






Ecologica Consulting

Preliminary Translocation Management Plan for *Cycas megacarpa* Mount Hopeful Wind Farm

prepared for Umwelt

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Abbreviations List

Abbreviation	Details
Cth	Commonwealth
DCCEEW	Department of Climate Change, Environment, Energy and Water
DES	Department of Environment and Science
DTMR	Department of Transport and Main Roads
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
ha	Hectare
HRA	High Risk Area
km	Kilometre
m	Metre
MNES	Matter of National Environmental Significance
NC Act	*Nature Conservation Act 1992* (Qld)
Qld	Queensland
RE	Regional Ecosystem
spp.	Species
TBC	To be confirmed
This Plan	Translocation Management Plan for Cycas megacarpa, Mount Hopeful Wind Farm
~	Approximately

Definitions

Item	Definition
Known habitat (confirmed)	80 m buffer around confirmed record or density record point.
Known habitat (suspected)	Areas adjacent to records and connective habitat or where the field-based points are generally absent, however connective habitat is present and based on expert opinion of ecologists
Recipient site	Refers to the site where the salvaged and propagated *Cycas megacarpa* individuals will be planted.
Development Corridor	The Development Corridor is a 'buffered' version of the indicative Project layout, covering approximately 1,564.6 ha. This area represents the maximum spatial extent where disturbance may occur within the Study Area and includes areas required for temporary and permanent Project infrastructure, equipment and materials laydown, installation and access. This includes an access road corridor that is situated between the Burnett Highway at Dixalea and Glengowan Road at the southwestern extent of the Project.
Disturbance Footprint	The Disturbance Footprint covers approximately 883.6 ha and represents the maximum extent of clearing works and the indicative locations of Project infrastructure. It is a 'worst-case' scenario in terms of the extent of clearing works. As infrastructure will be micro-sited within the Development Corridor, the final clearing areas are anticipated to be lower than detailed in this assessment. The Disturbance Footprint will be used when discussing impacts, avoidance and mitigation measures pertaining to *Cycas megacarpa*. The Disturbance Footprint is shown in Figure 1.1.
Offset area	Biodiversity offset areas will be determined as part of post approval and will be further detailed within Project Offset Area Management Plans.
Project proponent	The company that is responsible for construction and implementation of the Mount Hopeful Wind Farm and compliance with approval conditions including under EPBC Act and NC Act. At time of preparation of this document this is Neoen Australia Pty Ltd.
Study Area	The Study Area refers to the boundaries of the 17 freehold land parcels which encompass the infrastructure that has been designed for the proposed wind farm, as well as the boundary of the access road corridor (inclusive of the local road reserve for Glengowan Road, Playfields Rd and McDonalds Rd and small area of one additional adjacent land parcel) and a connection to the switching station in the road reserve at South Ulam Road. The area covers approximately 16,976 hectares (ha) and extends approximately 25 km north-south at the longest point and 42 km east-west at the widest

Item	Definition
	point (this includes approximately 30 km of access road). The Study Area represents the limit of the vegetation and habitat mapped for the Project.
Viable and significant population	3,500 to 4,500 adult individuals are considered to be a viable population (Queensland Herbarium 2007)

1. Introduction

Neoen Australia Pty Ltd is proposing to construct the Mount Hopeful Wind Farm. The Project is located on the on the Ulam Range between Mount Hopeful (on the Dee Range) and Mount Alma (on the Mount Alma Range) approximately 50 km south of Rockhampton and 40 km north of Biloela (Figure 1.1). The Ulam Range State Forest borders the south eastern edge of the Study Area, which links within the Don River State Forest to the south. To the north, the Bouldercombe Gorge State Reserve, which includes Mount Hopeful, borders the north eastern side of the Study Area, with the Gelobera State Forest and Mount Hopeful Conservation Park.

The Study Area covers an area of 16,9756 hectares (ha) (refer Figure 1.1). The Study Area overlaps 17 properties which have similar landform attributes, consisting of steep and hilly terrain (elevation between 400-800 m) with flatter landscapes leading up to vegetated ridgelines. All properties primarily consist of a mixture of historically cleared land for agricultural purposes, particularly along lower lying creek flats, and extensive areas of eucalypt woodlands of varying age and condition on slopes and ridgelines. The woodlands are dominated by *Eucalyptus crebra* (narrow-leaved ironbark) and *Corymbia citriodora* (spotted gum). On lower ridgelines these are often sparse open woodlands that have been historically logged or thinned.

Other ridgelines on richer soils have more diverse, denser, and typically remnant woodland communities which include some large *E. tereticornis* (Queensland blue gum), *E. acmenoides* (white mahogany) and *E. major* (grey gum) among other species. Larger watercourses throughout the Study Area typically consist of mature riparian vegetation communities which also support large mature tree species such as *E. tereticornis* and *E. moluccana* (gum topped box).

The Study Area (16,976 ha) and Project Disturbance Footprint (883.6 ha) contains *Cycas megacarpa,* a species classified as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and the Queensland (Qld) *Nature Conservation Act 1992* (NC Act).

Based on historic surveys in the area the Mount Hopeful population was not known to occur. The data collected by Umwelt indicates that this population is an important and viable population in its own right. The population within the Development Corridor at Mount Hopeful is estimated to be over 6,000 individuals based on the field data and spatial analysis[1] within the Development Corridor, and potentially as large as 140,000 within the Study Area based on the presence of suitable habitat. Under the *National Multi-species Recovery Plan for the Cycads, Cycas megacarpa, Cycas ophiolitica, Macrozamia cranei, Macrozamia lomandroides, Macrozamia pauli-guilielmi and Macrozamia platyrhachis* (Queensland Herbarium 2007) 3,500 to 4,500 adult individuals is considered to be a viable population) As such the Mount Hopeful population is considered to be an important, significant and viable population.

There is also a high potential for the Mount Hopeful population to also be part of the Population 5 which is located in the northern section of the Study Area near Gelobera State Forest and Bouldercombe Gorge Resource Reserve. Also there is the potential that the population forms part of or links the Don River State Forest (Population 8) and Population 5 due to positioning of the population in the landscape. This is also reflected in the genetics analysis undertaken by the University of the Sunshine Coast (James et al 2018 and Shapcott and Lamont 2022).

These populations were also subject to translocation activities undertaken by Ecologica on behalf on proponents in the transport and gas sectors between 2008 and 2015. These translocation programs were developed in consultation with the relevant stakeholders and were successfully implemented for these projects and other similar projects on cycads in the area. The learnings from these programs have resulted in the refinement to the methodology outlined below.

Based on the surveys of the Study Area, 6,021 individuals are projected to occur within the Development Corridor, with 3,727 projected to occur within the Disturbance Footprint. Based on habitat mapping for the species within the Disturbance Footprint it is also estimated up to 145.1 ha of known habitat (confirmed)[2], and 79.2 ha of known

1 Sampled 1,400 individuals and spatial analysis - use an estimation of the distribution and density of *Cycas megacarpa* was undertaken using spatial analysis by interpolating the density data between points using an Inverse Distance Weighted (IDW) interpolation algorithm. The IDW tool uses a method of interpolation that estimates cell values by averaging the values of the sample data points in the vicinity of each processing cell. The method assumes that the variable being mapped decreases in influence with distance from its sample location

2 80 m buffer around confirmed record or density record point

habitat (suspected)[3] will be cleared (total of 224.4ha of known habitat (confirmed) and known habitat (suspected)).

C. megacarpa populations can be locally dense in terms of individuals, but the boundaries of populations can be quite sharp, with no apparent change in habitat, indicating dispersal-limited distribution (Primack and Miao 1992). This is evident within the Study Area, which is a highly intact area for the most part (i.e. clearing, current and historic, is limited due the areas natural landscapes and limited value as agricultural lands). Further discussions with landholders have indicated that there was limited poisoning occurring in the area, which is a reason for the species decline and/or absence in some areas.

Where practicable, direct impacts on the species will aim to be avoided and/or minimised through the implementation of an overall performance objective being that there is a no net loss of individuals. This will be achieved through the following:

- Project design to consider measures to retain individuals within the Disturbance Footprint (i.e. some individuals based on location could be retained under powerlines or infrastructure moved to avoid larger clusters where practicable);
- All healthy *C. megacarpa* that cannot be avoided will be translocated to identified recipient sites in suitable nearby habitat within the wider Study Area; and
- Any individuals that cannot be translocated due to poor health, or that do not survive the translocation, will be replaced with propagated plants at a ratio of 1:2.

Translocation activities including salvage, seed collection and propagation for *C. megacarpa* have been successfully used on other linear projects on a smaller scale to this project in Central Queensland.

Based on the current projections of *C. megacarpa* impacted by the project and with consideration of the loss of 30% of the cycads (worst case scenario based on previous programs) the program will result in the addition of at least 1,118 individuals to the local population. An overview of the translocation program is provided in Table 1. This information will be further refined with consideration to additional avoidance measures currently being considered, the final design and the outcome of the direct count survey which will confirm the number of plants which can and cannot be salvaged form the Disturbance Footprint.

Table 1: Overview of the translocation and salvage activities

Description	Number
Salvaged cycads from the project development footprint	
Number of cycads directly impacted	3,727
Number of cycads which cannot be salvaged (i.e. poor trunk condition or local constraints)	TBC
Cycads translocated to recipient site/s	3,727
Cycads lost due to from the translocation activities	TBC
Translocated cycads alive at the end of the program	2,609 (assume 30% loss)
Translocated plants dead at the end of the program and to be offset at ratio of 1:2	1,118 (assume 30% loss)
Seed collection and propagation	
Number of propagated cycads alive at the end of the program	2,236
Cycads to be planted out in the recipient site	3,194 (assume 30% loss)
Cycads to be propagated in the nursery	4,563 (assume 30% loss)
Cycad seeds to be collected (Project Disturbance Footprint and Study Area)	6,519 (assume viability is 70%)
Total number of cycads alive at the end of the program	**4,845**
Total net gain	**1,118**

Table notes:
TBC – to be confirmed following direct counts.

3 areas adjacent to records and connective habitat or where the field based points are generally absent, however connective habitat is present and based on expert opinion of ecologists

1.1 Purpose of this Plan

The purpose of the Translocation Management Plan for *Cycas megacarpa* (herein referred to as The Plan) is to identify the performance outcomes and actions for the salvage, propagation and translocation of *C. megacarpa* as a result of the Mount Hopeful Wind Farm Project (the Project).

This Plan has been developed in accordance with the *National Multi-species Recovery Plan for Cycads* (Queensland Herbarium, 2007), the *Guidelines for the Translocation of Threatened Plants in Australia* (Commander *et al* 2018) and with consideration to learnings from other translocation programs for the species undertaken by Ecologica staff for the coal seam gas and transport sectors between 2008 and 2015.

The Plan provides specific assessment, management, monitoring and reporting measures to be implemented prior to, during and post translocation of *C. megacarpa*. Key actions addressed are:

- *C. megacarpa* individuals will be salvaged from the Disturbance Footprint and moved to permanent recipient sites located within the broader Offset Area;
- Seed collection;
- Propagating individuals under nursery conditions prior to planting out;
- Planting out of tube stock and management in field;
- Monitoring and reporting.

A performance outcome will be that the translocation and propagation programs will result, based on current projections, in at least 4,845 individuals surviving in the recipient sites post seven years from their translocation or planting, which is 1,118 plants more than the number being directly impacted by the project.

The Plan is a live document and will continue to be updated in response to inputs from the regulator and final approval conditions under the EPBC Act and the NC Act, final design, outputs of the direct count, final recipient site locations and design and other factors. In response to these inputs this Plan will be updated and submitted to DCCEEW and where applicable DES for their information.

