

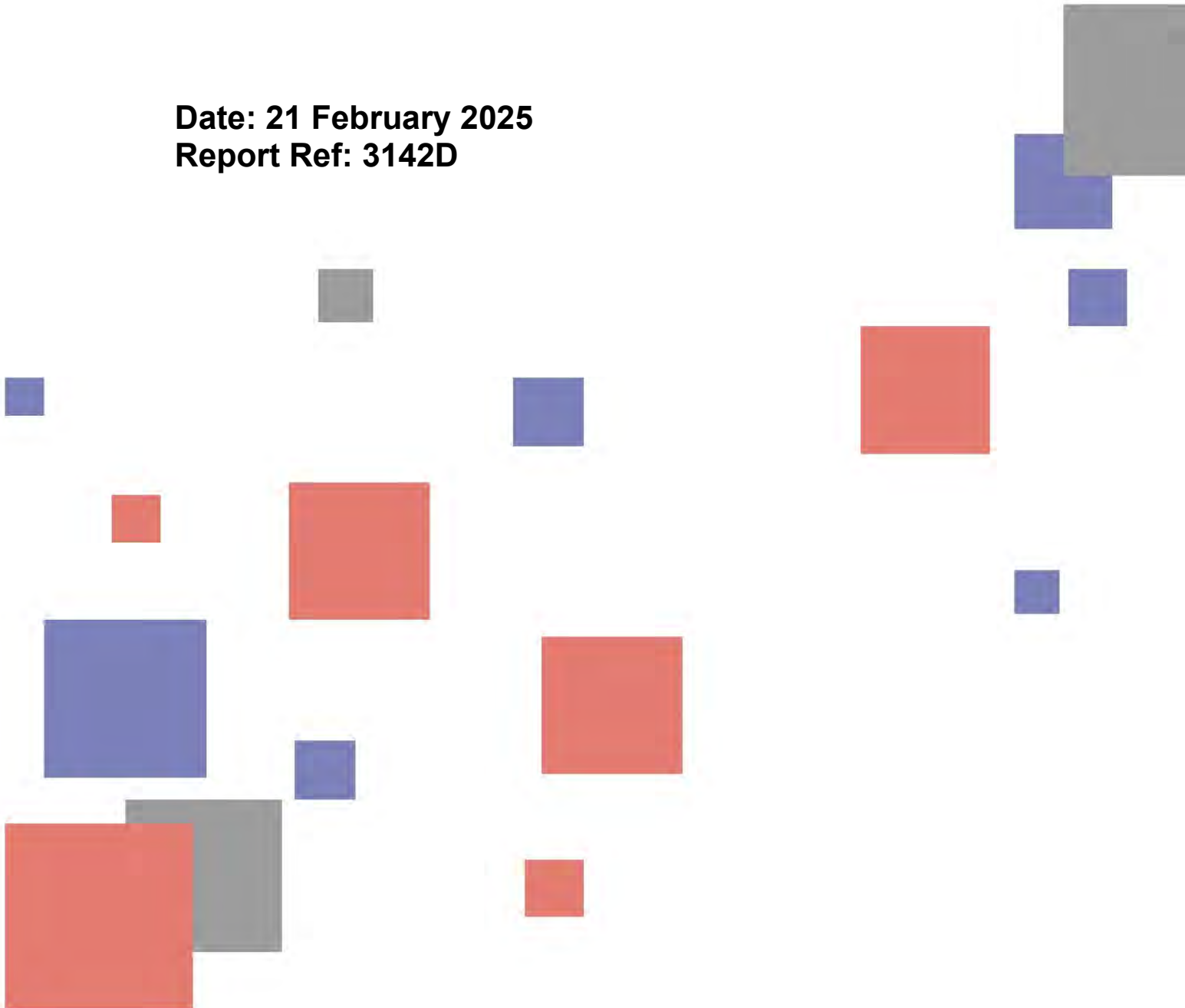
Report

Geotechnical Investigation for Coastal Erosion Vulnerability Assessment

Old Dunsborough, City of Busselton WA

Date: 21 February 2025

Report Ref: 3142D



DOCUMENT HISTORY

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EXECUTIVE SUMMARY

A geotechnical investigation has been carried out as part of a coastal erosion assessment at Old Dunsborough in the City of Busselton, Western Australia. During the investigation ground geophysical and intrusive geotechnical testing was conducted within a 2000m corridor of coastal beach and dune formation along the Old Dunsborough foreshore which has been identified as a potential site for coastal inundation.

The investigation scope consisted of acquiring Multi-channel Analysis of Surface Waves (MASW) data as a series of specified transects either along-shore (parallel to the coast) or cross-shore (perpendicular to the coast) and Cone Penetration Testing (CPT) at spot locations along these transects. This was supplemented with geological mapping of surface rock outcrops and topographic survey using high resolution aerial photogrammetry for the generation of a surface level model and orthomosaic image.

The acquired MASW dataset was processed for the generation of seismic velocity sections along the transects showing variations in the seismic shear wave velocity of the subsurface material to a target depth of 10-15m below ground level (BGL). The seismic velocity sections were calibrated with the CPT plots and demarcated into velocity ranges representing different material types and conditions for the generation of interpreted geological sections consisting of loose to compacted sediment and variably weathered to fresh rock.

The interpreted geological sections have been compiled to develop subsurface models of the level to rock substrate (relative to AHD) and overlying sand thickness within the region between the foreshore and the settlement. This model will be used to assess the potential vulnerability of the site to erosion and future inundation risk, and whether there is a continuous rock barrier located below the ground surface of sufficient strength and height that may prevent the advancement of erosion to the settlement.

The following observations have been made:

- There is a significant difference between observed rock levels within the northern and southern sections of Old Dunsborough. The level to rock substrate in the northern section ranged from -4.5mAHD to 4.0mAHD and was typically lowest within the sandy beaches between the rocky points and highest within the dune formation and settlement. Rock substrate was much lower in the southern section ranging from -20mAHD to -9mAHD for the beach foreshore, dune formation and settlement.
- Sand thickness overlying rock substrate ranged from 0m (as outcropping rock) to 6m for the northern section and was much thicker for the southern section which ranged from 10m to 23m.

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1 INTRODUCTION

At the request of The Government of Western Australia Department of Transport (DoT), GBG Group carried out a geotechnical investigation at Old Dunsborough, City of Busselton in January 2025. During the investigation seismic geophysical testing and intrusive geotechnical testing was conducted within a 2000m corridor of coastal beach and dune formation along the Old Dunsborough foreshore which has been identified as a potential site for coastal inundation.

The objective of the investigation was to provide detailed mapping of the extent, elevation and consistency/strength of the rock underlying the coastal beach and dune formation. In particular, the key outcome of the investigation was to develop a subsurface model of the level to competent rock substrate (relative to AHD) within the region between the foreshore and the settlement. This model will be used to assess the potential vulnerability of the site to erosion and future inundation risk, and whether there is a continuous rock barrier located below the ground surface of sufficient strength and height that may prevent the advancement of erosion to the settlement.

To achieve the project objectives, data from the following investigation methods was acquired, processed and analysed to obtain the required subsurface information within the anticipated geological conditions:

1. **Geological mapping** of surface rock outcrops within the study area using high resolution photogrammetry.
2. **Geophysical testing** by way of Multi-channel Analysis of Surface Waves (MASW) to obtain seismic shear wave velocity models related to variations in subsurface material stiffness.
3. **Intrusive geotechnical testing** by way of Cone Penetration Testing (CPT) to measure sediment stiffness and compressibility, depth to top of rock, and for calibration and ground truthing of the geophysical dataset.
4. **Topographic survey** using Differential GNSS receiver and photogrammetry.

2 INVESTIGATION SITE

The investigation was carried out within approximate 2000m corridor of coastal beach and dune formation the extents of which are shown as yellow dashed area in Figure 1. The total area was split into northern and southern sections, separated by an area of cultural significance and as such was not included in the investigation.

Data was acquired as a series of transects for the seismic geophysical testing. These were positioned to best utilise existing roads, tracks, and beach whilst not impacting on native vegetation and to ensure the most optimal, efficient and economic acquisition methodology. Data was not acquired where surface obstructions were present such as thick vegetation, steep topography or where the beach was inundated with seawater. Photographs showing the typical site conditions are provided in Figure 2.

Topography at the site varied with the northern portion generally having a surface elevation of >5mAHD where the settlement was located, whilst surface elevation for the southern portion of the settlement was typically lower at approximately 2mAHD. Topographic maps showing surface level are provided in Appendix C drawings 3142D-013 and -14.



Figure 1: The extent of the geophysical investigation (yellow polygons) at Old Dunsborough. Aerial imagery from drone photogrammetry (main image) and Google Maps (inset image).



Figure 2: Typical site conditions at Old Dunsborough.

3 INVESTIGATION METHODOLOGY

3.1 FIELD SURVEY LOGISTICS

Geophysical data acquisition was carried out from the 20 to 24 January 2025 by a two-person team from GBG Group consisting of qualified geophysicists. CPT data acquisition was carried out by a technician from Probedrill on 21 and 22 January 2025. Where required, the site work was carried out under appropriate traffic and pedestrian management commissioned by the City of Busselton.

Prior to the commencement of data acquisition, a site assessment was carried out with representatives from the Traffic Management company. Potential concerns and issues including the placement of and access to the MASW transects and CPT points were addressed and the initial indicative survey plan was adjusted, where necessary.

The site work for the investigation consisted of a total of 3744m of MASW profiling acquired as 10 along-shore transects (parallel to the coast) and 7 cross-shore transects (perpendicular to the coast), and a total of 7 CPT points along the transects. Details of the acquired MASW transects and CPT points are provided in Tables 1 and 2 respectively. The extents of the MASW transects and locations of the CPT points overlaid onto aerial imagery are shown in Appendix A drawings 3142D-01 and -02.

Table 1 – Acquired MASW Transects (Coordinates in GDA2020, MGA Zone 50).

Transect ID	Area	Orientation	Start Coordinate		End Coordinate		Length (m)
			East	North	East	North	
MASW-01	North	Along-shore	324093.90	6280917.74	324169.72	6280047.49	1024
MASW-02	North	Along-shore	324102.39	6280930.90	324178.06	6280655.29	320
MASW-03	North	Along-shore	324239.89	6280487.37	324186.76	6280421.25	56
MASW-04	North	Along-shore	324174.21	6280359.78	324187.97	6280306.69	56
MASW-05	North	Along-shore	324200.52	6280272.76	324245.35	6280218.09	72
MASW-06	North	Along-shore	324226.93	6280089.16	324198.67	6280061.89	40
MASW-07	North	Cross-shore	324052.65	6280777.95	324071.51	6280786.78	24
MASW-08	North	Cross-shore	324179.52	6280534.53	324242.36	6280531.17	64
MASW-09	North	Cross-shore	324136.01	6280312.85	324181.30	6280316.24	48
MASW-10	North	Cross-shore	324215.45	6280093.62	324219.51	6280078.49	16
MASW-11	South	Along-shore	324144.77	6279883.92	324747.37	6279068.63	1056
MASW-12	South	Along-shore	324176.35	6279862.72	324251.70	6279778.12	112
MASW-13	South	Along-shore	324347.97	6279690.19	324520.87	6279443.25	320
MASW-14	South	Along-shore	324522.78	6279418.06	324781.10	6279093.27	416
MASW-15	South	Cross-shore	324169.51	6279841.95	324207.33	6279844.44	40
MASW-16	South	Cross-shore	324550.03	6279311.00	324585.10	6279328.12	40
MASW-17	South	Cross-shore	324611.26	6279236.33	324640.53	6279260.87	40

Table 2 – Acquired CPT Points (Coordinates in GDA2020, MGA Zone 50).

CPT ID	Coordinate	
	East	North
CPT 01	324635.59	6279255.71
CPT 02	324573.85	6279318.76
CPT 03	324192.69	6279845.93
CPT 04	324219.77	6280072.27
CPT 06	324211.91	6280532.14
CPT 07	324058.09	6280773.13
CPT 07A	324121.24	6280696.45

3.2 MULTI-CHANNEL ANALYSIS OF SURFACE WAVES

MASW is a seismic geophysical method that utilises phase and frequency information to calculate Shear wave (S-wave) velocities in vertical layer models averaged over an array of linearly spaced geophones. These 1D models can be laterally stacked to provide 2D cross-sections of S-wave velocity in layers. Under most circumstances it is an indicator of material stiffness and as such the method can be used to provide quantitative results on the compaction of the subsurface material.

MASW data was acquired using a Geode (Geometrics) seismograph connected to a receiver array of 24 geophones set at 1m intervals for a total array length of 23m. The receiver array was mobilised on a land streamer whereby the geophones are mounted on base plates attached to webbing, and either towed behind a 4WD vehicle or manually pulled by the field team. Seismic energy was generated using summed impacts from a PEG-40 (R.T. Clark) vehicle mounted accelerated weight drop (AWD) or softened steel sledgehammer with source points made at a constant offset from the receiver array. MASW acquisition parameters are provided in Table 3.

Table 3 – MASW Acquisition Parameters

Parameter	Value
Number of geophones	24
Geophone spacing	1 m
Array length	23 m
Geophone frequency	4.5 Hz
Record length	1 s
Sample interval	0.125 ms
Source	40kg AWD / 5.9kg Sledgehammer
Source offset	4 m
Sounding interval	8m
Source stacks	3

The MASW data was observed to be of high quality with the seismic records having high signal to noise ratio. The generated overtone images plotting phase velocity against frequency mostly showed a prominent dispersion curve of the surface wave component. The MASW data was processed using SurfSeis version 6++ (Kansas Geological Survey, 2017) with the following processing routine:

1. Import acquired seismic data files and apply geometry including geophone spacing, source offset and sounding interval.
2. Generate overtone images giving the percentage intensity of phase velocity versus frequency for each seismic record (Figure 4).
3. Pick the maximum intensity across the useful range of frequencies for each overtone image resulting in a dispersion curve.
4. Run the dispersion curves through a 10-layer inversion algorithm to produce 1D soundings plotting seismic S-wave velocity with depth.

The S-wave velocity soundings were compiled with reference to distance along the transects and gridded with Surfer version 25 (Golden Software, 2023). The resulting contoured cross-sections show the variation in the modelled S-wave velocity of the subsurface material in metres per second laterally along each of the transects and with elevation.

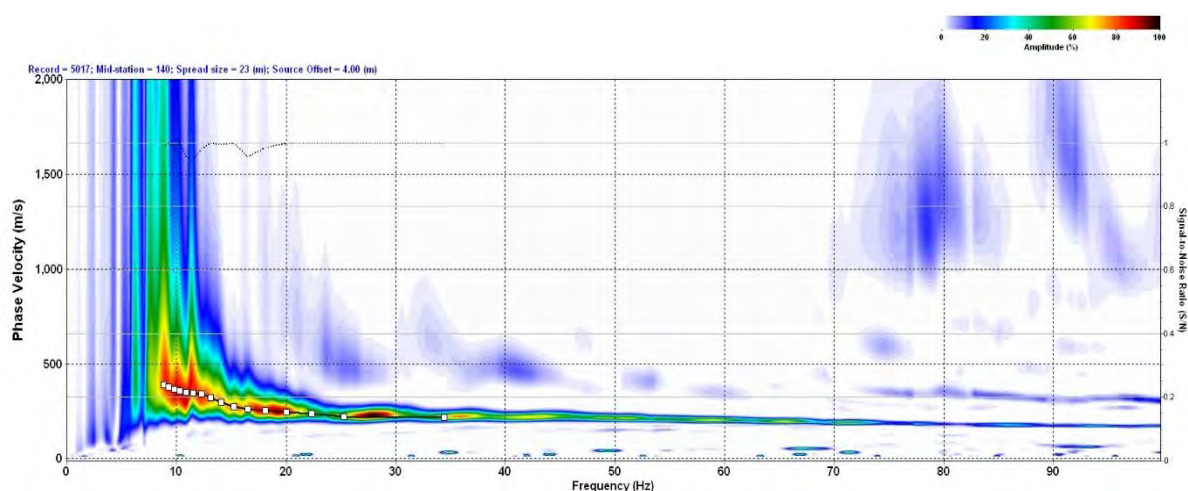


Figure 4: MASW overtone image with high signal to noise ratio and picked dispersion curve.

3.3 CONE PENETRATION TESTING

CPT is a geotechnical test method for evaluating the properties of soils and assessing subsurface stratigraphy including the sediment/rock interface at spot locations. The method involves pushing a calibrated cone and rod into the ground with a measured force with the resulting friction resistance plotted against depth to provide sediment compaction rates as well as the refusal depth indicating the depth to competent rock.

Testing was carried out using a M2 (Morooka) 11 tonne track mounted CPT Rig, specifications of which are provided in Appendix D. The test points were initially marked out at suitable locations near to the intersecting geophysical transects. Dial Before You Dig enquiries and if necessary, utility locating was carried out prior to testing commencing where required.

CPT readings were made with sufficient ground bearing pressure to obtain a target depth of 10m or prior refusal. Where shallow refusal depths of less than 2m were encountered, when deemed necessary, an additional offset test was made to ascertain whether shallow refusal was due to a rock floater or other shallow obstruction.

3.4 SPATIAL POSITIONING AND PHOTOGRAMMETRY

Spatial positioning of the acquired geophysical transects was achieved using Reach RS2+ (Emlid) GNSS receivers with a coordinate recorded for each MASW sounding location. Coordinates of the geophysical transects have been provided in GDA2020, MGA zone 50 for horizontal component and Australian Height Datum (mAHD) for vertical component. An accuracy of $\pm 0.2\text{m}$ is expected for both vertical and horizontal components.

To achieve precise reduced levels referenced to AHD, the positioning data was acquired with Real-Time Kinematics (RTK) using a Geoscience Australia AUSCORS station in Busselton for the base corrections. Details of the AUSCORS station used for this investigation are provided in Table 4.

Table 4 – Details of AUSCORS station

Parameter	Value
Mount Point	BUSS00AUS0
Latitude	S 33° 40' 27.66"
Longitude	E 115° 18' 31.788"
Ellipsoidal height (m)	-26

A reduced level of 0.0mAHD is considered to be the Mean Sea Level (MSL) for the purpose of this investigation. This relationship for Mean Sea Level was established by the Geoscience Australia Survey in 1971*.

[*http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/datums-projections/australian-height-datum-ahd](http://www.ga.gov.au/scientific-topics/positioning-navigation/geodesy/datums-projections/australian-height-datum-ahd)

Aerial photogrammetry was carried out to obtain an up-to-date high-resolution aerial image and a surface level model of the survey area. Data was acquired with a Mavic 3E (DJI) multi-rotor drone with RTK capability for the capture of multiple overlapping images.

The acquired photogrammetry images were processed using Metashape Professional (Agisoft) for the generation of a point cloud, surface level model and orthomosaic image of the survey area. Note for this investigation, vegetation has not been removed during the processing stage and as such the height of existing vegetation needs to be considered when assessing surface levels.

4 RESULTS AND INTERPRETATION

4.1 PRESENTATION OF RESULTS

The results of the geotechnical investigation at Old Dunsborough, City of Busselton are presented in Appendices B and C of this report as follows:

Appendix B – Geophysical and Interpreted Sections

- **3142D-03.** Transect 01 (0-500m) seismic S-wave velocity model and interpreted geological section.
- **3142D-04.** Transect 01 (500-1024m) seismic S-wave velocity model and interpreted geological section.
- **3142D-05.** Transect 02 seismic S-wave velocity model and interpreted geological section.
- **3142D-06.** Transect 03, 04, 05 and 06 seismic S-wave velocity model and interpreted geological section.
- **3142D-07.** Transect 07, 08, 09 and 10 seismic S-wave velocity model and interpreted geological section.

