

# Whyte Island Rehabilitation Program - Year 1 Assessment

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Checked By	Dr Darren Richardson
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## Executive Summary

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Port of Brisbane Proprietary Limited has entered an external financial agreement to rehabilitate 10 ha of degraded land at Whyte Island by 2026. The project area comprises part of Lot 730 SP142207 south of Boat Passage and east of Port Drive, Brisbane.

This report provides the first habitat condition assessment of the project area following Year 1 of the rehabilitation programme. The report:

- documents rehabilitation works undertaken within the project area
- assesses outcomes of the rehabilitation works in terms of habitat condition and extent compared with the baseline condition.

### Rehabilitation Actions Implemented in Year 1

The following on-ground rehabilitation works were implemented in Year 1:

- Cessation of slashing across the project area in late 2023.
- Installation of hard fencing around the northern and western boundaries of the project area in early 2024 to prevent unauthorised vehicular access.
- Treatment of 2ha of dense woody weed infestation surrounding the ephemeral wetland treated in mid-2024.
- Feral fox control conducted early 2024.
- Red Fire Ant control conducted 2024.

### Habitat Outcomes Following Year 1 Works

- **Removal of Slashing:**
  - 0.5 ha of previously slashed saltcouch grassland is increasing in cover with cover increasing from approx. 60% to 80% outside the access tracks.
  - 0.04 ha of previously slashed succulent saltmarsh is increasing in cover from approx. 60% to 80% outside the access tracks.
  - There has been a 0.2 ha gain of saltcouch grassland which is expanding landward into previously slashed exotic grassland habitat.
  - There has been a 0.06 ha of *Phragmites australis* wetland regeneration in previously slashed habitat.
- **Fencing:**
  - Fence installation around the perimeter of the project area has successfully removed illegal vehicle access to 4.2ha of estuarine wetland/claypan which is important habitat for disturbance-sensitive waders of conservation significance.
  - Vehicle removal has indirectly protected a further 15.6 ha of tidal wetlands and their shorebird assemblages from vehicle noise and visual disturbance.
- **Weed Control:**
  - Selective control for exotic *Schinus* shrubland surrounding the ephemeral wetland has had a high success rate with more than 80% successful weed kill in at least 0.7ha.

- **Pest Control**

- Successful initial pest control targeting red fox and fire ants.

## Summary

In summary, the Year 1 Rehabilitation Programme has:

- rehabilitated 0.5ha of saltmarsh which is a threatened ecological community under the EPBC Act
- contributed to the rehabilitation of more than 4ha of estuarine wetland/claypan which supports migratory shorebirds, including, species listed as critically endangered under the EPBC Act
- restored 0.2ha of saltmarsh
- restored 0.06ha of *Phragmites australis* wetland
- removed at least 0.7ha of woody weeds from a wetland riparian zone.

On-going annual monitoring assessments will be undertaken to measure outcomes of progressive rehabilitation works. The long-term monitoring results will be used to determine whether PBPL has satisfied its sustainability and financial commitments to rehabilitate 10 ha of degraded land at Whyte Island by 2026.



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# 1 Introduction

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## 1.1 Background

BMT assessed lands under Port of Brisbane Pty Ltd (PBPL) management for their suitability to support carbon reduction project/s in accordance with statutory vegetation methods under the Emissions Reduction Fund (ERF), specifically 'Reforestation by environmental plantings' and 'Tidal restoration of blue carbon ecosystems'. The capacity for potential projects to deliver co-benefits, particularly local biodiversity and water quality improvements, was also investigated.

Potential projects were prioritised by; viability of carbon sequestration method/s; potential carbon gain that could be produced; and co-benefit outcomes. Following consultation, degraded lands at Whyte Island (the project area) were identified to have the greatest restoration potential from an environmental and land use perspective and could deliver a range of biodiversity and social benefits.

The project area at Whyte Island comprises part of Lot 730 SP142207 south of Boat Passage and east of Port Drive. Although it is not intended to register this project under the Australian Carbon Credit Unit (ACCU) Scheme, PBPL has entered an external financial agreement to rehabilitate 10 ha of degraded land at Whyte Island by 2026.

The rehabilitation works are being undertaken by PBPL and the Bulimba Creek Catchment Coordinating Committee (B4C). Works completed to date include:

- fence installation to restrict vehicle access undertaken early 2024.
- cessation of slashing in saltmarsh and adjacent habitat undertaken late 2023.
- selective weed control undertaken mid-2024.
- initial feral pest control.

Future works will include:

- weed and feral animal control
- environmental plantings
- saltmarsh translocation trials
- fauna habitat enhancement including nest box installation
- construction of a dedicated walking access track for educational and recreation purposes
- bird hide installation.

## 1.2 Scope and Aims

This report provides the first habitat condition assessment of the project area following initial rehabilitation works. The aims of this report are to:

- document rehabilitation works undertaken within the project area
- assess outcomes of rehabilitation works in terms of habitat condition and extent compared with the baseline condition.

On-going annual monitoring assessments will be undertaken to measure outcomes of progressive rehabilitation works. The long-term monitoring results will be used to determine whether PBPL has satisfied its sustainability and financial commitments to rehabilitate 10 ha of degraded land at Whyte Island by 2026.

## 2 Methodology

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The assessment involved the following tasks:

### 2.1 Data Review

The following information was reviewed:

- On-line current and historical aerial photography (Queensland Globe and Google)
- Current environmental and ecological mapping layers within Queensland Globe (tidal, vegetation, habitat, soil and landform data) (Queensland Government 2024)
- Whyte Island Conceptual Rehabilitation Plan. BMT, June 2023. Report prepared for PBPL
- Fauna and flora surveys – Port of Brisbane lands at Lytton Lot 730 SP142207, Lytton. Austecology, December 2024. Report prepared for BMT on behalf of PBPL
- Whyte Island Rehabilitation Project – Baseline Monitoring Framework and Benchmarks. BMT, December 2023. Report prepared for PBPL
- Whyte Island Rehabilitation Project. Rehabilitation Targets and Supporting Mapping. BMT, February 2024. Technical Note prepared for PBPL
- Proposal and Scope of Work for Whyte Island. Bulimba Creek Catchment Coordinating Committee Inc. July 2024. Report prepared for PBPL
- Port of Brisbane - Blue Carbon Assessment. BMT, December 2022. Report prepared for PBPL.

### 2.2 Remote Sensing

To monitor regional vegetation condition and extent, two cloud-free WorldView-3 (WV3) images were used to capture both temporal and seasonal habitat changes across the project area and surrounds. The baseline image was captured 13 August 2023 following the dry season. The image captured April 9, 2024 followed the wet season and was taken following commencement of initial rehabilitation works. The WV3 satellite offers exceptionally high-resolution imagery with a spatial resolution of 1.2 meters across eight multispectral (MS) bands in the visible near-infrared (VNIR) range. This high level of detail and spectral diversity makes WV3 imagery particularly well-suited for vegetation studies, enabling detailed analysis of vegetation health, species differentiation, and land cover classification.

The images were used to classify vegetation cover and map its spatial distribution across the project area and surrounds. The condition or health status of each vegetation class was also assessed for each WV3 image using three key indices:

- Normalised Difference Vegetation Index (NDVI): This widely used index for vegetation monitoring calculates vegetation health by measuring the difference between near-infrared light (which vegetation strongly reflects) and red light (which vegetation absorbs).
- Enhanced Vegetation Index (EVI): This index is an optimised version of the NDVI. It corrects for distortions in the reflected light caused by atmospheric particles and the ground cover beneath the vegetation, providing a more accurate measure of vegetation health.
- Soil-Adjusted Vegetation Index (SAVI): This index is specifically designed to minimise the influence of soil brightness in environments with sparse vegetation, ensuring a more reliable assessment of vegetation health in such areas.

The three vegetation indices were assessed to identify and describe any discrepancies in results.

### 2.2.1 Change Vector Analysis (CVA)

The data obtained from the vegetation classification and health indices were analysed using a change detection approach to provide a comprehensive statistical analysis between the baseline and post rehabilitation images and to detect changes between the wet and dry seasons. This method allowed for the detection and measurement of variations in vegetation cover and health between the different temporal snapshots, offering valuable insights into the temporal dynamics and ecological shifts within the project area and surrounds. The data was also used to detect changes in habitat extent and/or condition attributable to the rehabilitation works.

## 2.3 Site Surveys

High resolution NearMap aerial imagery captured 16 June 2023 and 21 July 2024 were assessed to detect and map any changes in habitat extent as a result of rehabilitation works. A ground-truthing survey of the project area was undertaken to verify the aerial photo interpretation and to assess and document habitat community condition and extent following the initial rehabilitation works, including:

- fence installation to restrict vehicle access undertaken early 2024
- cessation of slashing in saltmarsh and adjacent habitat undertaken late 2023
- selective weed control undertaken in dense Schinus shrubland in mid-2024.

Rehabilitation works have not yet commenced in the majority of the BioCondition plots that were established as the baseline. In addition, the short timeframe between the on-ground works that have been undertaken and the first monitoring survey is not sufficient for substantive changes in habitat condition to have occurred. All BioCondition plots will be re-measured consistently at the same time in optimal conditions (i.e. post wet season) to capture best on offer habitat condition following rehabilitation and natural recruitment.

The site survey was undertaken on the 21 June 2024 by a qualified, senior ecologist.

### 2.3.1 Additional Baseline Assessments

Based on the site survey and proposed rehabilitation works, additional baseline assessments were established to ensure adequate coverage of each vegetation community within the project area prior to the bulk of the active rehabilitation works being undertaken, such as, planting.

## BioCondition Plots

Six BioCondition plots (sites 1-6) were established in sites to be directly targeted in the rehabilitation program by Austecology in 2023.

Based on the planting regimes proposed by B4C, additional baseline BioCondition plots (Sites 7-9) were established by BMT in June (2024) to ensure coverage of each vegetation community within the project area to be targeted by active rehabilitation works.

Table 2.1 and Figure 2.1 provide descriptions and locations of each BioCondition monitoring plot established in the project area.

Table 2.1 Whyte Island BioCondition Monitoring Plots

Plot	Description
1	<i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> and <i>Casuarina glauca</i> open forest on fill (modified RE 12.3.20)
2	<i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> and <i>Casuarina glauca</i> open forest on fill (modified RE 12.3.20)
3	Degraded saltmarsh (RE 12.1.2)
4	Degraded saltmarsh (RE 12.1.2)
5	Dense exotic shrubland dominated by <i>Schinus terebinthifolius</i>
6	Dense exotic shrubland dominated by <i>Schinus terebinthifolius</i>
7	Highly modified and managed low-lying exotic grassland
8	Highly modified and managed exotic grassland on elevated fill
9	Intertidal succulent saltmarsh and saltpan with vehicle disturbance (RE 12.1.2)

Plots were established and measured generally in accordance with the Queensland BioCondition framework (Eyre *et al.* 2015) as follows.

#### Site Condition

Site-based attributes were assessed for each plot in accordance with the framework as follows (note plot size was modified at some sites based on site condition):

- 100 m x 50 m plot were established to assess:
  - large native trees count
  - recruitment of woody perennial species
  - native tree canopy height
  - native tree species richness.
- 50 m x 10 m plot were established along the transect to assess native plant species richness for shrubs, grasses and forbs/other
- twenty 5 m x 5 m sub-plots were established each side of the transect to determine non-native plant cover
- a 50 m x 20m sub-plot was established to measure coarse woody debris (logs or dead timber on the ground that is >10 cm diameter and >0.5 m in length and more than 80% in contact with the ground)
- five 1 m x 1 m squares were established to measure and photograph native perennial grass cover and organic litter
- native tree and shrub canopy cover was estimated, and percentage of canopy cover measured along the 100 m transect line.

#### **Vegetation Transects**

In June (2024), four transects were also established perpendicular to highest astronomical tide to monitor potential changes in groundcover condition and extent at the interface between terrestrial and intertidal lands over the project timeframe. Variable transect lengths were established depending on site condition. Percentage and type of vegetation cover was measured along each transect with representative photos taken at each site at the approximate mid-point. Figure 2.1 provides locations of each transect established in the project area.

## Condition Scores

To provide quantitative data to compare baseline and post-rehabilitation works, site vegetation attributes were scored against the published Regional Ecosystem (RE) benchmark to evaluate the condition of site vegetation against 'best on offer' communities in south-east Queensland.

Historical aerial imagery and pre-clearing RE mapping indicates the entire project area comprised intertidal lands supporting a mosaic of estuarine wetlands. The project area was highly modified for road, rail and port development with land above current highest astronomical tide comprising fill. Whilst modified lands do not correspond to a land zone under the RE framework, these lands currently support patches of native regrowth and plantings consistent with remnant RE 12.3.11 and 12.3.20 woodlands, which occur in the near vicinity. Despite the small size of the project area, both RE's have been adopted as suitable benchmarks for the site with RE 12.3.11 occurring on higher ground and 12.3.20 occurring on lower ground directly adjacent to highest astronomical tide (HAT).

Refer Table 2.2 for BioCondition benchmarks for the following vegetation communities in the project area:

- RE 12.1.2 (Vegetation Management Act Class - Least concern / Biodiversity status - No concern at present / EPBC Threatened Ecological Community): Saltpan vegetation comprising *Sporobolus virginicus* grassland and samphire hermland. Includes saline or brackish sedgeland. Usually occurs on hypersaline Quaternary estuarine deposits.

Saltmarsh within the Port of Brisbane region is comprised of two distinct vegetation communities: *Sporobolus virginicus* grassland at the interface between terrestrial and intertidal lands, and; samphire formland with saltpan/claypan at the upper tidal range. The RE12.1.2 benchmark is more reflective of *Sporobolus virginicus* grassland and does not adequately measure local samphire formland attributes. For the purposes of this monitoring assessment, the RE12.1.2 benchmark was adjusted to reflect local vegetation conditions where samphire forbs are the dominant groundcover.

- RE 12.3.11 (Vegetation Management Act Class – Of concern / Biodiversity status – Of concern): *Eucalyptus tereticornis* +/- *E. siderophloia* and *Corymbia intermedia* open forest to woodland. *Corymbia tessellaris*, *Lophostemon suaveolens* and *Melaleuca quinquenervia* frequently occur and often form a low tree layer. Occurs on Quaternary alluvial plains and drainage lines along coastal lowlands.
- RE 12.3.20 (Vegetation Management Act Class – Endangered / Biodiversity status – Endangered): *Melaleuca quinquenervia*, *Casuarina glauca* +/- *Eucalyptus tereticornis*, *E. siderophloia* open forest. Occurs on lowest terraces of Quaternary alluvial plains in coastal areas. May be subject to storm surge inundation.

BioCondition scores for the assessment sites were determined by adding the scores obtained for each vegetation attribute and dividing by the maximum possible score for the community. Vegetation attributes are weighted to standardise the relative degree they have on the potential to impact on long-term condition (e.g. non-native plants), difficulty for replacement (e.g. large trees) or habitat value (refer Table 2.3).

Note that landscape-scale attributes were not used in this assessment given the small size of each site, their close proximity to each other, and the same landscape context across the project area.



