***Macrozamia conferta* Translocation Management Plan Monitoring Report – Year 1 – review of the assessment of the effectiveness of the management actions.**

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Qualifications

- 2014 – 2019 PhD Molecular Plant Sciences, University of Edinburgh, UK
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Short bio
James is a leading cycad specialist research scientist with research interests that focus on understanding the evolution and diversity of cycad and other gymnosperms using modern molecular and morphological approaches, including using novel and new DNA sequencing techniques for conservation genomics, forensics and phylogenetics to understand plant evolution and to help conserve species. He is also the Co-chair of the BGCI Global Conservation Consortium for Cycads, Australia and a member of the IUCN SSC Cycad Specialist Group and has been working with cycads for over 14 years.

General comments
As previously stated, good attention to detail has been applied to the report and in the ongoing monitoring of plants at the translocated site. This is despite the challenges posed by the slow growth rates and, at times, the dormant state of individuals.

As mentioned, advice has been taken to reduce the frequency of monitoring efforts due to the slow development and growth rates in Macrozamia. However, I do have one concern regarding the high pH of the dam water, as there was no mention of the base site's soil pH prior to the translocations. Furthermore, I would strongly recommend significantly reducing watering times after year two, as the plants should have established a suitable root system by then.

I was pleased to hear that no instructions for seedlings have yet been completed, as at this stage, their success rate would be very low. I would strongly suggest waiting until all seedlings reach at least 5cm in stem diameter before applying translocation. These plants will require more consistent watering and some protection from initial conditions to ensure their long-term survival.

Regarding the survival rate of large plants, I believe that if no growth has been observed from individuals at the translocation site after five consecutive years, they should be marked

as dead. It is highly unlikely that with water and rooting hormone treatment, they would remain inactive for longer than this period.

Page specific comments

Page 3: Please consider in addition to the previous comment "*The seed germination rates seem very low, and I am wondering if all the seeds are being given enough time to germinate or if there was good checking of seeds at the nurseries. The seeds may have gone past the recovery point even before collection and I do not think this is being recorded correctly and would more accurately reflect the true germination rate*." That cycad seed germination can be very inconsistent, and some seeds can even germinate one year, after being "planted". This can make this metric more difficult to monitor and observe.

Page 5 Seed collection and storage: "*The propagation program has so far included the collection of all seeds from translocated plants, with no seed so far collected from wild populations*" This statement is ambiguous and not clear. You are stating you have not collected seeds from wild populations, but from my understanding, seeds were collected from translocated populations that were wild. Or does this mean seeds were not collected from plants within the translocation site?

Page 7: I agree that monitoring survival/mortality rates with above-ground only is difficult. Some plants will go into dormant stages, and I think this is very likely due to the disturbance and regeneration of root systems. I would be very interested to see how the very largest plants are coming along.

Page 8: please consider that plants may not always show an increased number of leaves as they will only hold the total number of leaves they can sustain. Counting the number of older and dehisced leaves may be important here also. These plants can also go through long periods without producing new leaves, but higher water availability will change this.

Page 11: Initially untagged individuals: I am not sure why individuals with bifurcating stems needed a different tagging system. They should be applied with the same systems, and it is not unusual for cycads to produce multiple offsets. These are likely very old plants.

Page 15: 5.1.4 Watering: When is the watering going to be stopped on these sites for the translocated plants? Because by two years, these plants should have developed good enough root systems to stop watering. Please consider these plants are adapted to dry climates already, and water is a great way to give them an initial boost. However, I cannot see any indication when this will be stopped.

Page 15: water quality: The pH of this seems very high. What did the initial pH tests of the sites show? I think it will be fine overall, but it would be interesting to know.

Page 17: with regards to notes on the survival of individuals, we have been thinking about overall Macrozamia, and it is likely safe to say any individuals that have not produced new leaves in five years should likely be considered dead. Because five years is a long period for these plants to remain dormant and perhaps too long to store energy.

Page 20: The success rate of propagated seedlings planted at the recipient site: This is a good thing to see. Planting small seedlings too soon onto the recipient site would have a very low probability of success. I would advise waiting for plants to reach a stem diameter of approximately 5cm before considering planting out. This will be a slow process but will provide the best possible long term outcomes.

Page 25: "*58% of plants held living leaves in December 2023 – 13.8% lower than the April 2023 baseline*" This would be expected because plants would have lost a significant mass to their root systems and may take years to recover. This metric will likely remain lower than the reference site for the next five years or more.

Page 25: "*high male to female ratio*" This again is something to be expected as natural cycad populations are male-biased, and it is possible for male-representing plants to produce female reproductive structures, thus balancing the sex ratios in populations.

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Macrozamia conferta Translocation Management Plan Monitoring Report – Year 2

Prepared for: ACCIONA Energy Australia Global Pty Ltd

Date: 13 May 2024

Document information

Document	Macrozamia conferta Translocation Management Plan Monitoring Report – Year 2
Attexo ref	ACC-029
Date	13 May 2024
Prepared by	Peter Brennan, Joshua Prostramo
Reviewed by	Jeromy Claridge

Quality information

Rev	Date	Details	Authorisation	
			Name/position	Signature
1	13-05-2024	Draft for Review	Jeromy Claridge, Principal Environmental Scientist	

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1. Introduction

ACCIONA Energy Australia Global Pty Ltd (ACCIONA) is developing the MacIntyre Wind Farm (MIWF) and associated Overhead Transmission Line (OHTL) (the Project), which were approved under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) on 22 February 2022. EPBC Act conditions of approval for the Project (EPBC 2020/8756 and EPBC 2020/8759) required the development and approval of a *Macrozamia conferta* Translocation Management Plan (MTMP) (Attexo 2022a) to support the translocation and propagation of impacted *M. conferta* specimens. This MTMP was approved by the Department of Agriculture, Water and the Environment (now the Department of Climate Change, Energy, the Environment and Water) on 13 May 2022.

1.1 Purpose and scope

As set out in the MTMP, and as required to address Condition 25 of the EPBC Act approvals for the Project, a monitoring report that assesses the effectiveness of the management actions of the MTMP is required (this report). This assessment must be prepared *"within every twelve months for the first five years following the date on which the Minister first approved the MTMP and subsequently by every fifth anniversary of the date on which the Minister first approved the MTMP until the number of Macrozamia conferta individuals impacted by the action that survive for at least twenty years after the translocation exceeds the number of Macrozamia conferta individuals impacted by the action:"* (see **Table 1.2**).

This report is the second monitoring report (Year 2) on the effectiveness of management actions in the approved MTMP. The scope of this report was expanded by five days to include data relating to the final translocations which were completed on 18-May-2024. A timeline of key dates is presented in Table 1.1.