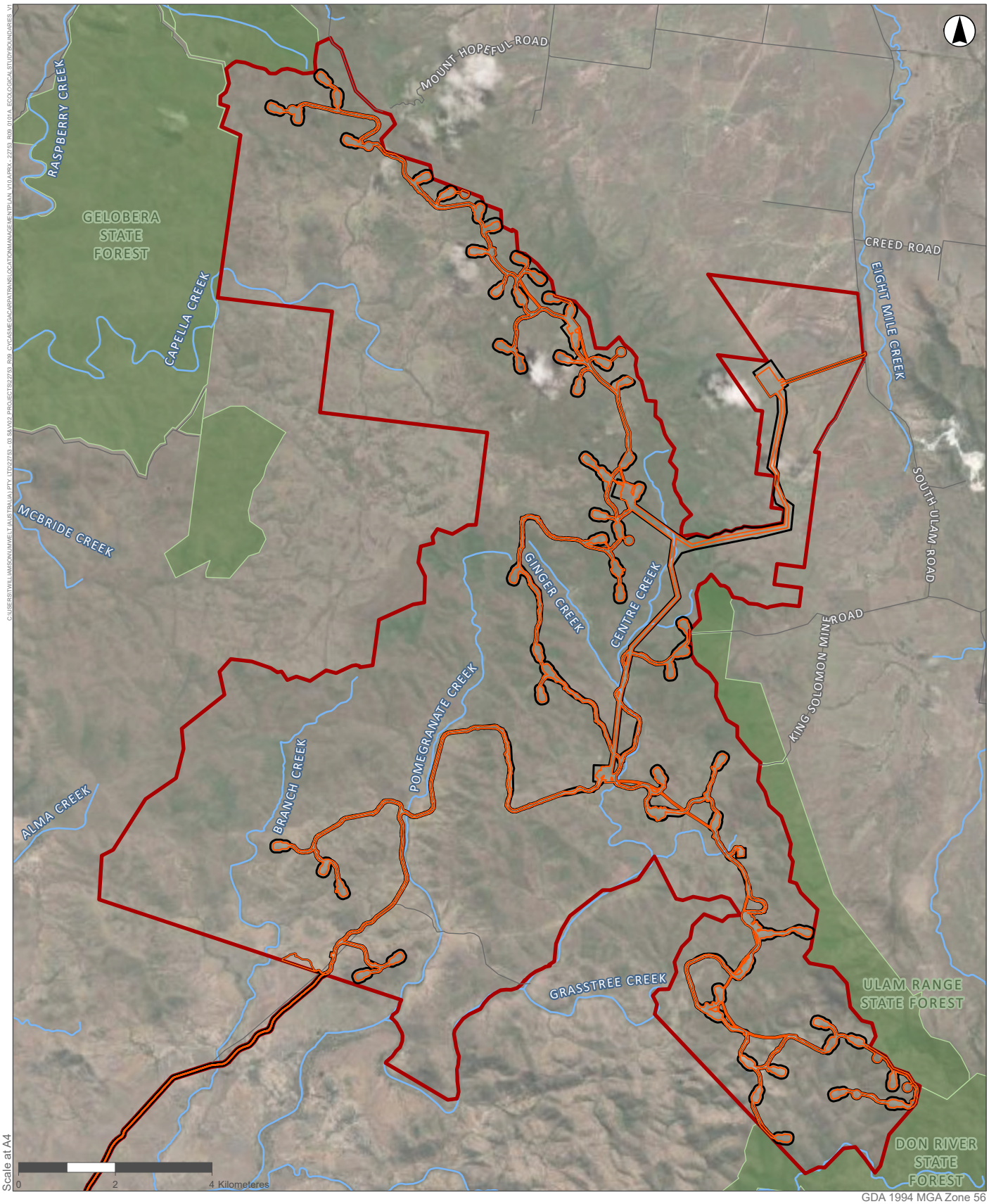


FIGURE 1.1A

ECOLOGICAL STUDY BOUNDARIES

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

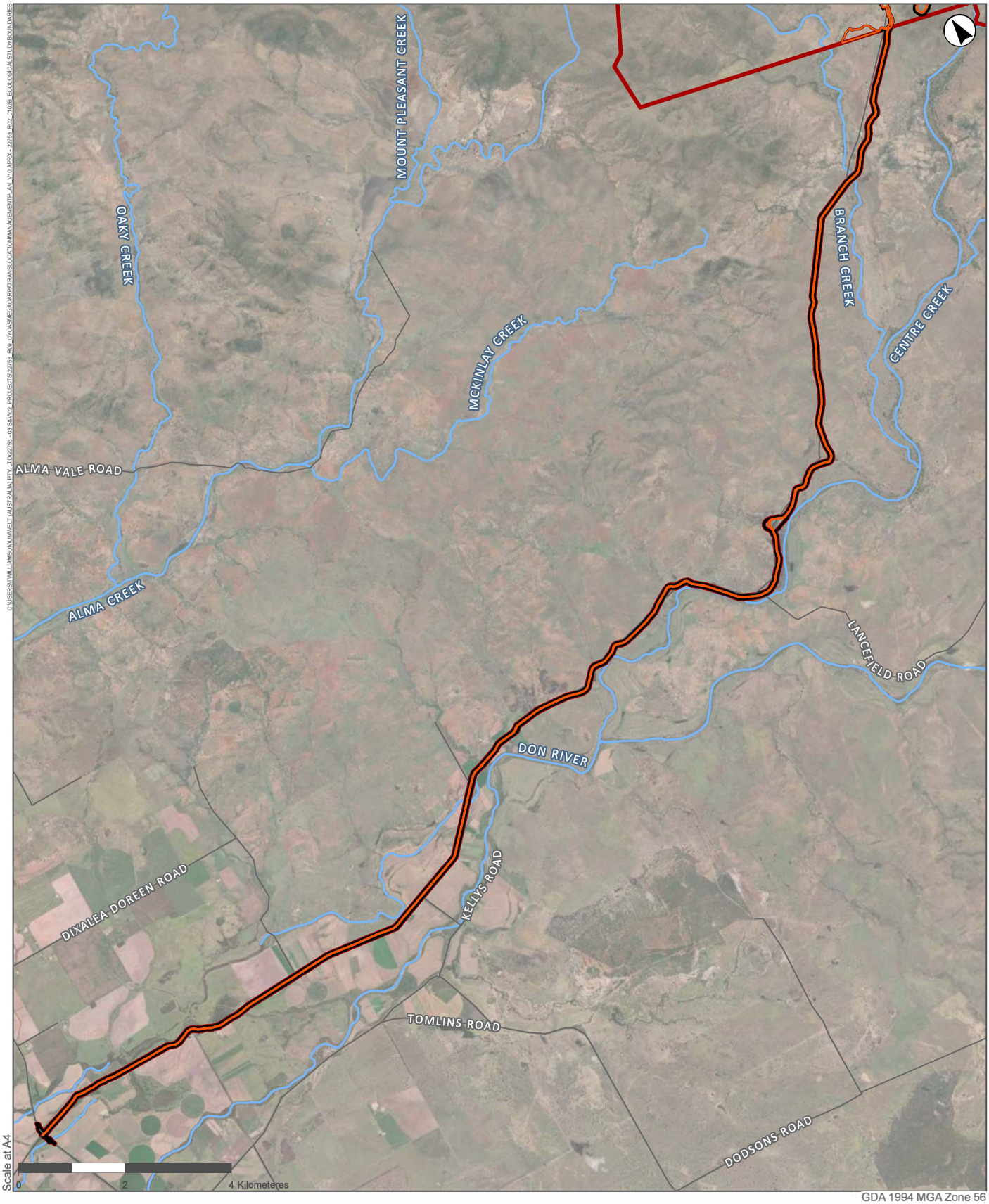
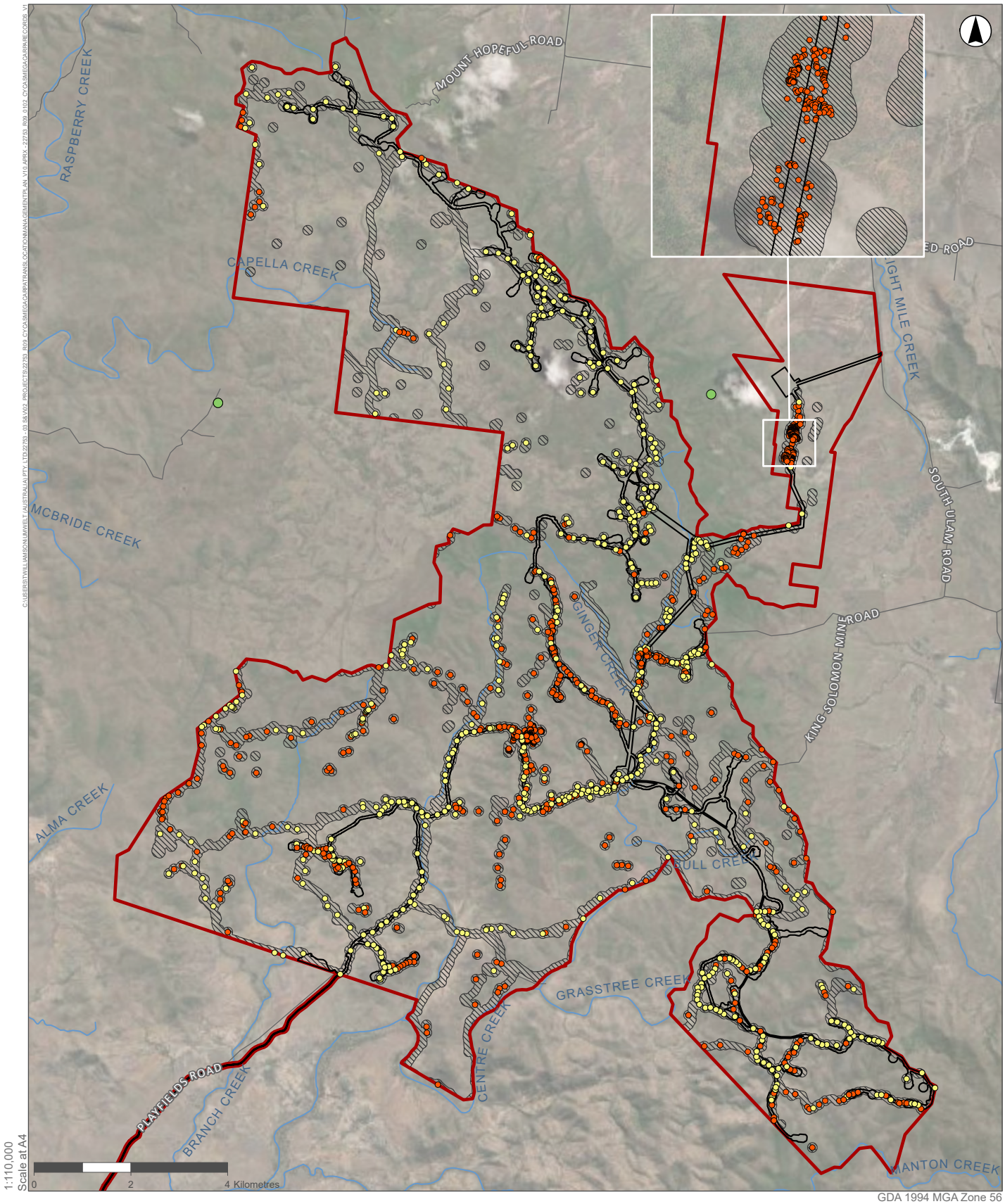


FIGURE 1.1B

ECOLOGICAL STUDY BOUNDARIES

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)



Legend

- Roads
- Watercourse
- Disturbance Footprint
- Study Area
- Field Survey Extent
- *Cycas megacarpa* Record (ALA)

***Cycas megacarpa* Records (Umwelt)**

- Yes
- No

FIGURE 1.2

CYCAS MEGACARPA RECORDS

Image Source: ESRI Basemap (2022) **Data source:** Department of Resources (2022)

2. Legislative framework

The legislation applicable to this Plan is outlined below.

2.1 *Environment Protection and Biodiversity Conservation Act 1999*

The EPBC Act provides that any action (i.e. a project, development, undertaking, activity or series of activities) that has, will have, or is likely to have a significant impact on a Matter of National Environmental Significance (MNES), or other matters protected under the EPBC Act such as the environment of Commonwealth land, requires approval from the Australian Government Minister for the Environment.

The Project was referred under the EPBC Act and on the 7 March 2022 the Minister for the Environment determined to be a controlled action (2021/9137) to be assessed based by Preliminary Documentation with a request for information (RFI). The Project was determined to be a controlled action due to the potential for significant impacts to occur to listed threatened species (including *C. megacarpa*) and listed migratory species. An RFI was then issued by the Department of Climate Change, Environment, Energy and Water (DCCEEW) in May 2022.

This Plan has been developed to respond to the RFI and support the assessment and approvals process, in particular to demonstrate how impacts on *C. megacarpa* individuals will be mitigated. The works will also be undertaken in accordance with associated management plans and commitments identified in the relevant Preliminary Documentation.

The Plan also aligns with the Translocation of Listed Threatened Species – Assessment under Chapter 4 of the EPBC Act Policy Statement (2013). The translocation activities are considered to be a salvage translocation under this policy. As noted, the management and monitoring measures outlined in this Plan have been successfully implemented on other *Cycas megacarpa* translocation activities. This includes consideration of potential issues with regard to genetic diversity, pest populations and competition with other individuals, along with the identification of appropriate mitigation and management measures.

2.2 The Plan also identifies key performance criteria to support the translocation activities both in the short and longer term. It is envisaged that is the program will retain long term value, 50 or 100 years without management input, if implemented. *Nature Conservation Act 1992*

The NC Act provides for the conservation of nature through protection of all native plants and animals in Queensland. Protection is provided under the NC Act through conservation of land as protected areas and wildlife protection outside of protected areas. Actions impacting on protected native flora and fauna are regulated under the NC Act.

The NC Act provides that a person must not take, use or keep a protected plant other than under a conservation plan applicable to the plant, a licence, permit or authority issued or given under a regulation or an exemption under a regulation. Take is defined under the NC Act as "gather, pluck, cut, pull up, destroy, dig up, fell, remove or injure the plant or any part of the plant" and seeds are considered plant parts under the act.

Permits for disturbance to native flora can be administered under the NC Act. The Queensland Nature Conservation (Plants) Regulation 2020 lists flora species considered to be 'extinct in the wild', 'critically endangered', 'endangered', 'vulnerable', 'near threatened' or 'special least concern' in Queensland.

Clearing activities that are outside of an area identified as a high-risk area (HRA) on the flora survey trigger map will not be subject to flora survey requirements unless a threatened species is known from the area. Under the framework, when a non-exempt clearing activity is proposed within a HRA, the proponent of that activity is required to complete a flora survey prior to commencement of clearing.

As *C. megacarpa* are known to occur in the Disturbance Footprint (both within and outside of mapped HRA's) a clearing permit under the NC Act will be sought by the project proponent post the EPBC Act approval being issued. Protected plant surveys (as outlined in Section 4.3) and this Translocation Management Plan will support the clearing application. A clearing permit will need to be obtained prior to any vegetation clearing or translocation occurring.

The clearing permit approval will allow for the seeds to be collected from within the Disturbance Footprint. As part of the clearing permit approval permission will also be sought for the collection of seeds outside of the Disturbance Footprint. Alternatively, approval may be sought under a protected plant growing licence to harvest whole restricted plants or plant parts for propagation (refer Section 8).

3. Translocation Team

The translocation and management of *C. megacarpa* will be co-ordinated by a team of suitably qualified and experienced professionals with successful experience in threatened species translocation preferably in cycad translocation, land management and ecological monitoring. Key team members include the following:

- Specialist Ecologist to lead the translocation and propagation program and provide strategic advice as required to ensure performance outcomes are met;
- Transplant specialist with experience in translocation and maintenance of threatened flora species, with a preference for experience with cycads;
- In field maintenance and horticultural management specialist (water, pest animal, weeds and general horticultural experience);
- Nursery horticultural specialist (seed collection and propagation);
- Project proponent environmental representative.

Team members will be finalised upon approval of this Translocation Management Plan and will be contracted by the project proponent prior to any works commencing.

Specialist Ecologist

The Specialist Ecologist will have demonstrated experience in leading successful cycad translocation programs. The Specialist Ecologist should have demonstrable experience in environmental management and have managed translocation projects with a preference for experience in cycads.

The Specialist Ecologist will oversee all stages of the program including on-ground maintenance of recipient sites, ecological monitoring and reporting.

This demonstrated experience will include involvement in all stages of the programs (planning, salvage and propagation, in-field maintenance of translocated and planted individuals, monitoring and reporting).

Transplant Specialist

Through a procurement process, a specialist transplant contractor will be engaged by the project proponent to salvage the *C. megacarpa* individuals from the Disturbance Footprint and plant out propagated individuals.

The transplant specialist will hold all appropriate permits and licences to undertake such activities and will ensure all machinery and equipment used is maintained to a maintenance and hygiene standard required to work within sensitive environs. This includes but is not limited to: weed and weed seed free; pathogen free (particularly for *Phytophthora* and *Puccinia psidii*); and in good working order with no leaks.

The specialist contractor will have an appropriate level of experience in salvage works and a preference will be given to experience with cycads and with a high success rate post two years of the translocation.

Maintenance and horticultural management

The project proponent will engage maintenance and horticultural resources to manage the recipient sites and propagate the *C. megacarpa* seeds required for this program.

The resources will be appropriately experienced within the horticultural industry and hold necessary permits and licences. It is preferable that the resources be experienced working on sites containing sensitive environs and have an appropriate level of experience in salvage works. The Specialist Ecologist will direct the on-ground maintenance and horticultural contractors in their works.

