TECHNICAL MEMORANDUM

DATE 5 March 2025

Reference No. PS139771-001-TM-Rev0

TO Daniel Hartshorn
Redland City Council

CC

FROM Romney Rayner

EMAIL romney.rayner@wsp.com

AMITY FLOW SLIDE BARRIER – GEOPHYSICAL SURVEY COMMENTS AND UPDATES

Redland City Council (RCC) have engaged WSP Australia Pty Ltd (WSP) to provide updated outputs from a previous geophysics survey undertaken in 2022 along the existing Flow Slide Barrier (FSB) at Amity Point, North Stradbroke Island.

Additionally, RCC have requested that WSP provide comparison plots of the cross-section plots from an earlier geophysics survey (completed between 2016 to 2017) and the more recent 2022 survey, and to also provide a review of commentary on the 2022 geophysics survey report provided in a Structural Audit report undertaken by Water Technology Pty Ltd (Water Technology).

This draft technical memorandum (TM) provides the results of the updated outputs, comparison plots, and review of the Water Technology comments.

The reports referenced in this TM include the following:

- Golder (now WSP) report “Additional Geophysics Investigation – Rock Armour Revetment, Amity Point”, dated 5 September 2017. Reference 1650770-006-R-Rev1.
- Golder (now WSP) transmittal “Rock Armour Cross Section – Amity Point”, dated 5 September 2017. Reference 1650770-007-Rev1.
- Golder (now WSP) report “Geophysical Survey of Flow-slide Barrier”, dated 6 April 2022. Reference 21453805-001-R-Rev0.
- Water Technology report “Amity Point Flow Slide Barrier – Structural Audit”, dated 30 August 2023. Reference 23020288_R01v01h_final report_structural audit FSB.

Updated Extents Plan and Cross-Section Plots from 2022 Geophysics Survey

The previous geophysics surveys undertaken by Golder (now WSP) along the FSB at Amity Point have included interpreted rock boulder material extents in plan-view and interpreted cross sections of the FSB profile. The provided cross-sections are extracted at profiles approximately perpendicular to the shoreline, and at approximately 50 m intervals along the survey extents.

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The interpreted cross-sections included:

- Surface profile, based on bathymetry and surface elevation data provided to WSP by RCC;
- The thickness of interpreted FSB rock boulder/sand profile based on the geophysics survey interpretations; and
- The lateral extents of the FSB rock boulder material based on the geophysics survey interpretations.

For the 2022 geophysical survey report, the interpreted material extents plan was provided in figure 57 and the interpreted cross-sections were provided in figures 58 to 61. The bathymetry dataset used on these figures referenced a 2020-03-25 file, while the ground profile referenced a 2009 data set.

RCC have provided WSP with updated bathymetry and lidar data files for the FSB survey areas. These updated bathymetry and lidar datasets have been used to generate an updated interpreted material extents plan figure as well as updated interpreted cross-section figures. These are provided in Appendix A as rev 1 versions of Figures 57 to 61.

The changes in bathymetry between the dataset used previously (2020 bathymetry) and the latest dataset (2023 bathymetry) have in some locations resulted in reduced thickness of interpreted boulder materials where the newer bathymetry is deeper. For example, the cross-section results for CH 1300. Conversely, where the newer bathymetry level shows a shallower sea floor than the previous bathymetry, the corresponding interpreted boulder and mixed sand and boulder layers have been thickened to extend up to the 2023 bathymetry level.

Comparison Plan and Cross-Section Plots

The plan view and cross-section plots from the 2017 geophysics survey and the updated plan view and cross-section plots from the 2022 geophysics survey have been overlain on top of each other and provided for comparison in Figures B1 to B5 in Appendix B.

A review of the comparison plan view provided in Figure B1 indicates that the extent of interpreted boulder material and mixed sand and boulder materials between the two surveys, shown as purple shaded areas for 2022 and as yellow hatched areas for 2017, show general agreement. The extents of interpreted materials for the 2022 survey are generally slightly increased compared to the 2017 survey, particularly to the south of the survey area between CH 650 to CH 850. These changes may be related to either movement in FSB materials or variations in survey results such as differences in equipment sensitivity and accuracy, line positioning, interpretation of results, or a combination of both.

The interpreted seaward toe of the sea wall, as observed in the side scan sonar data from the corresponding geophysics surveys, is also generally consistent between the two surveys (2017 survey shown by blue line, 2022 survey shown by red line). The sea wall toe appears slightly decreased in the 2022 survey compared to the 2017 survey in some locations, particularly between CH 1000 to CH 1100, and also appears more intermittent between CH 650 to CH 700. These differences are likely explained by movement of surface sands between survey dates.

A review of the comparison cross-sections provided in Figures B2 to B5 shows the extents of the interpreted predominantly boulder material to be reduced in comparison to the 2017 survey. This may be in part due to the 2022 survey equipment and data processing identifying these areas more accurately and better delineating between the predominantly boulder material and the mixed sand and boulder materials. The thickness of the predominantly boulder material is also generally reduced in the 2022 survey results, with the exception of the sections at CH 700, CH 750, CH 850, CH 900, and CH 1100 which show comparable or greater thickness of this layer in the 2022 survey.

Review of Water Technology Commentary

RCC have provided WSP with a copy of a report undertaken by Water Technology titled Amity Point Flow Slide Barrier – Structural Audit, dated August 2023. Section 6 of this report provides a geophysical survey review, which provides a brief commentary on the results of the geophysics surveys completed in 2017 and 2022.

In general, the commentary provided is consistent with the findings of the geophysics investigations. The limitations of the geophysics survey methods, including the quoted accuracy of the overwater and land-based methods and the influence of differing variables between surveys (e.g. test locations, equipment accuracy and sensitivity, environmental variations, positioning error, and data processing and interpretation ambiguities) which may impact on the results are consistent with the outcomes of the geophysics surveys.

It is noted in the commentary that the bathymetry dataset from 2020 is used for the 2022 survey results. This TM addresses this issue, with the updated results provided using the updated 2023 bathymetry dataset (Appendix A). A vertical offset is also noted between the 2017 and 2022 cross-sections, which is correctly attributed to differences in height datums used between surveys (i.e. 2017 used lowest astronomical tide [LAT], while 2022 used Australian height datum [AHD]). This has also been addressed in this TM, with the 2017 results provided in the comparison plots (Appendix B) having been shifted vertically -1.336 m to convert from LAT to AHD for consistency with the 2022 survey results. This correction value is based on the quoted mean sea level (MSL) value for the nearest available tide gauge (Brisbane Bar) as extracted from Maritime Safety Queensland online resources (https://www.msq.qld.gov.au/). This correction resolves the vertical offset noted between the 2017 and 2022 geophysics survey results.

The Water Technology commentary on the geophysics survey reports details a range of commentary on selected cross-section chainages and reference comparison cross-section plots generated by Water Technology and provided as an Appendix to that report. A review of the comparison cross-section plots provided by Water Technology indicates that the plots are not a reliable representation of the results from the 2017 and 2022 geophysics surveys. The interpreted boulder material and mixed sand and boulder material from the 2022 survey are well represented on these cross-sections, and shown as shaded purple and orange areas, and the extents of the interpreted rock armour and sand material from the 2017 survey are represented by black line work. However, the 2017 results presented on the Water Technology cross-section plots do not appear to be consistent with the results of the 2017 geophysics survey provided in the Golder (now WSP) transmittal “Rock Armour Cross Section – Amity Point” (dated 5 September 2017). Additionally, it appears that the 2017 results used in the Water Technology report suffer from the vertical offset error (LAT to AHD) discussed earlier.

