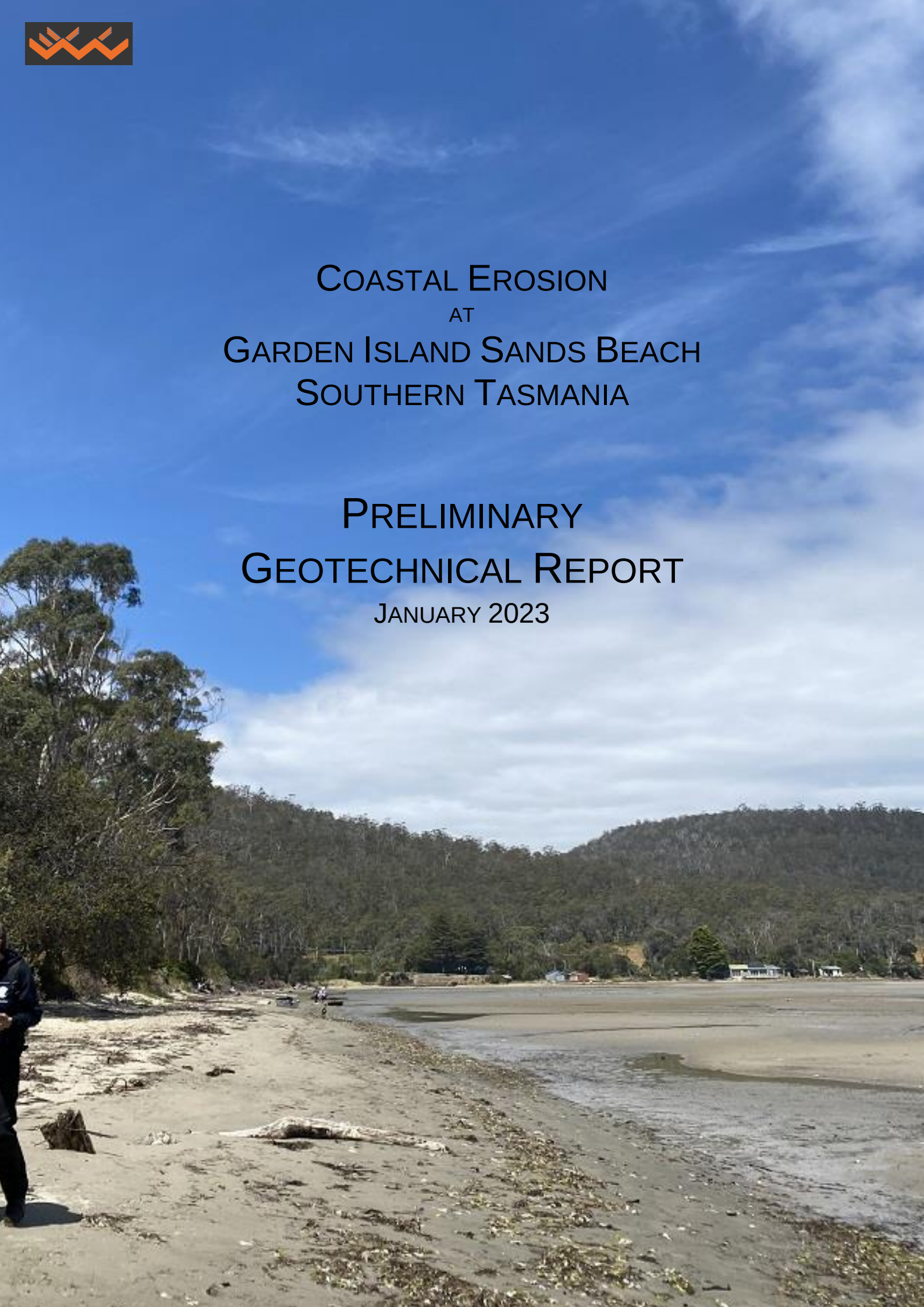
Coastal Erosion
at
Garden Island Sands Beach
Southern Tasmania

Preliminary
Geotechnical Report
January 2023



Cover
View east-southeast along Garden Island Sands Beach
Image: Bill Cromer, 3 January 2022

Refer to this report as
Cromer, W. C. (2023). *Preliminary Geotechnical Report, Coastal Erosion at Garden Island Sands Beach, Southern Tasmania.* Unpublished report for Friends of Garden Island Creek (FOGIC) by William C. Cromer Pty. Ltd., 11 January 2023.

Important Notes

Report Purpose and Distribution

This document has been prepared by William C Cromer Pty Ltd (WCC) for use by stakeholders including but not limited to regulators, planners, surveyors, real estate agents, lawyers, developers, architects, engineers, contractors, builders, building surveyors and landowners involved with coastal erosion issues at Garden Island Sands. It is to be used only for the purposes of managing any existing or potential geotechnical (including erosion) issues relating to the foreshore.

This report contains new geotechnical information. To enhance the geotechnical database of Tasmania, it will be lodged with Mineral Resources Tasmania, and be publicly available.

Hard copies of this report must be in colour and in full. No responsibility is otherwise taken by WCC for its contents.

Limitations of this geotechnical report

Site investigations for geotechnical reports like this one usually but not always involve digging test holes and taking samples, at locations thought appropriate based on site conditions and general experience. The reports only apply to the tested part(s) of the site, and if not specifically stated otherwise, results should not be extrapolated to untested areas.

The main aim of the investigations is to reasonably determine the nature of and variability in subsurface conditions at the time of inspection. The number and location of test sites, and the number and types of tests done and samples collected, will vary from site to site. Subsurface conditions may change laterally and vertically between test sites, so discrepancies may occur between what is described in the reports, and what is exposed by subsequent excavations. No responsibility is therefore accepted for (a) any differences between what is reported, and actual site and soil conditions for parts of an investigation site not assessed at the time of inspection, and (b) subsequent activities on site by others, and/or climate variability (eg rainfall), which may alter subsurface conditions at the sites from those assessed at the time of inspection.

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Footings and foundations

In this report, foundations are (usually) natural materials into which man-made footings are placed to support man-made structures.

1 Introduction

1.1 Background

Garden Island Sands is a small community of about 50 houses bordering Garden Island Sands Beach in southern Tasmania (Figure 1).

Coastal erosion of the beach has concerned residents for some time, and its landward retreat may be accelerating (Plate 1). Beach amenity is being lost and property is increasingly threatened.