Table 1.1 *Macrozamia* translocation management program - key dates

Event	Date
Macrozamia Translocation Management Plan approved	13 May 2022
Translocation works commence	15 June 2022
Baseline monitoring event	March/April 2023
First annual EPBC self-assessment report	13 May 2023
Final translocations (excluding incidental finds)	15 June 2023
6-month monitoring event	December 2024
Second annual EPBC self-assessment report	**13 May 2024**
Final translocation of incidental finds	18 May 2024
12-month monitoring event	June 2024
18-month monitoring event	December 2024
Third annual EPBC self-assessment report	May 2025
24-month monitoring event	June 2025

1.2 Compliance summary

Table 1.2 summaries how the *Macrozamia conferta* translocation project achieves compliance with the EPBC approval conditions which require reporting against the progress of the MTMP.

Table 1.2 *Macrozamia conferta* translocation compliance criteria and response

Condition number	Condition requirement	How condition has been addressed
25.	To determine the likely effectiveness of the management actions in the approved MTMP to translocate *Macrozamia conferta* individuals impacted by the action, the approval holder must engage a suitably qualified field ecologist to undertake, within every twelve months for the first five years following the date on which the Minister first approved the MTMP and subsequently by every fifth anniversary of the date on which the Minister first approved the MTMP, until the number of *Macrozamia conferta* individuals impacted by the action that survive for at least twenty years after translocation exceeds the number of *Macrozamia conferta* individuals impacted by the action, an assessment of the effectiveness of the management actions in the approved MTMP.	This report is the second monitoring report set to assess the effectiveness of management actions in the approved MTMP. **Section 10.4** of the MTMP outlines reporting requirements including the following: • The final number of *M. conferta* collected from the Project footprint – see **Section 4.1**; • The final number of seeds collected from translocated plants – see **Section 4.2**; • Propagation success in nursery of seed collected – see **Section 4.2**; • The success rate and health status of translocated *M. conferta* – see **Section 6.3**; • The success rate and health status of propagated seedlings transferred into recipient site – see **Section 6.3**.
26.	The approval holder must ensure that each assessment of the effectiveness of the management actions in the approved MTMP is: • Subject to a peer-review completed within 6 months of the completion of each such assessment; and • Published on its website with the findings of the peer-review within 6 months of the completion of the peer-review and remains published for the remaining duration of this approval.	This report will be subject to peer-review, with findings published on the Project website within the required timeframes.

1.3 Peer-review of the first annual monitoring report

A peer-review of the first annual monitoring reported was completed by James A. R. Clugston PhD, MSc, BSc (Hons) and published on the Project website (MTMP Annual Report – Year 1). The comments and recommendations made within the scope of the review are presented in **Table 1.3**. Additional management actions outside of the scope of the peer-review were suggested separately by Dr. Clugston and these are presented in **Table 1.4**.

Table 1.3 Recommendations of the peer-review of the first annual monitoring report

Topic	Comment/recommendation	Implementation
Extraction methods	*"Very good attention to detail on removal of plants to prevent damage…* *The equipment and methods used to remove and store plants seems good."*	n/a

Topic	Comment/recommendation	Implementation
Size of population	*"...over 12,000 plants were removed. This clearly demonstrates the populations of the species are in much better condition, than stated previously."*	n/a
Monitoring frequency	*"The original monitoring frequency of the plants after removal seems to be too frequent when compared to the slow development and growth cycle of cycads. This seems like a waste of initial resources and time. However, it does seem like modifications to monitoring have been made and the frequency reduced in the future."*	Monitoring frequency has been reduced as outlined in the first annual monitoring report and **Section 3.2** of this report.
Seed germination rates	*"The seed germination rates seem very low, and I am wondering if all the seeds are being given enough time to germinate or if there was good checking of seeds at the nurseries. The seeds may have gone past the recovery point even before collection and I do not this this is being recorded correctly and would more accurately reflect the true germination rate."*	Seed collection efforts will be planned for earlier in the growing season. Additional monitoring and reporting of seed viability prior to propagation by the nurseries will be implemented.
Monitoring metrics	*"I would be cautious about leaf counting as it is likely that these plants will deplete old leaves during or before a leaf flush. However, you would likely still see the older leaf for a short period of time. This is normal with most Australian* Cycas *and* Macrozamia*."*	Additional qualitative and quantitative metrics have been added to ongoing monitoring procedures. Results relating to these additional metrics are presented in **Section 6** and the conclusion of this report.

Table 1.4 Additional management actions suggested by the peer-reviewer

Topic	Comment/recommendation	Implementation
Application of fungicide on removed plants	*"Due to the fleshy root system of cycads the use fungicide to treat wounds on stems, despite mycorrhizal association. Applying fungicide would increase the survivability of the plants by helping to prevent root rot. The plants will re-establish mycorrhizal association in their new growing environment."*	Fungicide will be applied to future translocations.
Rooting hormone after translocation	*"Apply application of rooting hormone every three months during*	Rooting hormone was applied during additional watering in

Topic	Comment/recommendation	Implementation
	first year to help the plants root system re-establish. Although results may not be seen in one year due to the slow growth and development, but there would be a significant improvement in fibrous root development. I recommend the application of rooting hormone during future watering of any translocated plants."	January 2024 and will be applied during future watering events.
Removal of cones for two years (emphasis on female cones)	*"There needs to be some consideration to the removal cones from female plants during the first year of transplantation. This will help to reduce stress to plants as* Macrozamia *and many other cycads are known to cone after stress. This stress from resource intensive female cones and this can kill or reduce the health of the plant if the circumstances are not right."*	All female cones identified at the recipient site during maintenance and monitoring works have been removed.

2. Assessment of management actions

The effectiveness of management actions involved in the translocation program have been assessed in the following section. Where the details of management actions taken during translocation do not differ from those described in the first annual report, these details are not repeated in this report. Where implemented actions have varied from the MTMP or first annual report, explanation and justification for these variations have been provided.

No changes were made to the structure of metadata associated with the Translocation Database (TD) since the first annual report. The structure and content of data capture, storage, and analysis processes also remained unchanged. Ongoing implementation of weed and fire management procedures relating to the recipient site are described in **Section 2.1**. Details of the translocation works, and methodology variations are outlined in **Section 2.2**. **Section 2.3** includes information relating to the propagation of collected seed by accredited nurseries and germination rates current at the time of writing. **Section 3.2** establishes a reporting template for ongoing monitoring of the recipient site and contains monitoring data relating to survival rate, health metrics, and potential threats. Issues encountered during the translocation program are listed in **Section 3.3**.

2.1 Recipient site maintenance and management

2.1.1 Weed management

Surveys of the recipient site identified three species listed as Weeds of National Significance (WoNS) and Restricted Invasive Weeds (Category 3) under the Queensland *Biosecurity Act 2014*; *Opuntia tomentosa* (velvety tree-pear), *O. stricta* (common prickly pear), and *Senecio madagascariensis* (fireweed). *Opuntia* spp. were controlled through physical removal using hand tools before being buried to a depth of 2m at a site outside the offset area but within the same property allotment. *Senecio madagascariensis* records were minimal, and plants were removed by hand, sealed in a suitable container, and disposed of according to relevant advice from state and local authorities.