The comparison cross-section plots provided in the Water Technology report also appear to show that the upper extents of the 2022 boulder and mixed sand and boulder areas have been reduced where the line work from the 2017 survey has been overlain. It is not clear what the cause or reason for this is, however, it is noted that this is likely to have influenced the commentary of the cross-section results provided in the Water Technology report. This is particularly pertinent to cross-sections identified as having thinning sections in the “Thickness” bullet point of the Water Technology commentary.

The Water Technology commentary on the cross-section slopes appears consistent with the results presented in the geophysics reports.

The Water Technology commentary on the cross-section toe position indicates an increased extent of the toe of the FSB materials observed in the 2022 results when compared to the 2017 results. This is considered a reasonable observation if the toe of the FSB material is considered to be represented by the westernmost extent of the interpreted mixed sand and boulder materials. However, it is noted that in general the westernmost extent of the interpreted boulder materials in the 2022 survey shows a decrease in comparison to the 2017 investigation. As commented in the Water Technology report, this may be a result of improved survey quality allowing for better definition of these materials in the 2022 survey.

The Water Technology report indicates cross-section results at CH 1000, 1250, and 1450 failed to detect a noticeable toe or interpreted boulder material. This is generally correct for the 2022 survey, however it is noted that some interpreted boulder material was observed at these locations in the 2017 survey.

The Water Technology report commentary regarding the cross-section crests is consistent with the results of the geophysics surveys.

Closure

We trust that this technical memorandum meets your needs at the present time. If you have any questions or require clarification, please contact the undersigned at your convenience.

Golder Associates Pty Ltd

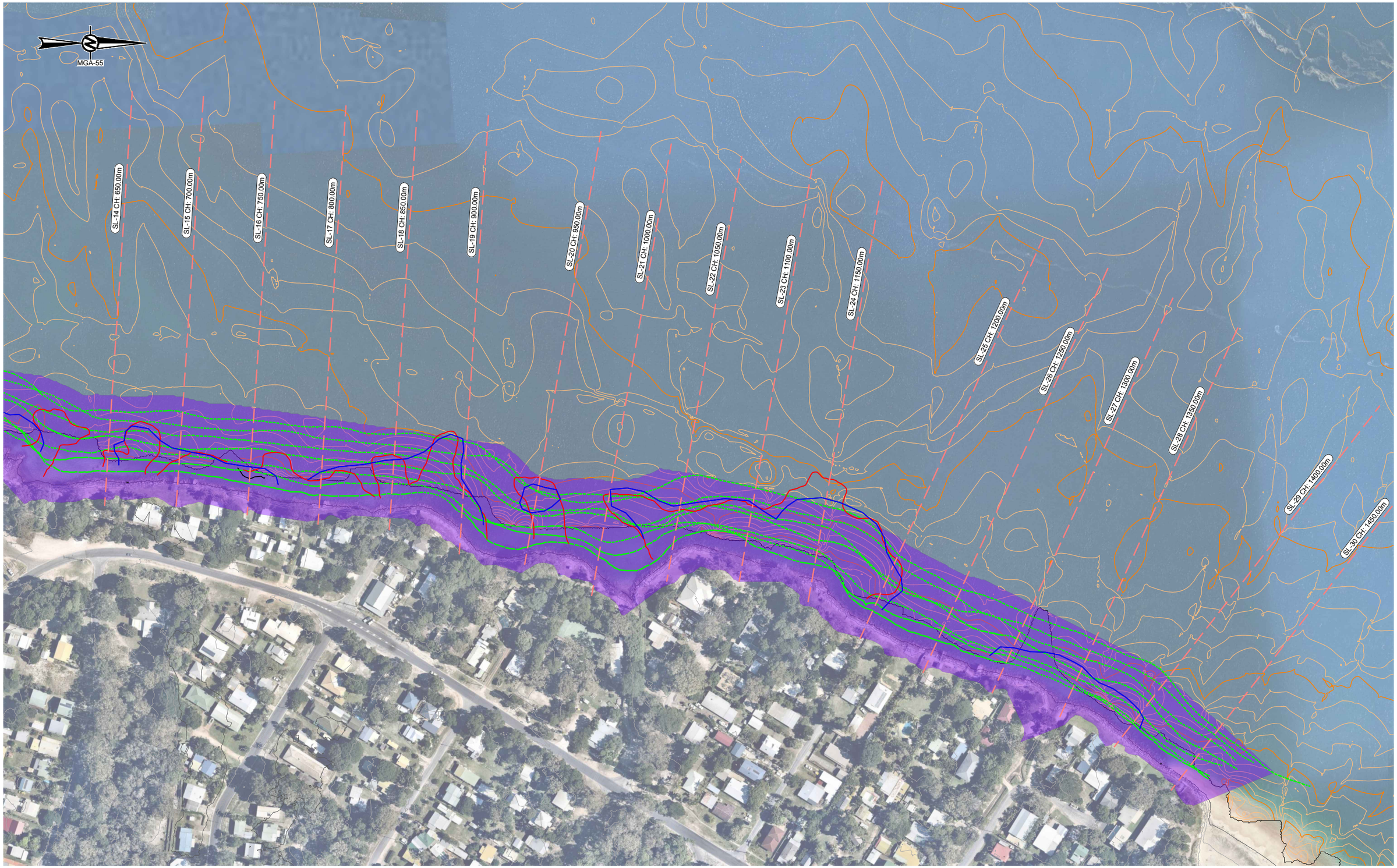
Romney Rayner
Principal Geophysicist

Tariq Rahiman
Technical Director

Appendices: A – Updated Interpreted Extents Plan and Cross-Sections From 2022 Geophysics Survey
B – Comparison Interpreted Extents Plan and Cross-Sections

APPENDIX A

Updated Interpreted Extents Plan and Cross-Sections From 2022 Geophysics Survey



LEGEND

- UPDATED BATHYMETRY 2023-12
- SBP LINES
- EXISTING GROUND 2022-09-05
- SEAWARD TOE
- INTERPRETED EXTENTS OF MIXED SAND AND BOULDER MATERIAL
- PREDOMINANTLY BOULDER MATERIAL

NOTES

1. FACTUAL DATA IS AT SBP AND MASW LINE LOCATIONS. ELSEWHERE DATA IS INFERRED
2. UNCERTAINTY RANGE IN THICKNESS OF ROCK ARMOUR
   LAND SECTION: ± 20%
   OVERWATER SECTION: ±40%

0 50 100
1:2,500 METRES

CLIENT
REDLAND CITY COUNCIL

CONSULTANT
GOLDER

YYYY-MM-DD	2024-06-05
DESIGNED	-
PREPARED	SD
REVIEWED	TR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR EXTENTS PLAN AND CROSS SECTION LOCATIONS

PROJECT NO.	CONTROL	REV.	FIGURE
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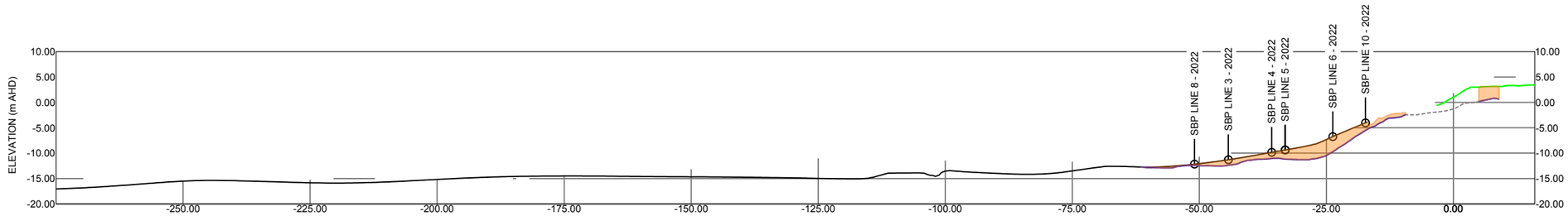

