Royal HaskoningDHV
Enhancing Society Together

Adaptive Risk Mitigation at Stockton

Lessons learnt from the field

June 2022

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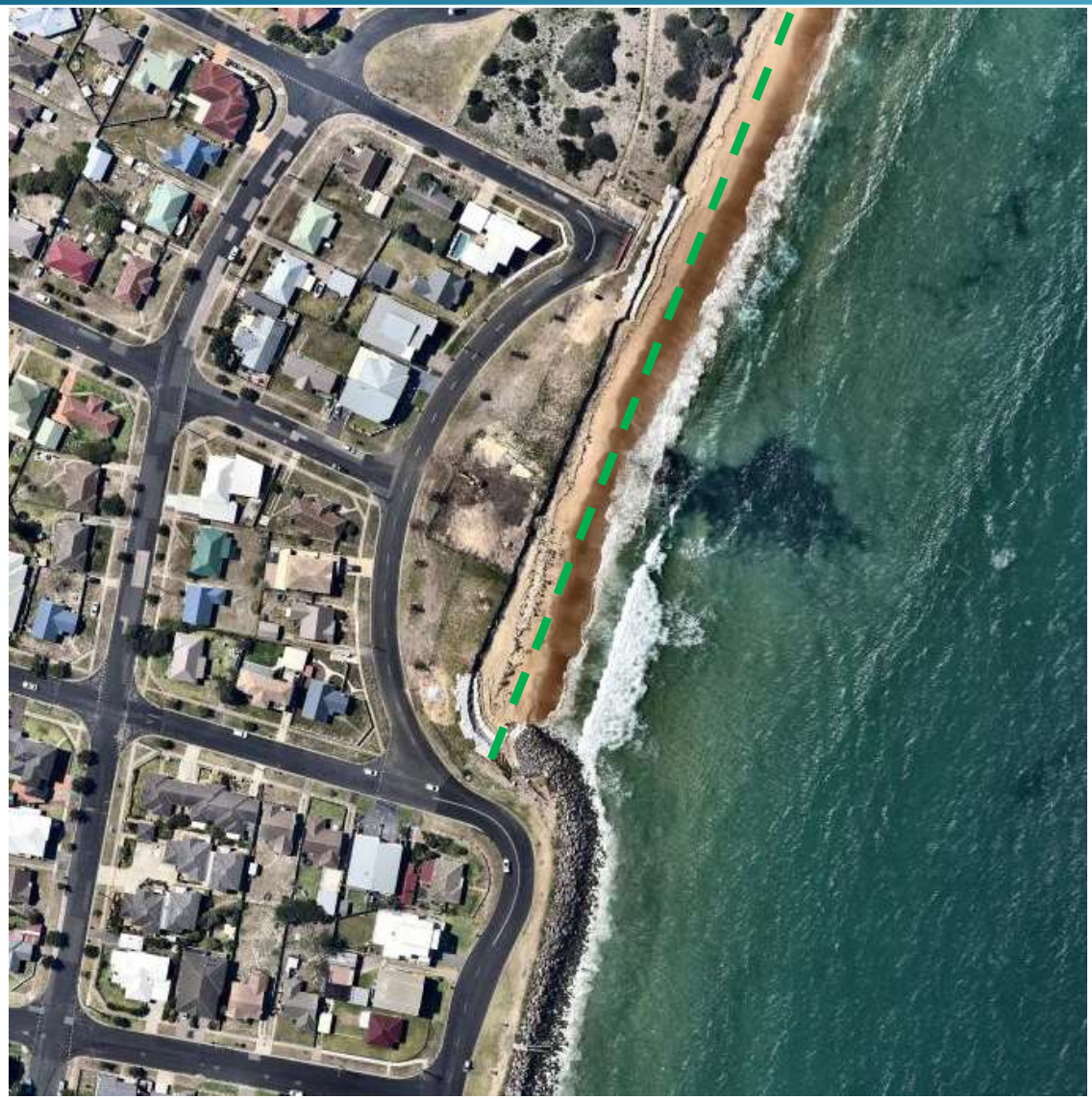
Barrie Cres Stockton

Royal HaskoningDHV

April 2011

April 2018

January 2019



October 2019

September 2020

CMP management actions triggered

Figure 1 Nearmap image (2 Sept 2020) with 2025 ZSA hazard line (Bluecoast, 2020)

