SH1, Peka Peka Development

Flood Hazard Assessment of Effects

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Excellence Heart Innovation

SH 1 PEKA PEKA DEVELOPMENT

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EXECUTIVE SUMMARY

The property owner at 169-171 Peka Peka Road is applying under the Fast-track Approvals Act 2024 for all necessary resource consents to subdivide its land and enable residential development with associated local centre shops.

The development site is shown in Figure 1.

Earthworks and landscaping are proposed to modify the existing dune topography allowing for residential development. In some low-lying areas fill will be required to raise the proposed lots to meet recommended building levels (in order to mitigate the effects from ponding). This will in turn alter the existing ponding depth and extent as fill displaces storage in some parts of the floodplain.

The primary form of stormwater mitigation for the displacement of storage on the floodplain associated with fill will be via storage/attenuation at a twin box culvert structure within the open channel at the south-western extent of the site allowing ponding depths to increase upstream of the structure.

Preliminary solutions for managing stormwater runoff from the developed areas within the site have been formulated as part of the engineering design of the project and are described in the Stormwater Management Plan, prepared by Landlink Ltd, dated 18 March 2026. As set out in the Landlink report, these solutions include the use of various elements such as swales, pre-treatment attenuation basins, soakage devices, on-lot attenuation/re-use storage tanks, diffuse discharge to vegetated surface areas and associated conveyance systems to achieve the required control of stormwater discharge to avoid adverse effects. In addition, the Hydrological Report prepared by OCDL, dated March 2026, sets out an assessment of hydrology issues associated with the project and the interaction between surface water generated within the site, groundwater, the Awa assessment of catchment wide stormwater/flooding issues and proposed ground level changes associated with the proposed development.

As described in Table 6 of the Hydrological Report, hydraulic neutrality will generally be achieved across the development utilising soakage and attenuation devices. Soakage will be utilised within each lot (except for the lots in the low-lying central and eastern zone of the site where earthworks filling is proposed for raising the land above expected ponding levels) and attenuation provided within each lot or in the road reserve or in areas adjacent to the low-lying floodable areas. The expected type, location and sizing of the low impact design solutions to achieve hydraulic neutrality are described in the Landlink Stormwater Management Plan.

The Awa modelling assessment has not incorporated specific discharges from the developed area within the site because these are considered to be generally neutral in potential effect on model assessment and minor in scale compared to catchment wide ponding capacity within the developed site. The final design of these devices will be confirmed and modelled at detailed design stage to ensure the proposed devices meet KCDC's requirements and to ensure surface discharges from these devices are incorporated into final design catchment wide modelling for the project.

Modelling indicates in the existing situation the low-lying areas of the site are flood prone with ponding confined to existing low areas throughout the site primarily bordering the existing open stream and drain channels.

Modelling indicates in the design situation the subdivision can largely be implemented with less than minor effects on surrounding flood levels with positive impacts, decreases in existing peak depths, in a number of surrounding properties as a result of the development mitigation design. The combination of the twin box culvert structure, storage/attenuation areas, open channels and earthworks has resulted in flood free building platforms within the site and less than minor impacts on downstream peak flood depths.

With reference to Figure 19 at location (5a) the bund between the development site and the adjacent property has completely removed ponding which would have otherwise occurred in the 100YR 2130 event. This decrease (removal of ponding) is in the order of 70 to 500 mm and removes approximately 15,000 sqm of ponding from this location. At location (5b), within the same property, the one-way culvert prevents backflow in the design scenario entering the property and maintains existing peak depths in this location, there is however a 40 to 100 mm increase in peak depth upstream of the culvert which is completely contained within the existing open channel/low area, the increase covers approximately 200 sqm.

At location (5c), within the same property, there is an increase in the order of 40 to 80 mm in an existing low-lying area which spans both properties. This increase is completely contained within the low-lying area.

On balance there has been a positive impact on peak depths within the adjacent property associated with the development design.

With reference to Figure 19 the 100YR 2130 peak depth difference comparison shows increases at locations (4a) and (4b) with increases in the order of 100 to 350 mm which are completely contained within existing open channels and do not overtop the channel banks. At location (4b) there is an increase in adjacent property peak depths in the order of 30 to 70 mm.

Given there are decreases in peak depths in the NZTA road reserve designation and adjacent properties at location (3) to the east of location (4b) there is an opportunity to throttle the flow from the east as it enters the development site to mitigate the increases at (4b) which will be investigated at detailed design stage.

Taking the above into account, AWA are confident there is sufficient scope to mitigate the increases in peak flood depths discussed at detailed design stage. In our professional opinion we see the site being considered suitable for future residential development subject to the implementation of strategies outlined in this report.

Expert Witness Code of Conduct

This report has been prepared by Tony Trueman, who is a Senior Hydraulic Modeler at AWA Environmental, experienced in undertaking assessment of effects modelling using Tuflow software. Mr. Trueman holds the qualification of BSc (Hons) Physical Geography.

Mr. Trueman has extensive experience in undertaking assessments of effects modelling of large-scale land development projects, with a focus on stormwater and mitigation, and is considered to be sufficiently qualified to undertake an assessment of this kind.

Although this document has not been written as a statement of expert evidence, I confirm that at all times I have complied with the Environment Court's Code of Conduct for Expert Witnesses contained in its Practice Note 2023 as well as the Engineering New Zealand Code of Ethics.

While this assessment has been undertaken using several software programs including Tuflow modelling software, ArcGIS, QGIS and AutoCAD, no part of the assessment has been undertaken using AI or similar software, also no part of the report has been authored by an AI or similar software.

I declare that in relation to my role in providing expert hydraulic modelling assessment and advice for this project I am not, to the best of my knowledge, subject to any real or perceived conflicts of interest.

CONTENTS

1. INTRODUCTION

Awa Environmental Limited (Awa) was requested by O'Callaghan Design Ltd (OCDL) to undertake flood hazard assessment of effects modelling providing input into an application under the Fast-track Approvals Act 2024 to enable the subdivision and urban development of a site at 169-171 Peka Peka Road as shown in Figure 1.

The subdivision will be built upon an existing green-fields site accessed off Peka Peka Road.

The KCDC Local Waikanae TUFLOW model has been used to undertake this assessment. This model allows for the interaction of hydrological and hydraulic parameters across the catchment including rainfall, groundwater and tidal influences along with stormwater network and open channel flows and includes the M2PP Expressway.

The model has been used to determine.

1. The extent and depth of ponding within the existing scenario,
2. The extent and depth of ponding within the developed scenario,
3. Options assessment for mitigating the development effects of the site.

Flood mitigation measures modelled include.

1. Design storage,
2. Design open channels,
3. Design twin box culver structure,
4. Initial sizing of key design culverts.

1.1. DEVELOPMENT OVERVIEW

The development site is located in Waikanae, on the Kāpiti Coast, adjacent the M2PP expressway.

The development consists of mixed density residential lots and local centre shops accessed off Peka Peka Road. The development extent and preliminary lot layout is shown in Figure 1.

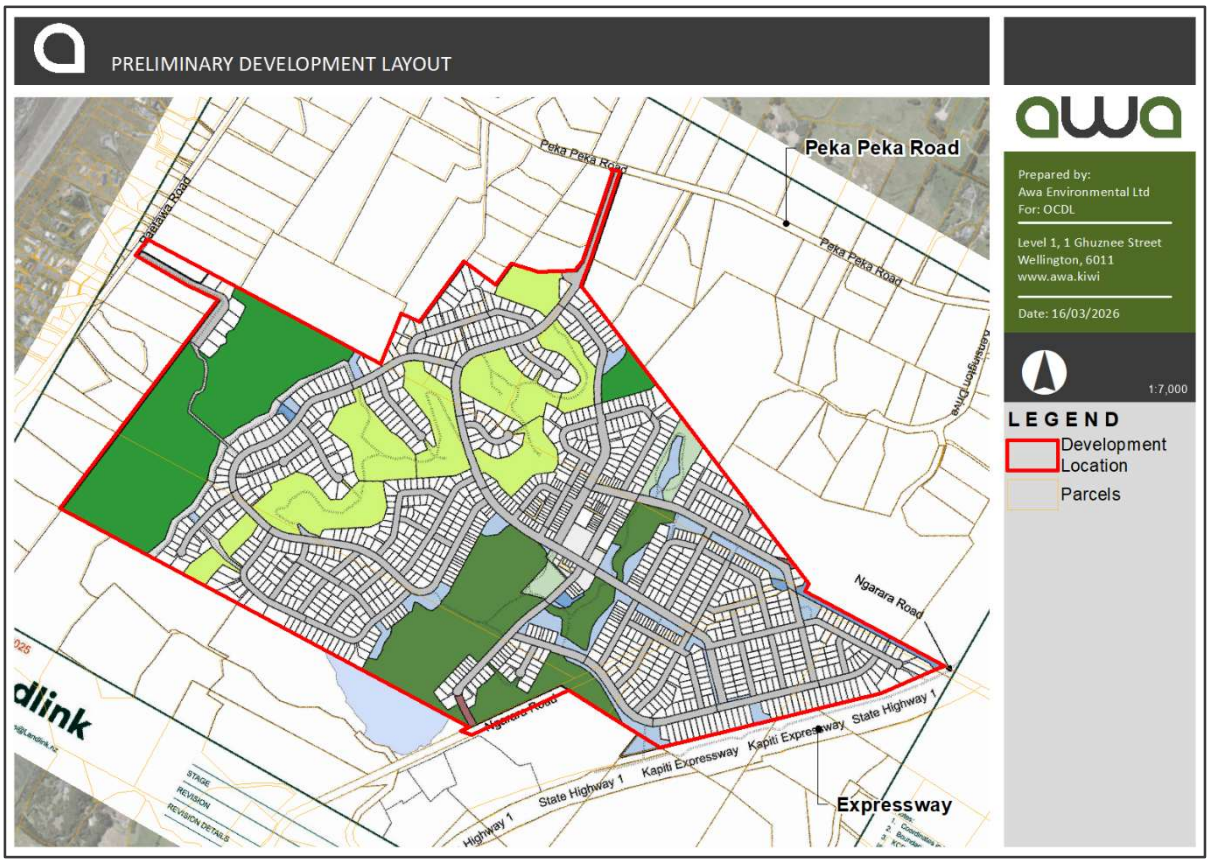


Figure 1. Development Site - Waikanae

1.2. KCDC FLOOD HAZARD PLANNING MAP

The development site is shown located within the ponding, storage, and stream corridor flood hazard categories in Kāpiti Coast District Council's flood hazard planning map (FHPM), as shown in Figure 2. These notations are reflected in the Council's District Plan. This FHPM incorporates flooding from sources including ponding and overflow paths from the local stormwater network and flooding from local streams.

It is worth noting that the FHPM is out of date in this location as fill associated with the M2PP Expressway has removed the ponding and storage currently shown on the Expressway.

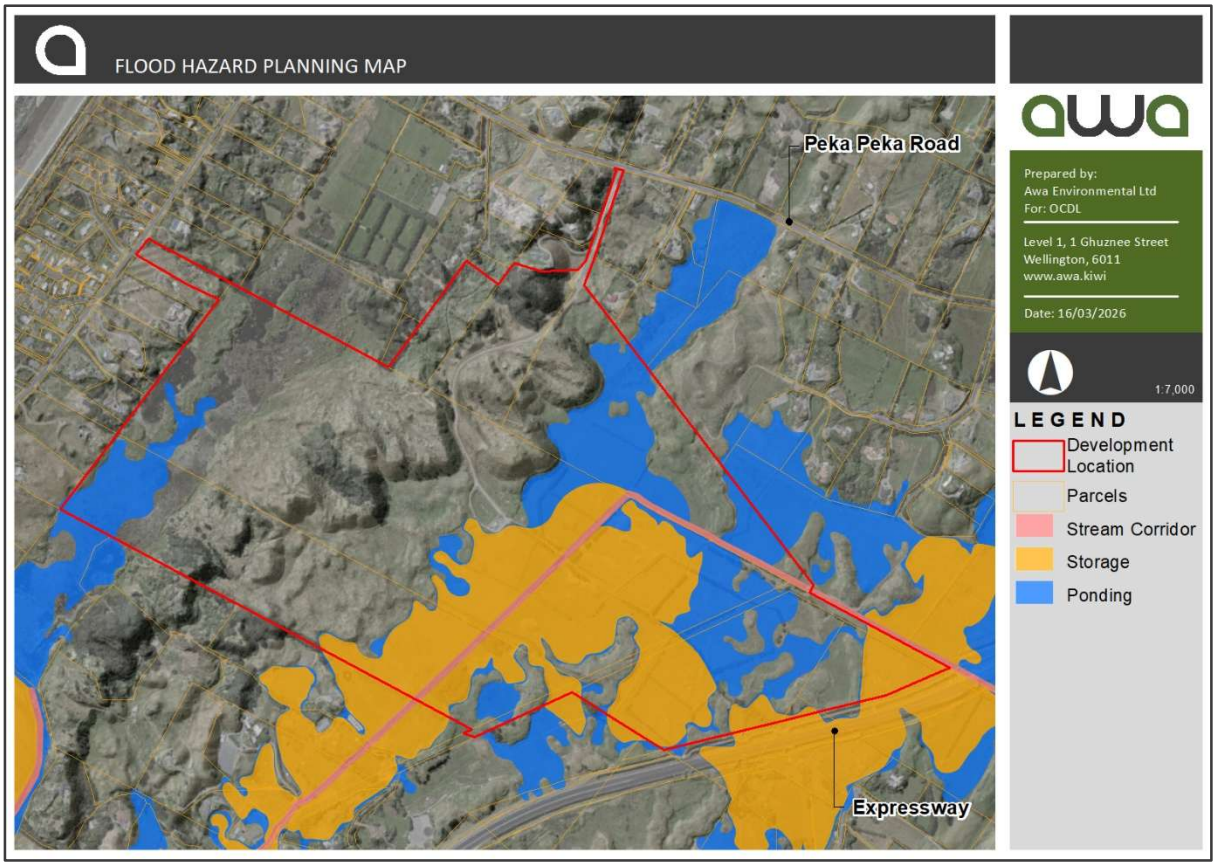


Figure 2 KCDC Flood Hazard Planning Maps

The FHPM represents nine flood hazard categories, as shown in Table 1, with the relevant flood hazard categories and descriptions for the development site shown in bold.

