



Omāhu Stopbank Concept Design Review

Prepared for
Hawke's Bay Regional Council
Prepared by
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1 Introduction

1.1 Background

Hawke's Bay Regional Council (HBRC) has engaged Tonkin & Taylor Ltd (T+T) to undertake an initial assessment review of potential flood mitigation options for the land categorised as 2C district Ohiti Road, Omāhu (Figure 1.1). The 2C portion of land has an area of 19 ha and includes the Ohiti Road subdivision, as shown below. This area was severely affected by Cyclone Gabrielle and experienced extensive flooding from the nearby Okawa stream.

Another, smaller portion of Omāhu (single property north of Taihape Rd) falls under Category 3, indicating that mitigation efforts may not be adequate to address the risks posed by severe future weather events. We understand that others are assessing the appropriateness of the Category 3 decisions. This report considers only the Category 2C land.

A Category 2C determination implies that a community scheme will be implemented. The aim of the proposed scheme protection requirement is to provide flood protection to a 1% AEP level of service. Currently a 1% AEP event in the Okawa stream catchment is not defined. HBRC will ultimately review the case for recategorization (to a Category 1), which we understand will need to include:

- A technically feasible solution that can be consented, summarised by the findings of this report.
- A Treasury approved business case to secure funding.
- Acquisition of necessary land or relevant easements (or agreement in principle).

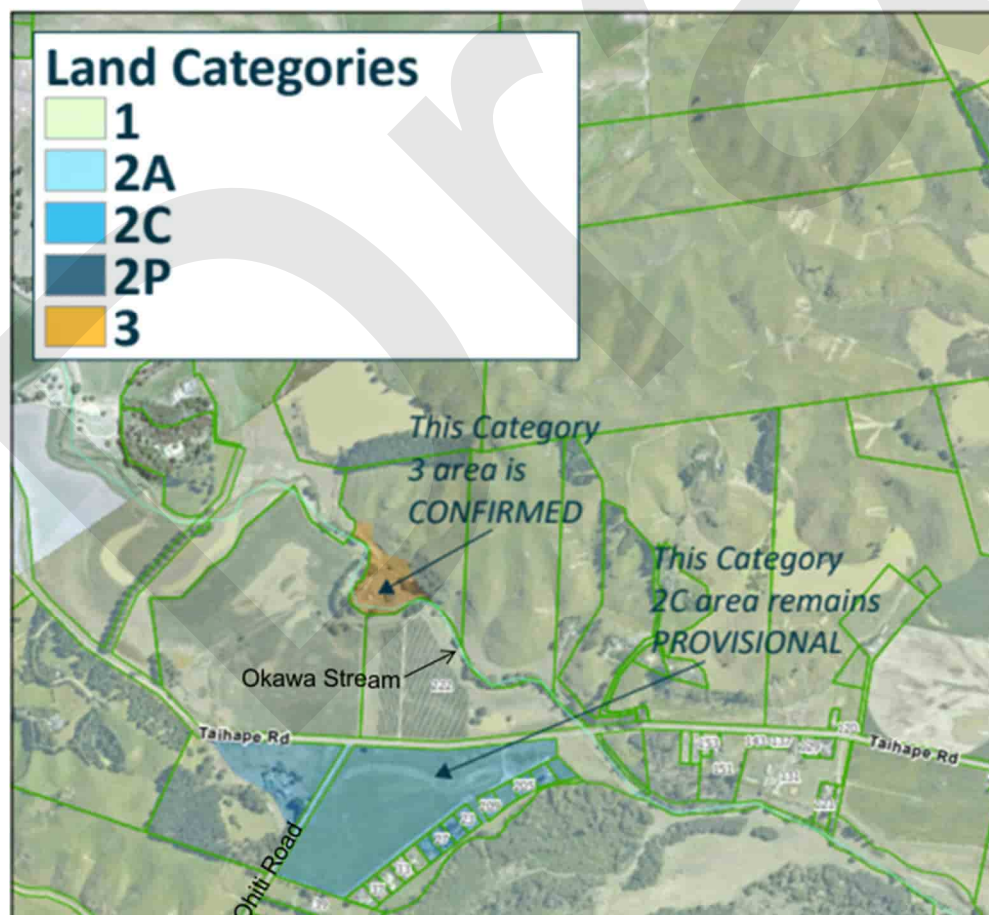


Figure 1.1. HBRC land Categorisation map for Omāhu.

1.2 Scope

This report provides an initial assessment of the background to the Cyclone Gabrielle flood event, a brief review of the catchment and an initial assessment of options to consider as part of flood mitigation.

This work has been undertaken in accordance with our proposal dated 27 June 2023¹, the scope of which has included the following (broadly consistent with the HBRC scope):

- 1 Review current Land Categorisation maps and baseline data.
- 2 Attend Community Briefings and capture potential options discussed (listen and observe only).
- 3 Review Land Categorisation information, community briefing outputs and compile a list of options for community- and property-specific enhancements that would enable properties in Category 2A, 2C and 2P to be updated to a Category 1 or Category 3. Refer Section 1.3 for Land Categorisation descriptions.
- 4 Shortlist feasible options.
- 5 Identify preferred solutions and provide concept designs with indicative budget and timeline.

Further work will be needed to support a resource consent and detailed design submission. Community consultation will be required, as well as input from Hastings District Council (HDC) in developing a final scheme proposal for the area.

1.3 Land Categorisation

The Government established categories after Cyclone Gabrielle which have been used to determine the future severe weather risk for specific areas across Hawke's Bay. HBRC provisional land categorisations definitions are listed below² in Table 1:

Table 1. Land Categorisation descriptions

1	Repair to previous state is all that is required to manage future severe weather risk event.
2C*	The outcome of quality assurance of existing stop bank rebuilds may see the categorisation change to a 1, which has the following definition: 'Repair [dwelling] to previous state is all that is required to manage future severe weather risk event.'
2C	Community level interventions are effective in managing future severe weather risk event.
2P	Property level interventions are needed to manage future severe weather event risk, including in tandem with community level interventions.
2A	Potential to fall within 2C/2P but significant further assessment required.
3	Future severe weather event risk cannot be sufficiently mitigated. In some cases some current land uses may remain acceptable, while for others there is intolerable risk of injury or death.

Initially, the Ohiti Road Subdivision and Taihape Road area was categorised as 2P, meaning property specific interventions would be required, which was then changed to 2A. This followed feedback from T+T and community that site specific mitigation would be impractical for small allotments, with dwellings on concrete slabs. At the community meeting on the 7th of November 2023, it was announced it had been moved again to 2C, meaning a community level intervention is proposed.

¹ Tonkin & Taylor Ltd, Letter of Engagement, HBRC Land Categorisation-Proposal for technical support for mitigation options assessment, 27 June 2023, T+T ref: 1017353.2301

² Land categorisation general information | Hastings District Council (hastingsdc.govt.nz)

2 Site description

2.1 Location

Omāhu Cat2C area is located to the northwest of Hastings on the north (left) bank of the Ngaruroro River (Figure 2.1). The subdivision has been developed from Māori landholdings on a flat terrace area located south of Taihape Rd. The site is located at about RL 30 m (Ngaruroro river level approx. RL26m).