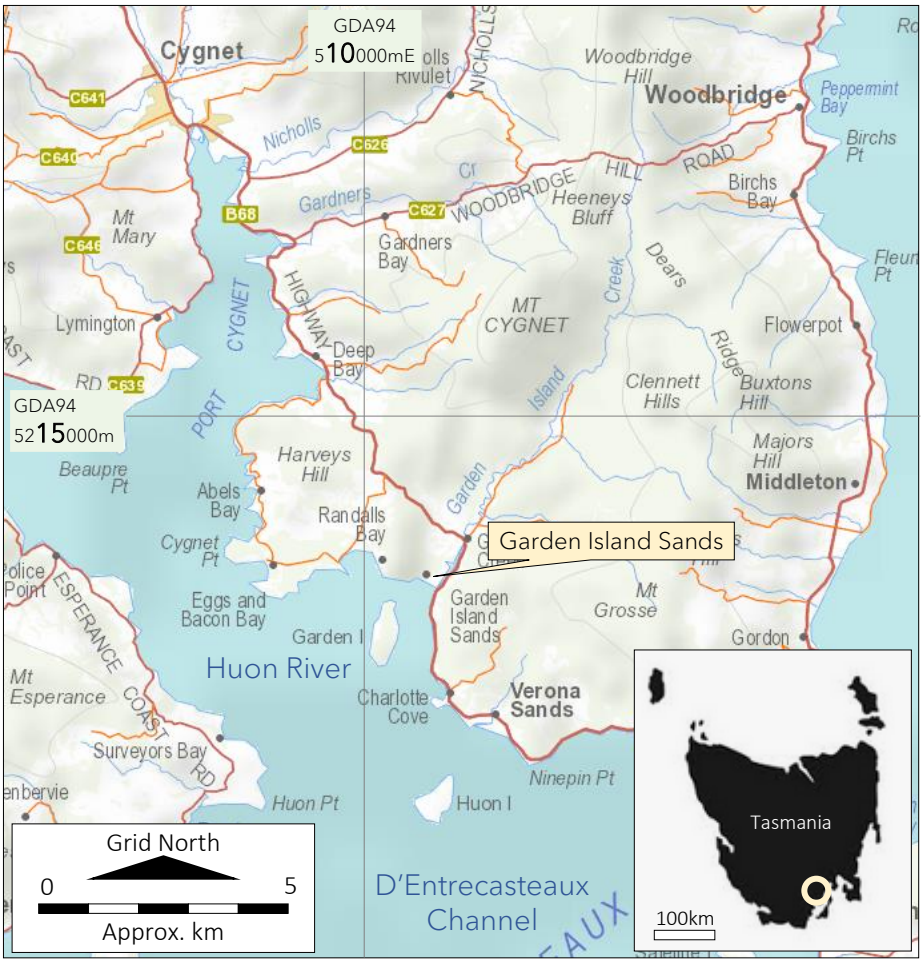


Figure 1. Location of Garden Island Sands

In a 2015 study funded by Huon Valley Council and the City of Hobart, consultants SGS reviewed the community costs and risks of coastal erosion associated with projected sea level rise[1]. Three general pathways were proposed to adapt to the risks:

1. Let climate change take its course and retreat early
2. Protect existing development as long as practical while protecting natural values
3. Protect existing development and support intensification as long as possible.

The pathways were reviewed by the Garden Island Creek community in May 2015. There was no community interest in pathway 1. Pathway 2 was considered the most practical.

[1] SGS (2015). *Garden Island Creek Coastal Adaptation Pathways.* Final Report by SGS Economics & Planning, prepared for Huon Valley Council and the Tasmanian Climate Change Office, July 2015.

Plate 1. View west-northwest along Garden Island Sands Beach in January 2022, showing active coastal erosion. Sharples (2023) has indicated the present scarp at the rear of the beach has retreated landwards 7 – 10m since 1948.

Subsequently, *Friends of Garden Island Creek* (FOGIC[2]) – a local group – was established to pursue Pathway 2. In January 2022, discussions between FOGIC, coastal geomorphologist Dr. Chris Sharples and engineering and groundwater geologist Bill Cromer resolved that effective remedial works to arrest the current rate of erosion might logically include, in order,

a) studies to understand the local processes involved, and to inform the design of any remedial works,

b) design of remedial works and obtaining regulatory approval, and

c) installation of the remedial works.

Sharples and Cromer were engaged by FOGIC[3] to address item a):

- Sharples has investigated and reported[4] on the recent geomorphic history and causes of coastal change at Garden Island Sands Beach, and

[2] Garden Island Creek is a small hamlet of 8 – 10 houses 1km north of Garden Island Sands. It is also the name of the creek which flows south past the hamlet and has its mouth and tidal estuary at the eastern end of Garden Island Sands beach.

[3] FOGIC has also commissioned other consultants to advise on flora/fauna/natural values, indigenous heritage, etc.

[4] Sharples (2023*). A Geomorphic Investigation of Shoreline Change at Garden Island Sands, Southern Tasmania*. Unpublished report by Chris Sharples (Coastal Geomorphology and Landform Management) for Friends of Garden Island Creek, January 2023.

- Cromer (this report) has conducted preliminary geotechnical investigations of shallow subsurface conditions at the base of the eroding beach scarp, to inform the design of possible future engineering works to alleviate the erosion.

1.2 Survey work and beach profile monitoring

Monitoring of surveyed beach profiles along Garden Island Sands Beach was considered a useful way of tracking erosional changes before and after any remedial works on the foreshore.

In August 2022, Nick Bowden and Dr Chris Sharples set up five markers along the beach as part of the TASMARC[5] network (Sharples, 2023). These were accurately surveyed on 12 August 2022 by Elliott Cromer (Attachment 3).

It is intended that after appropriate instruction, FOGIC and/or other community members will undertake continued beach profile monitoring using the markers.

1.3 Scope of and personnel for geotechnical investigations

1.3.1 Scope

The scope included:

- a preliminary site inspection and photography on 3 January 2022 with FOGIC and Dr. Chris Sharples,
- a desk-top review of relevant publicly-available information including topographic and geological maps, historical Google Earth satellite images, etc,
- geotechnical site investigations in the company of Dr. Sharples on 4 October 202; the work involved the digging, logging and photography of six excavator test pits, and
- desk-top review of field results and report compilation.

1.3.2 Personnel

The site investigations were conducted by engineering geologist Bill Cromer, aided by technical assistant Elliott Cromer. Dr. Chris Sharples attended the investigations.

[5] TASMARC = Tasmanian Shoreline Monitoring and Archiving Project. From the TASMARC website, TASMARC is an initiative started in 2004 by John Hunter, Chris Sharples, Richard Coleman and Werner Hanneke of the University of Tasmania. They were concerned about a lack of historical information about the Tasmanian shoreline and the way it is responding to storm events and sea-level rise. They identified a need for accurate measurements of shoreline positions and beach profiles with the data collected being securely archived for the future.
TASMARC relies on the work of volunteers who measure the profile of beaches from fixed survey marks using basic survey equipment (dumpy level, staff measuring tape). The measurements are usually made every 2 or 3 months depending on the availability of the volunteers.
The resultant data is stored in a database which can be accessed via the "Database" link on this web page. It includes the measurements recorded by the volunteers, profile plots and photographs. It will provide information about seasonal and long term changes in the shape and position of beaches. It will also provide information which can be used to verify beach measurements made by other methods.
Measurements were commenced in 2005 when 16 sites (ie beaches) were established. It has since been expanded to 30 sites with 20 of them being measured on a regular basis."
For further information about TASMARC contact: Nick Bowden nickbowden46@gmail.com

Auslocations checked the property for underground services on 3 October 2022, and the excavator was supplied by *Caydence Contracting* (operator Martin Lewis).

1.4 Locations of excavator test pits

Test pits were located at the erosion scarp at the rear of the beach. All except pit A were also aligned on or as close as practical to the beach profile line associated with each of the markers T503 – T507.

Test pit locations are shown in Attachments 2 and 4.

2 Results

2.1 Desk top study

Results of the desk-top study (Attachment 1) are:

- topographically the Garden Island settlement is almost flat, low-lying at less than 3m above sea level (ASL). The low-lying area extends inland for almost a kilometre bordering Garden Island Creek. More elevated ground exists to the west (up to 170mASL) and east (Maps 1.1 – 1.3 in Attachment 1).
- a search of Mineral Resources Tasmania files returned no relevant previous geological or related reports of Garden Island Sands – apart from published geological maps of the district[6],
- the bedrock of the area is Jurassic-age dolerite which has intruded older Permian- and Triassic-age sedimentary rocks. The sedimentary rocks are not exposed at Garden Island Sands, but dolerite is well-exposed at the western end of the beach, and on the eastern side of Garden Island Creek. The low lying areas of the settlement and beach are mapped as Holocene-age[7] alluvium and beach deposits.
- A set of historical satellite images from Google Earth for the period 2013 – 2022 are presented in Attachment 2.

2.2 Site investigations

2.2.1 Bedrock geology

Site inspection confirms the published geological mapping: Jurassic-age dolerite crops out at the western end of the beach, and was observed on foreshore exposures along the eastern side of the mouth of Garden Island Creek (Plates 2 and 3).

2.2.2 Holocene beach sediments

Tet pits A – F dug to depths of up to about 2m[8] below approximate high water mark all encountered only unconsolidated sand (Table 1 and Attachment 4). No dolerite bedrock was encountered to the depths investigated.