Table 1 Flood Hazard Planning Map Categories

Flood Hazard Category	Description
River corridor	This is the minimum area able to contain a flood of up to the 1% AEP event magnitude and enable flood water to pass safely to the sea. It includes flood and erosion prone land immediately adjacent to the river, where the risk to people and development is significant.

Stream corridor	***This is the minimum area able to contain a flood of up to a 1% AEP event magnitude and enable flood water to safely pass to the stream confluence or the sea. It includes flood and erosion prone land immediately adjacent to the stream.***
Overflow path	Overflow paths generally occur in lower-lying areas on the floodplain which act as channels for flood waters. They can be natural, or artificially formed, and are often characterised by fast flowing water during a flood event. An overflow path is a direct hazard.
Residual overflow path	A residual overflow path is a residual flood hazard for areas which are protected from flooding by structural measures, such as stopbanks or floodwalls, constructed to the 1% AEP flood standard. The residual hazard is in the event of a failure or overtopping of the flood protection structure.
Ponding	***These are areas where slower-moving flood waters could pond either during or after a flood event. A ponding area may be affected by a direct flood risk. Ponding can be associated with rivers and streams as well as the piped stormwater network. Ponding is a direct risk.***
Residual ponding areas	Residual ponding areas related to a residual flood risk for areas which are protected from flooding by structural measures, such as stop banks or floodwalls, constructed to the 1% AEP flood standard. The residual risk is in the event of a failure or overtopping of the flood protection structure.
Shallow surface flow areas	These are floodplain areas, typically on steeper catchments, where shallow moving flood waters could occur during a flood event. A shallow surface flow area is subject to a direct flood risk. This hazard is associated with high intensity rainfall that overwhelms the primary drainage paths resulting in shallow flows across the ground surface.
Flood storage areas	***Land that provides flood water storage either during or after a flood event. Flood storage areas are located on local streams only. They include land that has been identified as flood prone where loss of storage due to mitigating measures, or filling, will cause flooding elsewhere. Any proposal for development of these areas (including filling) will need to provide compensatory storage below set ponding levels.***
Fill control areas	Fill control areas are undrained “crater” type catchments where filling will raise the level of flooding on the property and on adjoining land.

2. EXISTING FLOOD HAZARD

2.1. EXISTING SITUATION

The KCDC 2YR 2130, 10YR 2130, 50YR 2130 and 100YR 2130 Local Waikanae TUFLOW models have been used to determine the existing flooding within the site.

Modelling indicates in the existing situation the low-lying areas of the site are flood prone in the 2YR 2130, 10YR 2130, 50YR 2130 and 100YR 2130 events with ponding confined to existing low areas within the site primarily bordering the existing open channels and field drains.

An overview of the flooding mechanisms within the site in the existing situation is as follows with reference to Figure 3, Figure 4, Figure 5 and Figure 6.

1. Flows enter the site from the east under the M2PP expressway via three culverts, which also capture and discharge flows from swales running parallel to the expressway.
2. The open channel (Main North Channel) drains a majority of the upstream catchment to the south-east under the M2PP expressway, this open channel extends through the site exiting along the south-western boundary.
3. Flows enter the site from the north-east via an existing open channel draining low lying land and runoff from the M2PP expressway attenuation/storage areas.
4. Flows enter the site from the north-east via an existing open channel draining low lying land.
5. Flows from the open channels and rainfall onto the ground surface result in ponding within the lower lying topography of the site.