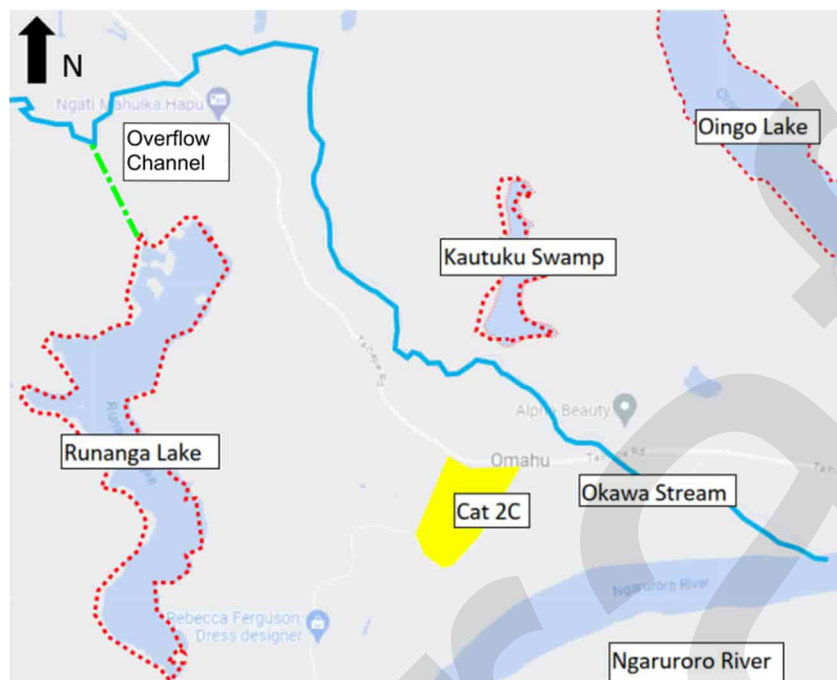


Figure 2.1 Map of Omāhu area

The Okawa stream headwaters are north of the subject site near Okawa homestead, before running south, crossing over Taihape Road three times. The Okawa stream has an overflow channel into Runanga Lake northwest of the subdivision. The Okawa flows through farmland to the north and west of the Cat2C subdivision area, before its confluence with the Ngaruroro River, southeast of the subdivision. The Okawa stream is also referred to as the Ohiwa stream in some historical information, although HBRC maps refer to the stream as the Okawa. In this report it is referred to as Okawa stream, except where historical information is being directly quoted.

2.2 Catchment

The site lies within the Ohiwa Sub-Catchment, part of the broader in the Ngaruroro Catchment³. The Ngaruroro catchment covers a total area of 201,246 ha. The Ohiwa sub-catchment land is predominantly used as pastoral sheep and beef grazing land. A significant portion, 42% or 84,857 hectares, is comprised of native landcover, while 52% or 103,742 hectares are identified as highly erodible land. The Ohiwa Sub-Catchment, constituting approximately 5% of the Ngaruroro Catchment, covers an area of 10,431 hectares. The estimated population in the Ohiwa Sub-Catchment is approximately 442 people. Key water bodies include the Ohiwa stream, Mangatarata stream, Hurimoana Swamp, Lake Runanga and Kautuku Swamp. The catchment areas are shown on Figure 2.3.

³ Hawkes Bay Regional Council, "Tutaekuri, Ahuriri, Ngaruroro, Karamu Catchments Riparian Assessment", April 2014, HBRC Report No. RM 14-11 – 4642

We understand that during high flows, an overflow spillway from the Okawa flows into the head of Lake Runanga as is shown on Figure 2.2 below. Based on discussions with local residents, Lake Runanga was 2-3m higher following Cyclone Gabrielle, which indicates that flows into the head of the lake was likely occurring. We also understand from discussions with Hastings District Council (HDC) roading team, that the Okawa stream broke its banks several times upstream of Lake Runanga and flowed over Taihape Road in several places. There are no HBRC gauging stations on the Okawa and HBRC does not have any assets in this catchment. Accordingly, there is very limited catchment or hydrology information available.



Figure 2.2-High flow spillway into Lake Runanga

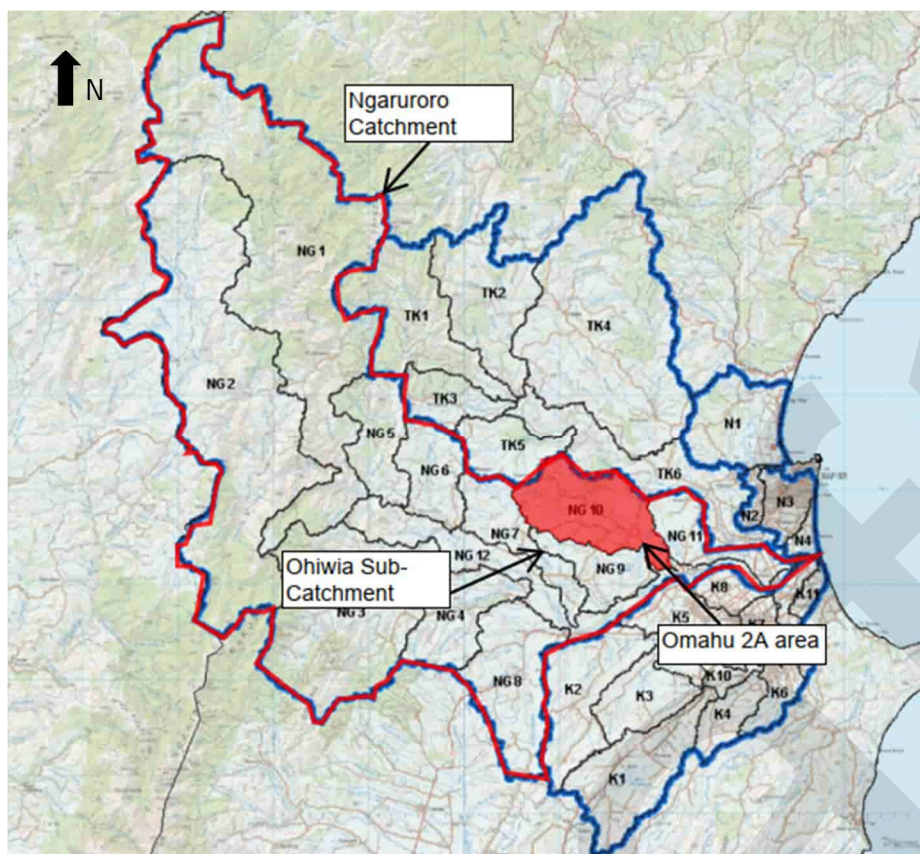


Figure 2.3 Catchment and sub-catchment of Ngaruroro.

2.3 Flood Event History

The Omāhu area has experienced many historical flooding events, listed from oldest to most recent below.⁴

- April 1897 North Island flooding - Flooding at Omāhu caused property damage, whares to be washed away, damage to crops and fences and three men drowned at Ohiti.
- June 1917 Hawke's Bay flooding - There was major flooding in Omāhu resulting in serious stock losses.
- March 1924 Hawke's Bay flooding - Omāhu flooded when the Ngaruroro River overflowed.
- April 1968 New Zealand ex-tropical Cyclone Giselle - Surface flooding occurred for some days in the Omāhu area.
- September 1988 North Island Cyclone Bola - There was a lot of surface flooding and scouring in Okawa.

2.4 2C area of Omāhu Development background

2.4.1 Ohiti Road Subdivision & Taihape Road property ownership

The Ohiti subdivision was subdivided through the Māori Land Court. Records collected from the Hastings Māori Land Court shows it was originally owned by Mare Reiharangi Kupa, before it was subdivided in 2014 into 8 blocks and sold. Kupa is assumed to still own the balance land between the subdivision and Taihape Road and also agriculture land across Taihape Road, opposite Ohiti

⁴ Niwa Historic Weather Events - <https://niwa.co.nz/climate/our-services/obtaining-climate-data-from-niwa>

subdivision. The Māori Land Court did not provide records for the 5 land parcels accessed via Taihape Road, but it is assumed to be subdivided and gifted/sold to family and is still Māori freehold land.

This area is classified as 'Plains Production Zone' in the Hastings District Plan. The wider area is used for cropping, viticulture, and orcharding. The goal of the HDC zoning is to preserve this land for productive purposes as a core sustainability principle for the Council.

We have been unable to source any engineering or flood assessment plans for the proposed site from HBRC or HDC.

The Category 2C area and associated property titles are shown in Figure 2.4 below.