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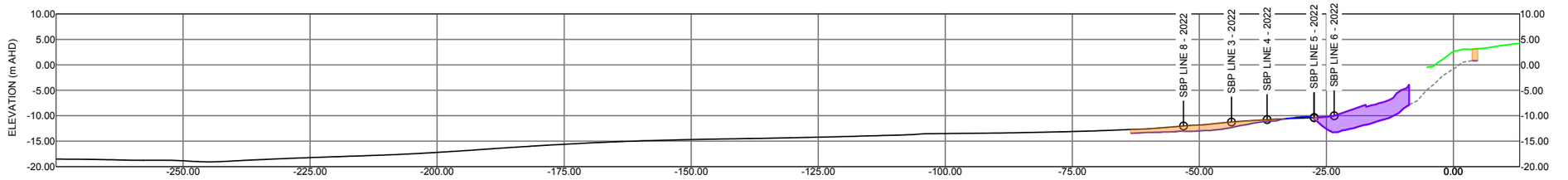

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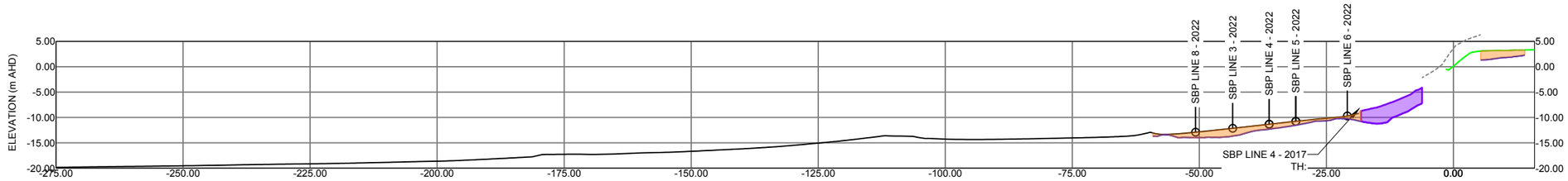

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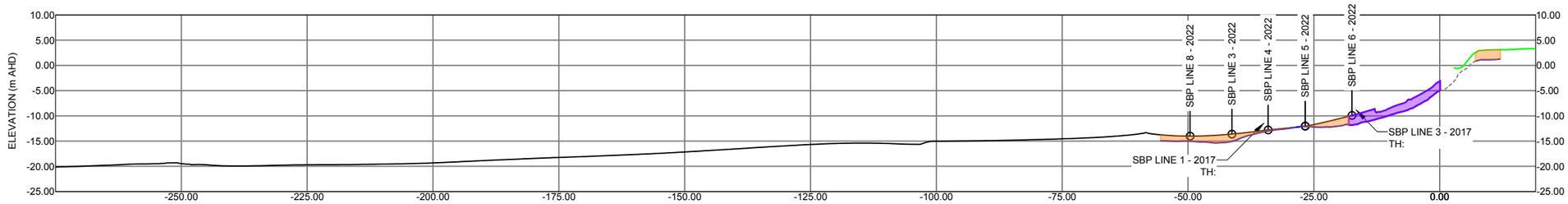

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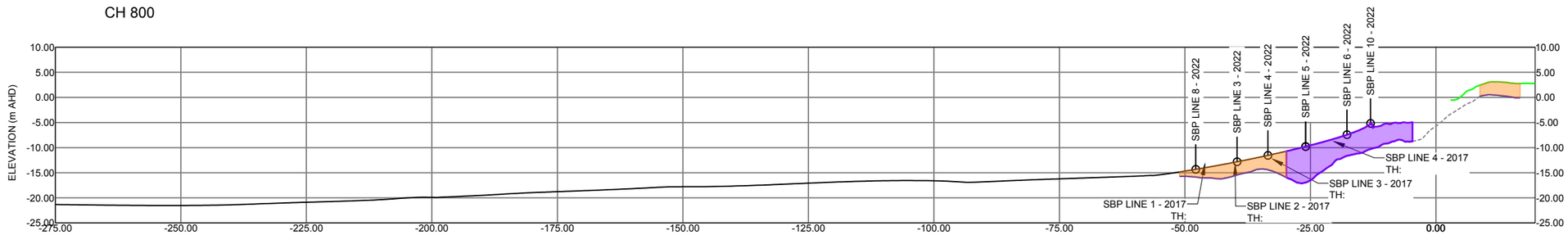

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LEGEND

- UPDATED BATHYMETRY 2023-12
- EXISTING GROUND 2022-09-05
- INTERPRETED EXTENTS OF MIXED SAND AND BOULDER MATERIAL
- PREDOMINANTLY BOULDER MATERIAL
- MIXED SAND AND BOULDER MATERIAL

NOTES

1. FACTUAL DATA IS AT SBP AND MASW LINE LOCATIONS. ELSEWHERE DATA IS INFERRED
2. UNCERTAINTY RANGE IN THICKNESS OF ROCK ARMOUR
   LAND SECTION: ± 20%
   OVERWATER SECTION: ±40%

0 25 50
1:1,000 METRES

CLIENT
REDLAND CITY COUNCIL

CONSULTANT
GOLDER

YYYY-MM-DD	2024-06-05
DESIGNED	-
PREPARED	SD
REVIEWED	TR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR CROSS SECTIONS SHEET 1 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
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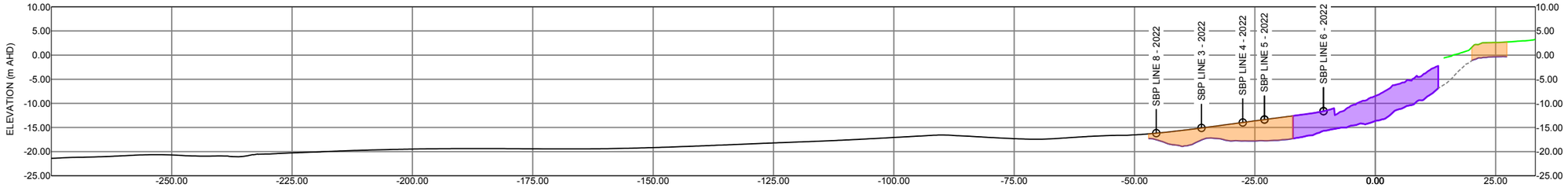

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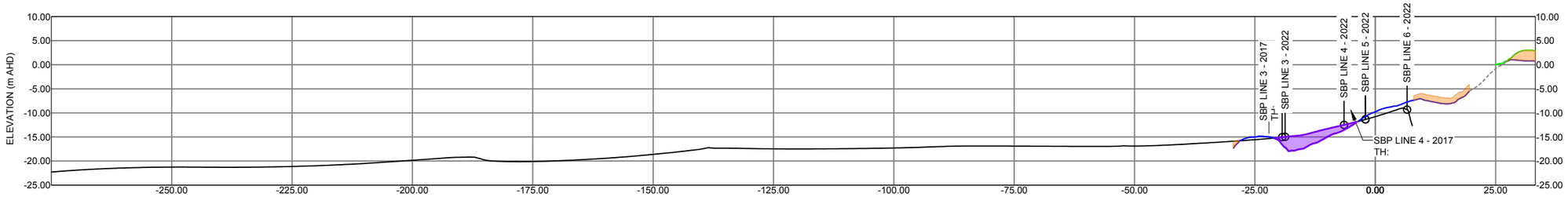