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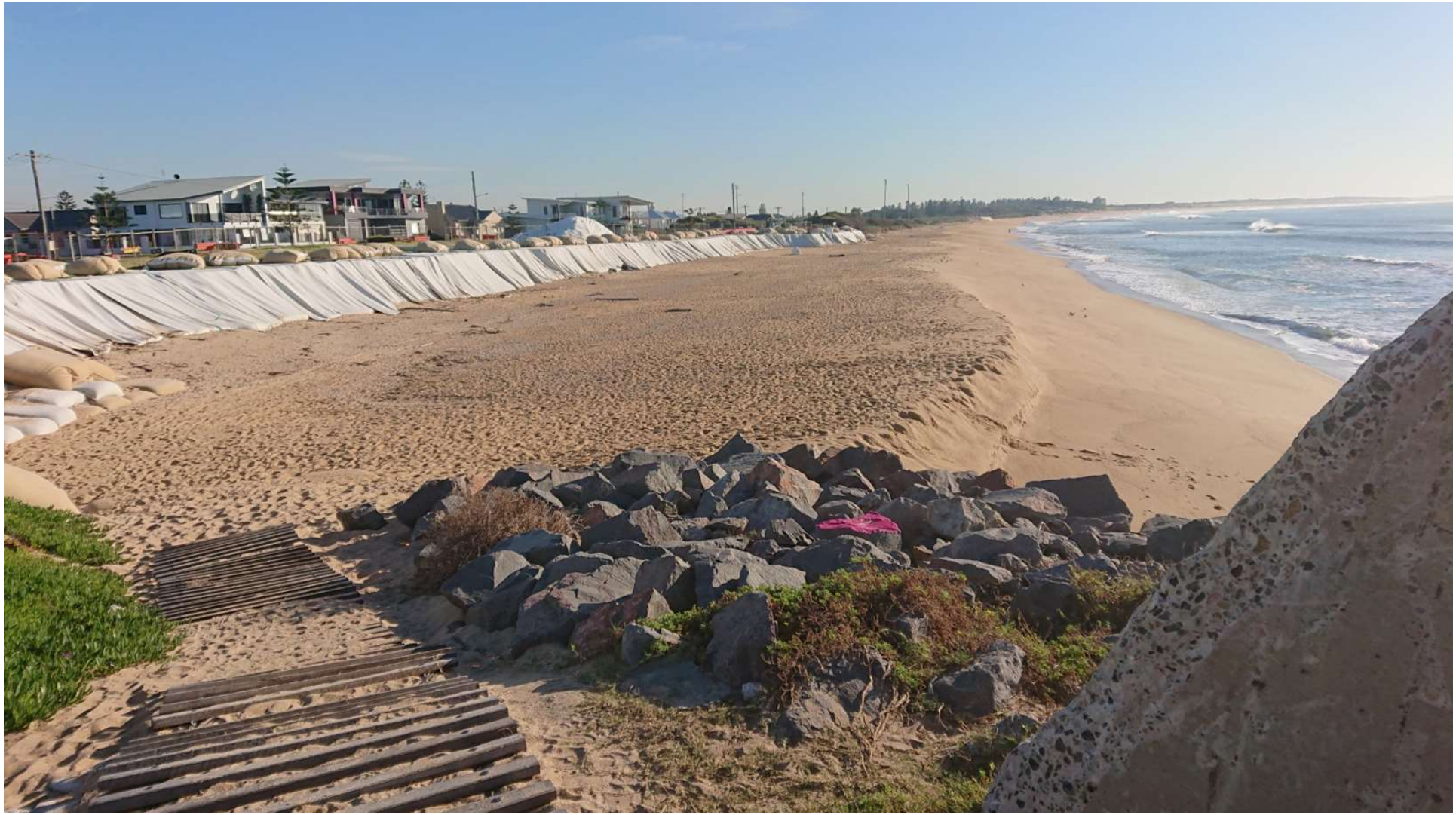