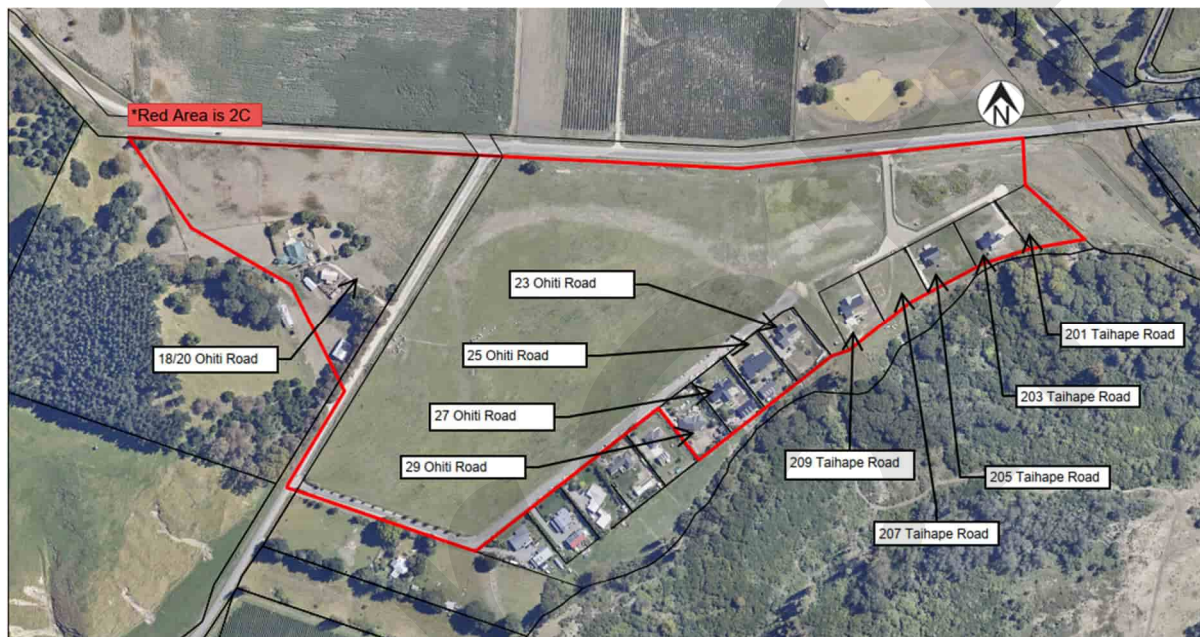


Figure 2.2 Omāhu 2C area property addresses. Note 207 and 201 Taihape road do not have records of legal addresses, so assumption of address has been made for the purposes of this report.

2.4.2 Flood Levels during Cyclone Gabrielle

In total, 153 houses were affected by flooding during Cyclone Gabrielle in the wider Omāhu area⁵. Some of these include houses damaged east of the subject site, due to stopbank breaches by the SH50 bridge at Fernhill. From discussions with community, it is understood the water levels on the Okawa stream during Cyclone Gabrielle were raised to the soffit of Taihape Road bridge (but it did not overtop), which sits at approximately 29 metres RL. The houses affected by flooding shown in the red 2C box also sit at 29 metres RL. Houses located at 29.5 metres RL and higher were unaffected, as shown in Figure 2.3.

⁵ [Omāhu Marae to host temporary homes for cyclone-hit whānau - NZ Herald](#)

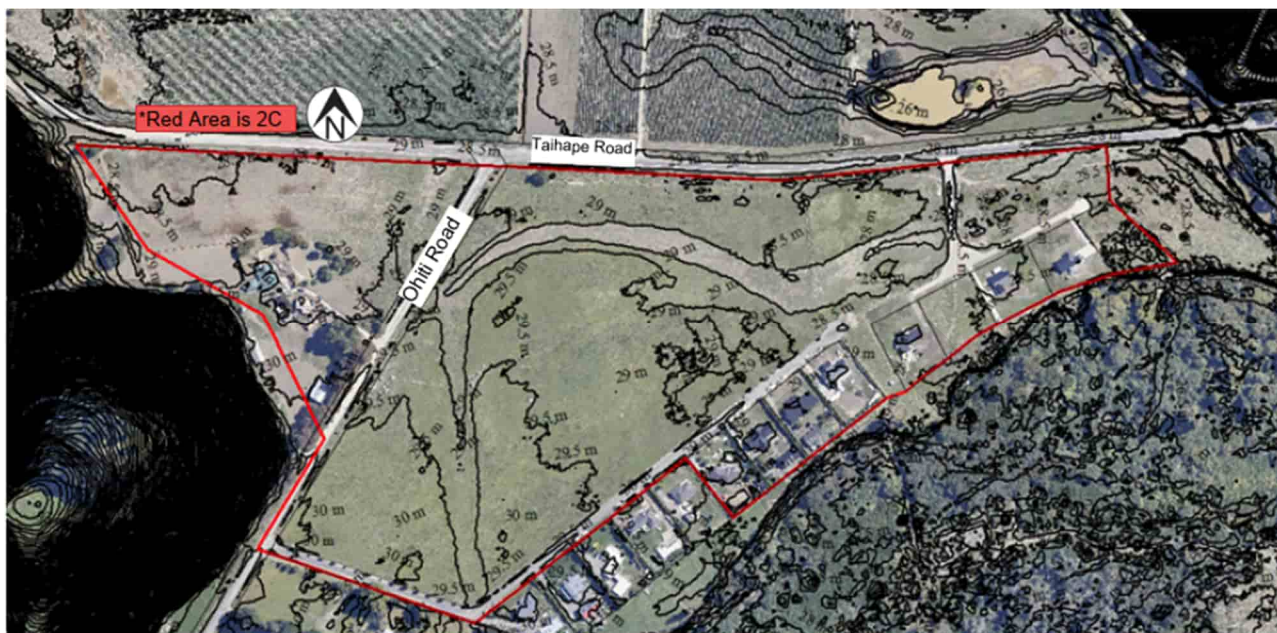


Figure 2.3 -Contour information based on 2020 LINZ Lidar

A local resident who lives in the area, stated the water got backed up at the Okawa bridge (Taihape bridge), as the waterway was not able to cope with the flow (or may have been partially blocked with debris?). Overland flow paths (Figure 2.4) show two local low points across Taihape road (marked in purple), where it is assumed breach water from Okawa stream crossed Taihape Road and into the subdivision. The marks of silt deposition and debris support this hypothesis.

There is also some suggestion that small farm bridges and footbridges across the Okawa, north of the site, may have contributed to blockages and out of channel stream flows into the subdivision.