4. Impact area

4.1 Habitat

Known populations of *C. megacarpa* occur at altitudes between 40-680 m, typically in undulating, high-relief terrain on well-drained rocky or clayey substrates. Preferred habitats consist of open eucalypt woodlands dominated by ironbark (*E. crebra* and *E. melanophloia*) or spotted gum (*C. citriodora*). In these areas, populations are generally most dense on steep slopes and within drainage lines which act as the primary dispersion means for the species (Queensland Herbarium 2007).

The species distribution and density varied spatially across the landscape of the Study Area, with the species recorded in a range of vegetation conditions from remnant to non-remnant sites (including existing vehicle access tracks). However, most cycads appear to occur typically in association with woodland to open forest of *E. crebra, C. citriodora, E. melanophloia, C. intermedia* and *E. tereticornis* on metamorphosed sediments and volcanic geologies on slopes and crests, as well as alluvial soils at altitudes of between 200 - 500 m.

Other habitat for this species included eucalypt communities dominated by white mahogany (*Eucalyptus acmenoides*) (RE11.11.4c), eucalypt communities occurring on lower colluvial slopes (RE 11.11.3c, 11.11.4b), communities on alluvial soils (RE 11.3.25b and 11.3.4), vine thickets (REs 11.11.5, 11.12.4) and areas of regrowth and non-remnant vegetation. *C. megacarpa* was recorded within all these communities, although at lower numbers and sporadically distributed. The species was largely absent from communities dominated solely by *E. moluccana* and *C. citriodora* within the Study Area, including the northern extent near Population 5.

The species was also common on ridgelines, though in part this is also where most of the Disturbance Footprint occurs so the significance of this may be biased due to increased survey effort. The survey effort also allows for the adjacent side slopes and saddles to be observed with the species occurring on some of these features but not in all instances which reflects the natural constraints associated with the species distribution.

C. megacarpa populations can be locally dense in terms of individuals, but the boundaries of populations can be quite sharp, with no apparent change in habitat, indicating dispersal-limited distribution (Primack and Miao 1992). This is evident in the field survey work undertaken to date where despite the presence of suitable habitat for the species, cycads were not present or were in low densities.

Similar observations have been made by Ecologica staff when conducting surveys for cycads within the Mount Morgan Range, Calliope Range and Callide Range.

Photo 1: *C. megacarpa* in-situ within *E. crebra* and *C. citriodora* woodland (Umwelt, 2020).

Vegetatively, this species has been recorded within one or more combinations of the following mapped Regional Ecosystems (RE's) (i.e., suitable habitat) within the Study Area (Umwelt 2022):

- RE11.3.4 - *Eucalyptus tereticornis* and/or *Eucalyptus* spp. tall woodland on alluvial plains;
- RE11.3.25b - *Melaleuca leucadendra* and/or *Melaleuca fluviatilis*, *Nauclea orientalis* open forest on alluvial plains;
- RE11.11.3 - *Corymbia citriodora, Eucalyptus crebra, E. acmenoides* open forest on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges;
- RE11.11.3c - *Eucalyptus moluccana* woodland on lower slopes in association with *Eucalyptus crebra* and/or *Corymbia citriodora* +/- *Eucalyptus* spp.
- RE11.11.4 - *Eucalyptus crebra* woodland on old sedimentary rocks with varying degrees of metamorphism and folding. Coastal ranges;
- RE11.11.4a - *Eucalyptus tereticornis* dominated woodland on old sedimentary rocks with varying degrees of metamorphism and folding.
- RE11.11.4b - *Corymbia trachyphloia* or *Eucalyptus acmenoides*, *Eucalyptus crebra* woodland and/or *Acacia leiocalyx* on old sedimentary rocks with varying degrees of metamorphism and folding.
- RE11.11.4c - *Eucalyptus moluccana* dominated woodland. Other tree species listed above may occur as sub or co-dominant species on old sedimentary rocks with varying degrees of metamorphism and folding.
- RE11.11.5a - Vine thicket, usually with no *Araucaria cunninghamii* emergents.
- RE11.11.15 - *Eucalyptus crebra* woodland to open woodland. Often with a shrubby layer. Occurs on deformed and metamorphosed sediments and interbedded volcanics;
- RE11.12.1 - *Eucalyptus crebra* shrubby woodland on ranges on igneous rocks;
- RE11.12.4 - Semi-evergreen vine thicket and microphyll vine forest on igneous rocks
- RE 11.12.6 - *Corymbia citriodora* woodland to open forest on igneous rocks (granite).

The Calliope Range populations are associated with RE11.12.6/11.12.1 both of which are common in the Study Area. RE11.11.15/11.11.4 is the main community type associated with the Callide Range population. The Boulder Creek population is primarily associated with RE11.12.1/11.3.4.

Based on RE mapping within the Study Area there could be up to 10,775.2 ha of suitable habitat for the species (i.e., habitat known to support the species, but where the species may not be present), with a population size projected to be 141,392[4]. However, the species does not occur throughout the area of suitable habitat which is in line with surveys of cycads in the region since 2008 (pers comms. Alicia Wain) and Primack and Miao (1992) which notes that species can exhibit strong population boundaries, with no apparent change in habitat.

C. megacarpa occur in habitats that are subjected to periodic fires of varying intensities. As with other cycads, adult plants are resistant to most fires, although the foliage may be destroyed, and some scarring of the stems may occur. Fires probably kill any small seedlings or seed that is either on the plant or locally dispersed (Queensland Herbarium 2007). In some locations fires were evident, potentially impacting on the health of the cycads (i.e. compromised trunk conditions), with previous translocation experience noting that these individuals are the most susceptible to failure.

The population has also been targeted by local landholders with poisoning or mechanical removal known to occur within the Study Area and this is likely to have impacted the characteristics of the population.

4.2 Population Characteristics

C. megacarpa populations typically comprise of numerous clusters ranging from several to hundreds of individuals. The Mount Hopeful population also displays this clustering and that it was not uncommon for the number of individuals within the cluster to vary, along with the age classes, presence of fertile material (male pollen cones or megasporophylls) and foliage insect attack.

Data captured by Umwelt to date indicate clustering occurs, within and adjacent the Disturbance Footprint (Figure 1.2). This information has been used to inform design with the intent to avoid dense patches or in the very least minimise impacts. This is evident with the Development Corridor projected to support 6,021 plants while the Disturbance Footprint is projected to impact on 3,727 plants. This number of plants suggests the cycads in the area are a viable and significant population and that Mount Hopeful is a newly discovered viable and significant population. Within the wider Study Area the number of cycads potentially present is projected to be 141,392.

Population structure in terms of size/age class is a reliable indicator of levels of attrition and natural recruitment in a population. Where there is progression of size/age classes with fewer, older individuals, down to many juveniles, the population can be considered to be adequately replacing itself (Queensland Herbarium 2007).

It is currently unknown from the data captured by Umwelt to date as to whether the population is able to adequately replace itself. That is, from the data the following has been noted:

- Seedlings (< 0.49m, non trunked) – 262 plants (21%)
- Juveniles (> 0.5m, not trunked; <0.49m, trunked) – 368 plants (30%)
- Adults (> 1m, trunked) – 572 plants (47%).

The issues with recruitment have been previously observed in other populations in the area including Boulder Creek and Specimen Hill. However, within these populations at least 10% of plants were seedlings though the percentage of juveniles was less than 10%.

Further assessment is required in this space to confirm the population characteristics of the site with this section to be updated following the assessment. Detailed graphs (J-curve) which characterise the population will be provided following direct counts as part of pre-clearance survey.

Of those recorded in the adult age class, less than 1% could be identified as either female[5] or male[6]. However, it is noted that based on the observations made by Umwelt, the number of females or males observed is significantly higher than recorded (strict counts of male and female plants were not made). This is much smaller than other projects where up to 37% of the adult plants and 17% of the population could be positively identified as female or

4 an estimation of the distribution and density of Cycas megacarpa was undertaken using spatial analysis by interpolating the density data between points using an Inverse Distance Weighted (IDW) interpolation algorithm. The IDW tool uses a method of interpolation that estimates cell values by averaging the values of the sample data points in the vicinity of each processing cell. The method assumes that the variable being mapped decreases in influence with distance from its sample location
5 Presence of seeds or megasporophylls
6 Presence of male pollen cone

male. The ratio of identifiable females to males within these other populations is also 3:2. This is not an uncommon trait and reflects the fact that not all plants reproduce each year and that the level of reproductive dormancy is not currently predictable.

Similar constraints have been observed across other known *C. megacarpa* populations with James *et al* (2018) suggesting the possibility of a demographic Allee Effect (a positive relationship between population size and/or density and per capita population growth rate). Within the Central Queensland populations, ecological observations recorded over a 10-year period by Wain (unpublished pers. comm. 2020) indicate the low levels of recruitment are likely due to a culmination of several factors including: the timing of reproduction events are not wholly synchronous; feral pig predation on seeds (active on site); too frequent fire regimes (active on site); drought (active on site); and poisoning/land clearing (active within the Mount Hopeful population).

C. megacarpa populations can be locally dense in terms of individuals, but the boundaries of populations can be quite sharp, with no apparent change in habitat, indicating dispersal-limited distribution (Primack and Miao 1992).

Therefore, the exact population size is unknown, however the Mount Hopeful population is considered to be both an important and a significant and viable population (3,500 to 4,500 adult individuals is considered to be a viable population (Queensland Herbarium 2007)).

A study by James et al. (2018), which looked at the distribution and genetic structure of *C. megacarpa*, identified evidence of considerable historic gene flow among populations across its entire range, and showed little differentiation across the entire species. Genetic clustering was shown to occur within a 36 km radius, consistent with the hypothesis that *C. megacarpa* existed as a set of three linked metapopulations, historically linked by gene flow. However, due to ongoing fragmentation that further increases population isolation, this may continue to reduce the species' viability. Based on this evidence it can be concluded that *C. megacarpa* can be considered one population, with the most genetic similarity within a 36 km radius.

Genetic analysis for other projects noted that the Boulder Creek population appears to link the populations to the north, south and east of it genetically. Further to this it was noted that in the northern region, where the Mount Hopeful population in part lies (Dee Range), individuals were genetically similar to each other when within a 16.8 km radius.

Decreasing genetic diversity was not found to occur even within smaller populations, potentially due to the persistence of adult cycads through multiple generations, allowing rare alleles to remain within the population over a longer period of time and potentially passed on to successive generations. This, and dispersal and cross pollination between adjacent populations, may maintain the genetic diversity of small populations (James et al., 2018).

The Mount Hopeful population intersects Population 5 in the northern section and is likely to be a part of the locally known populations (Populations 7 to 9). As such there is the potential for the local population to be in excess of 142,000 individuals. Noting that the study by James et al. 2018 identified three distinct metapopulations with Mount Hopeful located between the northern and Callide/Calliope metapopulations.

Population 5: Dee Range

This population is located in the Dee Range and potentially overlaps with parts of Bouldercombe Gorge Resource Reserve and also Gelobera State Forest. The population is considered to be a viable population and was estimated to be 5,600 individuals occupying an area of 100 ha (56 plants/ha). This population adjoins and potentially overlaps the northern extent of the Study Area.

The plants were recorded from RE11.11.3/11.11.15 with the species notes describing the area as woodland comprising of *E. crebra, E. acmenoides, E. tereticornis, Corymbia citriodora,* forest oak (*Allocasuarina torulosa*) and ribbon fan palm (*Livistona decora*).

The population is likely to be associated mainly with the Dee River catchment, Capella Creek subcatchment. Though the population may also be with the headwaters of Six Mile and Ewart creeks.

The northern section of the Study Area is located in Capella Creek and cycads within this section are likely part of Population 5. Though it is noted that there were few records in this area due in part to the area being mapped as RE11.11.3 where *E. moluccana* and *C. citriodora* occur.

Population 6: Mount McCamley

A small cluster (28) of plants were observed within a road reserve near Mount McCamley, Population 6. This population is not viable and is located approximately 2.7 km east of the Study Area. The population was recorded from woodland comprising of *E. crebra, E. melanophloia* and red bloodwood (*Corymbia erythrophloia*).

There is a high likelihood that the Mount Hopeful population links to this population as it is downstream/down gradient. However, the area around Mount McCamley has been heavily cleared and the plants may have migrated down from Dee Range via tributaries associated with Eight Mile Creek catchment.

Populations 7, 8 and 9: Don River State Forest

These three populations are associated with Don River State Forest, though they are located in the southern section of the state forest, between 10 and 15 km south of the Study Area.

Population 7 is located 10 km south of the Study Area and comprises only five plants. These records are known from Cattle Creek within an area mapped as RE11.3.26/RE11.3.25/RE11.11.3. The description of the vegetation the plants were recorded from was described as a woodland of *C. citriodora* and *E. crebra* on steep rocky slope.

Population 8 which is located 15 km south of the Study Area is predicted to be around 115,200 plants, a viable population, and occupies an area of 800 ha. The population is mainly associated with RE11.12.1/RE11.12.6 which is also the primary habitat for the species in the Study Area. The population overlaps both the Dee River catchment and the Calliope River catchment and is located in the headwaters of Cattle Creek, Dingo Creek and Back Creek.

Population 9 is located 15 km south of the Study Area and is comprised of only 49 plants. This population is located just outside Don River State Forest in the headwaters of Back Creek. The population is mainly associated with RE11.12.1/RE11.12.6 which is also the primary habitat for the species in the Study Area. The description of the vegetation the plants were recorded from was described as a woodland of *Corymbia citriodora* and *Eucalyptus crebra* on steep rocky slope.

These three populations are located in different subcatchments to the Mount Hopeful population.

4.3 Direct Count Surveys

At this stage in the Project and based on results of flora surveys completed to date, it is estimated that there are 3,727 *C. megacarpa* within the Disturbance Footprint. Avoidance strategies (i.e. retaining individuals on edges of power line corridors and moving infrastructure to avoid clusters where practicable) will likely reduce the number of cycads being impacted by the project.

Once detailed design has been finalised, direct count surveys will be undertaken. The purpose of the direct count survey is to finalise the numbers of *C. megacarpa* that are within the Disturbance Footprint, identify those that can be avoided, and those that are able to be translocated from the Disturbance Footprint, along with the plants which cannot be translocated (i.e. poor trunk condition or local constraints).

This survey may also be used as an opportunity to collect *C. megacarpa* seed as per Section 8 of this Plan and individuals to be translocated and left in-situ. Seed collection will be subject to relevant approvals under the NC Act and include areas of the Disturbance Footprint which are inaccessible for salvaging activities.