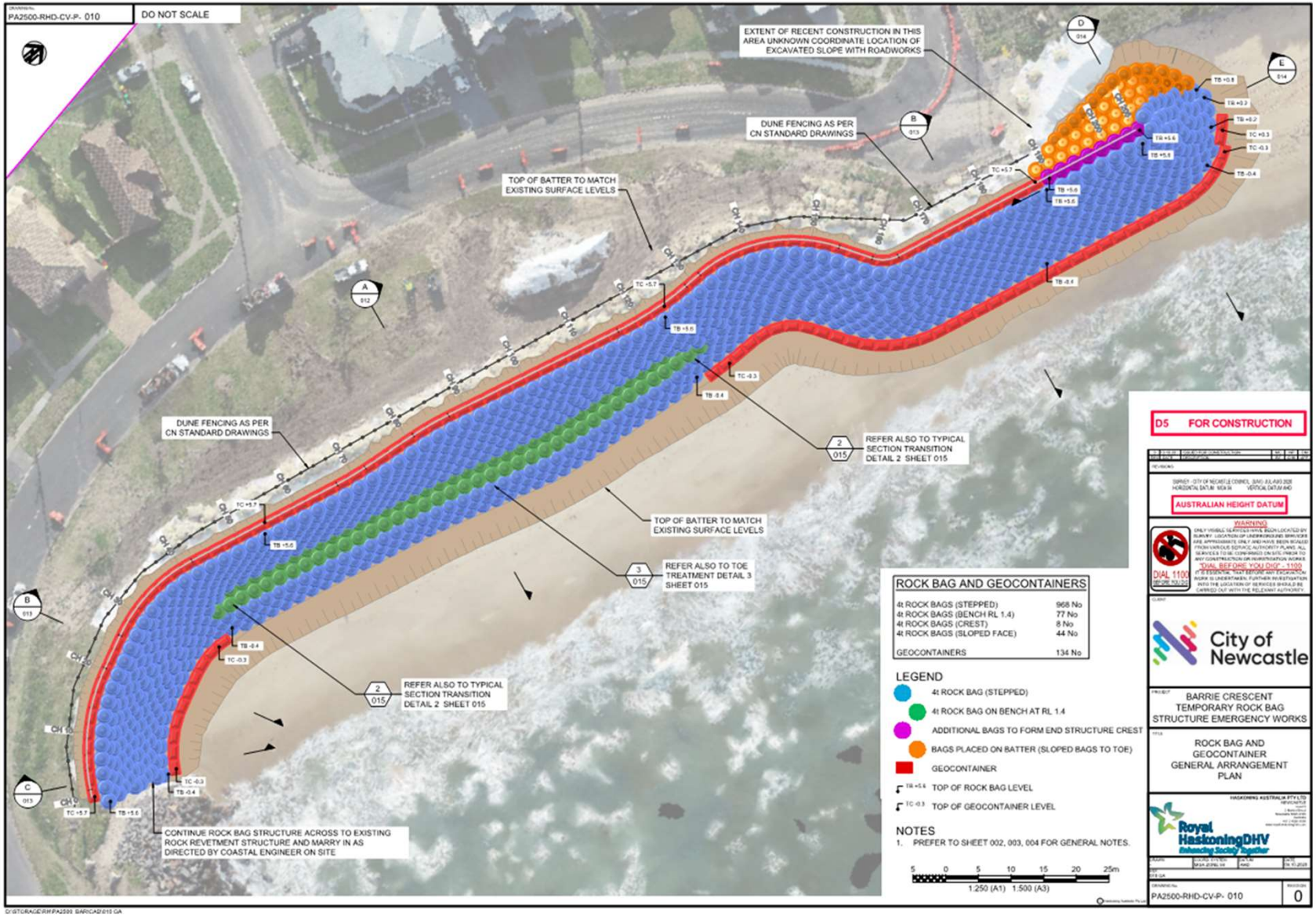
Geocontainers vs Rock Bags