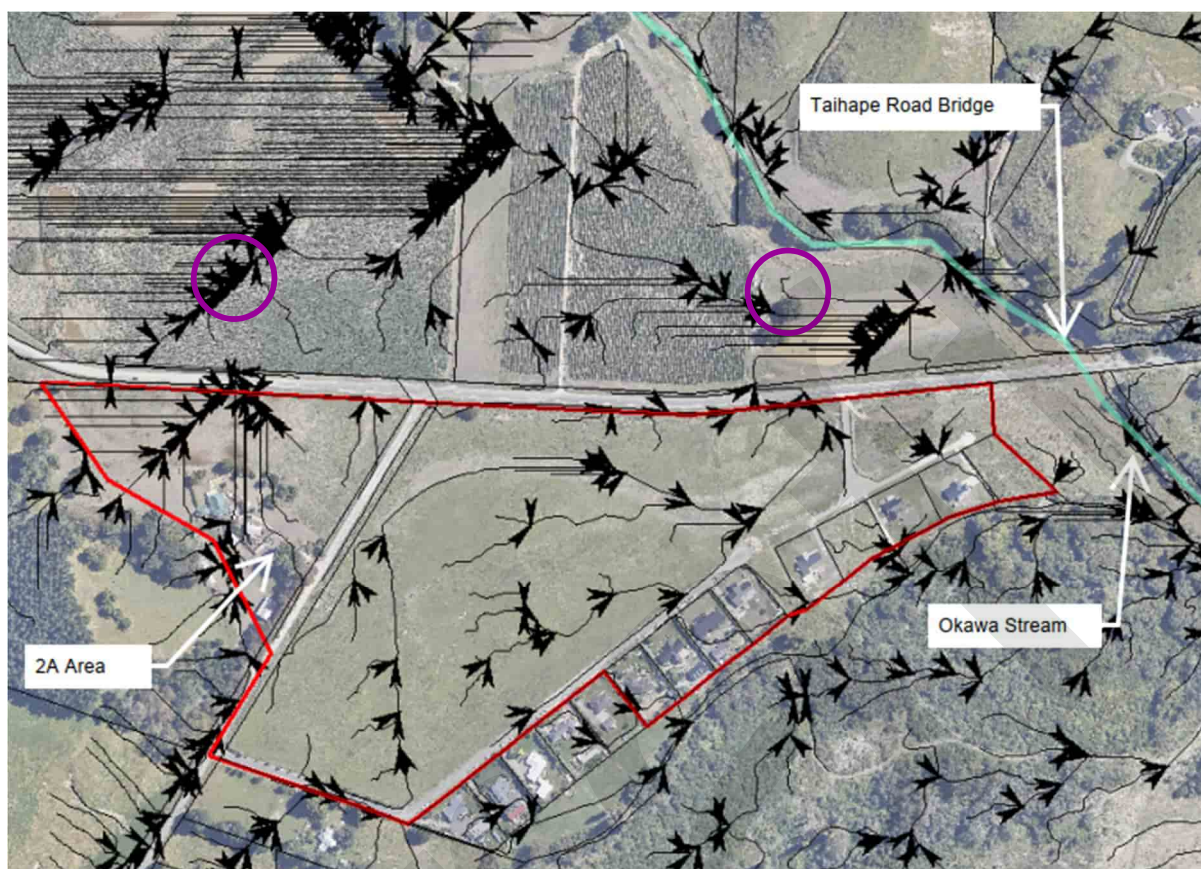


Figure 2.4 Overland flow paths Taihape Road area. Black lines are inferred overland flow paths.

Other residents also reported that flows broke out from the Okawa left bank and overflowed into the area surrounding Omahu Marae, east of the subject site.

Based on the observations of debris markers, a review of post cyclone aerial photography and discussions with HBRC and local residents, the assumed flood levels were about RL 29-29.5m.

T+T is conducting a modelling assessment post-cyclone on the Ngaruroro River as part of the Heretaunga Plains scheme review. The model relies on HBRC provided roughness and peak flows as advised by NIWA. At the time of writing, the NIWA flow information is currently under review.

The modelled 1% AEP event (using interim 2023 NIWA advised FFA information) and flood spot heights are shown in Figure 2.7. It depicts the encroachment of the river to the south of the subdivision this design event and shows backflow up the Okawa stream. The Ngaruroro model does not include specific inputs from the Okawa catchment. However, this model confirms that during large events into the Okawa, there are likely to be tailwater effects associated with high river levels in the Ngaruroro.

In events exceeding a 1% AEP event, there may be significant flooding from both breakouts of the Ngaruroro, along the terrace edge, and from the Okawa stream, should high tailwater levels cause backflows into the subject site. Further work is needed to assess the flood risk in larger, lower probability events.



Figure 2.5 Ngaruroro flood level estimate 100-year

2.4.3 Section 72 Building Code

In the building code, a 'Section 72' notice signifies that a property is likely to be subject to a natural hazard.

Notably, the last three subdivision houses accessed from Taihape (No 203, 205 and 209) include a 'Section 72', on the property title. We understand that the basis for this was provided by earlier flood models of the Ngaruroro provided by HBRC (we have not sighted the model but a planning overlay from the HB Hazards portal is provided in Figure 2.8). The Land Categorisation programme described above, is not intended to protect property for large scale flooding of the Ngaruroro. However, HBRC have suggested that some additional works could be undertaken to provide limited protection (i.e. to a 1% AEP standard). This is discussed further in subsequent sections. It must be noted that the aim of this assessment is not to remove the Section 72 notices. That is ultimately up to HDC as the building consent authority.

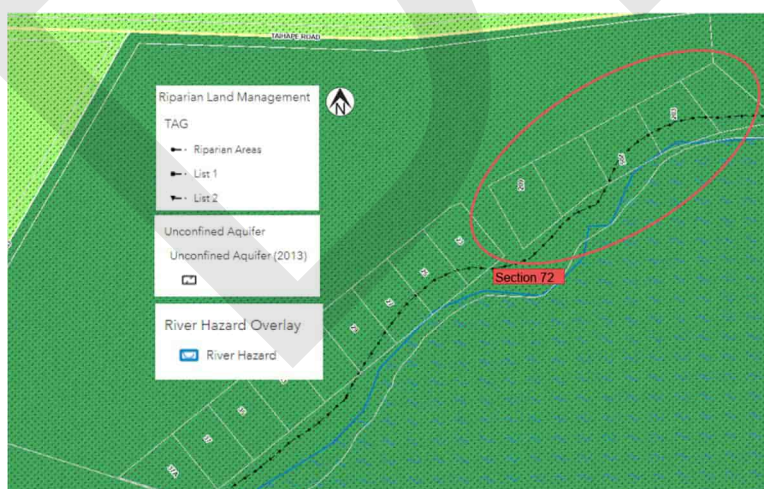


Figure 2.6 HDC river hazard mapping overlay- From Hawkes Bay Hazards Portal- <https://gis.hbrc.govt.nz/Hazards/>

3 Basis of Assessment and Initial Optioneering

In order for HBRC to initiate their land categorisation work, several key components must be addressed. This includes the development of a feasible and effective scheme, securing access/easements to the relevant land parcels, and securing the necessary funding.

The overarching objective of the flood mitigation options is to provide protection in accordance with the 1% Annual Exceedance Probability (AEP) standard (based on updated flood frequency taking account of Cyclone Gabrielle).

At this time, the 1% AEP event in the Okawa/Ohiwa catchment is not know. This design approach may undergo changes in response to hydrological assessment and flood modelling.

The following options in Table 2 were considered during a workshop held in August 2023 with HBRC to discuss flood protection measures:

Table 2. Flood mitigation options to move Omāhu category.

Options	Cost	Risks	Opportunities	Consider Further
1- Stream enhancement/widening in places, excavate silt and gravel build-up	Med	<ul style="list-style-type: none"> Stream erosion/geomorphology review needed. NES-F constraints, works in watercourses, seasonal restrictions etc Stability around scour pockets/abutments to be assessed. Easements or land purchase needed to acquire land for construction and maintenance. Further work needed to define design channel cross section and conveyance Potential to require localised bunding/stopbanks 	<ul style="list-style-type: none"> Strong local support Maintenance through targeted rate Could have increased recreational value Environmental improvements, i.e. planting, aesthetics, stream aquatic life. 	Yes
2- Moving/Raising the HDC road bridge	High	<ul style="list-style-type: none"> High cost Would block traffic on Taihape Road for extended time for construction, may require re-engineering of bridge approach Relies in HDC roading team to deliver (as asset owner) 	<ul style="list-style-type: none"> Increase flow capacity of Okawa stream Minimize debris loading onto bridge. Does not require land acquisition. 	No (unlikely to be priority for HDC)
3- Debris and woody debris management	Low	<ul style="list-style-type: none"> Does not improve flood conveyance Requires work on private land. Scope not well defined. 	<ul style="list-style-type: none"> Low cost No land acquisition. 	No (but consider as part of other options?)
4- Clearing Out Channels under Okawa Road Bridge & Raising/remove Upstream Footbridge only	Low/Med	<ul style="list-style-type: none"> Would need to be part of a wider scheme asset management. Does not completely resolve flood risk from upstream breach areas. Footbridge is privately owned 	<ul style="list-style-type: none"> Improves channel capacity locally around the key structures. Could be a short-term option while channel design is reviewed Low-cost option 	Yes
5- Construct stop bank parallel to road on north side and include managed overflow point across road with downstream channel/bund to direct flows away from houses	High	<ul style="list-style-type: none"> Land acquisition or easement required. Higher construction costs. Borrow site required. Tie in of levels to road bridge to be confirmed. Possible wetland next to Taihape bridge. Requires ecology review 	<ul style="list-style-type: none"> Relatively simple design Utilise flood silts for construction if possible? Minimal maintenance needed 	Yes
6- More properties to Cat 3 and offer voluntary buy out option	High	<ul style="list-style-type: none"> High cost Requires support of residents. May not meet Cat 3 threshold. 	<ul style="list-style-type: none"> Removes risk to lift for local residents. Removes residual risk to residents from >1% AEP event from Ngaruroro river. 	No (but HBRC should consider flood risk from Ngaruroro further)
7- Runanga Lake utilised as Flood Detention	Med	<ul style="list-style-type: none"> Inlet arrangement to be reviewed. Outlet stopbanks/embankment to be raised? Reservoir margin impacts, if lake levels increase Dam safety implications? Outlet weir operated by F&G, unclear on requirements. Property acquisition for intake and reservoir Would have to be maintained/managed Needs further ecological/hydrology assessment 	<ul style="list-style-type: none"> Potential to utilise more storage in lake Runanga? Manage high flows Environmental benefits? Limits downstream impact/property acquisition/stream works. 	No (as asset not owned by HBRC)
8- Combination of above	High	Combination of above	Combination of above	Yes