Table 2.2 Published BioCondition Benchmark (Queensland Herbarium 2021)

Attribute	RE 12.1.2	RE 12.3.11	RE 12.3.20
Max Score	25	80	80
Recruitment	na	100	100
Non-native Plants	0	0	0
Tree Species Richness	na	7	4
Shrub Species Richness	na	7	4
Grass Species Richness	1	12	2
Forb/Other Species Richness	3	25	8
Emergent Canopy Height	na	na	na
Tree Canopy Height	na	23	16
Tree Subcanopy Height	na	8	8
Emergent Canopy Cover	na	na	na
Tree Canopy Cover	na	56	70
Tree Subcanopy Cover	na	33	20
Large tree threshold (Eucalypt)	na	49	na
Large tree threshold (Non eucalypt)	na	36	30
Total Number Large Trees (Eucalypt)/ ha	na	22	na
Total Number Large Trees (non-eucalypt)/ ha	na	8	165
Shrub Canopy Cover	na	20	15
Native Perennial Grass/Samphire Forb <sup>3</sup>	35	44	20
Litter Ground Cover	na	37	30
Woody Debris Length/ha	na	555	890

<sup>3</sup> RE 12.1.2 benchmark was adjusted to reflect dominance of forbs in local samphire communities; na = not applicable

Table 2.3 Weightings for Vegetation Attributes (Eyre *et al.* 2015)

Site-based Condition Attribute	Weighting (%)
Large trees	15
Tree canopy height	5
Recruitment of canopy species	5
Tree canopy cover (%)	5
Shrub layer cover (%)	5
Coarse woody debris	5
Native plant species richness for four lifeforms	20
Non-native plant cover	10
Native perennial grass cover (%)	5
Litter cover	5

All Baseline data is provided in Annexes A to F.

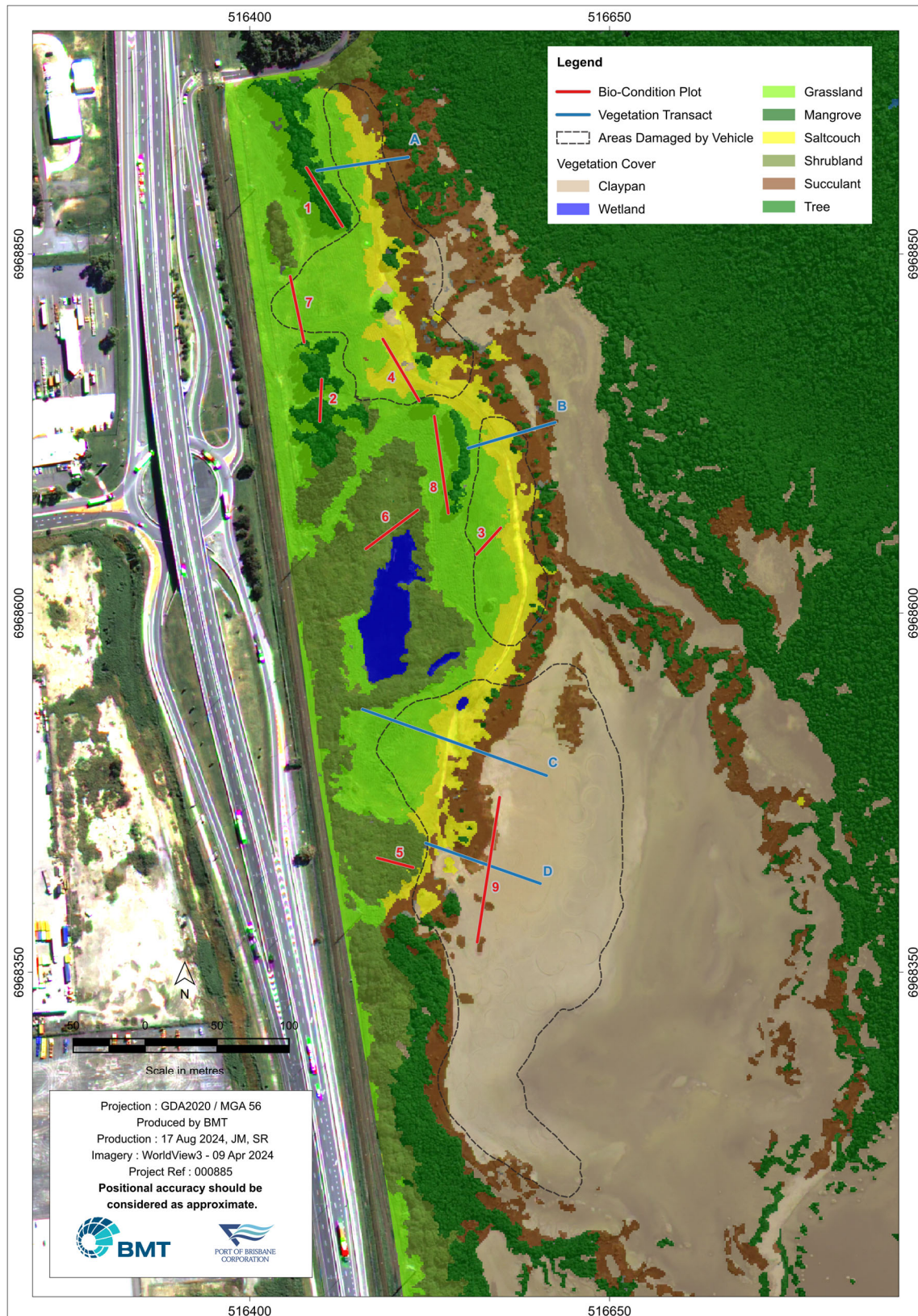


Figure 2.1 Whyte Island Habitat Features and Monitoring Locations

## 3 Results

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### 3.1 Vegetation Condition and Extent - Year 1

#### 3.1.1 Removal of Slashing

Prior to the rehabilitation programme, 3.7 ha of the project area was regularly slashed. This included regular disturbance to 0.5 ha of saltcouch grassland which resulted in extensive degradation to this saltmarsh community, including, groundcover removal averaging 60% in native grass groundcover (Austecology, 2023), soil disturbance via wheel ruts and compaction, and weed invasion.

In late 2023, slashing in the project area was discontinued to allow natural vegetation regeneration. As a result of removing this practice, the previously disturbed saltcouch grassland increased in cover (averaging 80% groundcover outside the access tracks) (refer Appendix F). An area of 0.04 ha of previously slashed succulent saltmarsh also increased in cover from approx. 60% to 80% outside the access tracks. Saltcouch grasslands also expanded landward, resulting in a 0.2 ha gain of saltmarsh in the project area. In addition, 0.06 ha of *Phragmites australis* wetland regenerated in previously slashed habitat. Refer to Table 3.1 for changes in vegetation extent and condition following the removal of slashing.



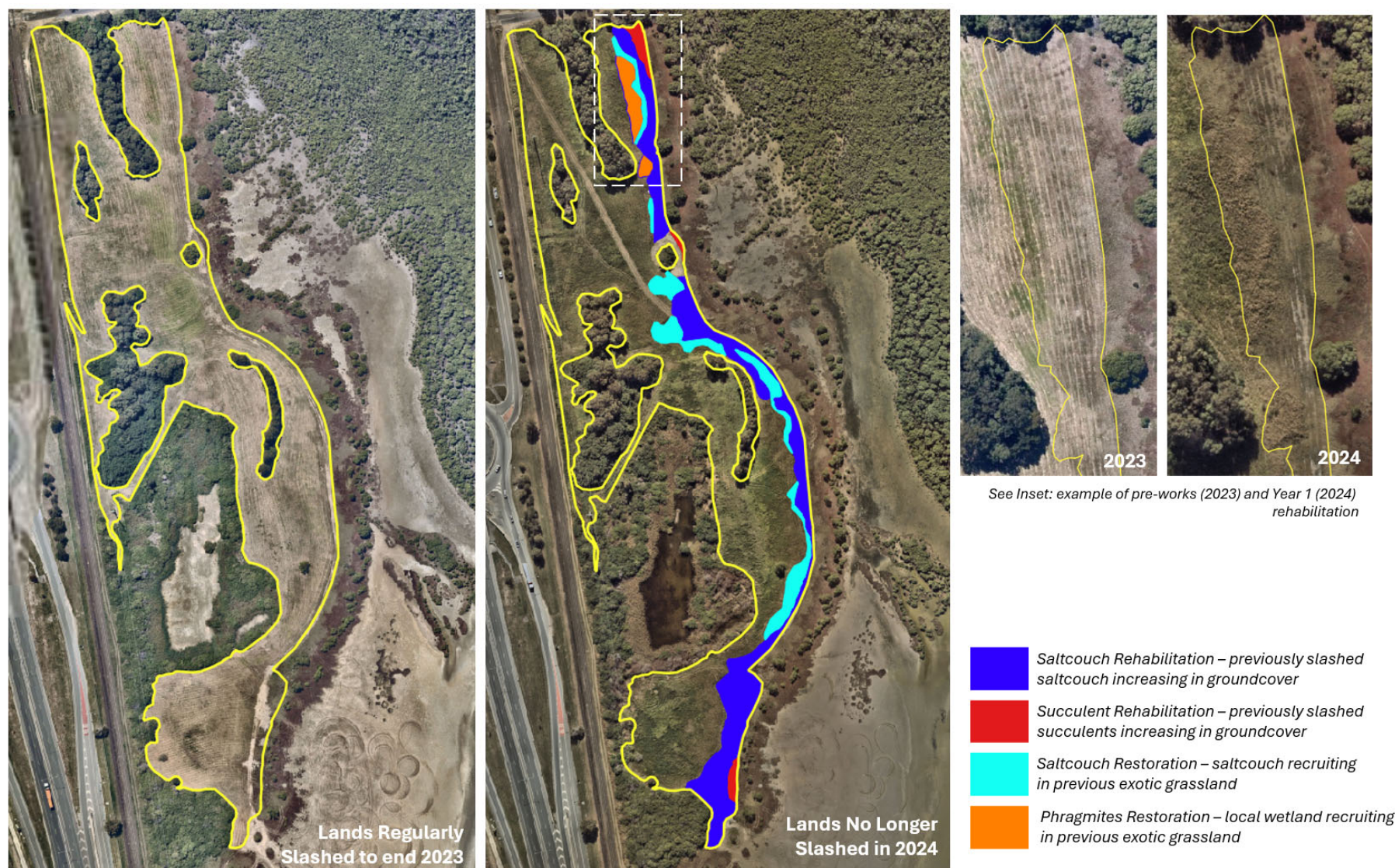


Figure 3.1 Year 1 – Outcomes of Removing Slashing



### 3.1.2 Weed Control

Selective weed control was undertaken in dense exotic *Schinus terebinthifolius* shrubland adjacent to the ephemeral wetland in mid-2024. The short timeframe between these on ground works and the first monitoring survey is not sufficient for substantive changes in habitat condition to occur. However, site observations indicate the weed control has had a high success rate (more than 80% successful weed kill) in at least 0.7 ha. This area will be progressively planted with native species.



Figure 3.2 Targeted Schinus Control Mid-2024 (red polygons indicating successful treatment of Schinus, June 2024)

### 3.1.3 Exclusion of Vehicles

The fence installed on the project area perimeter in early 2024 has successfully excluded illegal vehicle access and reduced disturbance to the claypan and adjacent saltmarsh. The short timeframe between these on ground works and the first monitoring survey is not sufficient for substantive changes in habitat condition to occur. However, site inspection and aerial photo analysis indicates 4.2 ha of wetlands were previously subject to direct vehicle disturbance and are presently undergoing natural recovery.

Prior to the installation of fencing, vehicles also represented a key source of visual and noise disturbance to shorebirds utilising saltpan/saltmarsh habitat within the project area (Austecology 2023; BMT 2024). Excluding areas already protected by other methods (i.e. slashing management, direct protection from vehicle damage, weed control), 15.6 ha of high value shorebird saltpan/saltmarsh habitat within 100 m of the area previously disturbed by vehicles is no longer subject to indirect vehicle disturbance.



Figure 3.3 Claypan Disturbance Prior to Fence Establishment (left) and Post Fence Establishment (right)

### 3.2 Remote Sensing Analysis of the Project Area and Surrounds

Detailed remote sensing analysis was undertaken to track seasonal and human-induced changes in habitat condition and extent within the project area and surrounds and to identify potential areas of disturbance/degradation that could be targeted through active rehabilitation.

Using high-resolution multispectral data from the WorldView-3 satellite, the following habitat categories were identified within the project area and surrounds (refer Figure 3.4, Figure 3.5 and Table 3.1):

- Mangroves: dominated by *Avicennia marina*.
- Mangrove Dieback.
- Saltcouch Saltmarsh: Most landward saltmarsh predominantly composed of the marine plant *Sporobolus virginicus*.
- Succulent Saltmarsh: Most seaward saltmarsh comprised of a mix of low succulent forbs.
- Claypan/Mudflat: dense, compact layer of soil with high clay content.
- Sea
- Grassland: Terrestrial grasslands dominated by exotic species.
- Shrubland: Dense *Schinus terebinthifolius* shrubland.

- Tree Habitat: *Eucalyptus tereticornis*, *Corymbia tessellaris* +/- *Casuarina glauca* regrowth/plantings.
- Ephemeral Wetland
- Other/Unclassified.

With the exception of the habitat changes described above in Section 3.1, comparison of the 2023 and 2024 remote sensing analysis indicate there has been no substantive change in habitat extent in the project area and surrounds since implementation of the rehabilitation program. Given the short timeframe between on ground works and the first monitoring survey these results are to be expected.

Appendix G provides technical detail on vegetation condition changes in the project area and surrounds detected via remote sensing. In summary, the results indicate:

- Dry season results show poor to moderate saltcouch condition near disturbed and degraded areas, notably the access tracks and slashed areas. This highlights the importance of protecting these communities from regular vehicle disturbance which can reduce their resilience to natural seasonal changes. The 2024 results indicate an improvement in saltcouch health over the wet season and following the removal of slashing. This is consistent with the positive changes in ground cover and extent described in section 3.1.
- Terrestrial grasslands, which are dominated by exotic taxa, show the highest seasonal variance among all vegetation cover classes in the project area. These communities are in good condition during the wet season but show extensive decline in health in the dry season, particularly in areas adjacent to HAT. Maintaining the condition of salt tolerant native taxa may give marine plants a competitive advantage over more salt/drought sensitive exotic grasses.
- All woody cover across the project area, including the exotic shrublands, display good vegetation health across all seasons highlighting the need for on-going weed control to target highly resilient exotic taxa, such as *Schinus*, which can outcompete native species.
- Mangroves across the project area are in relatively good condition, however, some mangroves along the fringes of the claypan in the north show moderate health. Whilst there are pockets of mangrove dieback, some sections are showing an improvement in health. On-going monitoring will focus on tracking changes in mangrove health and dieback to determine if changes are cyclical in response to natural climatic/hydrological variations or may be due to other stressors that could be targeted in an active rehabilitation program, such as plant pathogens/disease/weeds.