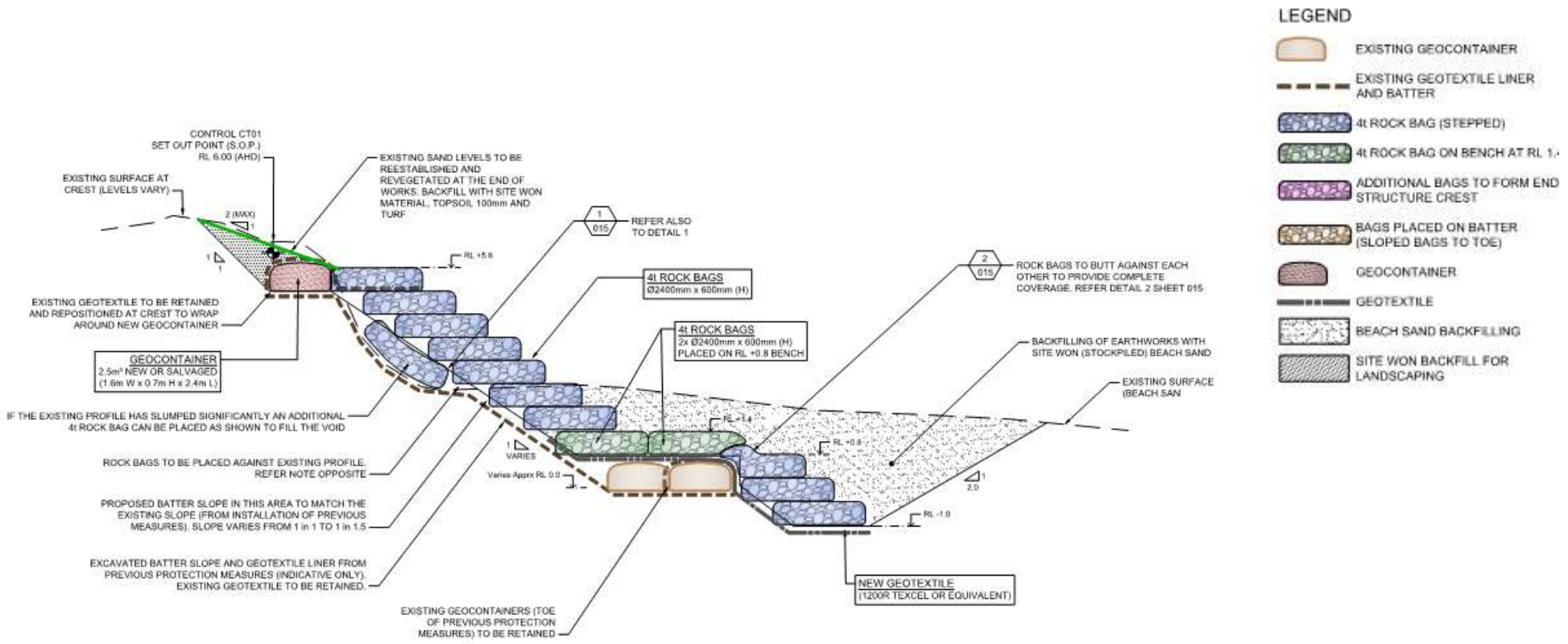
Rock Bags were deemed to be the preferred option due to the following factors:

- superior **hydraulic** and **energy dissipation** performance relative to similar mass geocontainers (as noted in WRL testing of 4T Rock Bags for NZ cruise terminal);
- similar or enhanced interlocking and resistance to sliding of the Rock Bags;
- reusable;
- speed and ease of installation in this exposed environment working within tidal windows; and
- reduced vulnerability to vandalism
- reduced vulnerability to toe failure due to undercutting

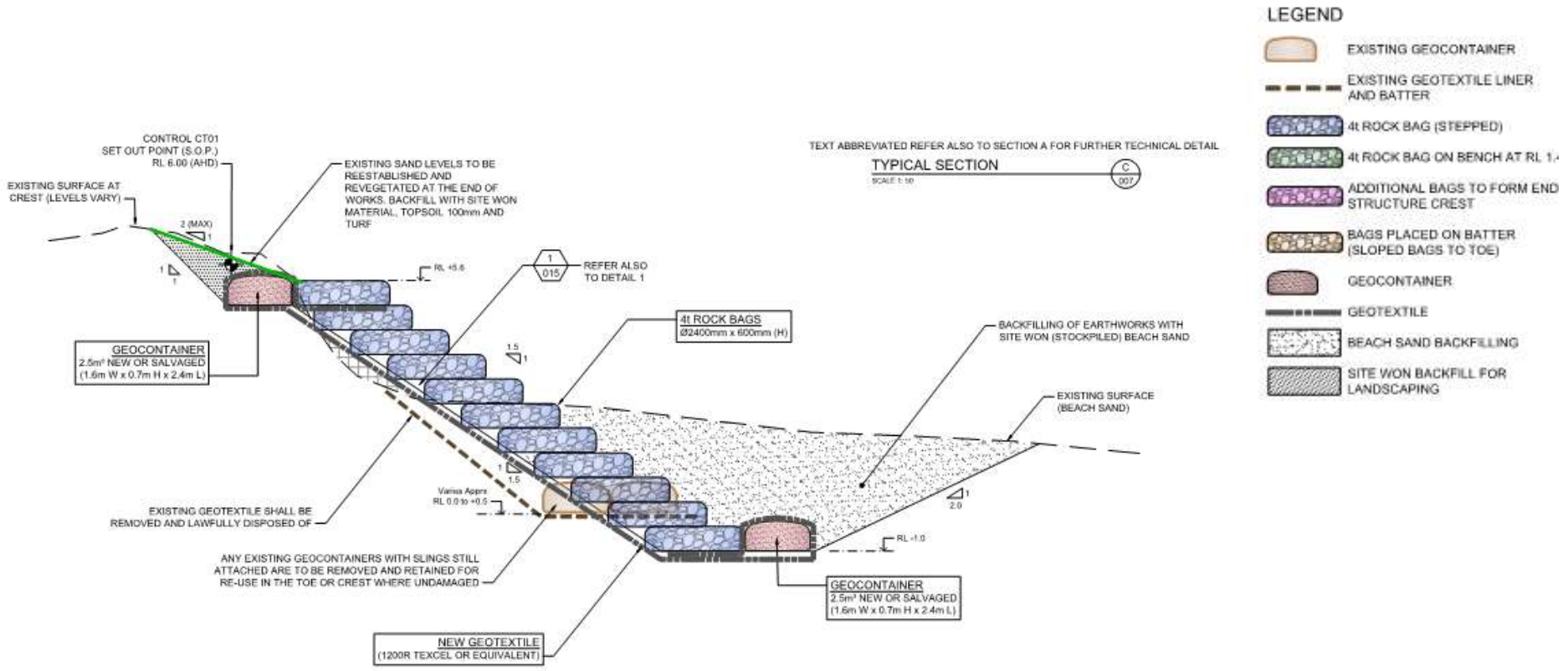

KOMATSU
PC
300
LC
219
KOMATSU




PA2500-RHD-CV-P- 010
DO NOT SCALE
EXTENT OF RECENT CONSTRUCTION IN THIS AREA UNKNOWN COORDINATE LOCATION OF EXCAVATED SLOPE WITH ROADWORKS
DUNE FENCING AS PER CN STANDARD DRAWINGS
TOP OF BATTER TO MATCH EXISTING SURFACE LEVELS
REFER ALSO TO TYPICAL SECTION TRANSITION DETAIL 2 SHEET 015
REFER ALSO TO TOE TREATMENT DETAIL 3 SHEET 015
CONTINUE ROCK BAG STRUCTURE ACROSS TO EXISTING ROCK REVETMENT STRUCTURE AND MARRY IN AS DIRECTED BY COASTAL ENGINEER ON SITE
ROCK BAG AND GEOCONTAINERS
4t ROCK BAGS (STEPPED) 968 No
4t ROCK BAGS (BENCH RL 1.4) 77 No
4t ROCK BAGS (CREST) 8 No
4t ROCK BAGS (SLOPED FACE) 44 No
GEOCONTAINERS 134 No
LEGEND
4t ROCK BAG (STEPPED)
4t ROCK BAG ON BENCH AT RL 1.4
ADDITIONAL BAGS TO FORM END STRUCTURE CREST
BAGS PLACED ON BATTER (SLOPED BAGS TO TOE)
GEOCONTAINER
TOP OF ROCK BAG LEVEL
TOP OF GEOCONTAINER LEVEL
NOTES
1. PREFER TO SHEET 002, 003, 004 FOR GENERAL NOTES.
1:250 (A1) 1:500 (A3)
D5 FOR CONSTRUCTION
AUSTRALIAN HEIGHT DATUM
DIAL 1100 BEFORE YOU DIG
City of Newcastle
BARRIE CRESCENT TEMPORARY ROCK BAG STRUCTURE EMERGENCY WORKS
ROCK BAG AND GEOCONTAINER GENERAL ARRANGEMENT PLAN
Royal HaskoningDHV
PA2500-RHD-CV-P- 010
0