These surveys will capture a range of data for each individual within the Disturbance Footprint comprising:

- Co-ordinates;
- Height;
- Trunk condition;
- The presence and developmental stage of fruiting material including number of seeds and degree of ripeness;
- Number of seeds collected from each individual; and
- Other relevant observations (e.g. the presence and degree of insect attack, along with the predator species present).

The habitat values and habitat quality in which each of the clusters occur in will also be recorded so that similar values may be accommodated within the recipient sites. Habitat quality will be assessed based on applying the *Guide to Determining Terrestrial Habitat Quality* (DES 2020).

4.3.1 Translocation limitations

The majority of the area is accessible for the purposes of the translocation program, including the ridgelines which were relatively flat and open allowing for easy access for machinery. A key challenge however is that there are few existing tracks and that some of the ridgelines are along steep slopes with dense vegetation and rocky granite present. As such it is not possible to translocate all the individuals within the Disturbance Footprint based on a number of factors:

- The cycad is considered to be dead – it is noted that cycads can be dormant for a period and may in some instances raise a pup. However, this is not possible for all cycads and some plants may be determined to be dead by the Specialist Ecologist during the direct count surveys. These plants will not be salvaged and offset at a ratio of 1:2
- Cycads which have poor trunk condition have generally been more susceptible to loss during translocation works despite horticultural treatments. These cycads will be offset at a ratio of 1:2.
- The terrain in some areas will hamper access to the cycads for the purposes of the salvaging activities. Other areas of concern include steep side slopes or where access tracks would require heavy machinery not available until construction commences. Cycads that cannot be salvaged will be offset at a ratio of 1:2. Seed collection will be undertaken from inaccessible locations for salvaging activities, where it is safe to do so.

This will be confirmed following the direct count survey, confirmation on the construction footprint and the engagement of the Specialist Ecologist and transplant specialist. Further there will be an opportunity to microsite infrastructure and clearing footprints following the direct count to avoid cycads in some of these areas.

5. Recipient Site

The translocation of plants from the Mount Hopeful site into other *C. megacarpa* populations, and that the addition of new plants, is likely to enhance the genetic diversity of receiver populations. Seedlings added to any potential offset populations created from translocated plants are also unlikely to lead to outbreeding depression and these would ideally be sourced from multiple locations to reduce the changes of genetic swamping by particular allelic variants.

A number of recipient sites have been identified for the species to be translocated to within the Project locality. The recipient sites allow for the challenges within the local landscape. That is, the sites allow for ongoing access for the purposes of monitoring and management and the habitat is known to support the species and that there is likely to be sufficient carrying capacity.

It is intended that the recipient sites will form part of environmental offset areas for *C. megacarpa*. Further detail pertaining to offsets is provided in the Mount Hopeful Environmental Offset Strategy. The recipient sites will be legally secured and managed in accordance with an offset area management plan.

Suitable areas which can be a recipient site or where recipient sites can be located are considered viable due to the following:

- Presence of *C. megacarpa* (i.e. the sites are in habitat contiguous with the impact area and in some cases the same cycad clusters being impacted);
- The habitat is known or suitable for cycads, noting that it is not uncommon for this species to have clear geographical breaks despite the presence of suitable habitats. Key considerations include the presence of suitable crown cover to protect the plants, especially seedlings and proximity to known cycads which is important for genetic variability, linkage and pollinators;
- Whether the site can link or supplement clusters and/or populations (i.e. enhance the viability of the population) including re-establishing the species in areas where the species has been targeted by landholders;
- The sites are accessible and do not pose a significant safety risk; and
- Threats such as weeds and fires could be mitigated within the recipient sites and adjacent areas.

Site 1 is approximately 99 ha in area and is located within the locality of the Project. The area is known to support cycads and is located within a different catchment to the rest of the Study Area. The site is connective with habitat in the Bouldercombe Gorge Resource Reserve. The site has been mapped by Umwelt and the State as predominantly regrowth associated with RE11.12.1, with numerous cycads in this area.

Site 2 is approximately 1024 ha and has been predominantly mapped by Umwelt as 11.12.6 with areas of 11.12.1 and vine thicket (RE11.12.4). This area was ground-truthed and cycads were detected. This area is located on upper slopes of steep hills making distribution of seeds once the plants are established a benefit of this area.

Site 3 is approximately 624 ha and mapped by the State as high value regrowth (RE11.11.3/11.11.15), with a section mapped by Umwelt as non-remnant, 11.3.25, 11.11.3 and 11.11.15 – there are a lot of cycads in this area and it would be preferred to keep the plants in the same catchment.

Site 4 is approximately 460 ha. The area has been mapped by Umwelt as predominately non-remnant, with patches of regrowth associated with RE11.3.25 and RE11.11.4. This area was ground-truthed in part and only a small number of cycads were detected. Cycads in this area are likely to be associated with Population 5 and where the species has been previously cleared or poisoned.

Site 5 is connective with Don River State Forest. Umwelt has mapped the area as remnant and regrowth predominately associated with RE11.11.3, along with areas of RE11.12.6 and non-remnant areas.

In addition to securing the land, the final location of the recipient sites and the size will be determined following field work to confirm the carrying capacity of the sites and suitability in terms of geology, along with ensuring that risks from the works will not impact on other ecological and cultural values in the area.

Additional field assessments of these sites will need to be undertaken by a suitably qualified and experienced ecologist to determine the following information gaps:

- Soil type(s);
- Vegetative habitat and condition;
- Planting areas and finalising locations for translocated and propagated individuals to go;

- Presence/absence and abundance of *C. megacarpa*. This includes identifying plants to be used as part of the reference monitoring;
- Potential values for or presence of other threatened flora species;
- Presence/absence of pollinators;
- Potential threats and constraints including:
  - Accessibility and site security;
  - Water availability and associated infrastructure requirements;
  - Weed prevalence and potential management requirements;
  - Domestic and feral animal management requirements;
  - Insect attack and soil borne pathogens; and
  - Fire risks.

The findings of the field assessments will be used to inform the recipient site preparatory requirements and support preparation of the recipient area management sub-plan which will include recommended actions to manage the site both prior to and post translocation activities. This will also include addressing the following:

- The specific edaphic conditions and elevation range within which the species is known to occur;
- The population demographics and long-term viability of the population, including:
  - Specific pollination mechanism of the species, and the potential to further fragment the species distribution by reducing cross-pollination between sub-populations;
  - Dioecy of the species[7], and how female and male plants will be distributed to maintain reproductive capacity of the translocated population; and
  - Genetic drift.

The recipient area management sub-plan will form part of the broader offset area management plan for the project. The offset area management plan will be finalised post EPBC Act approval once offset sites are finalised and habitat quality assessments completed. Further detail pertaining to environmental offsets is provided in the Mount Hopeful Environmental Offset Strategy.

The recipient sites are on private properties and access to the sites will be restricted. The locations of the translocated individuals should not be visible from public roads.

Genetics studies indicate that there are no anticipated impacts of outbreeding depression that would result from the translocation of plants from the Mount Hopeful site into other *C. megacarpa* populations and that the addition of new plants is likely to enhance the genetic diversity of receiver populations. Seedlings added to any potential recipient populations created from translocated plants from Mount Hopeful population are also unlikely to lead to outbreeding depression and these would ideally be sourced from multiple locations to reduce the changes of genetic swamping by particular allelic variants.

7 This will be a challenge as the sex of the plants is generally unknown. As noted in Section 4.2 only a small faction of the population can be identified as male or female.

6. Translocation Preparation

6.1 Tagging and In-Situ Condition Assessment

6.1.1 Disturbance Footprint

Pre-clearance Survey Methodology

All *C. megacarpa* individuals within the Disturbance Footprint will be tagged with a unique identification code[8] (fireproof/resistant aluminium tag); marked with hi-visibility paint (nontoxic) and have the following baseline information recorded against their ID number:

- Co-ordinates;
- Height (where applicable) or noting an individual is a seedling;
- Trunk condition (where applicable);
- No. of active and dead pups;
- Foliage development stage and any deformities;
- The presence of invertebrates including potential pollinators;
- The presence and degree of insect attack, along with the predator species present (e.g. *Theclinesthes onycha* and *Lilioceris nigripes*);
- The presence and developmental stage of fruiting material including number of seeds and degree of ripeness. Seeds may also be collected from female plants during this process for propagation in a nursery or bush-house;
- Presence of seedlings and how far and what direction from the parent plant the seedlings are located;
- Overall condition and other relevant observations (e.g. pig attack, fire damage); and
- Current height and crown condition recorded and photo logged (reference position north).

The unique identification code ideally will be comprised of the entity name/project; the year they were first tagged and assessed; and their number in sequence (e.g. BC 22 0001, BC 22 0002, etc).

Seedlings will receive their own unique ID number. However, where applicable, the ID number of their parent will be noted against them in an appropriate data management tool. Seedlings will also be identified using survey markers to assist in locating the plants during the translocation activities.

Any seedlings observed without fronds (i.e. very young seedlings) during in-situ assessments and tagging activities will be collected and grown in the bush-house. Should any additional seedlings that meet this criterion be located during salvage activities, all relevant data will be captured for them (as above) and the transplant contractor will carefully remove and prepare them for transport to the bush-house for optimal growing conditions.

To accommodate any potential margin of error in satellite accuracy (when recording each plants position) and any additional alignment adjustments, all plants within 5m either side of the Disturbance Footprint will be accounted for and have the following information recorded:

- Co-ordinates;
- Height;
- The presence and developmental stage of fruiting material including number of seeds and degree of ripeness. Seeds may also be collected from female plants during this process for propagation in the nursery or bush-house;
- Overall condition and other relevant observations; and
- Current height and crown condition recorded and photo logged (reference position north).

The field team undertaking the tagging and in-situ condition assessment will be led by suitably qualified Ecologist with prior experience with *C. megacarpa* translocation activities. This will ensure that the data collection is consistent with the outlined methodology; adequately captured; and able to be utilised for comparative analysis during future monitoring activities in the recipient site(s). The tagging and assessment activities will begin at least eight (8) weeks prior to translocation activities beginning.

[8] Identifying via a unique code allows individual health and location to be traced over the life of the monitoring program.

All baseline data will be input into the data management tool for analysis and reporting purposes.

Additional baseline data for monitoring purposes (e.g. presence/absence of coralloid roots (cycads) as well as damage during translocation) will also be collected by a suitably qualified and experienced person(s) during translocation activities.

The translocation activities are tentatively scheduled to commence in late 2023. This timeline is subject to approvals being in place, the project proponents timeline for construction and engagement of suitably experienced contractors.

6.1.2 Reference Site

In order to measure the success of the translocation program, the establishment of reference sites will be required so that the temporal variation between the recipient and reference site specimens can be analysed and compared (refer Section 9.1.1). The reference sites will be located in an area nearby to the recipient sites and accessible during the life of the monitoring program. The reference site areas will also be located in an area not subject to future development (e.g. adjacent or contiguous clusters on the same properties).

The reference sites will be a representative sample of the naturally occurring population(s) and will comprise of similar age classes and similar topography and aspect to those translocated as part of the project works.

The reference sites will be established, and first round of baseline information gathered, at the time of the recipient area surveys being completed. The final number of reference sites will be determined as part of the final translocation.

All reference site individuals will be tagged with a unique identification code[9] (fireproof/resistant aluminium tag) and have the following baseline information recorded against their ID:

- Co-ordinates;
- Height;
- Trunk condition;
- No. of active and dead pups;
- Foliage development stage and any deformities;
- The presence of invertebrates including potential pollinators;
- The presence and degree of insect attack, along with the predator species present (e.g. *Theclinesthes onycha* and *Lilioceris nigripes*);
- The presence and developmental stage of fruiting material including number of seeds and degree of ripeness. Seeds may also be collected from female plants during this process for propagation in the bush-house;
- Overall condition and other relevant observations (e.g. pig attack and fire damage); and
- Current height and crown condition recorded and photo logged (reference position north).

The unique identification code ideally will be comprised of the year they were first tagged and assessed; and their number in sequence (e.g. 22 0001 R, 22 0002 R, etc). Where applicable these tags may be placed on fireproof stakes next to the plants.

Seedlings will receive their own unique ID. However, where applicable, the ID of their parent will be noted against them in an appropriate data management tool. Seedlings will also be identified using survey markers to assist in locating the plants during the monitoring activities.

6.1.3 Planting Design/Layout

The findings of the direct counts (preclearance surveys) (Refer Section 4.3 and Section 5.3) will be used to confirm the carrying capacity of the recipient site(s) and inform the planting layout / design.

The optimal spacing between *C. megacarpa* individuals will be 6m which supports future recruitment across the recipient site(s).

[9] Tagging with a unique code allows their health and location to be traced over the life of the monitoring program.

The layout/design will include:

- Location of existing cycads and other values in the area;
- Location of access tracks and fire breaks;
- Location of essential infrastructure (e.g. water tanks, site office/shed, etc);
- Location of any threats;
- Locations for salvaged plantings;
- Locations for salvaged seedlings; and
- Locations for propagated seedlings.

Once finalised, a figure showing the planting layout / design will be provided as an appendix to this Plan.

6.1.4 Recipient Site Preparation

Once the recipient site(s) is secured, Commander *et al* (2018) recommends a number of actions that should be undertaken prior to the translocation of individuals into the recipient sites. This includes:

- Map out the ecological values of the site and any threats to these values. This will act as a baseline for annual monitoring of these values.
- Establishment of fire breaks and access tracks across the wider offset area;
- Map out the presence and extent of weeds and pest fauna (incl. evidence of) across the site. This will act as baseline for management and annual monitoring of these threats as per the relevant biosecurity plan;
- Fencing (where required);
- If applicable, any hazard reduction burns in accordance with the offset management plan[10];
- Establishment of temporary and permanent erosion and sediment controls (where applicable);
- Establishment of any infrastructure required for the horticultural activities, such as water tank and storage area for chemicals.

The above work is subject to requirements of the recipient site and will be detailed in the finalised management plan. All recipient site preparation works will be undertaken in accordance with the landholder agreements and the finalised management plan.

The following actions will be undertaken prior to the commencement of each round of planting activities:

- Finalise the planting design/layouts;
- Establish access tracks within the recipient sites (as per planting design/layouts):
- If applicable, establish fencing around planting areas (this should only be done prior to if it does not impeded movement of machinery during transplant activities);
- Remove and/or minimise of weeds within the immediate planting areas;
- Mark out planting locations within the recipient sites. This activity should be undertaken by the Specialist Ecologist to ensure appropriate spacing within the understorey;
- Commence digging holes of differing sizes in marked out locations (in accordance with planting design/layouts). NB. These holes will vary in size according to the salvaged individuals they will be receiving.