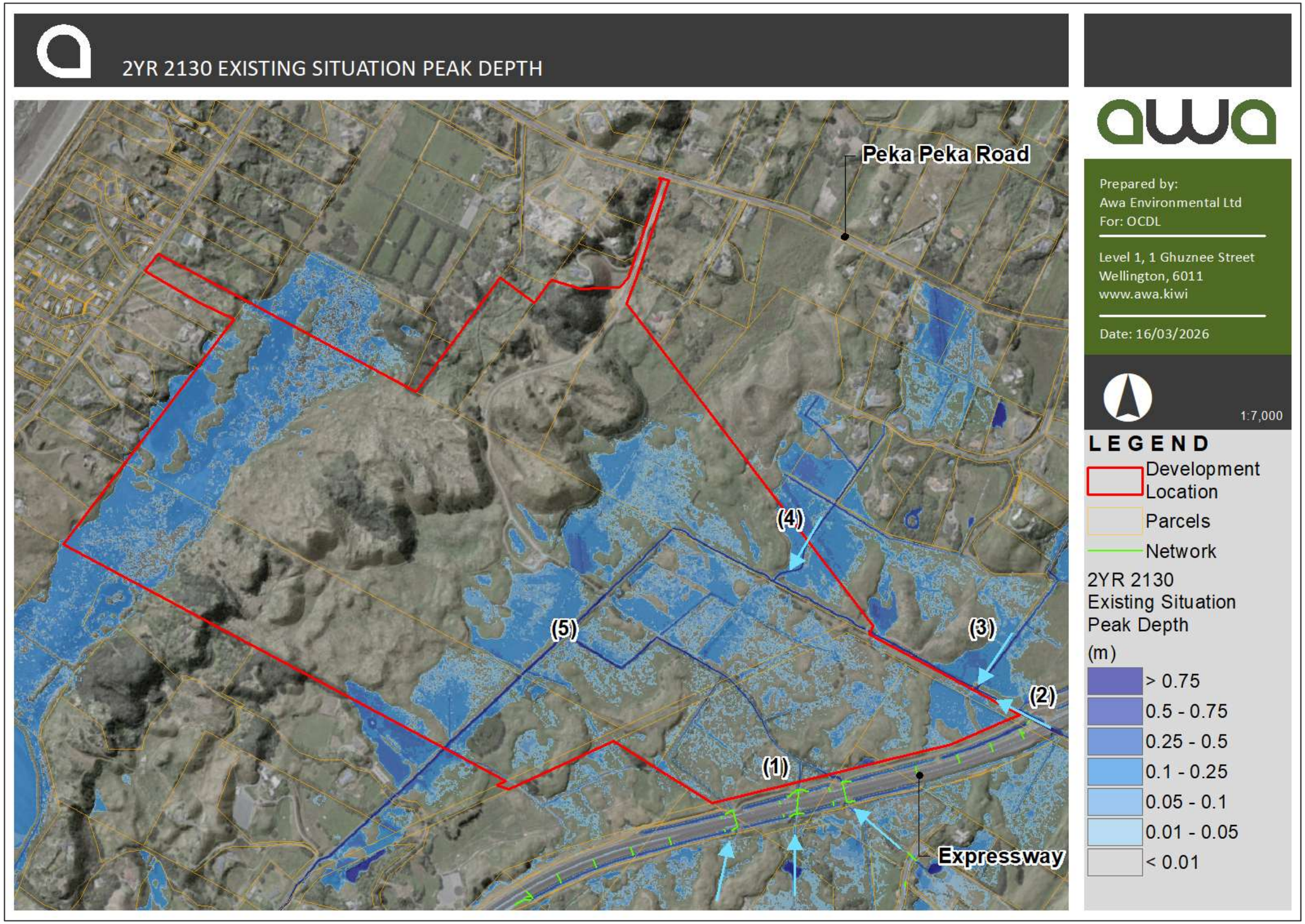


Figure 3 Existing Situation 2YR 2130 Modelled Peak Depth

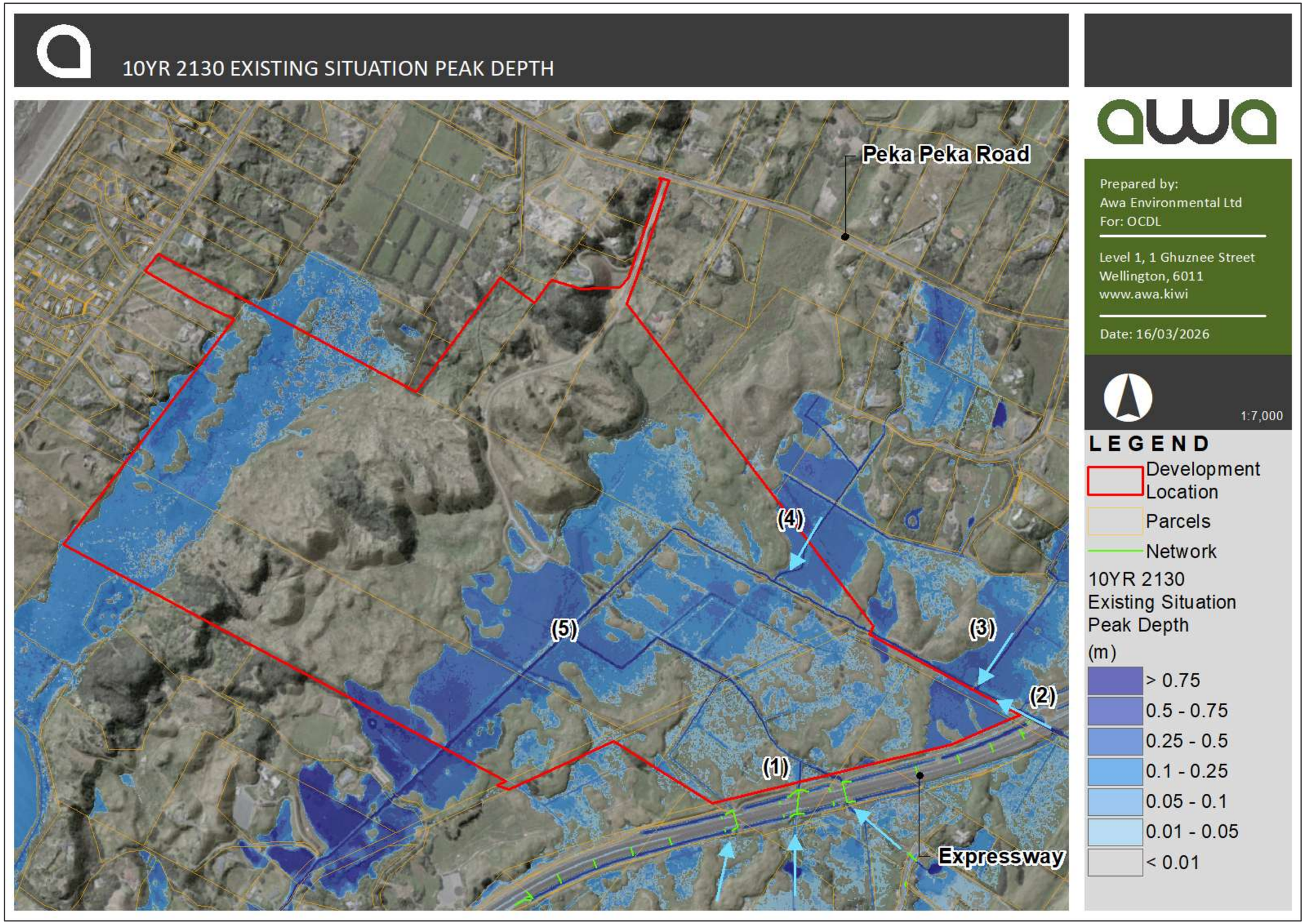


Figure 4 Existing Situation 10YR 2130 Modelled Peak Depth

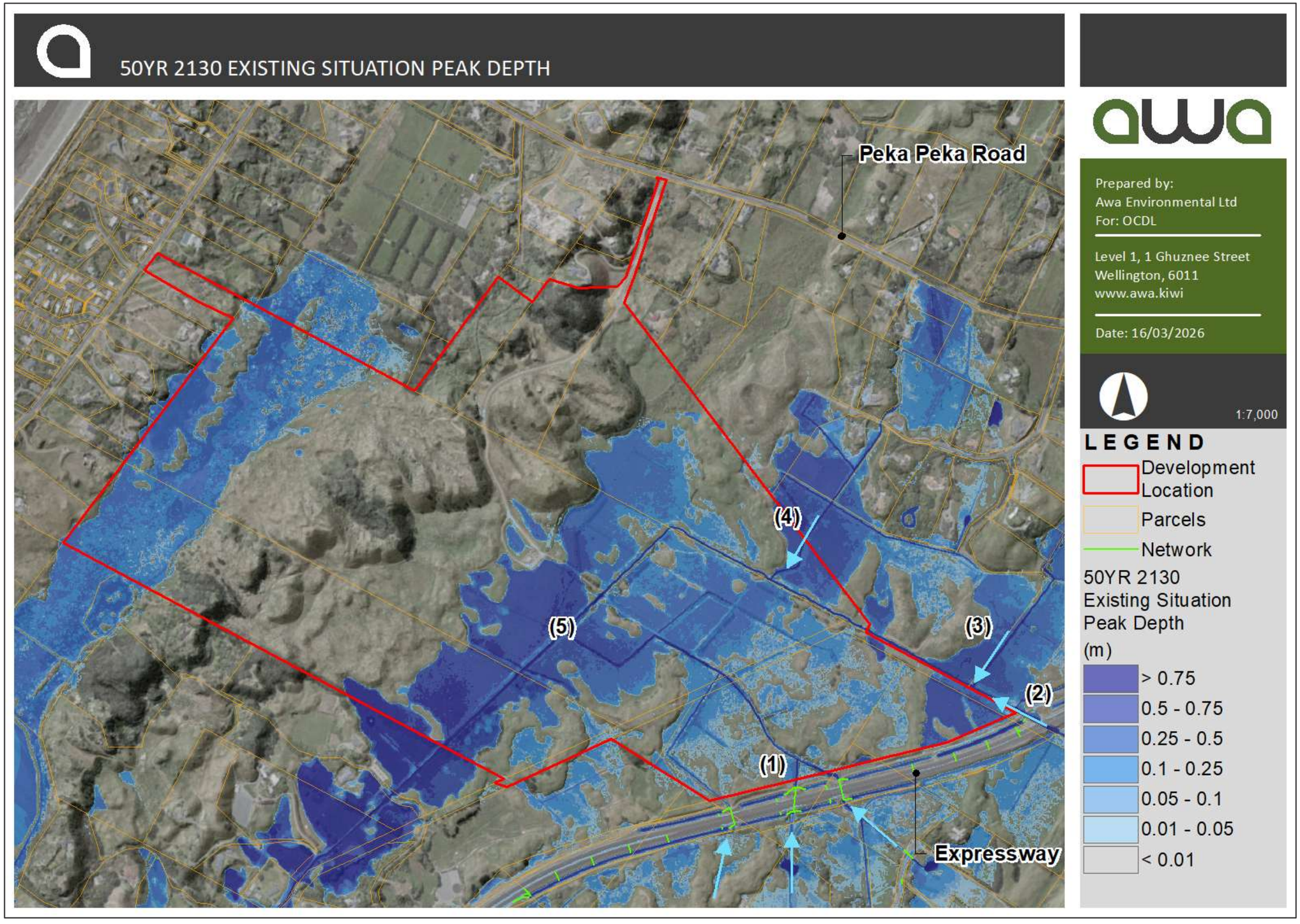


Figure 5 Existing Situation 50YR 2130 Modelled Peak Depth

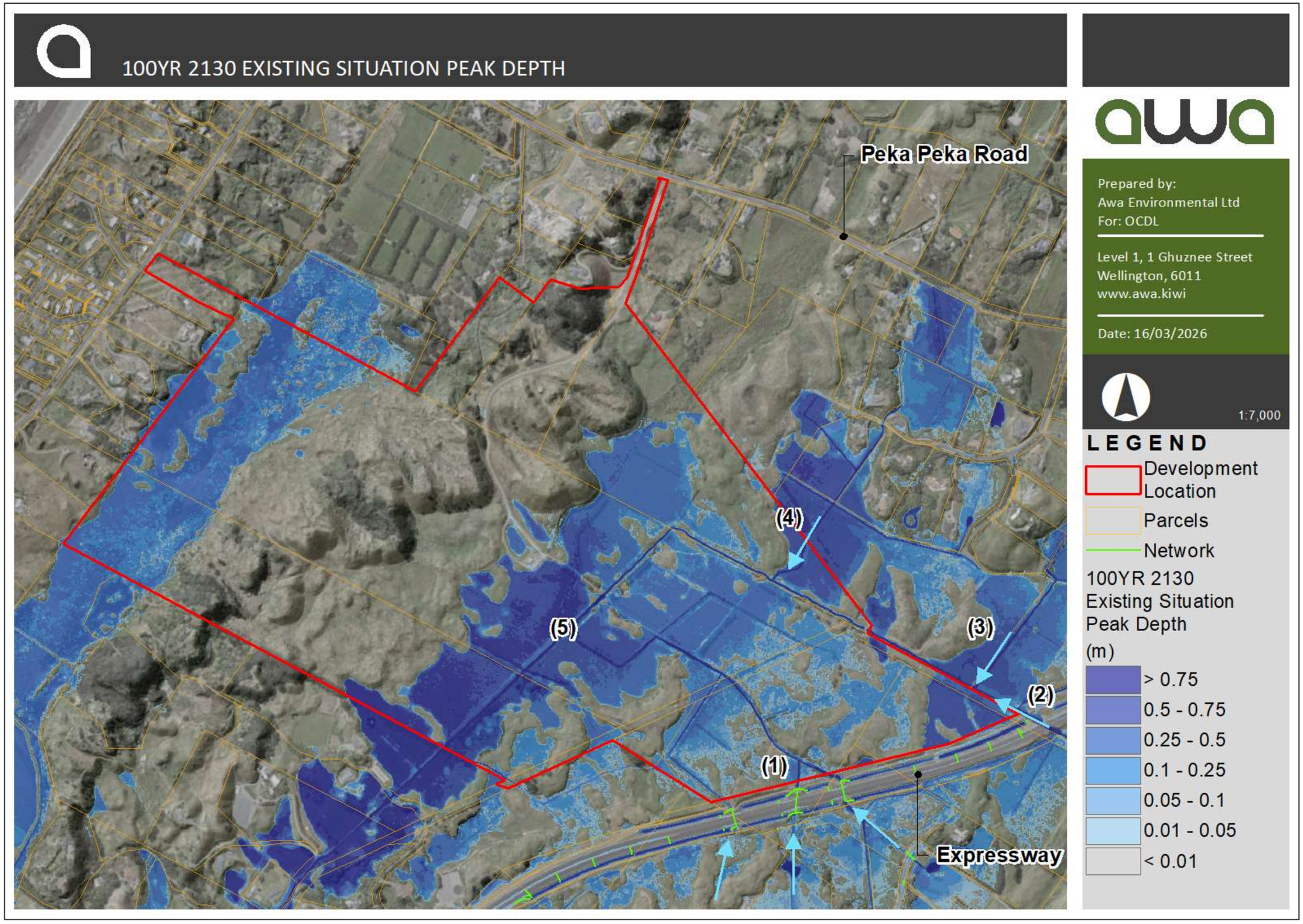


Figure 6 Existing Situation 100YR 2130 Modelled Peak Depth

3. DEVELOPMENT

3.1. DESIGN EARTHWORKS

Earthworks and landscaping are proposed to modify the existing dune topography to allow for residential development. In some low-lying areas fill will be required to raise the design lots to meet recommended building levels (RBL's) while some areas of elevated dune topography will be cut to provide fill and create building platforms.

A new design swale will be created within the development extent running parallel to the existing open channel (Main North Channel) for a length of approximately 400 metres to allow overflows from the existing open channel to overflow into the design swale to provide additional conveyance and storage.

The location/cross-section of the Main North Channel running through the site will be modified to connect to the design storage/attenuation areas.

The location/cross-section of the two open channels conveying flow through the site from the south under the M2PP expressway via three culverts will be modified with some sections of the existing open channels filled and others earth worked to create new design channels.

At the south-western extent of the site a raised bund and weir structure will be integrated with the twin box culvert structure to provide design storage/attenuation areas allowing ponding depths to increase upstream of the structure.

The existing site topography is shown in Figure 7 with the design topography shown in Figure 8 and the cut/fill earth work balance shown in Figure 9.