The pits were started in the beach escarpment, the upper levels of which probably included a capping of aeolian (windblown) sand. Below the veneer of aeolian sand, two types of materials are present:

- Layer 1 (in Table 1): light greyish brown SAND (SP): fine-medium grained, generally shell-free, up to about a metre or so thick, overlying
- Layer 2: grey, light grey SAND (SP): fine-medium grained, trace-some silt, shelly, with up to 10% well-graded, well-rounded, low-high sphericity gravel[9] (5 – 75mm) of quartzite, sandstone, siltstone and dolerite; at least 0.8 –1m thick.

[6] The geological mapping is of 1:50,000 scale, on two maps: Farmer, N. (1981). Geological Atlas 1:50,000 Scale Series. *Kingborough*. Department of Mines Tasmania, and Farmer, N. and Forsyth, S. M. (1993). Geological Atlas 1:50,000 Scale Series. *Dover*. Department of Mines Tasmania.

[7] Holocene represents the last 11,700 years or so of geological time.

[8] Excavation depth was limited by the rapid collapse of the saturated sides of each pit.

Plate 2 (above). View southwest from the western end of Garden Island Sands Beach, across the Huon River to Garden Island. Fractured, relatively fresh and unweathered dolerite bedrock crops out in the bank (arrowed, at right), and is exposed on a narrow wave-cut platform at low tide (arrowed, centre). The staff at right is 2m long. (Photo: 3 January 2022).

Plate 3 (below). View east towards fractured, relatively fresh and unweathered dolerite bedrock i(arrowed) exposed on the eastern bank of Garden Island Creek at the eastern end of the beach. (Photo: 3 January 2022).

[9] The gravel may have originated from erosion of Quaternary gravels on terraces between Randalls Bay and Egg and Bacon Bay, to the west of Garden Island Sands Beach (*Pers. comm*. Dr. Chris Sharples).

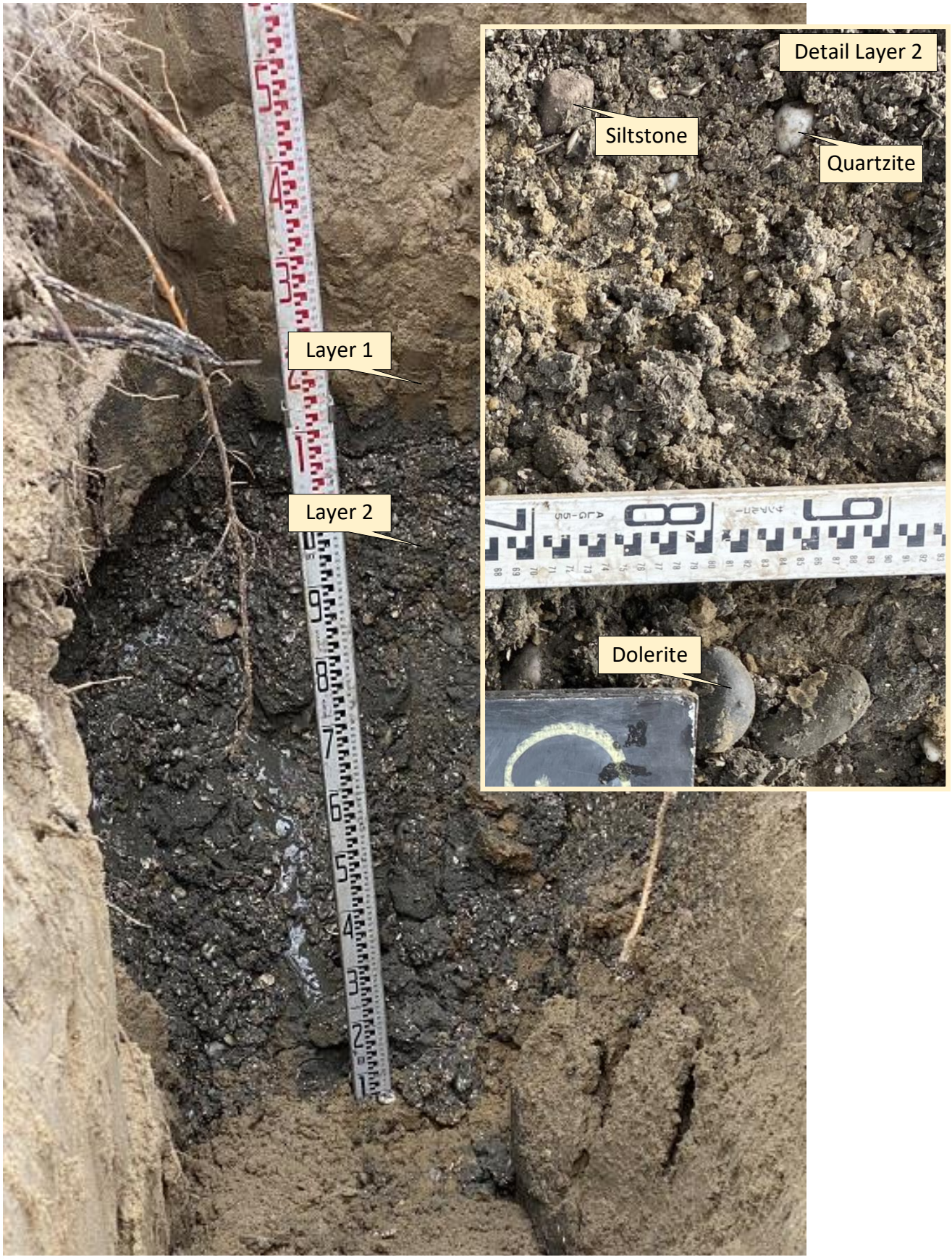


Plate 4 Layers 1 and 2 sand in test pit B. The detail shows types of gravel present in Layer 2. Layers 1 and2 materials are reasonably typical of materials in all six test pits, and by inference, beneath the full length of the beach. The large numbers on the scale are decimetres.

Table 1. Summary of test pits. See Attachment 4 for test pit photos.

Client FOGIC
Location Garden Island Sands Beach
Date dug 4-Oct-22

Test pit	**A**	**B**	**C**	**D**	**E**	**F**
Easting (GDA94)	511335	511370	511432	511474	511575	511651
Northing (GDA94)	5211611	5211587	5211568	5211554	5211490	5211422
Depth dug (m)[Note 1]	1.8	2.0	1.6	1.6	1.6	1.8
Water inflow (depths in m)	Inflow in all holes, from approx. mean sea level and below					
Standing water level (m)	Level rising during digging. Assumed to stabilise 0.5m below high water mark					

Note 1. Depth dug is below approx. high water mark

No.	**Layer**	**Details**	**USCS**	**Interp.**	Figures are approximate depths to top and bottom of layer, in metres					
1	**SAND**	Light yellowish brown, fine to medium grained; mostly shell-free; occasional artefacts (timber, concrete); loose; dry to moist, wet at base	SP	Holocene beach sand	0 to 1	0 to 0.9	0 to 1	0 to 1	0 to 0.8	0 to 1
2	**SAND**	grey, light grey (light yellowish brown in pit A), trace-some silt; fine-medium grained; shelly, with up to 10% well-graded, well-rounded, low-high sphericity gravel (5 – 75mm) of quartzite, sandstone, siltstone and dolerite; wet	SP	Quaternary near-shore sediments	1 to 1.8 Pit collapsing	0.9 to 2.0 Pit collapsing	1 to 1.6 Pit collapsing	1 to 1.6 Pit collapsing	0.8 to 1.8 Pit collapsing	1 to 1.8 Pit collapsing

Notes and abbreviations

USCS = Unified Soil Classification System
Grey cells indicate a missing layer or layers in a test pit
Easting and Northing coordinates from Google Earth and hand-held GPS. Datum is GDA94.

Excavability Equipment = 1.8t excavator; 0.45m GP bucket; 4 teeth; Operator: Martin Lewis
EAR = end as required; NR = no refusal; CR = close to refusal; R = refusal.