[10] This activity should not be carried out less than eight (8) weeks prior to the planting activities commencing.

7. Translocation Methodology

7.1 Timing

Salvage activities are tentatively scheduled to commence in late 2023 following approval of the project. The salvage works are estimated to take up to 12 – 16 weeks to complete. The timeframe for the salvage activities will be confirmed once a transplant specialist is engaged.

The planting of propagated specimens into the recipient site/s is scheduled to commence in 2025 allowing sufficient time for seed to develop. It is anticipated that the planting of propagated specimens will be conducted annually for up to seven years. Should this timeframe require revision, this Plan will be amended accordingly. Refer to Section 8 for further details.

7.2 Translocation Methodology

The translocation methodology outlined in this Plan is based upon the original 20 step process developed by Dr Paul Forster of the Queensland Herbarium. This methodology[11] has since been refined for consistency with Commander *et al* (2018) and as a result of successful *C.s megacarpa* translocations that occurred for both Department of Transport and Main Roads (DTMR) and LNG projects between 2009 and 2015 led by Ecologica Consulting.

Plants will be directly moved from the salvage site to the recipient sites with no temporary storage area proposed. This will greatly benefit the survival ability of the cycads being salvaged, as was demonstrated by previous translocations done this way for DTMR.

Should any plants which were tagged as part of the works in Section 6.1 but are located outside the Disturbance Footprint and not included in any further monitoring, will have their tags removed, with the plants left in-situ. To inform this works the Disturbance Footprint will be defined on the ground or dGPS will be used to inform the salvage and clearing works.

NB. A refined methodology may be required once the transplant contractor has been engaged; machinery and equipment availability is confirmed; and more detailed recipient site information becomes available. If translocation methods are revised this Plan will be updated and submitted to DCCEEW for their information.

Salvage Site

1. Each plant will be marked on one side with marker paint to ensure they are replanted with a similar north-south orientation and to discourage poaching from the new locality;
2. Tags will be retained on the plant, including where the plant is a multi-trunk and has more than one tag. Where the plant is not tagged, a temporary tag or equivalent identifier will be allocated to it (permanent tag can be allocated once in recipient site). The plant will be GPS'd and relevant data collected on the plant as per tagging and condition assessment methodology (e.g. height, trunk condition, photo etc);
3. With careful consideration of the coralloid root, the area around individuals will be cleared by hand or with machinery (e.g. bobcat or front-end loader) (refer Photos 2 and 3);
4. With the exception of early new growth, fronds will be trimmed back on trunked specimens to where the rachis is attached to the stem(s). All fertile material including seeds and pollen cones will also be removed at this time. Where applicable, these items will be appropriately stored and recorded against the unique identification code in the database. Noted information should include number of seeds and stage of development;
5. To reduce the risk of plants drying out, the trunks and crown areas (though not the crown itself) should be sprayed with an anti-transpirant (e.g. Envy®);
6. Soil around each individual will be loosened using a trenching pattern (either by hand, or ideally with an excavator or backhoe);
7. Each individual will be removed whilst attempting to retain as much soil around the plant as possible. This will either be done by hand (small plants) or with an excavator or backhoe bucket. Care will be taken in retaining soil without damaging the rootball from the weight;

[11] The methodology has been developed by Ecologica Consulting in consultation with the Queensland Herbarium, the Tondoon Botanic Gardens and Australian Natives (transplant specialist).

8. Where applicable, damaged roots will be trimmed with clean/sterile secateurs and a fungicide applied (e.g. Banrot®, Formula 20®) to prevent infection. *NB. Where possible at least 1/3 of the root shall be retained;*
9. All other individuals will be treated with a systemic fungicide to be applied around each rootball;
10. Vitamin B or Seaweed may also be applied to initiate root growth;
11. A photo and assessment of the subterranean trunk will be undertaken once the plant is removed;
12. Plants will be either wrapped in hessian or placed into an appropriately sized bag with handles for transport to the recipient site. Care will be taken to avoid damaging the coralloid root which can be taped to the side of the plant if achievable;
13. During vehicle transport, care will be taken to minimise bruising of plant stems. Heavy plants will be loaded using a soft sling that is slung on a backhoe or excavator bucket and packed using rolls of hessian sacking or similar to protect the trunk;
14. Upon excavation the plants will be immediately transported to the pre-prepared recipient site. If there is a delay, the hessian sacking or alternative will be sprayed with water so the rootball(s) remains moist.

Any seedlings without fronds (i.e. very young seedlings) observed during salvage activities will be carefully removed and prepared for transport to the nursery for optimal growing conditions. These seedlings will not be included in the final count of salvaged individuals, with the plants to be considered propagated individuals (refer Section 8).

The final number of plants translocated will be compared to the number initially tagged and with consideration to those plants which deemed not viable to be salvaged. This information will be conveyed to the Specialist Ecologist who will be onsite during the works and where applicable the numbers in this document will be updated to reflect the final number. This information will also be reported to the project proponent, and where applicable DCCEEW and DES. Further information on the reporting as part of the translocation activities is provided in Section 12.

Photos 2 & 3:Time must be taken to carefully remove soil from around base of plants.

Recipient site

1. Holes at the recipient site will be dug by hand or with an excavator or backhoe. The soil will be loosened, and the hole will not be much deeper than the rootball of the plants being transplanted. Each hole must be at least 1.5 times the size of the plants subterranean trunk;
2. The hessian sacking (or pots) should be removed from each plant as they are placed into the ground. Any roots which have sustained further damage during transit should be trimmed and sprayed with the fungicide powder;
3. Plants will be positioned in new holes to ensure that the north-south orientation from the old locality is maintained;
4. Washed river sand or sandy loam will be packed around the roots and rootball. This will provide a suitable substrate for production of new roots, reduce the risk of new root breakage in heavy soils and promote drainage of excess moisture which can lead to rot. This introduced soil will be free from weed seed;
5. Backfilling will use the original topsoil removed from the recipient site hole. Where necessary, plants will be staked to assist with stabilisation (with multiple stakes or surrounding trees where needed). If applicable, rocks can be placed around the base of the trunk to aid in stability, to provide protection from fires and to insulate roots from hot weather conditions. Where possible, plants will be placed in a vertical alignment;
6. The trunks will be sprayed a second time with an anti-transpirant to prevent them losing too much moisture;
7. The crown of each plant will be sprayed with an insecticide (either Confidor® at a rate of application of 10 mL per 9 L of water or application of Crown® at a rate of application of 5 mL per 9 L of water) after transplant;
8. A systemic fungicide such as Banrot® should be applied at the recommended rate around each rootball area;
9. Depending on local weather conditions, each plant may be watered thoroughly (in addition to that received through systemic treatments);
10. Without damaging the roots, a star picket will be driven into the north side of the ground beside each plant so that its' unique identification tag can be attached with high tensile wire. This will reduce the risk associated with losing the tags over time as well as reduce its likelihood of fire damage and reduce safety risks (e.g. spider bites etc);
11. Any damage incurred to the plant through the transplant process will be recorded and photo-logged for input into the database. This will assist in identifying any future horticultural requirements and inform monitoring analysis when tracking the progress of a plant (particularly if transplant failure occurs);
12. Once transplant is complete, each plant will be photo-logged and height measured. The new co-ordinates for each transplanted individual will also be recorded at this time. All data will be input into the database for future monitoring and tracking purposes.

7.3 Disturbance Footprint Management

To protect the in-situ *C. megacarpa* population and the ecological values within and adjacent the Disturbance Footprint, the footprint will be left in a stable and self-sustaining state following the removal of cycads.

Any rehabilitation works to be undertaken will occur post construction of the wind farm.

In undertaking the salvage works the transplant specialist is required to comply with the relevant environmental management plans, policies and approval conditions applicable to wind farm and where applicable, the following measures will be undertaken post cycad translocation:

- Reinstatement of the disturbed area. Topsoil and subsoil to be re-instated in the same order as extracted to minimise inversion of sub and topsoils. Topsoil to be replaced to match surrounding ground levels;
- Re-profiling of natural contours and drainage lines to their original profile with topsoil spread across the project footprint to minimise erosion and promote vegetation regrowth (refer Photo 4);
- Spreading of any fallen woody debris or rocks across disturbed area to protect the topsoil and provide additional seed stock and fauna habitat. When re-spreading on slopes, tree trunks should be along the line of the contour;
- Reinstatement shall not be undertaken in wet conditions;
- Rock may be stockpiled in the footprint to 1.5 m depth as fauna habitat ;
- No weed species to be introduced and a biosecurity management plan or protocols specific to cycad removal works to be implemented;
- No areas left in an unstable condition;
- Drainage patterns reinstated correctly and drainage lines to be restored as appropriate;

- All work areas, temporary access tracks and other areas that have been compacted by construction activities to be ripped or scarified to relieve compaction and to trap water and seed;
- Access tracks in existence prior to construction are not to be blocked in anyway;
- All waste materials and equipment to be removed from the Disturbance Footprint area once cycad removal works are completed.

Photo 4: Recontouring access tracks to support drainage paths post salvage.

8. Seed Collection, Propagation & Planting

To meet the performance outcomes of a no net loss of *C. megacarpa* individuals, and to replace those lost at a 1:2 ratio it is estimated that 4,563 salvaged and propagated *C. megacarpa* will need to be alive within the recipient sites seven (7) years post translocation and preferably five years post the end of maintenance works. This includes 2,609 translocated individuals and 2,236 propagated individuals (i.e. 1,118 cycads of the 3,727 individuals within the Disturbance Footprint will be required to be replaced at 1:2).

To support this requirement and accommodate likely attrition rates, it is estimated that 6,519 seeds will need to be collected and propagated. This figure incorporates a 1:2 replacement ratio (for expected fail rates through salvage activities (TBC) and plants that cannot be salvaged (TBC)) as well as anticipated seedling survival in terms of seed viability (70% though the natural viability is likely much lower given the number of seedlings present in the field), strike rate (70%) and survival once planted into the recipient sites (70%).

At least 3,194 propagated individuals will be planted into the recipient sites where they will be monitored and managed for a minimum period of two (2) years post translocation.

These numbers will continue to be reviewed by the Specialist Ecologist in response to actual deaths in the translocated cycads, along with seed viability and strike rates.

With the exception of those within the Disturbance Footprint, the seeds will be collected from the wider population (preferably from the Study Area and/or Offset Area) to help ensure that the impacts from the legal harvesting of seeds on the population(s) is negligible (refer Section 8.1.1 and Section 8.1.2).

To encourage genetic variation within the recipient sites, the methodologies outlined below ensure that any seed collected will not be restricted to those clusters/population(s) being directly impacted by the project works.

8.1 Seed Collection Methodology

To meet the requirements of the program, it is anticipated that over 6,500 seeds[12] will need to be collected from both within the Disturbance Footprint and the wider population.

Seed collection, where applicable, will be undertaken in accordance with the *Code of Practice for the Taking and Use of Protected Plants* (Code of Practice) (EHP 2013). This Code of Practice provides standards for the conduct of people involved in the taking, keeping and use of protected plants in Queensland. The standards relevant to the taking of seed for propagation of *C. megacarpa* include the following:

- Taking plants from the wild — general standards;
- A person who intends to take protected plants must obtain the permission of the landholder of the land where collecting is to be undertaken;
- The harvester must contact the landholder before starting any activity and must comply with any reasonable request or direction in relation to the use of weapons and vehicles;
- The officer in charge of State land must be informed and shown a copy of the permit or licence to take protected plants on State land;
- Harvesters should take care to minimise damage to any understorey plants including flowers and groundcovers by trampling under foot or by vehicles;
- All nesting sites, tree hollows and other forms of shelter for protected animals must be left undisturbed;
- Harvesters must take precautions to prevent themselves, their vehicles and equipment spreading weed seeds, unwanted plants and pathogens into and out of harvest areas;
- Clean tools should be used (use of soap and water is acceptable) and they should be cleaned before moving to a new location;
- Soil should be removed from boots and shoes and propagules from clothing before moving to a new location;
- Vehicles should be routinely washed, within the region where the vehicle was last used, to remove soil and propagules, before moving to a new region. Tyres should be inspected to ensure plant propagules and soil (e.g. burrs) are not caught in the tread or clinging to sidewalls;
- Liaise with land managers to determine local requirements or restrictions which may be in force with regard to dieback or other plant or animal diseases;

12 This assumes that 1,239 plants will be lost as part of the salvage works which may not be the case given the active measures planned in this document

- Harvesters must take precautions to minimise damage to soils, roads and tracks, especially in wet conditions. Vehicle access to harvesting areas should only be on roads and tracks as directed and approved by the landholder. Any inadvertent damage to roads and access tracks must be repaired and restored to at least the pre-existing condition as required to maintain function, safety and environmental management.
- Livestock must not be interfered with and any disturbance to these animals must be kept to a minimum. Any sightings of injured, sick or dead stock must be reported immediately to the landholder;
- All gates must be left as they are found, closed if hung closed, and left open if hung open;
- Any damage caused to fences, gates or other property must be reported immediately to the landholder;
- The harvester must be aware of requirements of the *Workplace Health and Safety Act 2011* (Qld) and comply with provisions of that legislation;
- All fires must be reported immediately to the landholder and the local fire authority;
- Taking of seed and other propagating material — standards;
- In order to maximise biological diversity in the harvested material, seed is (where possible) to be taken from five or more plants of the same species at least 100 metres apart;
- Take only as much seed as is required and ensure all cuts are judicious;
- No more than 20 percent of the fruits or other propagating material from any one plant is to be collected in any 12-month period;
- Where possible, take only fully ripe seed. All cycad seed harvested must be ripe and shed from the plant or be on the point of being shed;
- Because proof of origin of seed might be required, at collection all containers should be labelled clearly with the species of plant, date and place of collection, harvester's name and address and any licence number.
- All collected seed should be transported and kept in containers under conditions suitable for its maximum viability.

8.1.1 Inside Disturbance Footprint

All fully ripe cycad seeds within the Disturbance Footprint will be collected in accordance with relevant approvals prior to translocation of individuals occurring. Collection is likely to occur during the direct count survey and during the translocation activities which are expected to commence in late 2023.

The number of seeds within the footprint is currently unknown and will be confirmed during the direct count surveys. Noting that based on similar demographics observed in adjacent populations there could be up to 3,000 seeds present in the footprint noting the ecology of the species as a key limitation.

Seeds will be collected and bagged according to either their parent plants unique ID or the cluster in which they are located[13]. The following information recorded for each bag collected:

- Bag No.;
- No. of seeds in bag;
- Parent ID no. or cluster no. (whichever is applicable);
- Date collected;
- GPS co-ordinates;
- Presence of predation (eaten by fauna).

