Report to Dune Restoration Advisory Group – Monitoring / Research

s9(2)(g)(ii)

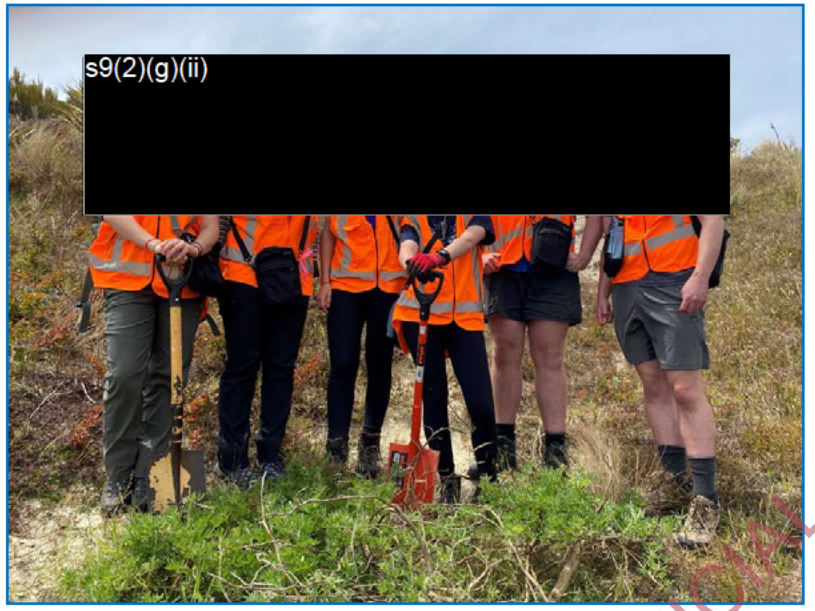
School of Geography

21 October 2024

University of Otago

Fieldwork*
2023/24

4 trips
148 p days



1. Masons, 4 – 12th December 2024
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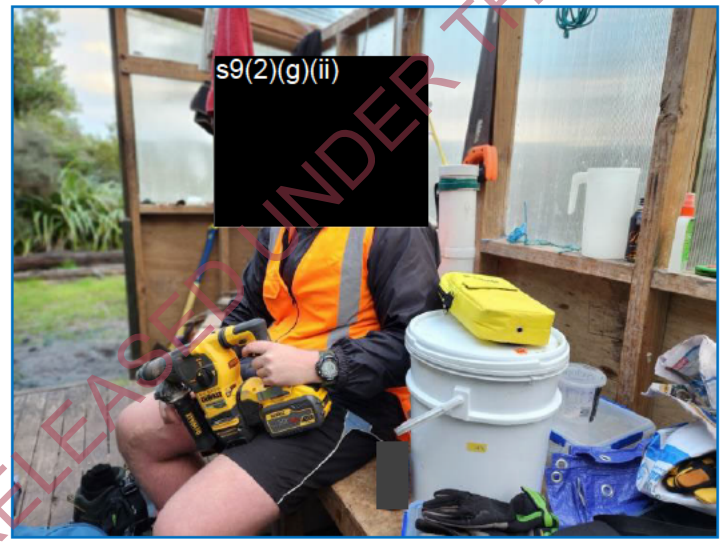
4. Masons, 18 – 30th September 2024
s9(2)(g)(ii)



2. Doughboy, 2 - 6th May 2024
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3. Mason Bay, 6 – 12th May 2024

5. Masons, 1-5th Nov 2024

s9(2)(g)(ii) completed their theses in late 2023/early 2024

Monitoring

- observations of marram regrowth in MUs (using old boundaries)
- Ditto … lupin in Central Dunes (east of fire dam, north of old C73)
- *E. glauca* translocation trial
- landform / habitat development in Central Dunes
- Darwin's Barberry search – Masons
- marram regeneration from rhizome (P6)
- Rainfall (Homestead) & water levels (Chocolate Swamp, boardwalk, Scott Burn)

"Action research"

- Grid searched and pulled/dug all marram and lupin in most MUs east of the parabolic dunes (Central Dunes) including shrub margins

In what circumstances might vollie-based operations contribute to Programme outcomes / success?

Research

(i) **Theses completed:**

- tree lupin nitrogen enrichment & synergies with marram and other exotic invasive grasses at Masons [redacted]
- the biogeography and botany of seepage communities in the northern & central dunes at Mason Bay [redacted]
- foredune morphology and sea lion mobility ([redacted], with some examination of Doughboy Bay)

(ii) **Storm surge (sea-levels) and invasive species dispersal** [redacted], May 2025)

Can we predict marram rhizome stranding events? What combination(s) of sea state and topography increase the risk of a successful stranding?

(iii) **The State of New Zealand Dunes Project**

What remains of dune biodiversity and which systems should be prioritised for conservation investment? (http://tinyurl.com/Activedunes)

What we didn't do over the last 12 months:

- survey lupin in the northern dunes, Duck Creek area, or in the Martin's Creek corner of the Central Dunes
- revise management units in the Northern Dunes – if that's needed?
- calculate metrics of Programme success (e.g. Pikao habitat restored)

… but we have a trip to Doughboy trip 3 – 14th December 2024, to mark 25 years of large-scale operations, during which we'll complete a botanical survey (led by T)

- visit other dune systems on Rakiura
- publish our 'state of the NZ dune' study, but close
- s9(2)(g)(ii) are contributing to DOCs Red List Ecosystem – Active Dunes programme

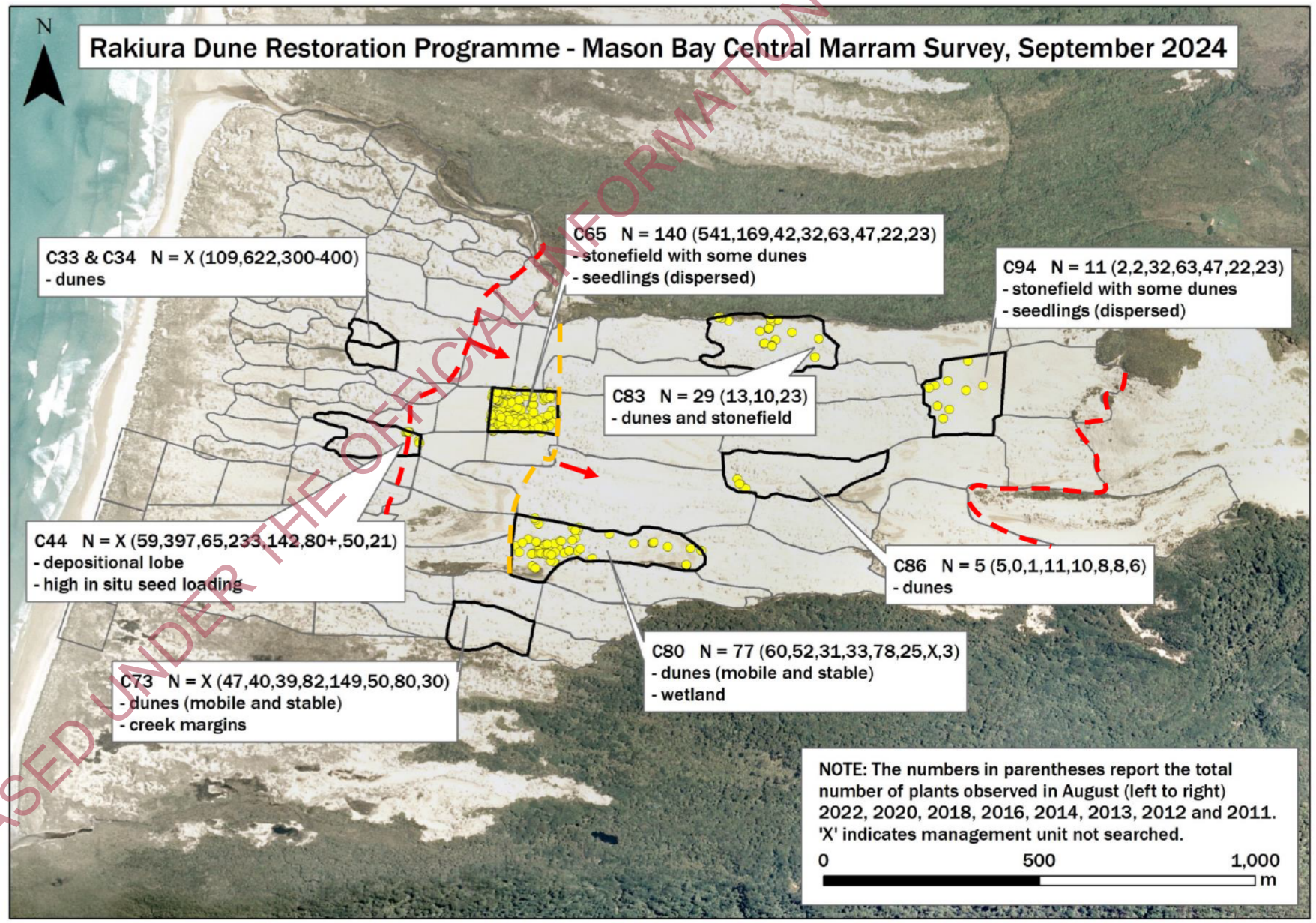
Notes:

- we shifted our storage bin another 100m inland in P4
- we maintained the P4 - P6 quadrats, with the aim of a 10-year survey in August 2025

Post-treatment marram monitoring (using the old management units to allow continuity, 2011 – 2024)

- counts based on 9/24 survey (12/23 data not included)
- similar trends of decreasing numbers away from the foredune
- high numbers in stonefield c/w dunal units?
- good to see a decline in numbers in C65 c/w 2022