2.1.2 Fire management

Stick raking was undertaken to consolidate fallen timber fuel sources in preparation for future hazard reduction burns. As planting holes for translocated *Macrozamia conferta* were dug, woody debris was grouped into small piles located away from translocated plants.

2.2 Translocation methods undertaken

Translocation methods and variations were implemented in a manner consistent with the first annual report. A post-planting application of exogenous growth hormone (auxinone) was applied to all plants in January 2024 as recommended by the addendum to the peer review of the first annual report.

2.3 Propagation and cultivation information collected

To offset potential post-translocation losses, the MTMP outlines a propagation program to supplement translocations. Propagation protocols outlined for seed collected from *Macrozamia conferta* are being followed by two nurseries with previous experience in growing *Macrozamia* species (**Section 2.3.2**). These two nurseries report regularly on propagation progress and rates of successful germination (**Table 6.7**).

2.3.1 Seed collection and storage

EPBC approval condition 21 requires *"a commitment to a program of propagation of seedlings to replace or exceed the number of Macrozamia conferta individuals impacted by the action that do not survive for at least twenty years after translocation"*. The propagation program has so far included the collection of all seeds from translocated plants, with no seed so far collected from wild populations.

2.3.2 Propagation

Seeds are currently being propagated at two nurseries with relevant experience propagating *Macrozamia* spp.: The Australian Botanic Garden Mount Annan, and Wallum Nurseries Pty Ltd. Both nurseries operate under the *Australian standards for maintenance of plant health* and the *Nursery Industry and Garden Australia Standard*. Evidence of operation under these standards can be provided upon reasonable request.

The number of seeds provided to each nursery and the current number of propagated individuals can be found in **Section 6**. Attexo facilitated collaboration between the two propagation nurseries in using the same propagation methodology based on expert advice and available literature. Methods for propagation proposed in the approved MTMP are as described in the first annual report.

2.3.3 Tissue culture

Cultivation from tissue culture was proposed in the MTMP as a measure, additional to seed propagation, to offset potential losses in the translocated population where translocation and propagation rates fell short of targets. Analysis of success rates is ongoing for both translocation and propagation efforts and cultivation from tissue culture is not being considered at this time.

2.3.4 Planting from nursery stock

The planting of nursery stock will be undertaken using a similar methodology to translocated *Macrozamia conferta*. It is expected that plants propagated in the nursery will be large enough to plant at the recipient site in late 2024 or early 2025.

3. Monitoring information collected

3.1 Monitoring plots

Two monitoring events were conducted in the current reporting period (June 2023 and December 2023) to meet the specified requirements of the MTMP to assess the ongoing health of the translocated population and ensure appropriate actions are taken to achieve a net-loss of zero individuals over 20 years. To assess population metrics in an efficient manner, five monitoring plots of equal area were initially established. One monitoring plot (T2) was removed from ongoing monitoring efforts as proposed in the first annual monitoring report. Two plots lie within the recipient site to capture data on translocated plants and two plots lie within the nearby Durikai State Forest to capture data on existing populations of *Macrozamia conferta* in the wild (the reference site).

Selection of the reference site was based on criteria that aimed to achieve similar population structure, density, vegetation community, soil quality and altitude to the recipient site. It should be noted that plant age class was hard to determine without excavation, reducing the accuracy of any assessment of population structure.

3.2 Monitoring metrics and parameters

Ongoing monitoring is specified by the MTMP to assess the performance of individual plants over time and compare performance between translocation and reference populations. The parameters by which performance is to be assessed and reported are explained in **Table 3.1**. The metrics to underpin these parameters of performance are outlined in the MTMP and their implementation is shown in **Table 3.2**. Data were collected using ArcGIS Survey123 platform and included in the TD.

Adjustments to the frequency and quantity of monitoring events were proposed and justified in the first annual report and these changes were supported by the peer-review of that report. In response to additional advice provided by the peer-reviewer, an increased focus on the monitoring of qualitative parameters (predation, desiccation, inundation, symptoms of disease) was implemented to supplement the collection of quantitative performance parameters (pers. comm. J. Clugston, 2003). Ongoing frequency and quantity of monitoring events are presented in **Table 3.3**.

Table 3.1 Performance monitoring metrics outlined in the MTMP

MTMP Performance measures	MTMP description	Implementation using data
Survival/mortality	Total number of individuals present and population structure (i.e. % dead, mature and coning, mature, juvenile, or seedling).	The total number of individuals for each population will be reported based on the number of unique specimen ID entries for data collected in each plot. Each unique plant in a plot is expected to be monitored. Population structure will only be reported as: • Total number of plants; • Percentage of plants known to be mature (from coning in either the past or present as determining age for plants based on foliage alone is unreliable); and • Recruitment (indicative of seedling or juvenile numbers). The length of time between flushes of above ground foliage is unknown for *Macrozamia conferta*, so distinguishing living from dead plants based on above ground plant material is impossible. Performance will instead be reported using two proxy statistics:

MTMP Performance measures	MTMP description	Implementation using data
		• Percentage of plants displaying new growth since the previous monitoring period (Performance Measure – New growth; and • Percentage of plants bearing living leaf material. These two metrics approximate survival as plants that display an increased number of leaves since the previous monitoring period and plants with live leaves are likely alive. Analysis of these metrics across monitoring periods, will allow the reporting of population trends, and (assuming all translocated plants were alive at the time of planting) an approximation of the successful accomplishment of net zero loss of *M. conferta* by the Project.
Gender and reproduction	Presence of reproductive organs (i.e. cones and seed) and Male : Female ratio in the population	Whether a cone is present, the sex of the cone, and the developmental stage of the cone will be used to report: Percentage of plants that are known to be mature (individuals that have coned in the past or present [including sex identified from extraction data]); Percentage of plants confirmed as mature that are coning during the current monitoring period (ripe or undeveloped cones); Male : Female ratio of known-mature plants in each population; and Percentage of known females that have ripe cones at the time of monitoring (indicating seeding potential / presence of seeds).
New growth	Presence or absence of new growth	New growth will be reported as the percentage of plants that have experienced an increase in either the total number of leaves or an increase in the total number of live leaves, since the last monitoring round. This measurement encapsulates plants that have experienced new growth since the last monitoring round, even if all leaves are senescent in the most recent monitoring round (e.g. a plant may have one live leaf in monitoring round 1, but two senescent leaves in monitoring round two, and so has experienced new growth between monitoring periods). This metric of new growth is likely to be more useful in understanding population health than simply describing whether young or "new" leaves are present on a plant (e.g. in the Extraction Form).
Predation	Presence or absence of insect damage on leaves or cones).	Any obvious insect damage will be recorded. The percentage of individuals affected by predation will be reported. Large infestations in translocated plants will be dealt with if noticed as per the MTMP.

