Noosa & District Landcare

Department of Transport and Main Roads

Bruce Highway – Cooroy to Curra (Section D: Woondum to Curra)

Macrozamia pauli-guilielmi Translocation Final Report

Limitations Statement

Information presented in this report is based on an objective study undertaken in response to the brief provided by the client. Any opinions expressed in this report are the professional, objective opinions of the authors and are not intended to advocate any proposal or pre-determined position.

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Introduction

Project background

The Bruce Highway upgrade Cooroy to Curra Section D is being undertaken by the Department of Transport and Main Roads (TMR). TMR engaged Noosa District Landcare Group to undertake the translocation of the endangered *Macrozamia pauli-guilielmi* within the project area. *M. pauli-guilielmi* is listed as endangered under the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act) and is therefore a matter of national environmental significance. The national recovery plan for the *M.pauli-guilielmi* recommends that individual plants under immediate threat should be translocated to suitable habitat.

M.pauli-guilielmi populations were identified by targeted flora surveys from 2015 – 2017 and locations recorded for future salvage works. Noosa District Landcare began salvage works in August 2020 and completed works in December 2020. Works followed the Translocation Management Plan and the Translocation Memo provided by Peter Moonie at Red Ash Consulting which contained additional information to assist in the translocation of this species.

Both seedlings and adult plants of the *M.pauli-guilielmi* were translocated from Salvage site 2 and Salvage site 3 and transported to the recipient site on 878MCH1061 adjacent to Curra State Forest. The recipient site had a pre-existing population of *M.pauli-guilielmi* and was deemed satisfactory to be the receiving site for all translocated *M.pauli-guiliemi*. A total of 242 seedlings and 35 adults were translocated by Noosa District Landcare and the subcontractor Ace of Spades.

The translocation works at the time of this report have shown to be successful with plants surviving the stress of translocation. This report will outline the methodologies used and the monitoring being undertaken.

Plant description

M.pauli-guilielmi is listed as endangered under the EPBC Act and NC Act. *M. pauli-guilielmi* is a small cycad with a swollen, underground, non-branching trunk that is not visible from the surface and grows to 25 cm long and 20 cm diameter with one to three parsnip like roots. Mature plants have between two and eight erect leaves that emerge from the soil to a length of 30 to 80 cm. The leaf stems are strongly spirally twisted and have narrow, pale green leaflets. The species is dioecious, having separate male and female plants. Female plants produce erect oval cones that are 9 to 14 cm long and resemble small pineapples with a collection of large seeds that are 17 to 25 mm long and 13 to 20 mm wide that change colour from green to red or orange when ripe. Male plants produce cones that are 8 to 14 cm long.

Plate 1. Shows the underground trunk on an adult M.pauli-guilielmi where soil fell away.

Taken during translocation works 16.12.20

Plate 2. Shows fronds and female cones on an adult M.pauli-guilielmi that was translocated.

Taken after translocation works 4.12.20

Plate 3. Shows a seedling of the Macrozamia which stood at about 20cm tall.

Plate 4. An example of the coralloid root found on both seedlings and adults.

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Taken 22.1.21

Plate 5. Shows an example of a seedling which was dug out and soil fell away. Displays swollen stem and the coralloid root.

Taken 12.9.20

Taken during translocation 12.9.20

Plate 6. Shows the swollen trunk and tap root of an MPG base which came off of a large clump of adults plants. Note the indentation.

Taken 16.12.20

Translocation Methodology

Pre-works Survey

A pre works survey was undertaken across the 2 salvage sites that will be directly impacted by the Bruce Highway upgrade project. These salvage sites are number 2 and 3 on Figure 1 below and were accessed off of Bradys Road, Curra.

Survey works were undertaken in July 2020 by two suitably qualified Noosa Landcare staff – Steve Husband and Jennifer Coleman. The survey involved finding and recording the location of *M.pauli-guilielmi* using previous flora survey data provided by TMR. Locations were recorded on the AVENZA mapping program and individuals demarcated by placing an orange flag next to the plant for easy identification. Both seedlings and adults were identified and recorded in this manner. Plates 7 and 8 show the method and orange flags used in this project.