Do not place seeds picked from adult plants and seeds found on the ground into the same bag if the origin of those on the ground is not certain.

The field team undertaking the seed collection will be led by a suitably qualified and experienced person(s) to ensure that:

- Seeds are only collected when fully ripe and either ready to drop from the parent plant or have already dropped from the parent plant;
- The data collection is consistent with the outlined methodology, is adequately captured and is able to be utilised for comparative analysis during future monitoring activities during propagation activities and within the final recipient site(s).

[13] In rare instances, seed found on the ground away from the parent plant may occur. Where there is uncertainty regarding which female the seed belongs to, the cluster ID is acceptable.

Do not place seeds picked from adult plants and seeds found on the ground into the same bag if the origin of those on the ground is not certain.

Any seedlings observed without fronds (i.e. very young seedlings) during in-situ assessments and tagging activities will have the relevant data captured and will be collected, appropriately stored and transported for growing in the nursery. The Specialist Ecologist will ensure these are delivered to the nursery and/or bush-house within an appropriate timeframe. Any additional seedlings without fronds located during salvage activities will have this same process undertaken.

8.1.2 Outside Disturbance Footprint

Seed collection will also be required outside of the Disturbance Footprint, subject to approval, with the majority of the seeds to be sourced from the surrounding areas. Based on current projections there is the potential for there to be 142,000 plants in the Mount Hopeful population, while there is also a high likelihood that this population is also linked to the Don River State Forest population which is in excess of 100,000 individuals.

To minimise the risk of the seed collection works adversely impacting the population it is proposed to sample from a large area and that the collection will occur over multiple years (min. 2 years) due to the following factors:

- 20% of seeds on a plant to be collected (generally between 30 and 60 seeds on a plants);
- Not all females fruit each year and fruit is generally present on less than 20% of the plants based on similar projects in the region;
- Cycads have a low level of recruitment in the wild.

The number of seeds to be collected outside of the Disturbance Footprint will be confirmed following the direct count and the translocation activities. If 2,000 seeds[14] can be collected from the Disturbance Footprint, approximately 5,200 seeds will need to be collected. Assuming that there are 50 seeds on a plant[15] and a collection rate of 20%, 520 fruiting female cycads would need to be sampled. Noting that for other projects only 50% of the females sampled had seeds and the level of development varied across the plants.

There is a high likelihood that the required number of seeds can be collected as the local cycad population is projected to be in excess of 100,000 individuals. Based on observations from other surveys female plants are likely to represent 18% of the adult plants, however, this does not mean they will have seeds present. The sampling methodology will allow for the take of seeds from the same plant if required over multiple years, while more recent observations also noted a large amount of seedlings being present compared to previous surveys.

Each seed collection trip should occur during the peak fruiting period (to improve propagation success). Current knowledge suggests this to be between March and May/June (Queensland Herbarium, 2007), with collection to be completed after a two or three year period (2024 to 2026). The seed collection will aim to avoid areas subject to previous seed collection activities undertaken as part of the LNG transmission pipeline projects or other recent wind farm developments. Genetic analysis suggests that plants taken from an area will bring genetic diversity to any receiver population.

In accordance with permit conditions, each seed collection trip will harvest fully ripe Cycad seeds from the approved habitat areas. The plants harvested from will be tagged with a fireproof tag containing a unique ID code in order to track the viability of her seed and determine future collection options.

Using pro-forma (hard copy or electronic), each plant in which seed is harvested from will have the following data captured:

- Co-ordinates;
- Height;
- Trunk condition incl. if it's a single or multi trunked specimen;
- No. of active and dead pups;
- Foliage development stage and any deformities;
- The presence of invertebrates including potential pollinators;
- The presence and degree of insect attack, along with the predator species present;
- The developmental stage of fruiting material including number of seeds and degree of ripeness;
- Overall condition and other relevant observations;
- A photo log showing trunk and crown condition.

14 The number of females and seeds within the Project Disturbance Footprint is currently unknown, though the level of development varied across the site – ripe, unripen, overripe etc. As such not all seeds would be available during the translocation works
15 Average number of seeds per plant observed on other similar projects was 41 seeds per plant

Using pro-forma (hard copy or electronic), the following information will be recorded for each bag collected:

- Bag No.;
- No. of seeds in bag;
- Parent ID no. (tag no.);
- Date collected;
- GPS co-ordinates;
- Presence of predation (eaten by fauna).

Do not place seeds picked from adult plants and seeds found on the ground into the same bag if the origin of those on the ground is not certain.

The field team undertaking the seed collection will be led by a suitably qualified and experienced person(s) to ensure that:

- Seeds are only collected when fully ripe and either ready to drop from the parent plant or have already dropped from the parent plant;
- The data collection is consistent with the outlined methodology, is adequately captured and is able to be utilised for comparative analysis during future monitoring activities during propagation activities and within the final recipient site(s).

At the end of each seed collection trip, a copy of the pro-forma(s) or the data input into a spreadsheet will be forwarded to the Specialist Ecologist for migration into the data management tool.

8.2 Propagation and Management

In consultation with key nursery personnel and the Specialist Ecologist, project proponent will develop and implement specific propagation, horticultural management and monitoring methods for *Cycas megacarpa* seeds that are collected as part of this program.

As a minimum, these methods will detail how the seeds will be propagated and managed in nursery conditions under the supervision of a suitably qualified and experienced horticulturist. The lead horticulturist will ensure that the seeds and any treatments applied can be tracked from collection; through the propagation process; and until they are transported to the recipient sites for planting out.

Once finalised, these methods will be included either within this section or as an appendix to this Plan.

8.3 Planting Out

As part of this program, *C. megacarpa* will be grown from seed within a controlled nursery or bush-house environment and planted into the recipient sites once sufficient maturity is achieved. Due to the number of propagated individuals required and the limited availability of seeds in the wild, it will take several years to collect, propagate and plant out the specimens within the recipient sites (3-5 years from collection).

Project proponent will confirm the dates for each planting round at least six (6) months in advance. This will be communicated to the nursery personnel so that appropriate preparatory measures can be undertaken.

Prior to planting out, propagated specimens will undergo a hardening off period in order to prepare them for local conditions at the recipient site, this is particularly relevant for watering rates, humidity levels and sun/shade tolerances under nursery conditions. This hardening off should commence at least six (6) months prior to scheduled planting activities.

Once ready for planting out, the propagated individuals will be marked with hi-visibility paint on their north facing side (nontoxic) and have the following baseline information recorded against their ID:

- Crown condition;
- Foliage development stage and any deformities;
- The presence of invertebrates including potential pollinators;
- The presence and degree of insect attack; and
- Overall condition and other relevant observations.

If it does not already have one, each plant will be individually tagged with a unique identification code (fireproof/resistant aluminium tag)[16].

It is recommended that a photolog be taken to confirm the condition of the plants prior to leaving the nursery and/or bush-house.

Care will be taken in the transportation of plants from the nursery and/or bush-house to the recipient sites, and to ensure that the plants are kept cool during transportation.

The planting of propagated individuals will follow the methods outlined in Section 7.2 (recipient site).

[16] This tag must allow the plant to be traced back to the parent plant and the associated monitoring captured during its time in the nursery/bush house.

9. Data Management Tool

All data collected will be input into an appropriate, project specific data management tool that will allow for the monitoring team to track the health of the translocated and reference site individuals over time and report on the findings.

Separate, component specific spreadsheets and photo management systems may be used by the Specialist Ecologist, site management; seed collection; and nursery personnel. This data will be collated; kept within a central repository; and used for reporting purposes by the Specialist Ecologist and the project proponent.

10. Horticultural Management (Recipient Sites)

Outlined below are specific measures relating to the management of salvaged/transplanted individuals within the recipient sites. It is expected that the horticultural management of these individuals will occur over a minimum period of two (2) years.

The duration of the management and maintenance requirements for *Cycas megacarpa* are based on both the guidelines outlined by Commander *et al* (2018) and horticultural management programs previously undertaken for *C. megacarpa* translocations in Central Queensland. As a minimum, the following shall occur:

- Depending on rainfall and soil moisture, each plant shall be given up to 15 litres of water once per month for the first 12 months into the post translocation program or as appropriate (higher frequency may be required in drier periods and lower in the wet season). The watering regime should be staggered down over months 13 to 24 so that plants are sufficiently hardened off to local conditions at the end of a two (2) year period;
- A soil moisture meter should be used to determine water requirements within the recipient site;
- Plants shall be given an appropriate growth stimulant at least monthly until new signs of growth are clearly visible;
- When Cycads begin to show signs of growth, they should be sprayed thoroughly with a systemic insecticide (e.g. Crown or Confidor) to reduce insect attack. These systemic insecticides should be applied at a high concentration (eg 5ml Crown per 9L of water; 10ml Confidor per 9 litres of water)[17];
- Plants will be checked for insect attack at least fortnightly for the first six (6) months[10] of the post translocation program and then as required (min. monthly inspections). If pest attack is observed, particularly on new growth, plants will be managed accordingly;
- Plants will be checked within 1-2 weeks following a high rainfall event to mitigate against severe insect attack (particularly around the Cycad base)[18];
- Plants should be treated with an appropriate fungicide once a month for the first 6-12 months and then as required for the next 12 months;
- Plants will be checked for signs of rot and/or pest intrusion into the base and subterranean base at least fortnightly for the first six months of the post translocation program and then as required (min. monthly inspections). If rot or pest intrusion is observed, plants will be managed with appropriate fungicides and pesticides accordingly;
- The pH levels around a sample of salvaged Cycads will be checked at least monthly for the first six (6) months to ensure soil chemistry is optimal.
- Application rates of all horticultural treatments (including watering) will be recorded on a pro-forma (hard copy or electronic) for each site visit. Any observations such as rot and/or additional ameliorative measures undertaken on specific plants shall also be recorded on the pro-forma during each visit.
- The pro-forma data will be entered into an appropriate database such as excel with copies sent to the Specialist Ecologist on a monthly basis. This will allow for data migration into the larger program management tool maintained by the Specialist Ecologist.

Specific measures relating to the management of the recipient site(s) in general will be outlined in a management plan for the areas (forming part of the broader offset area management plan) and agreements between project proponent and the landholder(s). Activities are likely to include:

- Fire breaks will be established around the recipient sites and offset area. Fire breaks will be inspected and managed at the beginning of each dry season. Fuel loads around translocated plants will be removed or reduced to manage risk;
- Weeds within the recipient site will be managed. The focus of weed reduction will be in areas containing *C. megacarpa*;
- Pest species, particularly pigs (*Sus scrofa*) will be managed within the recipient areas and larger offset area;
- Site fencing which may be established around the recipient site(s) to exclude cattle for at least two (2) years post translocation.

[17] This is particularly relevant for the first flush post translocation where frond development is critical to support root development. After this, insecticides and herbicides should be scaled back to support the re-establishment of pollinators around translocated individuals.

[18] Often severe insect attacks, particularly by blow fly's on the root systems of the Cycads, coincides with high rainfall events. If a high rainfall event occurs (e.g. spring rains) outside the fortnightly maintenance checks, it is recommended that the contractor undertake a maintenance check 1-2 weeks following the event.

10.1.1 Horticultural Management Schedule (Recipient Site)

Once planted into the recipient sites, salvaged and propagated individuals will be managed by suitably qualified and experienced horticultural personnel for a minimum period of two (2) years following planting.

A tentative schedule is provided in Table 2 and Table 3 below. These schedules will be updated as required to reflect the most current information regarding planting schedules. Noting that the Table 3 is dependent on the seed collection activities and timeframe required to propagate the seeds.

Table 2: Tentative horticultural maintenance schedule (salvaged individuals)

Date	Management Requirement (salvaged)	Date	Management Requirement (salvaged)
Month 1	Fortnightly	Month 13	As needed
Month 2	Fortnightly	Month 14	As needed
Month 3	Fortnightly	Month 15	As needed
Month 4	Fortnightly	Month 16	As needed
Month 5	Fortnightly	Month 17	As needed
Month 6	Fortnightly	Month 18	As needed
Month 7	At least Monthly	Month 19	As needed
Month 8	At least Monthly	Month 20	As needed
Month 9	At least Monthly	Month 21	As needed
Month 10	At least Monthly	Month 22	As needed
Month 11	At least Monthly	Month 23	As needed
Month 12	At least Monthly	Month 24	As needed

Table 3: Tentative horticultural maintenance schedule (propagated individuals – post translocation)

Date	Round 1	Round 2	Round 3	Date	Round 2	Round 3
Month 1	Fortnightly^	-	-	Month 26	As needed	Fortnightly
Month 2	Fortnightly	-	-	Month 27	As needed	Fortnightly
Month 3	Fortnightly	-	-	Month 28	As needed	Fortnightly
Month 4	Fortnightly	-	-	Month 29	As needed	Fortnightly
Month 5	Fortnightly	-	-	Month 30	As needed	Fortnightly
Month 6	Fortnightly	^	-	Month 31	As needed	Fortnightly
Month 7	At least monthly	-	-	Month 32	As needed	At least monthly
Month 8	At least monthly	-	-	Month 33	As needed	At least monthly
Month 9	At least monthly	-	-	Month 34	As needed	At least monthly
Month 10	At least monthly	-	-	Month 35	As needed	At least monthly
Month 11	At least monthly	-	-	Month 36	As needed	At least monthly
Month 12	At least monthly	Planting out	-	Month 37	As needed	As needed
Month 13	As needed	Fortnightly	-	Month 38	-	As needed
Month 14	As needed	Fortnightly	-	Month 39	-	As needed
Month 15	As needed	Fortnightly	-	Month 40	-	As needed
Month 16	As needed	Fortnightly	-	Month 41	-	As needed
Month 17	As needed	Fortnightly	-	Month 42	-	As needed
Month 18	As needed	Fortnightly	^	Month 43	-	As needed
Month 19	As needed	Fortnightly	-	Month 44	-	As needed
Month 20	As needed	At least monthly	-	Month 45	-	As needed
Month 21	As needed	At least monthly	-	Month 46	-	As needed
Month 22	As needed	At least monthly	-	Month 47	-	As needed
Month 23	As needed	At least monthly	-	Month 48	-	As needed
Month 24	As needed	At least monthly	Planting out	Month 49	-	As needed
Month 25	As needed	As needed	Fortnightly			

Table note:

^ The project proponent or Specialist Ecologist notifies the nursery team that planting will occur in 6 months time (or 6 months prior) for the horticulturist to prepare the site for the planting activities)

11. Monitoring

11.1 Ecological Monitoring

The ongoing care, management and monitoring of translocated individuals is vital for success of any translocation program. Changes to the recipient site over time will need to be recorded so that any problems or threats to the translocated plants can be detected and responded to early, minimising impacts to the individuals. Monitoring will also be critical in evaluating the success of the translocation program and provide invaluable data for future translocation efforts, particularly those relevant to cycad species which are often conservation significant species (Queensland Herbarium 2007).