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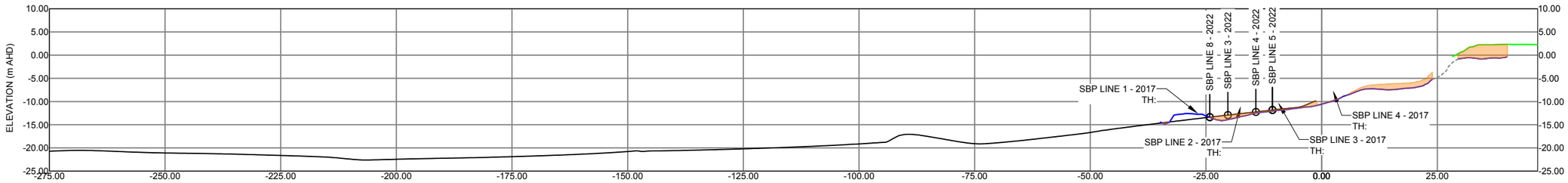

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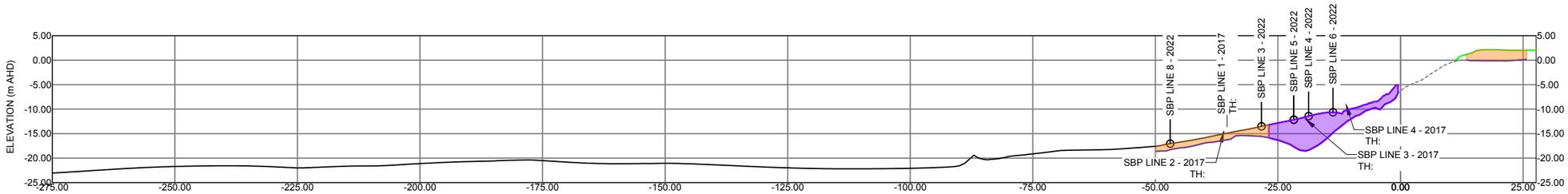

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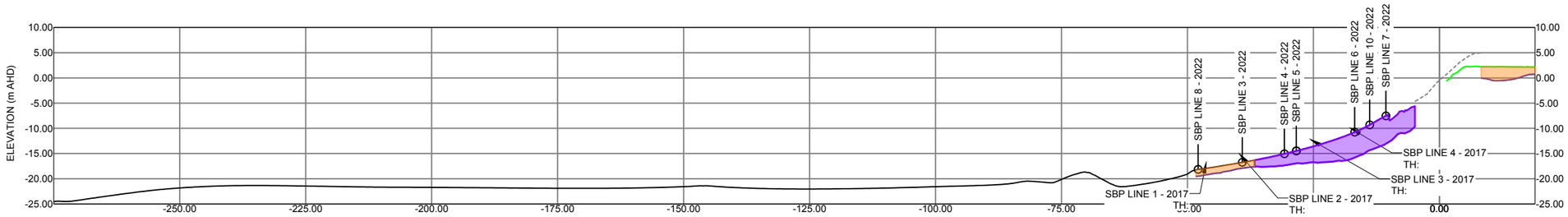

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- UPDATED BATHYMETRY 2023-12
- EXISTING GROUND 2022-09-05
- INTERPRETED EXTENTS OF MIXED SAND AND BOULDER MATERIAL
- PREDOMINANTLY BOULDER MATERIAL
- MIXED SAND AND BOULDER MATERIAL

NOTES

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   OVERWATER SECTION: ±40%

0 25 50
1:1,000 METRES

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GOLDER

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PREPARED	SD
REVIEWED	TR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR CROSS SECTIONS SHEET 2 OF 4

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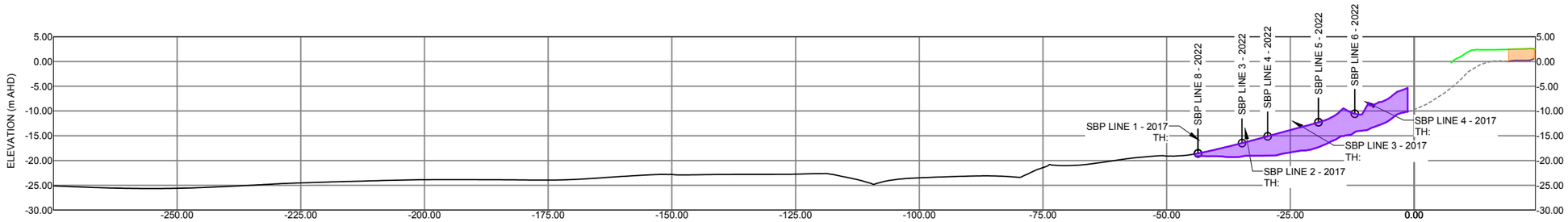

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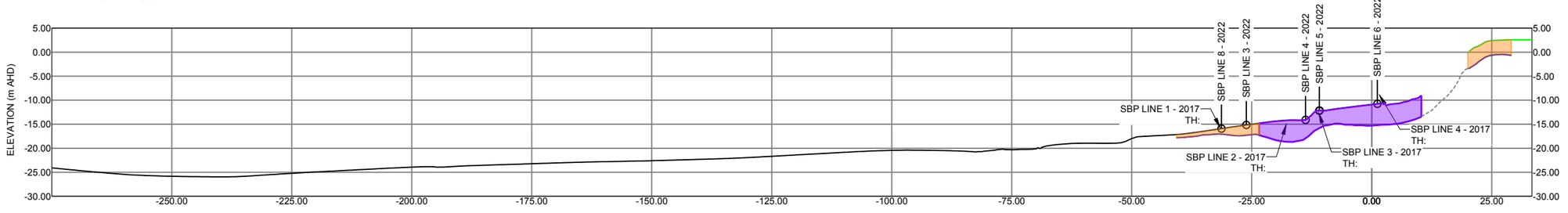

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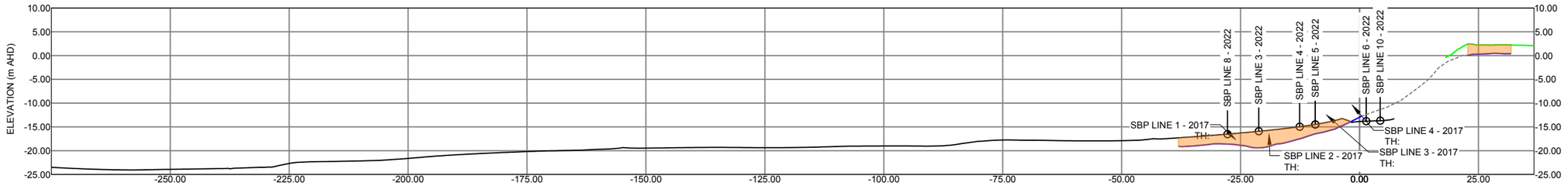

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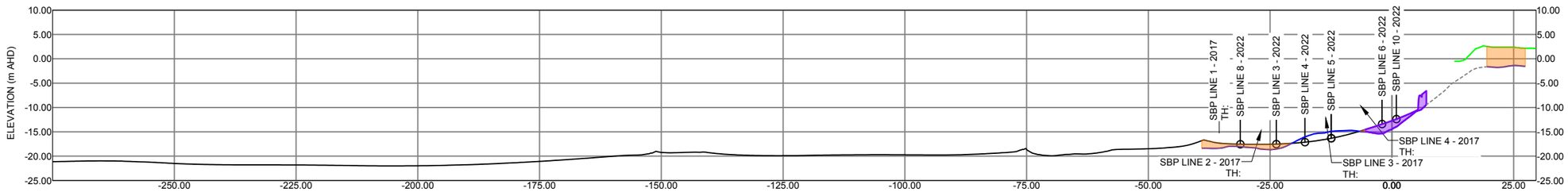