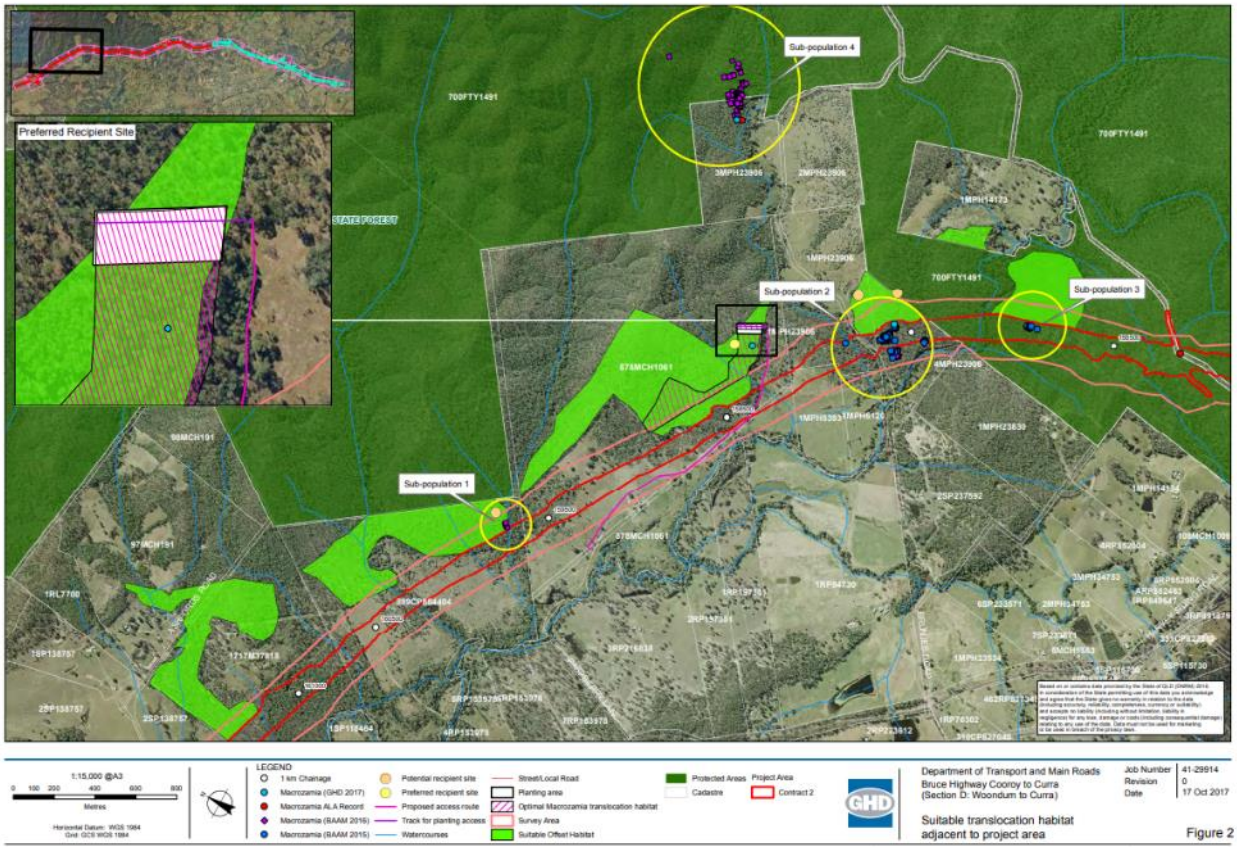

Figure 1. Locations of *M.pauli-guilielmi* sub – populations in relation to Project footprint. *(Bruce Highway - Cooroy to Curra (Section D: Woondum to Curra) Macrozamia pauli-guilielmi Translocation Management Plan)*

Plate 7. Pre works survey was undertaken using Avenza mapping program and maps of surveyed MPG. This photo shows team identifying and recording.

Taken August 2020

Plate 8. An example of the orange flags used to mark the location of the MPG with the addition of a number.

Taken August 2020

Prepare recipient site

The preparation of the recipient site for *M.pauli-guilielmi* translocation works started with finding the best access to the recipient site depicted in Figure 2 below. This was off of Raspberry Lane, Curra and was the main access point for the entire project.