- **3142D-08.** Transect 11 (0-500m) seismic S-wave velocity model and interpreted geological section.
- **3142D-09.** Transect 11 (500-1056m) seismic S-wave velocity model and interpreted geological section.
- **3142D-10.** Transect 12 and 13 seismic S-wave velocity model and interpreted geological section.
- **3142D-11.** Transect 14 seismic S-wave velocity model and interpreted geological section.
- **3142D-12.** Transect 15, 16 and 17 seismic S-wave velocity model and interpreted geological section.

Appendix C – Modelled Level to Surface, Top of Rock and Sand Thickness

- **3142D-13.** Contoured surface level models derived from aerial photogrammetry – Northern section.
- **3142D-14.** Contoured surface level models derived from aerial photogrammetry – Southern section.
- **3142D-15.** Contoured level to modelled top of rock – Northern section.
- **3142D-16.** Contoured level to modelled top of rock – Southern section.
- **3142D-17.** Class post map level to modelled top of rock – Northern section.
- **3142D-18.** Class post map level to modelled top of rock – Southern section
- **3142D-19.** Contoured modelled sand thickness over rock / depth to top of rock – Northern section.
- **3142D-20.** Contoured modelled sand thickness over rock / depth to top of rock – Southern section
- **3142D-21.** Class post map modelled sand thickness over rock / depth to top of rock – Northern section.
- **3142D-22.** Class post map modelled sand thickness over rock / depth to top of rock – Southern section

4.2 SEISMIC SHEAR WAVE VELOCITY SECTIONS

The seismic S-wave velocity (V_s) sections modelled from the MASW data acquired along the along-shore and cross-shore transects are presented at the top of each drawing in Appendix B. These sections show variations in the modelled V_s as per the colour scale with velocity ranging from 150m/s to 1000m/s representing a wide range of material types and conditions.

Seismic S-wave velocity is governed by the elastic properties of the medium that the wave propagates through as shown in the equation below. In particular, it is primarily a function of soil density, void ratio and effective stress. As such calculated values can provide a useful guide to the subsurface material condition with increasing velocity an indication of increasing material stiffness.

Seismic S-wave velocity

$$V_s = \sqrt{\frac{G}{\rho}}$$

where; G = Shear modulus,
 ρ = In-situ material density

4.3 INTERPRETED GEOLOGICAL SECTIONS

Below the seismic S-wave velocity sections are the interpreted geological sections based on detectable seismic velocity contrasts. Four classes have been defined representing different subsurface material conditions as follows:

1. **Very low seismic S-wave velocity** ($V_s < 250\text{m/s}$). Representing the lowest seismic velocities modelled during the investigation, this class is interpreted as sediment of low compaction from either the beach or dune formation.
2. **Low seismic S-wave velocity** ($V_s 250\text{-}350\text{m/s}$). This class is interpreted as sediment of moderate compaction due to increased depth of cover on the beach and dune formation, or due to development adjacent to the settlement.
3. **Moderate seismic S-wave velocity** ($V_s 350\text{-}475\text{m/s}$). This class is interpreted as low strength variably weathered rock. Where continuous and at base of the sections it likely represents a transitional zone to stronger, more competent underlying rock. Where present as isolated anomalies within the interpreted sediment, it is likely to represent partially lithified sediment or rock lenses.
4. **Moderate to high seismic wave velocity** ($V_s > 475\text{m/s}$). This class is interpreted as moderate strength slightly weathered to fresh rock. It is typically observed at the base of the sections as competent rock underlying the variably weathered rock.

4.4 CALIBRATION WITH GEOTECHNICAL TESTING AND ROCK MAPPING

The results of the CPTs are presented in Appendix D showing the plots of cone tip resistance in megapascals against depth in metres. The CPT plots are also shown in Appendix B and overlayed onto the interpreted geological sections with the following observations being made:

- **CPT-01 on Transects 14 and 17** – no refusal to a depth of 10.2m Below Ground Level (BGL) corresponding with deep or no rock observed.
- **CPT-02 on Transects 14 and 16** – no refusal to a depth of 10.2m Below Ground Level (BGL) corresponding with deep or no rock observed.
- **CPT-03 on Transects 12 and 15** – no refusal to a depth of 10.2m Below Ground Level (BGL) corresponding with deep or no rock observed.

- **CPT-04 on Transect 06** – refusal due to rod inclination at a depth of 0.58m Below Ground Level (BGL) which corresponds to slightly deeper interpreted bedrock.
- **CPT-06 on Transect 08** – refusal of 102MPa was at a depth of 3.16m Below Ground Level (BGL) which corresponds to interpreted bedrock.
- **CPT-07 on Transects 01 and 07** – refusal of 97MPa was at a depth of 1.92m Below Ground Level (BGL) which corresponds to interpreted bedrock.
- **CPT-07a on Transects 01 and 02** – refusal due to rod inclination at a depth of 1.90m Below Ground Level (BGL) which corresponds to slightly deeper interpreted bedrock.

The differences in the modelled level to compacted sediment and low strength rock as interpreted from the MASW transects and from the CPT data can be attributed to the fact that the geophysical methods used are broad scale whilst the CPT is a point method. Geophysical methods sample a volume of subsurface material with the calculated depths at any particular point representing an average value over this volume. The CPT method samples the subsurface directly below the probe and is influenced by local variations in the subsurface such as rock floaters, highly weathered zones or lenses of partially lithified sediment. The differences in the type of subsurface sampling of the methods will not adversely affect the results as the CPT results have been used to constrain the geophysics interpretation and as such the results represent the best modelled fit between the datasets.

Surface outcropping rock was observed within the northern section of Old Dunsborough particularly at the rocky points between the sandy beaches. Areas of outcropping rock can be identified on the orthomosaic image from the aerial photogrammetry. No surface outcropping was observed within the southern section of Old Dunsborough.

4.5 MODELLED LEVEL TO TOP OF ROCK AND SAND THICKNESS

Subsurface models for the level to top of rock substrate and overlying sand thickness within the region between the coastal foreshore and settlement are presented in Appendix C. These have been generated by digitising the interface between the interpreted sediment and underling rock profile from the interpreted geological sections along the acquired along-shore and cross-shore transects. The modelled sand thickness was then generated by subtracting this from the surface level model obtained from the photogrammetry. Interpreted rock depths and levels should be analysed in conjunction with interpreted seismic sections in Appendix B. The following subsurface models have been provided:

- **Contoured Surface Level Model** (drawings 3142D-13 and -14) – generated from the aerial photogrammetry, this presents the level to ground surface ranging from 0mAHD to 15mAHD for both northern and southern areas. Note: vegetation height has not been removed from these models.
- **Contoured Level to Top of Rock Substrate** (drawings 3142D-15 and -16) – this presents the level to the top of rock substrate ranging from -7mAHD to 5mAHD for the northern area and -21mAHD to -9mAHD for the southern area.

- **Classed Post Map Level to Top of Rock Substrate** (drawings 3142D-17 and -18) – this presents the level to the top of rock substrate along the acquired transects at 2m level increments from < -6mAHD to > 6mAHD for the northern area and at 4m level increments from < -18mAHD to > -6mAHD for the southern area.
- **Contoured Sand Thickness / Depth to Top of Rock** (drawings 3142D-19 and -20) – this presents the thickness of sand overlying the rock substrate ranging from 0mBGL to 5.5mBGL for the northern area and 9mAHD to 25mAHD for the southern area.
- **Classed Post Map Sand Thickness / Depth to Top of Rock** (drawings 3142D-21 and -22) – this presents the thickness of sand overlying the rock substrate along the acquired transects at 1m depth increments from < 1mBGL to > 6mBGL for the northern area and at 2m depth increments from < 10mBGL to > 20mBGL for the southern area.

The following limitations should be considered when assessing the subsurface models for the level to top of rock substrate and overlying sand thickness:

The expected accuracy of the top of rock substrate modelled from this investigation is +/-0.5mAHD. Similarly, an accuracy of +/-0.5m is expected for the modelled sand thickness over rock. The quoted accuracies have been based on consideration of the accuracy of the GNSS receivers used during the site work, 1D inversion of the MASW dataset using a 10-layer model and expected undulations in the sand/rock interface. Note the quoted accuracies are only valid along the geophysical transects. Values given between transects have been interpolated in the contour maps and as such the accuracy in this case is indeterminable.

The generated contours will give the general trend of the top of rock profile however will not image local variations when the extent of these is less than transect spacing. Spatially small features such as karst sinkholes or pinnacle features may not be imaged. The significance of this limitation is considered minor for this investigation since although local geological features such as pinnacles may not be represented in the data, the generated surface of the top of rock will show the broad trends in the geology over the site which is suitable for a coastal erosion assessment.

Transition zones including between fresh and weathered rock and between sediment and lithified/partially lithified sediment may be gradational and as such the interface between these layers are not well defined.

The calculated levels to the top of rock will only be valid along the geophysical transects. Values shown on the contour maps not on the transects have been interpolated using the krigging algorithm and as such the accuracy of these levels is indeterminable. The contour surface will give the general trend of the interface however may not image local variations, it is recommended that the interpreted geological sections presented in Appendix B be used to obtain more accurate top of rock levels and overlying sand thickness.

5 PROJECT SUMMARY

A geotechnical investigation has been carried out as part of a coastal erosion assessment at Old Dunsborough in the City of Busselton, Western Australia. During the investigation ground geophysical and intrusive geotechnical testing was conducted within a 2000m corridor of coastal beach and dune formation along the Old Dunsborough foreshore which has been identified as a potential site for coastal inundation.

The investigation scope consisted of acquiring multi-channel analysis of surface waves data as a series of specified transects either along-shore (parallel to the coast) or cross-shore (perpendicular to the coast) and cone penetration testing at spot locations along these transects. This was supplemented with geological mapping of surface rock outcrops and topographic survey using high resolution photogrammetry for the generation of a surface level model and orthomosaic image.

The acquired MASW dataset was processed for the generation of seismic velocity sections along the transects showing variations in the seismic shear wave velocity of the subsurface material to a target depth of 10-15m below ground level. The seismic velocity sections were calibrated with the CPT plots and demarcated into velocity ranges representing different material types and conditions for the generation of interpreted geological sections consisting of loose to compacted sediment and variably weathered to fresh rock.

The interpreted geological sections have been compiled to develop subsurface models of the level to rock substrate (relative to AHD) and overlying sand thickness/ depth to top of rock within the region between the foreshore and the settlement. This model will be used to assess the potential vulnerability of the site to erosion and future inundation risk, and whether there is a continuous rock barrier located below the ground surface of sufficient strength and height that may prevent the advancement of erosion to the settlement.

The methods used during the investigation are geophysical and as such the results are based on indirect measurements and the processing and interpretation of seismic wave signals calibrated with intrusive geotechnical testing. The findings in this report represent the professional opinions of the authors, based on experience gained during previous similar investigations.

We trust that this report and the attached drawings provide you with the information required. If you require clarification on any points arising from this investigation, please do not hesitate to contact the undersigned on 08 9354 6300.

For and on behalf of

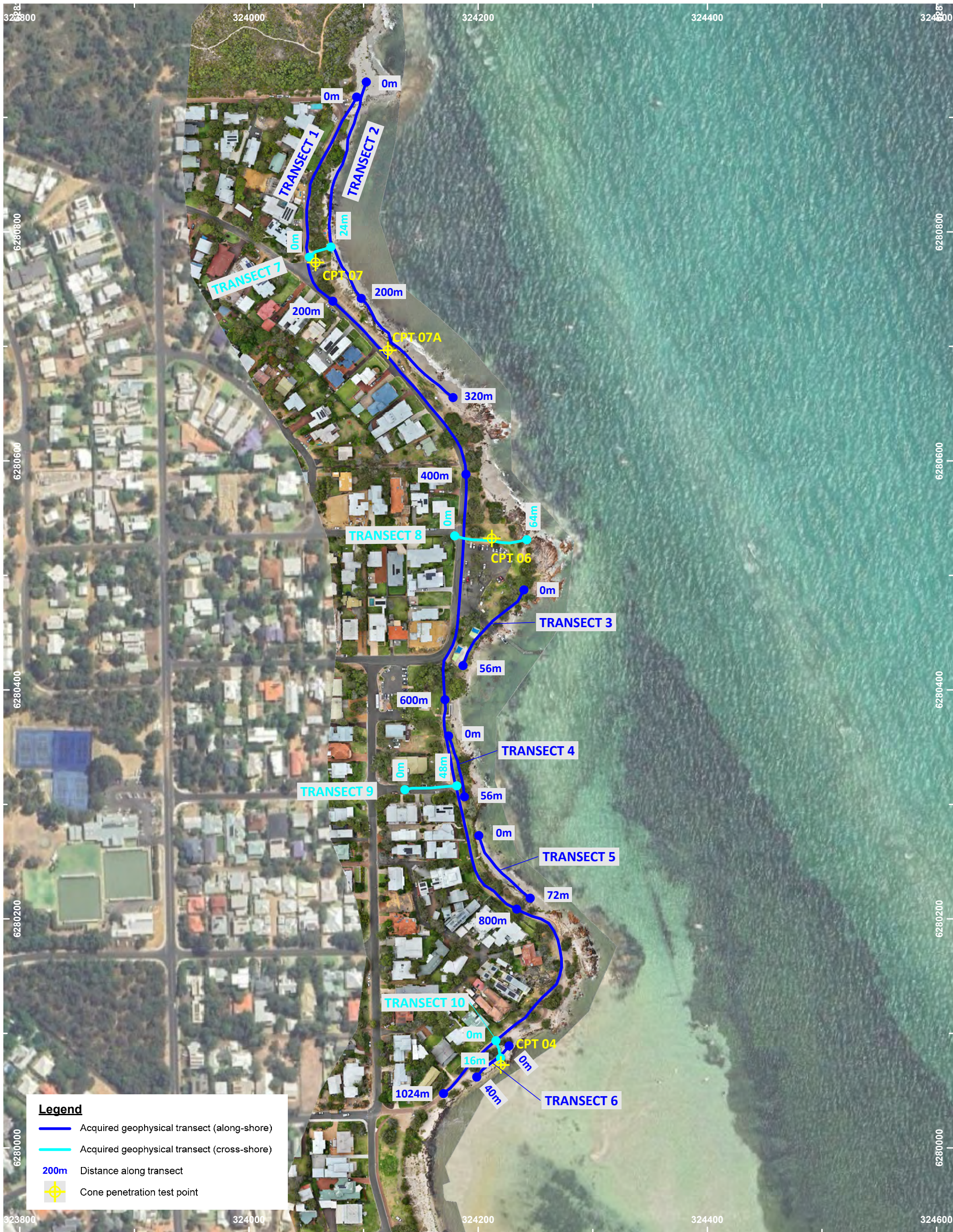
GBG GEOTECHNICS (AUSTRALIA)



BAQIR AL ASADI
Senior Geophysicist

APPENDIX A – INVESTIGATION SITE MAP

INVESTIGATION SITE MAP (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



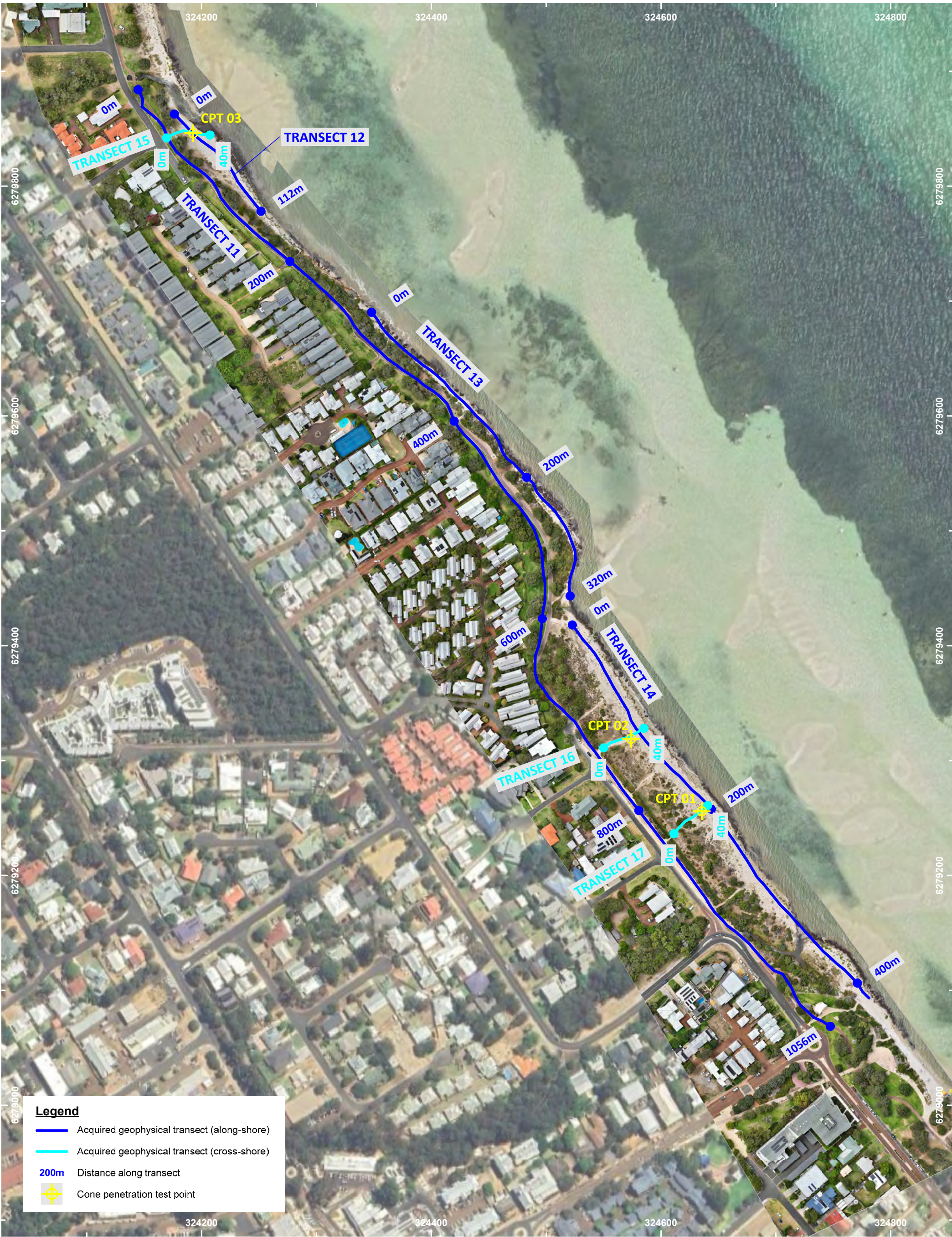
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Scale	1:3000
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Paper Size	A3
Drawn	AHWS
Revision	0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA

**GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA**

INVESTIGATION SITE MAP (SOUTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.