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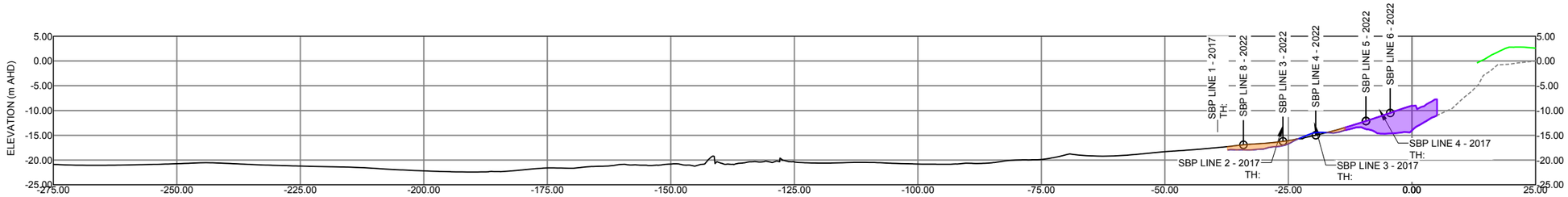

LEGEND

- UPDATED BATHYMETRY 2023-12
- EXISTING GROUND 2022-09-05
- INTERPRETED EXTENTS OF MIXED SAND AND BOULDER MATERIAL
- PREDOMINANTLY BOULDER MATERIAL
- MIXED SAND AND BOULDER MATERIAL

NOTES

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   OVERWATER SECTION: ±40%

0 25 50
1:1,000 METRES

CLIENT
REDLAND CITY COUNCIL

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GOLDER

YYYY-MM-DD	2024-06-05
DESIGNED	-
PREPARED	SD
REVIEWED	TR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR CROSS SECTIONS SHEET 3 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
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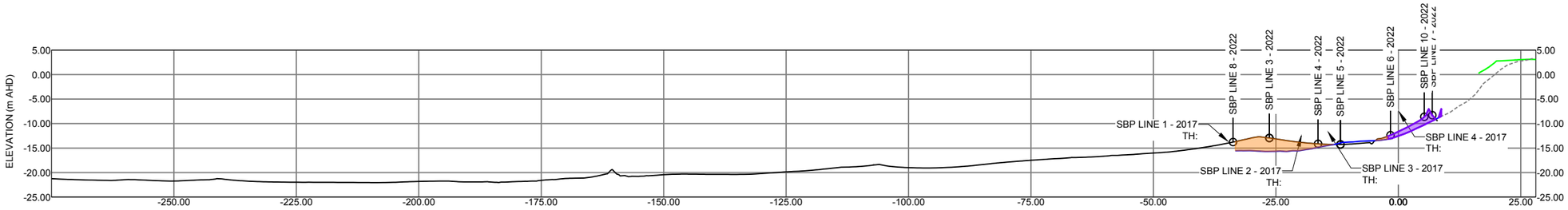

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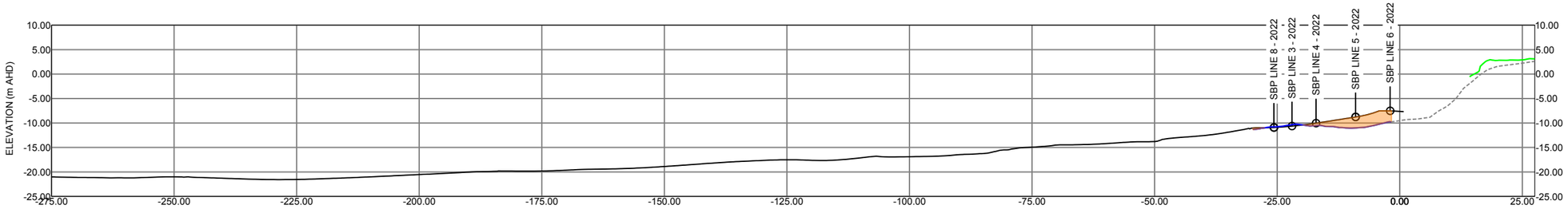

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LEGEND

- UPDATED BATHYMETRY 2023-12
- EXISTING GROUND 2022-09-05
- INTERPRETED EXTENTS OF MIXED SAND AND BOULDER MATERIAL
- PREDOMINANTLY BOULDER MATERIAL
- MIXED SAND AND BOULDER MATERIAL

NOTES

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   LAND SECTION: ± 20%
   OVERWATER SECTION: ±40%

0 25 50
1:1,000 METRES

CLIENT
REDLAND CITY COUNCIL

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GOLDER

YYYY-MM-DD	2024-06-05
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REVIEWED	TR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR CROSS SECTIONS SHEET 4 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
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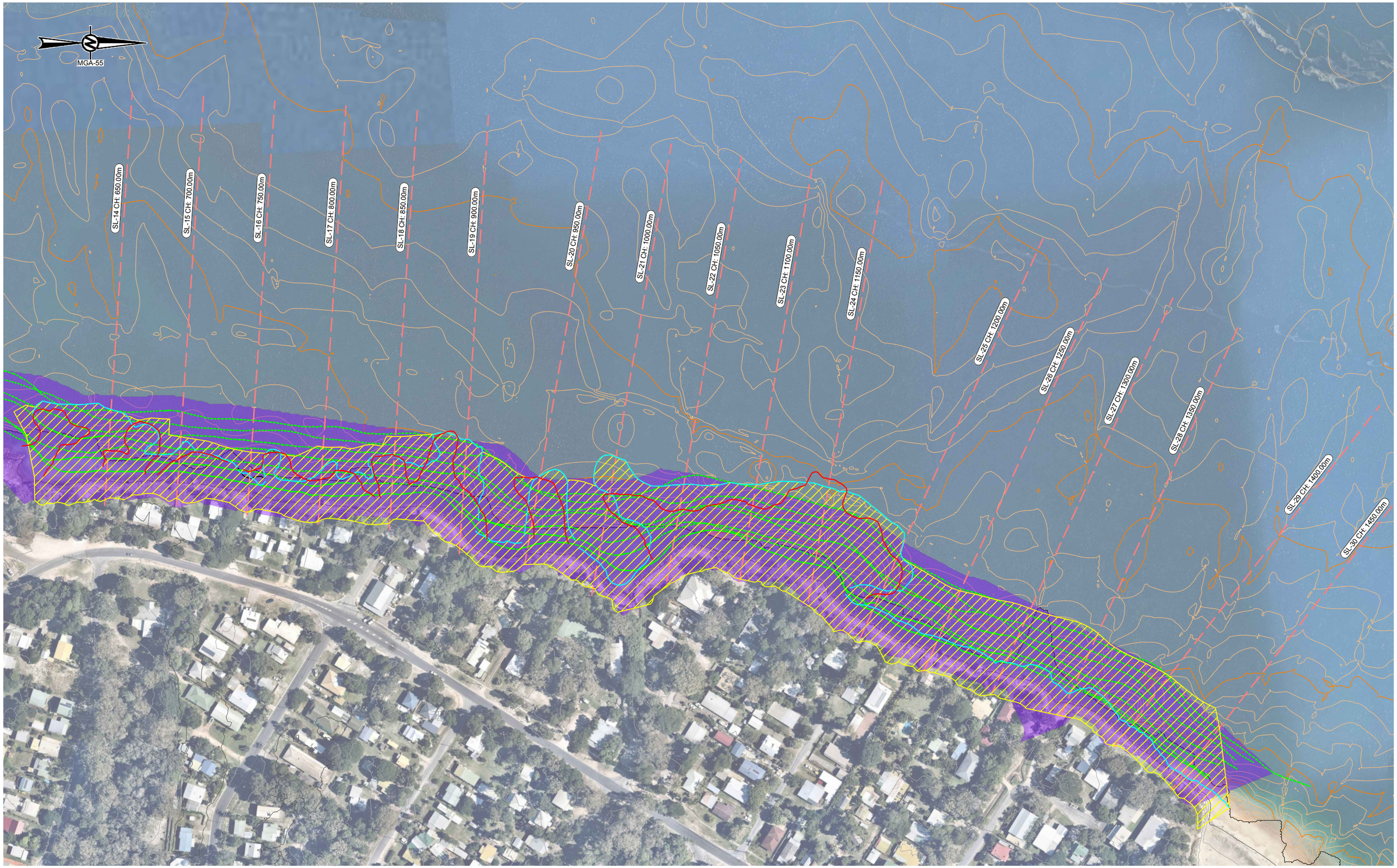
APPENDIX B