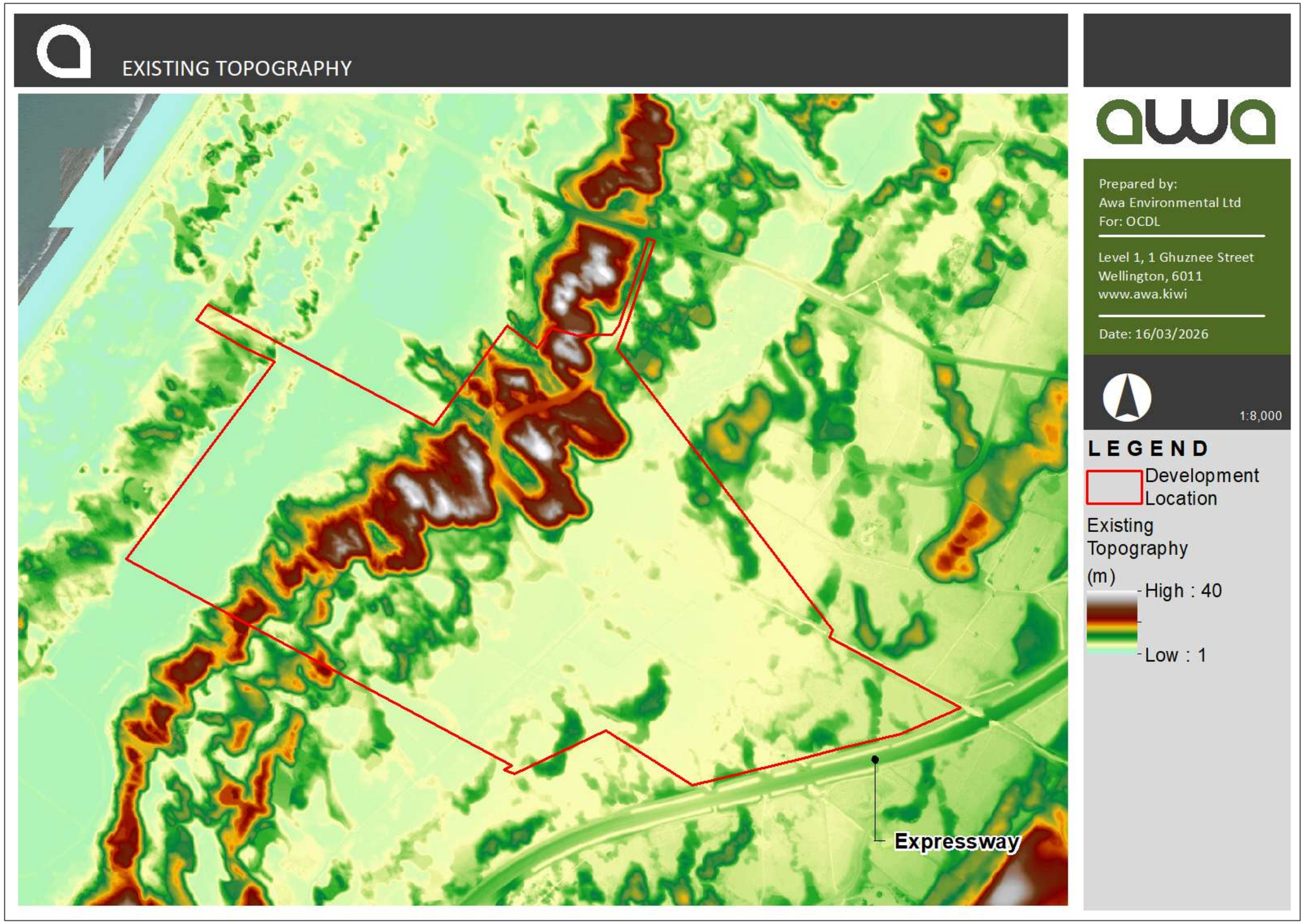


Figure 7 Existing Topography

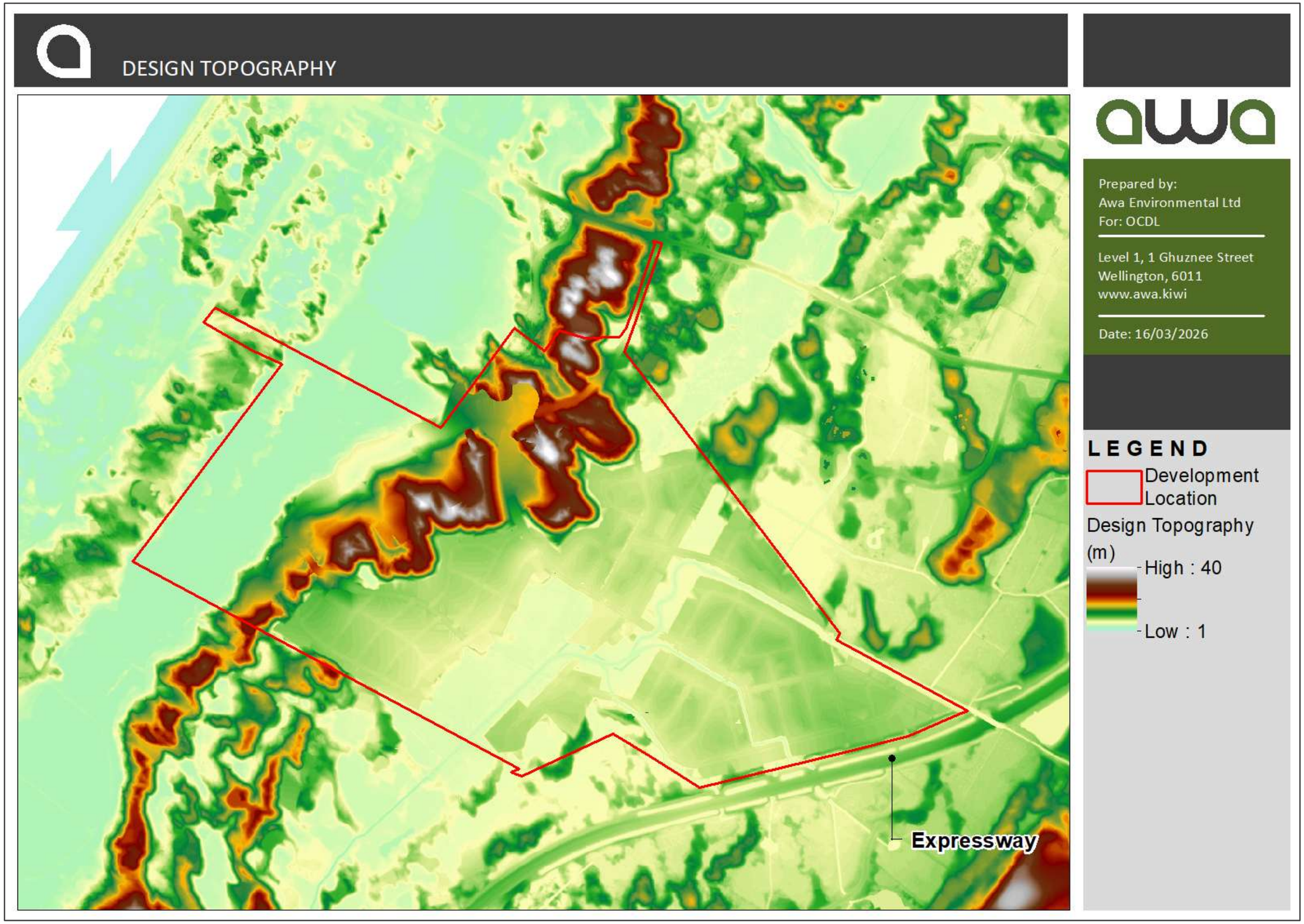


Figure 8 Design Topography

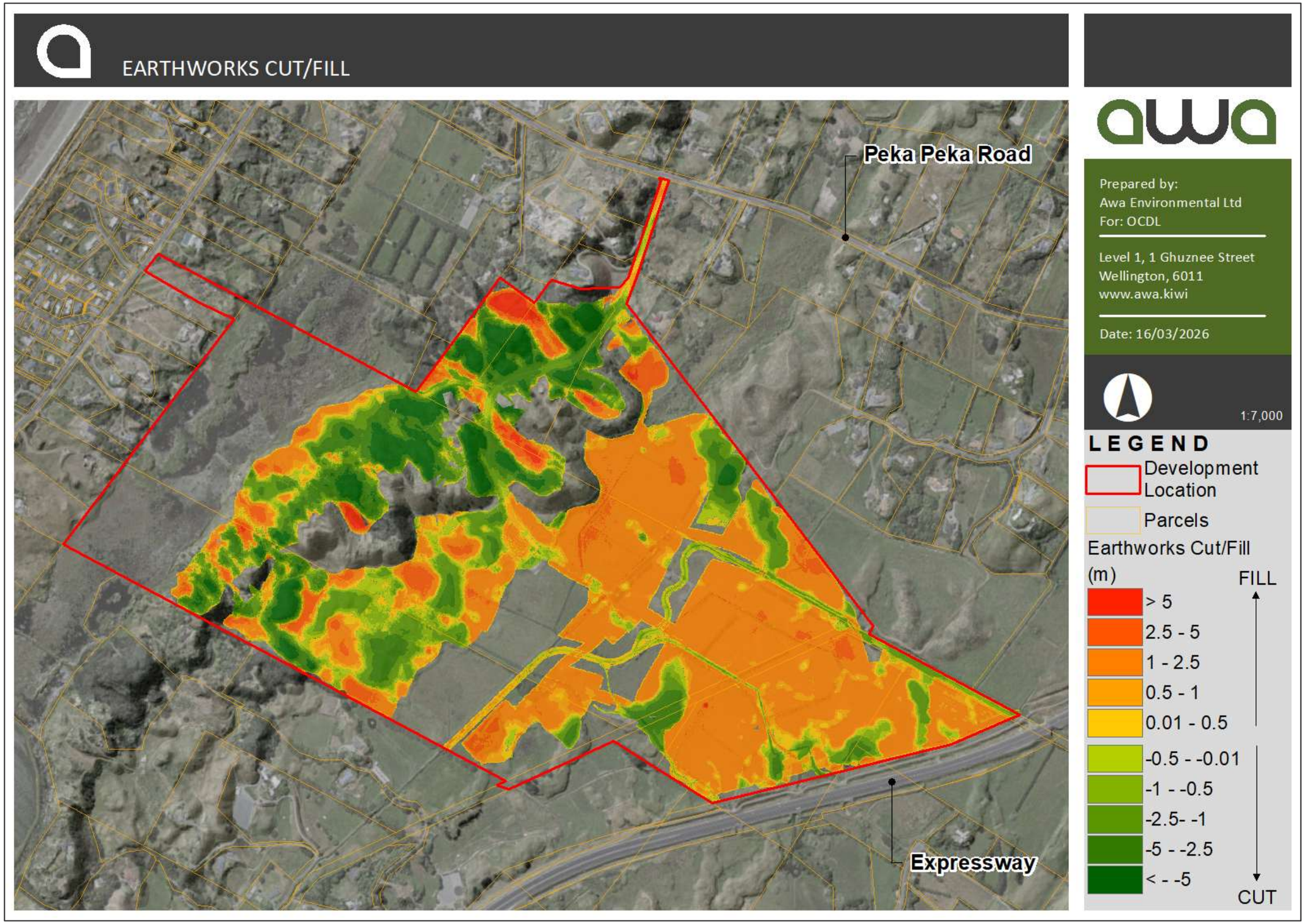


Figure 9 Earthworks Cut/Fill

3.2. DESIGN MITIGATION

The primary form of stormwater mitigation, for the displacement of storage on the floodplain associated with fill, will be via storage/attenuation at the twin box culvert structure within the design open channel allowing ponding depths to increase upstream of the structure into storage/attenuation areas.

Hydraulic neutrality will be achieved across the development utilising soakage and attenuation devices. Soakage will be utilised within each lot (except for the lots in the low-lying central and eastern zone of the site where earthworks filling is proposed for raising the land above expected flood levels) and attenuation provided within each lot or in the road reserve or in areas adjacent to the low-lying floodable areas.

3.2.1. DESIGN COMPENSATORY STORAGE

An overview of the design compensatory storage mechanisms and open channels within the site is as follows with reference to Figure 10.

(1a) The existing open channel (Main North Channel) as it enters the site, the open channel (blue line) is within the neighbouring property.

(1b) A new secondary overflow channel (orange dashed line) will be constructed within the development extent parallel to the existing channel for a length of approximately 400 metres. This secondary overflow channel will operate in tandem to the existing channel in larger flood events.

(1c) The location/cross-section of the Main North Channel running through the site (yellow dashed line) will be modified to connect to the design storage/attenuation areas. Some sections of the existing open channel will be filled and others earth worked to create a new design channel to provide additional conveyance and storage.

(1d-e) Modification of the location of some sections of the existing open channel with some filled and others earth worked to create new design channels.

(2a-b) New culverts maintaining existing flows into the development extent.

A number of culverts are required to maintain flows from surrounding properties into the development site and to convey flows within the development; these have been sized using peak flows from the model.

(3) The creation of design storage/attenuation areas throughout the low-lying areas of the site interconnected by the design open channels. The ground level within the storage/attenuation areas has been raised by 150 mm in the design scenario to account for storage loss associated with vegetation bulk as the areas are to be planted.

(4) A design twin box culvert structure in this location will throttle flows leaving the site allowing ponding depths to increase upstream of the structure into the design storage/attenuation areas. The design structure consists of 2* 2.0 metre (wide) by 0.8 metre (high) box culverts with a 6-metre-wide weir crest at RL 6.65 (VD1953) and a raised bund either side of the weir crest at RL 7.0 (VD1953) connecting to the existing elevated dune ridge in this location.

The new twin box culvert structure is located outside of the urban development footprint in the neighbouring property. The neighbour has agreed to this and has accepted the additional ponding on their site during the design events. An easement has been secured to provide for this structure and associated ponding.

(5) A design bund and one-way culvert in this location will stop ponding from moving into the neighbouring property outside the development extent in both the existing and design scenarios.

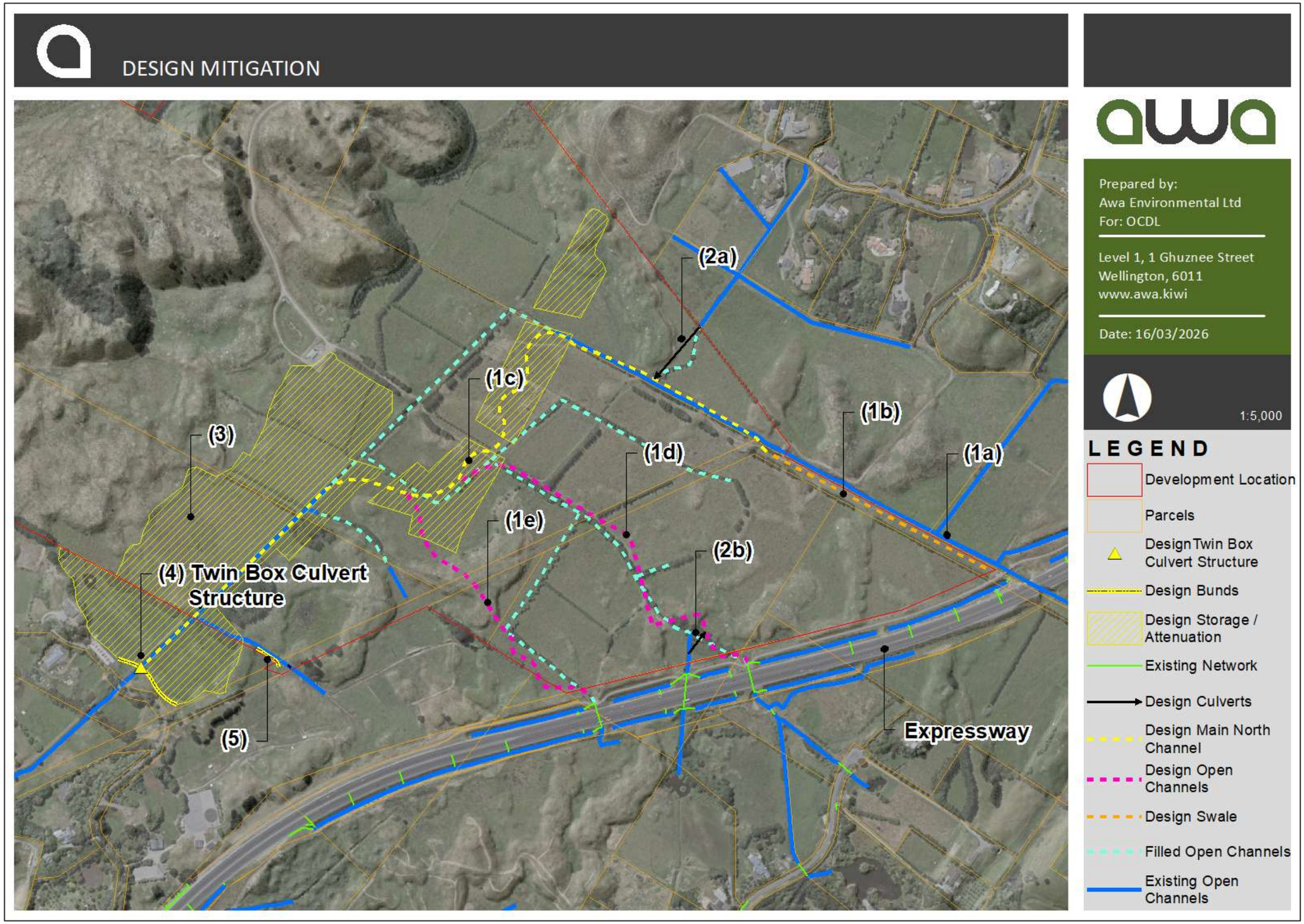


Figure 10 Design Mitigation

3.2.2. LOW IMPACT DESIGN

Development of the site will result in an increase in discharges associated with impervious areas. As set out in the Landlink Stormwater Management Plan, it is proposed to utilise low impact stormwater design solutions as the primary form of mitigation. These will take the form of soakage and attenuation devices located within each individual lot or within the road reserve or open space land and final design of these will be subject to approval by KCDC to ensure the proposed devices meet KCDC's requirements.

4. DESIGN FLOOD HAZARD

4.1. DESIGN SITUATION

The KCDC 2YR 2130, 10YR 2130, 50YR 2130 and 100YR 2130 Local Waikanae TUFLOW models have been modified with the design earthworks and mitigation measures to determine the design flood hazard within the site.