Samples D = disturbed sample; U50 = Undisturbed 50mm diameter drive tube sample

Weathering For rock only. F = fresh; SW = slightly weathered; MW = moderately weathered; HW = highly weathered;
EW = extremely weathered (ie soil properties; material can be remolded in the hand, with or without water)

Moisture D = dry; M = moist (M<=>PL = moisture less than, equal to or greater than Plastic Limit); W = wet.

Consistency *(silt and clay only)*
Fb = Friable (crumbles to powder when scraped with thumbnail)
S = Soft (Easily penetrated by fist; 25 - 50kPa)
F = Firm (Easily penetrated by thumb; 50 - 100kPa)
St = Stiff (Indented with thumb; penetrated with difficulty; 100 - 200kPa)
VSt = Very stiff (Easily indented with thumbnail; 200 - 400kPa)
H = Hard (Indented by thumbnail with difficulty; >400kPa)

Rel density *(sand and gravel only)*
VL = Very loose (ravelling)
L = Loose (easy shovelling)
MD = Medium dense (hard shovelling)
D = Dense (picking)
VD = Very dense (hard picking)

3 Conclusions

Based on the preliminary geotechnical investigations described here,

- unconsolidated beach sand extends the full length of Garden Island Sands Beach to depths of up to about 1.8m below high water mark
- except for the extreme western end of the beach (adjacent to dolerite outcrops), no hard bedrock will be encountered in excavations to at least this depth,
- the sands are saturated below about mean sea level, and excavations below this depth will collapse.

These findings will inform possible designs for coastal defences to arrest or at least substantially mitigate beach erosion in the short-long term,

4 Recommendations

In relation to the designs and possible installation of coastal defences at Garden Island Sands Beach,

1. engineering and geotechnical engineering advice should be obtained from persons appropriately experienced and qualified in coastal engineering, and
2. depending on design, follow-up geotechnical investigations should be done as required.

W. C. Cromer
Principal

11 January 2023

This report is and must remain accompanied by the following Attachments

Attachment 1. Published maps of the Garden Island Sands area (5 pages)
Attachment 2. Historical satellite imagery 2013 – 2022 (4 pages)
Attachment 3. TASMARC markers T503— T507 established August 2022 (8 pages)
Attachment 4. Site and test pit photos (17 pages)

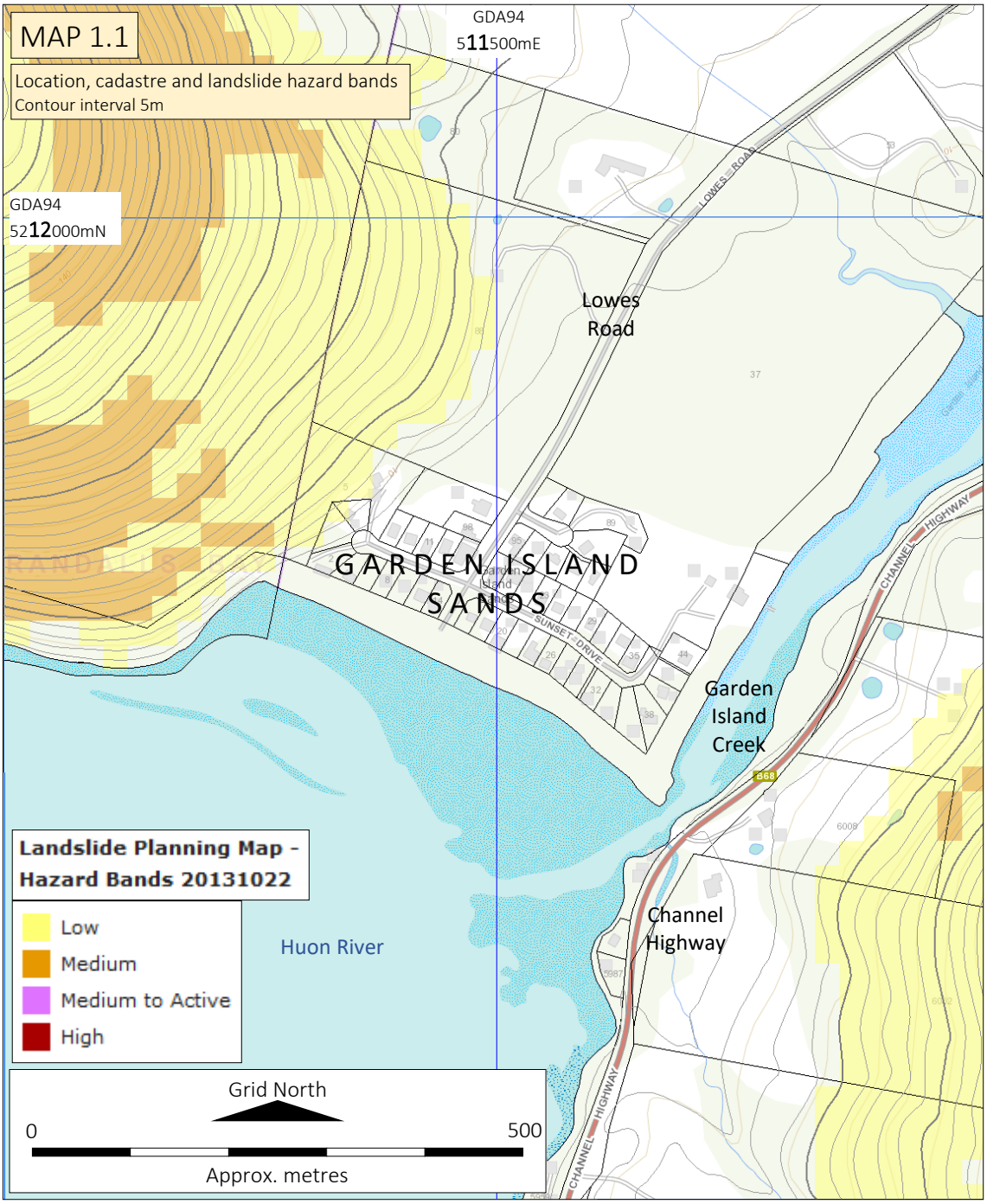
Attachment 1

(5 pages including this page)

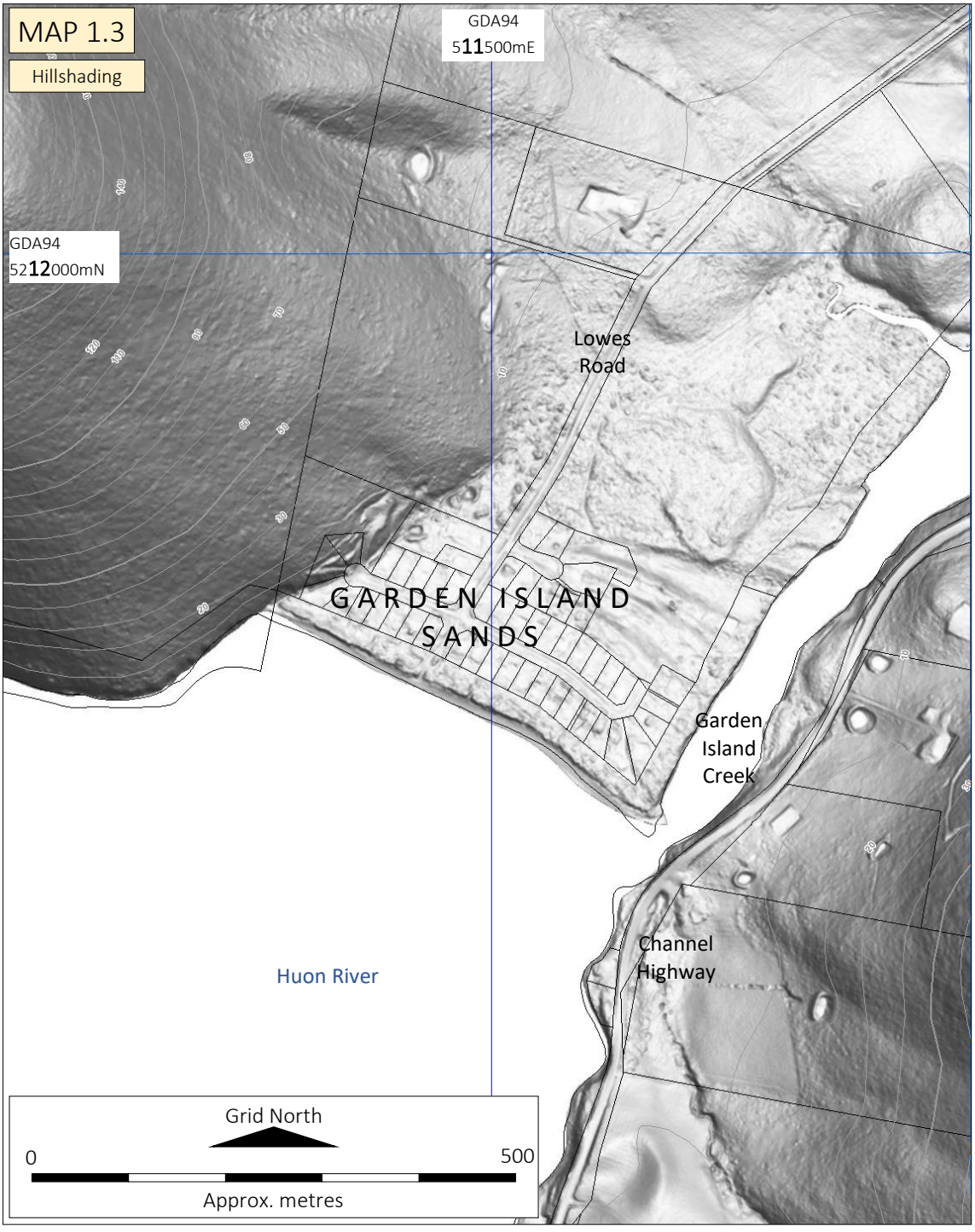
PUBLISHED MAPS OF THE GARDEN ISLAND SANDS AREA