Preparation works included the marking out of the individual recipient polygons which corresponded to the two different salvage sites. Other areas of the site were also used for *Marsdenia coronata* translocation, all of the translocation areas are shown in Figure 2. All polygons were marked out using the AVENZA GPS program and flagging tape on ground.

Access tracks were maintained and widened and noxious weed Giant Rats Tail Grass controlled on immediate tracks to reduce risk of spreading into receiving site.

Weed control works were undertaken prior to translocation which included removing large *Lantana camara* stands and the control of the invasive vine *Passiflora* ssp. via cut and swab. Cut material was taken out of marked polygons to make room for plantings.

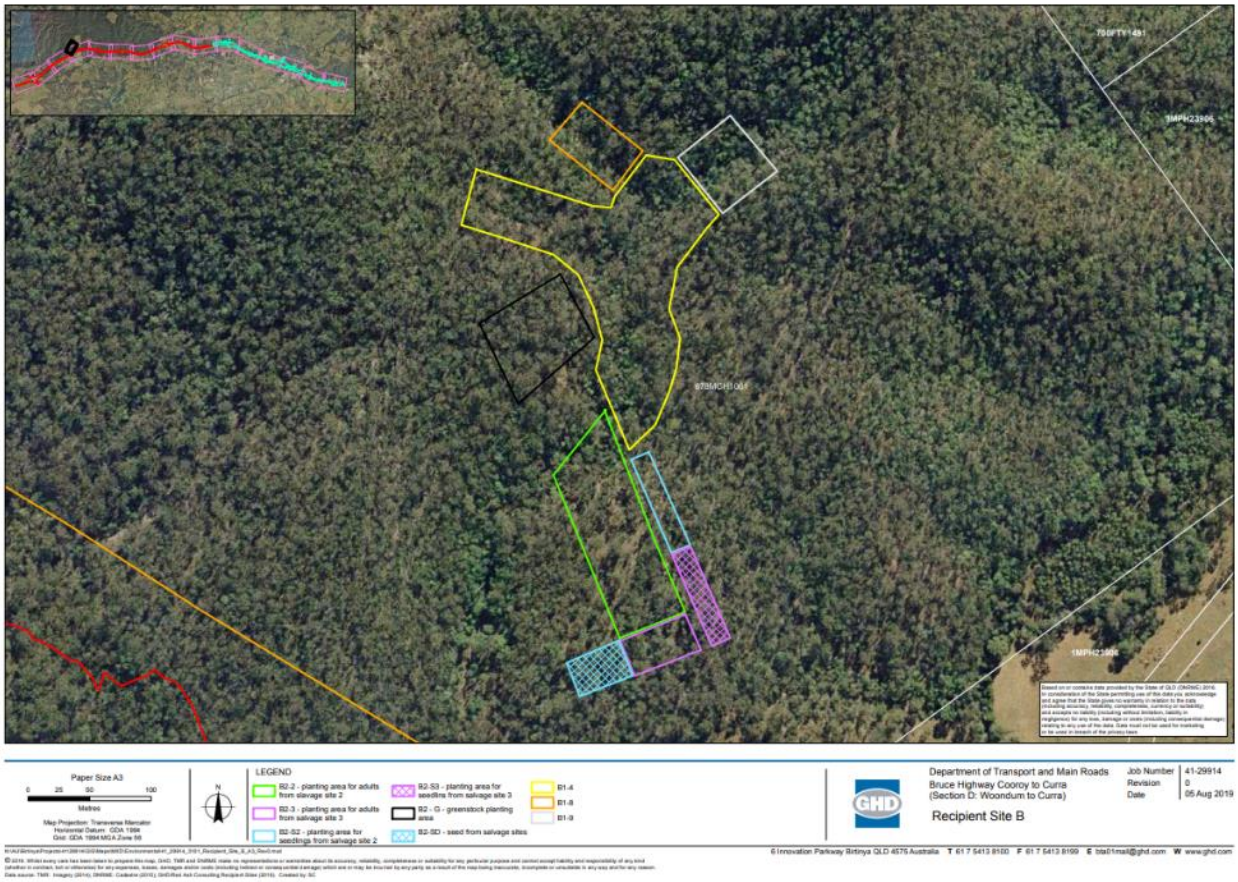

Figure 2. Map of *M.pauli-guilielmi* recipient site polygons. *(Bruce Highway - Cooroy to Curra (Section D: Woondum to Curra) Macrozamia pauli-guilielmi Translocation Management Plan)*

Plate 9. Site preparation works were undertaken throughout receiving site removing weeds and identifying suitable areas for planting.