Comparison Interpreted Extents Plan and Cross-Sections



LEGEND

- UPDATED BATHYMETRY (2023-12)
- SBP LINES
- EXISTING GROUND (2022-09-05)
- SEAWARD TOE (2022)
- SEAWARD TOE (2016)
- MIXED SAND AND BOULDER MATERIAL (2022)
- MIXED SAND AND BOULDER MATERIAL (2016)

NOTES

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0 50 100
1:2,500 METRES

CLIENT
REDLAND CITY COUNCIL

CONSULTANT
GOLDER

YYYY-MM-DD	2024-06-06
DESIGNED	-
PREPARED	SD
REVIEWED	RR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
ROCK ARMOUR EXTENTS PLAN AND CROSS SECTION LOCATIONS

PROJECT NO.	CONTROL	REV.	FIGURE
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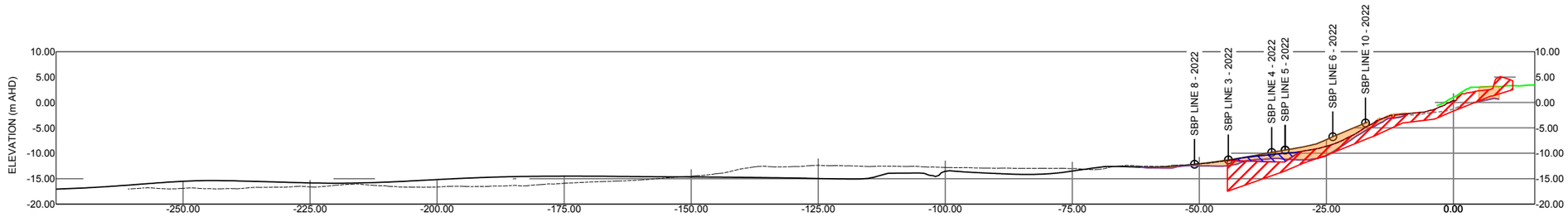

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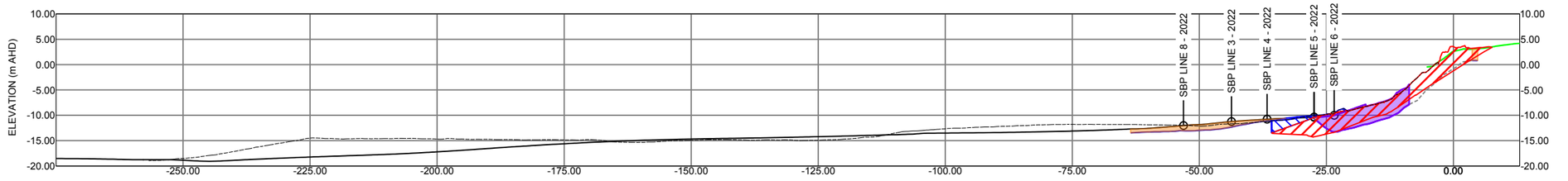

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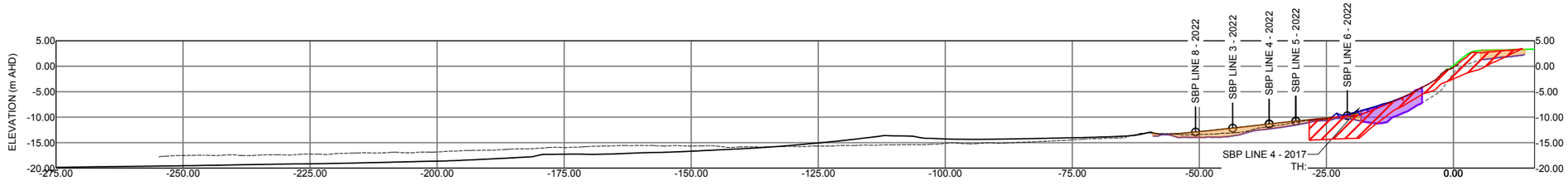

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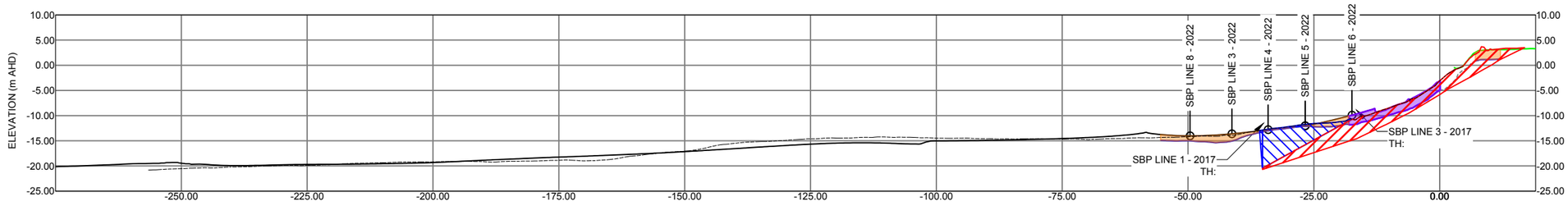
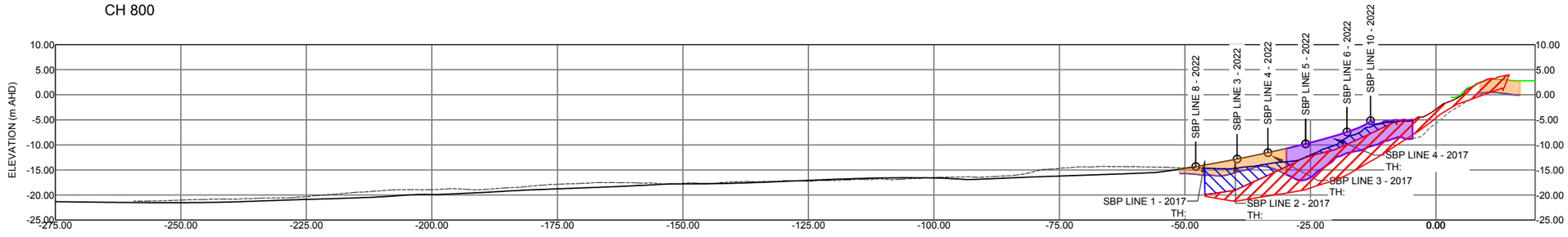


CH 800



CH 850

0 25 50
1:1,000 METRES

LEGEND

- UPDATED BATHYMETRY (2023-12)
- EXISTING GROUND (2022-09-05)
- PREDOMINANTLY BOULDER MATERIAL (2022)
- MIXED SAND AND BOULDER MATERIAL (2022)
- BATHYMETRY (2016)
- PREDOMINANTLY BOULDER MATERIAL (2016)
- MIXED SAND AND BOULDER MATERIAL (2016)