- we might capture C33, 34 C73 and C44 in November 2024



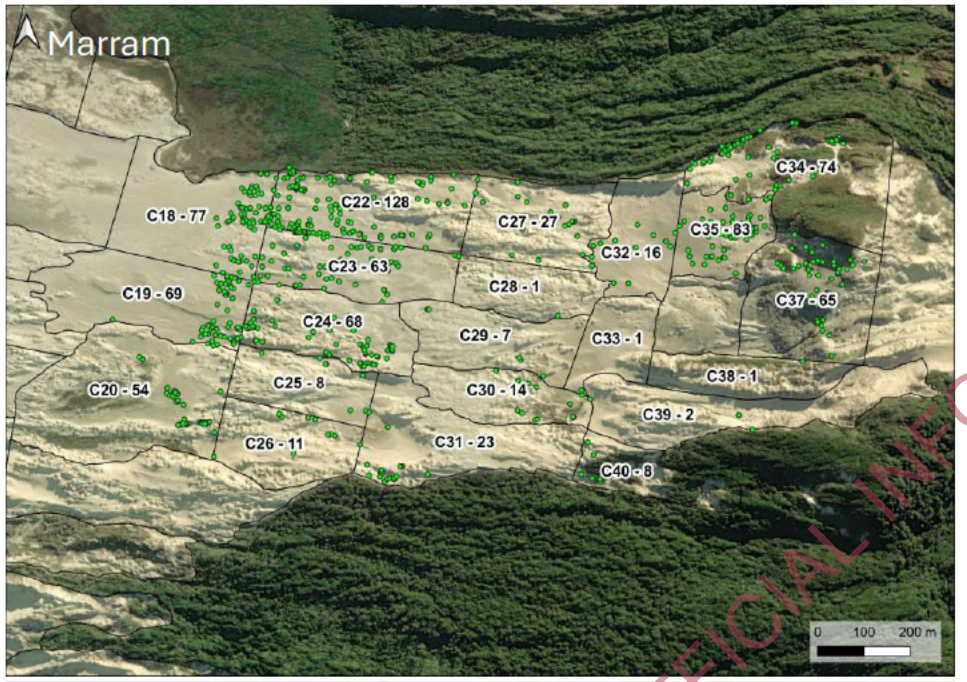
Vollie trip Dec 2023

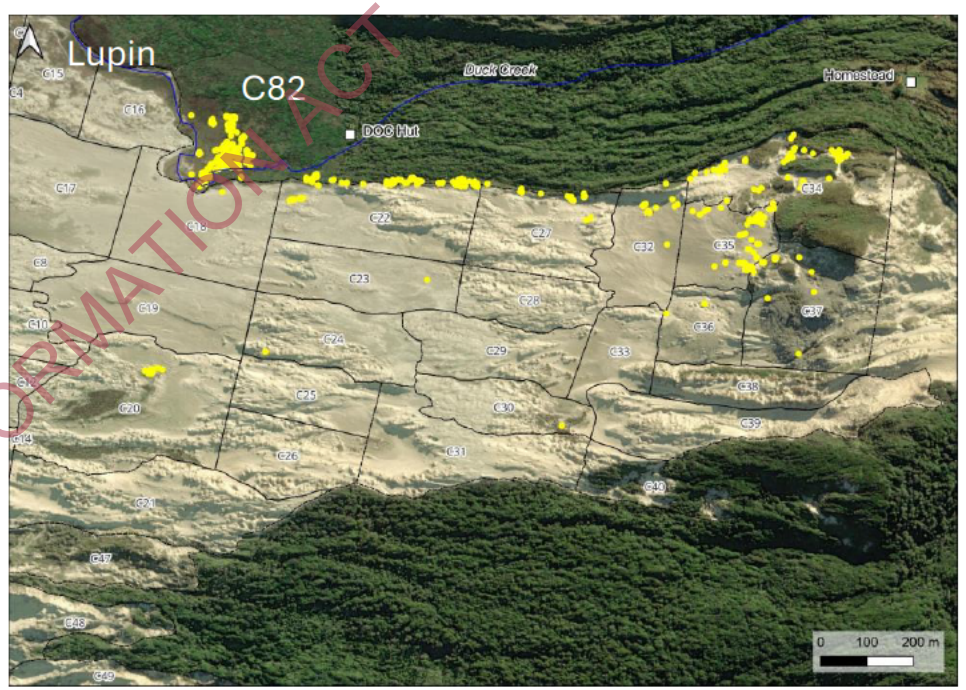
847 marram &
1204 lupin dug
(including all mature lupin in old C82)

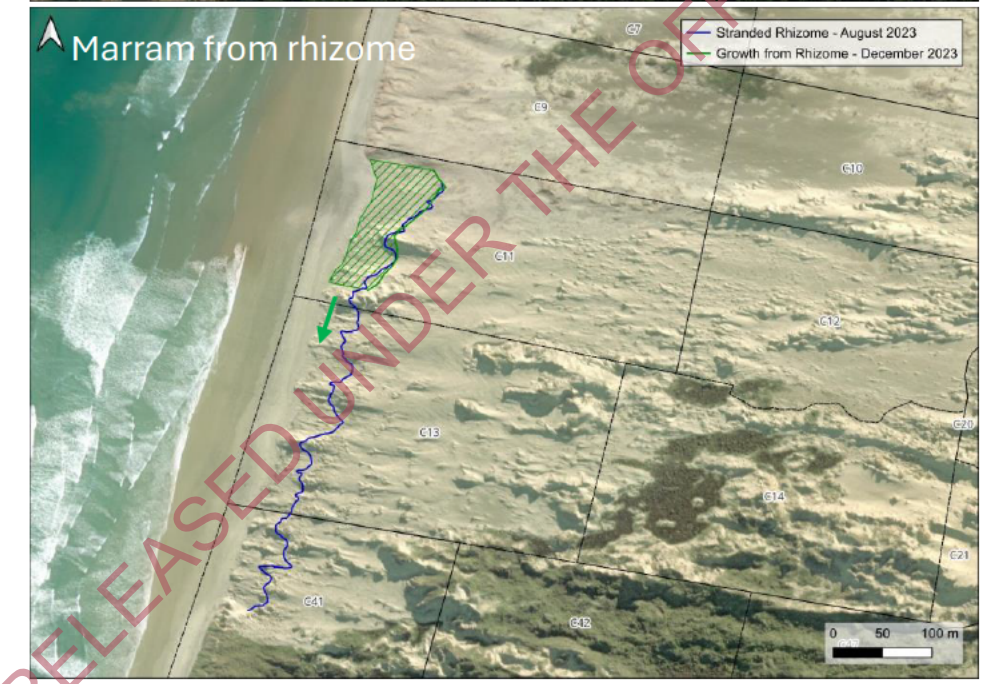
Barberry search

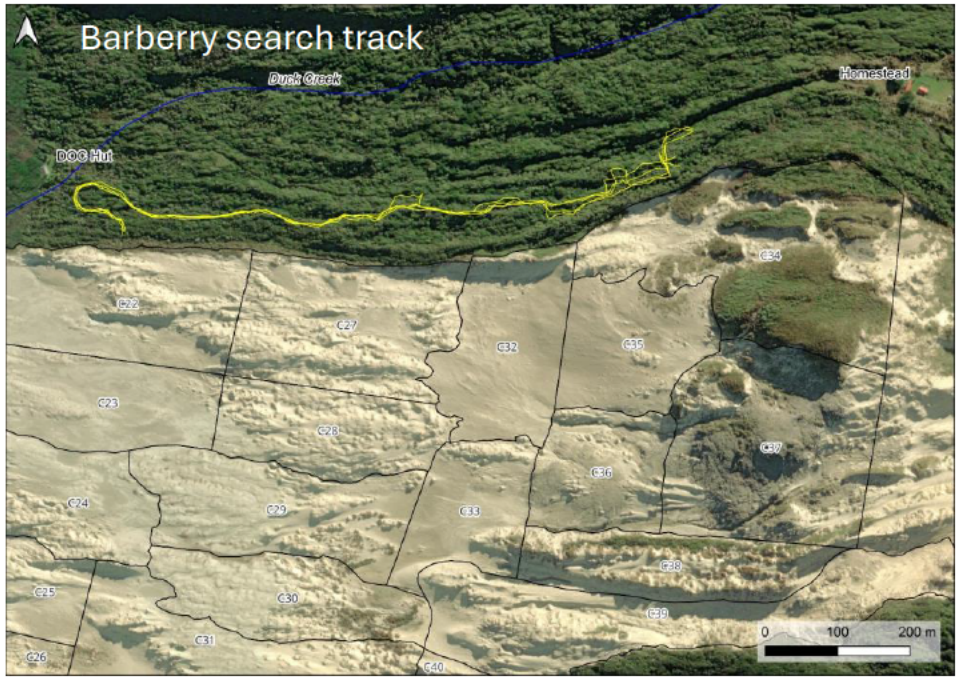
Marram from rhizome survey (P6)

See report
(25 Jan 2024)







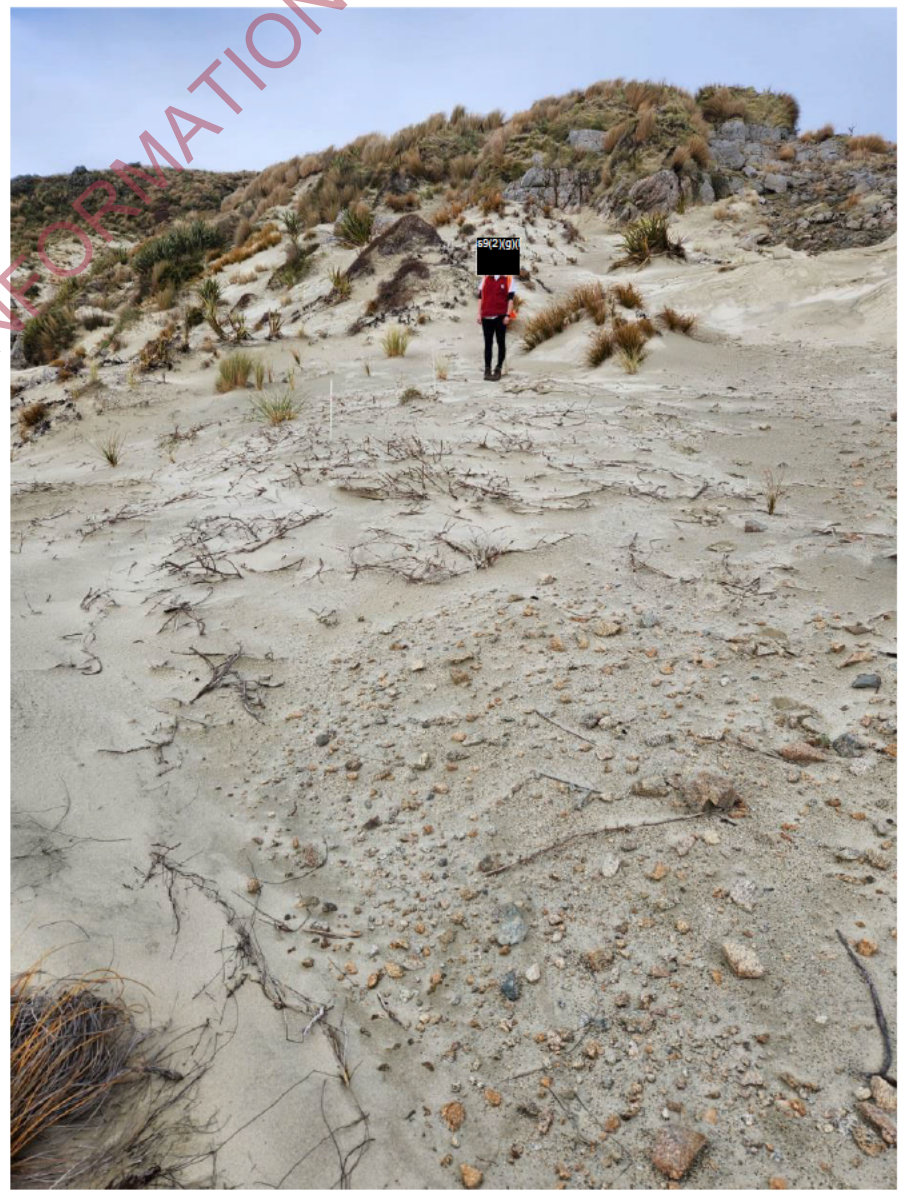


Advantageous to remove lupin before it flowers

12/23

No flowers

9/24



No seedlings, two small plants nearby

Lupin – Special Place

8/2023

Very little regrowth - a few plants cleared in 12/23 and again in 9/24

... the value of early treatment; apparently very little (Gen-X) seed had been produced.

This didn't work … some re-gen from plant, plus rhizome on the pīkao nebkha was buried and 'sprouted' (despite season)

Plant should have been sprayed rather than dug and rhizome dumped into the forest nearby.

Lupin – to dig or cut?