An overview of the flooding mechanisms within the site in the design situation is as follows with reference to Figure 11, Figure 12, Figure 13 and Figure 14.

1. Flows from the three culverts south of the development site are conveyed through the development in the design channels entering the storage/attenuation areas in the low-lying areas of the site.
2. Flow within the open channel (Main North Channel) overflows into the design swale within the development extent. The design swale increases conveyance and storage through the site.
3. The design open channel has increased the channels conveyance and storage which has reduced the tailwater influence in this location increasing discharge from this open channel from neighbouring properties.
4. The design open channel has increased the channels conveyance and storage which has reduced the tailwater influence in this location increasing discharge from this open channel from neighbouring properties.
5. The downstream twin box culvert structure throttles peak flows resulting in an increase in peak flood depths within the low-lying design storage/attenuation areas. Some ponding within the site also occurs within the road reserve and will be mitigated with the modelling of the low impact design solutions.
6. A design bund and one-way culvert have removed ponding in the adjacent property in the 50YR 2130 and 100Y 2130 events. Also refer to the area 5a on Figure 18 and Figure 19 of the depth difference maps

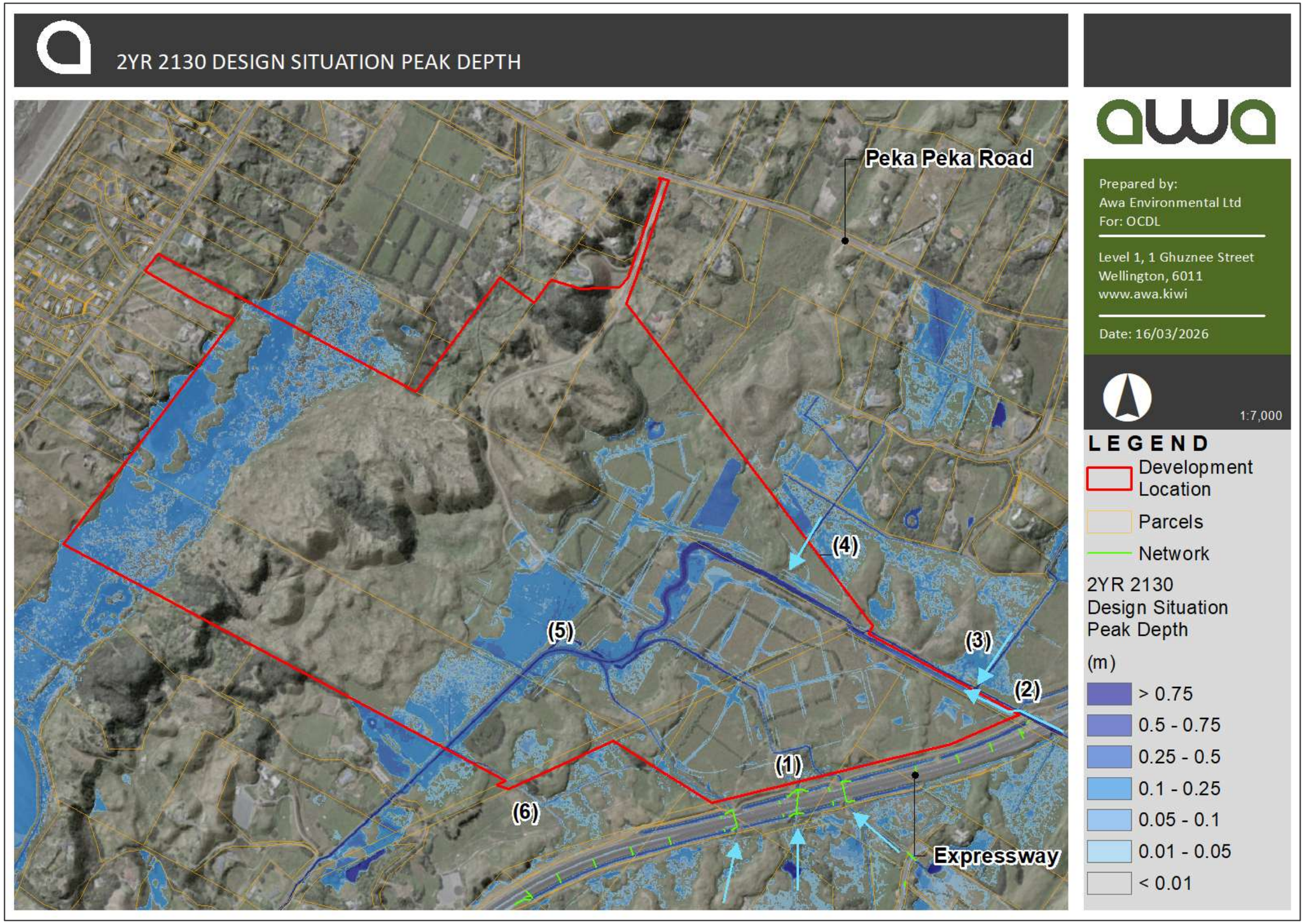


Figure 11 Design Situation 2YR 2130 Modelled Peak Depth

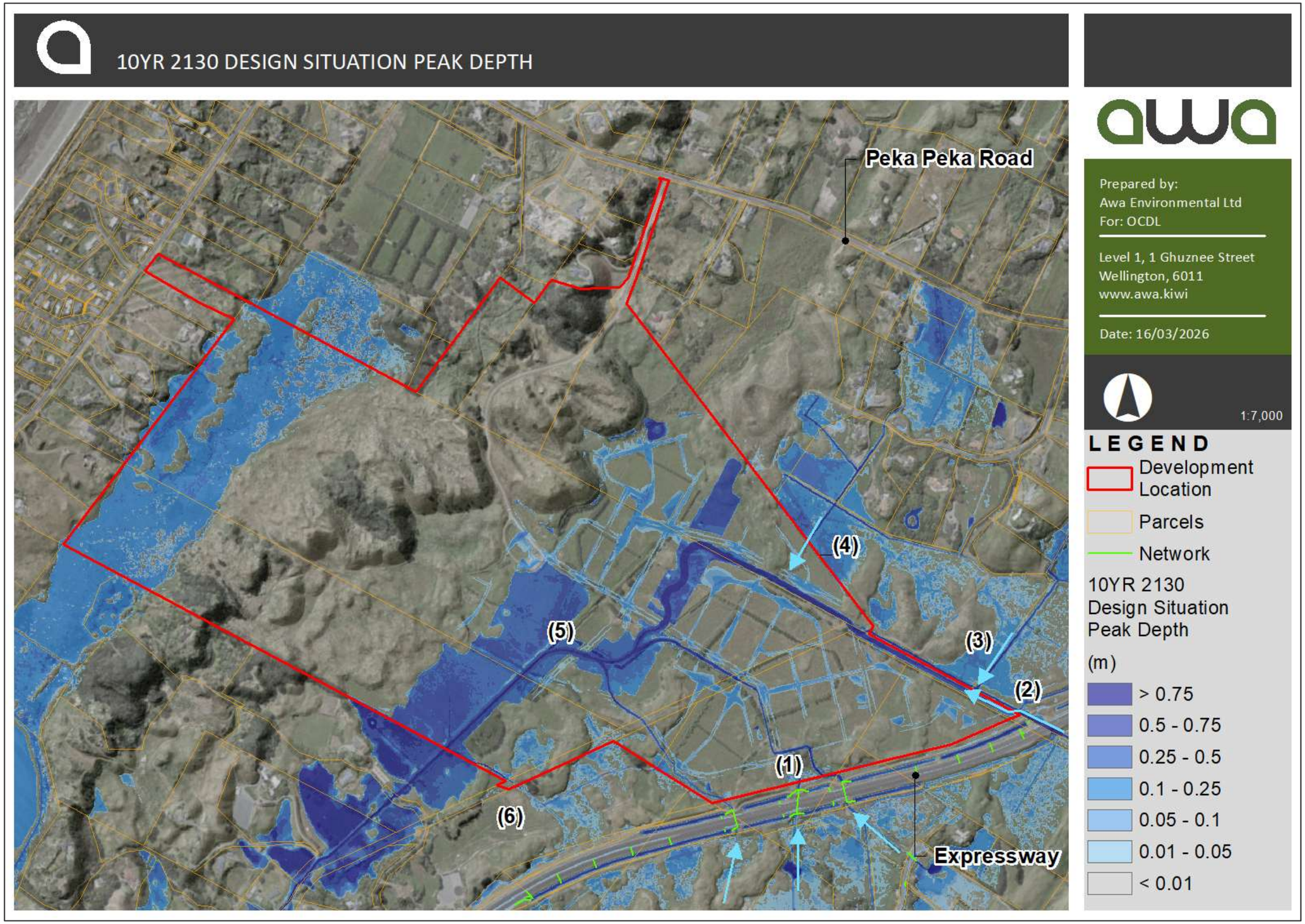


Figure 12 Design Situation 10YR 2130 Modelled Peak Depth

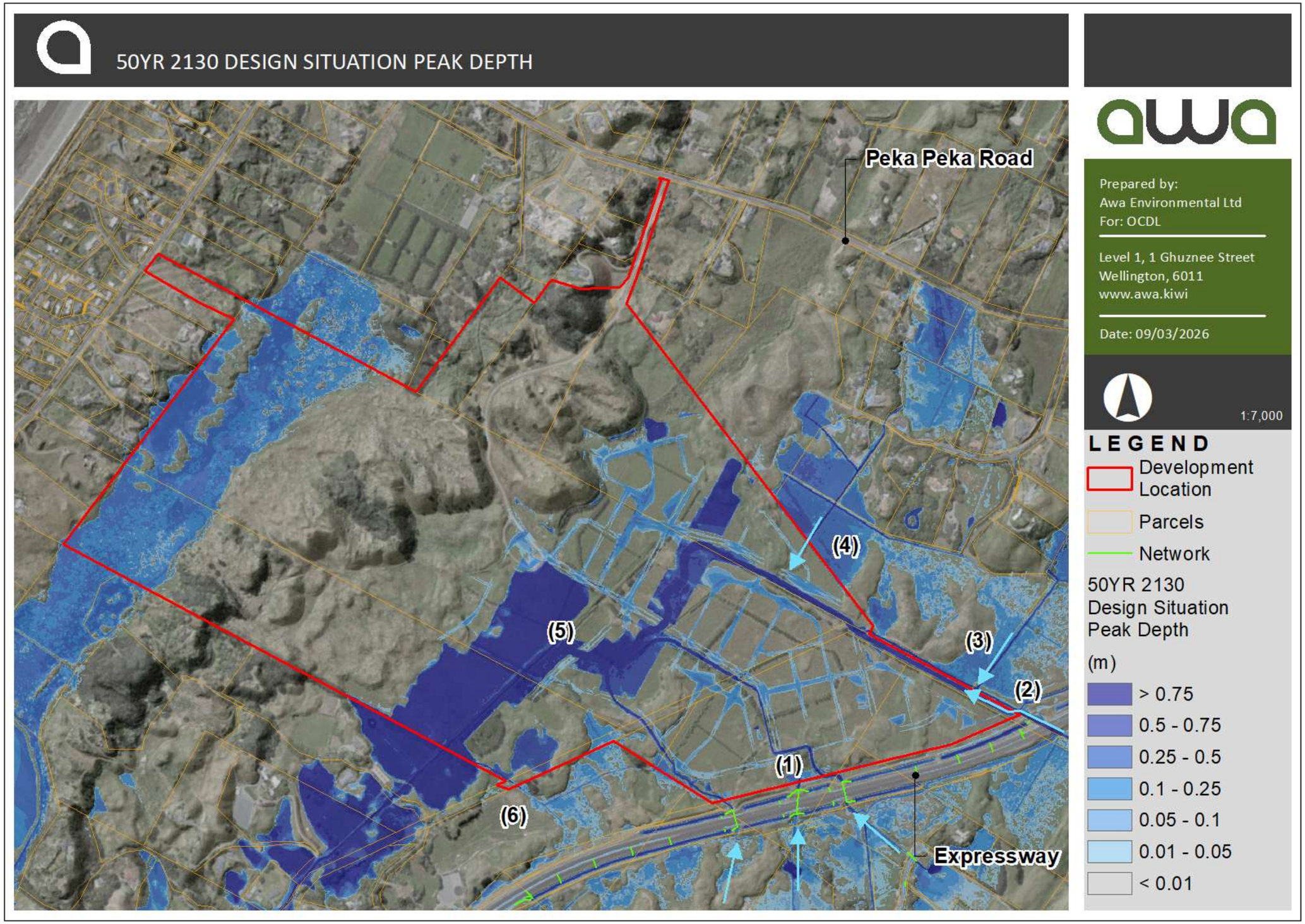


Figure 13 Design Situation 50YR 2130 Modelled Peak Depth

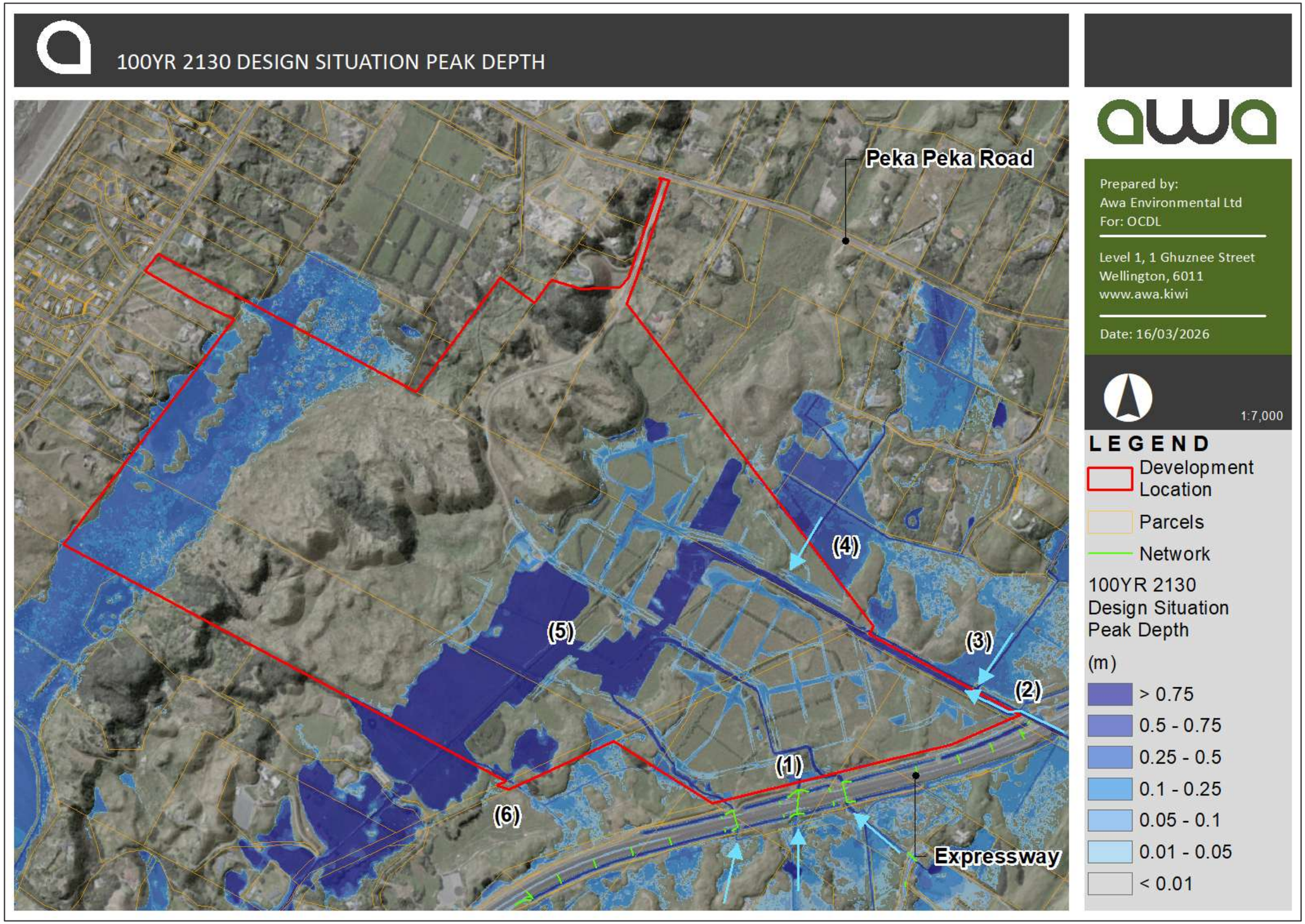


Figure 14 Design Situation 100YR 2130 Modelled Peak Depth

4.1.1. DESIGN TOP WATER LEVELS

Design top water levels for the 100YR 2130 design situation (VD2016) have been extracted from the model to show changing top water levels across the site as shown in Figure 15.

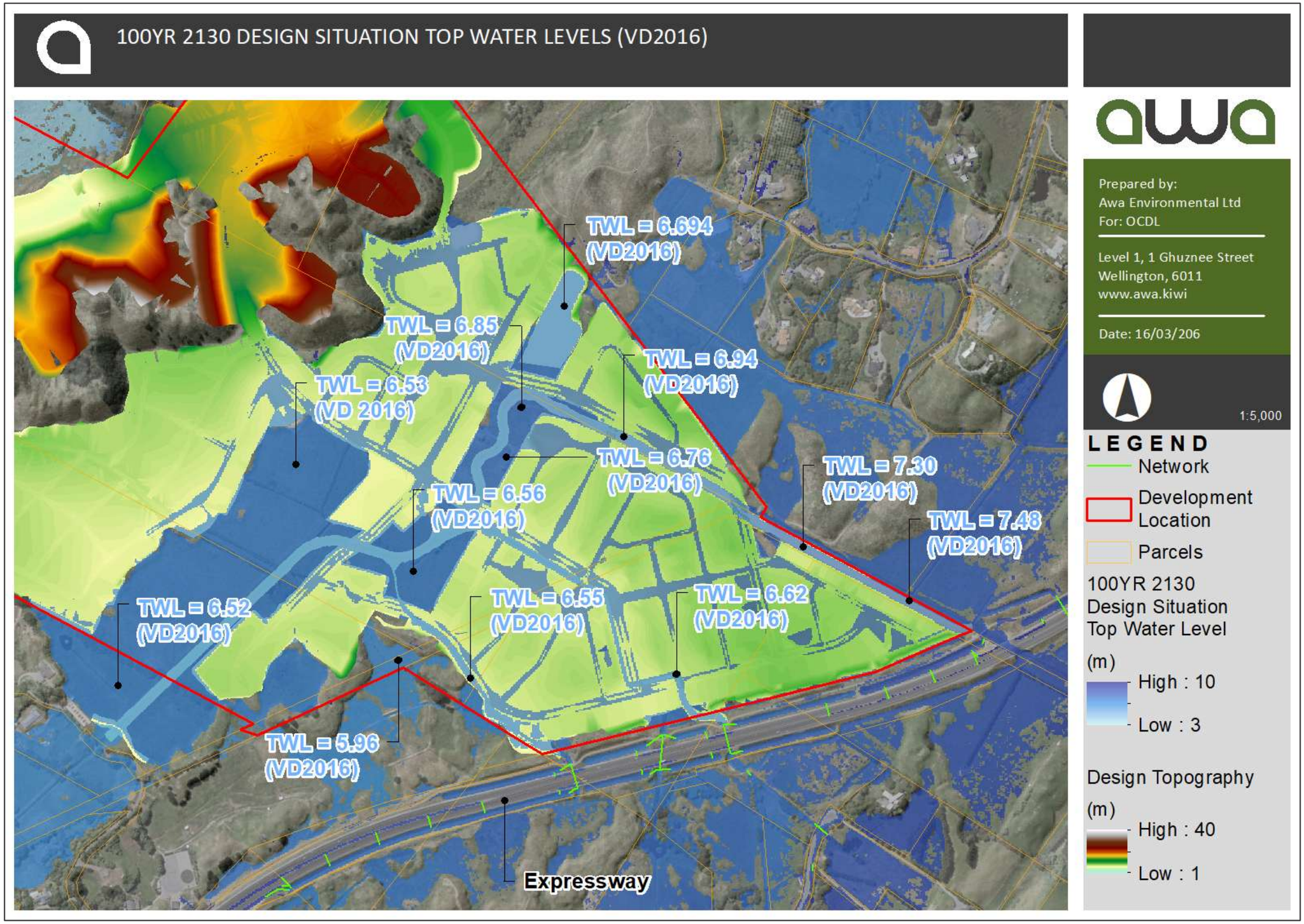


Figure 15 100YR 2130 Design Top Water Levels

4.1.2. INUNDATION DEPTH DIFFERENCE

A comparison of the peak depth difference between the 2YR, 2130 10YR 2130, 50YR 2130 and 100YR design situation and existing situation has been undertaken by extracting the peak inundation depth results from the design situation and subtracting them from the peak inundation results from the existing situation.

Any increase/decrease in peak flood depth +/- 20 mm has been excluded as this is outside the tolerance of flood modelling and is therefore considered by AWA to be less than minor.

Colours (orange to red) represent an increase in peak depth with (green) representing a decrease in peak flood depth.

An overview of the peak depth difference between design situation and existing situation is as follows with reference to Figure 16, Figure 17, Figure 18 and Figure 19**.**

2YR 2130 DEPTH DIFFERENCE

The 2YR 2130 peak depth difference comparison shows decreases in ponding depths in properties to the north-west of the development in the order of 120 to 130 mm at location (1). There are no other increases/decreases outside of the development extent +/- 20 mm.

10YR 2130 DEPTH DIFFERENCE

The 10YR 2130 peak depth difference comparison shows decreases in ponding depths in properties to the north-west of the development in the order of 40 to 300 mm at location (1) and 60 to 200 mm at location (2). At location 3 the bund and one-way culvert have stopped flows which would have otherwise entered the neighbouring property. There are no other increases/decreases outside of the development extent +/- 20 mm.