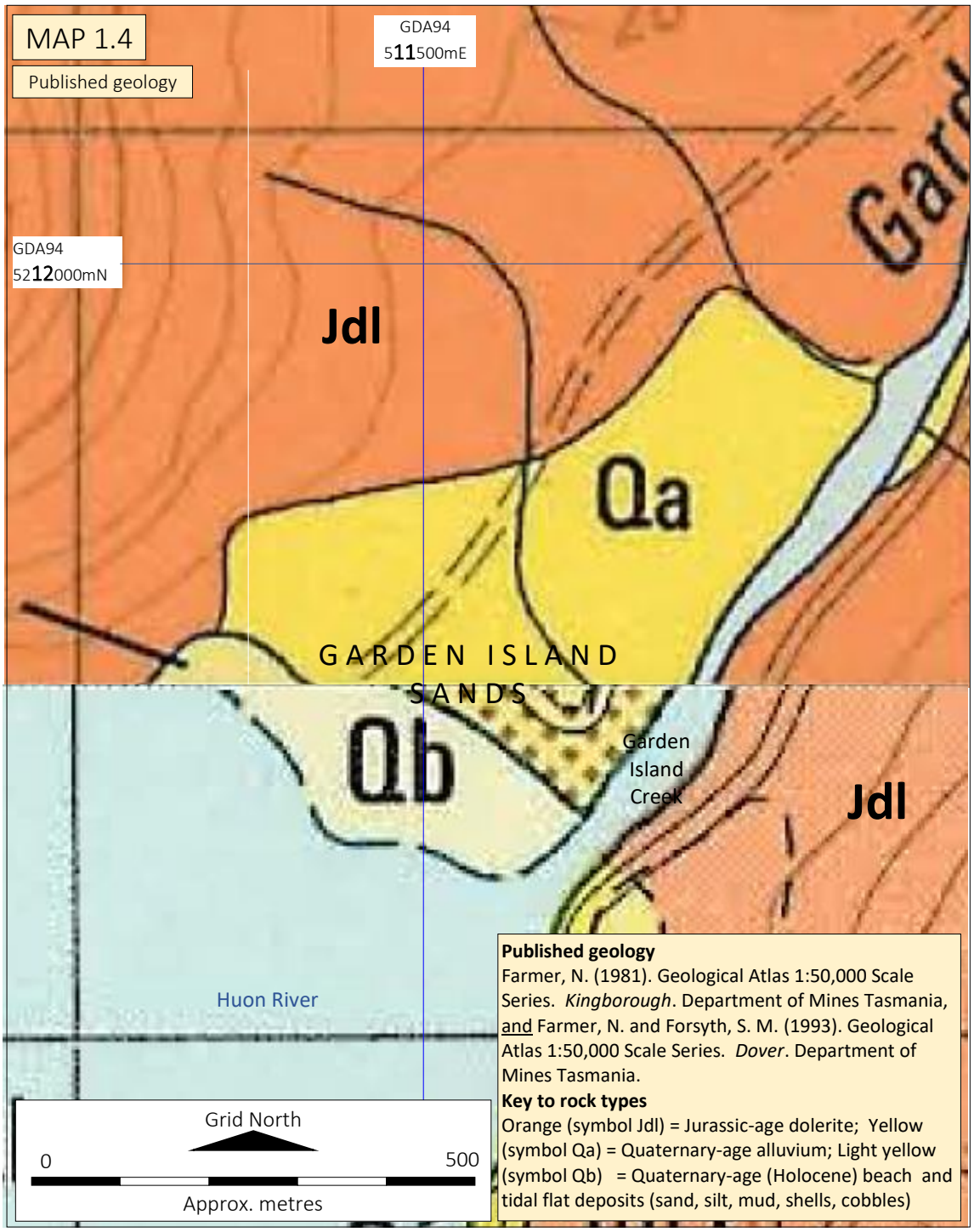
Source: www.thelsit.tas.gov.au

Map 1.1 Location, cadastre and landslide hazard bands
Map 1.2 Aerial imagery
Map 1.3 Hillshading
Map 1.4 Published geology


MAP 1.1
Location, cadastre and landslide hazard bands
Contour interval 5m
GDA94
511500mE
GDA94
5212000mN
Lowes Road
GARDEN ISLAND SANDS
SUNSET DRIVE
Garden Island Creek
Channel Highway
Huon River
Landslide Planning Map - Hazard Bands 20131022
Low
Medium
Medium to Active
High
Grid North
0
500
Approx. metres


MAP 1.2
Aerial imagery
GDA94
511500mE
GDA94
5212000mN
Lowes Road
GARDEN ISLAND SANDS
Garden Island Creek
Channel Highway
Huon River
Grid North
0
500
Approx. metres


MAP 1.3
Hillshading
GDA94
5211500mE
GDA94
5212000mN
Lowes
Road
GARDEN ISLAND
SANDS
Garden
Island
Creek
Channel
Highway
Huon River
Grid North
0
500
Approx. metres


MAP 1.4
Published geology
GDA94
511500mE
GDA94
5212000mN
Jdl
Qa
GARDEN ISLAND SANDS
Qb
Garden Island Creek
Jdl
Huon River
Grid North
0
500
Approx. metres
Published geology
Farmer, N. (1981). Geological Atlas 1:50,000 Scale Series. Kingborough. Department of Mines Tasmania, and Farmer, N. and Forsyth, S. M. (1993). Geological Atlas 1:50,000 Scale Series. Dover. Department of Mines Tasmania.
Key to rock types
Orange (symbol Jdl) = Jurassic-age dolerite; Yellow (symbol Qa) = Quaternary-age alluvium; Light yellow (symbol Qb) = Quaternary-age (Holocene) beach and tidal flat deposits (sand, silt, mud, shells, cobbles)