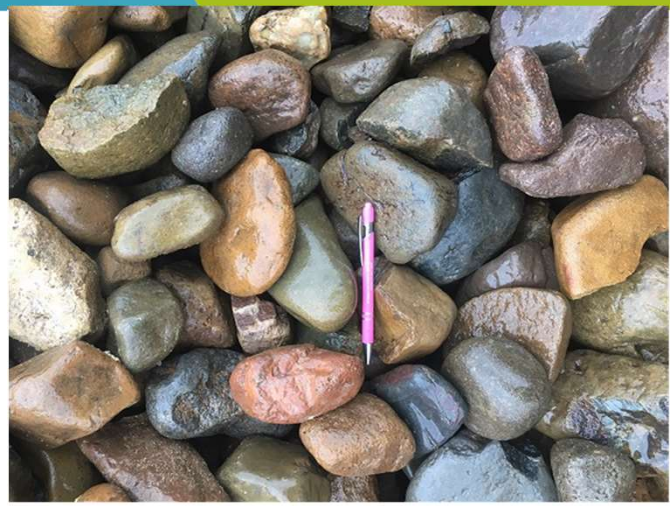


Typical section retro fitted on existing structure



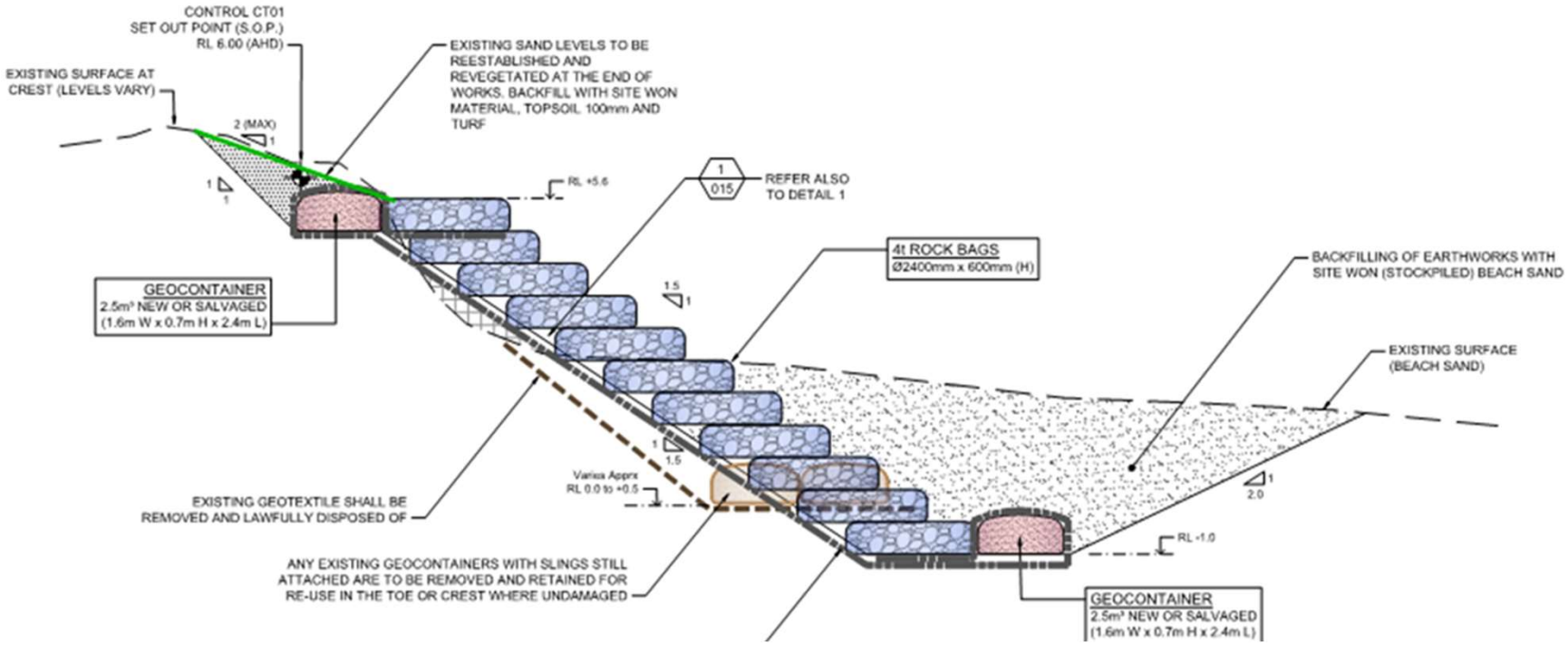
Typical section new structure

Rock Bag filling…



Construction commences at existing geocontainers structure…

Storm imminent – toe design modification