Taken August 2020

Plate 10. Site preparation works were undertaken throughout receiving site removing weeds and identifying suitable areas for planting.

Taken August 2020

Salvage plants in project area

Salvage works for the *M.pauli-guilielmi* translocation differed greatly for adult plants and seedlings. All works followed the Bruce Highway - Cooroy to Curra (Section D: Woondum to Curra) Macrozamia pauli-guilielmi Translocation Management Plan and also the Translocation Memo provided by Peter Moonie at Red Ash Consulting.

The two sub populations of *M.pauli-guilielmi* requiring translocation are shown in Figures 3 and 4. Majority of plants were in clusters due to the nature of the seed dispersal being close to the parent plant. This meant that careful planning and strategy had to be used to reduce the risk of trampling and damage to the *M.pauli-guilielmi.* For this report works have been separated below into *M.pauli-guilielmi* seedling salvage works and *M.pauli-guilielmi* Adult salvage works.

Any loose seeds found in or around plantings were collected before translocation works began and utilised in propagation works.

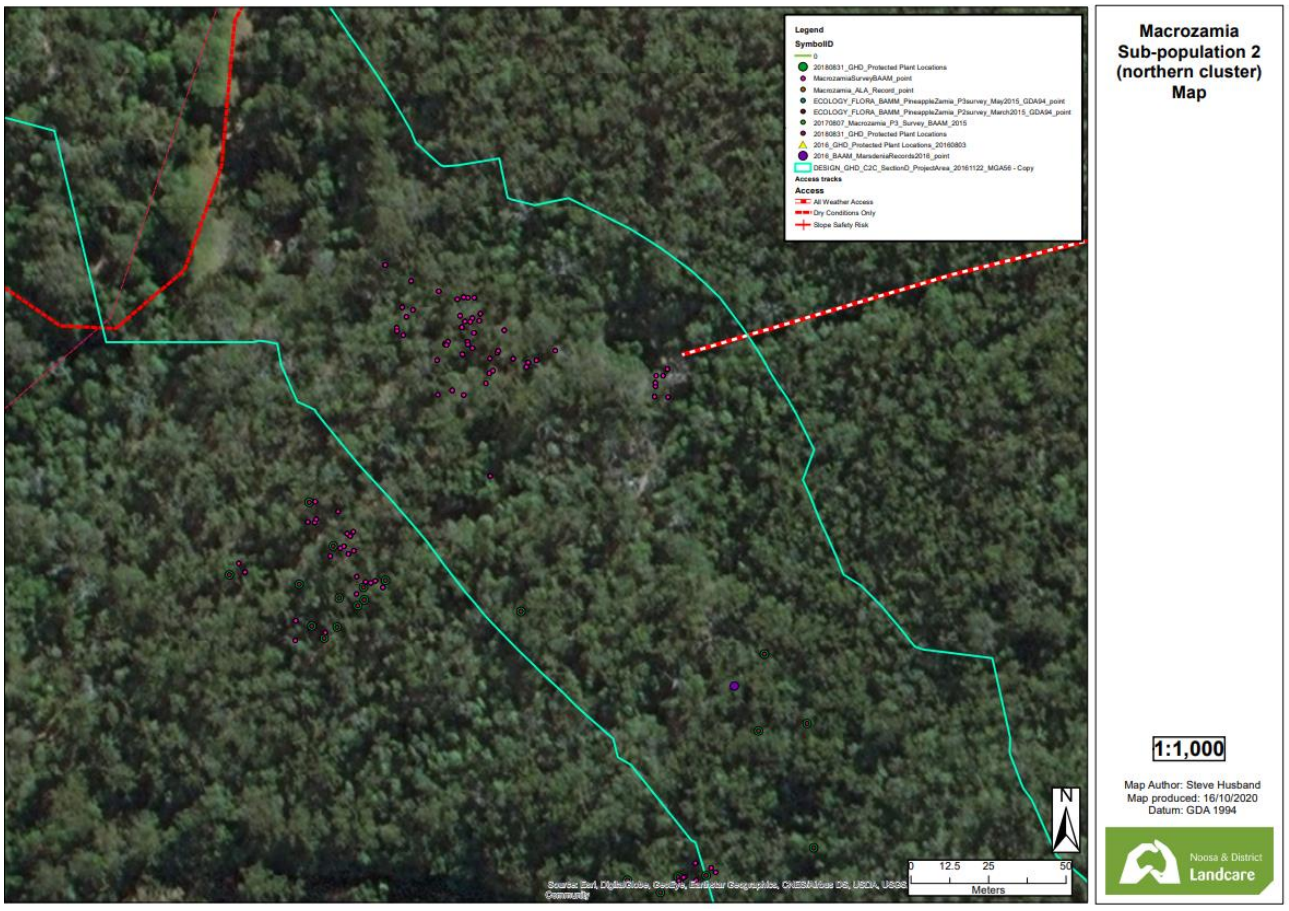

Figure 3. Macrozamia Sub – population 2 (northern cluster).

Figure 4. Macrozamia Sub – population 3 (southern cluster).

Methodology for *M.pauli-guilielmi* seedlings salvage works

Seedlings of *M.pauli-guilielmi* were dug up first to make area clear for the salvaging of the adult plants. The seedling were dug out by Noosa District Landcare staff. The methodology used is listed step by step below:

- Seedling was identified, if there was a cluster of seedlings example 2+ plants within 10cm of each other they were dug out as one root ball.
- Area approximately 20cm radius around seedling was cut into with shovel (shown in Plate 11) and then water poured over area to drench root ball. This was done to keep root ball intact when moved.
- Once radius around plant was cut and loosened shovel was used to lever root ball up. Hands were then used to tease and lift the root ball making sure not to damage tap root (shown in Plate 13). Root ball was carefully placed on pre - cut hessian moistened and wrapped making sure to hold bottom.
- Plants were then recorded with a number and their features such as number of leaves, size, health, visible pest damage etc. on the data recording sheet.
- All seedlings were sprayed with an anti – transparent once dug out.
- Plants were then carefully placed in buckets or pots for transportation (plate 14).