NOTES

1. ALL 2016 ELEVATIONS HAVE BEEN LOWERED 1.336 m TO CONVERT FROM LAT TO AHD DATUM.
2. FACTUAL DATA IS AT SBP AND MASW LINE LOCATIONS. ELSEWHERE DATA IS INFERRED
3. UNCERTAINTY RANGE IN THICKNESS OF ROCK ARMOUR
   LAND SECTION: ± 20%
   OVERWATER SECTION: ±40%

CLIENT
REDLAND CITY COUNCIL

CONSULTANT
GOLDER

YYYY-MM-DD	2024-06-06
DESIGNED	-
PREPARED	SD
REVIEWED	RR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
COMPARISON ROCK ARMOUR CROSS SECTIONS SHEET 1 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
PS139771	001	0	B2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm

0

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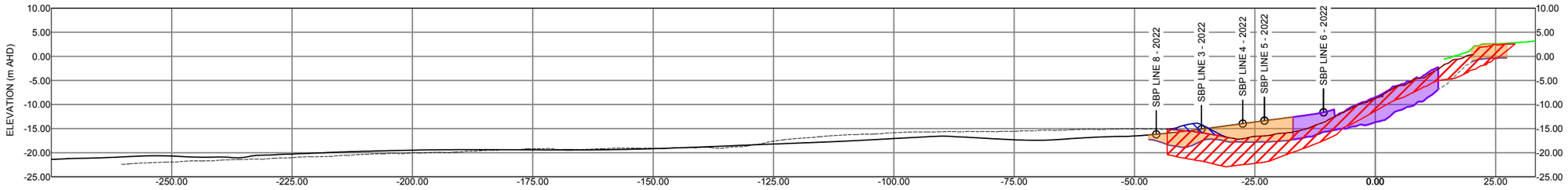

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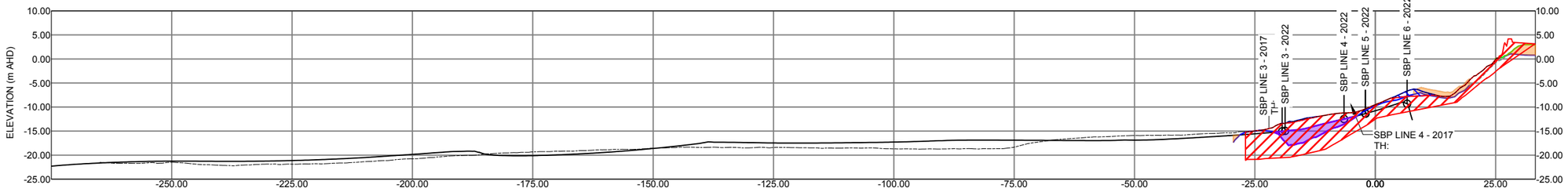

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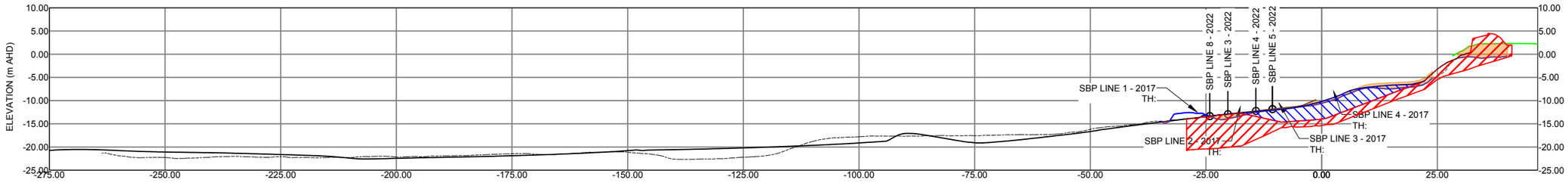

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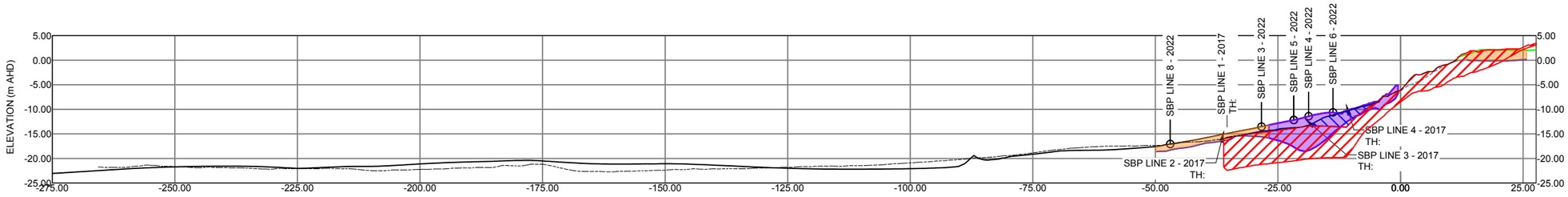

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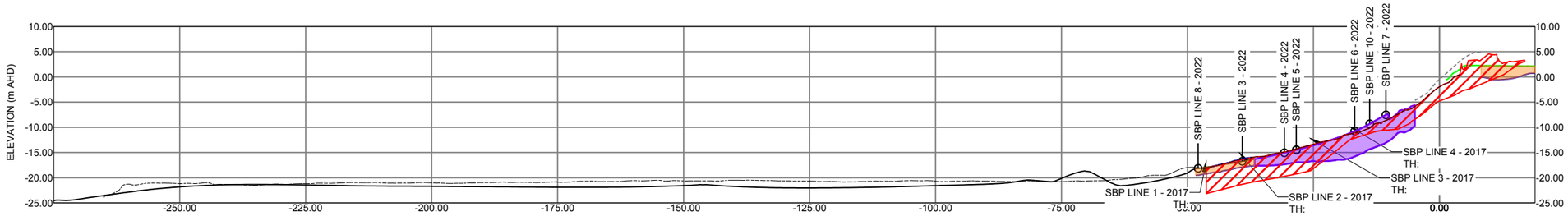

CH 1100

0 25 50

1:1,000 METRES

LEGEND

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- EXISTING GROUND (2022-09-05)
- PREDOMINANTLY BOULDER MATERIAL (2022)
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YYYY-MM-DD	2024-06-06
DESIGNED	-
PREPARED	SD
REVIEWED	RR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
COMPARISON ROCK ARMOUR CROSS SECTIONS SHEET 2 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
PS139771	001	0	B3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm

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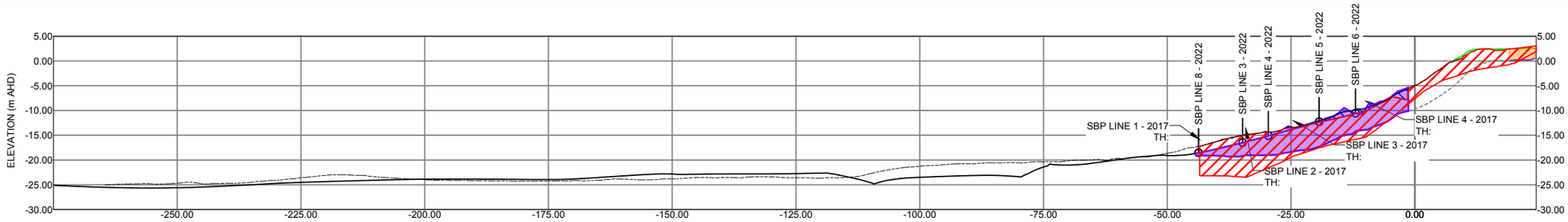
Path: \\corp.pbwan.net\ANZ\Transition\Golder\Brisbane\Geomatics\redland city council\amity point north stradbroke island\99_projects\ps139771-geophysics_comparison\02_PRODUCTION\DWG\ | File Name: PS139771-001-F-001_005.dwg