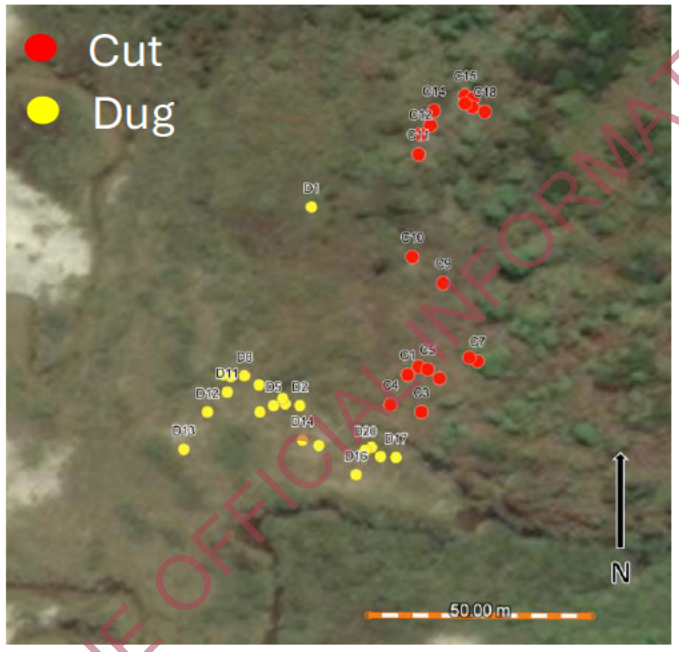
Comparison of dug and cut (mature) lupin (12/23 –9/24)

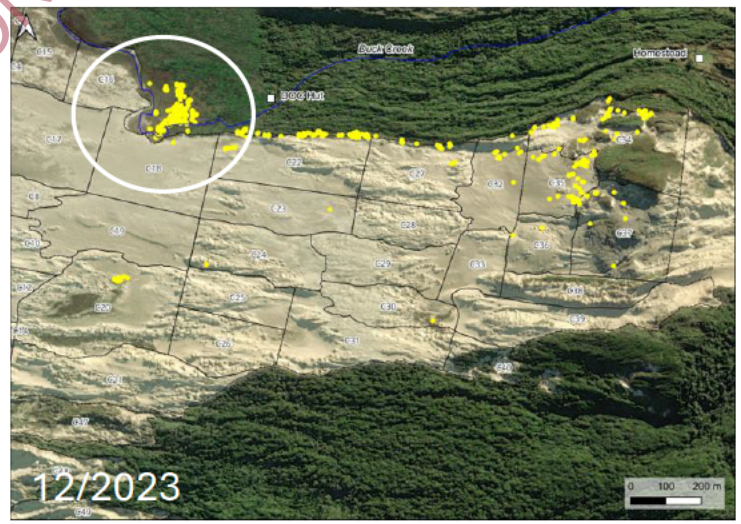
Dug 1-9 seedlings / 3m^2

Mean = 3.45

Cut 1 -18 seedlings / 3m^2

Mean = 8.55





Both treatment sites contained regrowth.

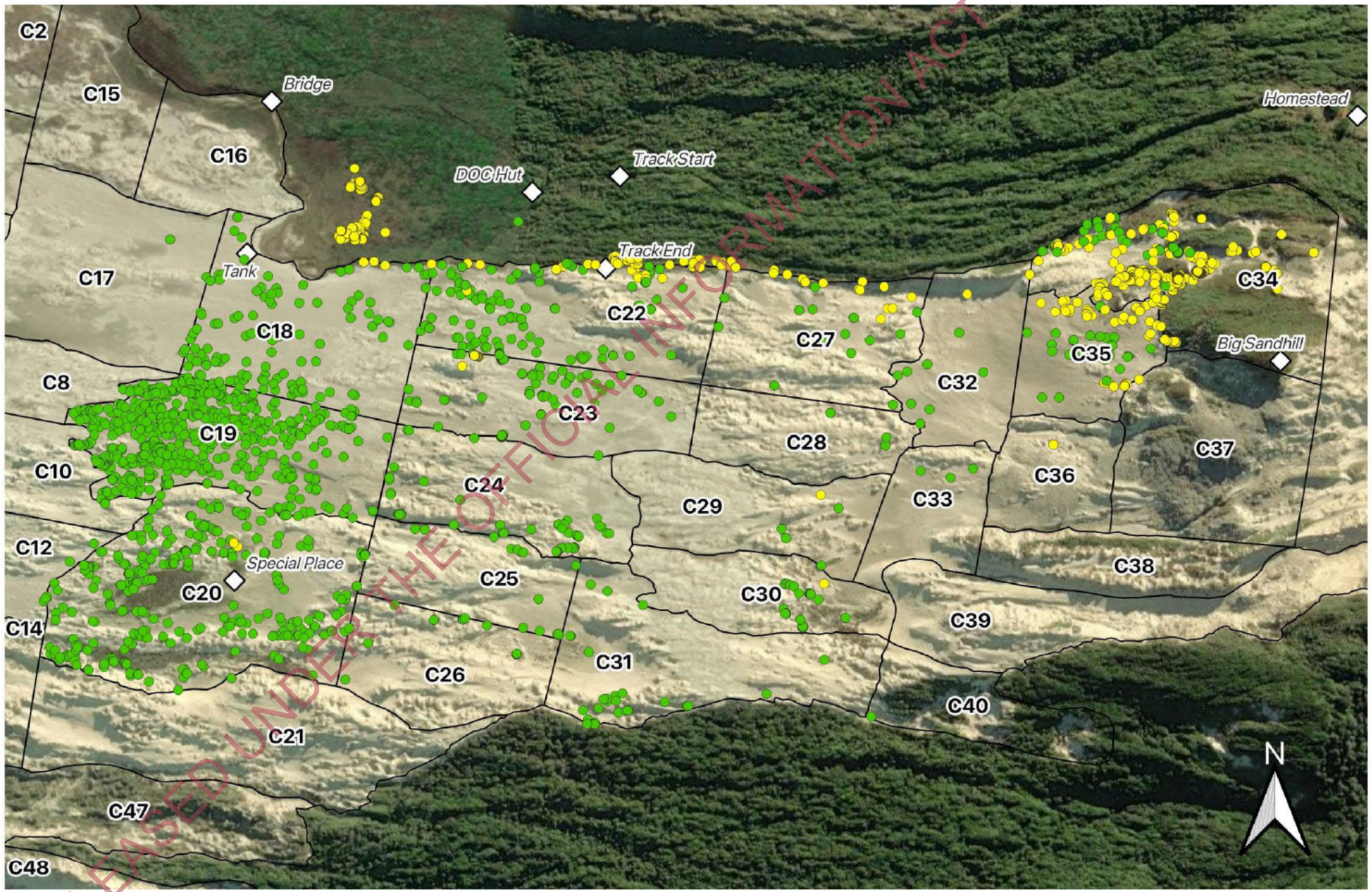
Digging accelerates germination and seedbank depletion so might be beneficial in exposed dunal sites?

Cutting might be favoured where the management goal is to limit lupin growth & seed dispersal via deer while native shrub cover develops (e.g. C82)?

Marram & lupin dug / pulled in September 2024

- 6 days searching
- all weathers
- close supervision
- nightly GIS mapping & review
- 2 x 3 p teams
- explicit SOP
- total cost $5,700-

  SIF - $2400
  Food - $1200
  Road/parking - $600
  Supplies - $500



MASON BAY 19th - 30th SEPTEMBER 2024
Central Dunes - Marram Control Programme
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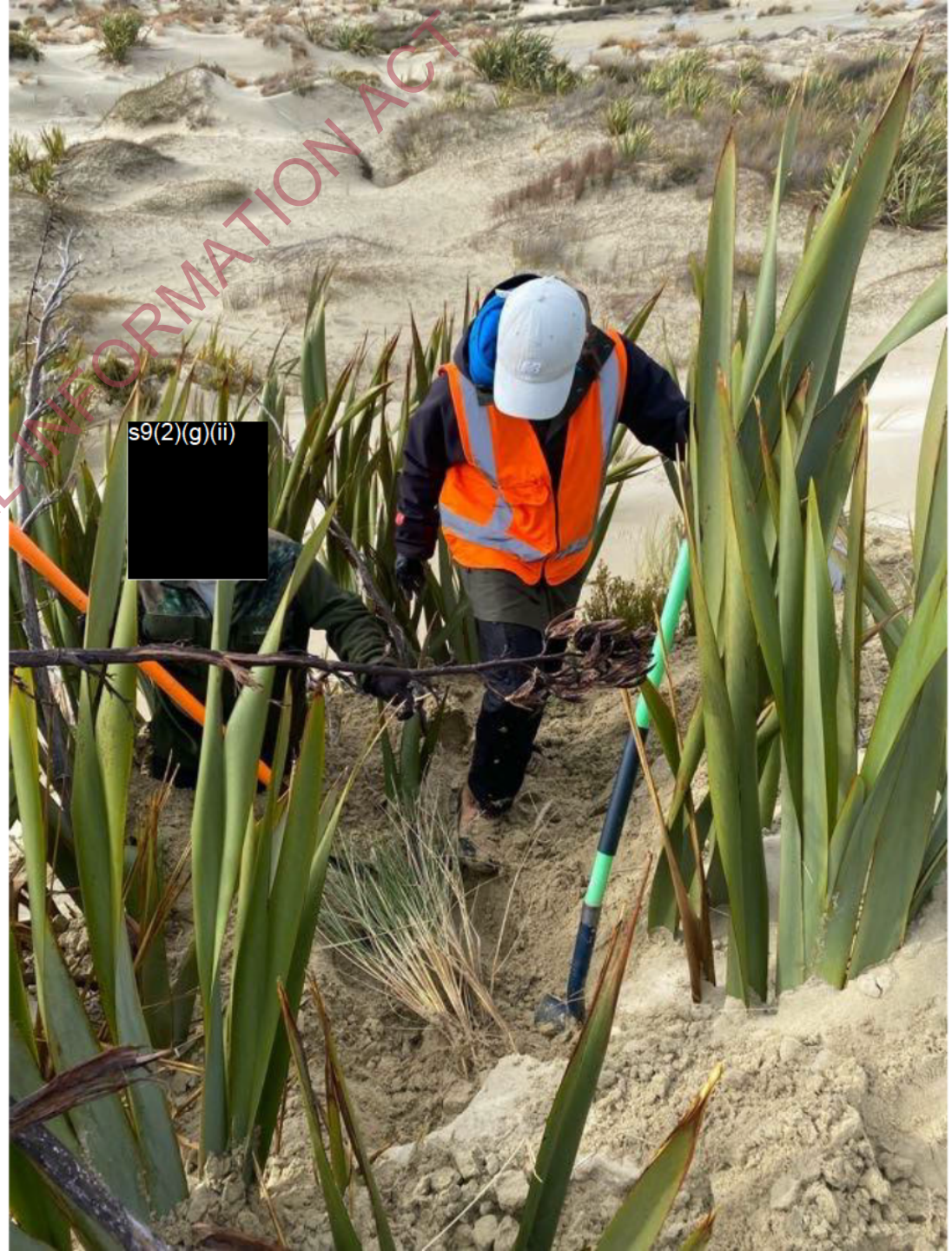
One main day on lupin (Sept 2024)