This methodology worked well, at the beginning we were not using enough water and plants were losing their soil (Plate 12) but with the addition of water and careful work majority of root balls remained intact.

Plate 11. Shows team member digging out a seedling using a shovel, special care was taken to not disturb the root ball and to keep the root ball intact.

Taken September 2020

Plate 12. Shows a complete plant that was dug out at the beginning before we started to use water to keep the soil intact.

Taken September 2020

Plate 13. Shows team moving root ball of seedling with soil intact, next steps wrapping in moist hessian to keep it all together.

Taken September 2020

Plate 14. Shows how the seedlings were wrapped in hessian with soil intact and transported to recipient site.

Taken October 2020

Methodology for *M.pauli-guilielmi* adult's salvage works

For the salvaging of the adult *M.pauli-guilielmi* Noosa District Landcare engaged Ace of Spades Tree Relocators who specialise in tree assessment, removal and transplanting. Russel and his team were experienced in translocating endangered and threatened trees and had the right equipment, knowledge and care to complete the job.

The translocation of the adult plants was initially postponed due to dry conditions and it was decided by all parties that it would be best to wait for substantial rain before starting the translocation. This meant that translocation of the adult plants was delayed to December 2020.

Equipment for the translocation of adult *M.pauli-guilielmi* included 5t tilt head excavator, bogie tipper, 4WD ute with water tanks and fire - fighting pump, John Deere 8410 w/62" Big John tree Spade and custom made tree cages 1140 x 650mm.

Plate 16. Shows the semi – trailer carrying the John Deere tractor and spade.

Taken December 2020

Plate 17. Shows bogie tipper and 5t excavator from Ace of Spades.

Taken December 2020

Below is the methodology observed for the translocation of adult *M.pauli-guilielmi.*

- Adult *M.pauli-guilielmi* were identified and witches hats placed next to plants for clearer visibility shown in Plate 18.
- In majority of instances the excavator had to be used to dig out around the diameter of the root ball (shown in Plate 19) which was made to fit the 1100mm tree cage. This had to be done on majority of plants first due to the large rocks around the area and under the plants which meant the spade couldn't get through the soil/rock. An example of the root ball is shown in Plate 20.
- The next step was to manoeuver the tree spade over the plant, Ace of Spades took special care to make sure the plant would be in the middle of the root ball (shown in Plate 21).