Ultimately, the HBRC decision was to proceed with Option 8, which involves a combination of a stopbank along the northern side of the subdivision to protect from Okawa stream, clearing out channels under Okawa Road bridge (to improve conveyance) and debris and woody debris management (a scope of which is yet to be defined).

4 Concept Design

4.1 Concept Design Assumptions

T+T has prepared two short listed options for the stopbank alignment, Option 1 and 2. Both options are based on the same assumptions and design parameters discussed in this section.

Following an evaluation that involved both community input and a desktop study of the affected areas, it was determined that the floodwater reached a level of about 29 to 29.5m RL. No formal flood models have been prepared for the Okawa catchment. T+T has prepared an offer of service to complete the Okawa catchment hydrology assessment and modelling but this has not been accepted to date. HBRC have subsequently requested that T+T assume a crest level of the stopbank of about RL 30m, providing 1m of freeboard above reported observed flood levels. This approach will need to be validated by robust catchment assessment and modelling.

Based on our observations of current stopbanks in Hawkes Bay following Cyclone Gabrielle, scour was common on slopes steeper than about 2.5H:1V. A number of these scours led to full scale breaches once the headward erosion developed. To mitigate future overtopping scour, flatter batter slopes are recommended.

The following assumptions have been made to support the design of the stopbank:

- Stopbank batter to be 3H:1V
- Stopbank crest to be 4 m wide to provide adequate maintenance access for mowing etc.
- A provision for keying in the stopbank to the surrounding ground levels
- The western of the stopbank to tie in with high ground.
- The eastern end of the stopbank will include a return bank along the true right of the Okawa stream.
- We have assumed that some sections of local roads (either Taihape Road, or Ohiti Road) will need to be locally raised in order for stopbank to be constructed. the stopbank alignment and elevation will be confirmed in the detailed design stage. Traffic design input will be required to confirm sight lines, vertical and horizontal geometry of the road design.
- We have assumed the stopbank crest level at 30 RL (HBRC advised flood level plus 1 m free board), as is discussed in the previous section above. This needs to be confirmed with hydraulic modelling.

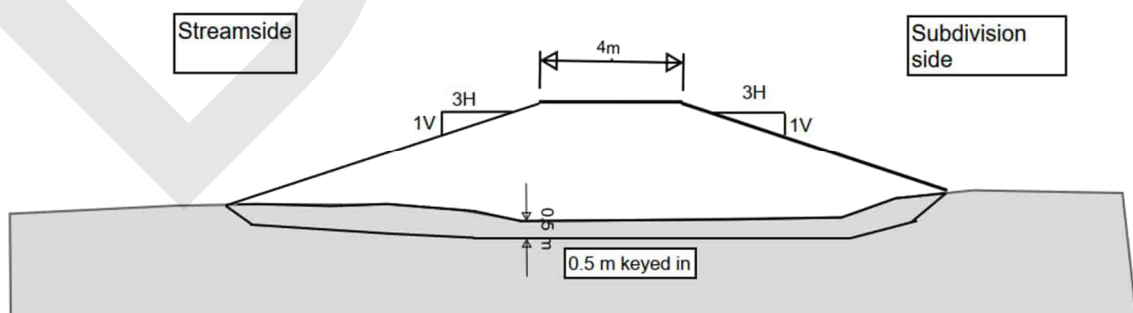


Figure 4.1. Typical stopbank alignment

Additionally, to support the stopbank the following has been proposed during optioneering:

- 1-metre-high local low height stopbanks or bunds are proposed on the true left of the Okawa, to protect the Omahu township from breakouts of the Okawa. The length of this local stopbank is about 200m. Locally raising Taihape Road on the eastern bridge approach may be necessary to complete this.
- 1 to 1.5-metre-high 600m long stopbank will start at the eastern end of the Okawa stopbank and run down the southern side of the subdivision to protect the rear of the properties from the Ngaruroro River in a 1% AEP event. Given this will require vegetation clearance, we recommend HBRC seek ecologist advice around vegetation and habitat removal. Additionally, discussions with the landowners will be required to confirm construction and maintenance access. Currently this alignment sits on private land.

4.2 Option 1 Overview

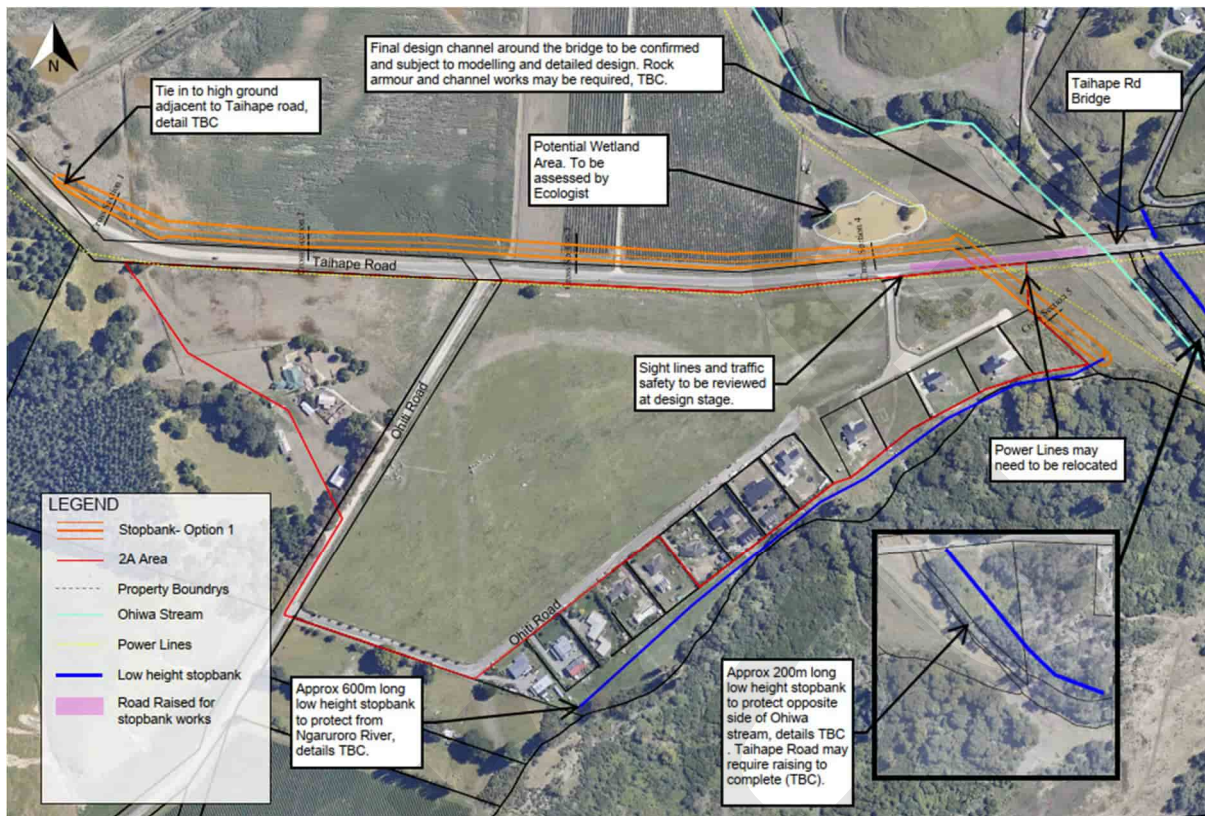
The proposed Option 1 Omāhu stopbank alignment extends along the northside of Taihape Road, starting opposite 18/20 Ohiti Road and running towards Okawa stream, crossing Taihape Road to the subdivision just before Taihape Road Bridge. Notably, the stopbank will be situated on all private land, necessitating agreements with the landowners of Omāhu 2C1A Block, Lot 10H Pt Omāhu 2C1C Block, and Lot 10I Pt Omāhu 2C1C Block along the northern side of Taihape Road as there is insufficient space between Taihape Road and these land parcels.