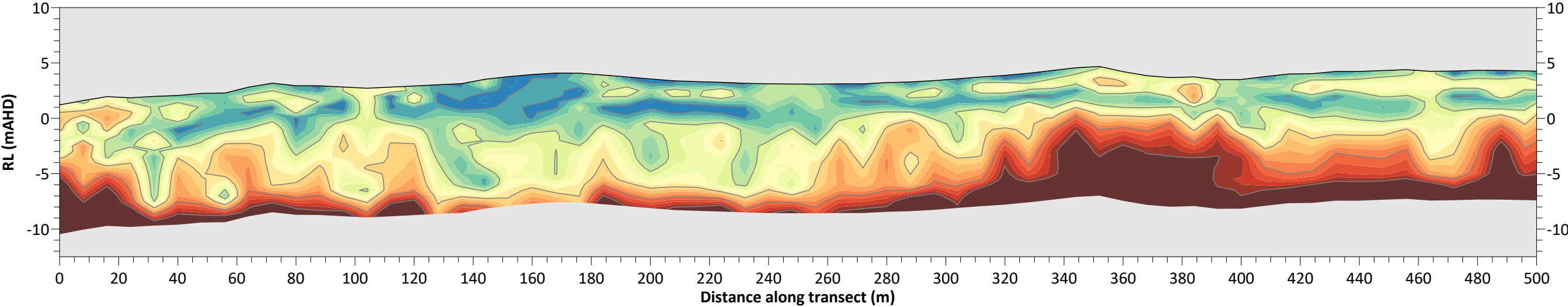


Date	23 January 2025	Paper Size	A3	DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT. OLD DUNSBOROUGH, CITY OF BUSSELTON WA
Scale	1:3000	Drawn	AHWS	
Drawing	3142D-02	Revision	0	

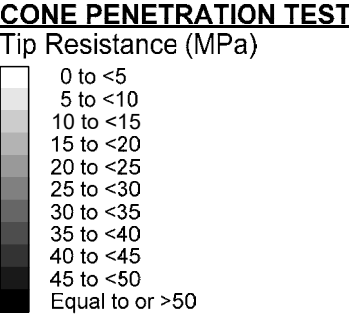
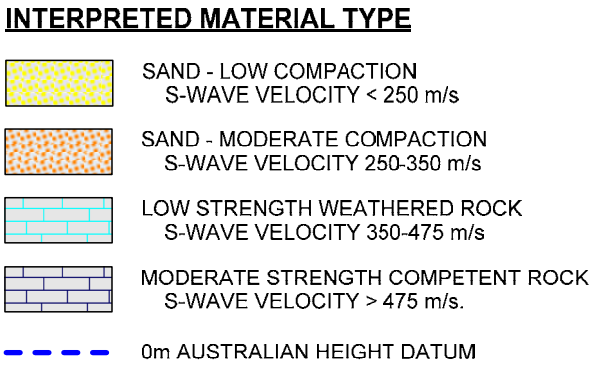
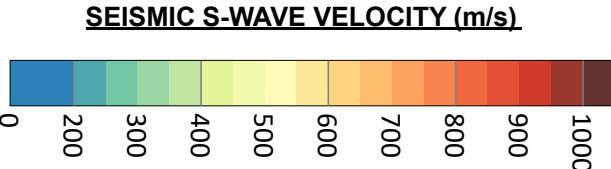
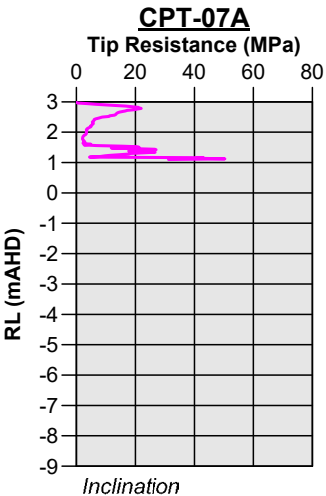
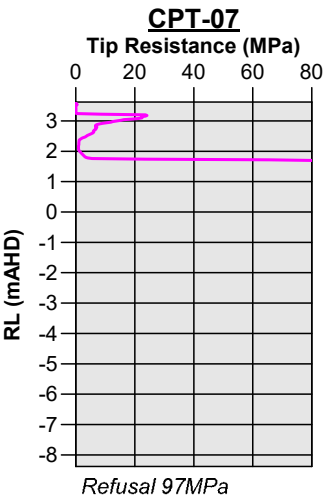
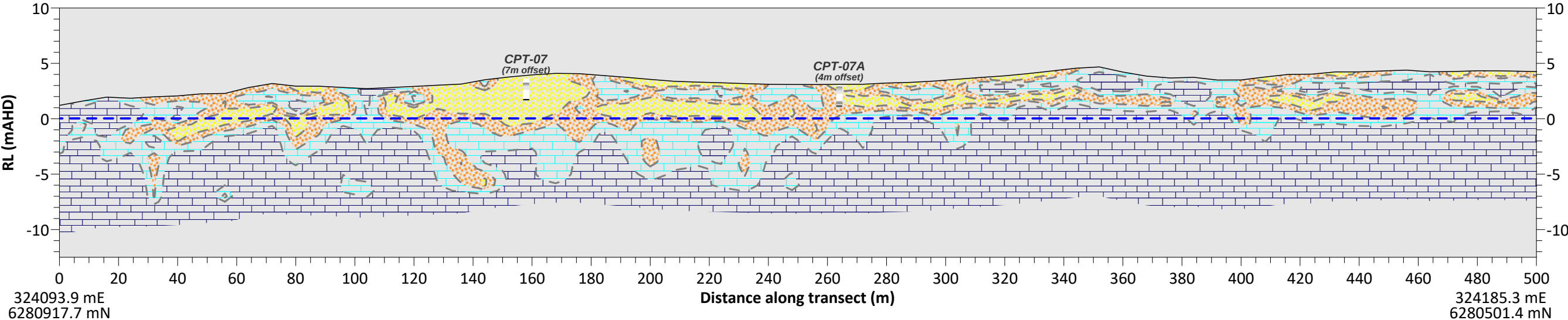
APPENDIX B – GEOPHYSICAL AND INTERPRETED SECTIONS

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

Transect 01 (0-500m) - SEISMIC SHEAR WAVE VELOCITY MODEL



Transect 01 (0-500m) - INTERPRETED GEOLOGICAL SECTION

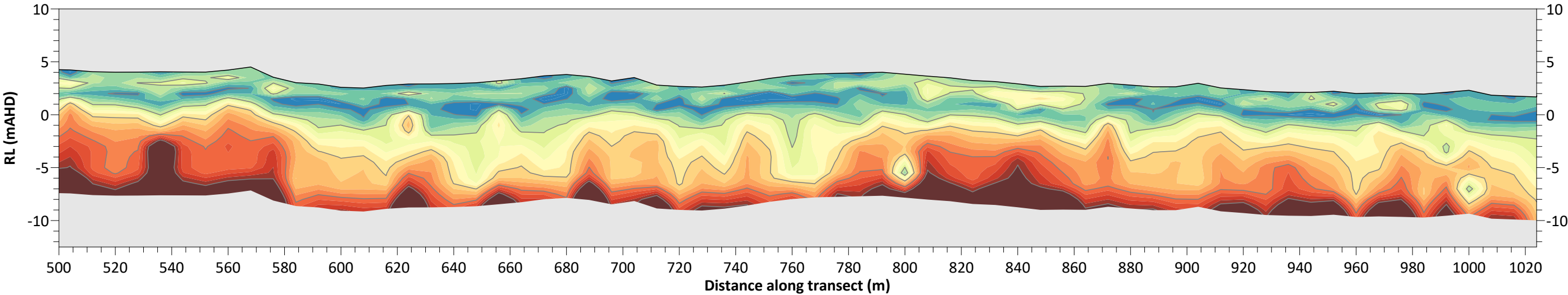


NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

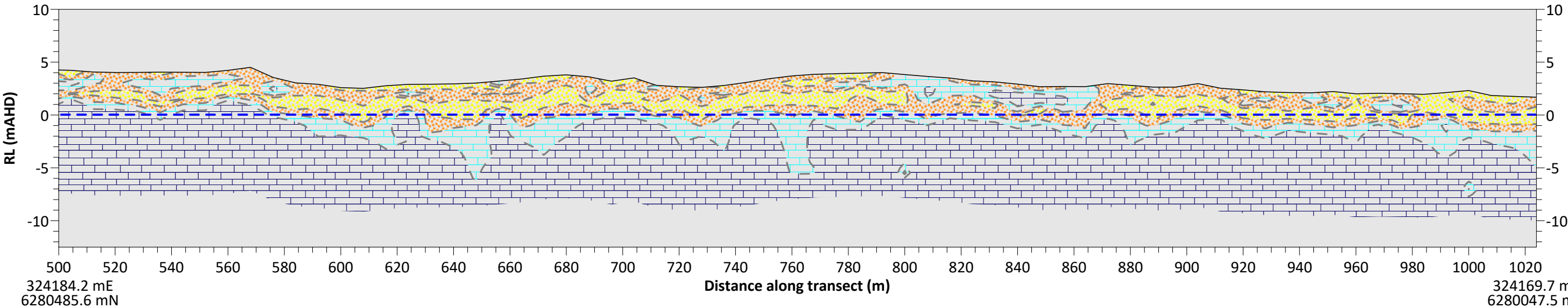
CLIENT	DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA	Date	24 January 2025	Paper Size	A3
	GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT. DUNSBOROUGH, CITY OF BUSSELTON WA	Scale	1:1500H, 1:400V	Drawn	SA
		Drawing	3142D-03	Revision	0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

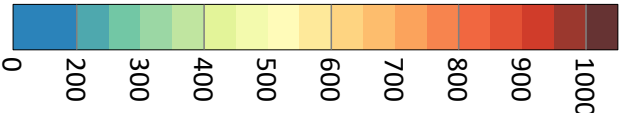
Transect 01 (500-1024m) - SEISMIC SHEAR WAVE VELOCITY MODEL



Transect 01 (500-1024m) - INTERPRETED GEOLOGICAL SECTION



SEISMIC S-WAVE VELOCITY (m/s)



INTERPRETED MATERIAL TYPE

- SAND - LOW COMPACTION
S-WAVE VELOCITY < 250 m/s
- SAND - MODERATE COMPACTION
S-WAVE VELOCITY 250-350 m/s
- LOW STRENGTH WEATHERED ROCK
S-WAVE VELOCITY 350-475 m/s
- MODERATE STRENGTH COMPETENT ROCK
S-WAVE VELOCITY > 475 m/s.
- 0m AUSTRALIAN HEIGHT DATUM

CONE PENETRATION TEST

- Tip Resistance (MPa)
- 0 to <5
 - 5 to <10
 - 10 to <15
 - 15 to <20
 - 20 to <25
 - 25 to <30
 - 30 to <35
 - 35 to <40
 - 40 to <45
 - 45 to <50
 - Equal to or >50

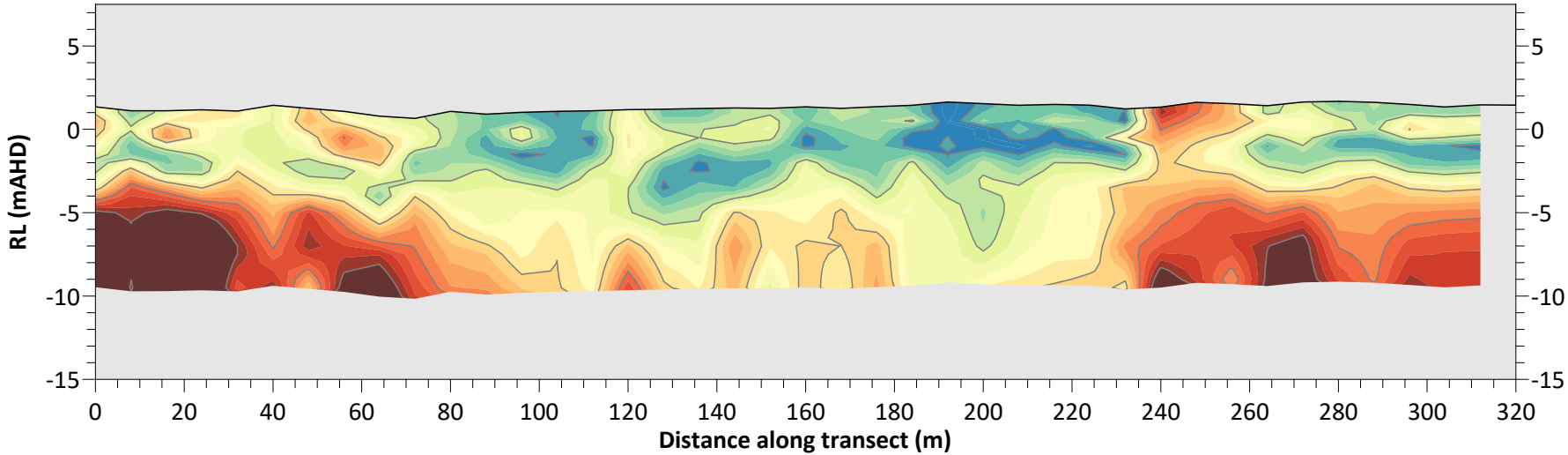
NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
DUNSBOROUGH, CITY OF BUSSELTON WA**

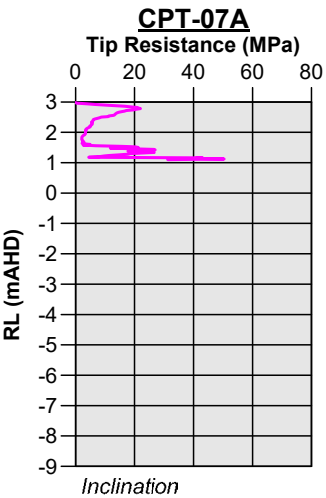
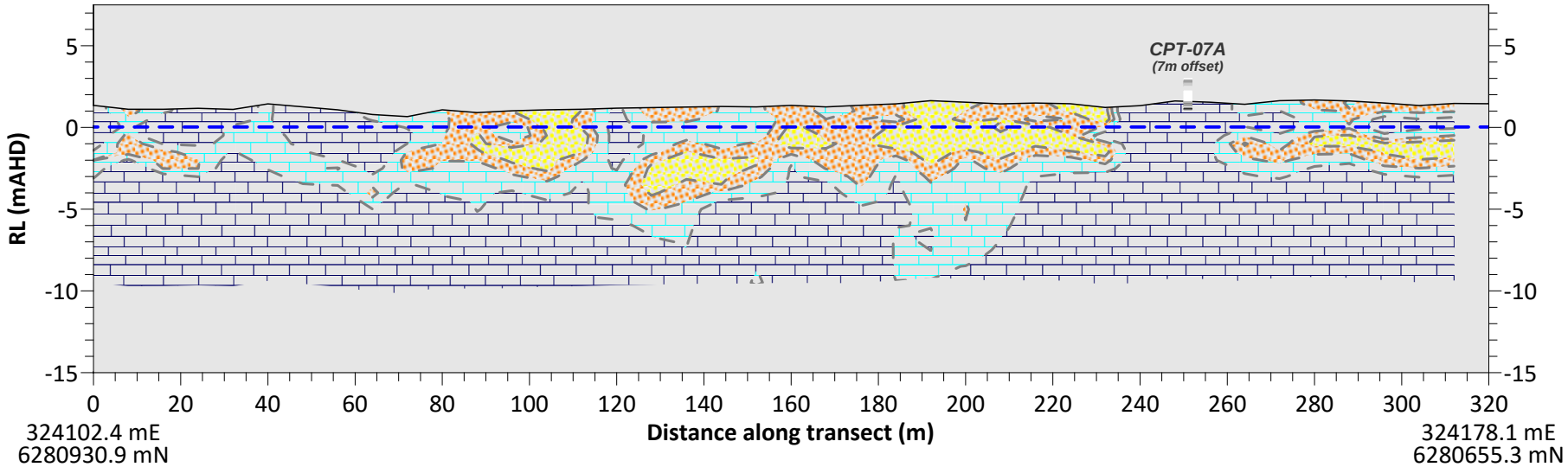
Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-04
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

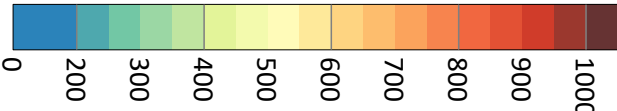
Transect 02 - SEISMIC SHEAR WAVE VELOCITY MODEL



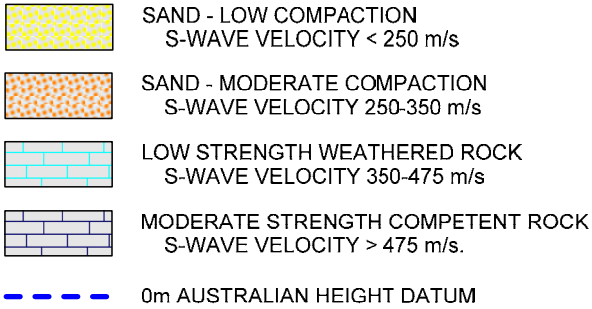
Transect 02 - INTERPRETED GEOLOGICAL SECTION



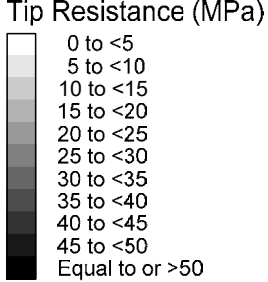
SEISMIC S-WAVE VELOCITY (m/s)