- The tree spade then moved the blades down and enclosed the root ball, while this was happening the root ball was watered to keep it intact and lubricate the blades.
- The root ball was then lifted up and a pre made tree cage placed in the hole and lined with pre - cut hessian shown in Plate 22.
- The plant was then released into cage undisturbed as you can see in Plate 23.
- All plants were sprayed with an anti – transparent once dug out.
- Once the plant is in the cage hessian was wrapped around and then left in the hole to retain moisture until it is ready to be loaded onto the tipper for transportation shown in Plate 24.

Plate 18. Shows the identified adult MPG ready to be dug out.

Taken December 2020

Plate 19. Shows how the majority of plants had to be dug out due to large rocks in the area. The excavator was used to dig around root ball so that the spade could get into the ground.

Taken December 2020

Plate 20. Shows the root ball still intact after the excavator dug around ready for spade.

Taken December 2020

Plate 21. Shows the spade then being used to move around plant and lift intact root ball out.

Taken December 2020

Plate 22. Shows the spade with root ball and plant inside lowering plant into cage lined with hessian.

Taken December 2020

Plate 23. Shows the plant sitting in the cage still intact and then ready for lifting into truck for transportation.

Taken December 2020

Plate 24. Shows plant in cage ready for transportation.

Taken December 2020

Transport

The transport of *M.pauli-guielmi* seedlings and adults followed the Translocation Management Plan, the Translocation Memo sent by Peter Moonie from Red Ash Consulting and best practice methodology from Ace of Spades. Due to the nature of the job some methods outlined in the management plans could not be used but special care was taken to make sure plants were moved safely.

M.pauli-guilielmi seedlings

The *M.pauli-guilielmi* seedlings were transported in a covered canopy Ute. They were packed in moist hessian and then placed in pots which then sat in Styrofoam boxes to prevent plants from tipping (shown in Plate 25). Due to only digging out approx. 30-40 seedlings on a day all plants could be transported to receiving site and planted on the day.

M.pauli-guilielmi adults

The adult Macrozamia were transported by the sub – contractors Ace of Spades. Russel and the team had the right equipment to transport the large plants safely and securely. With the addition of the wire cages that held the root ball in place it meant that 8 root balls could be transported at a time in the truck. As shown in Plate 26 the plants were secure and then tied down. Once on the truck plants were taken to receiving site for planting. The excavator was used to lift the root balls carefully in and out of truck. The cage and hessian allowed retention of soil around the rootball and was a successful method to transport these plants safely.

Plate 25. This shows how the seedlings were transported from the salvage sites to the receiving sites.

Taken October 2020

Plate 26. Shows the adult MPG being secured in the back of a bogie tipper (8 baskets per trip). These were lifted on and off by the excavator.

Taken December 2020

Planting operations

M.pauli-guilielmi seedlings

Seedlings salvaged from both sub-populations 2 & 3 were planted at the receiving site on 878MCH1061 situated on the edge of Curra State Forest . There were two separate designated planting areas for salvage site 2 and 3. Below is the method for planting the seedlings:

- Holes were dug roughly 2m apart and 30cm deep using mattock.
- The holes were kept in rows for ease of maintenance and monitoring.
- Seedlings were planted in holes making sure to keep them at the correct depth and to not damage any coralloid roots.
- Each plant was planted with its ID number and tag (shown in Plate 27). Special care was taken to plant at the correct depth and to keep as much of the original soil around the plant.
- A raised edge was built on the lower side to keep water in.
- All seedlings were watered in with 10L of water using quickspray unit.
- Each seedling was again sprayed with an anti –transparent.

Plate 27. Shows team planting a seedling by pre digging hole about 30cm x 30cm with a mattock and then placing the entire root ball with plant into hole. Special care was taken not to compact too much to protect coralloid roots.

Taken September 2020

Plate 28. Shows the MPG seedling after it was planted and then watered in.