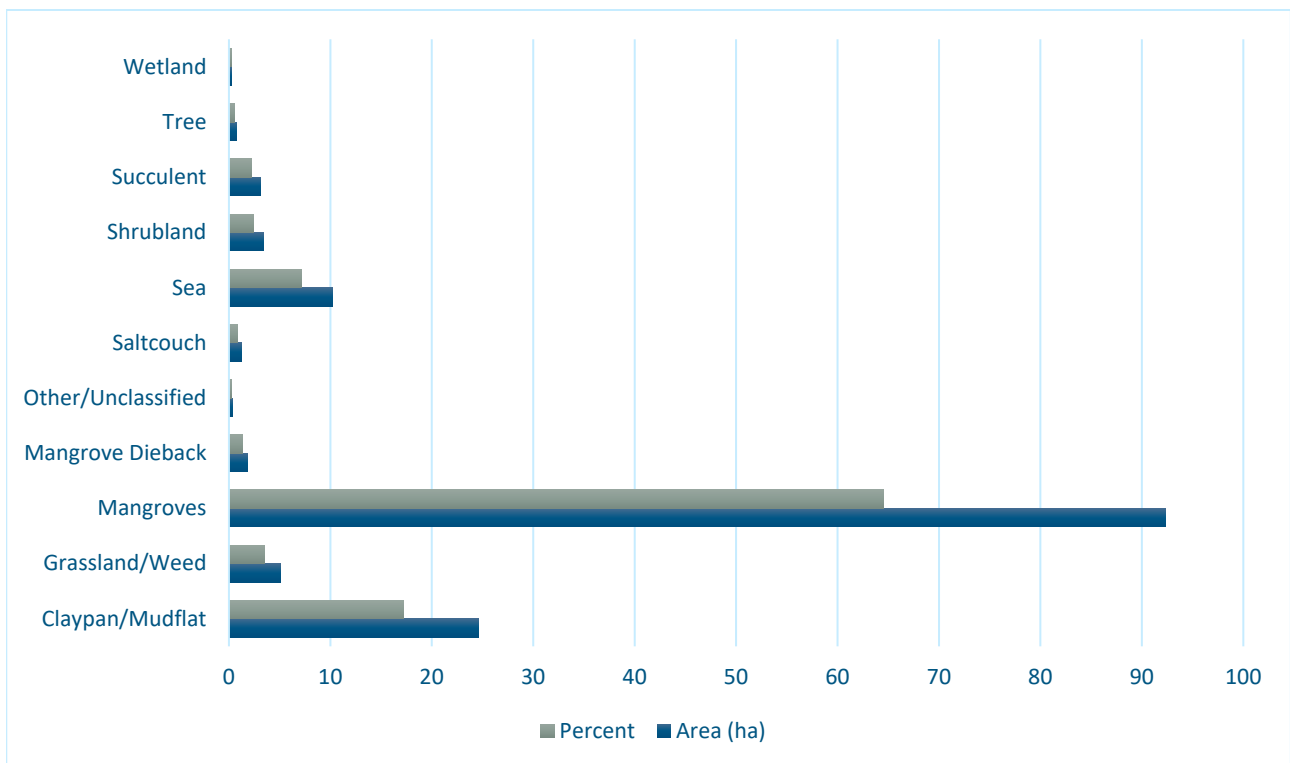


Figure 3.4 Habitat Category Extent Within the Project Area and Surrounds (2024)

Table 3.1 Habitat Category Extent Within the Project Area and Surrounds (2024)

Class	Area (ha)	Percentage (%)
Claypan/Mudflat	24.6	17.2
Grassland/Weed	5.1	3.5
Mangroves	92.4	64.5
Mangrove Dieback	1.8	1.3
Other/Unclassified	0.3	0.2
Saltcouch	1.2	0.8
Sea	10.2	7.2
Shrubland	3.4	2.4
Succulent	3.1	2.2
Tree	0.7	0.5
Wetland	0.3	0.2
Total	143.2	100



Figure 3.5 Habitat Category Extent Within the Project Area and Surrounds (2024)

## 4 Discussion

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### 4.1 Pre-Rehabilitation Disturbances and Habitat Condition

Historically, the project area comprised intertidal lands supporting a mosaic of estuarine wetlands. The project area was highly modified as part of port, rail and road development with land above current highest astronomical tide comprising fill. The project area and surrounds currently support a range of intertidal habitats of high ecological and fisheries value including mangroves (RE 12.1.3), intertidal mudflats, saltpan and upper tidal saltmarsh (collectively RE 12.1.2; federally threatened subtropical coastal saltmarsh ecological community listed under the EPBC Act<sup>1</sup>).

The pre-rehabilitation state of intertidal habitats was generally good, however the project area has been subjected to a range of human pressures notably vehicle damage, slashing of native communities and weed invasion.

The highly modified terrestrial lands are located on fill material and support a range of habitat types depending on topography, land management practices, duration of flooding/ponding, and exposure to tidal regime, including:

- exotic grassland on lands ranging from 1.4 - 2.7 m elevation dominated by Rhodes grass (*Chloris gayana*\*) with sparse exotic shrubs
- exotic grassland on slightly higher ground (1.6 - 3 m elevation) dominated by green panic (*Megathyrsus maximus* var. *maximus*\*) and red natal grass (*Melinis repens*\*)
- a brackish, ephemeral wetland with open water habitat and dense common reed (*Phragmites australis*) grassland (RE 12.3.8)
- exotic shrubland dominated by *Schinus terebinthifolius*\* (broad-leaved pepper) buffering the ephemeral wetland and on unmanaged, disturbed lands ranging from 1.0-4.9 m elevation
- native regrowth and plantings on unmanaged, higher ground ranging from 1.8-3.5 m elevation dominated by *Melaleuca quinquenervia* and *Casuarina glauca* on lower ground (RE 12.3.20 - Endangered under the Vegetation Management Act and federally threatened coastal swamp oak forest of south-east Queensland listed under the EPBC Act) and *Eucalyptus tereticornis* and/or *Corymbia tessellaris* (RE 12.3.11) on higher ground.

In terms of fauna use, birds were the most species rich and abundant of the fauna groups recorded in the project area, however, habitats are not large enough to sustain most of those species as residents (Austecology 2023). The large habitats adjacent to, and in proximity to, the project area are important for maintaining fauna. Improving habitat linkages to the project area will be important for maintaining and enhancing its long-term biodiversity values.

Whilst it is degraded in condition, the exotic shrubland of the project area supports native small ground mammals (Austecology 2023) and any rehabilitation works in these areas will need to be staged to avoid impacts to native species. There are no hollow-bearing trees and there is a lack of fallen timber in the project area. Installation of a variety of artificial boxes and log and rock piles will be required to improve habitat variation for native fauna (Austecology 2023).

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<sup>1</sup> Environment Protection and Biodiversity Conservation Act 1999

The adjacent saltpan/claypan provide significant high tide roost habitat for threatened and migratory shorebirds and are in close proximity to extensive areas of intertidal shoreline feeding habitat. Relatively short surveys have provided counts of 1,200 -1,400 migratory shorebirds, including at least 110 *Numenius madagascariensis* (Eastern curlew) – listed as critically endangered under the EPBC Act (Austecology, 2023). Restrictions to vehicle and pedestrian access are regarded as priority management actions in this area.

A range of commonly occurring feral fauna species have been detected in the project area but no species have been recorded in any notable abundance. However, It has been recognised that feral animals are a threat to the biodiversity and restoration efforts in the project area, with European brown hare (*Lepus europaeus*) potentially having a significant impact on future planting efforts, and red fox (*Vulpes vulpes*) causing significant problems to bird and native rodent populations. Several fire ant (*Solenopsis invicta*\*) nests have been recorded along vehicle access tracks within the project area and will be an ongoing management priority.

#### 4.2 Rehabilitation Actions Implemented in Year 1

Since the commencement of the project the following on-ground rehabilitation works have been implemented by/on behalf of PBPL and/or B4C:

- Installation of hard fencing around the northern and western boundaries of the project area in early 2024 to prevent unauthorised vehicular access.
- Cessation of slashing across the project area in late 2023.
- Selective weed control surrounding the ephemeral wetland undertaken May/June 2024.
- Feral fox control conducted early 2024.
- Red Fire Ant control conducted 2024.

#### 4.3 Habitat Condition Following Year 1 Works

Rehabilitation works have not yet commenced in the majority of the BioCondition plots and surrounds. In addition, the short timeframe between the on-ground works that have been undertaken and the first monitoring survey is not sufficient for substantive changes in habitat condition to have occurred. All BioCondition plots will be re-measured consistently at the same time in optimal conditions (i.e. post wet season) to capture best on offer habitat condition following rehabilitation and natural recruitment.

The following results are based on aerial photo interpretation, remote sensing, and the site survey.

##### 4.3.1 Fencing

The fencing installed as part of the rehabilitation program has successfully removed illegal vehicle access to the project area. Whilst the short timeframe between these on ground works and the first monitoring survey is not sufficient for substantive changes in habitat condition to occur, site observations indicate the estuarine wetlands and claypan habitat are naturally recovering. Aerial photo analysis and the site survey confirms the 4.2 ha of wetlands are no longer subject to direct vehicle disturbance. Vehicle exclusion is likely to indirectly protected a further 15.6 ha of tidal wetlands and their shorebird assemblages from vehicle noise and visual disturbance. Results from future bird monitoring surveys, to be conducted during the optimal wader season, will be used to help confirm changes in wader habitat quality and/or extent as a result of removing vehicles from the estuarine wetlands.



#### 4.3.2 Slashing

Habitats adjacent to the upper tidal range are no longer regularly slashed. Removal of this practice has promoted the recruitment of native wetland taxa. An area of 0.5 ha of previously slashed saltcouch is increasing in cover from approximately 60-80% groundcover outside access tracks. An area of 0.04 ha of previously slashed succulent saltmarsh is also increasing in cover from approx. 60% cover to 80% groundcover outside the access tracks. There has also been a 0.2 ha gain of saltcouch and 0.06 ha gain of *Phragmites australis* wetland in previously slashed habitat. Remote sensing condition assessments also indicate poor saltcouch condition during the dry season, particularly in proximity to disturbed and degraded areas, which highlights the importance of protecting these communities from regular vehicle disturbance. Maintaining the condition of salt tolerant native taxa may also give marine plants a competitive advantage over more salt/drought sensitive exotic grasses. BioCondition plots and vegetation transects established at the terrestrial/intertidal interface will be used to monitor further changes in vegetation composition and extent associated with improved land management practices.

#### 4.3.3 Weed Control

An area of 2 ha of dense woody weed infestation surrounding the ephemeral wetland was treated just prior to the June 2024 inspection. Due to the recent treatment, it was not suitable to repeat the BioCondition assessment in June 2024. However, site observations indicate the weed control has had a high success rate (more than 80% successful weed kill) in at least 0.7 ha. This area will be progressively planted with native species. Follow up monitoring will be undertaken to re-measure BioCondition plots established in this area to quantify changes in habitat condition as a result of weed control and revegetation. All woody cover across the project area, including the exotic shrublands, display good vegetation health across all seasons highlighting the need for on-going weed control to target drought exotic taxa, such as *Schinus*, which can outcompete native species.

#### 4.3.4 Feral Animal Control

An initial fox control program managed by Brisbane City Council has been undertaken within the project area. A minimum of six traps have been set in January and March 2024 with five foxes successfully removed from the project area. Stomach contents of two female foxes captured from Whyte Island indicated that birds are a primary food source.

Several fire ant nests have been recorded along vehicle access tracks within the project area. Spot control is undertaken on a regular basis by PBPL staff and will be an ongoing management priority. Whilst the removal of slashing has had a positive impact on the condition and extent of estuarine wetlands and their wader values, regular slashing will be undertaken outside the estuarine wetlands and revegetation areas for fire ant monitoring and control purposes.

### Summary

Table 4.1 summarises:

- baseline habitat descriptions (refer Appendix A-F)
- baseline BioCondition scores (refer Appendix A-F)
- site factors limiting condition
- targeted rehabilitation measures to be undertaken
- Year 1 actions that have been implemented
- Outcomes of rehabilitation works undertaken to date.

This table will be updated throughout the program to quantify changes in habitat condition and/or extent in response to the rehabilitation program.

Table 4.1 Summary of Year 1

Plot	Baseline Description and BioCondition Score	Site Factors Limiting Habitat Condition	Rehabilitation Measures to Enhance Habitat Condition	Year 1 Actions	Year 1 Outcomes
1	Regenerating <i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> and <i>Casuarina glauca</i> open forest on fill (RE 12.3.20)  BioCondition Score of 0.54	Weed cover Low shrub species* richness Low forb species richness Lack of large trees and hollows Lack of woody debris	Increase native species richness through weed control Install logs/mulch to improve ground conditions Nest box installation to substitute lack of hollow bearing trees	Nil	NA
2	<i>Eucalyptus tereticornis</i> , <i>Corymbia tessellaris</i> and <i>Casuarina glauca</i> open forest on fill (RE 12.3.20)  BioCondition Score of 0.54	Weed cover Low shrub species richness Low forb species richness Lack of large trees and hollows Lack of woody debris	Increase native species richness through weed control Install logs/mulch to improve ground conditions Nest box installation to substitute lack of hollow bearing trees	Nil	NA
3	Degraded <i>Sporobolus virginicus</i> saltmarsh (RE 12.1.2)  BioCondition Score of 0.72	Weed cover	Weed control by removing slashing/vehicle disturbance	Cessation of slashing (late 2023)	Groundcover increase from approx. 60% to 80% cover
4	Degraded <i>Sporobolus virginicus</i> saltmarsh (RE 12.1.2)  BioCondition Score of 0.62	Weed cover	Weed control by removing slashing/vehicle disturbance	Cessation of slashing (late 2023)	Groundcover increase from approx. 60% to 80% cover
5	Dense exotic shrubland dominated by <i>Schinus terebinthifolius</i>  BioCondition Score of 0.13	Lack of tree species Lack of shrub species Low grass species richness Low forb species richness Low native recruitment	No works proposed in current program: to be used as a control site for site 6	Nil	NA

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Plot	Baseline Description and BioCondition Score	Site Factors Limiting Habitat Condition	Rehabilitation Measures to Enhance Habitat Condition	Year 1 Actions	Year 1 Outcomes
		Lack of large trees and hollows Lack of woody debris			
6	Dense exotic shrubland dominated by <i>Schinus terebinthifolius</i>  BioCondition Score of 0.11	Lack of tree species Lack of shrub species Low grass species richness Low forb species richness Lack of large trees and hollows Lack of woody debris	Staged weed control Tree, shrub, groundcover plantings (RE 12.3.20) Installation logs/mulch to improve ground conditions Nest box installation to substitute lack of hollow bearing trees	At least 0.7 ha of dense woody weed infestation surrounding the ephemeral wetland treated mid-2024	More than 80% successful weed kill observed following recent weed control application
7	Highly modified and managed low-lying exotic grassland  BioCondition Score of 0.06	Lack of tree species Lack of shrub species Low grass species richness Low forb species richness Low native recruitment Lack of large trees and hollows Lack of litter Lack of woody debris	Weed control Tree, shrub, groundcover plantings (RE 12.3.20) Installation logs/mulch to improve ground conditions	Nil	NA
8	Highly modified and managed exotic grassland on elevated fill  BioCondition Score of 0.07	Low tree species richness/cover Lack of shrub species Low grass species richness Low forb species richness Low native recruitment Lack of large trees and hollows Lack of litter Lack of woody debris	Weed control Tree, shrub, groundcover planting (RE 12.3.11) Installation logs/mulch to improve ground conditions	Nil	NA

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Plot	Baseline Description and BioCondition Score	Site Factors Limiting Habitat Condition	Rehabilitation Measures to Enhance Habitat Condition	Year 1 Actions	Year 1 Outcomes
9	Remnant RE 12.1.2. intertidal succulent saltmarsh and saltpan with vehicle disturbance  BioCondition Score of 0.92	Site in very good condition but some vehicle disturbance.	Enhance RE condition and improve wader habitat conditions by removing vehicle access	Fencing to remove vehicle access (late 2023)	Site protected from vehicle access and natural restoration occurring.

*\*Species refer to native taxa only*



## 5 Conclusion

In summary, the Year 1 Rehabilitation Programme has:

- rehabilitated 0.5 ha of saltmarsh which is a threatened ecological community under the EPBC Act
- contributed to the rehabilitation of more than 4 ha of estuarine wetland/claypan which supports migratory shorebirds, including, species listed as critically endangered under the EPBC Act
- restored 0.2 ha of saltmarsh
- restored 0.06 ha of *Phragmites australis* wetland
- removed at least 0.7 ha of woody weeds from a wetland riparian zone.
- Implemented initial pest control targeting red fox and fire ants.

On-going annual monitoring assessments will be undertaken to measure outcomes of progressive rehabilitation works. The long-term monitoring results will be used to determine whether PBPL has satisfied its sustainability and financial commitments to rehabilitate 10 ha of degraded land at Whyte Island by 2026.