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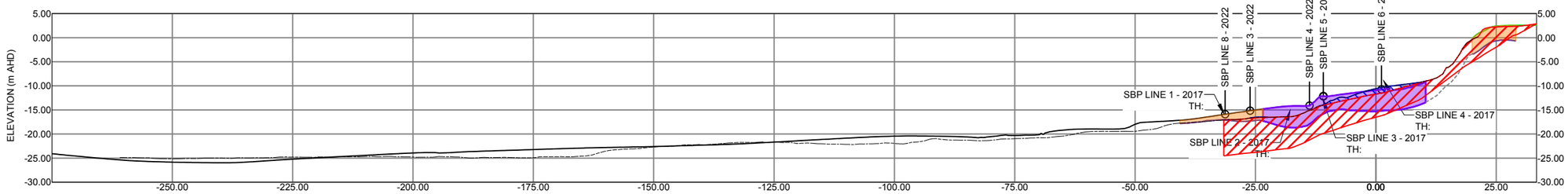
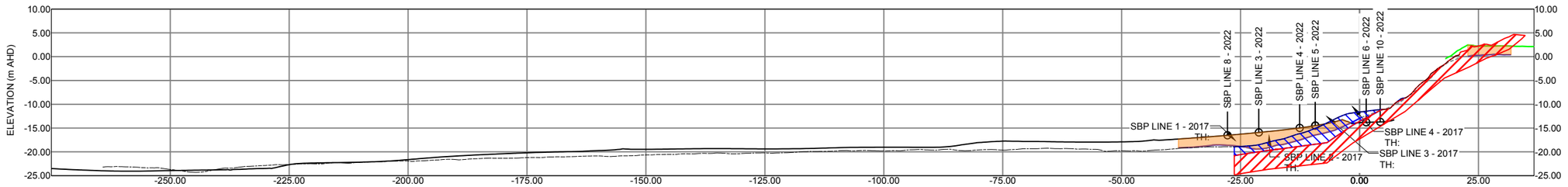


CH 1200



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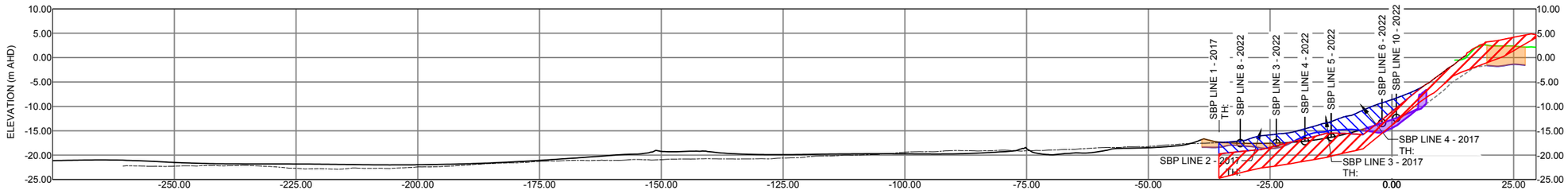
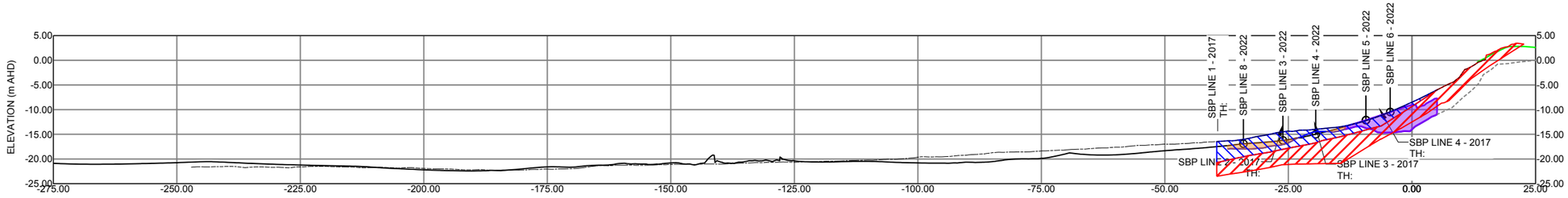


CH 1300



CH 1350

LEGEND

- UPDATED BATHYMETRY (2023-12)
- EXISTING GROUND (2022-09-05)
- PREDOMINANTLY BOULDER MATERIAL (2022)
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0 25 50
1:1,000 METRES

CLIENT
REDLAND CITY COUNCIL

CONSULTANT
GOLDER

YYYY-MM-DD	2024-06-06
DESIGNED	-
PREPARED	SD
REVIEWED	RR
APPROVED	TR

PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
COMPARISON ROCK ARMOUR CROSS SECTIONS SHEET 3 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
PS139771	001	0	B4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3

25 mm

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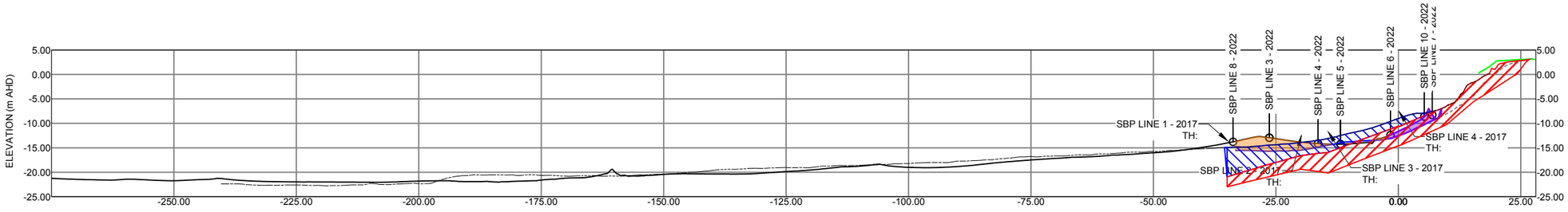
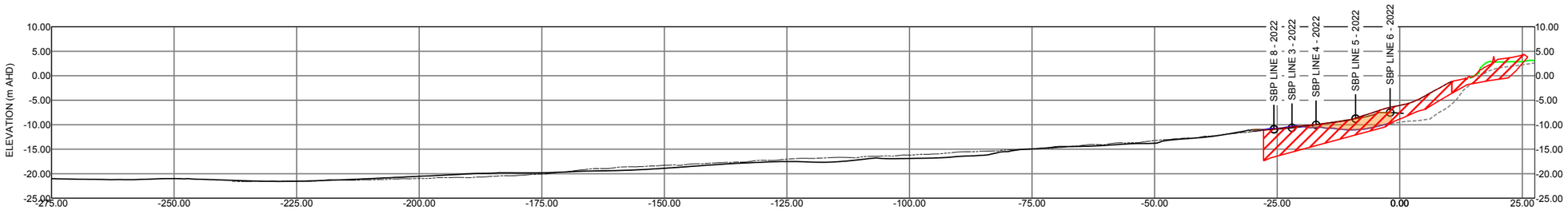


CH 1400



CH 1450

LEGEND

- UPDATED BATHYMETRY (2023-12)
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0 25 50
1:1,000 METRES

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PROJECT
GEOPHYSICAL SURVEY OF FLOW-SLIDE BARRIER
AMITY POINT, NORTH STRADBROKE ISLAND

TITLE
COMPARISON ROCK ARMOUR CROSS SECTIONS SHEET 4 OF 4

PROJECT NO.	CONTROL	REV.	FIGURE
PS139771	001	0	B5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
25 mm
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Path: \\corp.pbwan.net\ANZ\Transition\Golder\Brisbane\Geomatics\redland city council\amity point north stradbroke island\99_projects\ps139771_geophysics_comparison\02_PRODUCTION\DWG\ | File Name: PS139771-001-F-001_005.dwg