	Yacht Club South (beach)

13 References

Table 13-1 lists the documentation referenced in this EPR.

Table 13-1: References

Ref. No.	Description	Document ID
1.	Chevron Australia. 2020. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Terrestrial and Subterranean Environment Monitoring Program*. Rev. 2.0. Chevron Australia, Australia, Western Australia. Available from: https://Australia.chevron.com/-/media/Australia/our-businesses/documents/gorgon-terrestrial-and-subterranean-environment-monitoring-program.pdf [Accessed 4 Sep 2022]	GOR-COP-01696
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4.	Chevron Australia. 2017. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Terrestrial and Marine Quarantine Management System*. Rev. 1.0. Chevron Australia, Perth, Western Australia. Available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/terrestrial-and-marine-quarantine-management-system.pdf [Accessed 20 Sep 2022]	GOR-COP-01854
5.	Chevron Australia. 2015. *Five-year Environmental Performance Report (August 2010–August 2015)*, Rev. 0, Chevron Australia, Perth, Western Australia, available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/gorgon-and-jansz-feed-gas-pipeline-5-year-environmental-performance-report-2010-2015.pdf [accessed 6 Oct 2022]	G1-NT-REPX0007517
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7.	Pendoley Environmental. 2022. *Gorgon Gas Development: Marine Turtle Monitoring Program 20210/22: Barrow Island and Mundabullangana*. Unpublished report for Chevron Australia, Perth, Western Australia.	ABU220800133
8.	Chevron Australia. 2022. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Lighting Effectiveness Review and Audit Report (2021–2022)*, Chevron Australia, Perth, Western Australia.	ABU220800042
9.	Chevron Australia. 2019. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Short-Range Endemics and Subterranean Fauna Monitoring Plan*. Rev. 4. Chevron Australia, Perth, Western Australia. Available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/gorgon-emp-short-range-endemics-and-subterranean-fauna-monitoring-plan.pdf [Accessed 4 Sep 2022]	G1-NT-PLNX0000295
10.	Chevron Australia. 2015. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Fire Management Plan*. Rev. 1.0. Chevron Australia, Perth, Western Australia. Available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/gorgon-emp-fire-management-plan.pdf [Accessed 20 Sep 2022]	GOR-COP-01238

Ref. No.	Description	Document ID
11.	Chevron Australia. 2020. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Air Quality Management Plan*. Rev. 3. Chevron Australia, Perth, Western Australia. Available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/gorgon_project_emp_air_quality_management_planrev2amendment1.pdf [Accessed 5 Sep 2022]	G1-NT-PLNX0000301
12.	Chevron Australia. 2020. ABU Occupational Hygiene Corporate OE Process, April 2020, Chevron Australia, Perth, Western Australia.	OE-03.11.02
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22.	Stantec. 2021. *Ecosystem Function Analysis 2020: Gorgon Pipeline Rehabilitation Monitoring on Barrow Island*. Unpublished report for Chevron Australia, Perth, Western Australia.	ABU190901312
23.	Chevron Australia. 2020. *Gorgon Gas Development and Jansz Feed Gas Pipeline: Five-year Environmental Performance Report (August 2015–August 2020)*. Rev. 1. Chevron Australia, Perth, Western Australia. Available from: https://australia.chevron.com/-/media/australia/our-businesses/documents/gorgon-and-jansz-feed-gas-pipeline-5-year-environmental-performance-report-2015-2020.pdf [Accessed 20 Sep 2022]	ABU200101038

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25.	Chevron Australia. 2022. *Section 72 Waste discharge notification – Jansz Inlet Processing Foam Skid.* Rev. 0. Chevron Australia, Perth, Western Australia.	ABU220200159
26.	Chevron Australia. 2022. *Section 72 Waste discharge notification – Stormwater Holding Pond and Oily Water Sump*. Rev. 0. Chevron Australia, Perth, Western Australia.	ABU220300493
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