Table 3.2 Parameters to assess performance during ongoing monitoring

MTMP Collection Field	Implementation of field
Ecologist on site	The name of the ecologist undertaking the monitoring survey was recorded against each entry for an individual plant in the monitoring form.
Date and time	The date and time at which an individual plant was assessed during monitoring was recorded.
Specimen ID	The unique indentification number of each plant (read from the steel tag adjacent each plant) was recorded so leaf data can be used to monitor plant growth over multiple monitoring periods. Inconsistencies in the number of monitoring plants will be addressed in future monitoring events by the creation of a list of plant specimen IDs for each plot to ensure all plants are checked during each monitoring event. Newly recruited plants will be given an ID for future monitoring purposes and added to the list.
Plot ID	Plot ID is recorded for each plant according to the ID of the monitoring plot in which it was found at either the recipient site (T1, T3) or reference site (R1, R2).
GPS coordinates	GPS coordinates for each plant are automatically recorded and used to assess whether Site ID was correctly recorded. A list of plant specimen IDs was created for each plot so that Plot ID can be confirmed, should GPS fail to record or appear incorrectly.
Number of green (living) fronds	The number of living fronds (those bearing green, photosynthetic material) is recorded for each plant.
Number of young fronds	The number of recently emerged 'young' fronds is recorded for each plant.
Number of dead fronds	The number of dead fronds (without green, photosynthetic material) is recorded for each plant.
Cone development and sex	Whether a cone is present on a given plant is recorded. If a cone is present, sex (Male, Female) and stage of development (Undeveloped, Ripe, Old) is recorded. Cones that are both 'Female' and 'Ripe' will be used to assess seed development (Collection field 10).
Seed development	Seed development will be assessed using information collected for cone development and sex (see Collection field 9).
Recruitment	The number of newly recruited plants in a plot will be recorded during each monitoring period. New plants will be given a unique specimen ID and added to the ID list for the plot in which they are recruited.
Presence of pollinators	Whether pollinators are present is recorded. It is expected that the type of potential pollinator will be recorded in the notes (Collection field 15).
Disturbance type	Visible impact to leaves (e.g. missing or discoloured material) is recorded) and classified by likely cause (Predation, Dehydration, Fire, Other).

MTMP Collection Field	Implementation of field
Disturbance intensity	Disturbance intensity is estimated categorically according to the percentage of living leaf surface area impacted by disturbance (Low <5%, Medium 5-50%, High >50%).
Notes	Notes can be taken using the monitoring form for any reason, such as referencing the type of pollinator found or ID of a pest insect.

Table 3.3 Summary of monitoring efforts do date

Monitoring event parameter	MTMP description	MTMP frequency/quantity	Progress to date
Plant growth/population monitoring frequency	Growth of *Macrozamia conferta* individuals and population. Total number of individuals present and population structure (i.e. % living, mature and coning, mature, juvenile or seedling, M:F ratio	Biannually (months 1-24) Annually (after 24 months)	Monitoring surveys completed for months 1, and 6.
Threat monitoring frequency	Identification of potential and existing threats from: • Predation • Fire • Weeds	Monthly for the first 6 months Each 6 months up to 24 months Annually after 24 months	Monitoring surveys completed for months 1, 2, 3, 4, 5, and 6.
Plant growth/population monitoring sample size	Plants within monitoring plots will be monitored post-translocation to measure and assess individual and population growth, identify potential threats or environmental factors within the translocation that may impact *M. conferta*, and provide recommendations to improve methods of translocation.	Two monitoring plots representing 10.9% of translocated plants and 6.9% of total recipient site area.	All monitoring events have proceeded based on this quantity of survey effort.

3.2.1 Fauna pest monitoring

The threat of disturbance to translocated plants from pest fauna remains low and monitoring activities have not identified evidence of damage to plants. Monitoring and management of pest fauna within the recipient site (as part of the broader Project offset area management) has commenced (Ecosure 2023 MacIntyre Wind Farm Pest management Plan, Revision 02, dated 13 October 2023).

3.3 Issues and corrective actions

As per the MTMP, any issues encountered during translocation, propagation, and monitoring are to be reported. Unexpected issues and how they were resolved are discussed in **Table 3.4**.

Table 3.4 Response to issues relating to translocation, propagation, and monitoring

Issue	Resolution
Translocation	
Initially untagged individuals	Clusters of *Macrozamia conferta* foliage may represent a group of multiple plants or a single multi-stemmed plant with separate leaf clusters. This uncertainty leads to some plants requiring their unique specimen identification tag to be assigned and affixed post-planting. In other cases, a tag may be dislodged and separated from the plant during transportation to the recipient site. If the correct tag could not be re-associated with its corresponding plant specimen, a new tag was assigned to the plant. The database entries related to these processes are then updated accordingly. Some translocated plants do not appear to have an excavation entry after being assigned a new tag where the original ID could not be re-associated.
Incidental finds of previously unidentifiable individuals	*Macrozamia conferta* can persist for many years without above ground plant parts. In this condition, individuals are unidentifiable to survey efforts despite ongoing growth of the subterranean caudex and root structures. When these individuals produce new leaf material which emerges above the ground surface, they are identified and translocated as 'incidental finds'.
Propagation	
Lower than expected germination rates	As of 13 May 2024, germination rates for seeds collected during the translocation process are below the 85% germination rate assumed in the MTMP. All collected seed was retrieved from the ground post-release from the maternal cone. Seed maturity and viability were difficult to determine, and it is likely that non-viable seed, delivered to the nursery led to a reduction in germination rate (pers. comm. J. Clugston, 2024). Future seed collection from wild populations will be timed to collect ripe seed on the cone, or recently released seed. Future estimates of the number of seeds required to be collected to meet translocation targets will be based on a 65% germination rate.
Monitoring	
Ambiguity of survival metrics	In response to recommendations made during peer-review of the first annual monitoring report (Table 1.1), additional quantitative and qualitative metrics of survival have been included in ongoing monitoring works. Since the presence/absence of living leaf material is insufficient to make an absolute determination of survival rates, trends in the number and life stage of leaves will be analysed across multiple monitoring periods. Qualitative assessments will be made on the quantity and cause of leaf damage. General observations on site condition and population health may also be included in future reports. The accumulation of this additional information over time will support future inferences on survival rates within the translocated population.
Timeline adjustments to accommodate additional translocations	As discussed in the first annual monitoring report, the number of translocated individuals increased by a factor of 3.5 compared with initial survey estimates. Delays in the completion of translocations due to this increase required adjustments to the timeline of monitoring outlined in the MTMP. Baseline monitoring data was collected in April and May of 2023, prior to the completion of translocation works. The MTMP monitoring schedule commenced as specified - following conclusion of translocation works in June 2023, with the first monitoring event taking place six months later in December 2023.