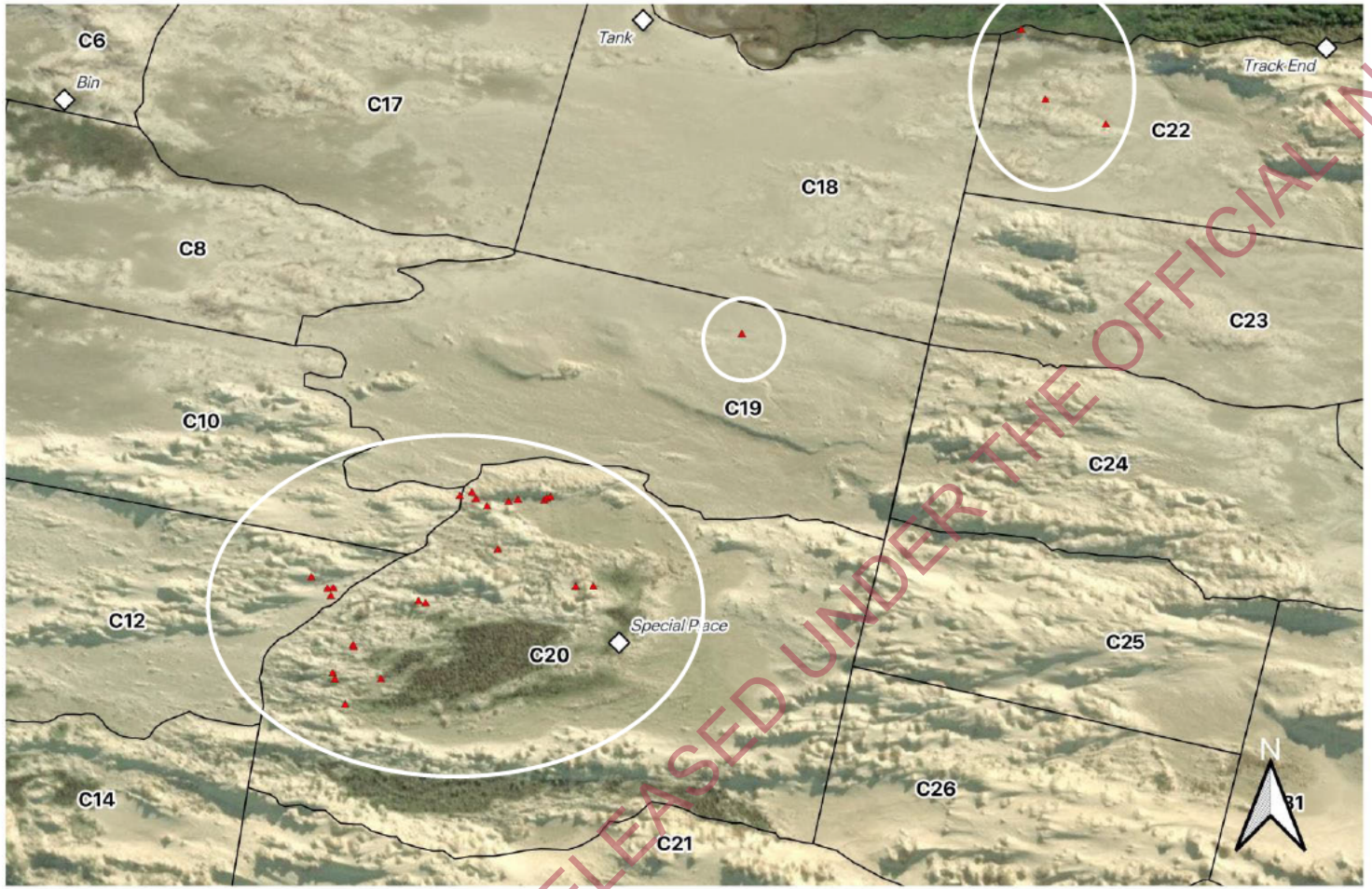
Big Sandhill

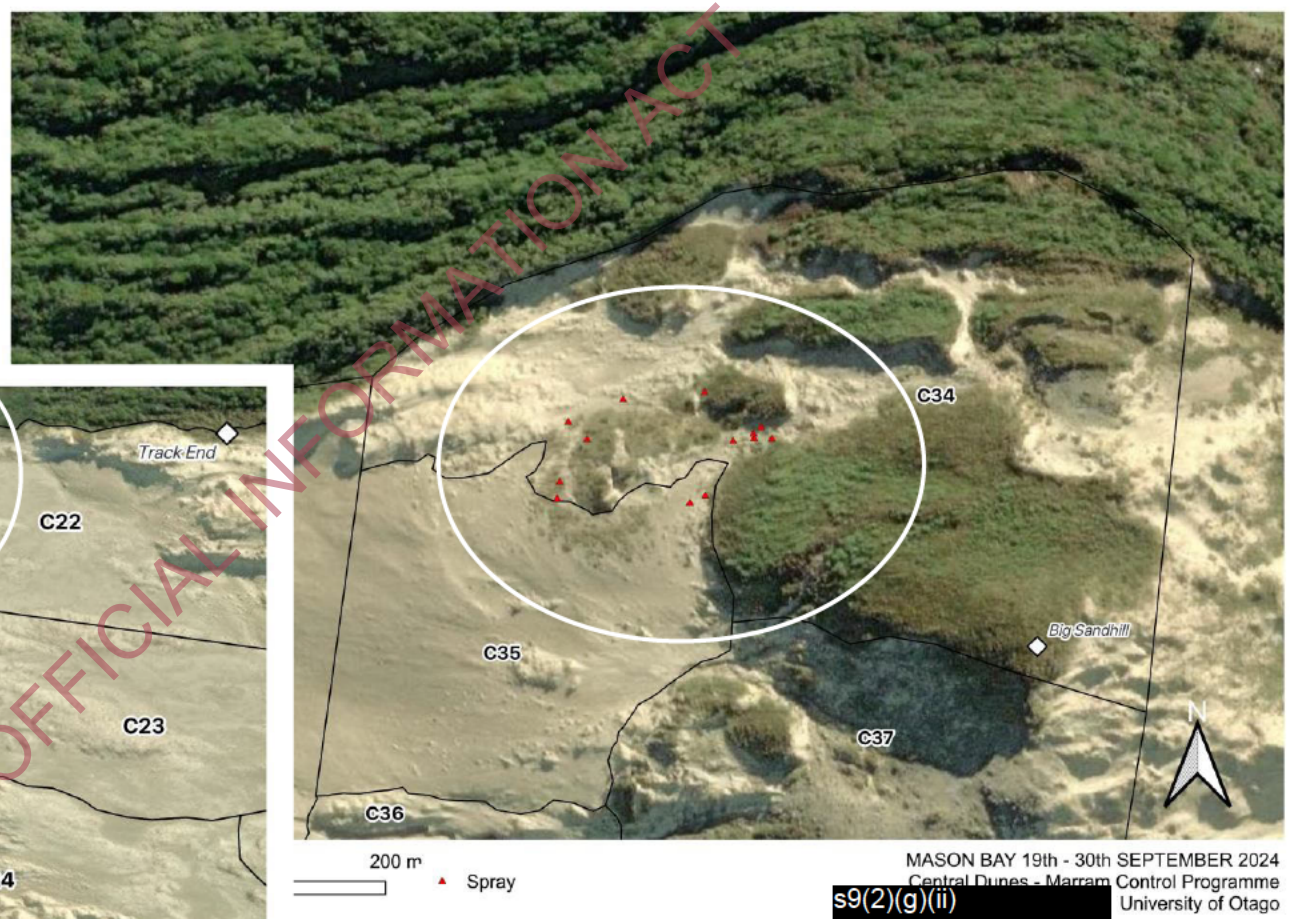
We GPS'd plants to spray, but invariably we found ourselves digging plants we probably should have left to spray (the "have spade, will dig" force).



Marram growing within flax (C30)