Table 5.1 Rehabilitation Targets and Year 1 Status

Year	Target	Actual Works Completed	Area Directly Rehabilitated or Restored	Area of High Value Shorebird Habitat Indirectly Protected
2023	Habitat Assessment & Program Development	<ul style="list-style-type: none"> <li>• Habitat Assessment &amp; Program Development</li> <li>• Slashing management</li> </ul>	N/A	N/A
2023-2024	≥3 ha	<ul style="list-style-type: none"> <li>• Fencing to prevent vehicle access allowing natural saltmarsh/saltpan regeneration</li> <li>• Ongoing slashing management</li> <li>• Active weed management</li> <li>• Feral animal control</li> </ul>	5.46 ha	~16 ha
2024-2025	≥4 ha (≥7 ha cumulative)	Future works	Future works	Future works
2025-2026	≥3 ha (≥10 ha cumulative)	Future works	Future works	Future works

## 6 References

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Austecology (2023). Fauna and flora surveys – Port of Brisbane lands at Lytton. Draft Report. 13 December 2023. Report prepared for BMT.

BMT (2022) Port of Brisbane - Blue Carbon Assessment. BMT, December 2022. Report prepared for PBPL.

BMT (2023a). Whyte Island Rehabilitation Project - Monitoring Framework and Benchmarks. Draft Report. 23 December 2023. Report prepared for PBPL.

BMT (2023b). Whyte Island Conceptual Rehabilitation Plan. 16 June 2023. Report prepared for PBPL.

BMT (2024) Whyte Island Rehabilitation Project - Rehabilitation Targets and Supporting Mapping. 2 February 2024. Report prepared for PBPL.

Eyre, T.J., Kelly, A.L, Neldner, V.J., Wilson, B.A., Ferguson, D.J., Laidlaw, M.J. and Franks, A.J. (2015). BioCondition: A Condition Assessment Framework for Terrestrial Biodiversity in Queensland. Assessment Manual. Version 2.2. Queensland Herbarium, Department of Science, Information Technology, Innovation and Arts, Brisbane.

## Annex A Baseline BioCondition Photos

### A.1 Site 1 (Austecology 2023)



**Above left – North. Above right - South**



**Above left – East. Above right - West**



**Above - ground**



## A.2 Site 2 (Austecology 2023)



**Above left – North. Above right - South**



**Above left – East. Above right – West**



**Above - ground**

### A.3 Site 3 (Austecology 2023)



**Above left – North. Above right - South**



**Above left – East. Above right – West**



**Above - ground**



#### A.4 Site 4 (Austecology 2023)



**Above left – North. Above right - South**



**Above left – East. Above right – West**



**Above - ground**

### A.5 Site 5 (Austecology 2023)



**Above left – North. Above right - South**



**Above left – East. Above right – West**



**Above - ground**



## A.6 Site 6 (Austecology 2023)



**Above left – North. Above right – South**



**Above left – East. Above right – West**



**Above - ground**



A.7 Site 7





**BMT (OFFICIAL)**





## A.8 Site 8





**BMT (OFFICIAL)**



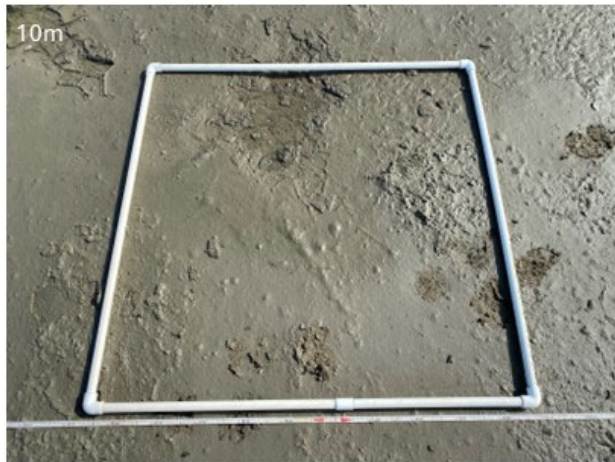


A.9 Site 9





**BMT (OFFICIAL)**



## Annex B Baseline BioCondition Data

Biocondition Datasheet									
Site ID	1				Date	26/09/2023			
Observers	Lindsay Agnew, Heath Agnew								
<b>Site Information:</b>									
<b>100x50m Area:</b>									
<b>Location (GPS reference)</b>					Bioregion	SEQ			
Datum	GDA94								
Zone	56J	Easting	516464.24		Northing	6968869.25			
Plot origin			516439.38			6968910			
Plot centre									
Plot Bearing	Plot Alignment Description								
Locality	Port of Brisbane								
<b>Regional Ecosystem and Tree height</b>									
Habitat Description	Eucalyptus tereticornis with Corymbia Tesselaris and Casuarina Glauca sub-canopy on fill								
Regional Ecosystem	n/a		Median Tree canopy Height (m)			15			
	Emergent height (m)		Subcanopy ht (m)						
<b>Site Photos</b>	Plot centre	North	5565		South	5566			
	Photo Numbers	East	5567		West	5568			
	Plot Origin				other	5569			
Disturbance									
Type	mean fire scar height	severity	last event	obs type					
Wildfire	na				Tree Spp. Count				
Prescribed burn	na								
Logging	na								
Treatment	na								
Grazing	na				50 x 20m Area: Coarse woody Debris				
Non-native plant cover					Specimen length (mm)				
Erosion	na				2500				
Regeneration	na				site total m				
Storm	na				per ha (m)				
Other (specify)	na				25				
<b>50 x 10m Area</b>		<b>Native Plant Species Richness</b>					<b>Total</b>		
Shrub sp.	Murraya paniculata* Ochna serrulata* Senna pendula*								
Grass sp.	Imperata cylindrica Melinus repens* Sporobolus virginicus Phragmites australis								
Forbs/other	Bidens pilosa* Calyptocarpus vialis* Commelina ensifolia Conyza canadensis* Cyperus polystachyus								
	Hypochaeris microcephala* Lepidium virginicum* Medicago polymorpha*								
	Senecio madagascariensis* Sida rhombifolia								

Biocondition datasheet (cont.)							
<b>10 x 10m Plots: Ground Cover</b>							
<b>Ground cover type</b>		1	2	3	4	5	Mean
Native perennial (preferred and intermediate) grass		100		70	100		54
Native non-preferred grass							
Native forbs and other species							
Native shrubs (< 1m height)							
Non-native grass							
Non-native forbs and shrubs			15				3
litter			85	30		100	43
rock							
bare ground							
Cryptograms							
Total		100	100	100	100	100	100
<b>Tree Species Richness</b>	Plot size	100x 50		100x 20		100 x 10	
	Euc (E)		DBH				
	Non-Euc (N)						
Species		Diam (cm)					
Alectryon coriaceus	N	n/a					
Casuarina glauca	N	n/a					
Corymbia tessellaris	N	n/a					
Cupaniopsis anacardioides	N	n/a					
Eucalyptus tereticornis	E	n/a					
Ficus obliqua	N	n/a					
Livistona australis	N	n/a					
Lophostemon confertus	N	n/a					
Melaleuca quinquenervia	N	n/a					
Pittosporum undulatum	N	n/a					
Eucalypts	Avg DBH threshold		RE		Euc Benchm	Euc Benchmark	
	No. Trees	n/a	No. Trees >= Benchmark/ha				
Non-Eucaly	Avg DBH threshold		RE		Euc Benchm	Euc Benchmark	
	No. Trees	n/a	No. Trees >= Benchmark/ha				
<b>100m Transect: Tree and Shrub Canopy Cover</b>				Canopy (C), Subcanopy (SC), Emergent (E), Shrub (S)			
Distance (m)	Type	Distance (m)	Type	Distance (m)	Type		
7.8	SC	24.9	C				
5.1	SC	32.6	C				
3.6	SC	24.5	C				
15	SC						
3	SC						
9	SC						
19.5	SC						
						canopy total	82
						subcanopy total	63
						emergent total	
						shrub total	

Biocondition Datasheet									
Site ID	2				Date	26/09/2023			
Observers	Lindsay Agnew, Heath Agnew								
<b>Site Information:</b>									
<b>100x50m Area:</b>									
<b>Location (GPS reference)</b>						Bioregion	SEQ		
Datum	GDA94								
Zone	56J	Easting	516448.63		Northing	6968733.54			
Plot origin			516449.86				6968762.56		
Plot centre									
Plot Bearing			Plot Alignment Description						
Locality	Port of Brisbane								
<b>Regional Ecosystem and Tree height</b>									
Habitat									
Description	Eucalyptus tereticornis with Corymbia Tesselaris sub-canopy on fill.								
Regional Ecosystem	n/a		Median Tree canopy Height (m)						
	Emergent height (m)		Subcanopy ht (m)						
<b>Site Photos</b>	Plot centre	North	5560		South	5561			
Photo Numbers		East	5562		West	5563			
		Plot Origin			other	5564			
Disturbance					<b>100 x 50m Area: Tree SPP. Richness</b>				
Type	mean fire scar height	severity	last event	obs type	Tree Species				
Wildfire	n/a								Tree Spp. Count
Prescribed burn	n/a								6
Logging	n/a								
Treatment	n/a								
Grazing	n/a								
Non-native plants	n/a				50 x 20m Area: Coarse woody Debris				
Erosion	n/a				Specimen length (mm)				
Regeneration	n/a				2000				site total m
Storm	n/a								2
Other (specify)	n/a								per ha (m)
									20
<b>50 x 10m Area</b>		<b>Native Plant Species Richness</b>					Total		13
Shrub sp.	Melaleuca linariifolia Melaleuca viminalis								
Grass sp.	Chloris gayana* Cynodon dactylon Imperata cylindrica Panicum maximum* Phragmites australis Urochloa decumbens*								
Forbs/other	Bidens pilosa* Calyptocarpus vialis* Commelina ensifolia Conyza canadensis* Lepidium virginicum* Senecio madagascariensis								



[illegible]



Biocondition Datasheet							
Site ID	3			Date	26/09/2023		
Observers	Lindsay Agnew, Heath Agnew						
<b>Site Information:</b>							
<b>100x50m Area:</b>							
Location (GPS reference)				Bioregion	SEQ		
Datum	GDA94						
Zone	56J	Easting	516574.38	Northing	6968659.27		
Plot origin	516557.55			6968640.79			
Plot centre							
Plot Bearing	Plot Alignment Description						
Locality	Port of Brisbane						
<b>Regional Ecosystem and Tree height</b>							
Habitat Description	12.1.2						
Regional Ecosystem	n/a		Median Tree canopy Height (m)				
	Emergent height (m)		Subcanopy ht (m)				
<b>Site Photos</b>	Plot centre	North	South				
Photo Numbers	East	West					
	Plot Origin	other					
Disturbance					<b>100 x 50m Area: Tree SPP. Richness</b>		
Type	mean fire scar height	severity	last event	obs type	Tree Species		
Wildfire	n/a				Tree Spp. Count		
Prescribed burn	n/a				0		
Logging	n/a						
Treatment	n/a						
Grazing	n/a				50 x 20m Area: Coarse woody Debris		
Non-native plants	n/a				Specimen length (mm)		
Erosion	n/a				site total m		
Regeneration	n/a				0		
Storm	n/a				per ha (m)		
Other (specify)	n/a						
<b>50 x 10m Area</b>	<b>Native Plant Species Richness</b>				Total	8	
Shrub sp.							
Grass sp.	Sporobolus virginicus Sporobolus elongatus Panicum maximum* Cynodon dactylon Phragmites Australis						
Forbs/other	Plantago lanceolata* Medicago polymorpha* Aster subulatus* Suaeda australis Portulaca oleracea						
	Sida rhombifolia Sesuvium portulacastrum						

[illegible]

Biocondition Datasheet									
Site ID	4				Date	26/09/2023			
Observers	Lindsay Agnew, Heath Agnew								
<b>Site Information:</b>									
<b>100x50m Area:</b>									
<b>Location (GPS reference)</b>					Bioregion	SEQ			
Datum	GDA94								
Zone	56J	Easting	516517.75		Northing	6968747.63			
Plot origin					6968790.75				
Plot centre									
Plot Bearing	Plot Alignment Description								
Locality	Port of Brisbane								
<b>Regional Ecosystem and Tree height</b>									
Habitat Description	12.1.2								
Regional Ecosystem	n/a		Median Tree canopy Height (m)						
	Emergent height (m)		Subcanopy ht (m)						
<b>Site Photos</b>	Plot centre	North	South						
Photo Numbers	East	West							
	Plot Origin	other							
Disturbance	100 x 50m Area: Tree SPP. Richness								
Type	mean fire scar height	severity	last event	obs type	Tree Species				
Wildfire	n/a								Tree Spp. Count
Prescribed burn	n/a								0
Logging	n/a								
Treatment	n/a								
Grazing	n/a				50 x 20m Area: Coarse woody Debris				
Non-native plants	n/a				Specimen length (mm)				
Erosion	n/a								site total m
Regeneration	n/a								
Storm	n/a								
Other (specify)	n/a								
<b>50 x 10m Area</b>		<b>Native Plant Species Richness</b>			<b>Total</b>				<b>5</b>
Shrub sp.									
Grass sp.	Cynodon dactylon Panicum maximum* Sporobolus elongatus Melinus repens* Sporobolus virginicus								
Forbs/other	Medicago polymorpha* Aster subulatus* Plantago lanceolata* Bacopa monnieri Conyza canadensis* Hypochaeris radicans								

[illegible]

Biocondition Datasheet									
Site ID	5				Date	26/09/2023			
Observers	Lindsay Agnew, Heath Agnew								
Site Information:									
100x50m Area:									
Location (GPS reference)					Bioregion	SEQ			
Datum	GDA94								
Zone	56J	Easting	516513.34		Northing	6968422.77			
Plot origin			516488.56			6968429.43			
Plot centre									
Plot Bearing					Plot Alignment Description				
Locality	Port of Brisbane								
Regional Ecosystem and Tree height									
Habitat									
Description	Dense shrubland of Schinus terebinthifolia								
Regional Ecosystem	n/a		Median Tree canopy Height (m)						
	Emergent height (m)		Subcanopy ht (m)						
Site Photos	Plot centre	North			South				
Photo Numbers		East			West				
		Plot Origin			other				
Disturbance					100 x 50m Area: Tree SPP. Richness				
Type	mean fire scar height	severity	last event	obs type	Tree Species				
Wildfire	n/a								Tree Spp. Count
Prescribed burn	n/a								
Logging	n/a								
Treatment	n/a								
Grazing	n/a								
Non-native plants	n/a				50 x 20m Area: Coarse woody Debris				
Erosion	n/a				Specimen length (mm)				
Regeneration	n/a				1500				site total m
Storm	n/a				3000				5
Other (specify)	n/a				500				per ha (m)
									50
50 x 10m Area		Native Plant Species Richness				Total		1	
Shrub sp.	Murraya paniculata* Lantana camara* Senna pendula* Schinus terebinthifolius*								
Grass sp.	Panicum maximum* Chloris gayana*								
Forbs/other	Aster subulatus* Conyza canadensis* Sida rhombifolia								



[illegible]