INTERPRETED MATERIAL TYPE



CONE PENETRATION TEST



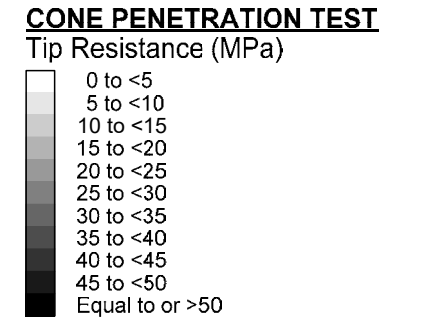
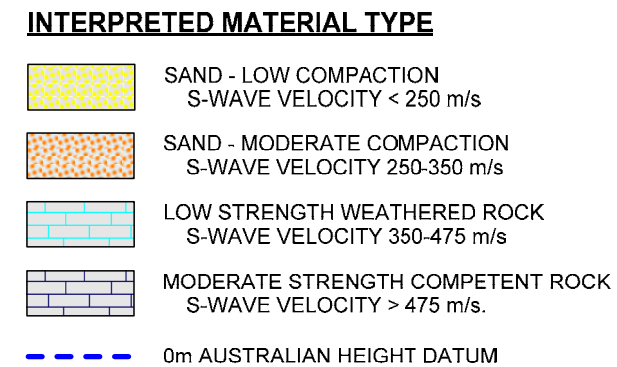
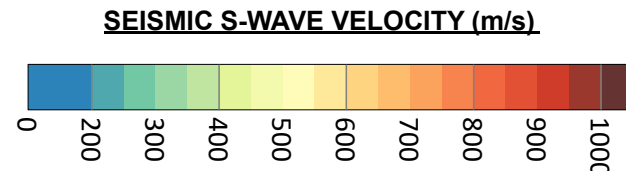
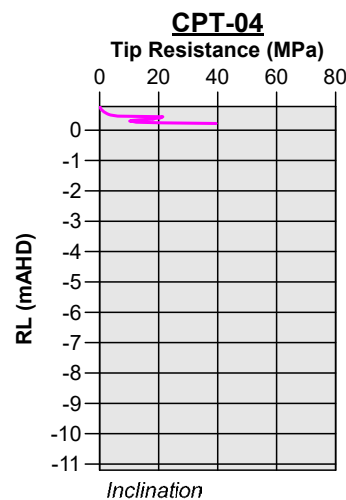
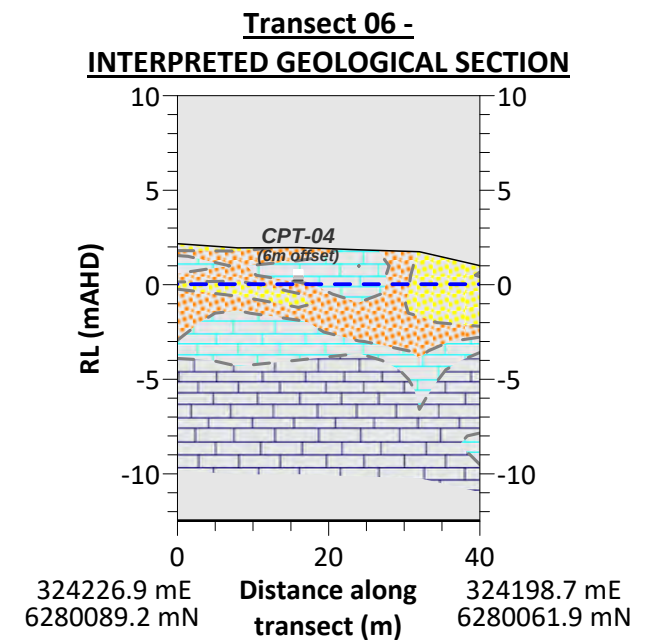
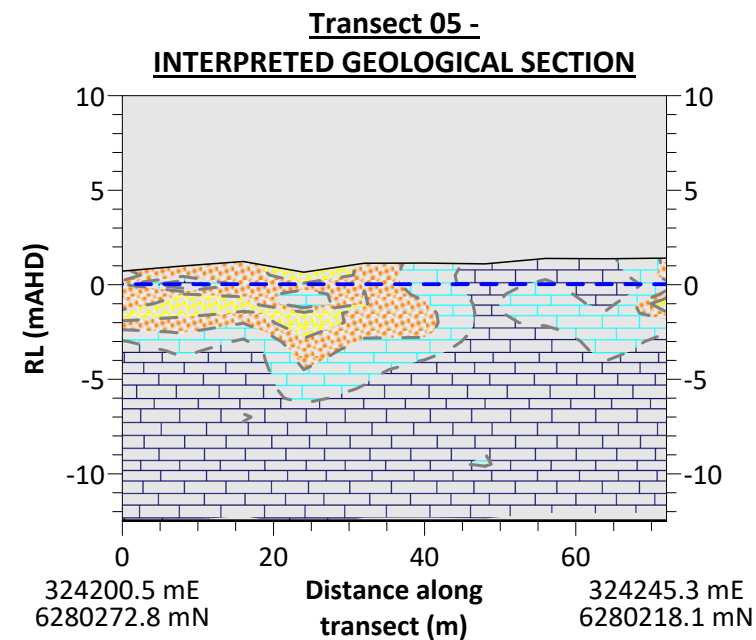
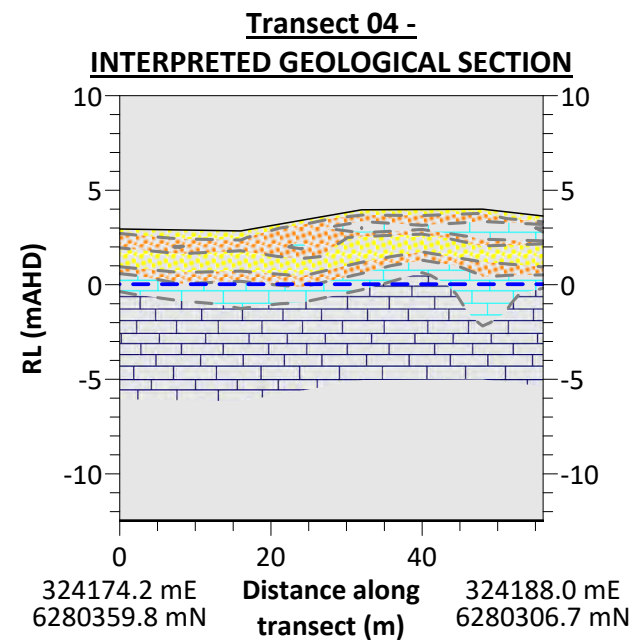
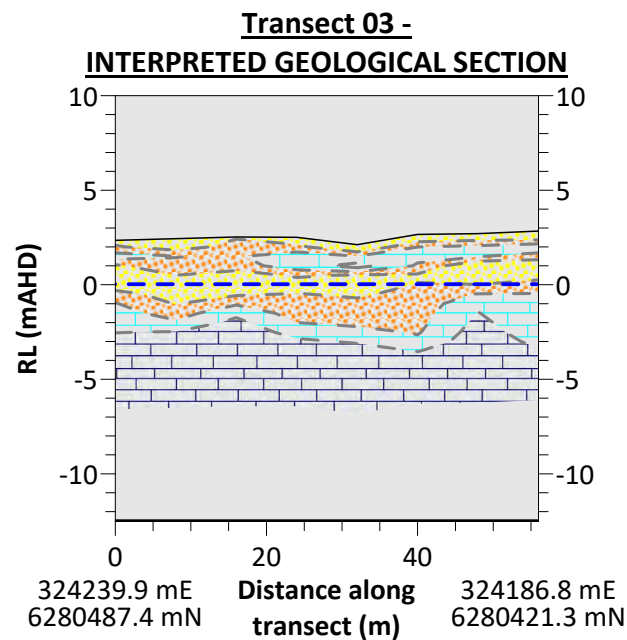
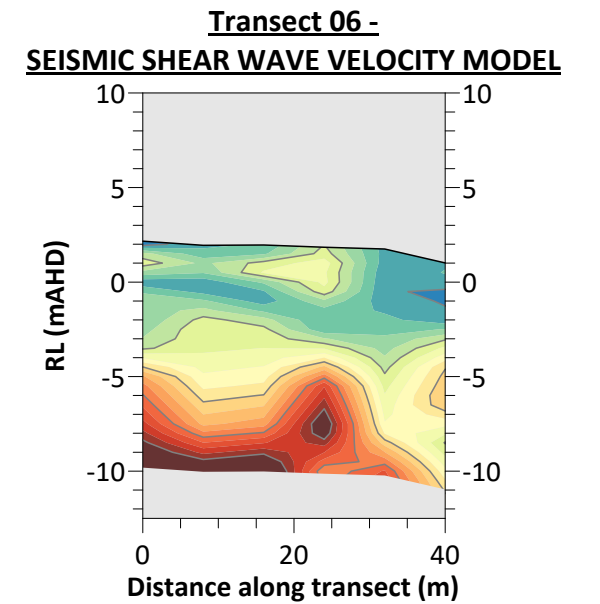
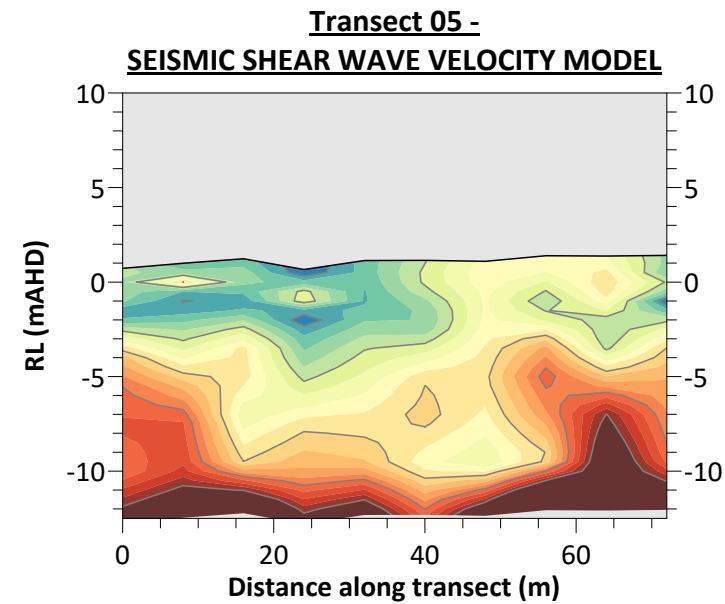
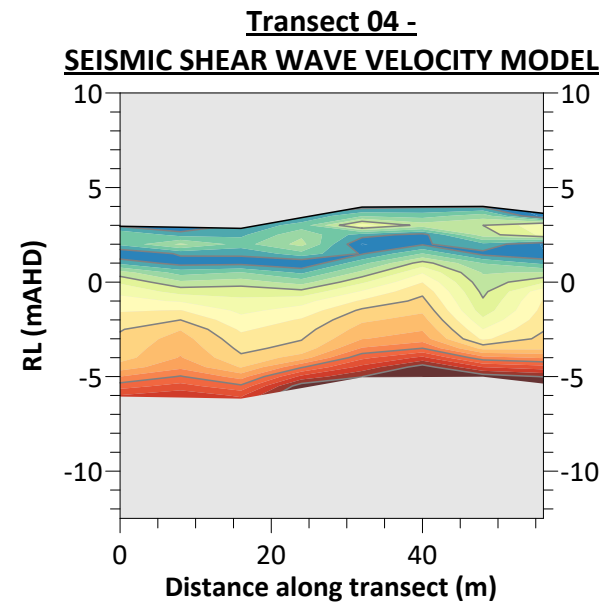
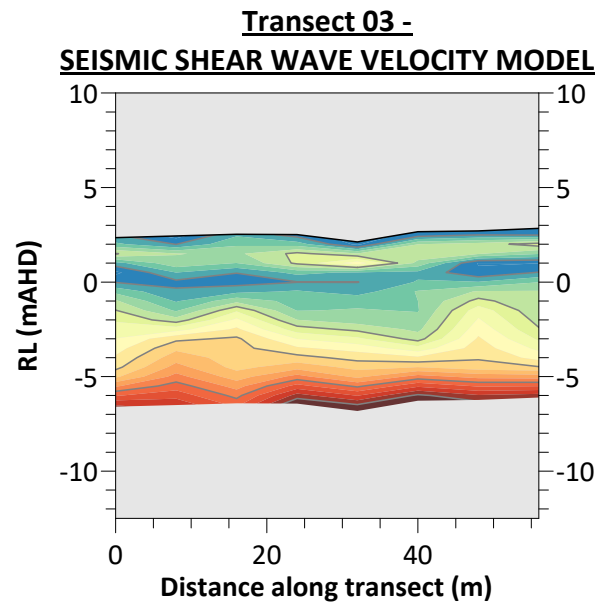
NOTES

Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT,
DUNSBOROUGH, CITY OF BUSSELTON WA**

Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-05
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA



NOTES

Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**

**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
DUNSBOROUGH, CITY OF BUSSELTON WA**

Date 24 January 2025

Scale 1:1000H, 1:400V

Drawing 3142D-06

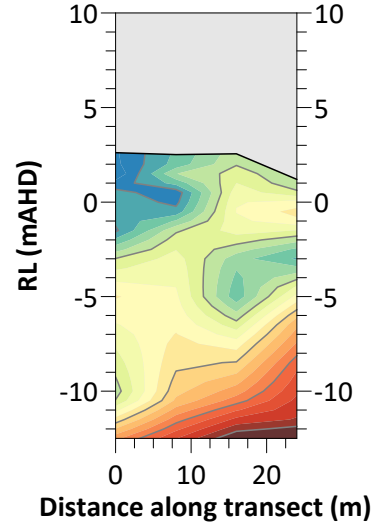
Paper Size A3

Drawn SA

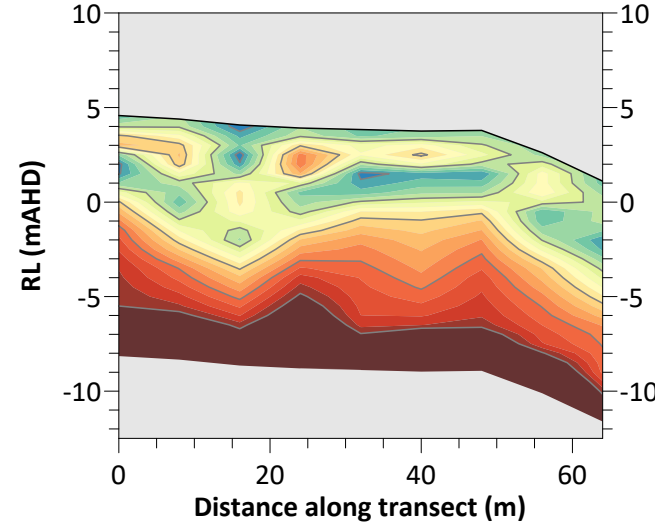
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

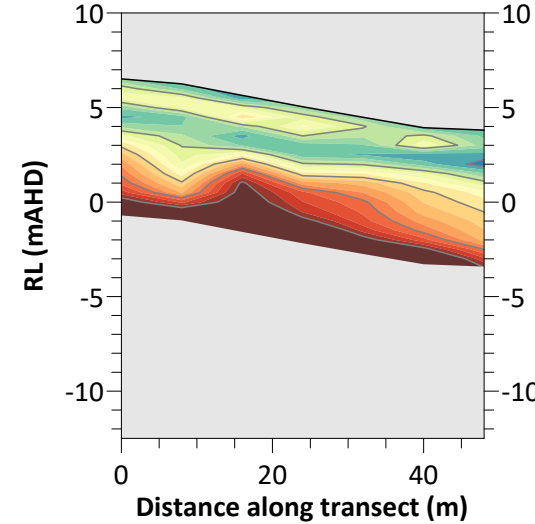
Transect 07 -
SEISMIC SHEAR WAVE VELOCITY MODEL



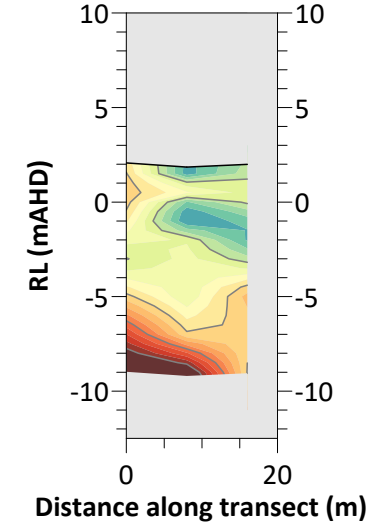
Transect 08 -
SEISMIC SHEAR WAVE VELOCITY MODEL



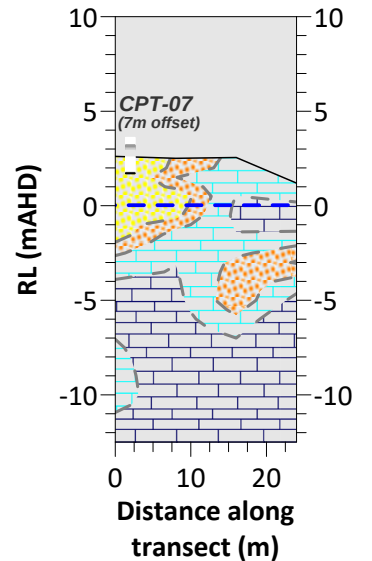
Transect 09 -
SEISMIC SHEAR WAVE VELOCITY MODEL



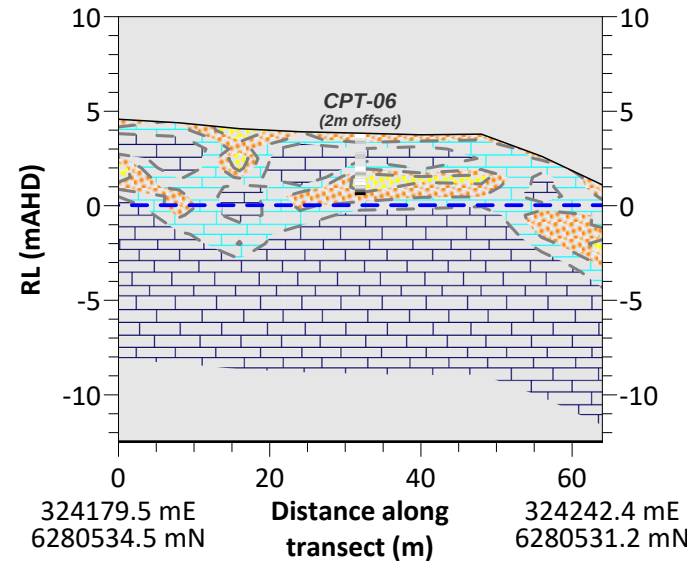
Transect 10 -
SEISMIC SHEAR WAVE VELOCITY MODEL



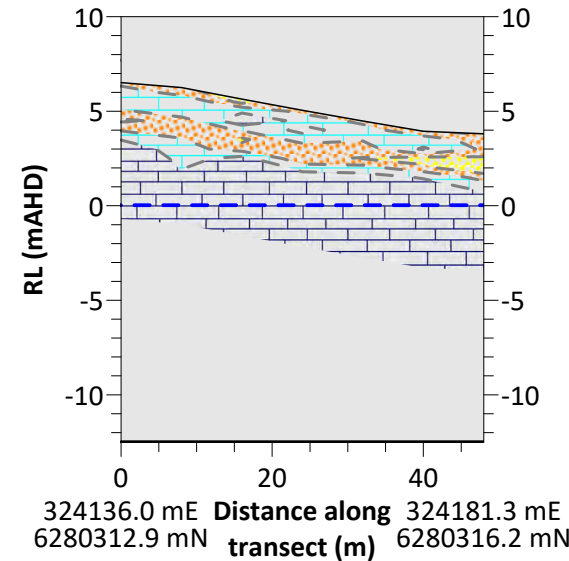
Transect 07 -
INTERPRETED GEOLOGICAL SECTION



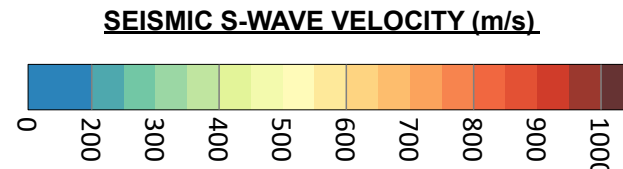
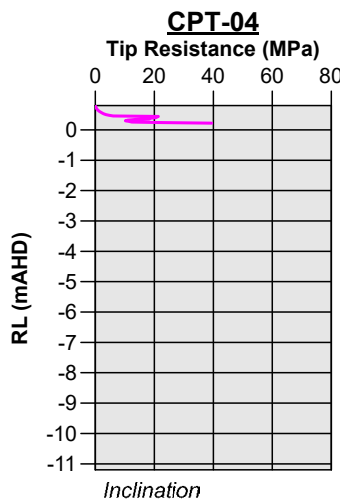
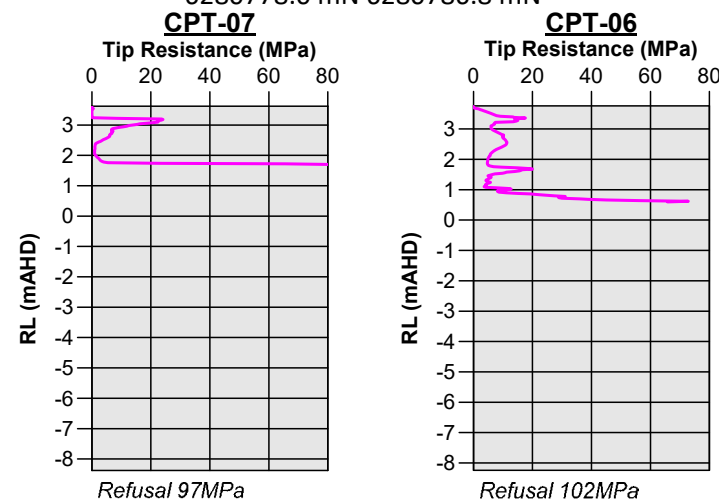
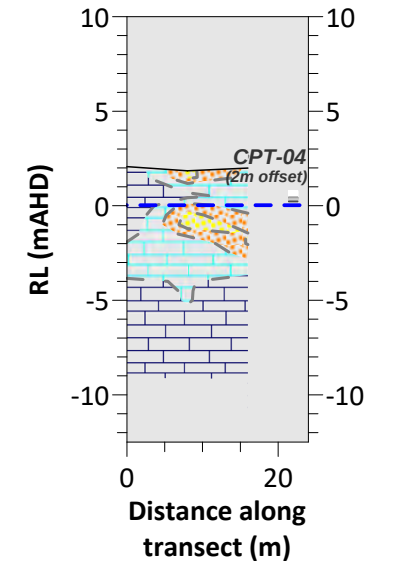
Transect 08 -
INTERPRETED GEOLOGICAL SECTION