Marram plants left to spray during season 24/25



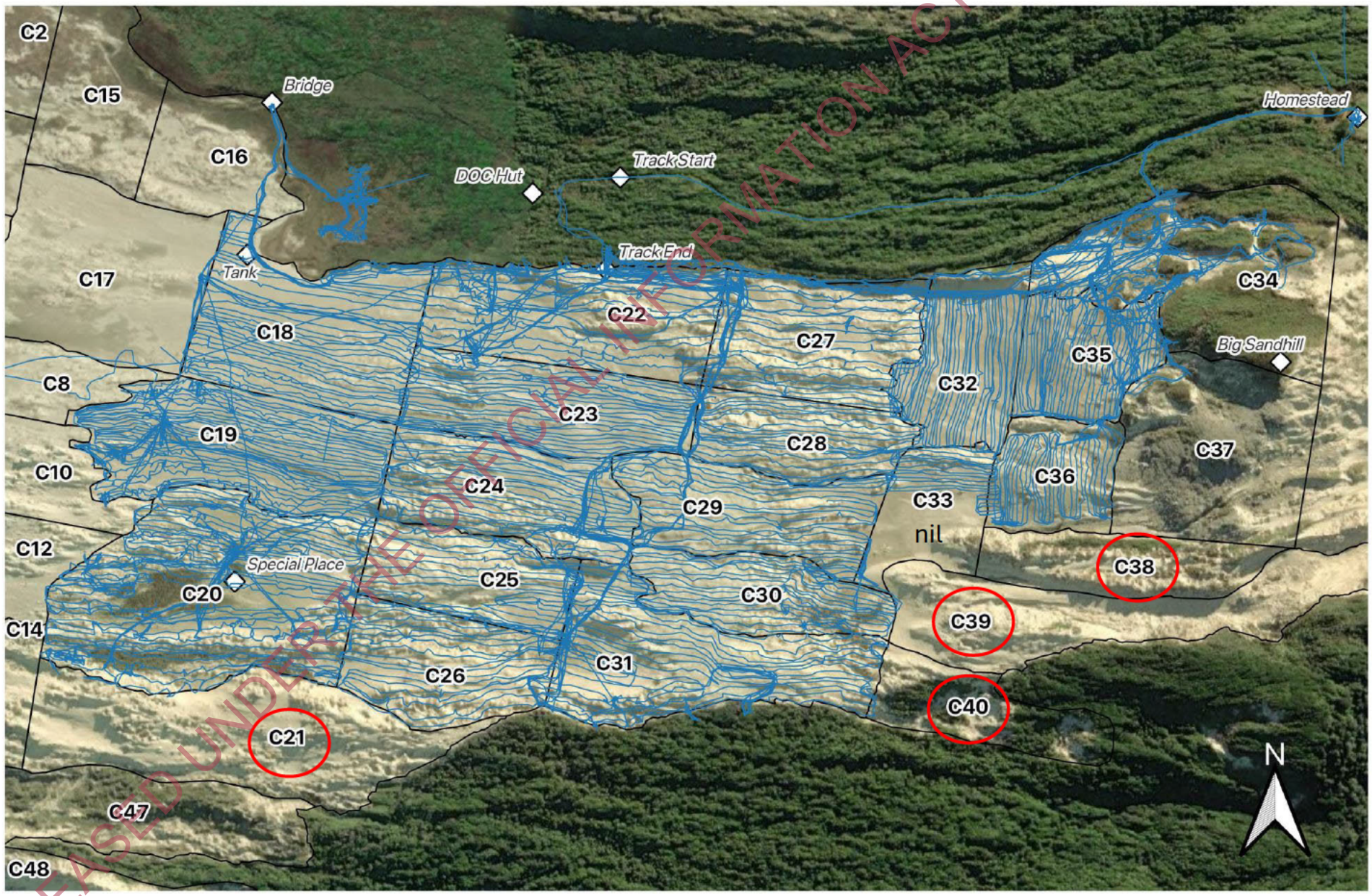


Coverage & disposal of rhizome

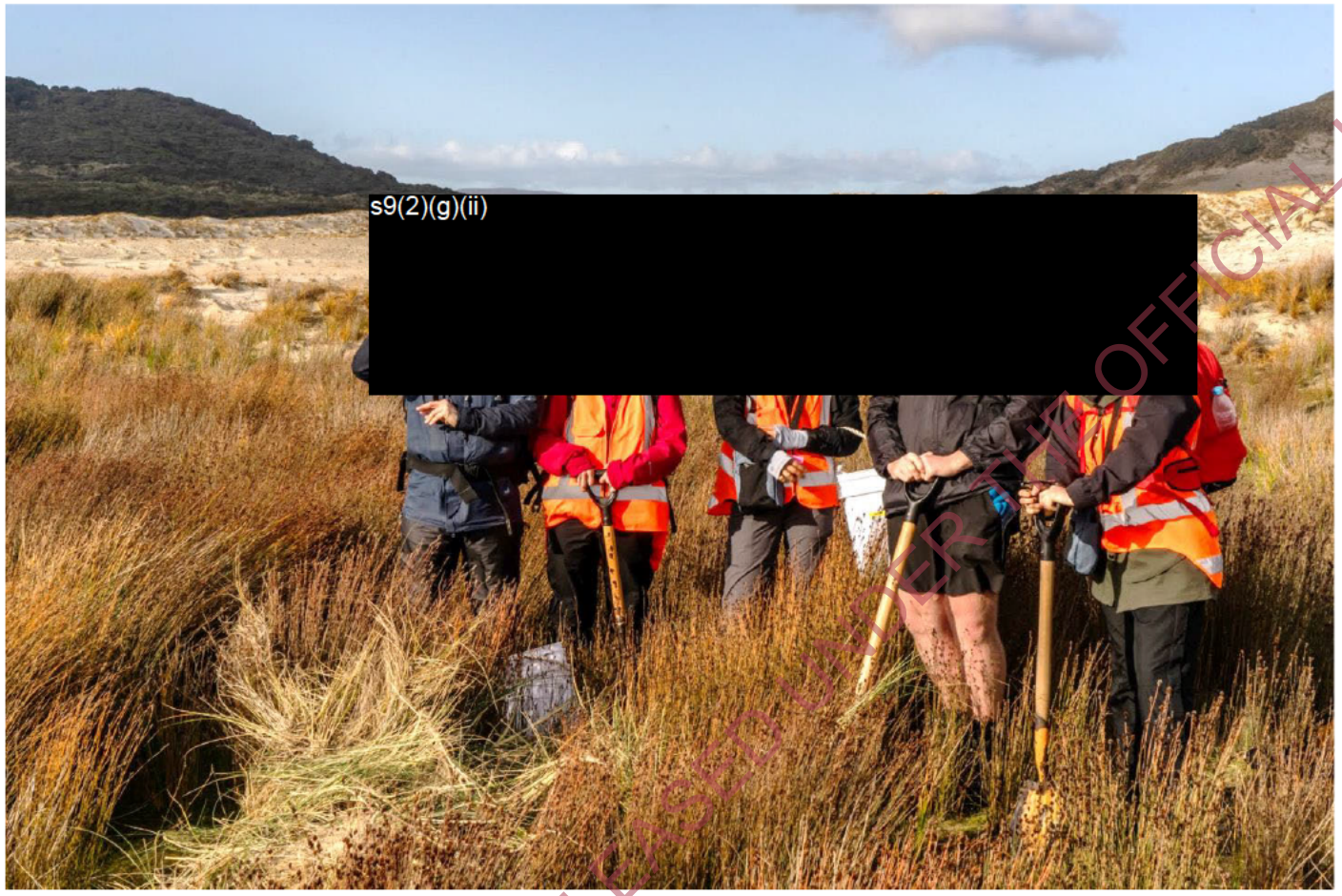
Marram & lupin search tracks, Sept 2024

OK … but room to improve. Spacing tighter or not depending on supervision & physical characteristics of the MU. Better gear would help.

○ Not surveyed



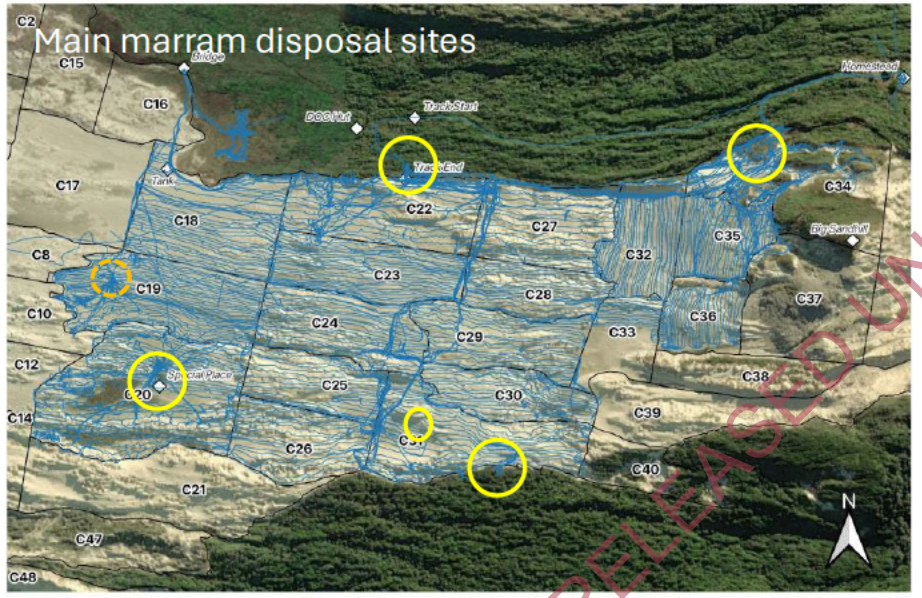
Rhizome was disposed of in stable wetlands or exported to the forest /shrub margins in packs and buckets. With lower volumes all could be exported.

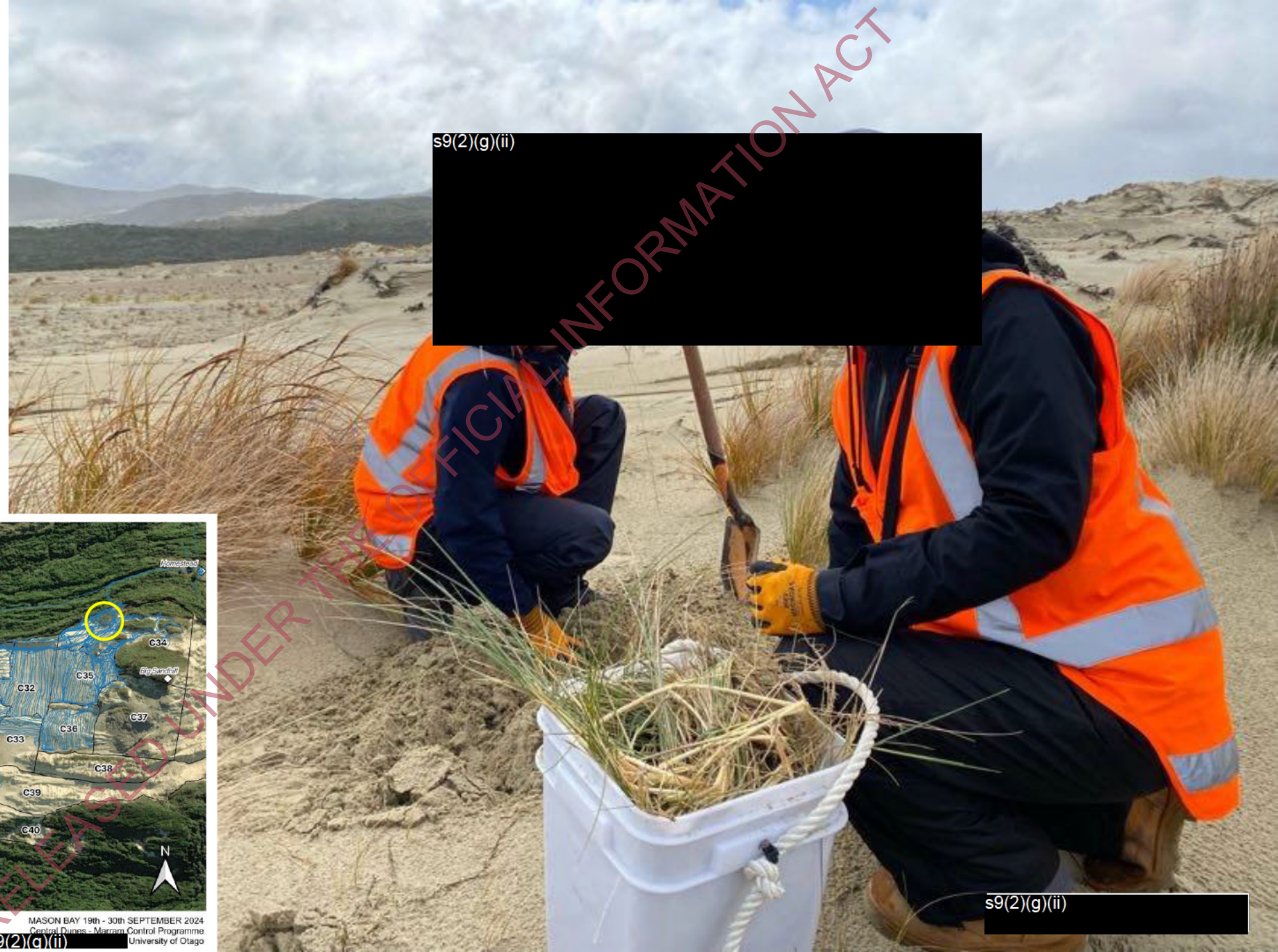


Special Place, Sept 2024

All rhizome needs to be disposed of carefully

... we used rubbish bags to store rhizome during the day (after having to pick up a pile in the stonefield that had blown away)





Where are we most likely to find marram?

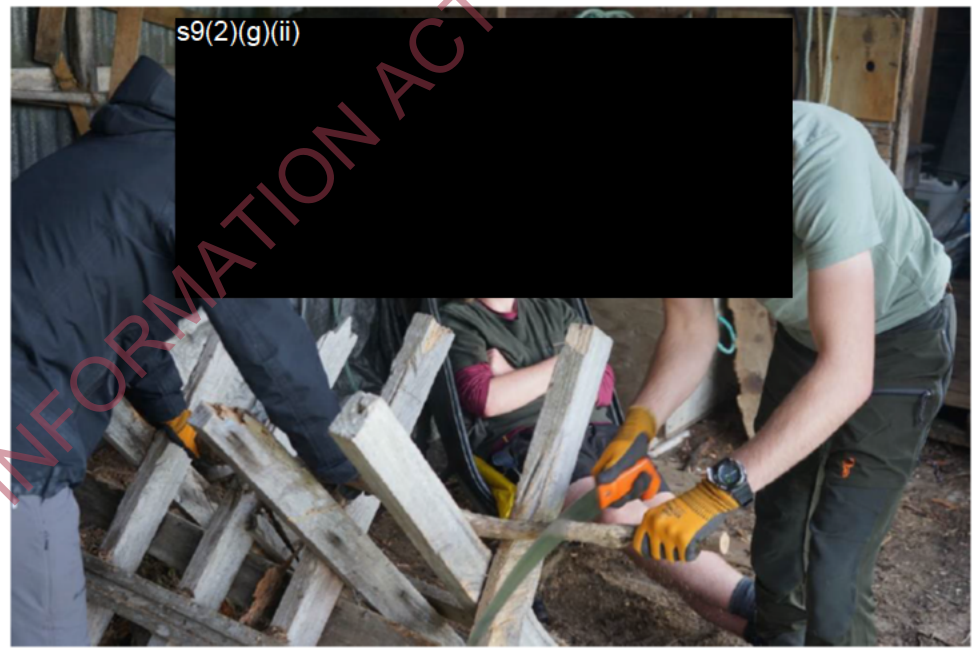
There is a close association between surface texture & marram recruitment – most seed blown inland from the foredune / parabolic zone is trapped in the Great Stonefield.