4. Translocation and propagation data

4.1 Translocation locations and numbers

In the 12-month reporting period from 13 May 2023 to 18 May 2024, an additional 285 *Macrozamia conferta* were translocated. These plants were not holding live, above ground leaves during the translocation program and were only identified incidentally once they produced new leaves, after translocation works had been completed. The total number of individuals translocated was 12,946 as of 18 May 2024. Translocation of plants within the construction footprint is complete. The location of plants extracted from the construction footprint in the current reporting period (between 13 May 2023 and 18 May 2024 only) is shown in **Figure 4.1**, with a breakdown of numbers translocated from each construction zone presented in **Table 4.1**.

Table 4.1 Number of *Macrozamia conferta* extracted for each EPBC approval area and construction zones between 13 May 2023 and 18 May 2024.

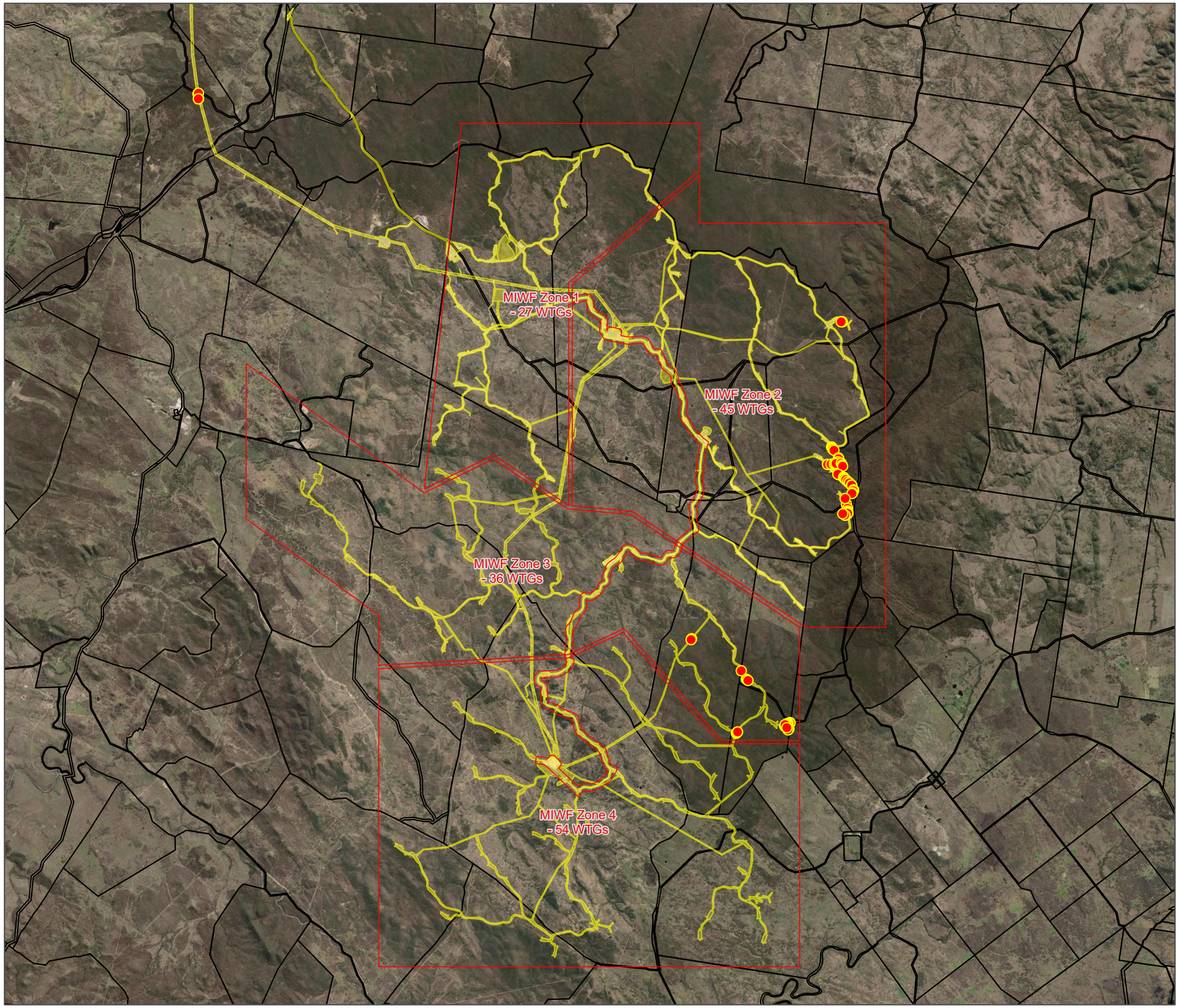
Location	Construction Zone	Total Count
Overhead Transmission Line (EPBC 2020/8759)		6
MacIntyre Windfarm (EPBC 2020/8756)	MIWF Zone 1:	0
	MIWF Zone 2:	184
	MIWF Zone 3:	95
	MIWF Zone 4:	0
	MIWF Total:	**279**
Total		**285**

4.2 Translocated plant statistics

Data gathered from plants translocated during this reporting period was limited, since all plants had recently emerged from a subterranean growth phase. All plants translocated during this period were assigned to the sub-adult age class. No reproductive material was present at the time of translocation so no determination of sex could be made.

Table 4.2 Severity of disturbance of extracted *Macrozamia conferta* prior to translocation during the reporting period 13 May 2023 – 18 May 2024.

Severity of Disturbance	Percentage of Plants in Extraction Form
Low	29
Moderate	38
High	33



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MacIntyre Wind Farm and Overhead Transmission Line

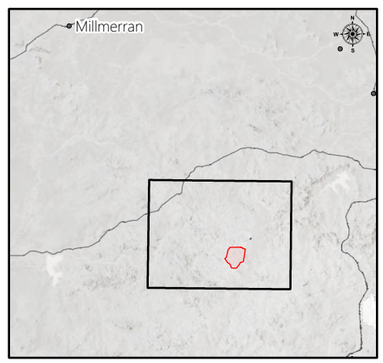
Extracted Plants - Year 2

Figure 4.1

- Clearing Corridor
- Extracted *Macrozamia conferta*
- Construction Zone Boundary
- Property Boundary

Date: 15/11/2024
Author: AT

Reviewed: PB
Project: ACC-029



0 1 2 3 4 5 Km

Scale: 1:100,000@A3

Data Source(s):
Digital Cadastral Database - Department of Natural Resources, Mines and Energy (2021)
Earthstar Geographics, © State of Queensland (Department of Resources) 2023, Esri, CGIAR

Path: C:\Users\FanMo\Attexo Group\Attexo - Documents\Projects\ACCIONA Energy\ACC-005 MIWF Offsets Delivery\5. GIS\4.3 Cartography\02_MacrozamiaMP\02_MacrozamiaMP.aprx

5. Management activities undertaken during reporting period

Following completion of major translocation works on 30 June 2023, threat monitoring occurred monthly for the first 6 months and is now being conducted every 6 months for the first 24 months. After 30 June 2025, threat monitoring will occur annually. Watering may occur more frequently if required, according to the decision framework outlined in the first annual monitoring report.