50YR 2130 DEPTH DIFFERENCE

The 50YR 2130 peak depth difference comparison shows decreases in peak depths in properties to the north-west of the development in the order of 80 to 340 mm at location (1) and 90 to 200 mm at location (2). At location (3) there are decreases in neighbouring properties to the south in the order of 40 to 100 mm. At locations (4a) and 4(b) these are increases in peak depths in the order of 100 to 200 mm which are completely contained within existing open channels and do not overtop the channel banks. These increases are contained within the NZTA road reserve designation.

Given there are decreases in peak depths in the NZTA road reserve designation at location (3) to the east of location (4b) there is an opportunity to throttle the flow from the east as it enters the development site to mitigate the increases at (4b) which will be investigated at detailed design stage.

At location (5a) the bund between the development site and the adjacent property has completely removed ponding which would have otherwise occurred in the 50YR 2130 event. This decrease (removal of ponding) is in the order of 40 to 350 mm and removes approximately 10,000 sqm of ponding from this location. At location (5b), within the same property, the one-way culvert prevents backflow in the design scenario entering the property and maintains existing peak depths in this

location, there is however a 30 to 100 mm increase in peak depth upstream of the culvert which is completely contained within the existing open channel/low area, the increase covers approximately 200 sqm.

At location (5c), within the same property, there is an increase in the order of 30 to 80 mm in an existing low-lying area which spans both properties. This increase is completely contained within the low-lying area.

100YR 2130 DEPTH DIFFERENCE

The 100YR 2130 peak depth difference comparison shows decreases in peak depths in properties to the north-west of the development in the order of 80 to 320 mm at location (1) and 90 to 110 mm at location (2). At location (3) there are decreases in neighbouring properties to the south in the order of 40 to 100 mm. At locations (4a) and 4(b) these are increases in peak depths in the order of 100 to 350 mm which are completely contained within existing open channels and do not overtop the channel banks. At location (4b) there is an increase in adjacent property peak depths in the order of 30 to 70 mm.

Given there are decreases in peak depths in the NZTA road reserve designation and adjacent properties at location (3) to the east of location (4b) there is an opportunity to throttle the flow from the east as it enters the development site to mitigate the increases at (4b) which will be investigated at detailed design stage.

At location (5a) the bund between the development site and the adjacent property has completely removed ponding which would have otherwise occurred in the 100YR 2130 event. This decrease (removal of ponding) is in the order of 70 to 500 mm and removes approximately 15,000 sqm of ponding from this location. At location (5b), within the same property, the one-way culvert prevents backflow in the design scenario entering the property and maintains existing peak depths in this location, there is however a 40 to 100 mm increase in peak depth upstream of the culvert which is completely contained within the existing open channel/low area, the increase covers approximately 200 sqm.

At location (5c), within the same property, there is an increase in the order of 40 to 80 mm in an existing low-lying area which spans both properties. This increase is completely contained within the low-lying area.