The total length of the stopbank is estimated to be about 1030 meters, with an approximate imported fill volume of about 18,900 cubic meters (excluding works to Taihape Rd). There will be very limited cut along the alignment. The proposed stopbank side slopes are at 1V:3H, with a 4m crest width. The stopbank may need to be locally steepened near a potential wetland area, north of Taihape Road. Further input and review by an ecologist is required. The crest level follows assumptions made in section 4.1.

The stopbank will go through a section of Taihape Road, which will require locally raising on the western side of the bridge approach. This road serves as a crucial route between Napier and Taihape, so closures could cause major traffic diversions and delays. Traffic safety and a review of vertical geometry will required during initial design. The subdivision access point may need to be amended, pending the roading design.

The proposed alignment of stopbank runs very close to local powerlines operated by Unison Ltd, which may require potential relocation or a close approach permit. We suggest HBRC approach Unison to confirm requirements.

Figure 4.2 Option 1 concept stopbank alignment



4.3 Option 2 Overview

The proposed Omāhu stopbank Option 2 alignment extends along the southside of Taihape Road, starting at 18/20 Ohiti Road and spanning towards Okawa stream, crossing Ohiti Road. Notably, the stopbank will be situated on all private land, necessitating agreements with the landowners of 18/20 Ohiti Road, Lot 10H Pt Omāhu 2C1C Block, and Lot 10I Pt Omāhu 2C1C Block along the southern side of Taihape Road.

The total length of the stopbank is estimated to be about 960 meters, with an approximate fill volume of about 13,800 cubic meters. The proposed stopbank side slopes are at 1V:3H, with a 4 metre crest width. The crest level follows assumptions made in section 4.2.

The stopbank will go through a section of Ohiti Road, this will require that Ohiti Road will need to be locally raised, near the intersection with Taihape Road. Traffic safety impacts will need to be assessed for this option, including sight lines and vertical geometry towards the intersection. The existing access point to the eastern end of the subdivision will need to be removed and the Ohiti Rd subdivision cul-de-sac extended to provide access to the last few properties.

The proposed alignment of stopbanks will also come into close proximity to Unison powerlines and will require their consultation.

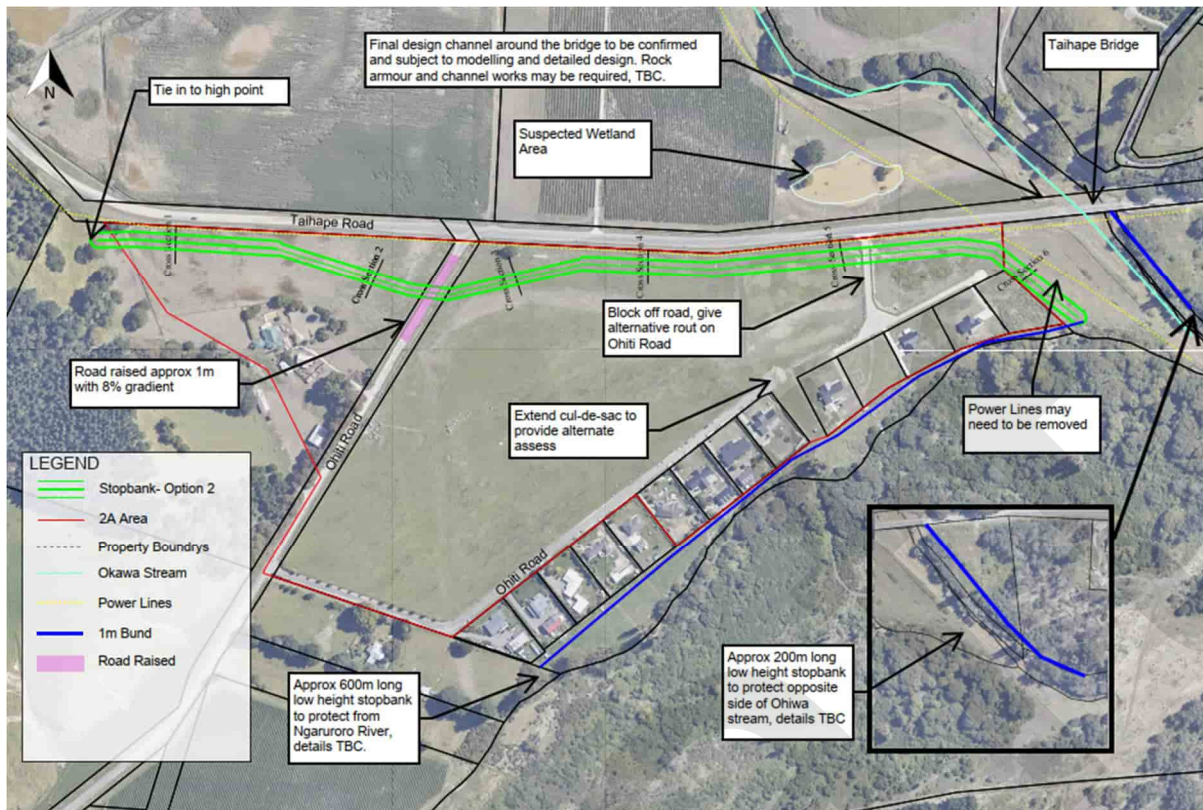


Figure 4.3 Option 2 concept stopbank alignment

Alternative alignments, or a combination of Option 1 and 2 could be considered.

4.4 Borrow materials

It is unclear where the material to construct the stopbanks will be sourced from. Initial discussions have been held with a landowner near Omarunui Landfill (about 5km from the site), who may be able to supply a significant quantity of weathered rock. No assessment of the suitability of this borrow (or any other options) have been undertaken. We strongly recommend HBRC initiate discussions with local landowners to confirm suitable borrow locations.

4.5 Okawa Stream Management

Both stopbank Option 1 & 2 will need to be combined with improvements to conveyance around the Taihape Road bridge. Based on our site visit and review of bridge as-built information. It appears the stream berms have built up with sediment, about 1.5-1.8m from the soffit of the bridge. Further work will be required to confirm a design channel alignment, including review of bridge abutment stability. Figure 4.4 shows the build-up of sediment under the Taihape Road bridge.

Local rock armouring may be required to minimise stream erosion onto the left bank of the Okawa. We suggest further discussions with HDC (as the bridge owner) once designs are more mature to confirm erosion protection requirements.



Figure 4.4 Taihape Road bridge

5 Potential Resource Consent Requirements

A preliminary analysis of the statutory planning provisions that could be relevant to both concept designs is provided in Appendix B. Further detailed statutory analysis of the proposed activities will be required once the final design is confirmed and as part of the resource consent and Assessment of Effects on the Environment (AEE) report preparation process.

In summary, resource consent is likely required from HBRC and HDC for the following activities.

HBRC:

- Exotic vegetation clearance on land within 5 m of the Okawa Stream – restricted discretionary activity under rule 8.