Biocondition Datasheet									
Site ID	6				Date	26/09/2023			
Observers	Lindsay Agnew, Heath Agnew								
Site Information:									
100x50m Area:									
Location (GPS reference)						Bioregion	SEQ		
Datum	GDA94								
Zone	56J	Easting	516516.76		Northing	6968671.64			
Plot origin			516480.64				6968644.66		
Plot centre									
Plot Bearing			Plot Alignment Description						
Locality	Port of Brisbane								
Regional Ecosystem and Tree height									
Habitat Description	Dense shrubland of Schinus terebinthifolia and Phragmites Australis								
Regional Ecosystem	n/a		Median Tree canopy Height (m)						
	Emergent height (m)				Subcanopy ht (m)				
Site Photos	Plot centre	North	South						
Photo Numbers	East	West							
	Plot Origin	other							
Disturbance					100 x 50m Area: Tree SPP. Richness				
Type	mean fire scar height	severity	last event	obs type	Tree Species			Tree Spp. Count	
Wildfire	n/a							0	
Prescribed burn	n/a								
Logging	n/a								
Treatment	n/a								
Grazing	n/a								
Non-native plants	n/a								
Erosion	n/a							site total m	
Regeneration	n/a							0	
Storm	n/a							per ha (m)	
Other (specify)	n/a								
50 x 10m Area		Native Plant Species Richness				Total		2	
Shrub sp.	Senna pendula* Ochna serrulata* Leucaena leucocephala* Baccharis halimifolia								
	Schinus terebinthifolius*								
Grass sp.	Panicum maximum* Melinus repens* Chloris gayana* Urochloa decumbens*								
	Phragmites Australis								
Forbs/other	Aster subulatus* Anagallis arvensis* Asparagus plumosus* Bidens pilosa* Conyza canadensis*								
	Senecio madagascariensis*								

[illegible]

# BMT (OFFICIAL)

Date	21/07/2024		
Observers	BMT		
Location	Whyte Island comprising part of Lot 730 SP142207 south of Boat Passage and east of Port Drive, Port of Brisbane, Lytton.		
Bioregion	South-east Qld		
Datum	GDA 94		
Zone	56J		
Site ID	7	8	9
Plot Start	-27.403745	-27.404618	-27.407923
	153.166178	153.167194	153.167501
Plot centre	-27.403951	-27.404932	-27.40749
	153.166231	153.167246	153.167576
Plot End	-27.404158	-27.405232	-27.407018
	153.166281	153.167293	153.16766
Habitat Description	Highly modified and managed low-lying exotic grassland.	Highly modified and managed exotic grassland on elevated fill.	Intertidal succulent saltmarsh and saltpan with vehicle disturbance.
Target/Remnant Regional Ecosystem	12.3.20	12.3.11	12.1.2
Tree (EDL) Canopy Height (m)	0	15	0
Emergent Canopy Height (m)	0	0	0
Subcanopy Height (m)	0	0	0
Coarse Woody Debris (m/ha)	0	0	0
Recruitment (%)	0	0	0



## BMT (OFFICIAL)

Native Plant Species Richness:					
Tree	0		2	<i>Eucalyptus tereticornis, Pittosporum undulatum</i>	0
Shrub	0		0		0
Grass	1	<i>Cynodon dactylon</i>	0		1 <i>Sporobolus virginicus</i>
Forb/others	3	<i>Cyperus polystachyos, Bacopa monnieri, Cyperus sp.</i>	0		3 <i>Salicornia quinqueflora, Sesuvium portulacastrum, Suaeda australis</i>
Non-native plant cover (%)	95		95		0
Ground Cover	5		0		20
Number of Large Trees	0		0		0
Tree Canopy Cover	0		0		0
Tree Subcanopy Cover	0		0		0
Shrub Canopy Cover	0		0		0

## Annex C Baseline BioCondition Scores

BioCondition assessments conducted by Austecology and BMT were undertaken to measure broad ecological condition states typical or expected of the RE.

The following table summarises the baseline BioCondition scores measured for each plot within the project area. All baseline BioCondition plots will be re-measured consistently at the same time following the wet season to capture optimal habitat conditions following rehabilitation and natural recruitment.

Table C-1 Baseline BioCondition Scores

Plot	1	2	6	7	8	3	4	9
Regional Ecosystem	12.3.20	12.3.20	12.3.20	12.3.20	12.3.11	12.1.2	12.1.2	12.1.2
Recruitment	5	5	0	0	0			
Non-native Plant Cover	3	3	0	0	0	3	3	10
Tree Species Richness	5	5	0	0	2.5			
Shrub Species Richness	0	2.5	0	0	0			
Grass Species Richness	5	5	2.5	2.5	0	5	5	5
Forb/Other Species Richness	2.5	0	0	2.5	0	5	2.5	5
Emergent Canopy Height								
Tree Canopy Height	5	3	0	0	3			
Tree Subcanopy Height	0	0	0	0	0			
Emergent Canopy Cover								
Tree Canopy Cover	5	5	0	0	0			
Tree Subcanopy Cover	3	5	0	0	0			
Total Number Large Trees (Eucalypt)/ ha					0			
Total Number Large Trees (non-eucalypt)/ ha	0	0	0	0	0			
Shrub Canopy Cover	0	0	0	0	0			
Native Perennial Grass Cover	5	5	1	0	0	5	5	3
Litter Ground Cover	5	5	5	0	0			
Woody Debris Length/ha	0	0	0	0	0			
<b>Plot Score</b>	<b>43.5</b>	<b>43.5</b>	<b>8.5</b>	<b>5</b>	<b>5.5</b>	<b>18</b>	<b>15.5</b>	<b>23</b>
<b>Max Score for RE</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>80</b>	<b>25</b>	<b>25</b>	<b>25</b>
<b>% Benchmark Condition</b>	<b>0.54</b>	<b>0.54</b>	<b>0.11</b>	<b>0.06</b>	<b>0.07</b>	<b>0.72</b>	<b>0.62</b>	<b>0.92</b>

\*Blank cell denotes NA to RE

Vegetation attributes at sites 1, 2, 6 and 7 were scored against 'best on offer' RE12.3.20 communities in south-east Queensland. This endangered RE comprises *Melaleuca quinquenervia*, *Casuarina*

*glauca*, *Eucalyptus tereticornis* open forest in low coastal areas that may be subject to storm surge inundation. Baseline data indicates:

- Sites 1 and 2 supported regenerating open forest with an average BioCondition Score of 0.54 (i.e. 54% of Benchmark Condition) which may be considered average ecological condition. Weed cover, low shrub and forb species richness, and the lack of woody debris and large trees at both sites contributed to their overall lower habitat value compared with intact remnant communities. Rehabilitation measures focusing on weed control and installation of fauna habitat would improve overall condition scores in these regenerating communities.
- Site 6 is a highly degraded exotic shrubland with an average BioCondition Score of 0.11 (11% of Benchmark Condition) which is considered to be poor ecological condition. The lack of native tree and shrub species and evidence of their recruitment, low native grass and forb species richness and lack of woody debris contribute to the overall low condition of this shrubland. Rehabilitation measures focusing on planting, weed control and installation of logs would improve its overall habitat condition. Despite its highly degraded condition the dense exotic shrub cover provides some fauna habitat value and rehabilitation works should be staged to minimise impacts to resident fauna. Note that Site 5 (score of 0.13) is similar in condition to Site 6 but is not currently part of the rehabilitation programme and will be used as a control site.
- Site 7 is a cleared site with an average BioCondition Score of 0.06 (6% of Benchmark Condition) which is considered to be very poor ecological condition. The lack of native tree and shrub species and evidence of their recruitment and low native grass and forb species richness contributes to its low condition. Weed dominance and the lack of litter and woody debris also contributes to its overall low habitat value. Rehabilitation measures focusing on planting, weed control and installation of logs and mulch would improve its overall habitat condition.

Vegetation attributes at site 8 were scored against 'best on offer' RE 12.3.11 *Eucalyptus tereticornis* open forest in coastal areas of south-east Queensland. Site 8 is predominantly cleared with an average BioCondition Score of 0.07 (7% of Benchmark Condition) which is considered to be very poor ecological condition. The low native tree cover/richness, lack of shrub species, no evidence of woody recruitment and low native grass and forb species richness contribute to its poor condition. Weed dominance and the lack of litter, woody debris and large trees also contributes to its overall low habitat value. Rehabilitation measures focusing on planting, weed control and installation of logs, mulch and nest boxes would improve its overall habitat condition.

Vegetation attributes at sites 3 and 4 were scored against 'best on offer' RE 12.3.20 *Sporobolus virginicus* communities in south-east Queensland. The sites measured an average BioCondition Score of 0.72 and 0.62, respectively (72 and 62% of Benchmark Condition) which may be considered good ecological condition. Both sites support degraded saltmarsh at the upper tidal limits which have a history of regular slashing. Weed cover contributes to their overall lower habitat value compared with intact remnant communities. Rehabilitation measures focusing on weed control and removing regular slashing could improve overall habitat condition.

Site 9 measured an average BioCondition Score of 0.92 (92% of Benchmark Condition). The site supports remnant saltmarsh in very good condition when scored against 'best on offer' RE 12.3.20 samphire forbland communities in south-east Queensland. Although the site supports high vegetation cover it is impacted by recreational vehicles. Preventing vehicle access to saltmarsh habitat could improve vegetation cover and overall habitat condition particularly for disturbance-sensitive waders.

In addition to BioCondition scores, Annex D provides Ecological Condition Profiles for the target RE's in the project area. These have been developed by the Qld Herbarium as a visual guide for the rapid appraisal of broad ecological condition states typical or expected of the RE, where Condition State 1 represents the reference state from which benchmark values are derived and Condition State 4 being the lowest condition. Baseline results for the project area indicate:

- RE 12.3.20: sites 1 and 2 represent Condition State 3; Sites, 5, 6 and 7 represent Condition State 4
- RE 12.3.11: site 8 represents Condition State 4
- RE 12.1.2: site 9 represents Condition State 1; sites 3 and 4 represent Condition State 2 due to the relatively high weed cover.



## **Annex D   Queensland Herbarium Ecological Condition Profiles**

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## Ecological Condition Profile

Queensland Herbarium



### 12.1.2 Saltpan with *Sporobolus virginicus* grassland and samphire herbland, marine plains/tidal flats

Values are for within a 50 x 20 m plot area



#### Condition class 1

##### Reference condition, minimal disturbance

- Tree canopy cover: na; Tree height: na
- Tree subcanopy cover: na; Tree subcanopy height: na
- Native shrub cover: na
- Large trees: na
- Coarse Woody Debris: na
- Species richness: Trees na; Shrubs na; Grass  $\geq 1$ ; Forbs and other  $\geq 3$
- Ground cover: Perennial grass cover:  $\geq 35\%$ ; Organic litter cover: na
- Non-native plant species:  $< 2\%$  cover
- Regeneration: na



#### Condition class 2

##### Some disturbance e.g. grazing

- Tree canopy cover: na; Tree height: na
- Tree subcanopy cover: na; Tree subcanopy height: na
- Native shrub cover: na
- Large trees: na
- Coarse Woody Debris: na
- Species richness: Trees na; Shrubs na; Grass 1; Forbs and other 2
- Ground cover: Perennial grass cover 20-35%; Organic litter cover na
- Non-native plant species: 2-15% cover.
- Regeneration: na



#### Condition class 3

##### Moderate disturbance e.g. grazing, clearing

- Tree canopy cover: na; Tree height: na
- Tree subcanopy cover: na; Tree subcanopy height: na
- Native shrub cover: na
- Large trees: na
- Coarse Woody Debris: na
- Species richness: Trees na; Shrubs na; Grass 1; Forbs and other 1
- Ground cover: Perennial grass: 10-20%; Organic litter: na
- Non-native plant species: 15-25% cover
- Regeneration: na



#### Condition class 4

##### High disturbance e.g. frequent moderate to high intensity burning, weeds

- Tree canopy cover: na; Tree height: na
- Tree subcanopy cover: na; Tree subcanopy height: na
- Native shrub cover: na
- Large trees: na
- Coarse Woody Debris: na
- Species richness: Trees na; Shrubs na; Grass  $\leq 1$ ; Forbs and other  $\leq 1$
- Ground cover: Perennial grass:  $< 10\%$ ; Organic litter: na
- Non-native plant species:  $> 25\%$  cover
- Regeneration: na

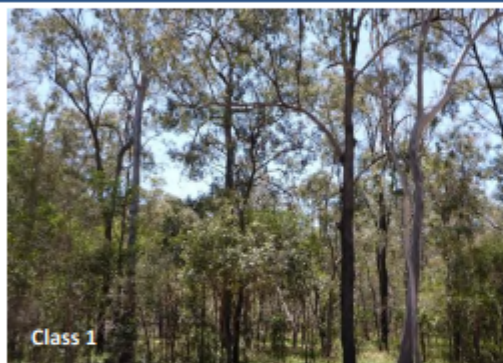
## Ecological Condition Profile

Queensland Herbarium



### 12.3.11 *Eucalyptus tereticornis* +/- *E. siderophloia*, *Corymbia intermedia* open forest on alluvial plains

Values are for within a 50 x 20 m plot area



#### Condition class 1

##### Reference condition, mature and minimal disturbance

- Tree canopy cover: > 55%; Tree height: > 23 m
- Tree sub-canopy cover: > 32%; Tree sub-canopy height: > 8 m
- Native shrub cover: 20-25%
- Large trees: > 2 eucalypts > 49 cm DBH
- Coarse Woody Debris: 50-60 m total length
- Species richness: Trees ≥ 7; Shrubs ≥ 7; Grass ≥ 12; Forbs and other ≥ 25
- Ground cover: Perennial grass cover 45-50%; Organic litter cover > 35%
- Non-native plant species: < 2% cover
- Regeneration: > 5 tree species in regeneration phase



#### Condition class 2

##### Mature, some disturbance e.g. fragmentation, grazing

- Tree canopy cover: 35-55%; Tree height: 18-23 m
- Tree sub-canopy cover: 20-32%; Tree sub-canopy height: 5-8 m
- Native shrub cover: 10-20%
- Large trees: 1-2 eucalypts > 49 cm DBH
- Coarse Woody Debris: 30-50 m total length
- Species richness: Trees 4-7; Shrubs 4-7; Grass 7-12; Forbs and other 15-25
- Ground cover: Perennial grass cover 25-45%; Organic litter cover 20-35%
- Non-native plant species: 2-15% cover.
- Regeneration: 3-5 tree species in regeneration phase



#### Condition class 3

##### Advanced regrowth or moderate disturbance e.g. grazing, clearing

- Tree canopy cover: 10-35%; Tree height: 10-18 m
- Tree sub-canopy cover: 10-20%; Tree sub-canopy height: 5-8 m
- Native shrub cover: < 10% or > 50%
- Large trees: ≤ 1 eucalypts > 49 cm DBH
- Coarse Woody Debris: 10-30 m or > 120 m total length
- Species richness: Trees < 4; Shrubs < 4; Grass < 7; Forbs and other 5-15
- Ground cover: Perennial grass cover < 25% or > 70%; Organic litter cover 10-20%
- Non-native plant species: 15-25% cover
- Regeneration: 0-3 tree species in regeneration phase



#### Condition class 4

##### Cleared, some regrowth or high disturbance e.g. fire, grazing, weeds

- Tree canopy cover: < 10%; Tree height: 2-10 m
- Tree sub-canopy cover: < 10%; Tree sub-canopy height: 2-5 m
- Native shrub cover: < 10% or > 50%
- Large trees: 0 eucalypts > 49 cm DBH
- Coarse Woody Debris: < 10 m total length or > 120 m total length
- Species richness: Trees < 4; Shrubs < 4; Grass < 7; Forbs and other < 5
- Ground cover: Perennial grass cover < 25% or > 70%; Organic litter cover < 10%
- Non-native plant species: > 25% cover
- Regeneration: 0-3 tree species in regeneration phase