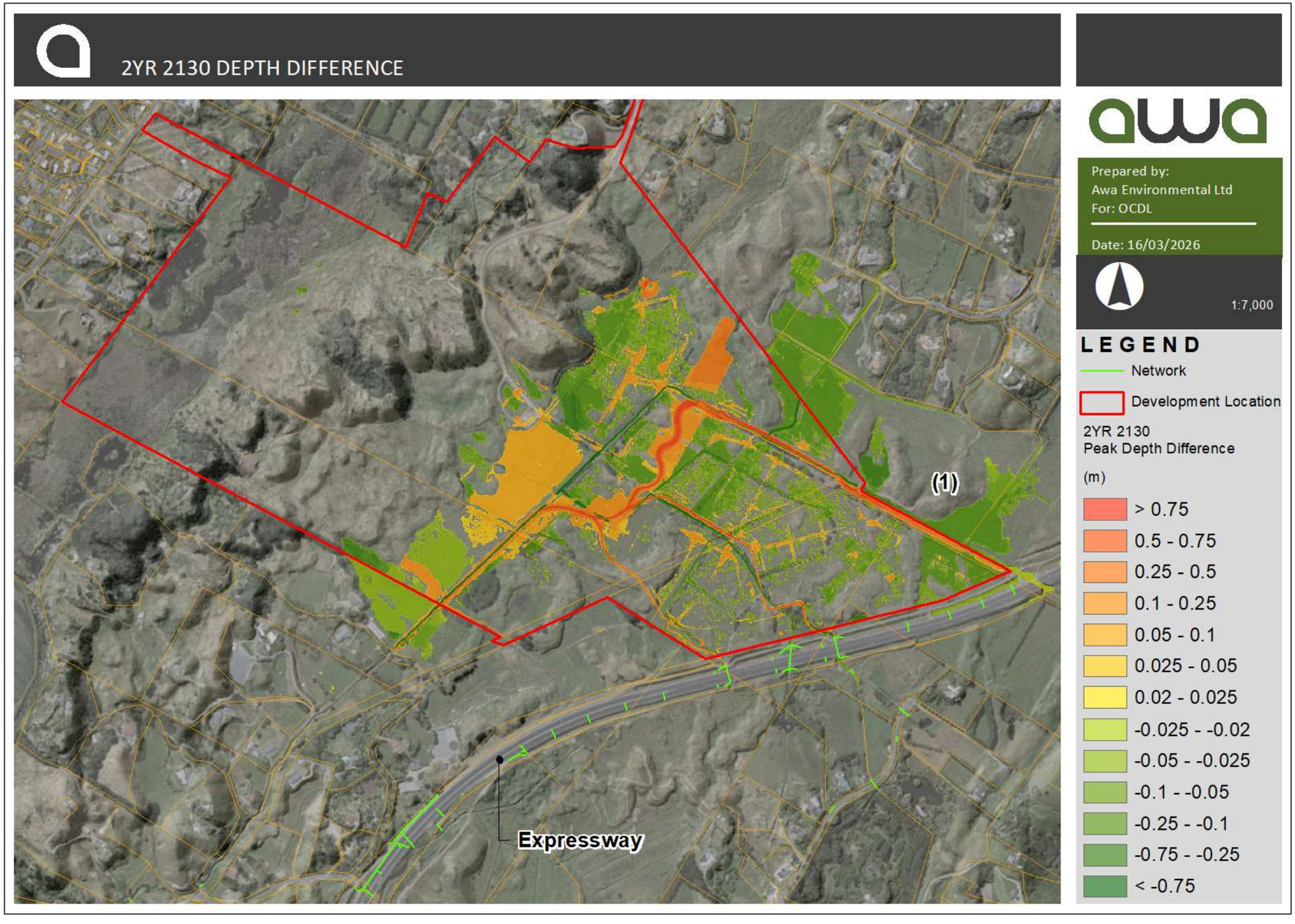


Figure 16 Depth Difference 2YR 2130

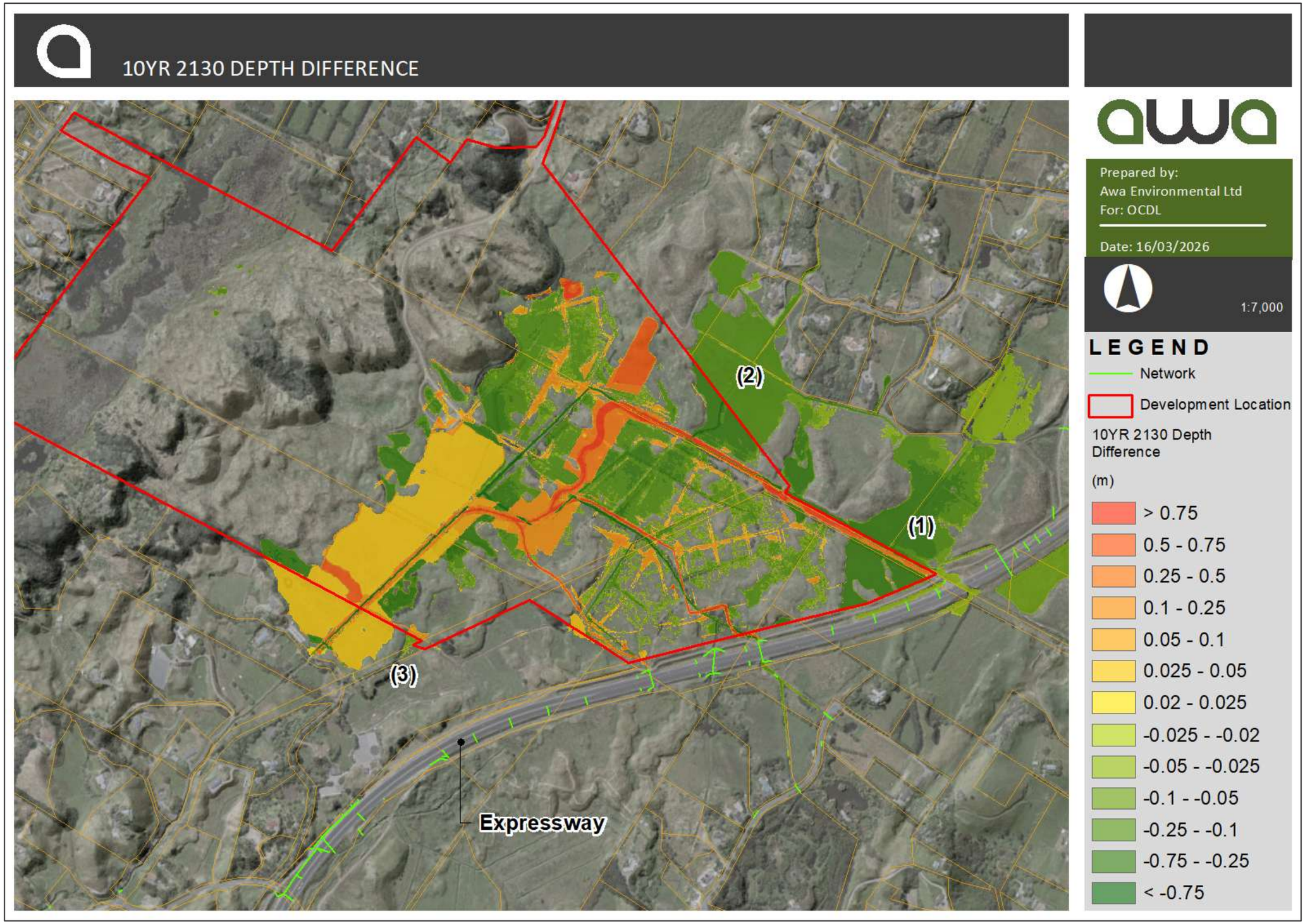


Figure 17 Depth Difference 10YR 2130

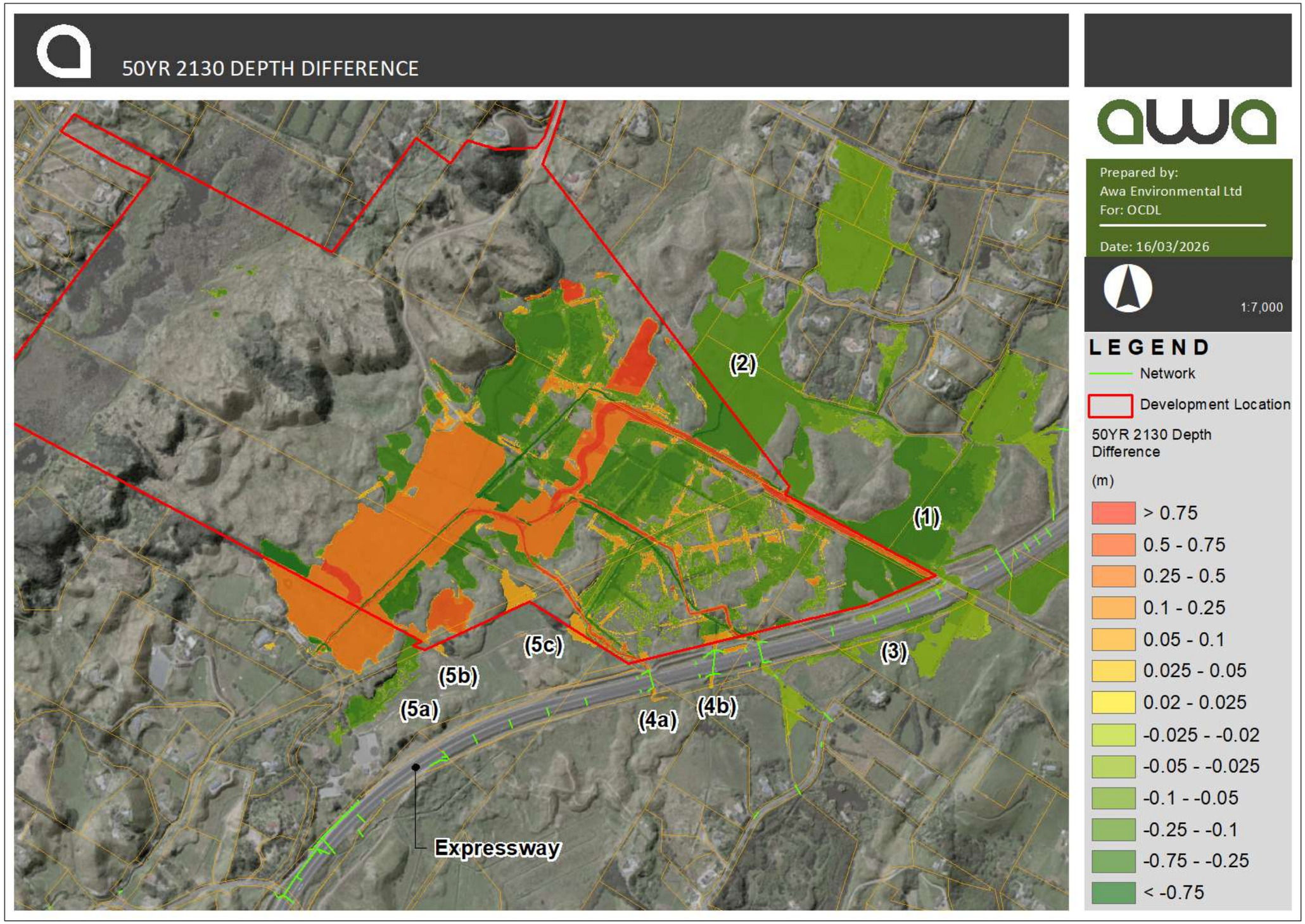


Figure 18 Depth Difference 50YR 2130

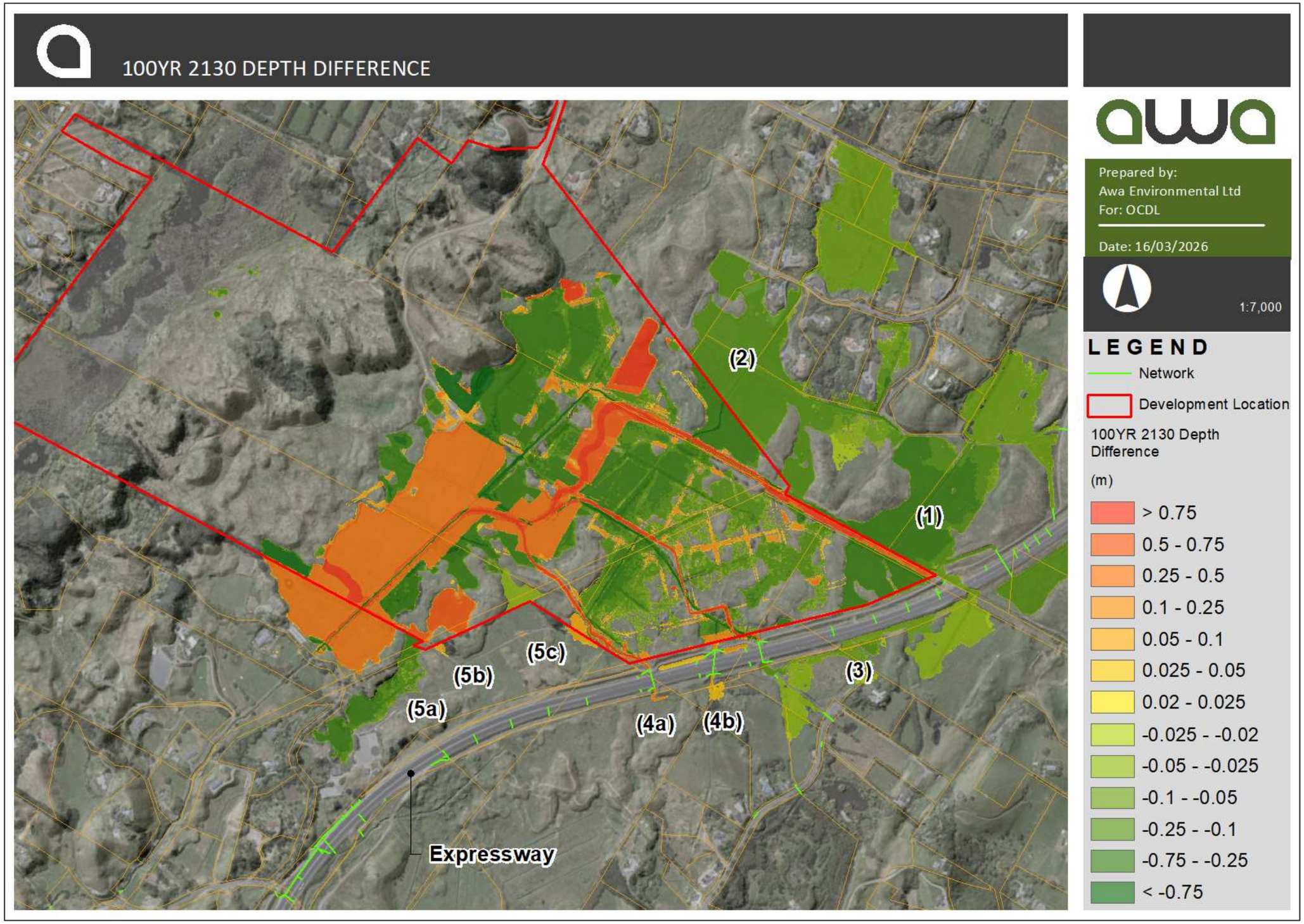


Figure 19 Depth Difference 100YR 2130

5. DESIGN LEVELS

5.1.1. RECOMMENDED BUILDING LEVELS

The existing RBL's vary across the site, from R.L 7.0 to R.L 8.2 (VD1953) and are informed by previous Kapiti Coast District Council modelling including an allowance for freeboard, typically 500mm around open channels and 300mm on the floodplain, to ensure building platforms are above the flood hazard and are flood free. On this site the primary solution for flood protection of developed areas within the site is mass ponding in controlled areas, with peak estimated floodwater storage levels controlled by a downstream control device. The area of ponding is significant when considering risk of increased/unexpected water level associated with greater events, modelling error etc. Freeboard allowance is, in part, provided to allow for these sorts of risks. The extensive flood storage capacity, combined with the high degree of certainty on outlet control water level associated with this site supports the adoption of a 300mm allowance for freeboard for this site.