Older marram in the dunes requires much more excavation because of rapid growth & rhizome development.

Reflections

- Method/outcomes - 70% happy with December 2023 trip, 90+% happy with September 2024 trip. SOP?
    - we dug some plants we should not have dug in September, we were missing a couple of items of equipment, and we took a day to decide on how to dispose of rhizome efficiently
- Vollie trip outcomes are largely independent of weather (c/w spray trips) and are relatively cheap.
- A number of co-benefits … training, potential PG students, focus on all weeds …
- Efficacy depends on a thorough selection process, good training, close supervision, having the right tools, deriving daily GIS maps, group dynamics and individual motivation (ie DOC SOPs).
    - which are all relatively easy to manage given all the participants are my UG or PG students

The vollie method works best when it follows spray operations (+12-18months), so that vollies are not confronted with large plants.



How long will regeneration inland be fuelled by wind-blown seed dispersal?

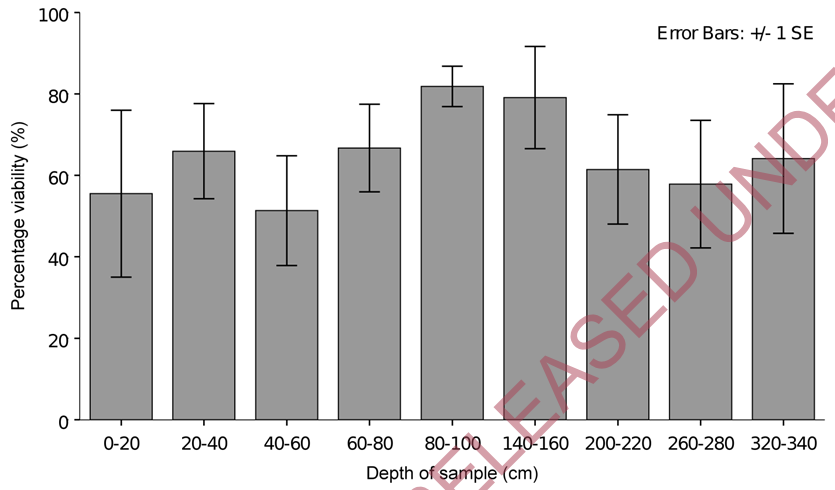
2017 survey

- high viability (20 years +), but modest numbers (0.61/L)
- potential seed release as foredune erodes to pre-marram form

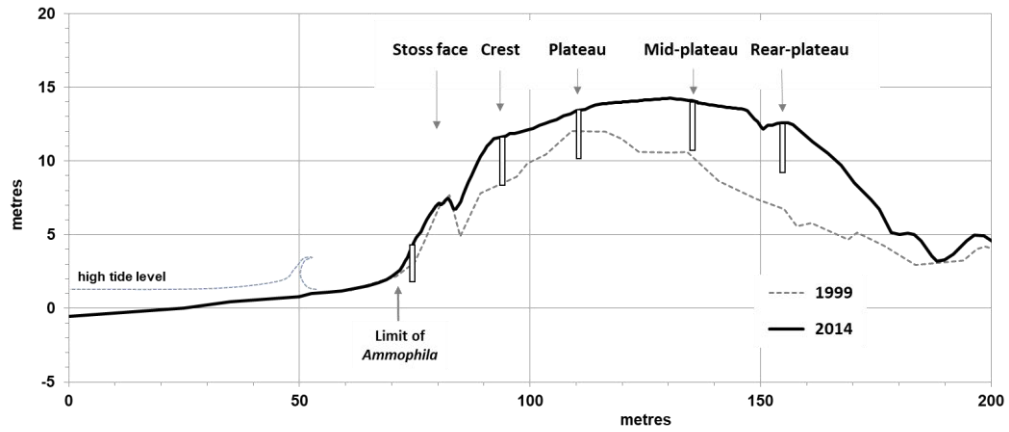
= 115M seeds (but only a small proportion will establish)

(… assuming 20 years longevity, volume difference between 1999 & 2010 profiles at P6 (x 1.5km), 60% viability, 0.61 seeds/L average across foredune)

Viability (60-80%)



Sampling – cores (2017)



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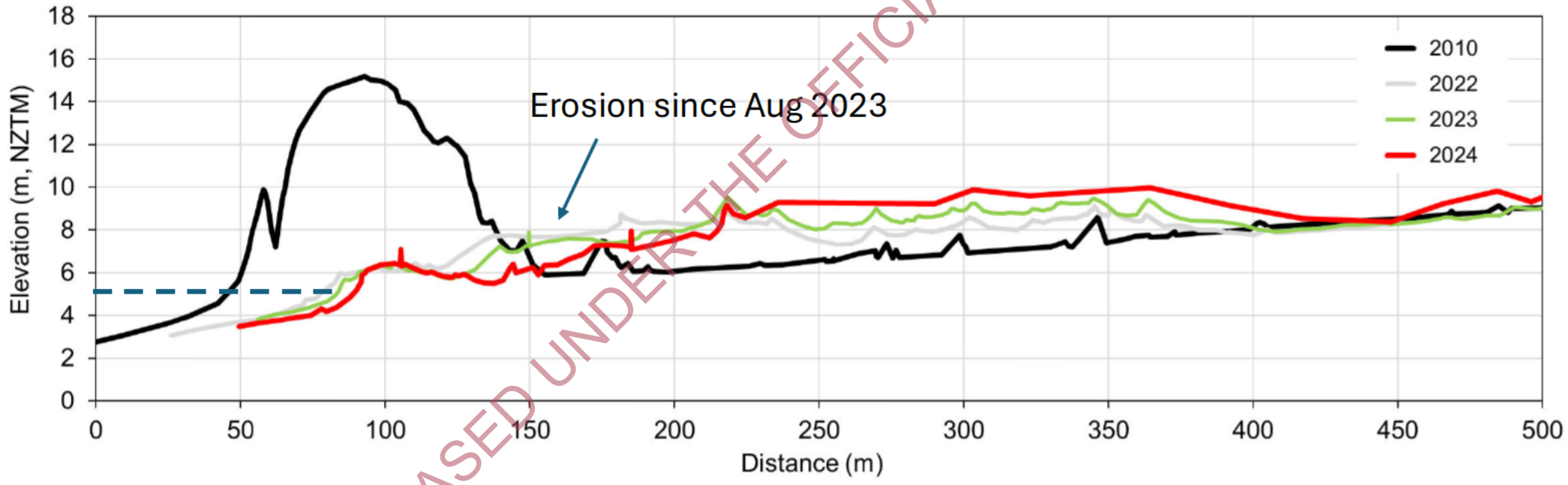
Some reassurance – the pre-existing (marram) foredune at P6 (the original Gallant treatment area) has now eroded, and the hinterland dune system, including the evolving parabolic dune and the dunal margins of the Special Place, do NOT contain much marram. So, seed may be released from the foredune in large numbers but recruitment is within 1000m of the foredune is low.

P6 profile (2010 - September 2024):



Seed pressure north of P6 will likely decline between now and 2030, when the foredune will have fully eroded.

How much viable seed remains?

We could repeat the 2017 seed bank assessment using third year GEOG301 students in 2025

Sept 2024

There is a significant lupin seedbank at Big Sandhill

Dug 9/24

To dig

C34

C35

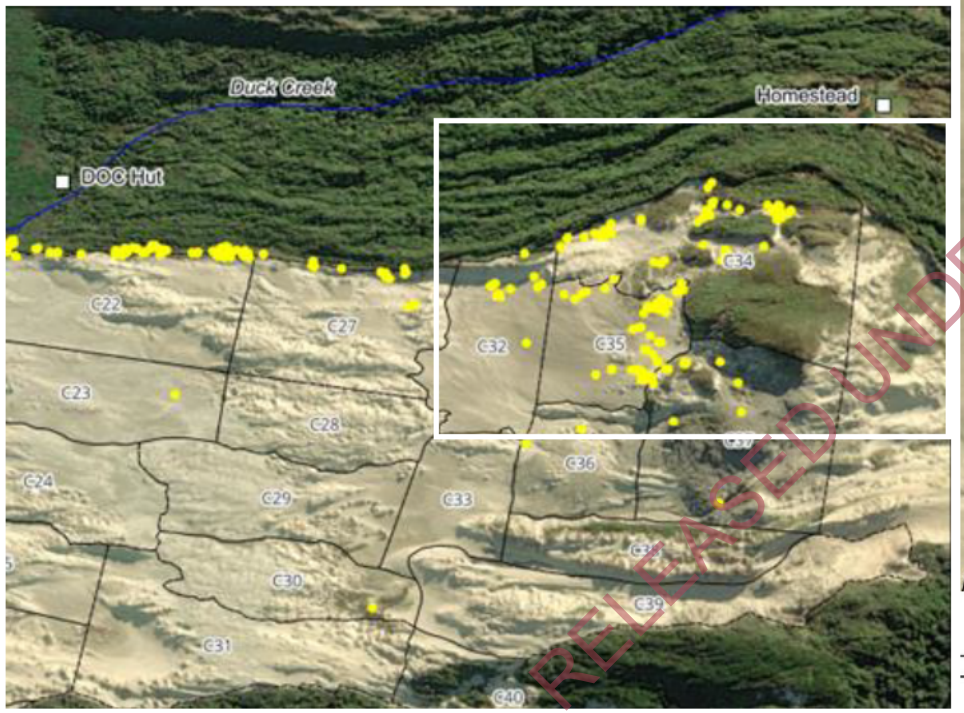
C37

C36

Big Sandhill

N

Dug 12/23



200 m

Lupin

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Landform development

- increasing sand deposition and pīkao nebkha development in the former parabolic dunes
- accelerating erosion of the foredune north of P6 – foredune should be fully eroded by 2030 (except Duck Creek section)
- There is very slow development of dunes within and along the western margins of the Great Stonefield (been trying to re-fly the Buckley survey area)