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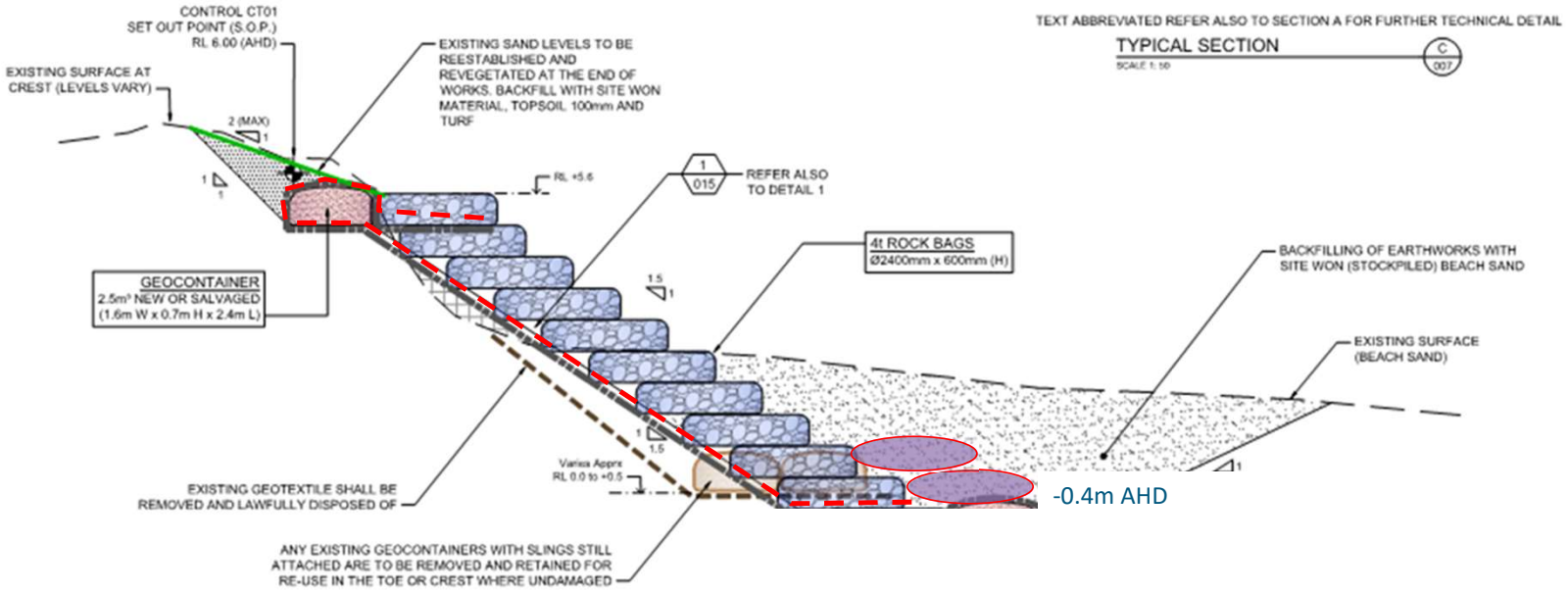
Storm imminent – toe design modification



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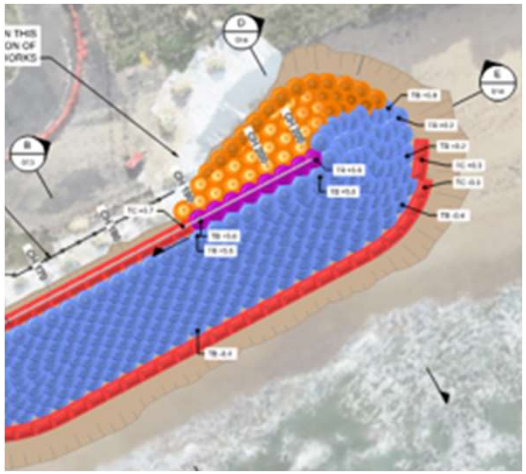
As the tide comes in….