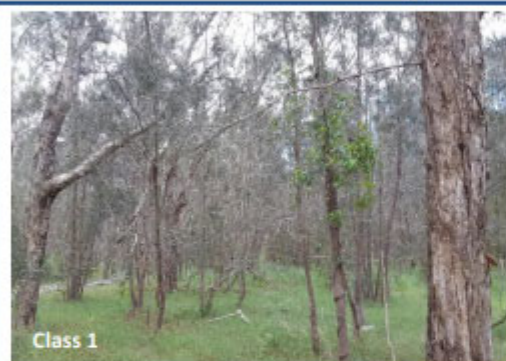
## Ecological Condition Profile

Queensland Herbarium



### 12.3.20 *Melaleuca quinquenervia*, *Casuarina glauca* open forest on low coastal alluvial plains

Values are for within a 50 x 20 m plot area



#### Condition class 1

##### Reference condition, mature and minimal disturbance

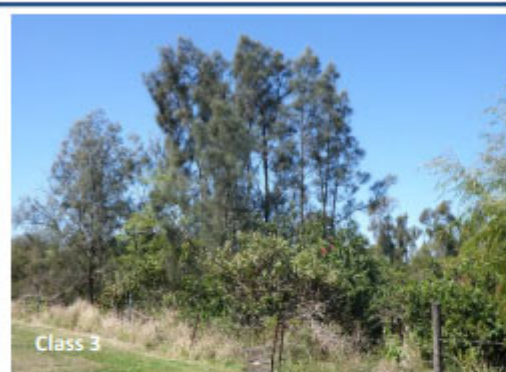
- Tree canopy cover: > 70%; Tree height: >15 m
- Tree subcanopy cover: 20-30%; Tree subcanopy height: > 7 m
- Native shrub cover: 15-20%
- Large trees: > 12 non-eucalypts > 30 cm DBH
- Coarse Woody Debris: 50-70 m total length
- Species richness: Trees > 3; Shrubs > 3; Grass > 1; Forbs and other > 7
- Ground cover: Perennial grass cover 20-40%; Organic litter cover >30%
- Non-native plant species: < 2% cover
- Regeneration: >2 tree species in regeneration phase



#### Condition class 2

##### Mature, some disturbance e.g. grazing

- Tree canopy cover: 50-70%; Tree height: 12-15 m
- Tree subcanopy cover: 10-20%; Tree subcanopy height: 5-7 m
- Native shrub cover: 5-15%
- Large trees: 5-12 non-eucalypts > 30 cm DBH
- Coarse Woody Debris: 20-50 m total length
- Species richness: Trees 2-4; Shrubs 1-3; Grass ≤ 1; Forbs and other 4-7
- Ground cover: Perennial grass cover 20-40%; Organic litter cover 10-30%
- Non-native plant species: 2-15% cover
- Regeneration: 1-2 tree species in regeneration phase



#### Condition class 3

##### Advanced regrowth and/or moderate disturbance e.g. grazing, clearing, frequent low intensity burning

- Tree canopy cover: 20-50%; Tree height: 8-12 m
- Tree subcanopy cover: 0-10%; Tree subcanopy height: 2-5 m
- Native shrub cover: < 5% or > 50%
- Large trees: < 5 non-eucalypts > 30 cm DBH
- Coarse Woody Debris: < 20 m or > 120 m total length
- Species richness: Trees < 2; Shrubs 1-3; Grass ≤ 1; Forbs and other < 4
- Ground cover: Perennial grass cover < 20%; Organic litter cover 10-30%
- Non-native plant species: 15-25% cover
- Regeneration: 1-2 tree species in regeneration phase



#### Condition class 4

##### Cleared, some regrowth and/or high disturbance e.g. frequent moderate to high intensity burning, gravel scrapes, weeds

- Tree canopy cover: < 20%; Tree height: 2-8 m
- Tree subcanopy cover: 0-10%; Tree subcanopy height: 2-5 m
- Native shrub cover: < 5% or > 50%
- Large trees: < 5 non-eucalypts > 30 cm DBH
- Coarse Woody Debris: < 20 m total length or > 120 m total length
- Species richness: Trees < 2; Shrubs 1-3; Grass ≤ 1; Forbs and other < 4
- Ground cover: Perennial grass cover < 20% or >40%; Organic litter cover < 10%
- Non-native plant species: >25% cover
- Regeneration: 1-2 tree species in regeneration phase



## Annex E Baseline Vegetation Transects

Table E-2 summarises the groundcover composition measured at transects across the terrestrial and intertidal interface. This data will be used to monitor potential changes in groundcover condition and extent at the interface between terrestrial and intertidal lands over the project timeframe.

Appendix F provides photos taken at each transect established at the interface between terrestrial and intertidal lands.

**Table E.1. Groundcover Composition at Terrestrial and Intertidal Interface**

Site	Percent Ground Cover (%)				
	Exotic Grass	Native Grass	Exotic Forb	Native Forb	Bare
A	22.6	39.5	1.5	33.6	2.9
B	14.8	35.0	1.6	39.1	9.5
C	37.5	12.2	2.4	11.9	36.0
D	0.0	5.4	0.0	14.0	80.6

## **Annex F 2024 Vegetation Transect Photos**

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**BMT (OFFICIAL)**





**BMT (OFFICIAL)**





**BMT (OFFICIAL)**



**BMT (OFFICIAL)**





## Annex G Remote Sensing - Vegetation Condition 2023-2024

The geo-median vegetation health indices, including NDVI, EVI, and SAVI, exhibit consistent patterns across all vegetation classes as shown in Figures 5.1 to 5.3. Large green leafy vegetation covers, such as mangroves, shrublands, and tree vegetation, display healthy NDVI values ranging from 0.7 to 0.9 between August 13, 2023, and April 9, 2024, indicating good vegetation health. Saltmarsh species, including succulents and saltcouch, exhibit naturally lower NDVI values ranging from 0.4 to 0.6 compared to larger or medium-sized vegetation covers. Succulent species are more resilient to stress in August due to their ability to store large amounts of water, while saltcouch shows minor stress during the dry season. As expected, grasslands are in good condition during the wet season but experience dieback in the dry season. Grasslands show the highest variance among all vegetation cover classes.

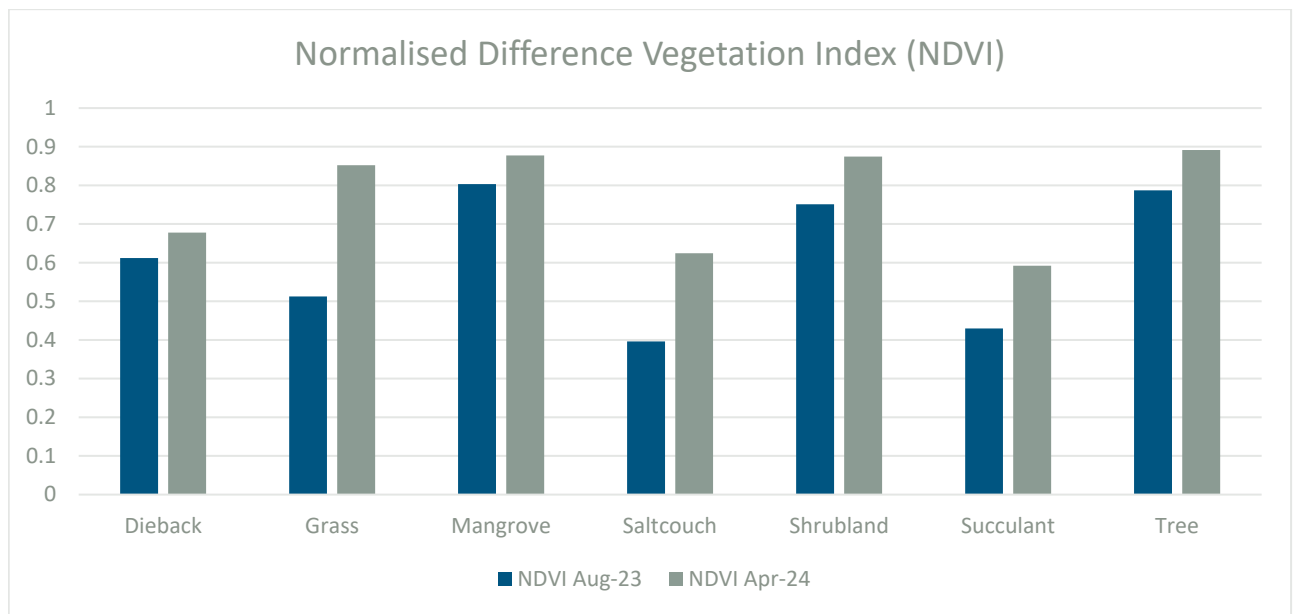


Figure G.1 The overall Normalised Difference Vegetation Index (NDVI) across vegetation categories

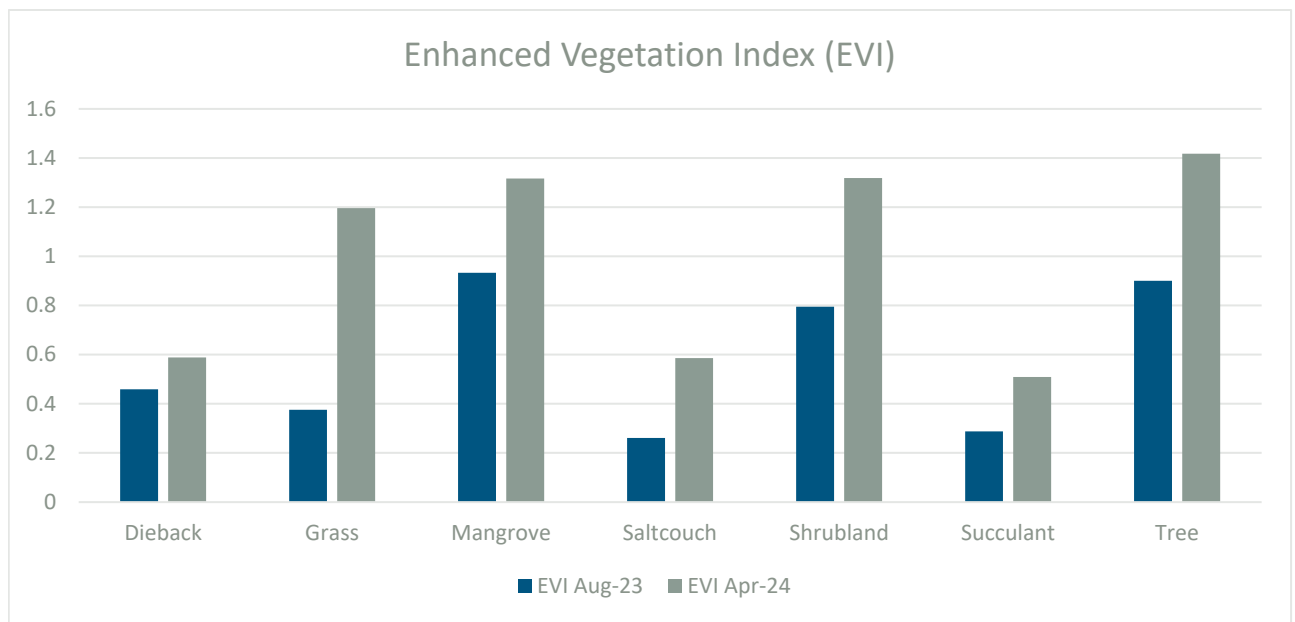


Figure G.2 The overall Enhanced Vegetation Index (EVI) across all vegetation categories

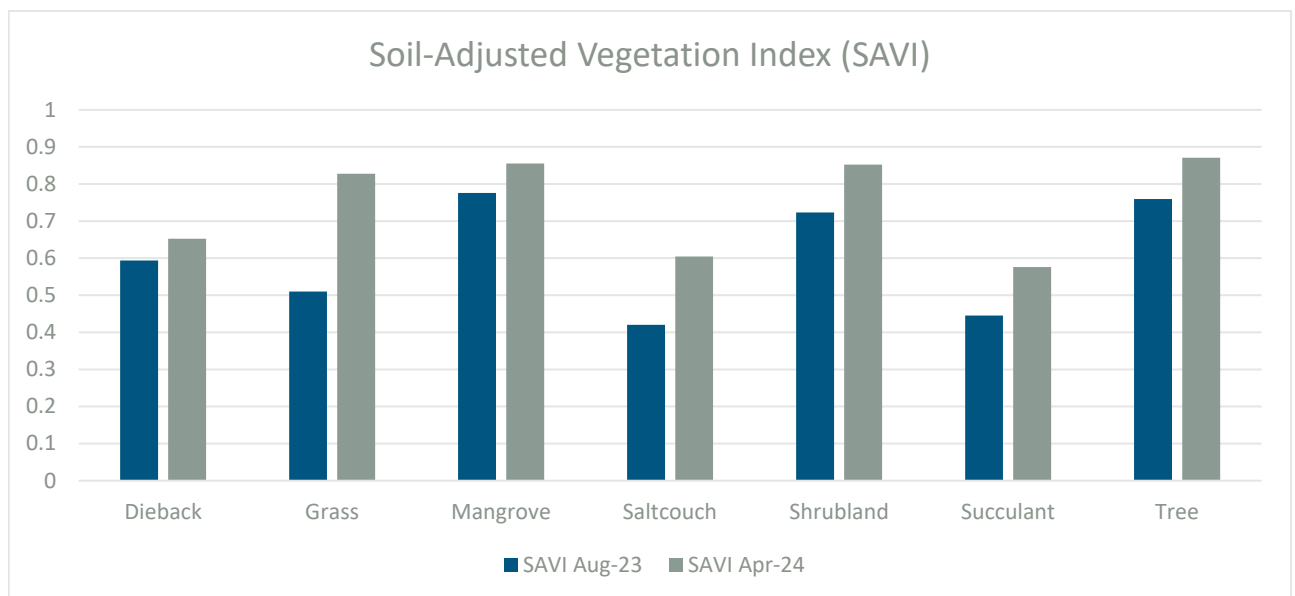


Figure G.3 The overall Soil-Adjusted Vegetation Index (SAVI) across all vegetation categories

The NDVI analysis results for grassland/weed vegetation cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.4. The dry season result (August 2023, image on the left) indicated that most of this class dried out ( $NDVI \leq 0.4$ ) during the dry months, except in areas benefiting from shade or available water sources. In contrast, the wet season results (April 2024, image in the middle) showed that the vegetation returned to full health ( $NDVI > 0.8$ ) in most areas, except those bordering saltcouch species, likely due to higher salt levels. Nevertheless, these areas still showed good health recovery. The CVA results (right image) indicated a good overall recovery, with only minor locations where the grassland/weed vegetation did not recover well.



The NDVI analysis results for mangrove vegetation cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.5. The dry season results (August 2023, image on the left) indicated that the majority of mangroves had excellent and good health indicators ( $\text{NDVI} > 0.7$ ). However, a significant portion also showed moderate health ( $0.5 < \text{NDVI} < 0.7$ ), particularly in the northern part of the mangrove area. Poor health indicators ( $\text{NDVI} \leq 0.4$ ) were mostly observed on the fringes, especially in the claypan/mudflat areas where the trees were relatively smaller, as well as in dieback areas, possibly due to already stressed or dying mangroves, or smaller juvenile mangroves. The wet season results (April 2024, image in the middle) showed that the majority of the mangrove cover exhibited excellent health ( $\text{NDVI} > 0.7$ ), with a significant portion also displaying moderate recovery ( $0.5 < \text{NDVI} < 0.7$ ). The CVA results (right image) revealed 'red spots' scattered across the mangrove cover, where the rate of change ranged equal to smaller than  $-0.2$ . These areas could indicate early signs of stress, suggesting that certain sections of the mangrove ecosystem may be experiencing environmental pressures or other factors affecting their health.