5.1 Water

5.1.1 Watering requirements

To control the risks associated with water supply (desiccation and waterlogging), rainfall of 35mm/month was required according to the water capture model described in the first annual monitoring report.

5.1.2 Rainfall data

During this 12-month monitoring period, daily rainfall data (**Figure 5.1**) was collected from the Mac North weather station maintained by ACCIONA and described in **Table 5.1**.

Figure 5.1 Historical rainfall at the *Macrozamia conferta* recipient site.

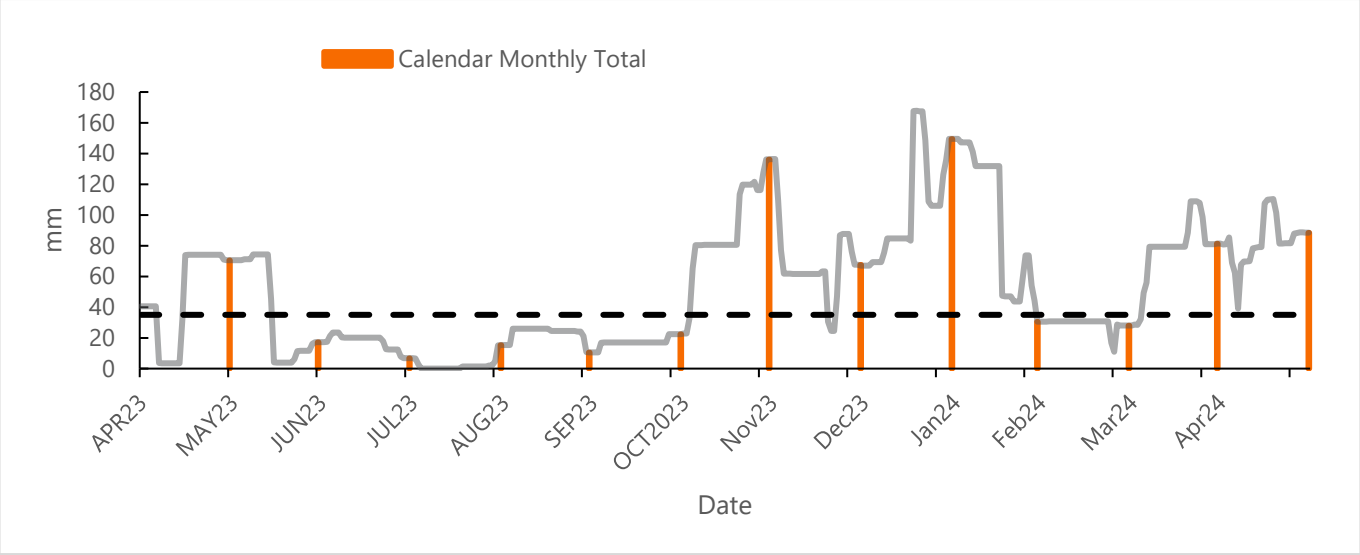


Table 5.1 Weather stations used to estimate rainfall at translocation site

Description	Location	Distance from recipient site	Suitability	Date range
Mac North Weather Station (Remote Access)	-28.3285°, 151.6067°	2.1km	Closest available weather station	20221218 - present

5.1.3 Rainfall data analysis procedure

Weather station data is reviewed monthly, and data collated into a Weather Database. Long range forecasts are also considered in watering decisions and this data was inspected from the Bureau of Meteorology at http://www.bom.gov.au/climate/outlooks/#/overview/summary/.

Total rainfall in each calendar month is plotted along with a moving total of daily rainfall from the previous 30-day period. Target rainfall represents the quantity of rain required to deliver 10L of water per plant based on the water capture model presented in the first annual monitoring report.

5.1.4 Watering decision framework

Water management decisions seek to minimise the risks associated with both desiccation and waterlogging in the context of monthly total rainfall, long-term weather forecasts and physical assessment of site conditions. Manual watering action may be triggered when rainfall received by the site drops below the target rainfall amount of 35mm in a given calendar month or moving 30-day period. Deferral of a triggered manual watering action may occur if sufficient rainfall is predicted within two weeks of the planned watering event. Where practical, on-ground inspections of site conditions will be used to support decision-making related to manual watering.

Additional water (20L/plant) was applied in late August 2023 in response to below target levels of rainfall in June and July and on-ground confirmation by field staff during July.

Additional water (10L/plant) was applied in early October 2023 due to low rainfall in the preceding month. 5L/plant of additional water was administered in early January 2024 despite adequate rain observed at the weather monitoring station, in anticipation of forecast low rainfall in February and March of 2024.

5.1.5 Water quality

Water was supplied to the translocated population from surface dams nearby. To assess water quality, samples of dam water were tested by qualified ACCIONA environmental staff to measure relevant water quality parameters including pH and electrical conductivity. Results were within normal range and the quality of the water was deemed suitable for irrigation purposes (**Table 5.2**).

Table 5.2 Water quality test results from surface dams at the translocation site.

Date	Source	Electrical conductivity	pH	Total dissolved solids
31-Aug-23	Dam 1	0.251 mS/cm	8.43	0.165 g/L
8-Oct-23	Dam 2	0.195 mS/cm	7.74	0.127 g/L

5.2 Fuel loads

Fallen timber and coarse-woody debris was consolidated into timber heaps prior to establishment of planting areas. A controlled burn by qualified personnel is planned, pending suitable weather conditions. Future monitoring events will report on the standing fuel load within the recipient site.

5.3 Erosion

No specific threats from erosion at the recipient site have been identified during this reporting period.

5.4 Weeds

Some recruitment of *Opuntia* sp. was observed at the site during this reporting period. Incidental identification and manual removal during routine maintenance activities is ongoing. Future threat monitoring activities may recommend additional action to remove weeds if levels of infestation rise.

5.5 Insects

No observations of Cycad Blue butterfly (*Theclinesthes onycha onycha*) were reported during the monitoring event in December 2023. Observations of any leaf predation increased by a factor 3.1 at the Translocation Site and 6.1 at the reference site. This increase may be explained by fluctuations in the life cycle of predators in response to changes in climactic conditions and seasonal variability. Additionally, since *Macrozamia conferta* typically flush new leaves once per year, the percentage of leaf area affected by predation is likely to increase over time. The monitoring methodology does not account for predation on senesced leaves, which may produce a periodic cycle in the measurement of leaf predation as new leaves are flushed, predated on, and senesced. The accumulation of data collected in subsequent monitoring events will allow a more realistic assessment of ordinary predation levels. Application of insecticide was deemed unnecessary during this reporting period.