June 2021

Articulating wrapped crest anchor

Daily protection and uncovering of leading edge of works

Roundhead construction



Roundhead

Pedestrian beach accessway

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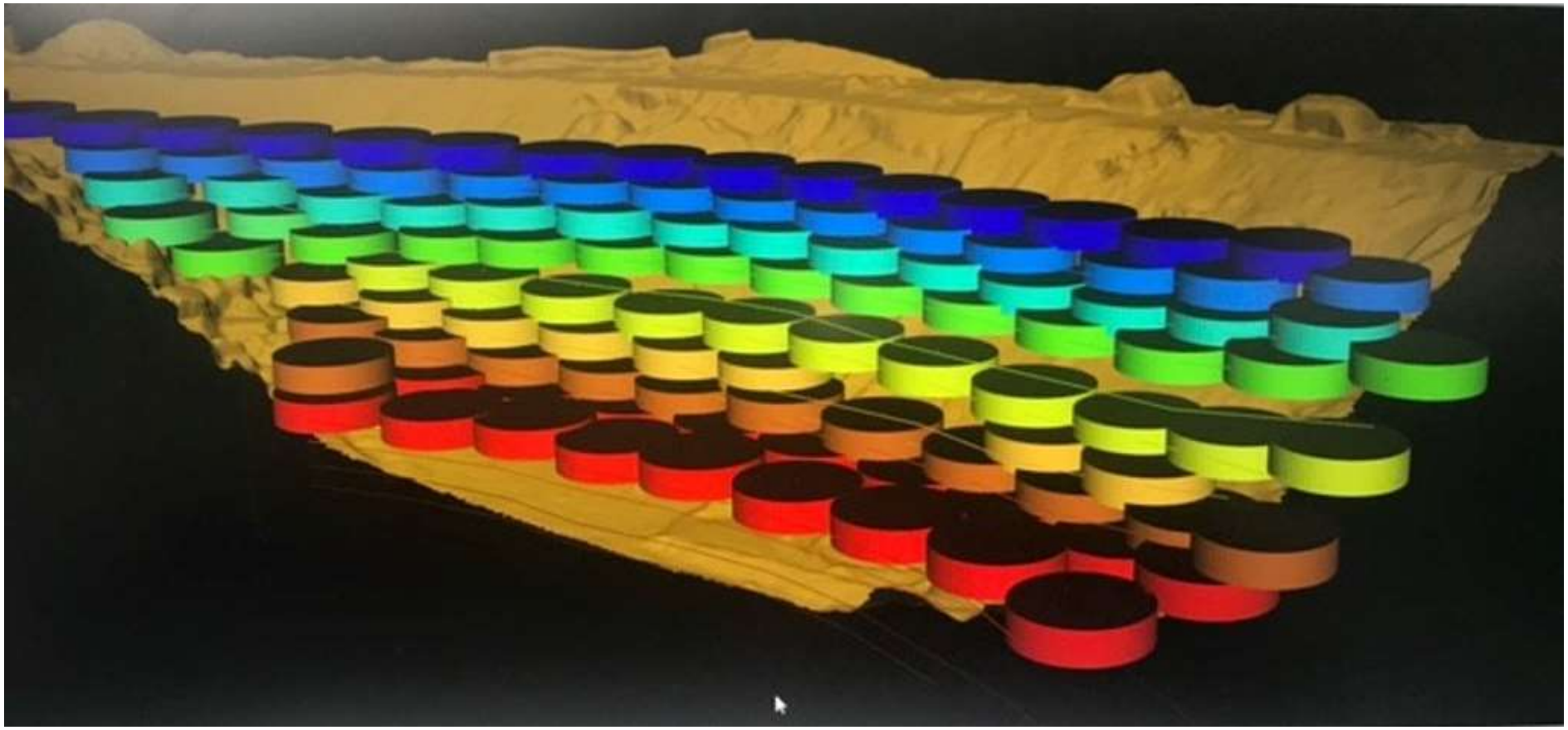
Pedestrian beach accessway



Lessons learnt in the field…

- Dewatering - Pump fixed to excavator works well in exposed location where spear points were not feasible
- Profile slope changes effective height of bags
- Curves are challenging, stretcher bond difficult to maintain and can change effective height of bags
- To maintain stretcher bond pattern often need to work a few rock bags ahead then ‘fit’ rock bags in between to avoid accumulating horizontal creep of joints
- Rock bags can be flattened by dropping another Rock Bag onto it with crane/excavator

Lessons learnt in the field…

- Need to cover edge of works with something easily removable at end of each day (if exposed site) such as geocontainers with slings to reduce time wasted carefully uncovering works (though it is still time consuming).
- Difficult to get a flat toe bedding if below water table. Can correct within next row though to achieve backward leaning structure.
- Much more moldable/flexible than sand filled geocontainers in terms of fitting into odd spaces.
- As Rock Bags will sift vertically down through sand, redundant bags can be used as toe protection if deep toe level can't be practically achieved.

Design Summary

- Rock Bags: 4t Kyowa 2.4m diameter, 0.6m high
- Structure length: approx. 220m
- Crest level: 5.4m AHD
- Toe level: -0.4m AHD with 3 additional Rock Bags in berm
- No. rows of bags: 11
- Effective height of bags placed: 0.5 to 0.55m
- No. bags placed: approx. 1200

Timing

- Filled bags at 80/ day (up to 100/day)
- Construction period 12 weeks for 1200 bags ie. 20 bags/day on average
- 60 bags/day max

Cost

- Rock Bag filling: $1070/filled bag
  (based on supply $800/4T bag, $50/tonne for rock, 2 x 30t excavators, 2 labour, 1 supervisor, $5500/day, based on 80 bags filled per day)
- Construction cost: $1.8 mill or $8,000/m or $1,500/bag
- **Rate/m:** $8000/m + $5900/m **= $14,000/m**
- **Rate/bag: $2,500 placed**
- **Potential for increased placement efficiency and construction cost optimization**
- **E.g if 60 bags/day could be achieved, total cost**  **from $2500/bag to $1500/bag**

Completed works

Following April 2022 storm events

Thank you… Questions??

https://youtu.be/HgVBWRvlreU

Swansea channel - https://youtu.be/2Fj0g5W783k