Taken September 2020

M.pauli-guilielmi adults

Adults salvaged from both sub-populations 2 & 3 were planted at the receiving site on 878MCH1061 situated on the edge of Curra State Forest. There were two separate designated planting areas for salvage site 2 and 3. Below is the observed method for planting the adults which was undertaken by Ace of Spades.

- Suitable areas for adult *M.pauli-guilielmi* adults were identified and marked by Peter Moonie from Red Ash Consulting.
- Once suitable area identified a 5t excavator was used to dig a hole approx. 1.5 m diameter (shown in Plate 29). Holes further into bush land were dug first to prevent any trampling.
- Once hole was dug the plant was then lifted out of truck using a lifting hook and hoist chains shown in Plate 30 and carried over to pre-dug hole which is shown in Plate 31.
- Once basket was placed in hole it was infilled if necessary and then the wire basket and hessian cut to soil level.
- Mulch from surrounding area was scattered over planted areas to retain soil moisture and reduce risk of weeds.
- All adult plants were watered in using aqua spear shown in Plate 32 with approx. 15L of water making sure to water in entire root ball.
- All plants and fronds were then sprayed with an anti – transparent.
- Photos were taken of all translocation adults.

Plate 29. Shows the excavator digging the large holes for the adult plants at the recipient site in their designated areas, suitable locations were decided on by ecologist Peter Moonie.

Taken December 2020

Plate 30. Shows an adult plant being lifted by the excavator out of the back of the truck and into the pre dug holes.

Taken December 2020

Plate 31. Shows adult plant after it has been; lowered into hole, excess hessian was then trimmed and basket cut to sit flush with the ground.

Taken December 2020

Plate 32. Shows the adult plant being watered in using a water spear, each adult plant was watered in making sure that the soil had well and truly settled around the root ball.

Taken December 2020

Plate 33. Shows adult plant after being watered in and leaf mulch spread around disturbed areas.

Taken December 2020

Recording

Using a DGPS unit the accurate location of each translocated *M.pauli-guilielmi* was recorded on a digital map and the coordinates for each individual plant recorded on the data sheet (Appendix 1). The ID number was written on the flag with permanent marker and then a photo taken of the number and the plant and added to the records.

A brief summary of data is in Table 1 below

Table 1. *M.pauli-guilielmi* final data

Salvage Site	Adults	Seedlings	Number of plants
Sub – population 2	23	178	201
Sub – population 3	12	64	76
Total	**35**	**242**	**277**