The monitoring program will be led by a suitably qualified and experienced Specialist Ecologist (refer Section 0). Support ecologists may not have direct experience with cycad translocation but will have experience in carrying out ecological monitoring including data collection and reporting.

The monitoring of salvaged and reference site individuals will be undertaken for a minimum of seven years post translocation. It is anticipated that propagated individuals will be planted out over several years and will be monitored for a minimum of two (2) post translocation (per planting round).

A monitoring schedule has been outlined in Section 11.1.3.

The monitoring results will be forwarded to DES and DCCEEW annually for at least five years following the final planting of salvaged and translocated specimens (refer Section 12.1).

11.1.1 Reference Site Monitoring

In order to measure the success of the translocation program, the establishment of four reference sites will be required so that the temporal variation between the recipient and reference site specimens can be analysed and compared. These sites will be located in a nearby area that can be accessed during the life of the monitoring program and will be located in an area not subject to future development (e.g. adjacent or contiguous clusters on the same properties).

The reference sites will be a representative sample of the naturally occurring population(s) and will comprise of similar age classes and similar topography and aspect to those translocated as part of the project works.

These sites will be monitored annually, with section 6.1.2 outlining the methodology to be adopted for the establishment of these sites. The data collected at these sites will be similar to that proposed for the translocated plants (refer Section 11.1.2).

It is anticipated that the findings at the end of the monitoring period will assist in determining the level of translocation success.

11.1.2 Monitoring Methodology

Observation data for each translocated specimen and reference site specimen will be recorded against its unique identification code on a pro-forma (hard copy or electronic). By matching the species to the sequentially listed codes, the margin for error can be reduced and all species can be accounted for and located straight away (the absence of data against a code on the spreadsheet will identify the need to locate it before the end of the monitoring event).

The following observations will be made about all targeted individuals within each recipient site and reference site during the relevant scheduled monitoring event (refer Section 11.1.3):

- Firmness in ground (root development indicator);
- Trunk condition (stress indicator);
- No. of active and dead pups (stress indicator);
- Frond development stage and any deformities (indicator for root development and stress);
- Presence and developmental stage of megasporophylls (females) and number of seeds present;
- Presence and developmental stage of pollen cones (male) including notable shedding;
- Presence and severity of herbivory (growth inhibition indicator);
- The presence of invertebrates including putative pollinators;

- Where applicable, the severity of an invertebrate attack (other than foliar) will also be noted (visual only), along with the presence of predator species such as *Theclinesthes onycha* and *Lilioceris nigripes*);
- The presence of vertebrates (e.g. frogs and birds) and growth abnormalities;
- Survival status (dead/alive). *NB. If a plant appears to have died (spongy appearance or bark falls off and crumbles), a photograph of the individual will be taken (where possible) for final analysis and close out purposes;*
- Measurements of recruitment including germination rates around maternal parent plant; developmental stage and survival rates;
- Weather data from an onsite weather station or similar.

A subset of salvaged, propagated and reference site individuals will be photo-logged on a 12-monthly basis[19]. This subset will be representative of age and condition classes for all groupings and be at least 20% of each grouping in size. Once identified, the subset will not change from year to year, in that the initial subset will be tracked for the life of the program. For propagated individuals, this subset should be chosen for each plantout. Photologs will include being photographed alongside a measuring staff from the same reference position (north).

If a fire (prescribed or wildfire) travels through any of the recipient sites during the monitoring program, the following information will be collected from each individual noticeably impacted:

- Level of impact to foliage and trunk or stems;
- If fruiting, the number of seeds burnt and stage of ripeness at time of being burnt (if able to tell);
- Level of observable stress to plant as a whole (i.e. has the plant died back, broken off, only partially burnt, etc); and
- Rate of recovery (new growth).

At least two (2) permanent photo points will be established in each of the recipient sites to visually record any changes to community composition and structure over the life of the monitoring program. These points will aim to capture as much area of the sites as possible including areas containing salvaged individuals and control site populations.

Monitoring data will be input into the data management tool for analysis and reporting purposes.

Any necessary amendments to the monitoring requirements should be amended in consultation with relevant government agencies.

11.1.3 Monitoring Schedule

Tentative monitoring schedules have been provided in this section. These schedules are subject to revision and will be finalised in accordance with approval conditions and confirmed dates for the translocation program.

Salvaged individuals

Salvaged individuals will be monitored for a minimum period of seven years following final planting. A final round of monitoring will occur as part of the close out of the translocation program.

Monitoring frequency has been developed based on the timing of the salvage activities; the build up to the first wet season; development rates of the plants and anticipated monitoring requirements as per approval conditions. Indicative monitoring requirements for salvaged individuals:

Year 1:	Monthly monitoring for first 12 months.
Years 2 and 3:	Bi-monthly monitoring.
Years 4 and 5:	Quarterly monitoring (four (4) rounds).
Years 6 and 7:	Bi-annual monitoring (two (2) rounds) including final round of monitoring.
Years 8 to 14:	Every two years, and where applicable on as basis
Year 15:	Final monitoring event (2039) to confirm that The Plan has been successful with a report provided to DCCEEW and DES.

Monitoring post year 7 (2031) will primarily be on an as needs basis including in response to natural events in the area. A close out monitoring round will occur in year 15.

[19] For consistency, this should be carried out during the same time each year.

Propagated individuals

It is anticipated that propagated individuals will be planted out into the recipient sites over several years (e.g. 2026, 2027 and 2028). Seed collection (within the Disturbance Footprint) is expected to commence as part of the direct count activities and/or the translocation activities scheduled for late 2023. Based on the current projections, between 1,000 and 2,000 plants may be ready for propagation in 2026, though the preference is plant out during the cooler months.

Each round of plantings will be monitored for up to five (5) years post translocation. A final round of monitoring will occur as part of the closing out of the translocation program. This is currently scheduled for 2031 but may be as late as 2033.

Monitoring frequency has been developed based on the timing of the planting activities; the build up to the first wet season; development rates of the plants and anticipated monitoring requirements as per approval conditions. Indicative monitoring requirements for propagated individuals:

Year 1:	Monthly monitoring for first seven (7) months. Bi-monthly monitoring (three rounds) for remainder of 1st year.
Years 2:	Bi-monthly monitoring (three rounds) for the first six (6) months. Quarterly monitoring (two rounds) for remainder of 2nd year.
Years 3 and 4:	Quarterly monitoring (four (4) rounds) per year, with the potential that bi-annual monitoring is suitable for year 4.
Year 5:	Bi-annual monitoring (two (2) rounds).
Final year:	One (1) final event to close out the program.

Post 2031 monitoring will occur every two years up to 2039, with this monitoring to occur concurrently with the salvaged individuals.

Reference site monitoring

Reference site individuals will be monitored on an annual basis for the duration of the translocation program. It is expected that monitoring at the reference site will occur annually with the first monitoring event will occur in late 2023 and the final round will be undertaken during 2031 to support the closing out of the program.

Monitoring of the reference site individuals will occur post 2031 every two years in line with the salvaged individuals monitoring program.

Reference sites will also be monitored as part of final monitoring works planned for 15 years post the translocation event.

11.2 Nursery Monitoring (Propagated Individuals)

In consultation with key nursery personnel and the Specialist Ecologist, the project proponent will develop and implement specific propagation, horticultural management and monitoring methods for *C. megacarpa* seeds that are collected as part of this program.

Monitoring within the nursery/bush house environment will be undertaken by suitably qualified and experienced horticultural personnel. Whilst under these controlled conditions, the following information will be captured monthly and forwarded to the programs Ecologist for collation and input into the data management tool and reporting requirements.

- Strike rates from each seed batch (linked to parent ID's);
- Mortality rates post germination (linked parent ID's);
- Frond growth against the photo log (Photo log will include the different stages of frond growth on Cycads from spikes (S) to advanced new growth (ANG));
- Horticultural treatments given including but not limited to fertiliser rates, watering rates, herbicide rates, insecticides rates;
- Presence / absence of insect attack.

A subset of propagated individuals from each collection and propagation round will be photo-logged on a 12-monthly basis[20]. Each subset will be representative of growth stages, condition classes and collection locations and be at least 20% of each grouping in size. Tags or identifying features must be clearly visible in the photo logs.

Once planted into the recipient site the methodology outlined in Section 11.1.2 will be adopted.

Any necessary revisions to the monitoring requirements should be undertaken in consultation with relevant government agencies.

[20] For consistency, this should be carried out during the same time each year.

12. Reporting and Communication

12.1 Ecological Reporting

Reporting will be prepared and submitted to the project proponent for the duration of the translocation program. This reporting will then be submitted to DCCEEW and DES for their information.

12.1.1 Pre-translocation

A summary of the in-situ tagging and condition assessments will be submitted to the project proponent by the Specialist Ecologist upon completion of the activity. This summary will include final salvage numbers, age class structure and overall health of specimens within the Disturbance Footprint.

The Specialist Ecologist will liaise with both the project proponent and lead nursery personnel on the outcomes of any ripe seed collection that occurs during the tagging and in-situ condition assessments. The Specialist Ecologist will liaise with the lead nursery personnel to organise for transportation and receipt of the seed into the nursery and/or bush-house. The relevant data pertaining to these individuals will also be forwarded to the lead nursery personnel for incorporation into their database tool.

12.1.2 Translocation Activities

Salvaged individuals

Fortnightly updates on salvage activities and its progression, particularly in relation to finalisation will be submitted to the project proponent by the Specialist Ecologist. This may be supplemented by information provided by the transplant specialist.

A final summary of the salvage outcomes will be submitted upon completion of the activity to the project proponent by the Specialist Ecologist. This summary will include the total salvage numbers, total number of seeds transported to the nursery and/or bush house from the Disturbance Footprint, overall health of the specimens and any damage that occurred during salvage activities. This may be supplemented by information provided by the transplant specialist.

Where seedlings without fronds are identified from within the Disturbance Footprint, the Specialist Ecologist will liaise with both the project proponent and lead nursery personnel to organise for transportation and receipt of these individuals into the nursery and/or bush-house. The relevant data pertaining to these individuals will also be forwarded to the lead nursery personnel for incorporation into their database tool.

Propagated individuals

For each scheduled planting out of propagated individuals (~3), fortnightly updates on planting activities and their progression, particularly in relation to finalisation will be submitted to the project proponent. This may be supplemented by information provided by the transplant specialist.

A summary of completion for each scheduled plantout will be submitted to the project proponent. These summaries will include the total planted numbers, the overall health of the specimens and any damage that occurred during planting activities. This may be supplemented by information provided by the transplant specialist.

12.1.3 Post Translocation

Post translocation activities will involve three (3) forms of ecological reporting.

With the exception of annual events, a short report outlining the findings will be prepared after each monitoring event and submitted to the project proponent by the Specialist Ecologist. This report will summarise the monitoring outcomes within the transplanted individuals. This may be supplemented by information provided by the horticultural team.

Key discussion points will include:

- Survival rate and overall condition;
- Observed stress factors;
- Reproductive capacity;
- Horticultural treatments.

Annual reporting will be completed and will collate and discuss data captured to date. As a minimum, this report will provide a discussion on: observed stress factors, horticultural treatments, rate of propagation success and continued survival; any temporal variation between the transplanted and reference site specimens including attrition and recruitment rates; and the current level of translocation success against the criteria (refer Section 14.1). The annual reports will be provided to the project proponent for submission to DCCEEW and DES.

A final report at the end of the monitoring program will be prepared and finalised within two (2) months following the final monitoring event. This report will be in accordance with approval conditions and will provide a discussion on: the success or failure of certain horticultural treatments; the rate of propagation success or failure; any temporal variation between the transplanted and reference site specimens including attrition and recruitment rates; and the level of translocation success against the performance outcomes (refer Section 14.1). The final report will be provided to the project proponent for submission to DCCEEW and DES.

12.2 Horticultural Reporting

12.2.1 Recipient Site

A summary outlining the frequency and rates of horticultural treatments (incl. watering) will be submitted to the project proponent on a quarterly basis for the duration of the post translocation horticultural program.

A copy of the summary as well as spreadsheet inputs will be forwarded to the Specialist Ecologist on a monthly basis from horticultural contractors. This information will be collated for migration into the data management tool.

This data will be used to analyse treatment success, particularly for those plants subject to translocation stress.

A final report at the end of the two (2) year horticultural program will be prepared and finalised within one (1) month following the final management visit. As a minimum, this report will include details of all treatments applied (including water) and their success or failure.

12.2.2 Nursery

Whilst under nursery conditions, a quarterly summary outlining strike rates, mortality rates (post germination), overall growth development and horticultural treatments administered (incl. watering) will be submitted to the project proponent.

A summary as well as the accompany spreadsheet data will be forwarded to the Specialist Ecologist (monthly basis). This information will be collated for migration into the data management tool.

This data will be used to analyse propagation success as well as the overall viability of the sub-populations in which seed has been collected from.

A final report at the end of the propagation program will be prepared and finalised within one (1) month following the final management visit. As a minimum, this report will include details of all treatments applied (including water); the strike rates from each seed batch, and mortality rates from each seed batch post germination, and any lessons learnt that could be applied to future success.

12.3 General Communication

Regular contact will be maintained with the project proponent and if applicable, the landholders throughout the duration of the translocation and monitoring programs.

Contact between the Specialist Ecologist and the lead horticultural personnel (recipient sites) will be maintained on a regular basis for the first two (2) years post translocation and then as needed for the remainder of the monitoring period. Contact will include:

- Notifying the landholder(s) and the project proponent of scheduled site visits at least one (1) week prior to a monitoring/management event;
- Contact between the project proponent, the Ecologist and lead horticultural personnel either during monitoring or within one week of the field inspection if severe stress/death of a plant is noticed, including the presence of significant numbers of insects and/or insect attack on any of the translocated specimens. This will allow relevant parties to organise the necessary maintenance and management requirements to address the issue. *NB. This will occur only for the duration of the horticultural maintenance contract*.

Contact between the Specialist Ecologist and the lead horticultural personnel (nursery) will be maintained on a regular basis for the duration of the seed collection and nursery program.

The project proponent will confirm the dates for each planting round at least six (6) months in advance. This will be communicated to the Lead nursery personnel so that appropriate preparatory measures can be undertaken.

12.4 Translocation Plan updates

This Plan provides information based on data that is available at this time. It is intended the Plan will be updated at key intervals as more detailed information is gathered and survey results considered.