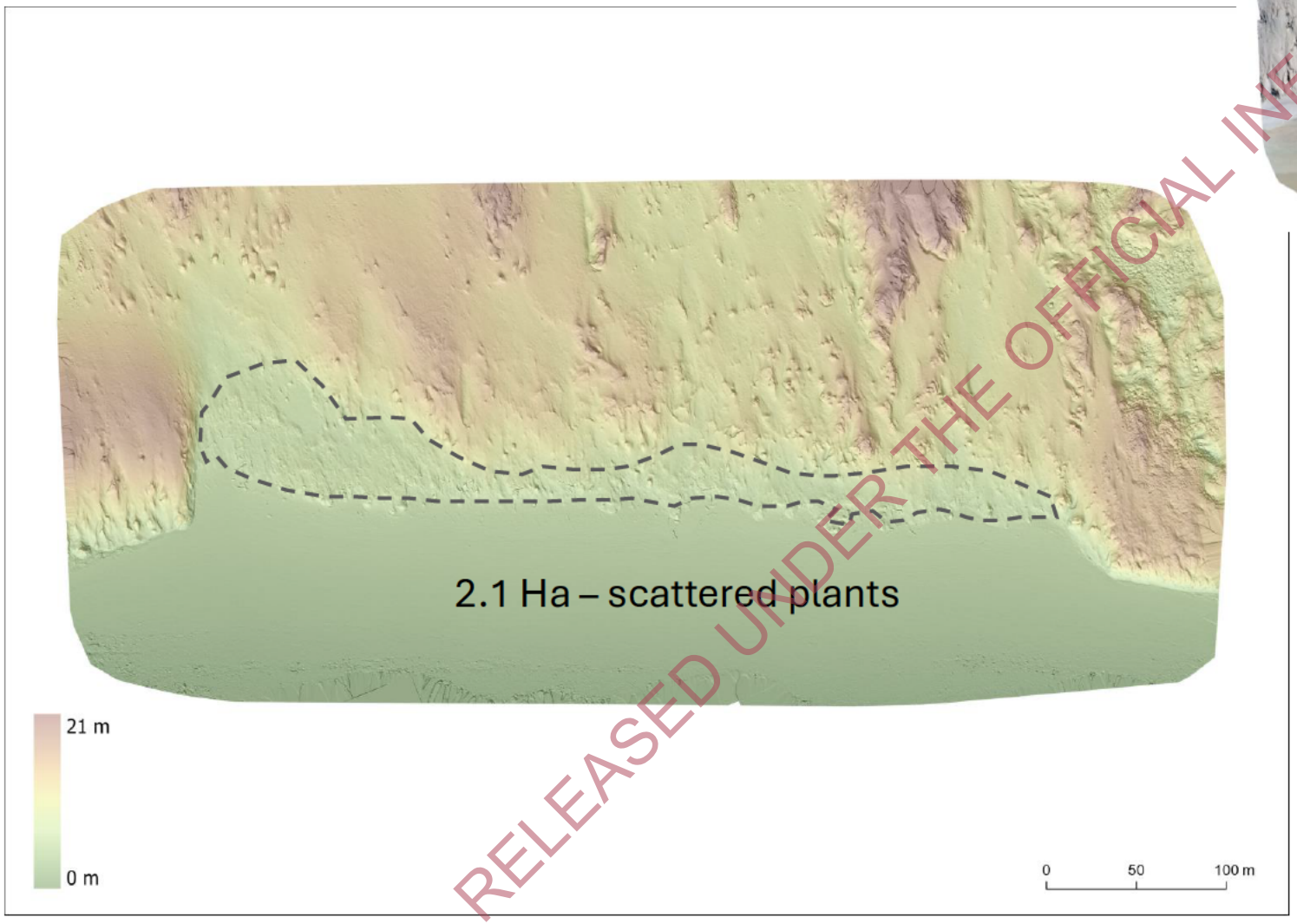
P5 – Sept 2024

P6 Profile

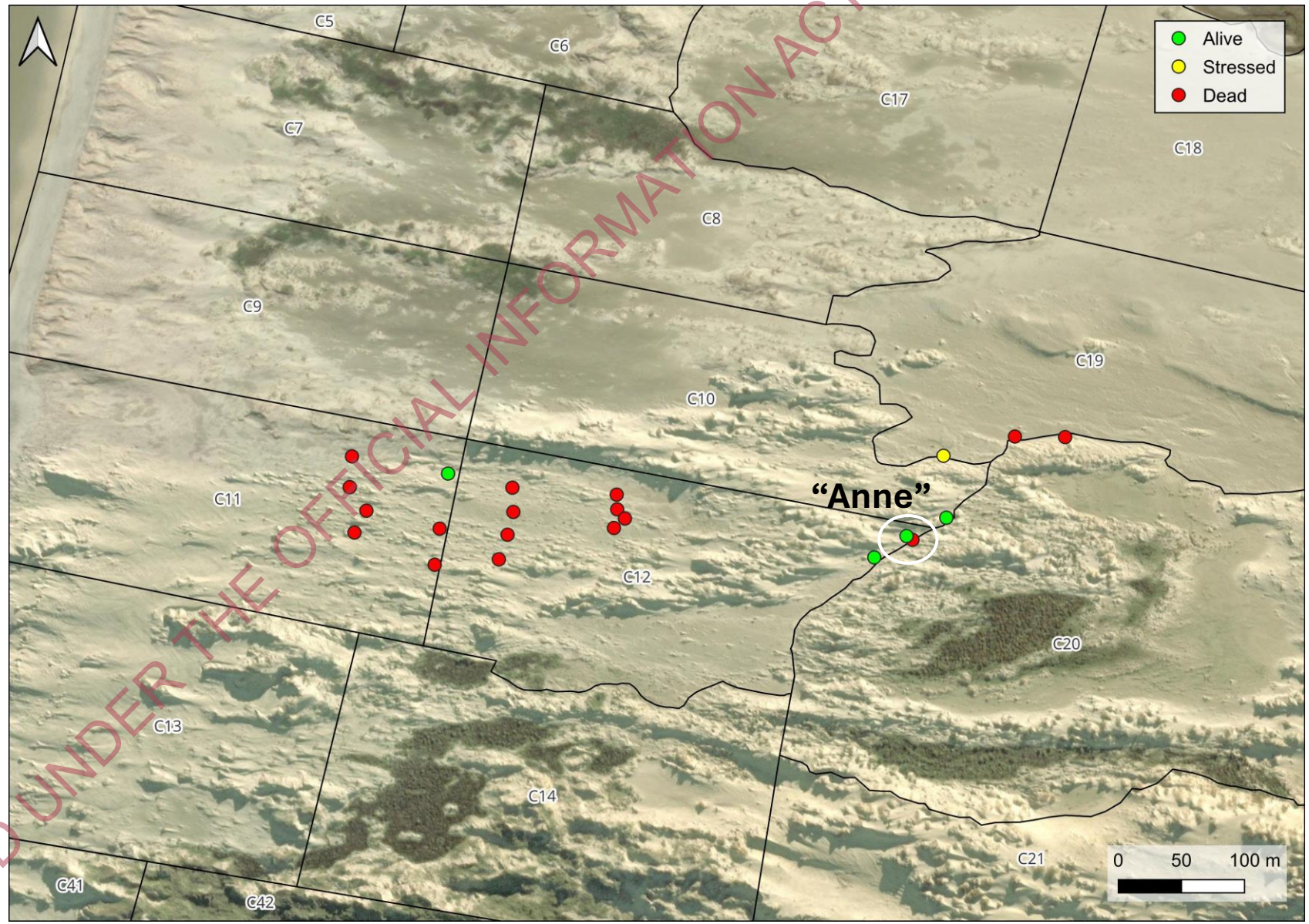
1999 - 2024

Marram growth from rhizome stranded in 2022

DSM / Orthomosaic - 30th Sept 2024



Euphorbia translocation trial



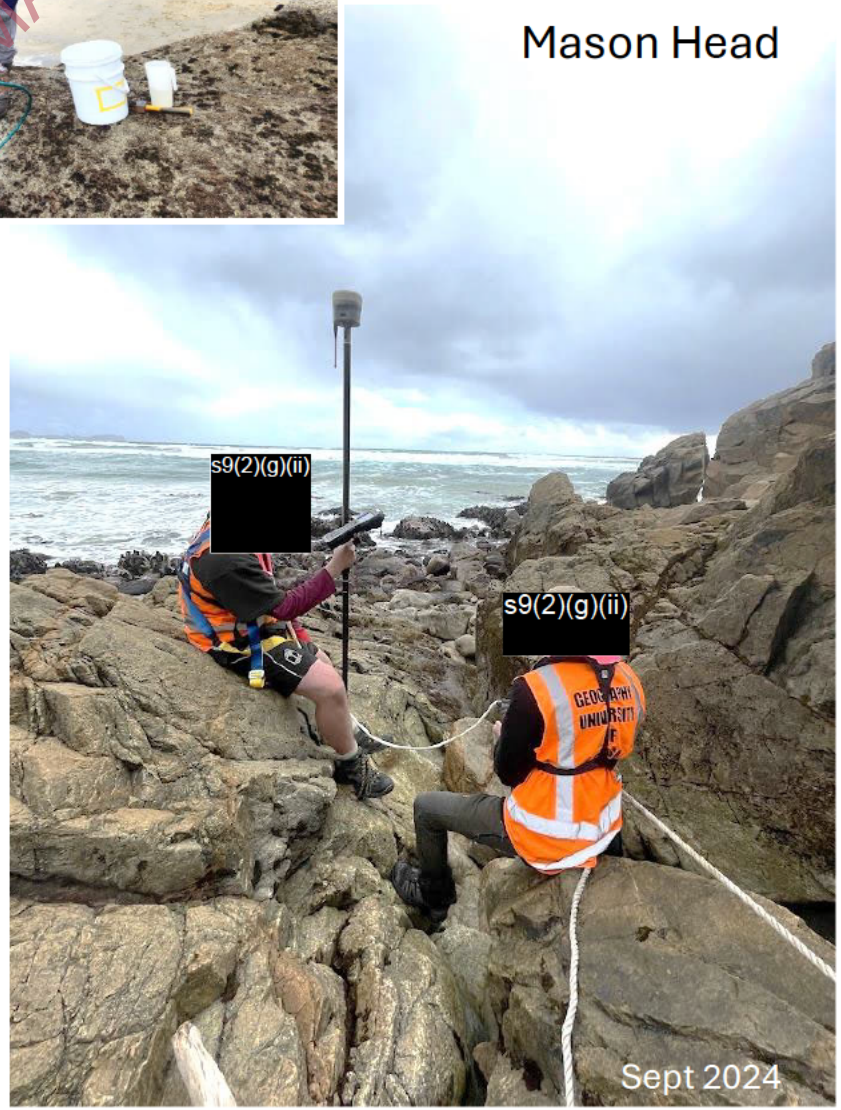
Plus 3 wild plants below Big Sandhill

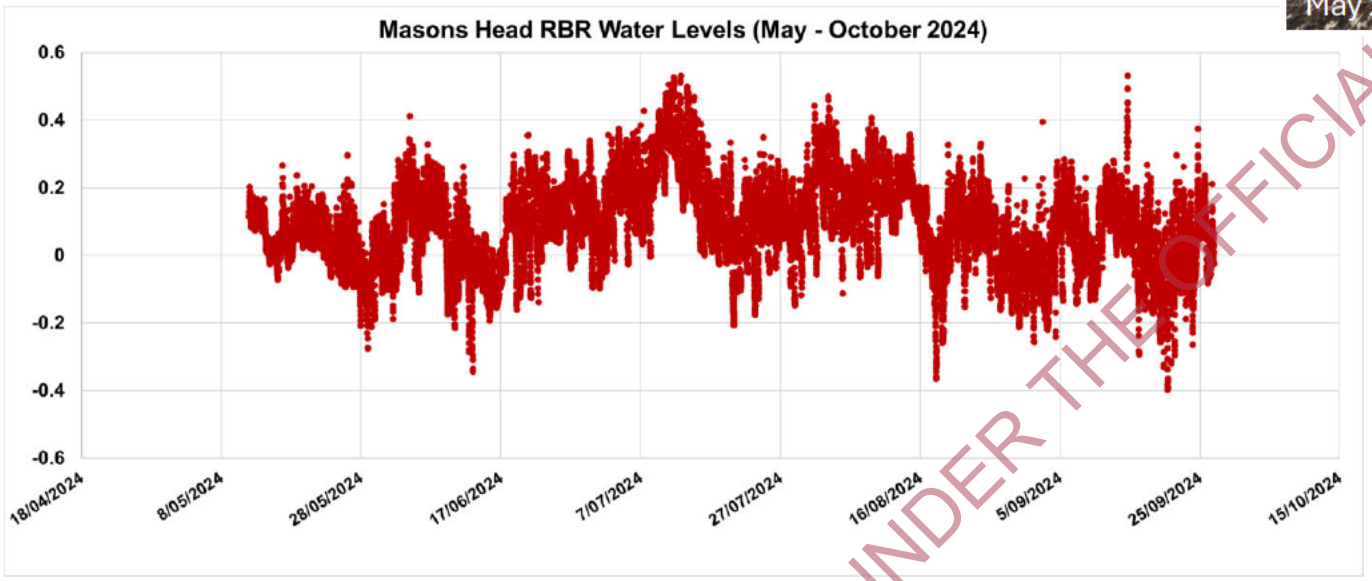
Initial observations of sea-level (mid to high tides) on the west coast of Rakiura

- 3 RBR water level sensors installed at Doughboy Bay & Mason Head in May 2024. High tide record.
- Masons removed Oct 2024.