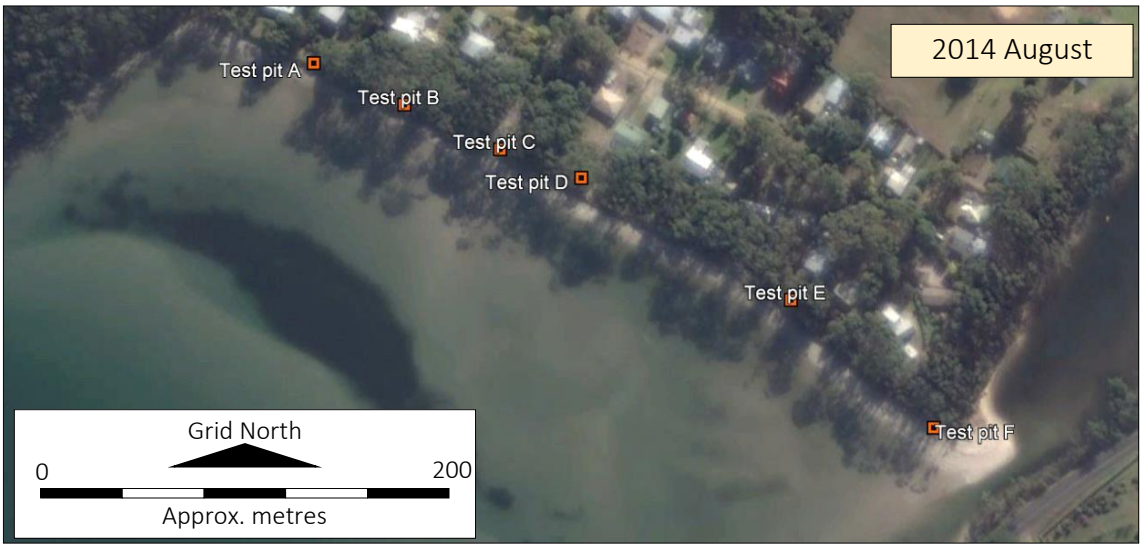
Attachment 2

(4 pages including this page)

Historical satellite imagery 2013 – 2022

Source: Google Earth


2013 September
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2014 August
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2015 December
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2016 January
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2017 November
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2018 September
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2019 April
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres

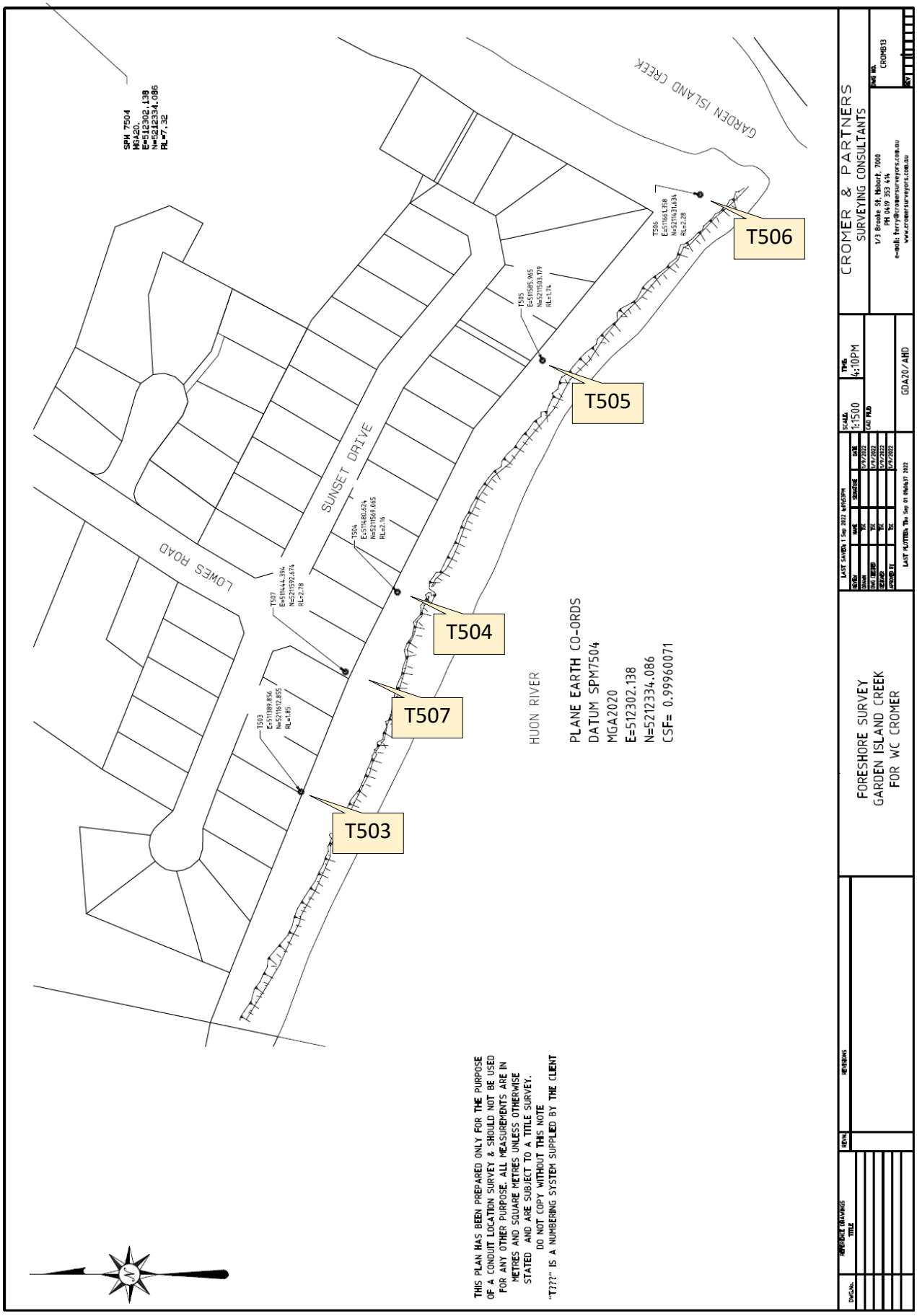

2021 January
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F
Grid North
0
200
Approx. metres


2022 March
Test pit A
Test pit B
Test pit C
Test pit D
Test pit E
Test pit F

Attachment 3

(8 pages including this page)

TASMARC markers T503— T507 established August 2022
Surveyed by Elliott Cromer 12 August 2022


SPM 7504
MGA20,
E=512302.138
N=5212334.086
RL=7.32
GARDEN ISLAND CREEK
SUNSET DRIVE
LOWES ROAD
HUON RIVER
T506
T505
T504
T507
T503
T506 E=511661.358 N=5211314.634 RL=2.28
T505 E=511985.965 N=5211503.179 RL=1.74
T504 E=511680.674 N=5211560.665 RL=2.16
T507 E=511444.394 N=5211592.674 RL=2.78
T503 E=511389.856 N=5211672.855 RL=1.85
PLANE EARTH CO-ORDS
DATUM SPM7504
MGA2020
E=512302.138
N=5212334.086
CSF= 0.99960071
THIS PLAN HAS BEEN PREPARED ONLY FOR THE PURPOSE OF A CONDUIT LOCATION SURVEY & SHOULD NOT BE USED FOR ANY OTHER PURPOSE. ALL MEASUREMENTS ARE IN METRES AND SQUARE METRES UNLESS OTHERWISE STATED AND ARE SUBJECT TO A TITLE SURVEY.
DO NOT COPY WITHOUT THIS NOTE
"T???" IS A NUMBERING SYSTEM SUPPLIED BY THE CLIENT
FORESHORE SURVEY
GARDEN ISLAND CREEK
FOR WC CROMER
CROMER & PARTNERS
SURVEYING CONSULTANTS
1/3 Brooke St Hobart 7000
PH 0419 353 414
e-mail: ferry@cromersurveyors.com.au
www.cromersurveyors.com.au
SCALE 1:1500
DWG NO. CROM813
GDA20/AHD


GDA94
511500mE
GDA94
5211500mN
Test pit A
T503
Test pit B
T507
Test pit C
T504
Test pit D
T505
Test pit E
Test pit F
T506
Grid North
0
200
Approx. metres