Note: HBRC's consents team may consider that rule 70 below extends to land based activities, including vegetation clearance (i.e. section 9 of the RMA 1991). However, as rule 70 states it relates to RMA 1991 section 13, 14 and 15 activities, conservatively we have assumed that Rule 7 applies.

- Discharge of cleanfill or fill containing contaminants to land (if contaminated fill [such as that from cleanfill sites] is to be imported) – discretionary activity under Rule 52 of the Resource Management Plan as the site is located over an unconfined aquifer.
- Earthworks outside, but within a 100 m setback from, a natural wetland – non-complying activity under Regulation 52 of the NES-F (applies to Option 1 only).
- Earthworks on land – permitted activity under rule 7;
- Excavation and works within the Okawa Stream – permitted activity under rule 70; and
- Tree clearance and planting within the Okawa Stream – permitted activity under rule 70.

HDC:

- Earthworks for stopbank construction – restricted discretionary activity under Rule EM6 of the District Plan.

Further information is required to confirm the final resource consent requirements and the activities that are permitted and do not require resource consent. Also, an ecological assessment will be required to support an application for vegetation removal and to confirm the presence of natural inland wetlands. This further information required is outlined in Appendix C.

Consultation with Heretaunga Tamatea, Ahuriri and affected landowners should be undertaken during the preparation of the resource consent applications.

6 Cost estimate

High-level cost estimates have been prepared based on the two design options of the stopbank. Earthworks rates have been summarised based on recent tender submissions and local experience in recent construction contracts.

The construction cost estimate (exclusive of GST) includes:

- Provisional estimate for vegetation clearance.
- Stripping of surficial material and topsoil.
- Undercut removal (0.5 m depth).
- Homogeneous bulk fill, placed and compacted, assumed to be imported to site.
- Topsoiling on completion.
- Re-grassing bank face.
- Taihape Rd/Ohiti Rd raising and releveling to an HDC roading spec.
- Construction of secondary bank structures on the true left of the Okawa stream and the southern edge of the subdivision.
- Preliminary and General (P&G) Costs (assumed at 20% of the construction total).
- Contingency of 40% to account for significant uncertainties in the project scope, end alignment and sourcing of fill material, contingency including P&G.

Initial estimates have been prepared for two options as part of the works, this includes:

Option 1 \$\$ TBC

Option 2 \$\$ TBC

Breakdowns are provided in Appendix D. TBC

The estimates outlined above should be considered as relative only and we recommend HBRC seek further professional QS guidance prior to detailed design.

Cost estimates exclude items such as:

- Land acquisition and/or easements.
- Consultancy and design fees.
- Construction MSQA and contract management.
- Consenting and associated fees.
- Iwi engagement.
- Track and pathway construction or reinstatement.
- Planting or vegetation works.
- Consultation and legal fees.

7 Project Risks

The following should be considered during preparation of initial project risk registers.

- 1 Okawa catchment hydrology is currently unknown. HBRC will require an assessment of catchment peak flows. T+T have provided a scope to complete this assessment. This assessment should consider impacts of Ngaruroro river acting as the tailwater during high river flows.
- 2 Consideration of Ngaruroro flood flows, in particular for events exceeding the 1% AEP. This may result in flood damage to property irrespective of the proposed works being completed. HBRC should consider the residual risks to property and life in such an event.
- 3 The alignment will require works to HDC owned roading networks. This may require road safety audits, peer review, pending HDC requirements. The road design will need to account for sight lines and vertical geometry.
- 4 Engineering approvals from HDC will likely be required for local roading works and amendments to subdivision roading.
- 5 Community consultation with landowners will need to be managed by HBRC, this should include local representatives of the Omāhu Marae and other Mana Whenua groups.
- 6 The in-stream works will be subject to ecological assessments, to confirm stream clearing/widening requirements. This may impact on project costs (as well as physical works) and consenting timeframes. Stream conveyance improvement will need to be assessed once the catchment assessment has been completed.
- 7 Erosion protection for the Taihape Rd bridge may need to be considered.
- 8 Power lines (unison) run very close to both proposed stopbank alignments. Consideration of costs to relocate, or seeking of close approach permits should be completed by HBRC.
- 9 Land acquisition will be required for stopbank works, as these lie within private property.
- 10 Borrow materials (and the lack of a clear local borrow site) is considered one of the biggest project risk and HBRC should identify alternative borrow sites to acquire the necessary fill volumes.
- 11 Unforeseen ground conditions (such as buried fill or soft alluvial soils) may require alteration of designs and require additional earthworks. Geotechnical investigations will assist in identifying these areas. However, contingency should be included to manage this risk.

8 Next Steps

This report identifies a proposed option to mitigate flood risk to the Omahu Cat 2C area. Further work is required to identify a preferred design concept.

- Hydrological Assessment of Okawa stream and catchment assessment outlined in T+T's scope to determine catchment peak flows.
- Evaluate the impact of Ngaruroro River and conduct a thorough evaluation of Ngaruroro flood flows, especially for events exceeding the 1% Annual Exceedance Probability (AEP), which could overtop the terrace edge into the subdivision. Stopbanking on the southern side of the subdivision may be required to minimise this risk.
- Coordinate with HDC roading for necessary road safety audits concerning the alignment's impact on roading networks and accommodates sight lines and vertical geometry per HDC requirements.
- HBRC to manage community consultation with landowners, including representatives from Omāhu Marae and other Mana Whenua groups, to address concerns and gather input.

- Conduct ecological assessments for Okawa stream to confirm stream clearing/widening requirements and impacts on any adjacent wetlands, considering potential impacts on project costs and consenting timeframes.
- Evaluate and plan for erosion protection for bridges (if required) and potential impact on power lines.
- Initiate the process of land acquisition as required for the project.
- Address the significant project risk related to the lack of a clear local borrow site. Identify alternative borrow sites for necessary fill volumes (about 20-25,000m³ required).
- Conduct geotechnical investigations to identify unforeseen ground conditions, such as buried fill or soft alluvial soils.
- Incorporate contingency plans in the project to manage risks associated with alterations to designs and additional earthworks due to unforeseen ground conditions (i.e. spoil disposal sites and additional borrow sources as required).

9 Conclusion

Hawke's Bay Regional Council has commissioned Tonkin & Taylor Ltd to conduct a review of land categorisation in the Omāhu area, with a specific focus on the 2C classified area.

Initial workshopping (long list of options) included consideration of debris management, clearing out channels under Okawa stream, stopbank along the north of the 2C area and a combination of stopbanks and stream management. A formal MCA process is yet to be completed.

The preferred solution involves a combination of a stopbank along the northern side of the subdivision to protect from Okawa stream, clearing out channels under Okawa Road bridge (to improve conveyance) and debris and woody debris management (as required- a scope for this is yet to be defined).

Two different alignment options for the stopbank were proposed as short listed options.

- Option 1 spans 1030m and its alignment extends along the northside of Taihape Road, starting opposite 18/20 Ohiti Road and running towards Okawa stream, crossing Taihape Road to the subdivision just before Taihape Road Bridge.
- Option 2 spans 960m and is aligned along the southside of Taihape Road, starting at 18/20 Ohiti Road and spanning towards Okawa stream, crossing Ohiti Road.

Additionally, further short sections of stopbanking may be required. One, approximately 200 metres long, will be located on the true left side of Okawa stream to protect properties towards Omahu township. Another 600m long bund will start at the east end of the stopbank and run down the southern side of the subdivision to protect the rear of the properties from the Ngaruroro River in a 1% AEP event.

To prepare for the detailed design phase, several key tasks have been identified, including an ecology assessment, on-site assessments for finalising the stopbank alignment, sourcing construction materials, conducting geotechnical investigations, checking consent requirements, securing landowner agreements and consulting with local Iwi.

Initial reviews suggest the construction of this scheme is feasible pending clarification of land acquisition and borrow materials as discussed above. We note that crest levels have been directed to us by HBRC. Further work is required to confirm the actual 1% AEP flood level in this catchment.