Transect 09 -
INTERPRETED GEOLOGICAL SECTION



Transect 10 -
INTERPRETED GEOLOGICAL SECTION



INTERPRETED MATERIAL TYPE

- SAND - LOW COMPACTION
S-WAVE VELOCITY < 250 m/s
- SAND - MODERATE COMPACTION
S-WAVE VELOCITY 250-350 m/s
- LOW STRENGTH WEATHERED ROCK
S-WAVE VELOCITY 350-475 m/s
- MODERATE STRENGTH COMPETENT ROCK
S-WAVE VELOCITY > 475 m/s.
- 0m AUSTRALIAN HEIGHT DATUM

CONE PENETRATION TEST

- Tip Resistance (MPa)
- 0 to <5
- 5 to <10
- 10 to <15
- 15 to <20
- 20 to <25
- 25 to <30
- 30 to <35
- 35 to <40
- 40 to <45
- 45 to <50
- Equal to or >50

NOTES

Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA

GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
DUNSBOROUGH, CITY OF BUSSELTON WA

Date

24 January 2025

Scale

1:1000H, 1:400V

Drawing

3142D-07

Paper Size

A3

Drawn

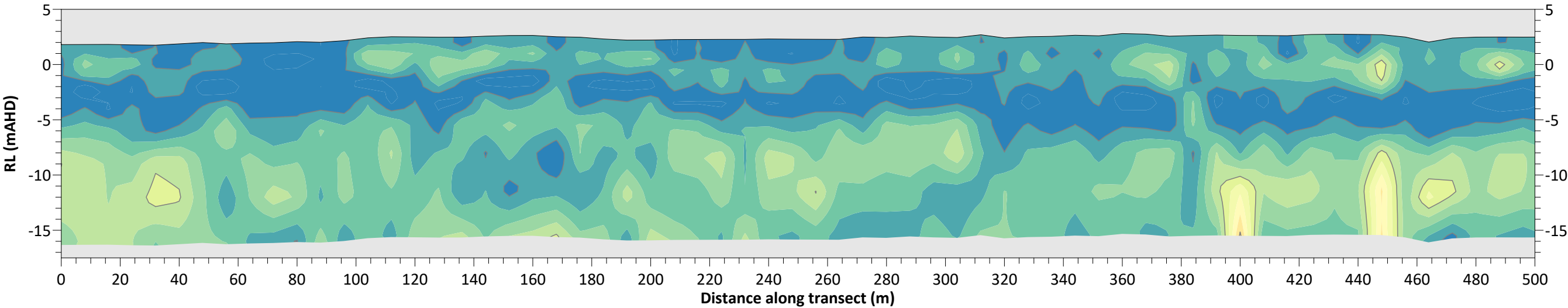
SA

Revision

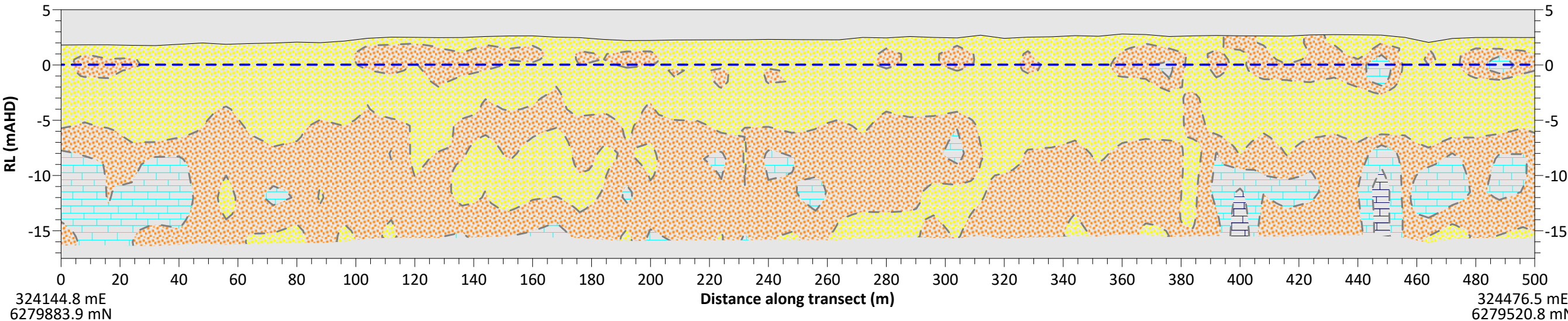
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GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

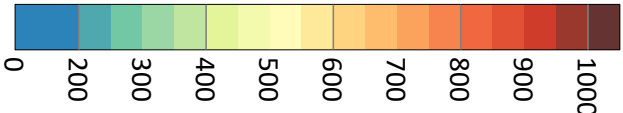
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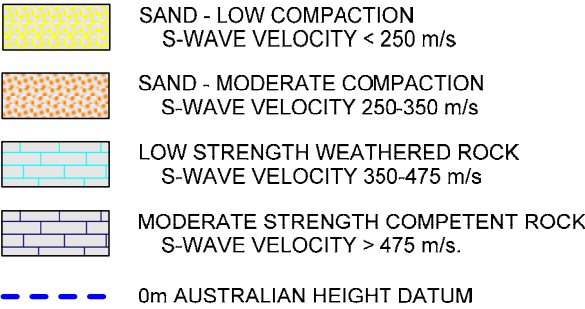
Transect 11 (0-500m) - INTERPRETED GEOLOGICAL SECTION



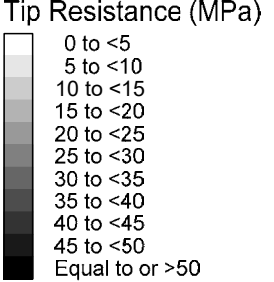
SEISMIC S-WAVE VELOCITY (m/s)



INTERPRETED MATERIAL TYPE



CONE PENETRATION TEST



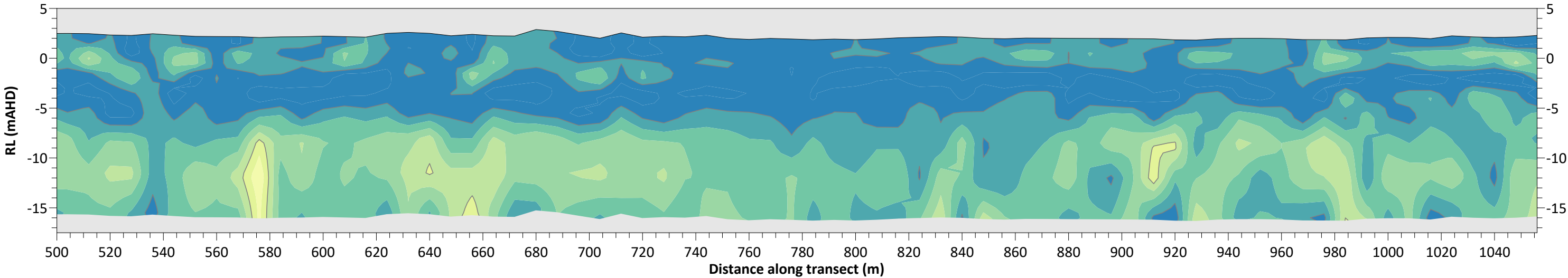
NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT,
DUNSBOROUGH, CITY OF BUSSELTON WA**

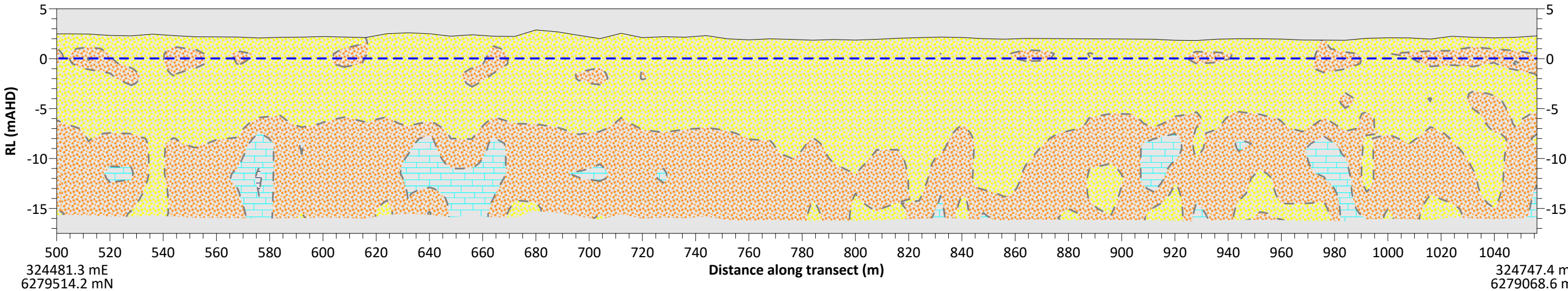
Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-08
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

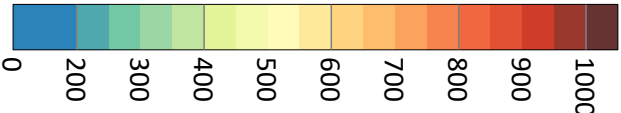
Transect 11 (500-1056m) - SEISMIC SHEAR WAVE VELOCITY MODEL



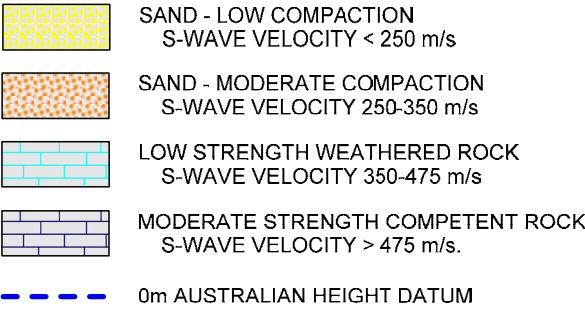
Transect 11 (500-1056m) - INTERPRETED GEOLOGICAL SECTION



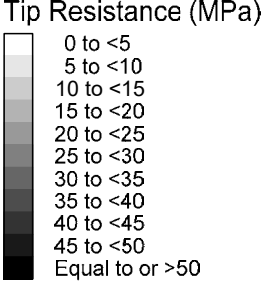
SEISMIC S-WAVE VELOCITY (m/s)



INTERPRETED MATERIAL TYPE



CONE PENETRATION TEST



NOTES

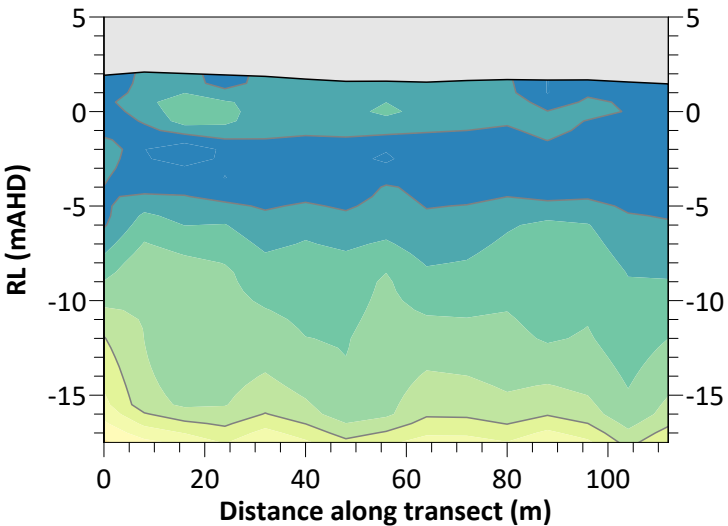
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT,
DUNSBOROUGH, CITY OF BUSSELTON WA**

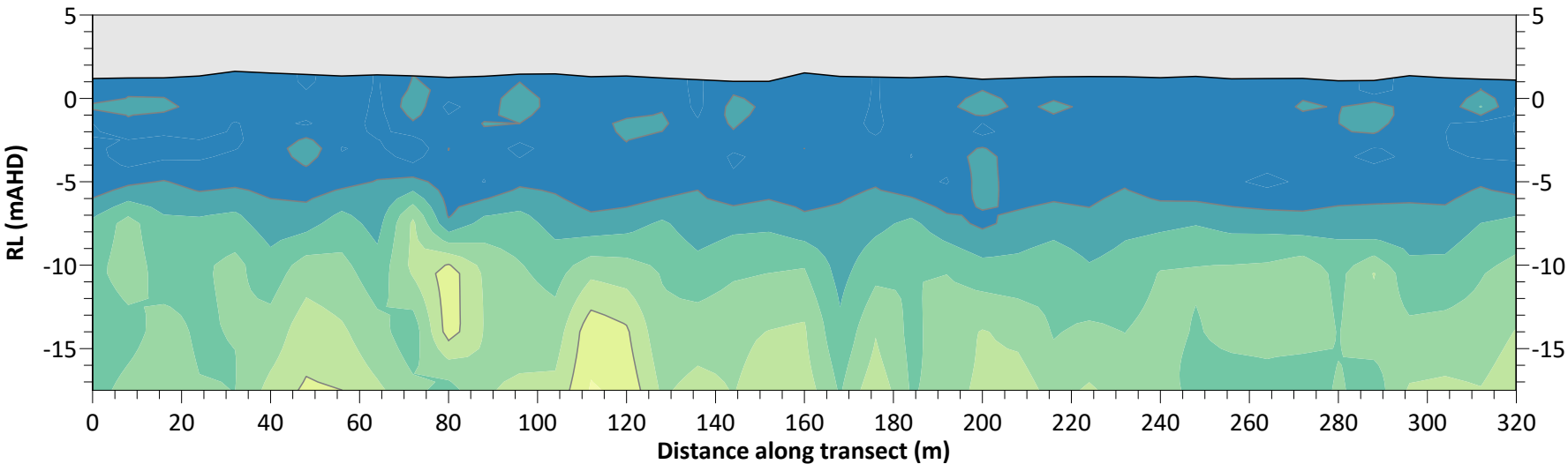
Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-09
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

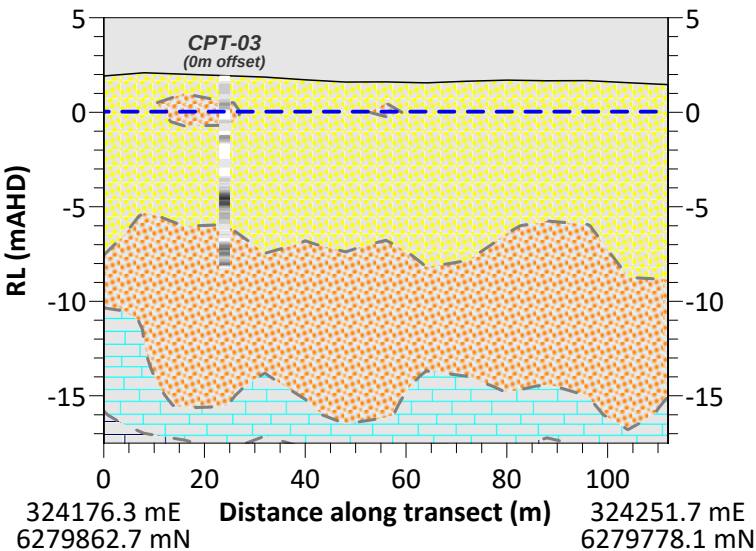
Transect 12 - SEISMIC SHEAR WAVE VELOCITY MODEL



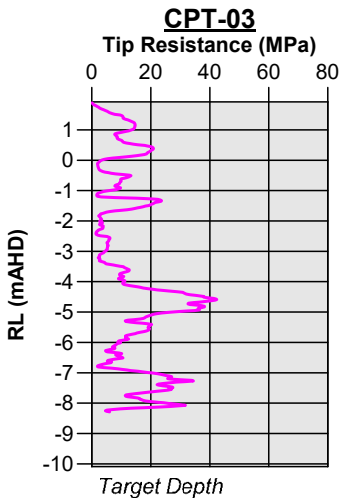
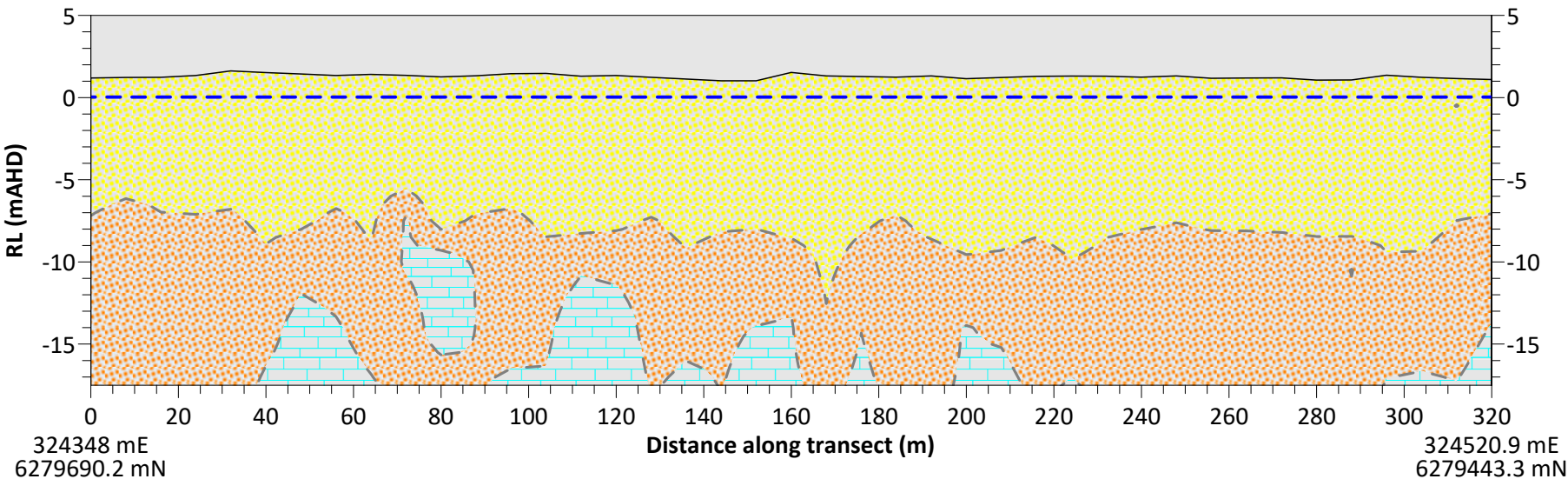
Transect 13 - SEISMIC SHEAR WAVE VELOCITY MODEL



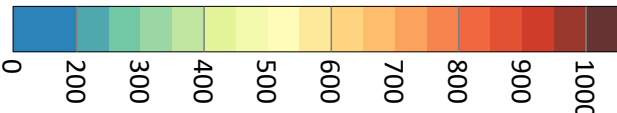
Transect 12 - INTERPRETED GEOLOGICAL SECTION



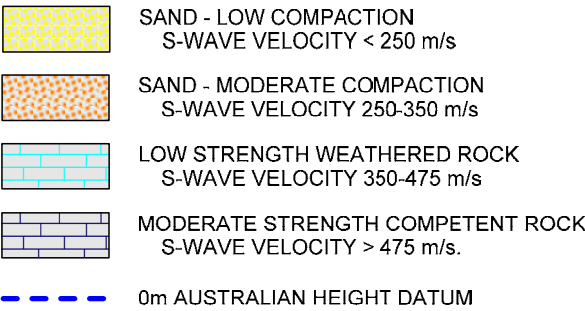
Transect 13 - INTERPRETED GEOLOGICAL SECTION