T503


T507
T507

T503
Test pit B
T507
Test pit C
T5

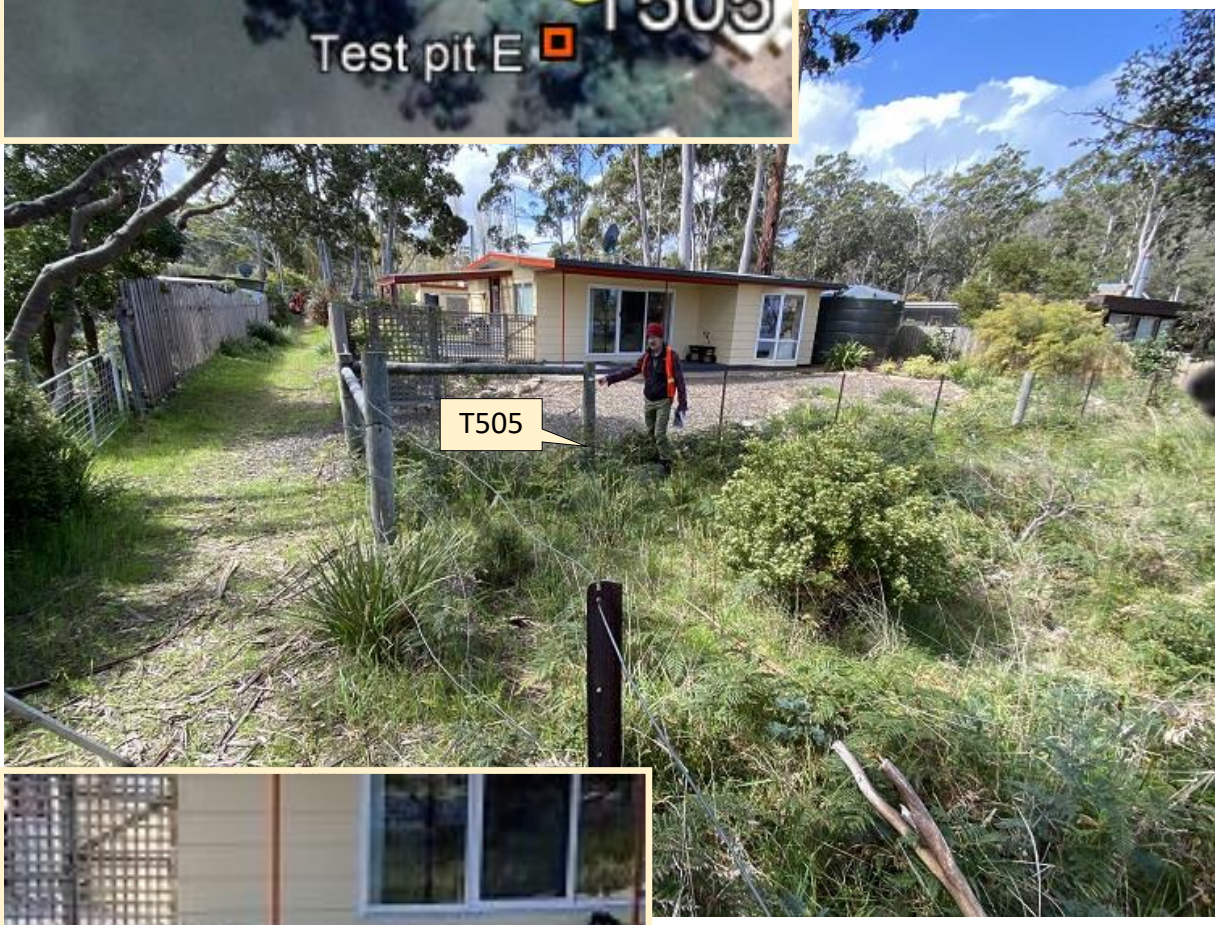

T507
t pit C
T504
Test pit D


T504

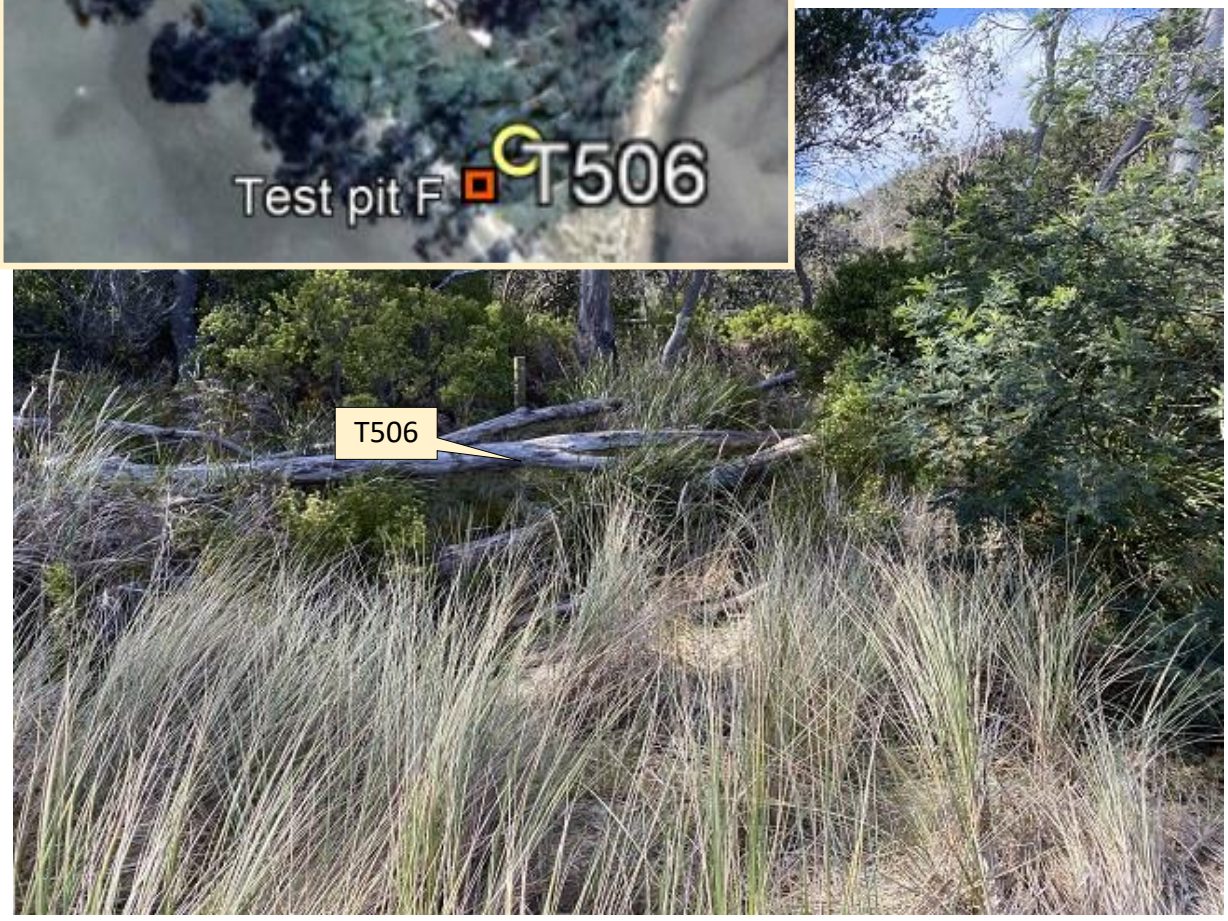
T504


T504

T505



T506

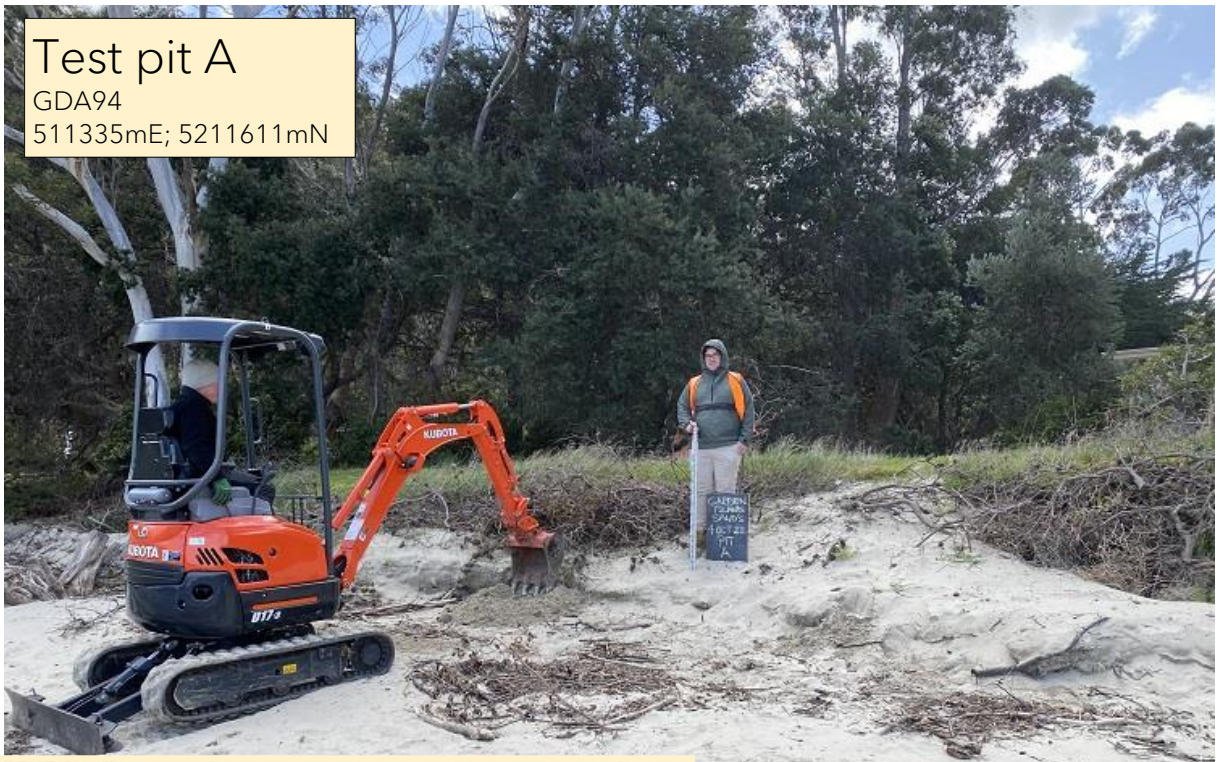


Attachment 4

(17 pages including this page)

Site and test pit photos

The scale in the photos is graduated in red- and black-numbered segments each one metre long. The black numbers are decimetres.


Test pit A
GDA94
511335mE; 5211611mN
KUBOTA


Test pit A
Test pit B
Test pit C


KUBOTA
U17-3


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
A
Layer 1
Layer 2


Test pit B
GDA94
511370mE; 5211587mN
On T503 beach profile
KUBOTA
U17-3
GARDEN ISLANDS SANDS
4 OCT 23
PIT
B


Test pit A
Test pit B
Test pit C


KUBOTA
GARDEN ISLANDS SANDS
4 OCT 23
PIT
B


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
B
Layer 1
Layer 2