The earthworks design has created a proposed new building surface in the building areas of the site that is greater than 300mm above the estimated peak flood level in the 100-year 2130 design event (which includes allowance for climate change). This design surface is controlled through consent conditions and ensures building platforms will be above minimum required levels for flood protection.

A modelling of a 50% blockage 100YR 2130 scenario has been undertaken to confirm the proposed 300 mm freeboard. The 50% blockage assumes the twin box culvert structure is 50% blocked across both culverts. Results from this scenario show the greatest increase in top water level is concentrated directly upstream of the twin box culvert structure within the storage/attenuation areas with a maximum increase across the development extent of 170 to 180 mm.

Development of a 7-lot zone at the north-western extent of the development site is proposed with access off Paetawa Road. This will require earthworks to ensure the lots and road access are above the existing modelled top water levels. Existing top water levels in this location are RL 3.76 (100YR 2130 VD1953) and RL 3.68 (10YR 2130 VD1953). The design of the lots and road including freeboard, at least 300 mm, will need to be at least RL 4.1 (VD1953).

Filling in this location will displace storage volume on the floodplain totaling approximately 1000 m3. Modelling of this impact has not been undertaken as part of the wider development assessment. Given the volume of displacement in the context of the adjacent ponding extent and depth it is likely the impact on surrounding top water levels of this fill volume would be less than minor.

6. DISTRICT PLAN PROVISIONS

6.1. OPERATIVE DISTRICT PLAN 2024 – NATURAL HAZARDS

Publicly and privately initiated development must be undertaken in a manner that achieves the objective for natural hazards. The Council has adopted a precautionary and risk-based approach to hazard management. The approach includes avoiding new development in areas subject to high risk from hazards, if the hazard cannot be mitigated, and allowing a greater level of development, especially if the hazard can be mitigated, in areas subject to lower risk from hazards or where the hazard has a low probability or long occurrence interval. The approach takes into account the effects of climate change and considers relocation of existing development subject to hazards worsened by climate change effects.[1]

This section considers the proposed development approach in the context of the Operative District Plan rules and standards.

The relevant objective and policies for assessing the proposed development are outlined in KCDC's Operative District Plan District Objectives and Policies – Flood Hazards as summarised below.

Natural Hazards Objective

DO-05	**Natural Hazards.**
To ensure the safety and resilience of people and communities by avoiding exposure to increased levels of *risk* from *natural hazards*, while recognising the importance of natural processes and systems.	

Policies – Flood Hazards

NH-FLOOD-P10	**Flood and Erosion Free Building Areas.**
All new allotments must have a flood and erosion-free building (excluding minor buildings) areas based on 1% AEP flood modelling.	
NH-FLOOD-P11	**Flood Risk Levels.**
A higher level of control on subdivision, use and development will be applied within river corridors, stream corridors, overflow paths and residual overflow paths areas. A generally lesser level of restriction on subdivision, use and development will be applied in ponding, residual ponding, shallow surface flow, flood storage and fill control areas.	
NH-FLOOD-P12	**High Hazard Flood Areas.**

[1] Operative District Plan 01/10/2024

Development in the river corridor, stream corridor, overflow path, and residual overflow path areas will be avoided unless the 1% AEP hazard can be mitigated on-site to avoid damage to property or harm to people, and the following criteria are met: 1. no increase in flood flow or level on adjoining sites or other parts of the floodplain; 2. no reduction in storage capacity on-site; and 3. all flow corridors or overflow paths are kept clear to allow flood waters to flow freely at all times.

NH-FLOOD-P13	**Ponding, Residual Ponding, Shallow Surface Flow, Flood Storage and Fill Control Areas.**
When assessing applications for subdivision, the use or development within a ponding, residual ponding, shallow surface flow, flood storage or fill control area, shall consider the following: 1. the effects of the development on existing flood mitigation structures. 2. the effects of the development on the flood hazard – in particular flood levels and flow. 3. whether the development redirects floodwater onto adjoining properties or other parts of the floodplain. 4. whether access to the site will adversely affect the flood hazard. 5. the extent to which buildings can be located on areas of the property not subject to flooding; and 6. whether any subdivision or development will or may result in damage to property or harm to people.	

The development site is shown located within the ponding, storage, and stream corridor flood hazard categories in Kāpiti Coast District Council's flood hazard planning map (FHPM), as shown in Figure 2.

The development site must consider policies NH-FLOOD-P10 - NH-FLOOD-P13.

The development has responded to these policies by ensuring development lots are elevated above the flood hazard and will remain flood free in the 100YR 2130 scenario. The preliminary design earthworks surface has been based on flood modelling results, and these will be finalised at detailed design stage, with minimal expected amendment.

Development within the design stream corridors has been avoided.

Modelling indicates in the design situation the subdivision can largely be implemented with less than minor effects on surrounding flood levels with positive impacts, decreases in existing peak depths, in a number of surrounding properties as a result of the development mitigation design. The combination of the twin box culvert structure, storage/attenuation areas, design open channels and earthworks has resulted in flood free building platforms within the site and less than minor impacts on downstream peak flood depths.

The 100YR 2130 peak depth difference comparison shows increases at locations (4a) and (4b) with increases in the order of 100 to 350 mm which are completely contained within existing open channels and do not overtop the channel banks. At location (4b) there is an increase in adjacent property peak depths in the order of 30 to 70 mm.

Given there are decreases in peak depths in the NZTA road reserve designation and adjacent properties at location (3) to the east of location (4b) there is an opportunity to throttle the flow from the east as it enters the development site to mitigate the increases at (4b) which will be investigated at detailed design stage.

7. RECOMMENDATIONS

We recommend the following as a condition of consent.

- The design of the proposed lot and roadway soakage/attenuation devices to offset the increase in imperviousness be confirmed in the model at detailed design.
- Final design of all hydraulic structures be confirmed in the model at detailed design stage.

8. CONCLUSION

8.1. CONCLUSION

Earthworks and landscaping are proposed to modify the existing dune topography allowing for residential development. In some low-lying areas fill will be required to raise the proposed lots to meet recommended building levels. This will in turn alter the existing ponding depth and extent as fill displaces storage on the floodplain.

The primary form of stormwater mitigation for the displacement of storage on the floodplain associated with fill will be via storage/attenuation at a twin box culvert structure within the open channel at the south-western extent of the site allowing ponding depths to increase upstream of the structure.

Hydraulic neutrality will generally be achieved across the development utilising soakage and attenuation devices. Soakage will be utilised within each lot (except in the low-lying areas where earthworks filling is proposed) and attenuation provided within each lot or in the road reserve or open space areas. The SMP prepared by Landlink describes the proposed type, location and sizing of the low impact design solutions to achieve hydraulic neutrality. It is expected that these will be confirmed and modelled at detailed design stage, along with soakage testing, to ensure the proposed devices meet KCDC's requirements.

Modelling indicates in the existing situation the low-lying areas of the site are flood prone with ponding confined to existing low areas throughout the site primarily bordering the existing open channels.

Modelling indicates in the design situation the subdivision can largely be implemented with less than minor effects on surrounding flood levels with positive impacts, decreases in existing peak depths, in a number of surrounding properties as a result of the development mitigation design. The combination of the twin box culvert structure, storage/attenuation areas, open channels and earthworks has resulted in flood free building platforms within the site and less than minor impacts on downstream peak flood depths.

With reference to Figure 19 at location (5a) the bund between the development site and the adjacent property has completely removed ponding which would have otherwise occurred in the 100YR 2130 event. This decrease (removal of ponding) is in the order of 70 to 500 mm and removes approximately 8000 sqm of ponding from this location. At location (5b), within the same property, the one-way culvert prevents backflow in the design scenario entering the property and maintains existing peak depths in this location, there is however a 40 to 100 mm increase in peak depth upstream of the culvert which is completely contained within the existing open channel/low area, the increase covers approximately 200 sqm.

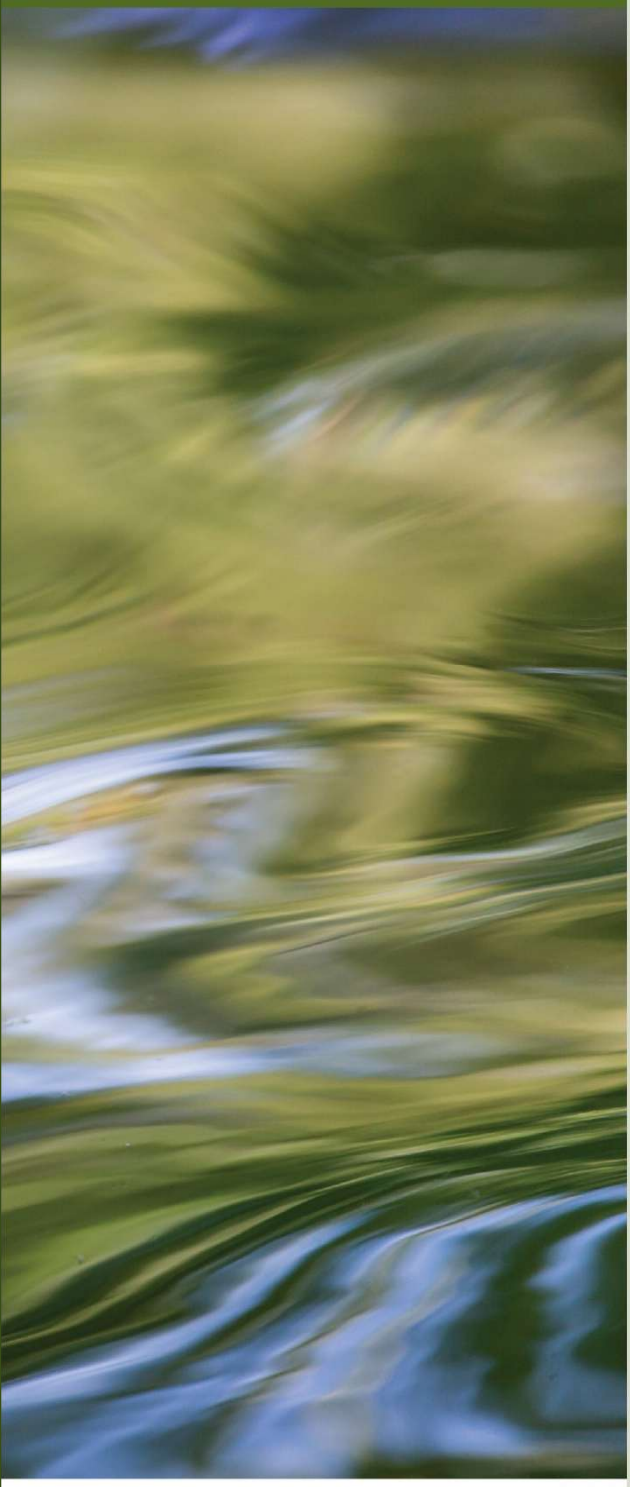
At location (5c), within the same property, there is an increase in the order of 40 to 80 mm in an existing low-lying area which spans both properties. This increase is completely contained within the low-lying area.

On balance there has been a positive impact on peak depths within the adjacent property associated with the development design.

With reference to Figure 19 the 100YR 2130 peak depth difference comparison shows increases at locations (4a) and (4b) with increases in the order of 100 to 350 mm which are completely contained within existing open channels and do not overtop the channel banks. At location (4b) there is an increase in adjacent property peak depths in the order of 30 to 70 mm.

Given there are decreases in peak depths in the NZTA road reserve designation and adjacent properties at location (3) to the east of location (4b) there is an opportunity to throttle the flow from the east as it enters the development site to mitigate the increases at (4b) which will be investigated at detailed design stage.

Taking the above into account, AWA are confident there is sufficient scope to mitigate the increases in peak flood depths discussed at detailed design stage. In our professional opinion we see the site being considered suitable for future residential development subject to the implementation of strategies outlined in this report.



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