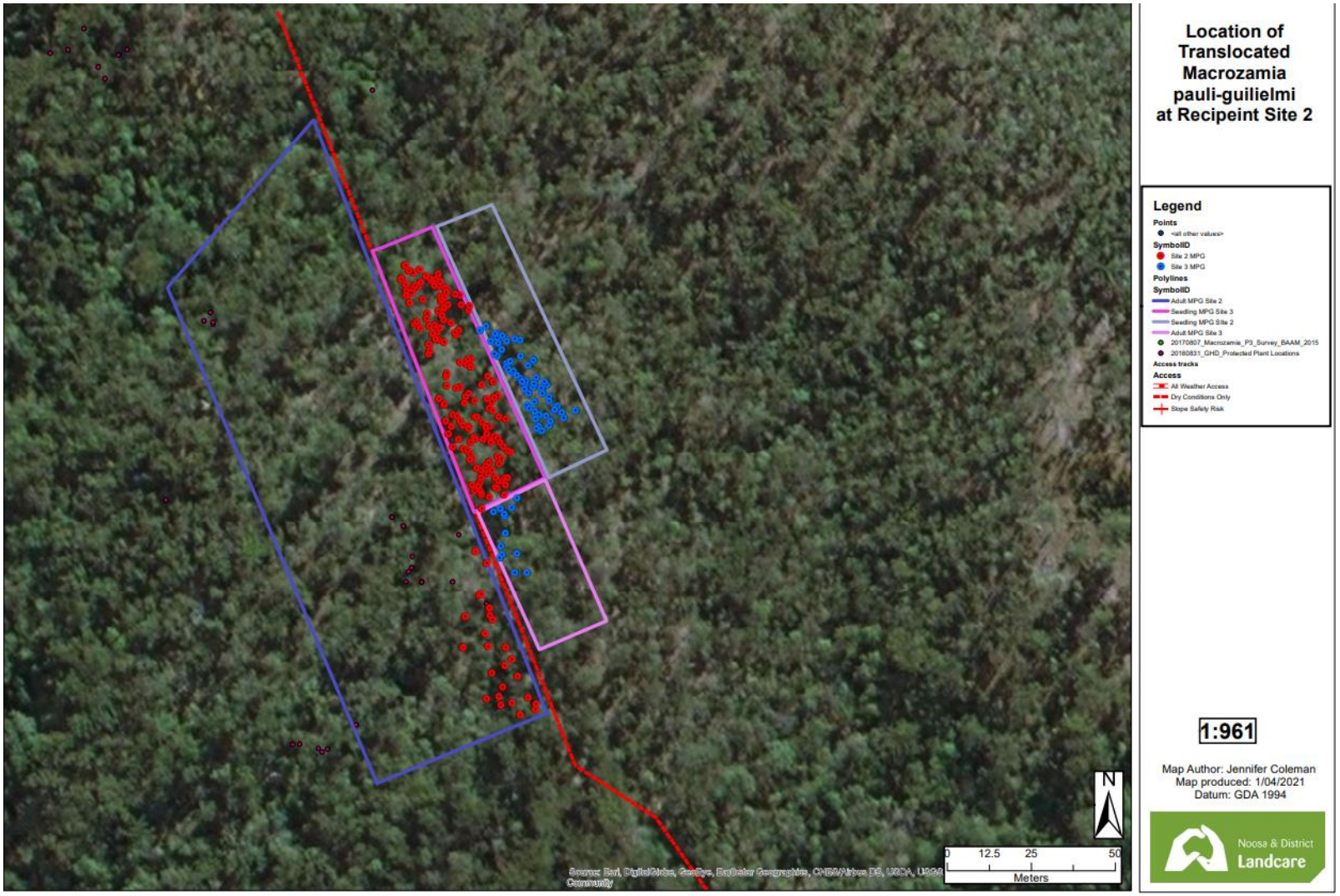

Figure 5. *Macrozamia pauli-guilielmi* final DGPS locations of translocated plants.

Maintenance

Maintenance works were carried out following the Translocation Management Plan and the Translocation Memo from Peter Moonie at Red Ash Consulting. Maintenance works were carried out in conjunction with *Marsdenia coronata* project and included the following;

- Watering of adult plants once per month and seedlings once per fortnight was undertaken from December to date and will continue for 6 months.
- In addition to water Seasol was used in two watering events once in December and once in January.
- Weeds, mainly *Lantana camara, Passiflora suberosa* were removed and in an area of at least 20m radius around planting area. These works were done in conjunction with watering events.
- During maintenance visits any dead fronds were cut off and damage either pest, erosion or grazing was recorded and addressed. To date there has been no evidence of damage.
- A treatment of the anti - fungicide Banrot was applied to all adults and seedlings of the MPG.

Learnings

The translocation of *Macrozamia pauli-guilielmi* was a unique project that allowed for Noosa Landcare to expand their knowledge and expertise on the translocation of threatened species. It was a chance for Landcare to work with other experts in the field which included Peter Moonie from Red Ash Consulting and Russel from Ace of Spades. Over the course of the project from the beginning surveys to the translocation and continued maintenance of the *M.pauli-guilielmi* the project has evolved and adaptive management and flexibility was needed to complete the project. Below is a summary of things that Noosa Landcare has learnt over the duration of the translocation events.

- *M.pauli-guilielmi* is quite resilient with its underground storage it was an ideal plant to translocate. To date plants are not showing any stress from the move which also is due to the excellent work carried out by Ace of Spades.
- The tree spade mounted on the tractor was the right machine for the job. It was perfect for retaining the root ball and minimal disturbance to the plants roots.
- The roots of the *M.pauli-guilielmi* can travel about 30-40 cm away from the main underground trunk. Coralloid roots were observed up to 30cm away from the plant. This is why the tree spade was the ideal equipment.
- The addition of the excavator was necessary to dig around the root balls first, due to the terrain being very rocky the excavator was very good in moving rocks and breaking up the sandstone.
- The tree cage was a great innovation, it held the plant up during transportation and contained the root ball.
- Watering the root ball worked really well to hold the soil together this was good for both seedlings and adult Macrozamia.