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
B


Test pit C
GDA94
511432mE; 5211568mN
On T507 beach profile
KUBO


Test pit A
Test pit B
Test pit C


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
C
Layer 1
Layer 2


Test pit D
GDA94
511474mE; 5211554mN
On T504 beach profile
GARDEN ISLANDS SANDS
4 OCT 22
PIT
D
KUBOTA
U17-3


Test pit D
Test pit E
Test pit F


KUBOTA
U17-3


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
D
Layer 1
Layer 2


SANDS
4 OCT 22
PIT
D


Test pit E
GDA94
511575mE; 5211490mN
On T505 beach profile


Test pit D
Test pit E
Test pit F

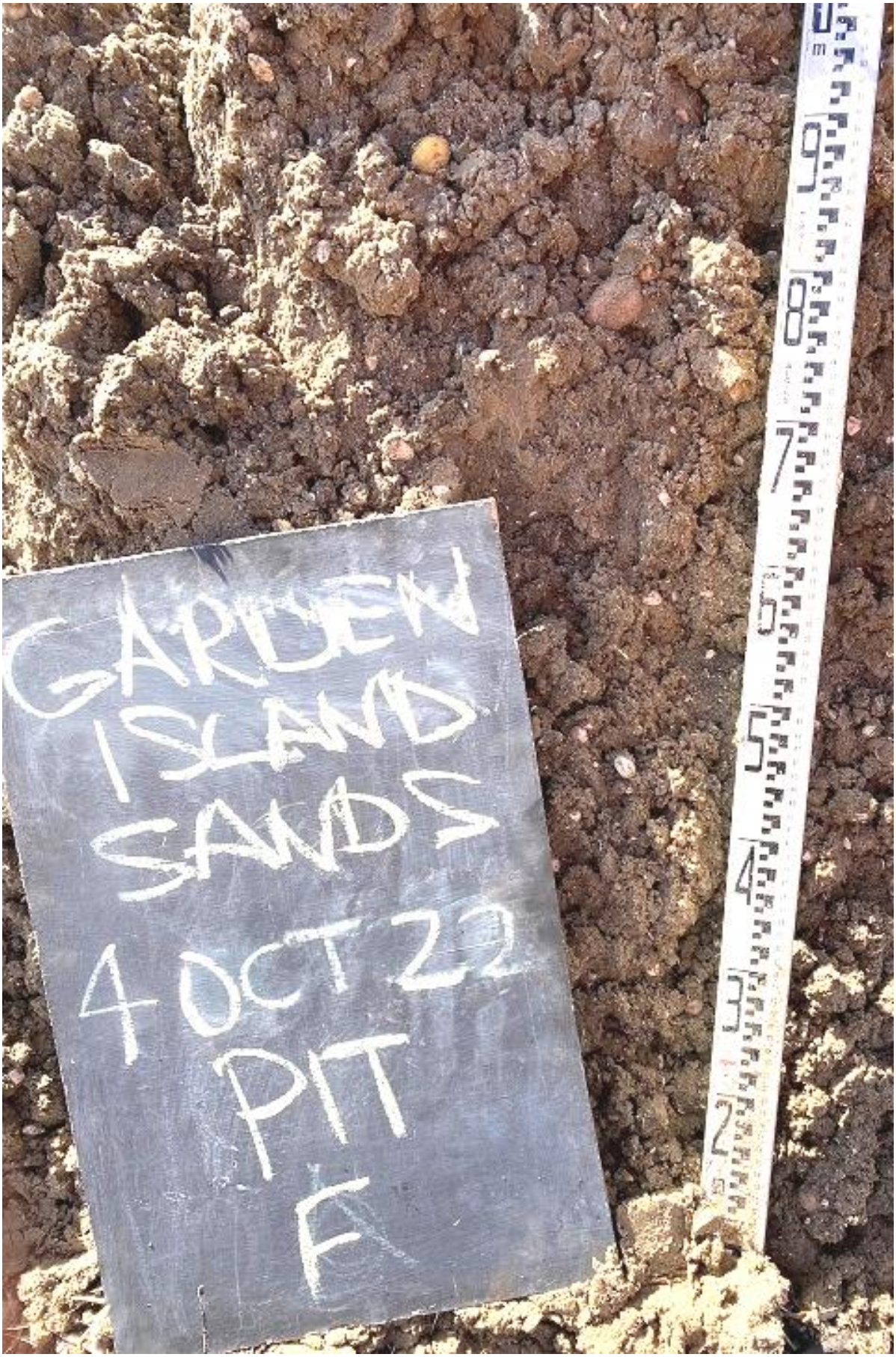

4 OCT 22
PIT
E
Layer 1
Layer 2


Test pit F
GDA94
511651mE; 5211422mN
On T506 beach profile
GARDEN ISLAND SANDS
4 OCT 22
PIT
F


Test pit D
Test pit E
Test pit F


KUBOTA


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
F
Layer 1
Layer 2


GARDEN
ISLAND
SANDS
4 OCT 22
PIT
F