6. Translocation and propagation monitoring data

6.1 Monitoring data

Table 6.1 presents data from monitoring plots for the December 2023 monitoring event in a format consistent with the presentation of monitoring data in the first annual report. Percentage change values were calculated against baseline data collected in April 2023, notwithstanding adjustments to the monitoring methodology implemented in response to the peer-review of the first annual monitoring report. **Section 6.3** presents a summary of trends developing in the monitoring data collected to date and a discussion of the implications for ongoing management activities. More detailed statistics for each individual monitoring plot can be found in **Appendix A**.

The predominantly subterranean morphology of the species has rendered the existing metrics of evaluation insufficient to make a binary determination on the survival or death of each individual plant. To address this challenge, and in response to advice from the peer-review of the first annual monitoring report (**Table 1.2**), additional quantitative metrics are presented in **Tables 6.2 – 6.6**. A discussion of success rates in the context of these additional metrics is provided in **Section 6.3**.

Table 6.1 Monitoring results for December 2023 – 6 months post translocation

Monitoring Data								
Population	**Plot ID**	**Number Tagged Plants**		**% Plants Known Mature (plants with cone present or past)**		**Male : Female Ratio of Known Mature Plants**		**% Plants with Visible Predation**
	R-Average	137		2.70		1:1		20.27
	T-Average	755		2.5		1.5:1		6.5
	R-Total	274						
	T-Total	1,510						
Reproduction	**Plot ID**	**Number New Plants (recruitment)**	**% Population Increase (compared to last monitoring event)**	**% Population Increase (compared to initial numbers)**	**% Known Mature Plants Currently Coning (undeveloped or ripe cones)**	**Male : Female Ratio of Currently Coning Plants (undeveloped or ripe cones)**	**% Known Female Cones Ripe (seeding potential)**	**Any Pollinators Present?**
	R-Average	2.5	1.83	1.83	71.43	1.5:1	33.33	No
	T-Average	0	0	0	37.84	2.5:1	25	No
	R-Total	5						
	T-Total	0						
Survival	**Plot ID**	**% Plants Bearing Living Leaf**	**% Change in Plants Bearing Living Leaf (compared to last monitoring event)**	**% Plants Bearing Living Leaf (compared to initial number of plants in plot)**	**% Plants Displaying New Growth**	**% Change in Plants Displaying New Growth (compared to last monitoring event)**	**% Change in Plants Displaying New Growth (compared to initial number of plants in plot)**	
	R-Average	97.45	3.09	3.09	28.83	n/a	46.25	
	T-Average	57.95	-13.79	-13.79	39.50	n/a	18.45	

R-Average is the mean of two reference plots located in Durikai State Forest. R–Total is the sum of the two reference plots.
T-Average is the mean of two monitoring plots within the recipient site used to represent the translocated population. T-Total is the sum of two monitoring plots.

Table 6.2 Percentage of plants with evidence of ongoing growth at the translocation site and reference site.

Location	December 2023 monitoring event
Translocation site	75%
Reference site	95%

Table 6.3 Percentage of plants with an increasing proportion of their leaf biomass classified as living.

Location	December 2023 monitoring event
Translocation site	73%
Reference site	60%

Table 6.4 Percentage of plants holding recently flushed leaf material (new growth).

Location	December 2023 monitoring event
Translocation site	9%
Reference site	27%

Table 6.5 Percentage of plants where evidence of disturbance is absent.

Location	December 2023 monitoring event
Translocation site	37%
Reference site	3%

Table 6.6 Percentage of plants where evidence of insect predation has been recorded.

Location	December 2023 monitoring event
Translocation site	4%
Reference site	4%

6.2 Propagation data

Data regarding seed collection, propagation, and survival over the reporting period are presented in **Table 6.7** and will be updated at each reporting period. Reports were received in February 2024 from both nurseries. The average germination rate was 60% at the time of reporting, however both nurseries report that germination is still ongoing and so the rate may increase over time.

Table 6.7 Seed collection and propagation data

Nursery	Seeds Provided to Date	Number of Plants Germinated to Date	% Germination Success	Previous Number of Plants in Nursery	% Increase (compared to last monitoring period)
The Australian Botanic Garden Mount Annan	307	161	52	143	12.6
Wallum Nurseries Pty Ltd	602	343	60	219	56.6
Total	909	504	55	362	39.2

6.3 Success rate of translocated plants

At the translocation site, 58% of plants held living leaves in December 2023 – 13.8% lower than the April 2023 baseline. At the reference site, 97.5% of plants held living leaves in December 2023 – 3.1% higher than the April 2023 baseline. As advised by the peer-review of the first annual monitoring report, this instantaneous leaf count is an insufficient metric with which to draw conclusions on the success rate of translocated plants. This statistic will continue to be reported and its fluctuations over the next 12 months may provide insight into the effect of seasonality and time-since-translocation on living leaf number.

Table 6.2 presents a derived statistic showing the percentage of individuals showing evidence of leaf production since monitoring began at the recipient site (75%) compared with the reference site (95%) in December 2023. Trends in this statistic measured across future monitoring events will provide an indication of the success rate of the translocated plants compared with those at the reference site. As the length of time increases in which an individual plant shows no evidence of leaf production, the likelihood of survival decreases (although the individual may be surviving below ground).

Table 6.3 presents a derived statistic indicating the percentage of individuals accumulating living leaves at a rate equal to or greater than the rate at which those leaves are senescing. A total of 73% of individuals at the recipient site were accumulating increased leaf biomass compared with 60% at the reference site. This may reflect recovery from loss of leaf biomass induced by the stress of translocation. Trends in this statistic measured across future monitoring events will provide an indication of the ongoing growth rate of the translocated plants compared with those at the reference site.

Table 6.4 presents a new data point which was added to the monitoring methodology in December 2023 and will be collected in future monitoring events. Newly emergent leaves on a *Macrozamia conferta* individual can be identified by the white indumentum - a soft, downy layer of hairs on the leaf surface (**Figure 6.1**). 9% of plants at the recipient site had recently emergent leaves compared with 27% at the reference site. Fluctuations and trends in this statistic over the next 12 months may provide insight into the effect of seasonality and time-since translocation on new leaf production.

The limited data collected to date, supports a translocation survival rate of approximately 75%, in line with the low-end rate specified in the MTMP. To support no net loss of *Macrozamia conferta* impacted by the Project, propagation of an additional 2,733 seedlings will be required. Based on a germination rate of 65%, collection of an additional 4,204 seeds from wild plants will be required. Given the long propagation timeline of the species, we recommend initiation of a seed collection program and application for a Queensland Protected Plant Growing License and Sustainable Harvest Plan.

Figure 6.1 White indumentum observed on surface of newly emergent leaves on recently translocated *M. conferta*.