Doughboy

Mason Head





Goal to relate observed marine-stranded marram rhizome and different morphologies to sea-level observations to resolve when stranding takes place, to what extent and which topographies are vulnerable to re-invasion.

G. hamiltonii

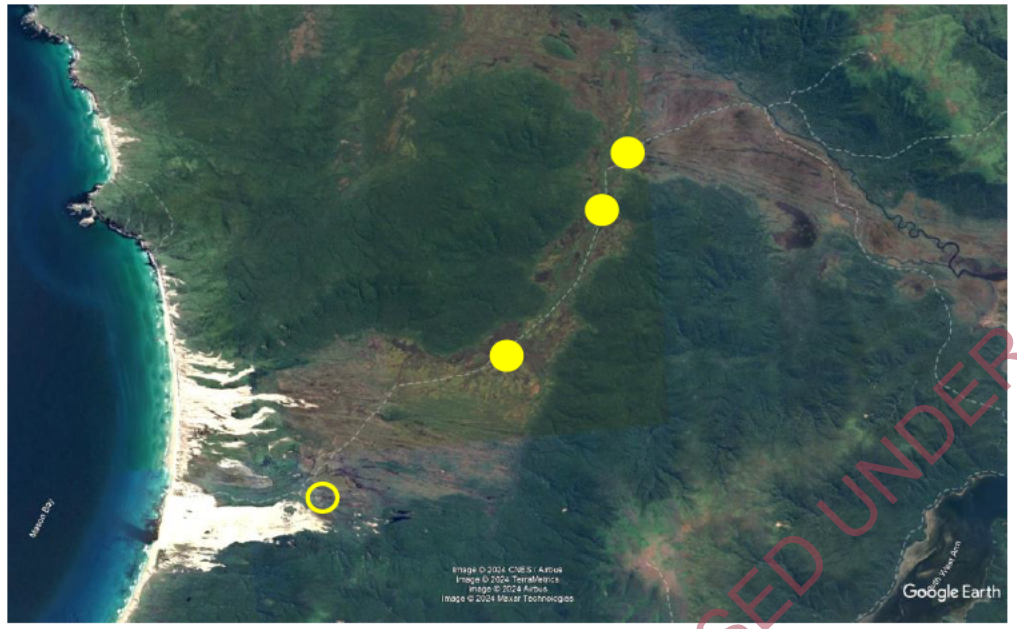
- Stressed but patchy

Dec 2023

Chocolate Swamp, Scott Burn & Boardwalk water levels

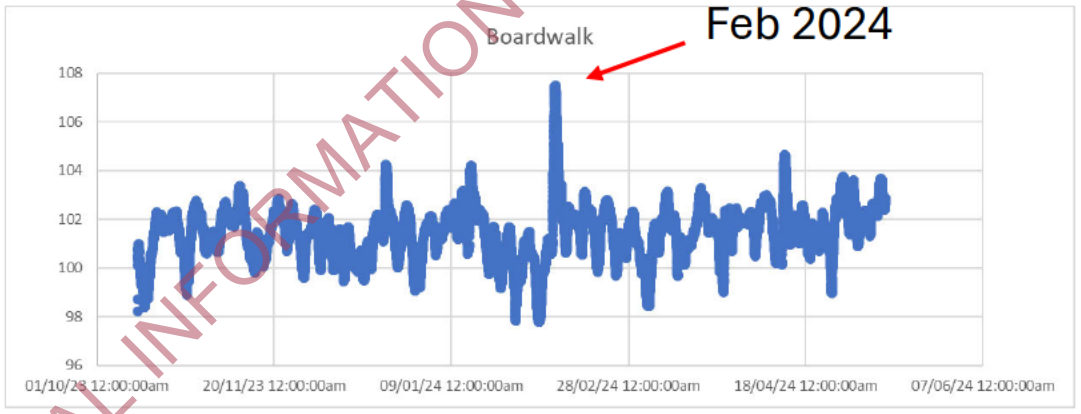
Water level recorders in swamp, under boardwalk and at Scott Burn bridge – removed Oct 2024.

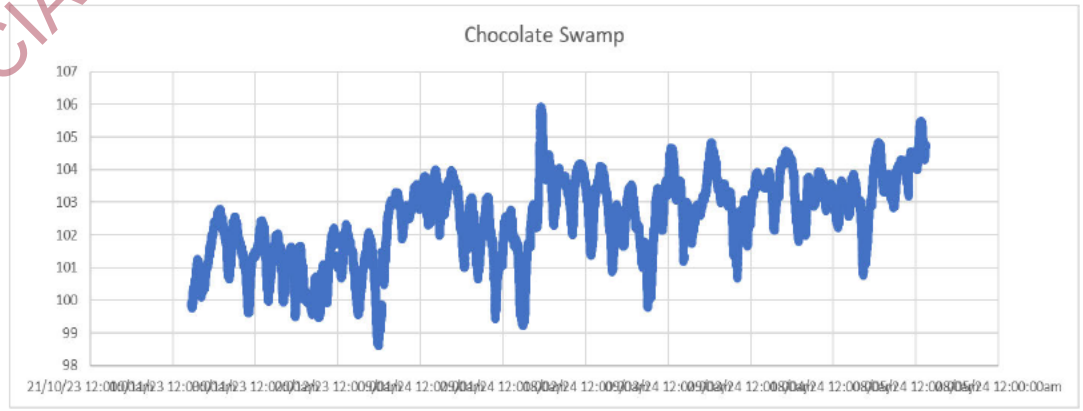
Rain gauge at Homestead.

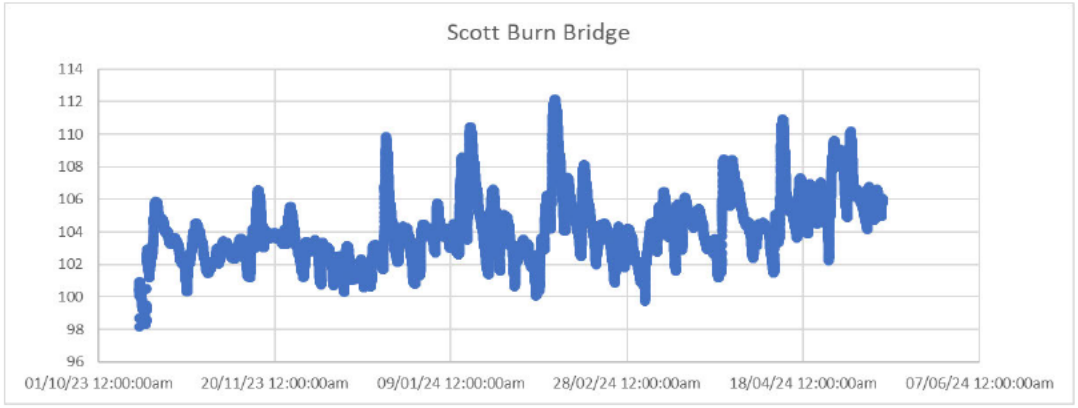


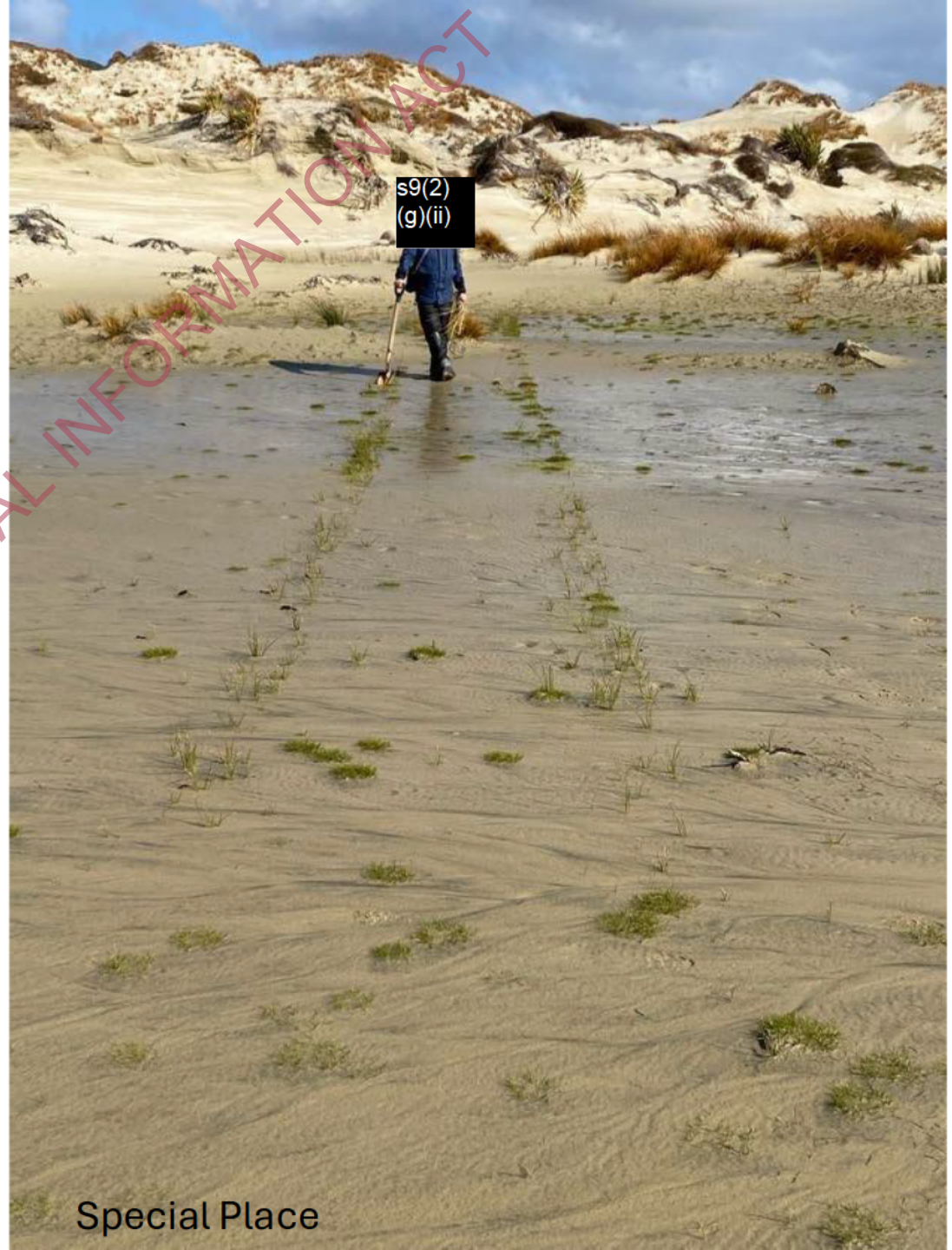
May 2024 – Oct 2024 and earlier data to add, correct for variations in atmospheric pressure & interpret in relation to rainfall at Oban and the Homestead.

Oct 2023 – May 2024









9/2024

Special Place

s9(2)(g)(ii), 29th September 2024