The NDVI analysis results for mangrove dieback cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.6. The dry season results (August 2023, image on the left) indicated that the majority of these areas exhibited poor to no photosynthetic activity, suggesting significant stress or dieback. However, some marginal areas showed limited photosynthetic activity, indicating slight resilience or less severe impact. The wet season results (April 2024, image in the middle) displayed a similar pattern to the dry season, with intensified activities in the active areas. The CVA results (right image) revealed the appearance of blue areas on the map, where the rate of change was equal or greater than  $0.2$ , indicating regrowth or recovery in those regions. This suggested that certain sections of the mangrove dieback cover are experiencing positive changes, reflecting an improvement in their health and vitality.

The NDVI analysis results for saltcouch cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.7. The dry season results (August 2023, image on the left) indicated that the majority of these areas exhibited moderate health status ( $\text{NDVI} > 0.4$ ) with poor to no vegetation activity ( $\text{NDVI} < 0.3$ ) near disturbed areas which were less dense and degraded. Similar to the grassland class, the majority of the vegetation had revived during the wet season (April 2024, image in the middle). The red areas likely represent disturbed areas or regions that did not recover. The CVA results (right image) revealed blue areas on the map, where the rate of change was equal to or greater than  $0.2$ , indicating regrowth or recovery in those regions. Additionally, there were small areas of negative change, where the rate of change was less than  $-0.1$ , indicating poor recovery.

The NDVI analysis results for exotic shrubland cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.8. The dry season results (August 2023, image on the left) indicated signs of stress ( $\text{NDVI} \leq 0.4$ ), particularly near the seasonal wetland. However, during the wet season (April 2024, image in the middle), these areas appeared to recover, achieving good to excellent health indicators ( $\text{NDVI} > 0.8$ ). The CVA results (right image) for this class were predominantly positive, highlighting the resilience of this species against water stress. The areas showing significant positive change indicate that the vegetation has not only survived but thrived despite the challenging conditions.

The NDVI analysis results for succulent cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.9. The dry season results (August 2023, image on the left) indicated signs of stress ( $\text{NDVI} \leq 0.2$ ), particularly near the fringes of the claypan/mudflats areas, while some areas showed excellent condition ( $\text{NDVI} > 0.6$ ). During the wet season (April 2024, image in the middle), these areas appeared to recover, achieving good to excellent health ( $\text{NDVI} > 0.4$ ). However, some areas still showed poor status ( $\text{NDVI} < 0.3$ ), particularly adjacent to the wetland. The CVA results (right image) for this class were mostly positive, indicating overall resilience, but the northern and southern regions showed some negative change, suggesting these areas might be stressed.

Finally, the NDVI analysis results for tree vegetation cover in August 2023 and April 2024, along with their CVA, are presented in Figure 5.10. The dry season results (August 2023, image on the left) indicated that the majority of these areas exhibited good to excellent health status ( $\text{NDVI} > 0.7$ ). However, there was poor to no vegetation activity ( $\text{NDVI} \leq 0.4$ ) in the north and east of the seasonal wetland, as well as near the left side of the infrastructure in the south. During the wet season (April 2024, image in the middle), these areas showed increased activity and achieved excellent health indicators ( $\text{NDVI} > 0.8$ ). However, the poor area near the east side of the infrastructure did not show any signs of improvement. The CVA results (right image) for this class were mostly positive, indicating overall resilience.

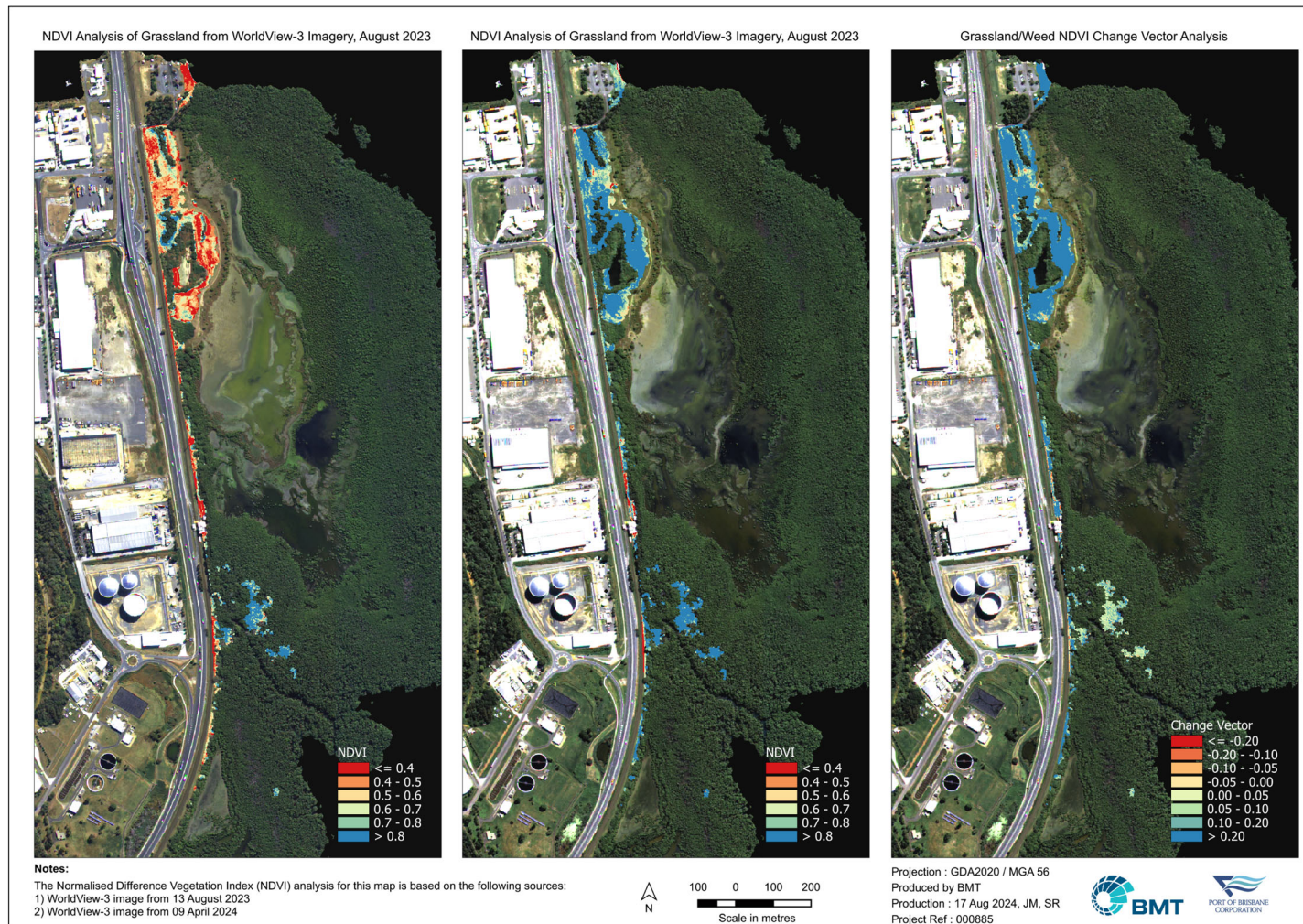


Figure G.4 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Grassland/Weed Areas



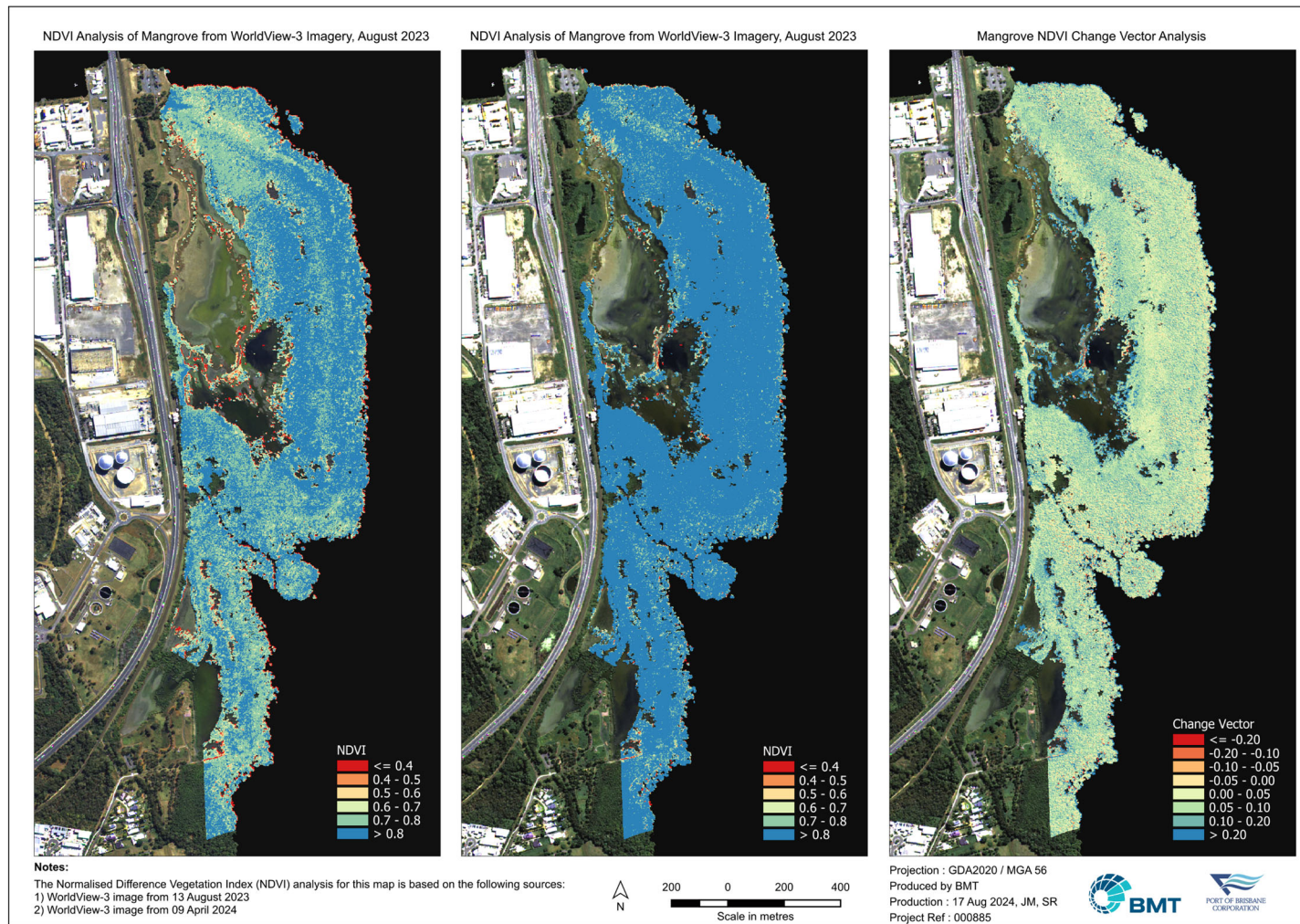


Figure G.5 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Mangrove Areas



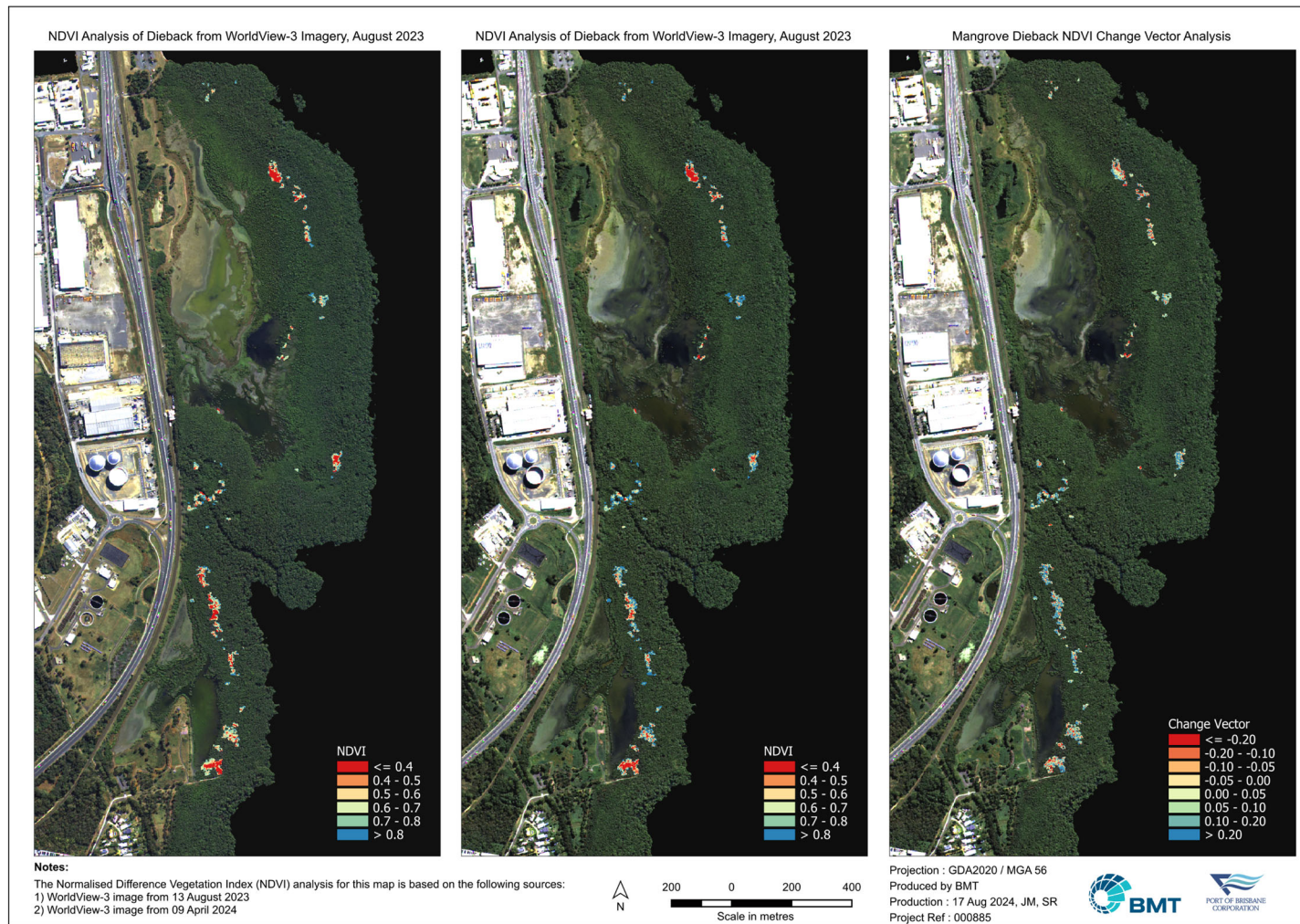


Figure G.6 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Mangrove Dieback Areas