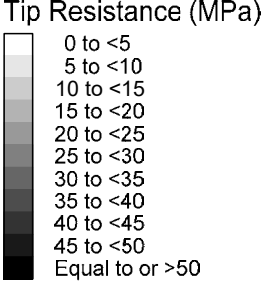
SEISMIC S-WAVE VELOCITY (m/s)



INTERPRETED MATERIAL TYPE



CONE PENETRATION TEST



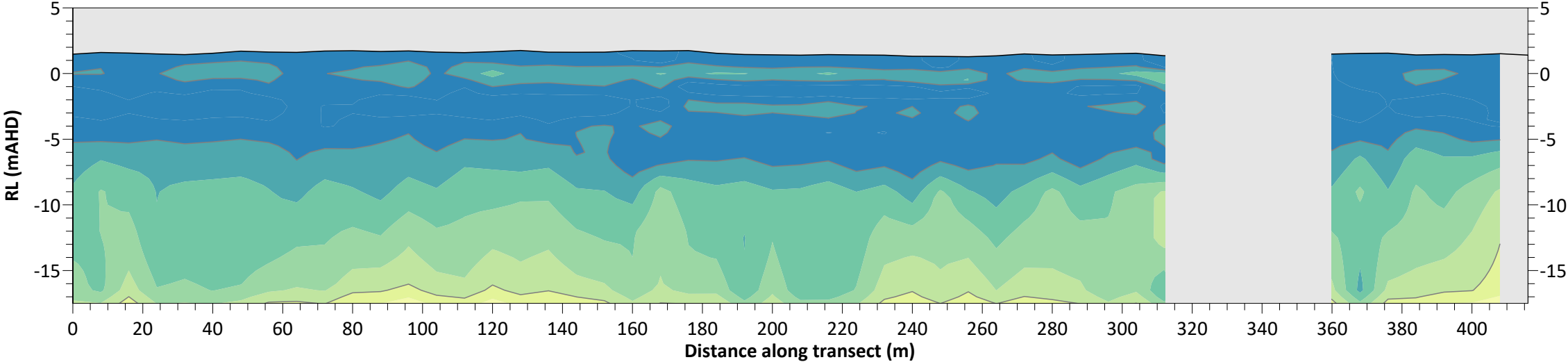
NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA
GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
DUNSBOROUGH, CITY OF BUSSELTON WA

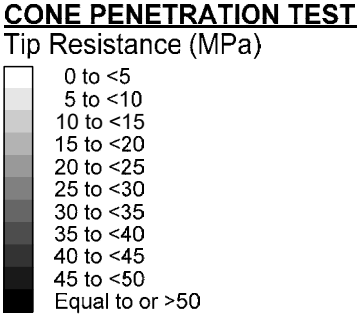
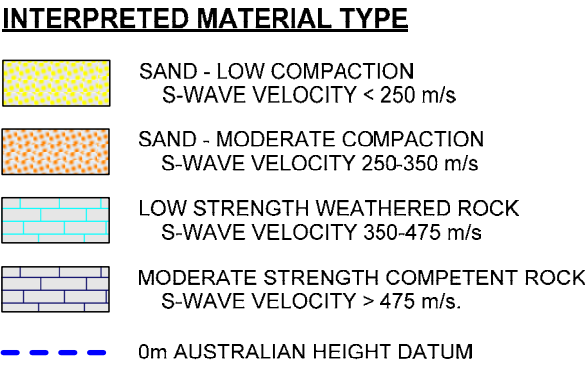
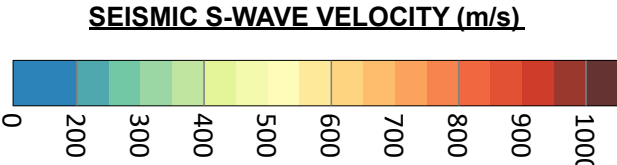
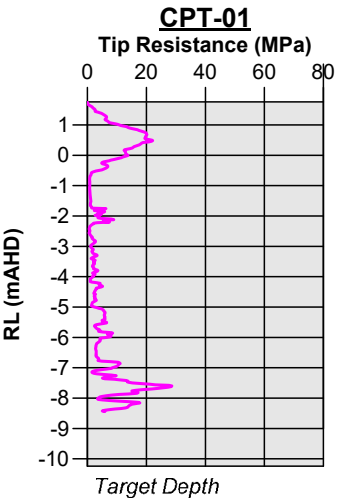
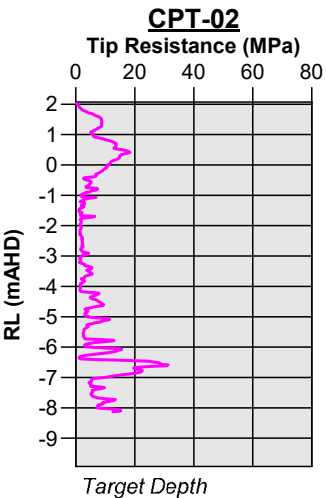
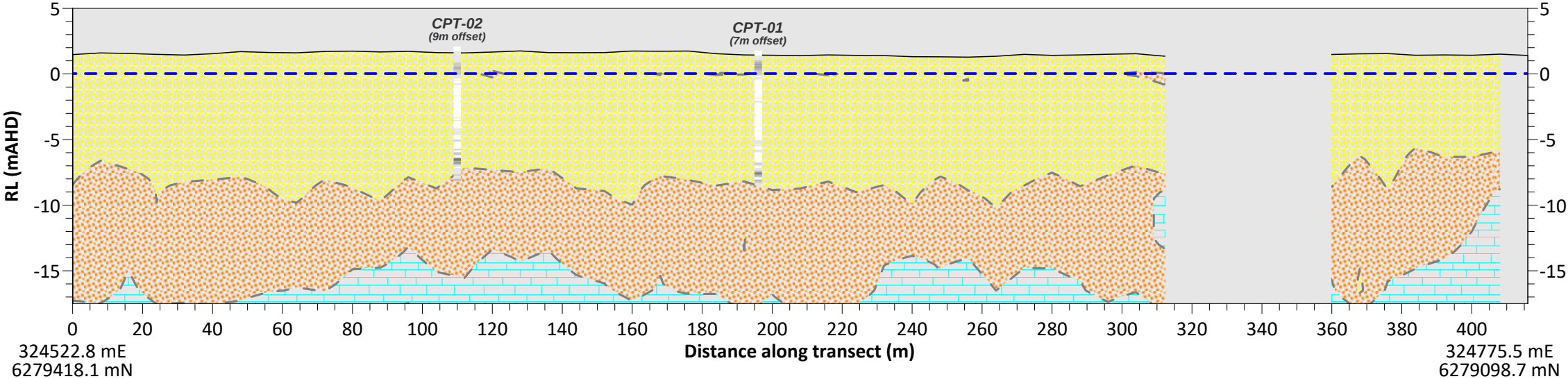
Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-10
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

Transect 14 - SEISMIC SHEAR WAVE VELOCITY MODEL



Transect 14 - INTERPRETED GEOLOGICAL SECTION



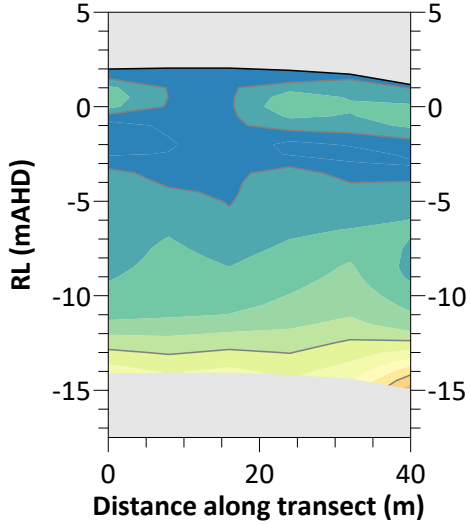
NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT **DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA**
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT,
DUNSBOROUGH, CITY OF BUSSELTON WA**

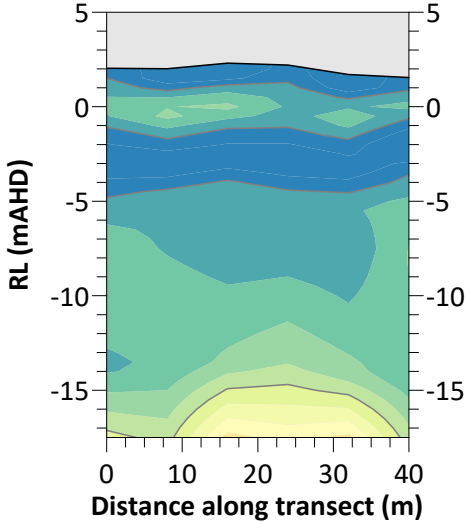
Date 24 January 2025
Scale 1:1500H, 1:400V
Drawing 3142D-11
Paper Size A3
Drawn SA
Revision 0

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT
OLD DUNSBOROUGH, CITY OF BUSSELTON WESTERN AUSTRALIA

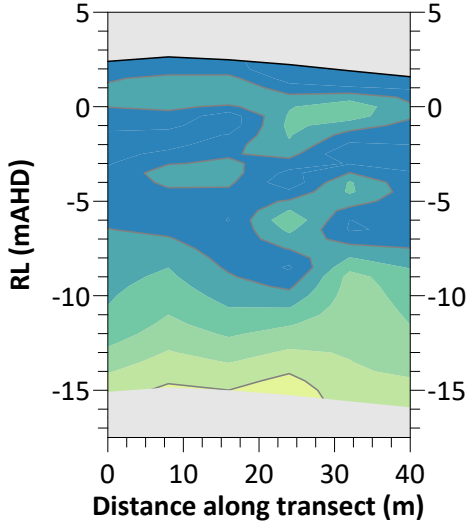
Transect 15 - SEISMIC SHEAR WAVE VELOCITY MODEL



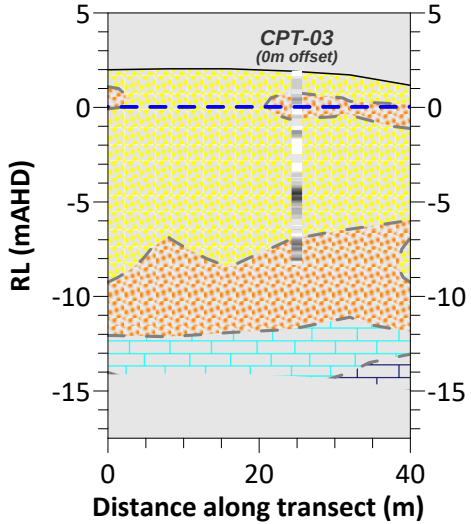
Transect 16 - SEISMIC SHEAR WAVE VELOCITY MODEL



Transect 17 - SEISMIC SHEAR WAVE VELOCITY MODEL

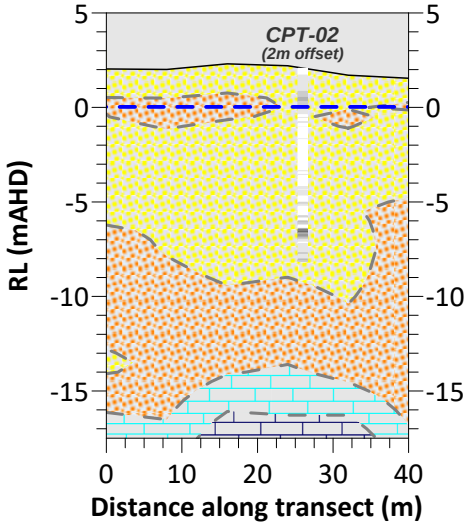


Transect 15 - INTERPRETED GEOLOGICAL SECTION



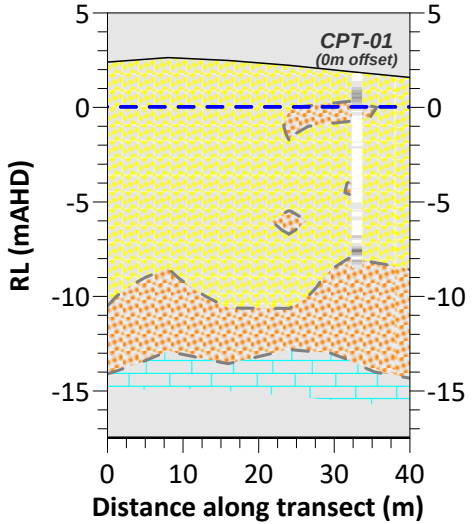
324169.5 mE 324207.3 mE
6279842.0 mN 6279844.4 mN

Transect 16 - INTERPRETED GEOLOGICAL SECTION

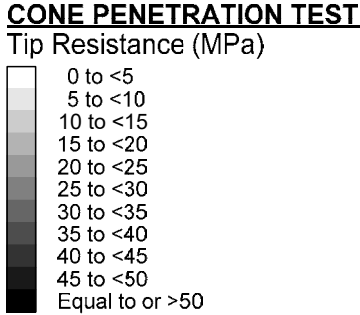
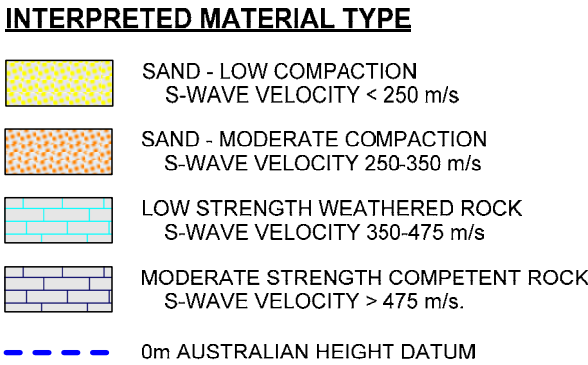
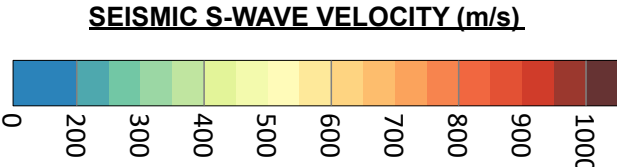
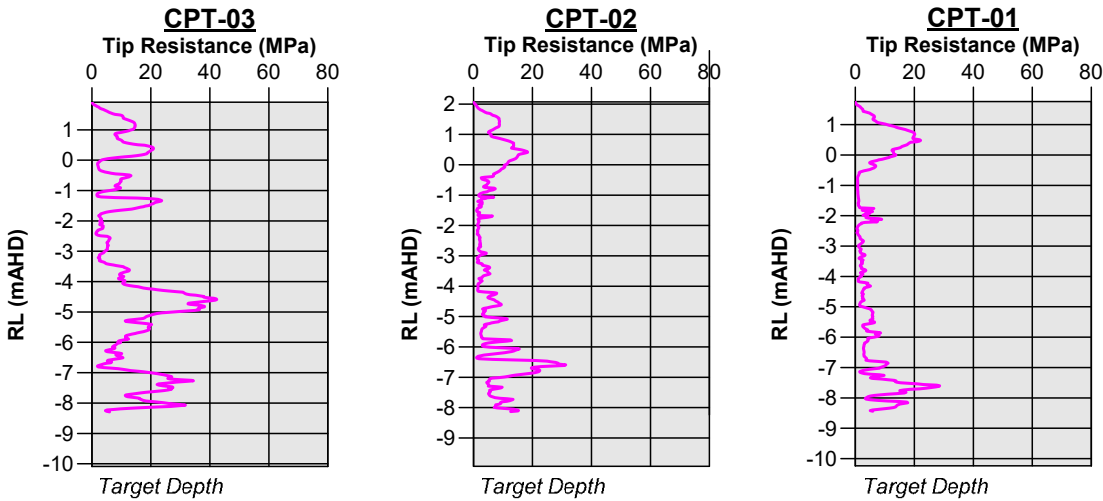


324550.0 mE 324585.1 mE
6279311.0 mN 6279328.1 mN

Transect 17 - INTERPRETED GEOLOGICAL SECTION



324611.3 mE 324640.5 mE
6279236.3 mN 6279260.9 mN



NOTES
Drawing to be used in conjunction with Report 3142D.
Positioning is given in GDA2020 zone 50.
Levels are given in Australian Height Datum (AHD).

CLIENT DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA
GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT,
DUNSBOROUGH, CITY OF BUSSELTON WA

Date 24 January 2025
Scale 1:1000H, 1:400V
Drawing 3142D-12
Paper Size A3
Drawn SA
Revision 0

APPENDIX C – MODELLED LEVEL TO TOP OF ROCK AND SAND THICKNESS

SURFACE LEVEL MODEL (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025	Paper Size	A3
Scale	1:3000	Drawn	PJE
Drawing	3142D-13	Revision	0

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GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

SURFACE LEVEL MODEL (SOUTH)



NOTES

Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro
and GBG photogrammetry.



Date	14 February 2025
Scale	1:3000
Drawing	3142D-14

Paper Size	A3
Drawn	PJE
Revision	0

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GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CONTOURED LEVEL TO TOP OF ROCK (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025	Paper Size	A3
Scale	1:3000	Drawn	PJE
Drawing	3142D-15	Revision	0

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GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CONTOURED LEVEL TO TOP OF ROCK (SOUTH)



NOTES

Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro
and GBG photogrammetry.



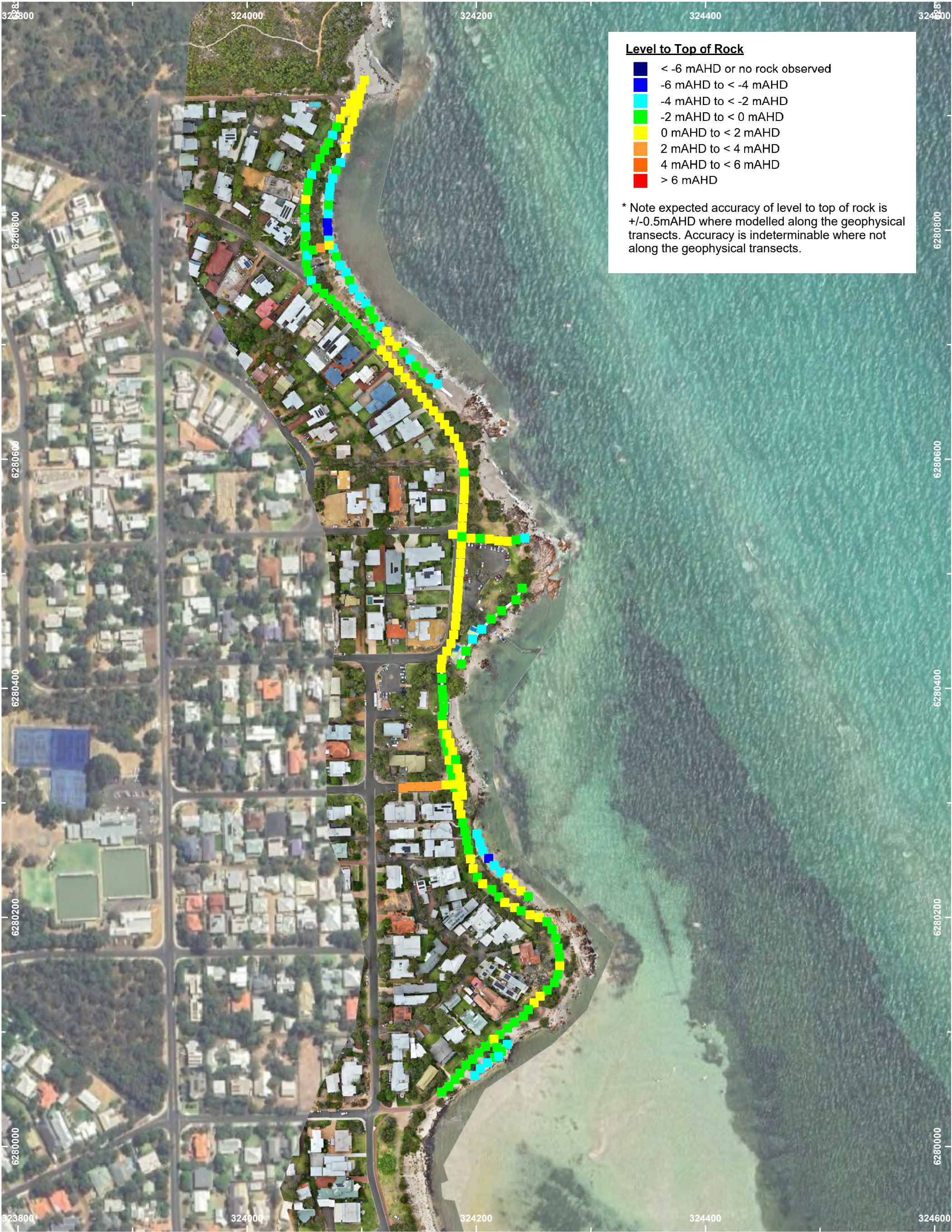
Date	14 February 2025
Scale	1:3000
Drawing	3142D-16

Paper Size	A3
Drawn	PJE
Revision	0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA

**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA**

CLASSED POST MAP LEVEL TO TOP OF ROCK (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025
Scale	1:3000
Drawing	3142D-17

Paper Size	A3
Drawn	PJE
Revision	0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CLASSED POST MAP LEVEL TO TOP OF ROCK (SOUTH)



NOTES

Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025	Paper Size	A3	DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT. OLD DUNSBOROUGH, CITY OF BUSSELTON WA
Scale	1:3000	Drawn	PJE	
Drawing	3142D-18	Revision	0	

CONTOURED SAND THICKNESS OVER ROCK (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025
Scale	1:3000
Drawing	3142D-19

Paper Size	A3
Drawn	PJE
Revision	0

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GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CONTOURED SAND THICKNESS OVER ROCK (SOUTH)



* Note expected accuracy of sand thickness over rock is +/-0.5m where modelled along the geophysical transects. Accuracy is indeterminable where not along the geophysical transects.

NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025
Scale	1:3000
Drawing	3142D-20

Paper Size	A3
Drawn	PJE
Revision	0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA
GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CLASSED POST MAP SAND THICKNESS OVER ROCK (NORTH)



NOTES
Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date	14 February 2025	Paper Size	A3
Scale	1:3000	Drawn	PJE
Drawing	3142D-21	Revision	0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA

GEOTECHNICAL INVESTIGATION FOR COASTAL EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA

CLASSED POST MAP SAND THICKNESS OVER ROCK (SOUTH)



NOTES

Drawing to be used in conjunction with GBG report 3142D.
Map Projection GDA2020 MGA Zone 50.
Aerial image from Google Earth Pro and GBG photogrammetry.



Date 14 February 2025
Scale 1:3000
Drawing 3142D-22

Paper Size A3
Drawn PJE
Revision 0

DEPARTMENT OF TRANSPORT, WESTERN AUSTRALIA
**GEOTECHNICAL INVESTIGATION FOR COASTAL
EROSION VULNERABILITY ASSESSMENT.
OLD DUNSBOROUGH, CITY OF BUSSELTON WA**



GBGGROUP
GB Geotechnics (Australia) Pty Ltd

ABN: 77 009 550 869
Telephone: 08 9354 6300
Email: info@gbgoz.com.au
Web: gb-group.com.au

APPENDIX D – CONE PENETRATION TEST PLOTS

ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

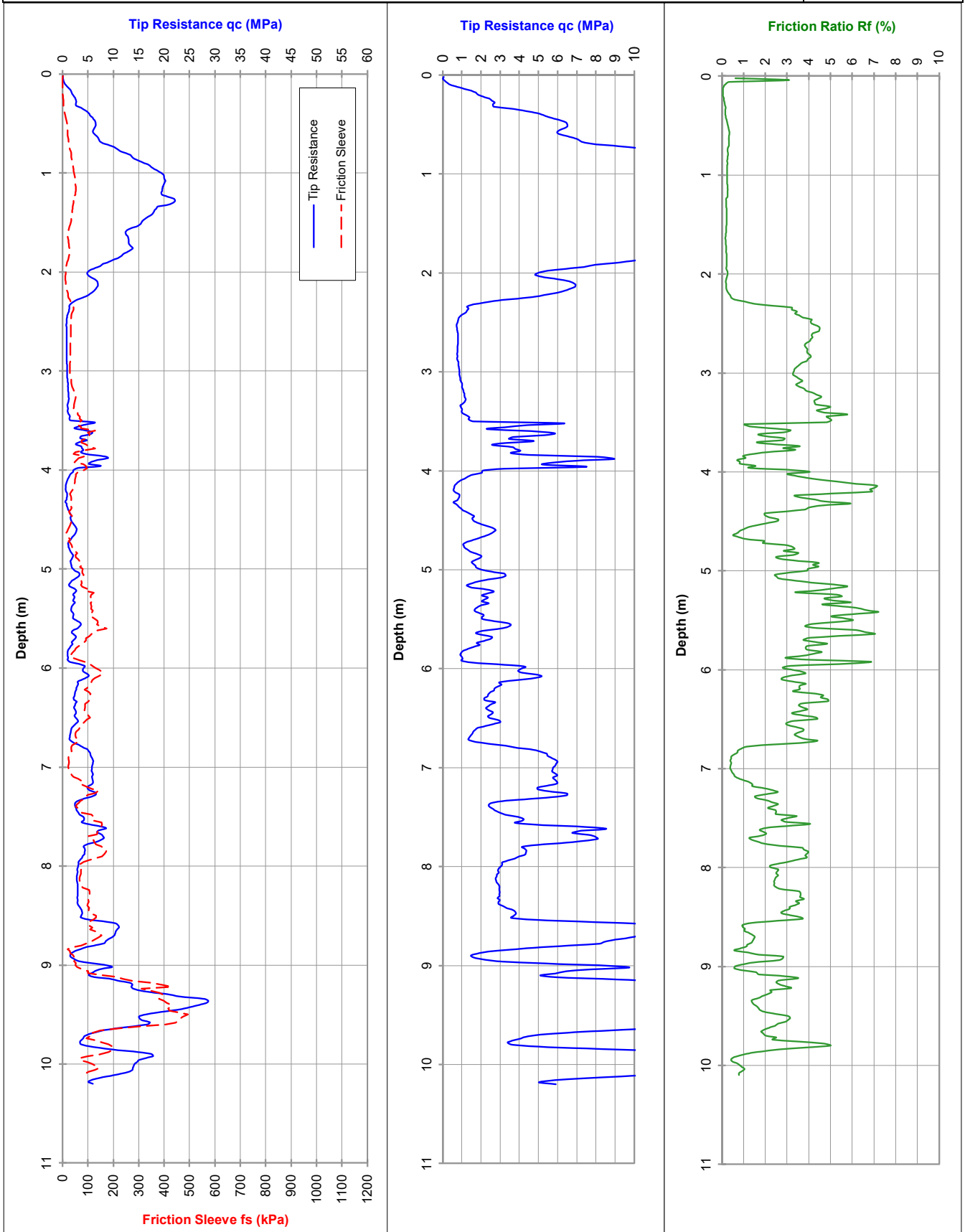
RL (m): 2.11

LOCATION: Dunsborough

Co-ords: 324635.59mE, 6279255.71mN

CPT 01

21-Jan-25



ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

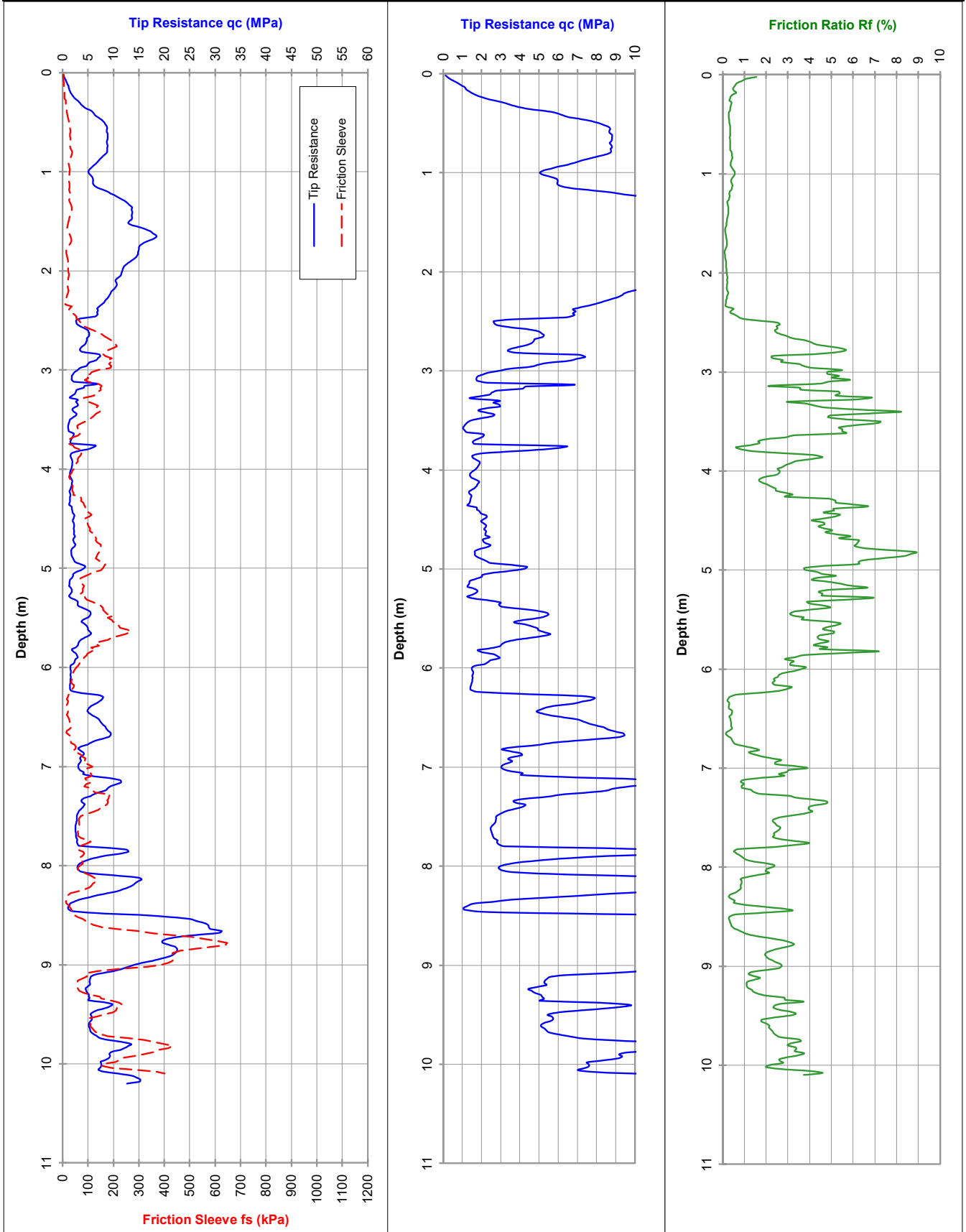
RL (m): 2.62

LOCATION: Dunsborough

Co-ords: 324573.85mE, 6279318.76mN

CPT 02

21-Jan-25



Tested in accordance with AS 1289.6.5.1-1999
and IRTF 2001 for friction reducer

Approx. water (m): -

Dummy probe to (m):

Refusal:

Cone I.D.: EC47

File: GB0078T

Rig Type: 7t track

ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

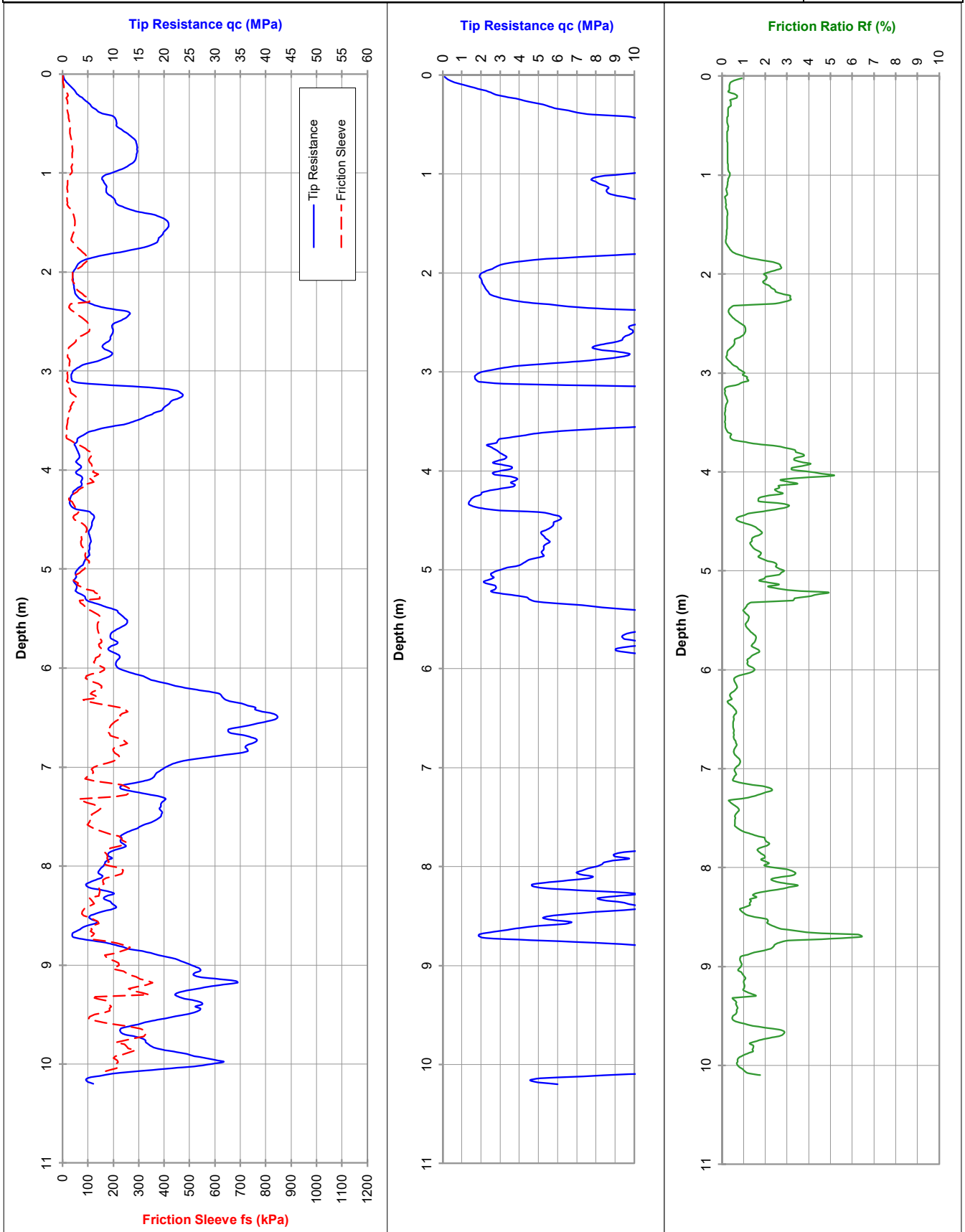
RL (m): 1.75

LOCATION: Dunsborough

Co-ords: 324192.69mE, 6279845.93mN

CPT 03

21-Jan-25



ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

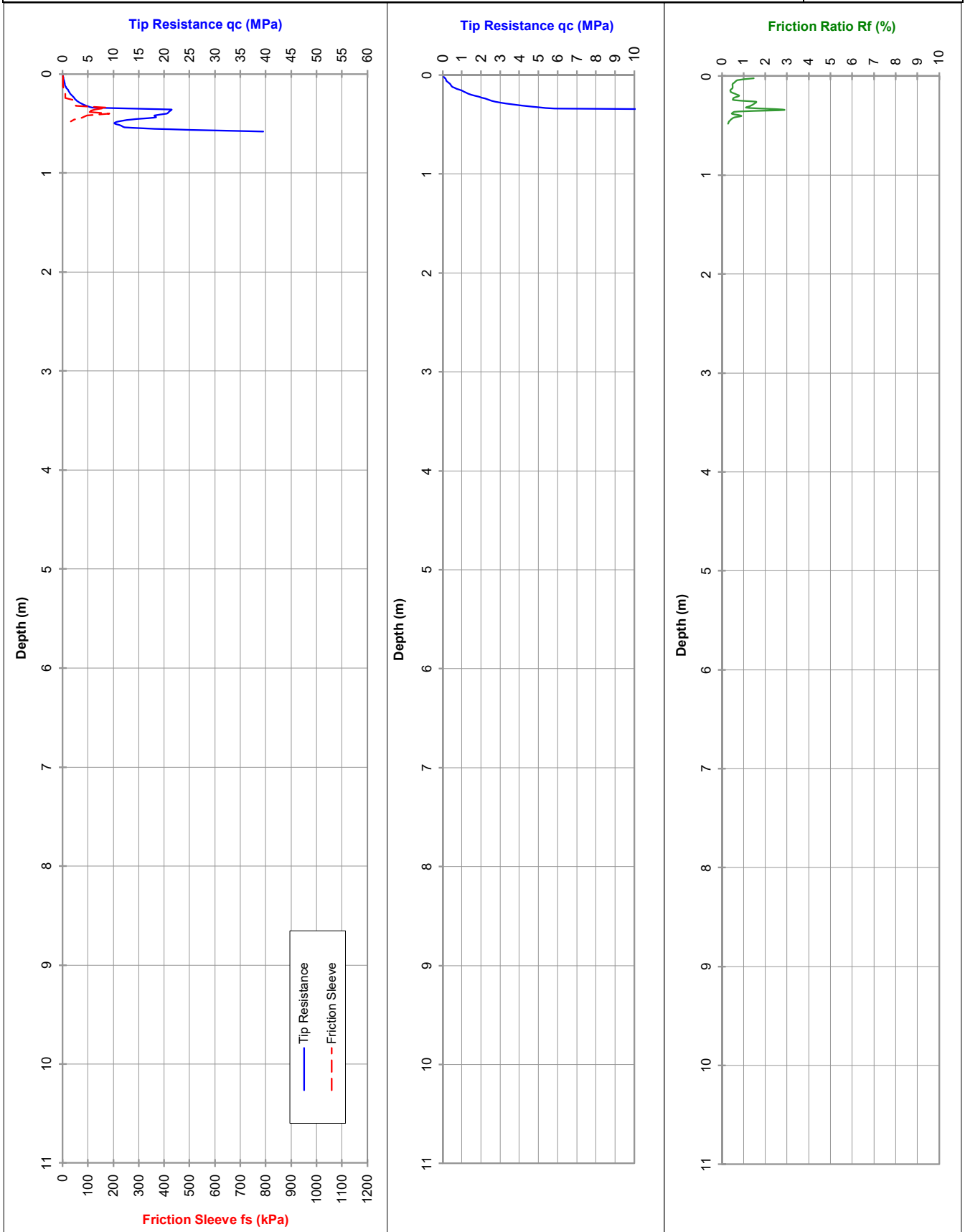
RL (m):

LOCATION: Dunsborough

Co-ords:

CPT 04

21-Jan-25



ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

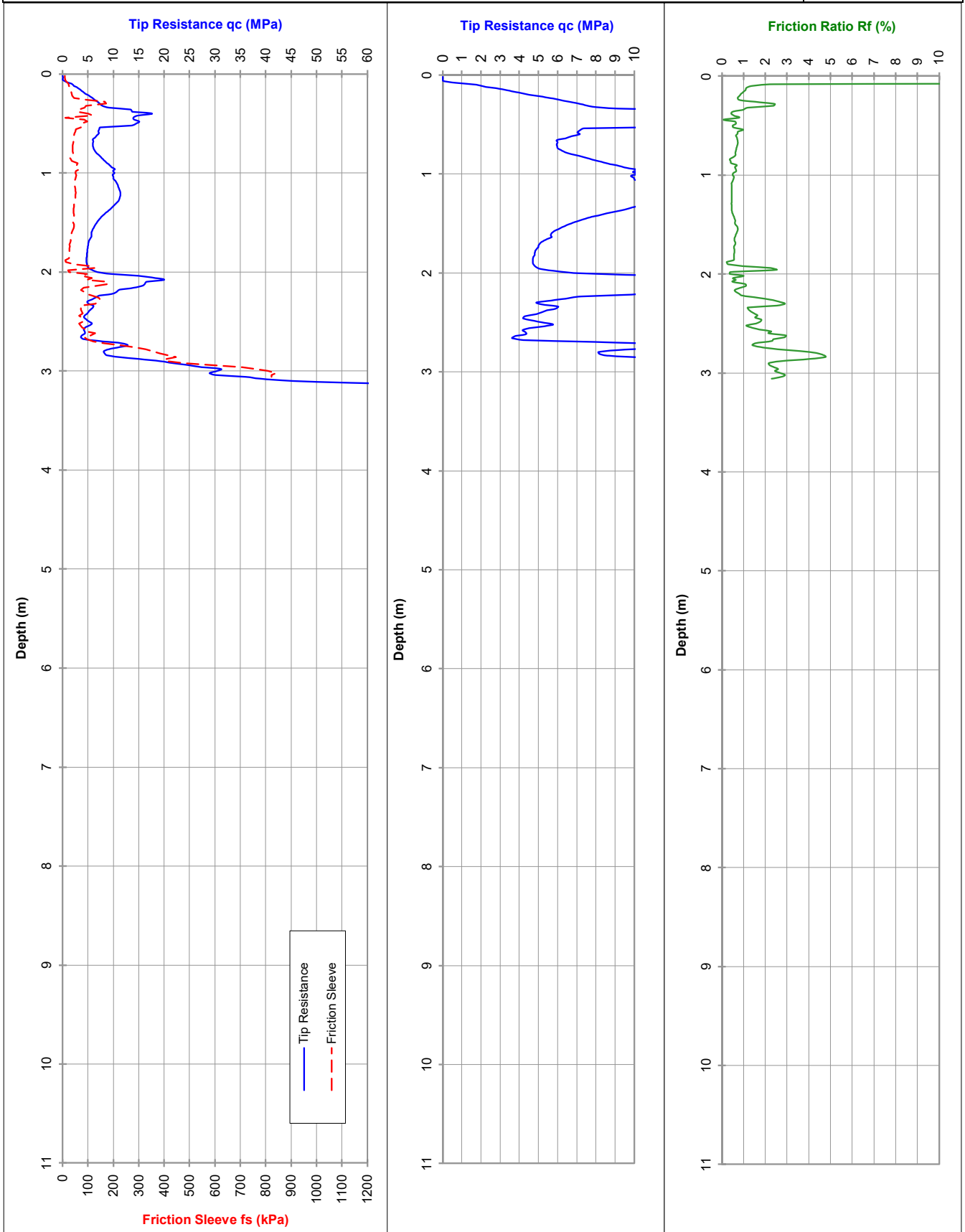
RL (m): 4.4

LOCATION: Dunsborough

Co-ords: 324211.91mE, 6280532.14mN

CPT 06

22-Jan-25



ELECTRIC FRICTION-CONE PENETROMETER

Probe I.D

CLIENT: Department of Transport

Job No.: 3142

PROJECT: Southern & Southwest Coastal

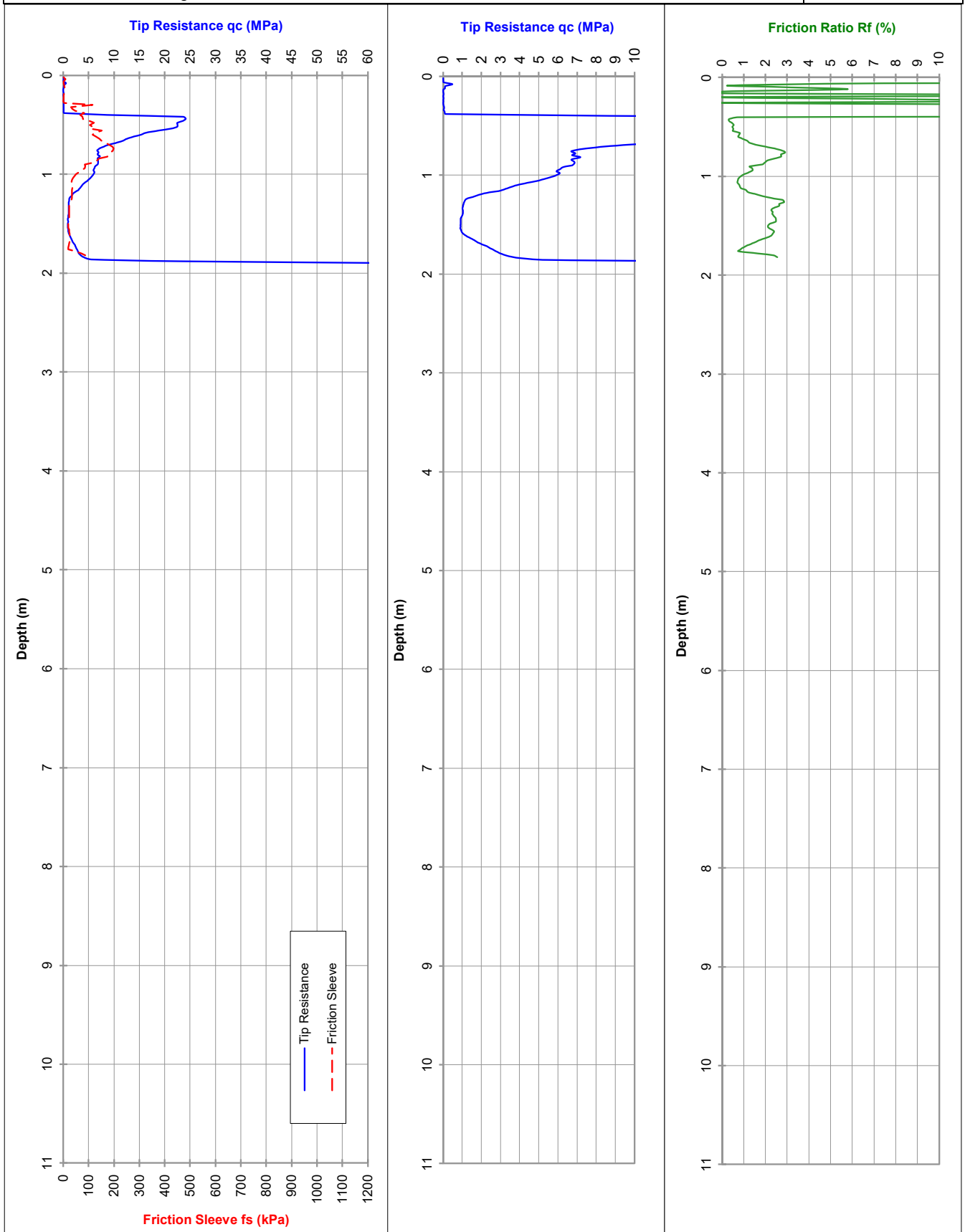
RL (m): 4.06

LOCATION: Dunsborough

Co-ords: 324058.09mE, 6280773.13mN

CPT 07

22-Jan-25

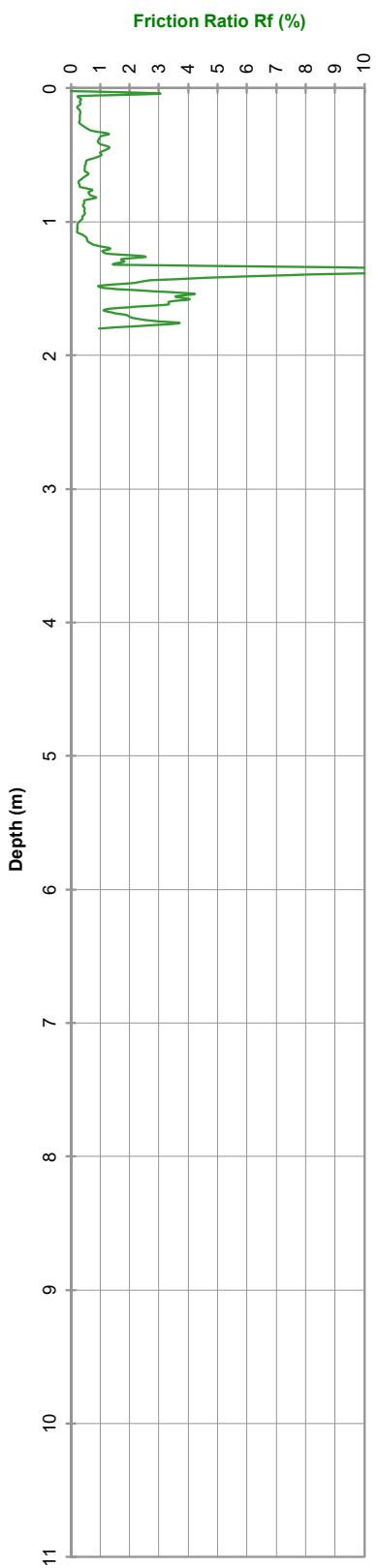
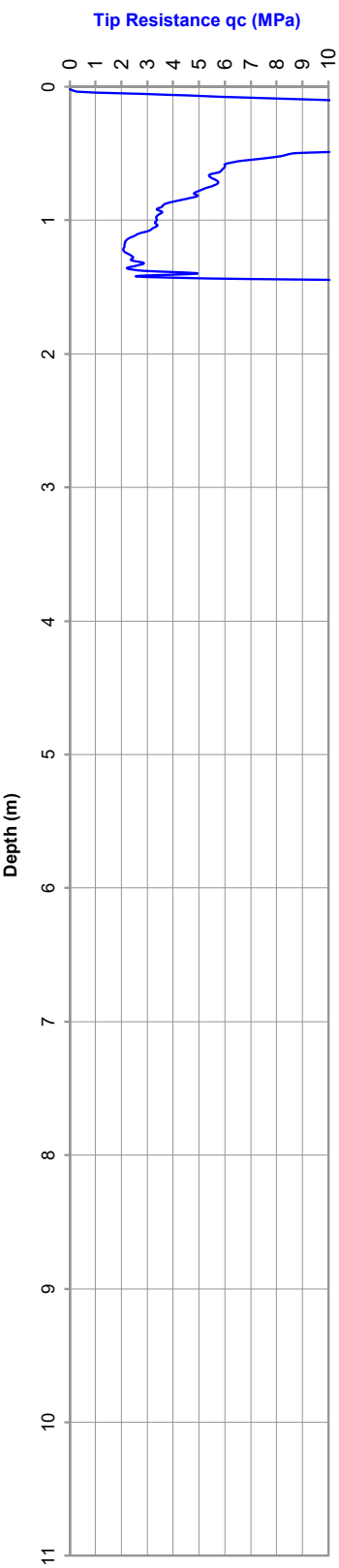
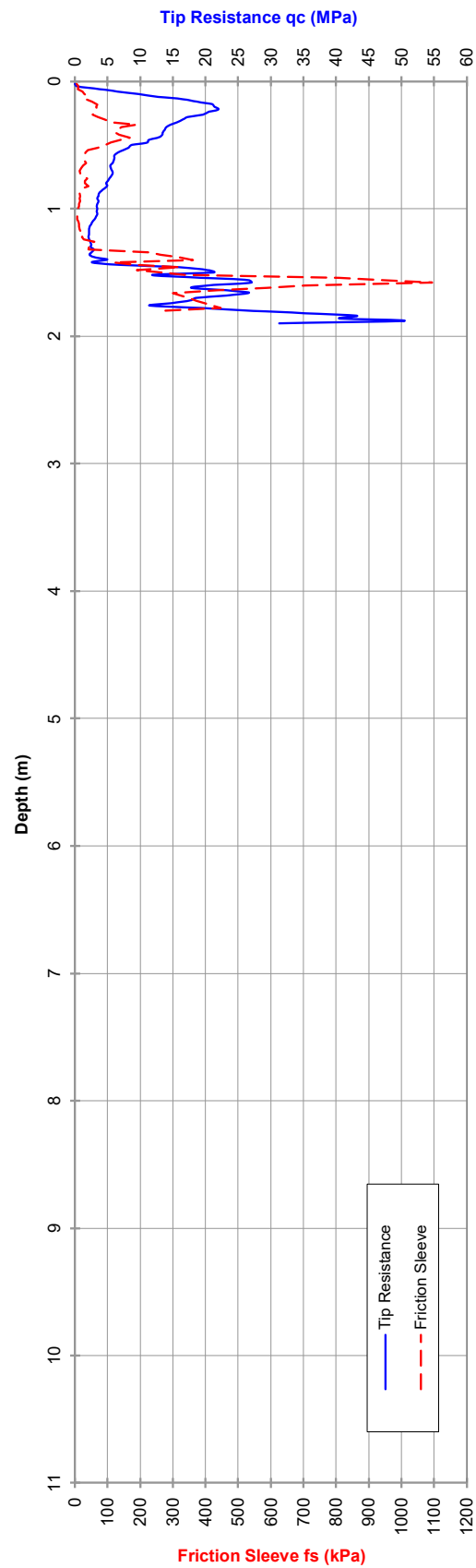


ELECTRIC FRICTION-CONE PENETROMETER

CLIENT: Department of Transport
PROJECT: Southern & Southwest Coastal
LOCATION: Dunsborough

Job No.: 3142
RL (m): 2.9
Co-ords: 324121.24mE, 6280696.45mN

Probe I.D
CPT 07A
22-Jan-25



CALIBRATION CERTIFICATE

CONE ID:

EC47

Cone Type:
Calibration Date (qc/fs):
Calibration Date (u):
Preliminary Inspection:
Calibrated By:
Calibration Procedure:
Force Application:
Reference Equipment:

Compression
20 November 2024
25 November 2024
Pass
Henky Lawer
ISO 22476-1:2012, IRTP 2001
Compression
PT - S type 100kN Serial # 5126009 (Calibrated 10/03/23 - NATA approved Cert. No. 230664)
Bongshin - S type 50kN Serial #44427 (Calibrated 05/06/24 - NATA approved Cert. No. 241683)
Digitron Panel Meter Serial #: 060213/01 (Calibrated 09/03/23 - NATA endorsed Report No. 230658, 230659, 230660)

Note: In accordance with AS1289 FS.1 the force calibration derived by NATA Calibration Certificates are converted to a qc reading in MPa and fs reading in kPa by dividing by 1000 mm² and 15000mm² respectively.

Results of Calibration:

qc (tip resistance):		
Capacity:	100 (MPa)	
Area	1000 (mm ²)	
Applied Load kN	Eqv. Pressure MPa	Mean Observed Reading Volts
0	0	0.000
10	10	0.757
20	20	1.514
30	30	2.273
40	40	3.033
50	50	3.797
60	60	4.562
70	70	5.330
80	80	6.100
90	90	6.865
100	100	7.634
90	90	6.889
80	80	6.131
70	70	5.372
60	60	4.610
50	50	3.850
40	40	3.084
30	30	2.318
20	20	1.549
10	10	0.780
0	0	0.004
R ² Value =	1.000	

fs (sleeve friction):		
Capacity:	2000 (kPa)	
Area	15000 (mm ²)	
Applied Force kN	Eqv. Load kPa	Mean Observed Reading Volts
0	0	0.000
3	200	0.746
6	400	1.502
9	600	2.259
12	800	3.014
15	1000	3.766
18	1200	4.517
21	1400	5.270
24	1600	6.022
27	1800	6.780
30	2000	7.540
27	1800	6.814
24	1600	6.067
21	1400	5.315
18	1200	4.563
15	1000	3.809
12	800	3.055
9	600	2.296
6	400	1.528
3	200	0.765
0	0	0.002
R ² Value =	1.000	

u (pore pressure):		
Capacity:	3500 (kPa)	
Position	u2	
Applied Pressure bar	Eqv. Pressure kPa	Mean Observed Reading Volts
0	0	0.000
3	300	0.351
6	600	0.700
9	900	1.050
12	1200	1.399
15	1500	1.749
18	1800	2.098
21	2100	2.443
25	2500	2.909
30	3000	3.488
35	3500	4.066
30	3000	3.495
25	2500	2.916
21	2100	2.452
18	1800	2.103
15	1500	1.754
12	1200	1.405
9	900	1.053
6	600	0.702
3	300	0.352
0	0	0.001
R ² Value =	1.000	

Zero Load Error: 0.06%
Max. Linearity 0.38%
Max. Hysteris 0.70%

Zero Load Error: 0.03%
Max. Linearity 0.47%
Max. Hysteris 0.61%

Zero Load Error: 0.01%
Max. Linearity 0.25%
Max. Hysteris 0.22%

MPa/Volt: **13.094**

kPa/Volt: **264.97**

kPa/Volt: **859.97**
Net Area (calibrated): **0.81**

"Class 1" Application Accuracy achieved (in accordance with ISO 22476:2012 classification)

Calibration Checked & Authorised: Kylie Walker

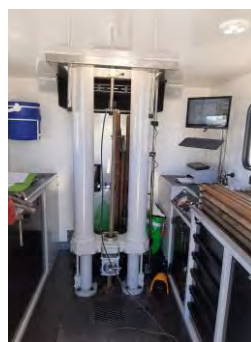
Job Details

Client: GBG Maps
Rep: Stephen Kelly
Location: Dunsborough

Date of Job: 21/01/2025
Tip Diameter: 35.8
Sleeve Diameter: 35.89

MOROOKA (M2)

11 tonne track mounted CPT Rig



SPECIFICATIONS

Overall Dimensions	Width: 2.3m; Length: 5.3m; Height: 3.2m (while travelling) Height: 4.4m (while probing)
Gross Weight	11 tonne
Ground Bearing Capacity	0.38 kg/cm ² (37kPa / 5.4psi)
Speed (Low/High)	Low gear: 8.3km High gear: 12km/h on level ground
Grade ability	60%
Engine	Mitsubishi (3910cc) 110 HP @ 2,800 rpm
Fuel Tank	80 L (Diesel)
Drive System	HST
Tracks	600mm wide rubber tracks
Levelling Jacks	0.8m stroke

EQUIPMENT / FEATURES

Other Equipment / Features	2.4m x 1.2m Plastic Bog Boards 1 x 9kg ABE Fire extinguisher Air conditioned work cabin and drive cabin
Transport	Prime Mover & 10m Drop-deck trailer with ramps

SERVICES

Geotechnical Services provided	CPT, CPTu, SCPT, SCPTu (1, 5, 10, & 15 tonne cones) DMT, SDMT Dissipation Testing Ball Penetrometer CPT casing for additional rod support Dual Tube (percussion) sampling Piston Sampling MOSTAP and PROBEDRILL soil sampling Vane Shear Testing (Electronically driven) Vibrating Wire Installation Water Sampling Standpipe Installation (20mm; 32mm & 50mm)
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