Table 6.5 and **Table 6.6** present measurements of general leaf disturbance and insect predation of leaves within the translocated and reference populations. The percentage of plants without observed leaf disturbance was 12.3 times higher at the recipient site than at the reference site. This figure reinforces the qualitative assessment of no significant impacts from threatening processes at the recipient site. This figure is expected to drop over time as the new leaf material produced post-translocation is exposed to biotic and abiotic sources of disturbance (sun, predation, pathogens, etc.). There was no difference between the recipient and reference site for the percentage of plants with observed evidence of leaf predation by insects (4%).

6.4 Success rate of propagated seedlings planted at the recipient site

As of 13 May 2024, no propagated seedlings have been planted at the recipient site. The survival statistics of propagated stock planted at the recipient site (within monitoring plots) in future will be presented here.

7. Conclusion

This report presents the results of December 2023 monitoring activities, along with a summary of translocation and propagation activities undertaken in the period 13 May 2023 to 18 May 2024 to support the implementation of the MTMP.

At the time of this report, a total of 12,946 *Macrozamia conferta* individuals had been translocated from the construction footprint of the MIWF and associated OHTL Projects.

Assessing the survival rate of the translocated population is confounded by the subterranean morphology and slow growth rate of the species. *M. conferta* can persist for many years without above ground plant parts. Estimates based on instantaneous leaf counts are likely to grossly underestimate survival rates where plants may have lost their fronds, or not held living fronds, during translocation. Identification of 'new' plants within a plot may represent either recruitment or the re-emergence of a pre-existing plant.

The monitoring challenges presented by *M. conferta* morphology are exacerbated by its comparatively slow and sporadic growth rate. In each growing season, a viable individual may produce none, one, or many new leaves. Living leaves have a proclivity to resist senescence and can be held in situ for several years.

At the translocation site, 58% of plants held living leaves in December 2023 – 13.8% lower than the April 2023 baseline. At the reference site, 97.5% of plants held living leaves in December 2023 – 3.1% higher than the April 2023 baseline.

In response to the peer-review of the first annual monitoring report, additional metrics of survival have been incorporated into this report to mitigate the distortion in survival rate estimates based on living leaf counts. The low-end survival rate assumption described in the MTMP (75% of translocated plants) is supported by the percentage of plants displaying evidence of ongoing leaf production (75%) and the percentage of plants observed to have increasing leaf biomass (73%) (Table 6.2, Table 6.3). The percentage of plants displaying recently flushed new leaf growth is three times lower at the translocation site (9%) than at the reference site (27%). An increase in this value of the next 12-month period will provide additional insight into the ongoing viability of the translocated population. Future monitoring data will allow the analysis of trends in these additional metrics and support a more accurate estimate of survival rate to be inferred in the third annual monitoring report.

The data included in this report suggests a higher male to female ratio in the translocated population than that seen in the reference population. The majority of monitored plants at the translocation site are still of undetermined sex. The possibility of genetic analysis of sex ratios in the translocation and reference population may be investigated in future, as recommended in the peer-review of the first annual report.

No increasing impact from threatening processes has been observed. No difference was measured in the percentage of plants impacted by insect predation between the translocation and reference sites. A greater percentage of plants at the translocation site (37%) were recorded as having no leaf disturbance than at the reference site (3%).

Future translocation monitoring events are scheduled to take place in June and December of 2024. Results from these monitoring events will be reported in the MTMP Annual Report Year 3. Incorporation of an additional 12 months of monitoring data will provide insight into the effects of seasonality and time-since-translocation on the survival rate of the translocated population.

Collection of additional seed from wild populations of *M. conferta* to offset potential translocation losses is recommended, subject to the acquisition of relevant permits and approvals.

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Appendix A

Monitoring Statistics

Table A.1: December 2023 Monitoring Statistics - Population

Plot ID	Total Number Tagged Plants	Number Known Mature Plants (plants with cone present or past)	% Plants Known Mature (plants with cone present or past)	Male : Female Ratio of Known Mature Plants	Number Plants with Visible Predation	% Plants with Visible Predation
R1	74	2	2.70	1:1	3	4.05
R2	200	5	2.50	1.5:1	6	3.00
T1	968	8	0.83	7:1	48	4.96
T3	542	29	5.35	3.1:1	17	3.14
R-Average	137	3.5	2.55	1.3:1	14	3.28
T-Average	755	18.5	2.45	3.6:1	7.5	4.30
R-Total	274	7			17	
T-Total	**1510**	**16**			**184**	

Table A.2 December 2023 Monitoring Statistics - Reproduction

Plot ID	Number New Plants (recruitment)	% Population Increase (compared to last monitoring event)	% Population Increase (compared to initial number of plants in plot)	Number of Plants Currently Coning (undeveloped or ripe cones)	% Known Mature Plants Currently Coning (undeveloped or ripe cones)	Male : Female Ratio of Currently Coning Plants (undeveloped or ripe cones)	% Known Female Cones Ripe (seeding potential)	Any Pollinators Present?
R1	0	0.000	0.00	2	100	1:1	100	No
R2	5	0.027	2.70	3	60	2:1	50	No
T1	0	0.000	0.00	6	75	2:1	0.00	No
T3	0	0.000	0.00	8	28	3:1	28.57	No
R-Average	2.5	0.018	1.82	2.5	71.43	1.5:1	33.33	
T-Average	0	0.000	0.00	7	37.84	2.5:1	25	
R-Total	5	0.018	1.82	5				
T-Total	0	0.000	0.00	14				

Table A.3 December 2023 Monitoring Statistics - Survival

Plot ID	Number Plants Bearing Living Leaf	% Plants Bearing Living Leaf	% Change in Plants Bearing Living Leaf (compared to last monitoring event)	% Change in Plants Bearing Living Leaf (compared to initial number of plants in plot)	Number Plants Displaying New Growth	% Plants Displaying New Growth	% Change in Plants Displaying New Growth (compared to last monitoring event)	% Plants Displaying Increased Growth (compared to initial number of plants in plot)
R1	74	100	0	100	18	24.32	n/a	45.95
R2	193	96.5	2.6	2.6	61	30.5	n/a	46.37
T1	562	58.06	-10.99	-10.99	19	1.96	n/a	18.34
T3	313	57.75	-14.64	-14.64	60	11.07	n/a	18.65
R-Average	133.5	97.45	3.09	3.09	39.5	28.83	n/a	46.25
T-Average	437.5	57.95	-13.79	-13.79	39.5	5.23	n/a	18.45
R-Total	267				79			
T-Total	875				79			
Ecologists on Site: Hannah Rigney, Peter Brennan, John Keep, Kye Chamberlain								

R-Average is the mean of two reference plots located in Durikai State Forest. R–Total is the sum of the two reference plots.

T-Average is the mean of two monitoring plots within the recipient site used to represent the translocated population. T-Total is the sum of two monitoring plots.