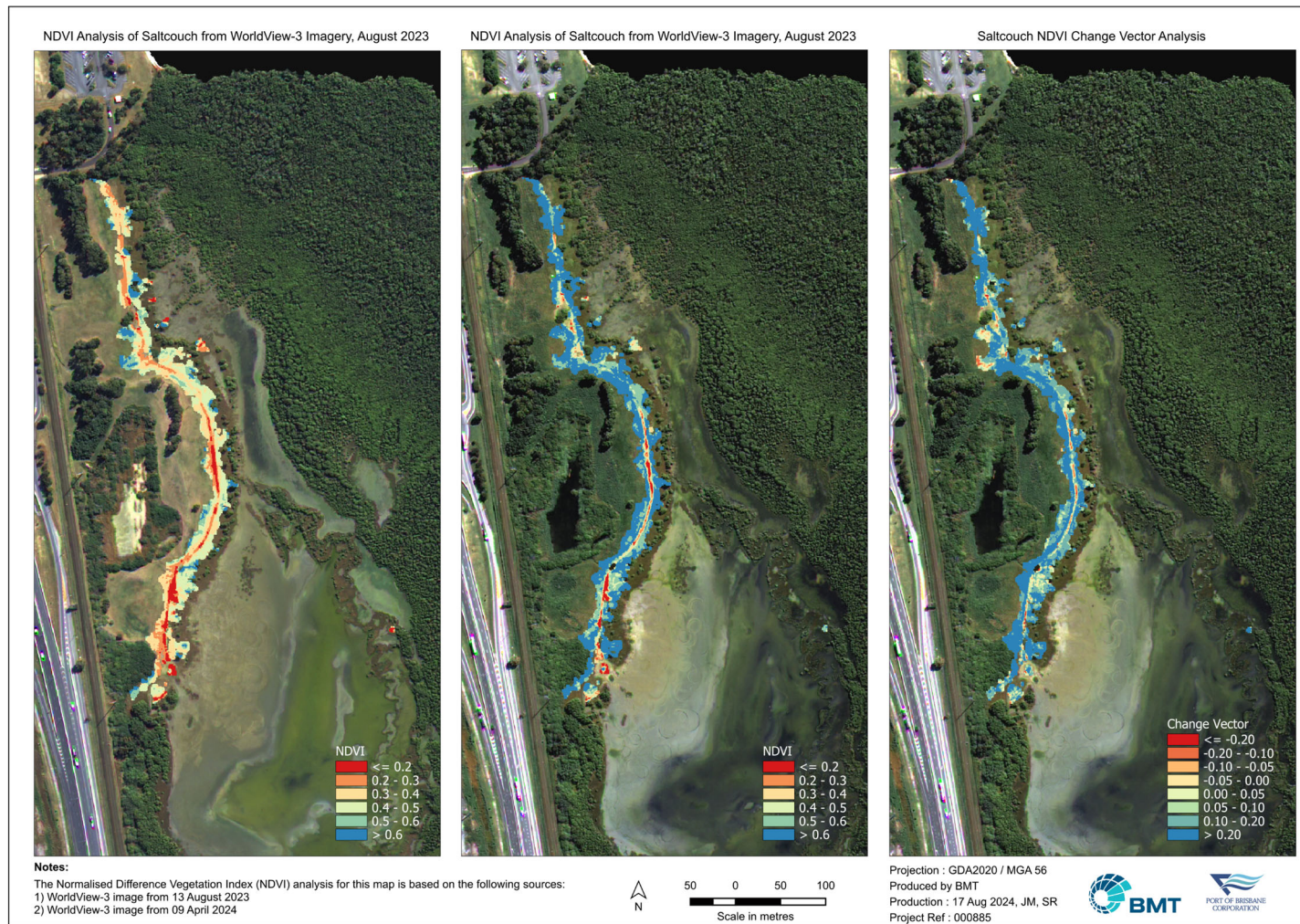


Figure G.7 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Saltcouch Areas



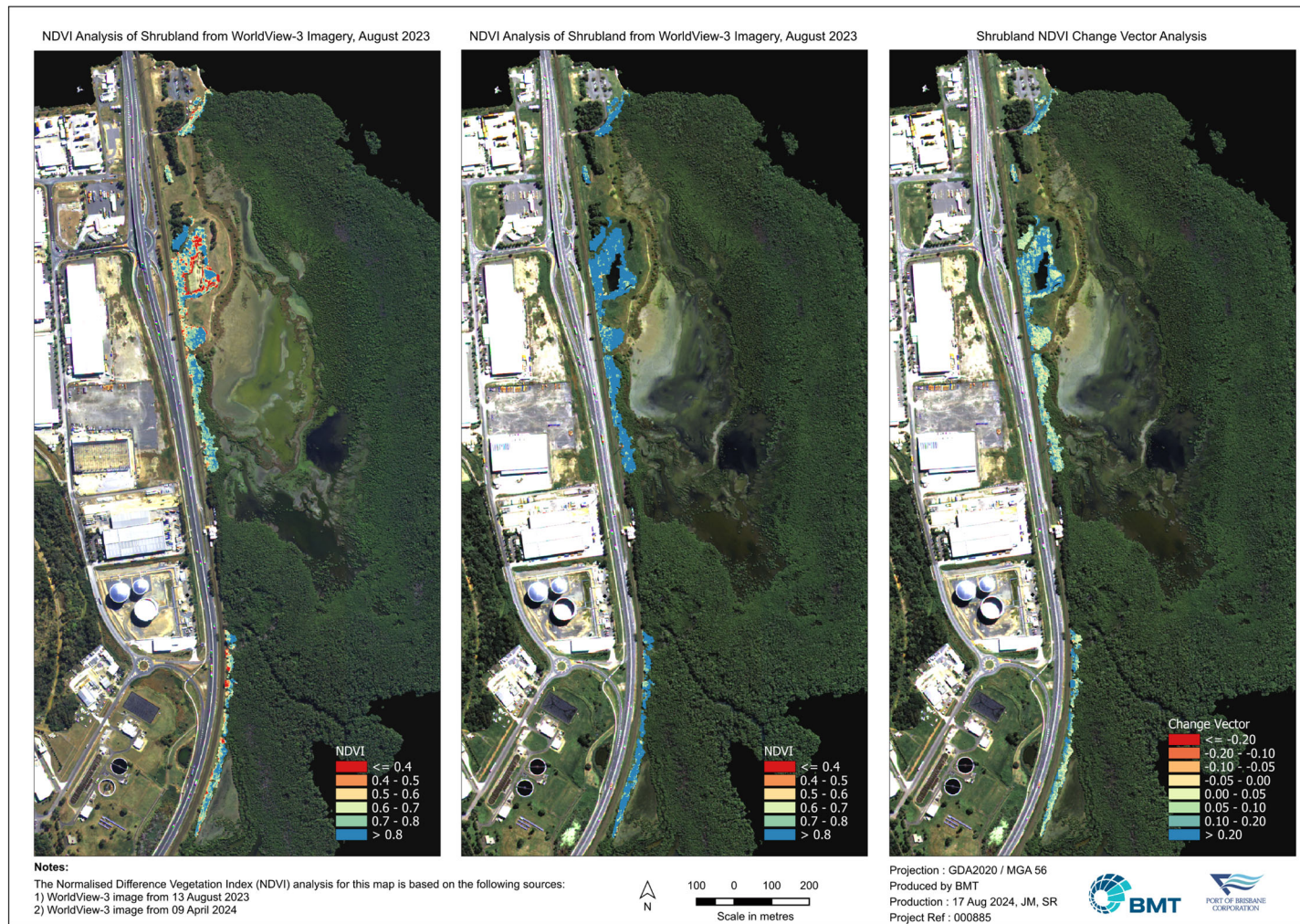


Figure G.8 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Shrubland Areas



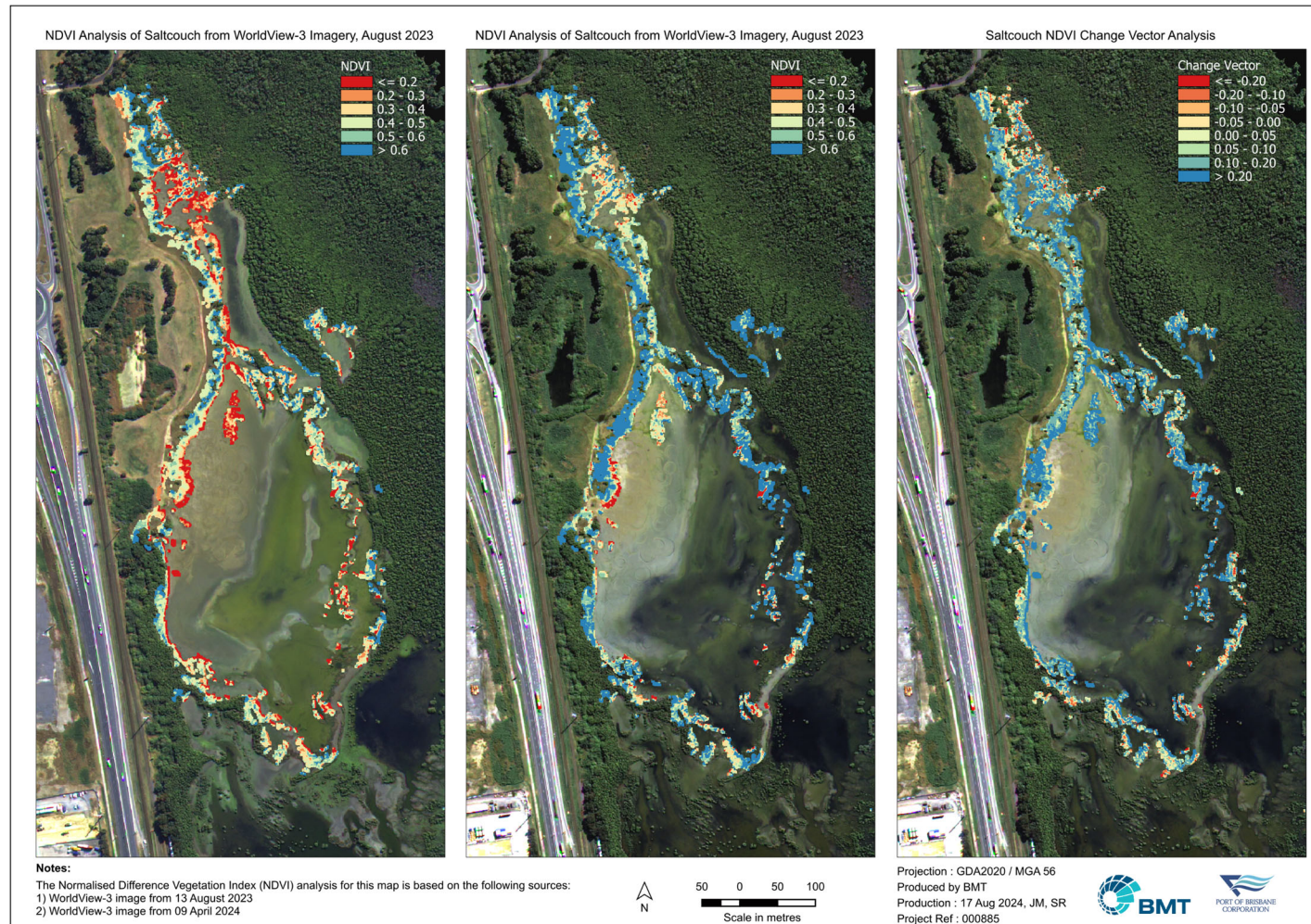


Figure G.9 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Succulent Areas



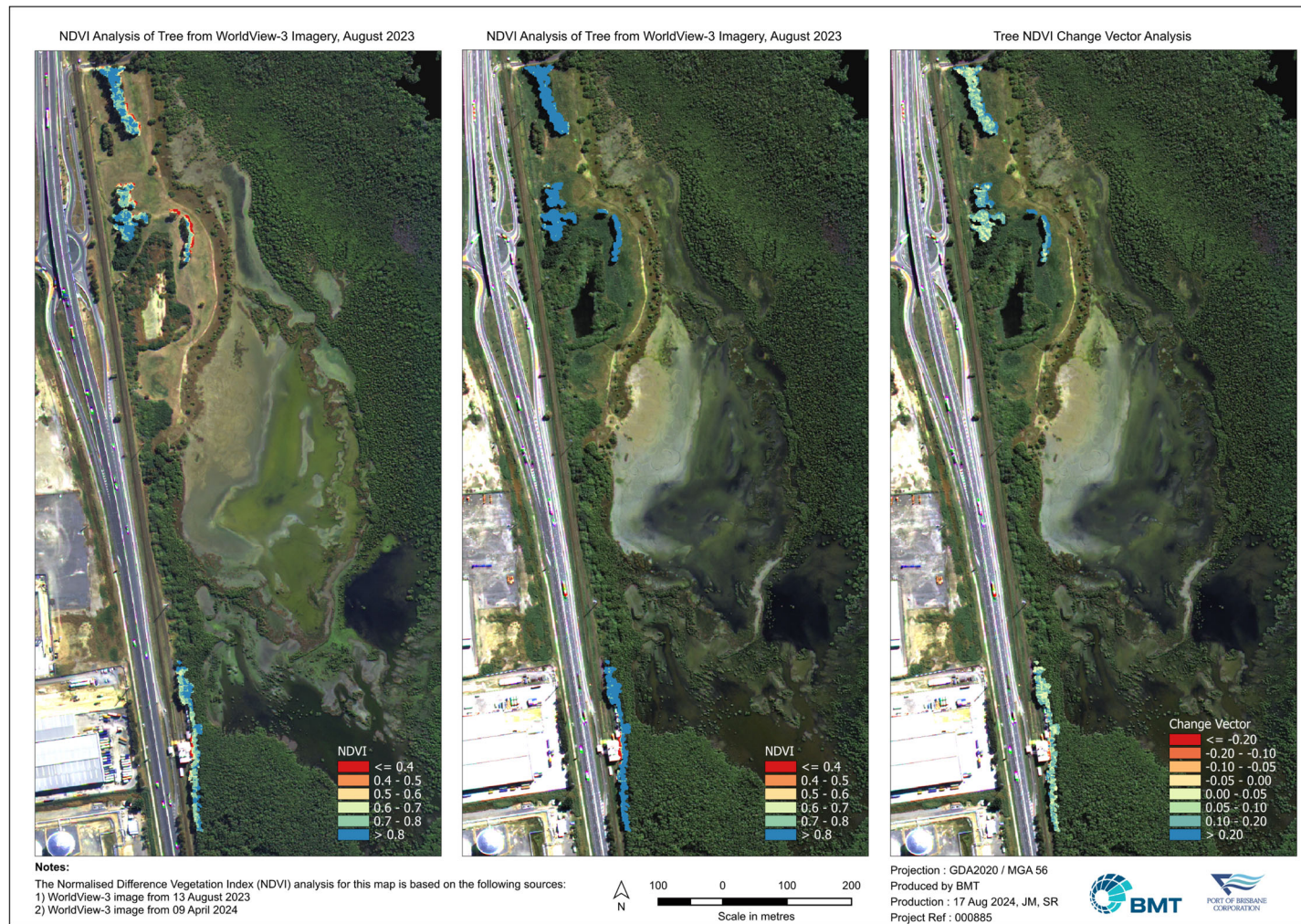
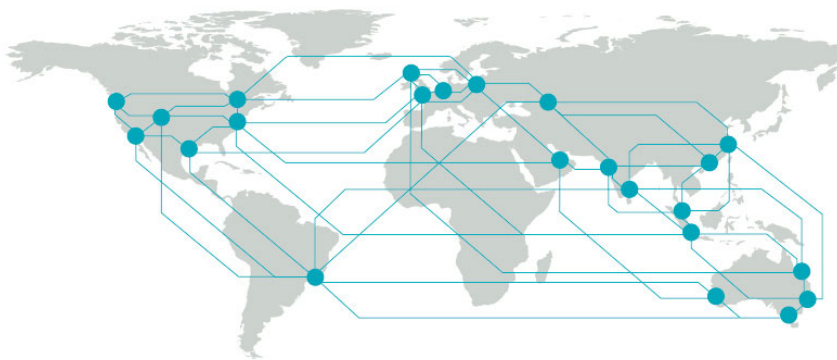


Figure G.10 Normalised Difference Vegetation Index (NDVI) and Change Vector Analysis for Tree Areas



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Level 5  
348 Edward Street  
Brisbane  
QLD 4000  
Australia  
+61 7 3831 6744

Registered in Australia  
Registered no. 010 830 421  
Registered office  
Level 5, 348 Edward Street,  
Brisbane QLD 4000 Australia

For your local BMT office visit [www.bmt.org](http://www.bmt.org)

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