It is intended the Plan will be updated at the following stages:

1. Post direct count surveys confirming final numbers in the Disturbance Footprint and numbers to be translocated. In addition, the number of seedlings to be collected outside of the Disturbance Footprint will be revised.
2. Post survey of the recipient site locations and finalisation of the recipient area management sub-plan.
3. A review of the Plan will occur annually and if revisions are required the Plan will be updated and submitted to DCCEEW and DES.

13. Correction and Prevention

It is expected that where practically possible, relevant parties will either commission or undertake the necessary maintenance and management requirements to mitigate the risks by maintaining individuals in a healthy condition and ensuring that the recipient site is effectively managed.

There is currently no reason to think that the translocation activities would fail if the CTMP is correctly implemented. This plan has been developed in consultation with a range of relevant experts and has been successfully implemented on a number of cycads program in the past decade.

Risks to the program failing may include:

- Translocated individuals dying – the program recognises that there will a natural attrition rate with it expected that a minimum of the 70% of salvaged and propagated individuals will survive. The measures outlined in the plan aim to ensure that this number is maintained.
- Hot bushfire impacting transplanted/propagated individuals is probably the biggest risk to the program failing. Though bushfire impacts on existing populations may impact the program by reducing the availability of seeds, pollinator relationships and/or the long-term viability of the population.
- Juveniles being smothered by weeds or seed recruitment being reduced through feral pigs.
- Propagated seeds not germinating.
- Illegal harvesting or clearing – low risk as the recipient sites are located on private land with limit to no public access.

Outlined below are specific corrective and/or preventive actions associated with the different the different components of the CTMP.

13.1 Construction Impact Area

In order to minimise the risk of accidental clearing, the extent of clearing works will be clearly delineated both prior to and throughout vegetation clearing and construction activities, including the salvage works. These clearing extents will be regularly inspected by the project proponent representative. This will ensure retained *C. megacarpa* are not disturbed during clearing or construction activities.

Measures will also be included as part of the project's final vegetation management plan for the salvaging of Cycads individuals potentially missed during the initial translocation activities (i.e. there is a risk given the local topography and landscape that Cycads may be missed). A preclearance survey will be undertaken to confirm the presence of any untagged individuals.

Should any unauthorised clearing occur, the onsite Environmental Officer will record the nature of the breach including its GPS location and provide the information to the project proponent within 24 hours of occurring. This information will be used to assess compliance with permit conditions and determine action to be taken.

No unauthorised clearing of *C. megacarpa* will occur once the wind farm becomes operational.

13.2 Translocated Individuals

It is reasonable to expect a degree of translocation failure and acceptable limits have been outlined in Section 14.1 based on similar programs undertaken since 2008. To support translocation success, Section 10 outlines measures that should reduce the risk of translocation stress and predation on the transplanted individuals.

Should any of the following be observed by either the horticultural and/or ecological personnel within the defined horticultural management periods, a series of measures will be undertaken, including:

- Severe stress/death of a plant; and/or
- The presence of significant numbers of insects; and/or
- Severe pest attack.

The project proponent, the lead horticulturist and the Specialist Ecologist will be made aware of the issue, and they will determine if corrective actions need to be implemented.

For severe stress/potential death of plant(s), the horticultural personnel will be given a list of impacted individuals using their unique identification code for tracking and it is expected that where practical, horticultural staff will begin measures to try and restore the health of the impacted individuals within two (2) weeks of notification.

These corrective actions will potentially include treatment with relevant herbicides, growth stimulants and where necessary the potential quarantining of the plant (i.e. temporarily relocate the plant away from the other plants).

For high numbers of invertebrates and/or severe pest attack, horticultural personnel and the Specialist Ecologist will promptly review prior health of individual to determine treatment options. If applicable, horticultural staff will then commence measures to try and restore the health of the impacted individual(s) within two (2) weeks of notification. These corrective actions will potentially include treatment with insecticides; removal of infected areas and application of relevant treatments and the potential quarantining of the plant (i.e. temporarily relocate the plant away from the other plants).

If their health cannot be restored within a six (6) month period, the horticultural personnel will provide a report outlining measures taken to try and restore the health of the individual(s) and the individual(s) still affected (using the identification codes). The numbers of individuals lost will be calculated and a proposal to replace them with propagated individuals at a 1:2 ratio outlined.

Over the course of the program, the Specialist Ecologist will regularly review current and projected survival rates. Should mortality rates exceed 10% in the first 12 months post translocation, the Ecologist may commence consultation with nursery personnel regarding safeguard measures which could include additional collection and propagation actions.

13.3 Fire

It is also recognised that fire contributes to the lifecycle of cycads[21] and therefore should not be completely excluded.

To reduce the risk of high mortality rates amongst seedlings, juveniles and propagated individuals, no prescribed burns will occur in the vicinity of recipient site plantings for the first five (5) years post translocation.

Risk reduction measures such as firebreaks, fuel load reduction and hazard reduction burns may be implemented as part of the Offset Area Management Plan. The intent to ensure a hot wildfire does not occur in the recipient site or broader offset area location. However, wildfires are uncontrollable factors that cannot be completely removed as a risk (refer Photo 5).

If a wildfire appears to negatively impact on individuals present within any of the recipient sites, translocated and reference site individuals will be monitored for a period of 12 months post impact. If they do not recover within this period (i.e. no indication of growth) the project proponent will consult DCCEEW and/or DES regarding potential compliance implications on the translocation and monitoring program and an appropriate course of action.

The overall risk to the success of the program is consider moderate if the measures outlined in the CTMP and the offset area management plan are implemented. As noted, the intent of the program is to have a self-sustaining population of cycads which will persist into the long-term, with cycads fire-dependant for successful reproduction and the adults are considered to be fire tolerant. However, the species is also fire-sensitive for mortality of seeds and seedlings and frequent intense fires (1 in 10 years) are a risk to the survival of a population. The area is mapped as a high risk bushfire area, though land practices as part of the offset area management plan will be undertaken such as maintaining fire-breaks.

[21] It is recognised that whilst fire is beneficial, it is also detrimental to seedlings, juveniles, seed on plants and pollinators.

Photo 5: Wildfire damage within Cycad habitat one (1) week prior to salvage activities (Ecologica, 2012).

13.4 Seedlings

Based on 3,727 cycads being impacted in the Disturbance Footprint, and that 1,118 plants will be replaced at a ratio of 1:2, along with the germination strike rates of the seeds, it is estimated that approximately 6,519 seeds will need to be collected and a minimum of 3,194 propagated individuals will be planted into the permanent recipient site over a staggered planting schedule.

This program will aim to ensure that a minimum of 2,236 propagated individuals are alive within the recipient sites seven years after planting and five years after the end of maintenance activities; and support a net gain of over 1,118 plants to the existing population. Over the course of the program, the Specialist Ecologist will regularly review current and projected survival rates for propagated individuals.

Regular consultation will also be undertaken with the seed collection and propagation personnel to ensure targets and milestones are being met. Should low propagation rates in the nursery and/or low survival rates in the recipient sites (once planted) be experienced, the Ecologist may commence consultation with nursery personnel regarding safeguard measures to ensure approval conditions and minimum survival rates are maintained. Such measures may include but not be limited to additional collection and propagation actions.

In the nursery this trigger will occur if germination rates from the first round of seed collection are below 70%. Within the recipient site, this trigger will occur if mortality rates exceed 10% in the first 12 months post translocation.

- The overall risk to the success of the program is considered low if the measures outlined in the CTMP are implemented. Furthermore, additional seeds can be collected if required.

13.5 Pollinators

The presence of recruitment within the recipient sites will be a key indicator that translocation activities have supported the sustainability and survival of the population into the long term.

A key factor in influencing this outcome is the presence of pollinators within the recipient sites.

Chemical treatments will be required immediately post translocation to assist the plants in establishing themselves within the recipient sites. However, to support the longer-term presence of potential symbiotic invertebrate/Cycad relationships, certain treatments will be stopped after the first six (6) months.

The exception to this will be individuals deemed to be in poor condition or those who have delayed their first flush of foliage post translocation. Should continue treatments be required for specific individuals, both the horticultural personnel and the Specialist Ecologist will review the prior health of the plants in question, as well as the potential benefits of additional treatment. If applicable, horticultural staff will then commence closely monitored measures.

- The overall risk to the success of the program is consider low if the measures outlined in the CTMP are implemented.

13.6 Weed and pest management

As outlined in Section 2.1 the works will be undertaken in accordance with associated management plans and commitments identified in the relevant Preliminary Documentation. This includes any biosecurity measures (i.e. Weed and Pest Management Plan; measures outlined in the Offsets Area Management Plan) developed for the project, noting that Section 7.3 notes the following with regard to the disturbance footprint management:

- No weed species to be introduced and a pest and weed management plan or protocols specific to cycad removal works to be implemented;
- It is likely that recipient sites will form part of the final offset portfolio, legally secured and managed as part of the offset area management plan. The CTMP outlines that the management of the recipient site(s) is to be undertaken in accordance with a management plan for offset areas. Therefore, it is expected that the overall weed and pest management plan for the offset area will apply to and/or complement the management of weeds in the recipient area.

Specific measures relating to the management of the recipient site(s) in general will be outlined in a management plan for the areas (forming part of the broader offset area management plan) and agreements between project proponent and the landholder(s). Activities are likely to include:

- Fire breaks will be established around the recipient sites and offset area. Fire breaks will be inspected and managed at the beginning of each dry season. Fuel loads around translocated plants will be removed or reduced to manage risk;
- Weeds within the recipient site will be managed. The focus of weed reduction will be in areas containing *C. megacarpa*;
- Pest species, particularly pigs (*Sus scrofa*) will be managed within the recipient areas and larger offset area;
- Site fencing which may be established around the recipient site(s) to exclude cattle for at least two (2) years post translocation.

Noting that the biosecurity risks and appropriate management measures associated with the recipient sites are yet to be determined. The requirements for biosecurity management of the recipient sites will be determined as part of the recipient site assessments proposed closer to construction (refer Section 6.1.4), which will also include alignment with overarching pest and weed management plans.

Other measures outlined in the CTMP relevant to the offset area are:

- The transplant specialist will hold all appropriate permits and licences to undertake such activities and will ensure all machinery and equipment used is maintained to a maintenance and hygiene standard required to work within sensitive environs. This includes but is not limited to weed and weed seed free; pathogen free (particularly for Phytophthora and *Austropuccinia psidii* (Myrtle rust)); and in good working order with no leaks.
- Harvesters must take precautions to prevent themselves, their vehicles and equipment spreading weed seeds, unwanted plants and pathogens into and out of harvest areas.
- The overall risk to the success of the program is considered low if the above mentioned measures are implemented. However, it is noted that the intent of the program is for a self-sustaining population and thus in the long term weeds and pest will be a natural risk.

14. Compliance and Evaluation

The project proponent will be responsible for engaging an appropriately qualified and experienced Ecologist to undertake or supervise the monitoring and reporting requirements outlined in Sections 11 and 12. The project proponent will also be responsible for ensuring that maintenance and management of the transplanted individuals is undertaken as per management requirements outlined in Section 10.

Should a non-compliance event occur the following actions will be taken:

- A determination by the project proponent environmental representative will be made as to whether a breach has occurred and if it requires further action;
- If required, the project proponent environmental representative will report the non-compliance and remedial action to both DCCEEW and DES within five (5) business days;
- The project proponent environmental representative will ensure the matter is brought into compliance within a reasonable timeframe either in accordance with approval conditions or as specified in writing by the relevant Departments.

An accurate record of data to this Plan will be retained with the data management tool (refer Section 9) and maintained by the Specialist Ecologist. All data will be made available to the project proponent and the relevant Departments or an independent auditor upon request.

14.1 Performance Outcomes

Outlined below are the desired criteria for translocation success for *Cycas megacarpa*. These criteria may require modification post the direct count surveys, and as works are undertaken throughout implementation of the translocation, propagation and maintenance works.

It should be noted that the level of success the program achieves is likely to be incumbent on the horticultural management program – specifically the duration and intensity of the program during post translocation activities and the understanding of the monitoring team regarding the issues that arise with the transplanted individuals.

14.1.1 Translocation Success

The criteria for translocation success excludes uncontrollable factors such as wildfires, significant weather events (e.g. cyclones) and drought which may occur from time to time.

Salvaged individuals

- 70% of the salvaged individuals are alive seven years after planting or five years after the end of maintenance activities [22];
- Fruiting is recorded on at least 5% of salvaged individuals (of reproductive height) or comparable to the percentage fruiting occurring within the reference sites (whichever is less) upon the completion of the monitoring program[23];
- The overall health of directly translocated specimens is equal to or better than those within the reference site. This may for example include: crown health; trunk condition; degree of invertebrate attack and reproductive capacity
- Active recruitment at year 15, along with demonstrating the trends above.

Propagated individuals (once planted out)

- 70% of the propagated individuals are alive five years after the end of horticultural maintenance activities[24];
- The overall health of propagated individuals is equal to or better than those of similar age class within the reference site. This may for example include: crown health and degree of invertebrate attack.

[22] This survival rate has been achieved for at least four (4) Queensland Cycad translocation programs under the same methodology and core translocation team members over the past 12 years.
[23] This measure will also assist in confirming the presence of pollinators across the recipient site areas.
[24] This survival rate has been achieved for at least four (4) Queensland Cycad translocation programs under the same methodology and core translocation team members over the past 12 years.

Propagation success

- At least 70% of propagated individuals are alive, healthy and able to be planted out during the scheduled timeframes.

14.1.2 Overall success

The criteria for overall success (i.e. no net loss of cycads) of the program are as follows:

- 70% of the salvaged individuals are alive seven years after planting and 70% of propagated individuals are alive seven years after planting, including five years post the end of horticultural maintenance;
- There are twice as many *C. megacarpa* (as those lost due to translocation activities or which cannot be salvaged from the Project) surviving in the recipient areas after seven years of monitoring post planting;
- The overall health of translocated specimens is equal to or better than those within the reference site/s;
- Plants grow without direct management to support individual *Cycas megacarpa* for a minimum of five years;
- Active recruitment at year 15 within the salvaged individuals;
- The clearing and management of *C. megacarpa* was undertaken in accordance with applicable permit conditions;
- The methodologies outlined in this Plan were complied with;
    - Maintenance and/or management concerns noticed during the monitoring surveys were relayed back to the project proponent and/or the applicable 3rd party within a reasonable timeframe and corrective actions implemented;
    - At least one (1) report for each 12-month monitoring period was received by the project proponent for submission to DCCEEW and DES. This report complied with the monitoring and reporting methodologies outlined in this Plan; and
    - A final report at the end of the monitoring period was received by the project proponent for submission to the relevant government agencies. This report complied with the reporting methodology outlined in this Plan.

15. References

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Legislation

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