10 Applicability

This report has been prepared for the exclusive use of our client Hawke's Bay Regional Council, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

The construction rates utilised for this high level cost estimate are based on assumed design concepts, estimated quantities and a combination of recently submitted tender rates for similar projects within the regional area along with the latest available rates from QV Cost Builder database (formerly Rawlinsons). These rates are based on historic information and data and do not include allowance for any cost escalation since the date of the data other than where/as specifically stated.

Consequently, a significant margin of uncertainty exists on the cost estimate and the contingency we have allowed should be considered as part of the cost rather than a potential add on.

In particular, we have not made any attempt to allow for the potential impact of COVID-19 in this estimate. Also, supply chain disruptions are currently having quickly-changing effects on construction costs and schedules. We recommend you seek up-to-date specialist economic advice on what budgetary allowances you should make for escalation, including for any potential changes in construction costs and timing in relation to both COVID-19 and supply-chain issues.

Tonkin & Taylor Ltd
Environmental and Engineering Consultants

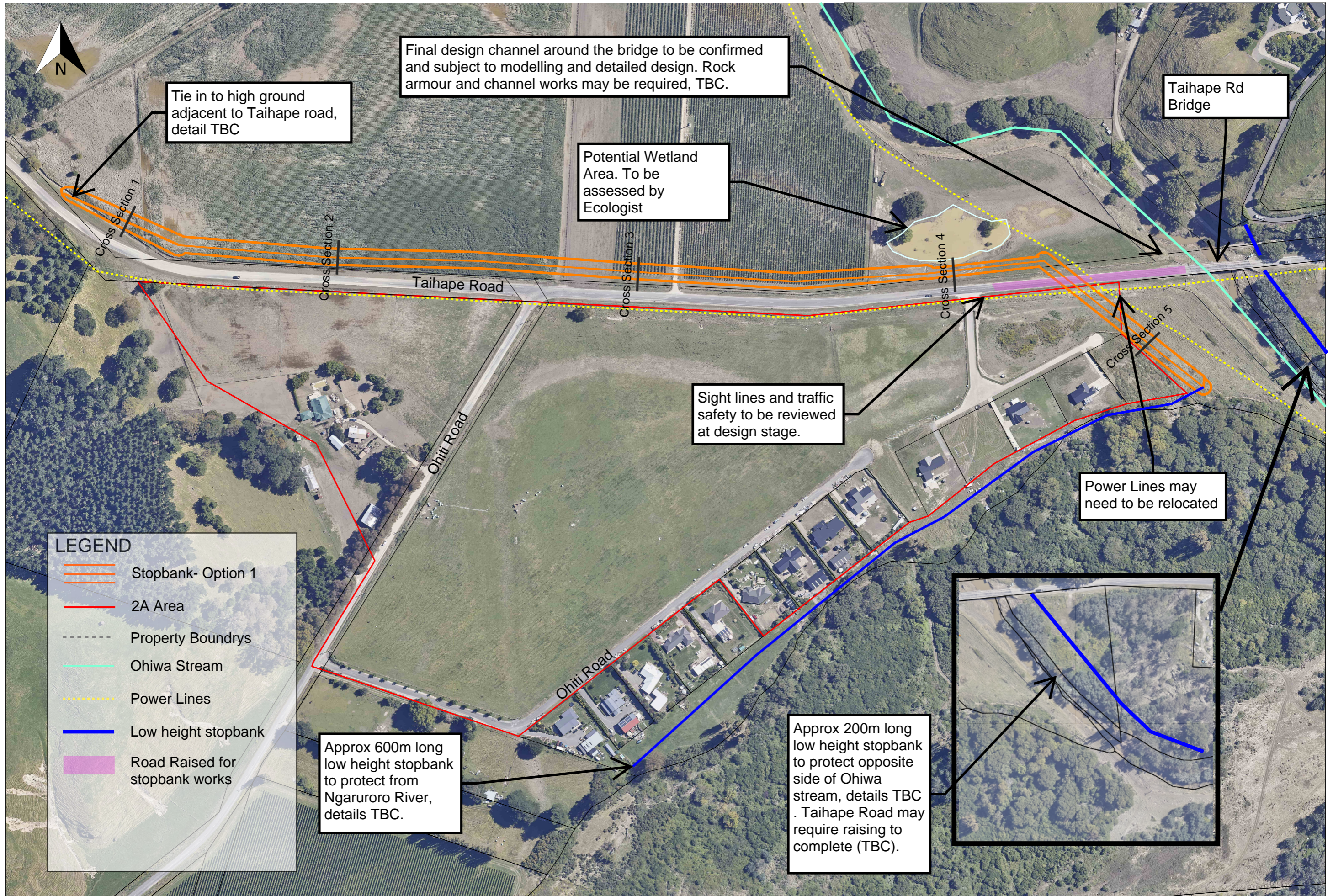
Report prepared by:

Authorised for Tonkin & Taylor Ltd by:

.....
Amelia Jeffery
Civil Engineer

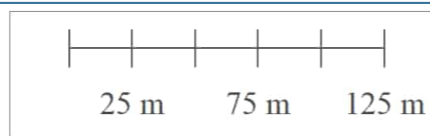
.....
Tim Morris
Project Director

Draft



NOTES:

Scale 1:3000



CRS: NZGD 2000 New Zealand Transverse Mercator METI/NASA, USGS, Hastings DC, LINZ, Maxar Credits: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare,

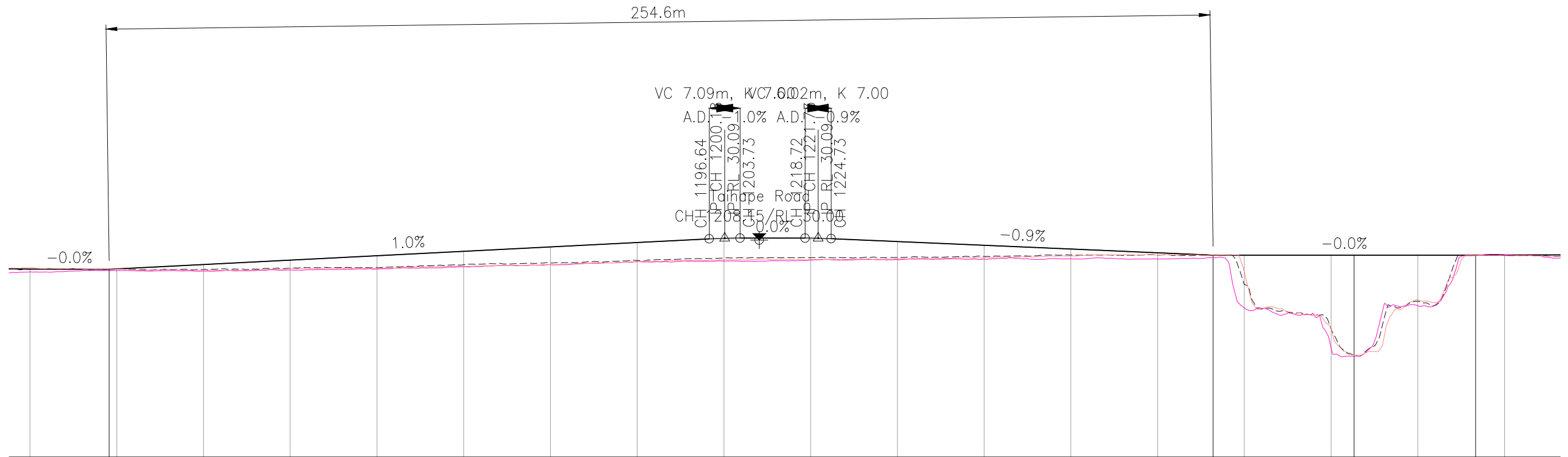
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DESIGNED	AMJE	OCT.23
DRAWN	-WEB-	OCT.23
CHECKED		

CLIENT	Hawkes Bay Regional Council
PROJECT	Land Catagorisation-Omahu
TITLE	Option1- Proposed Stopbank Alignment

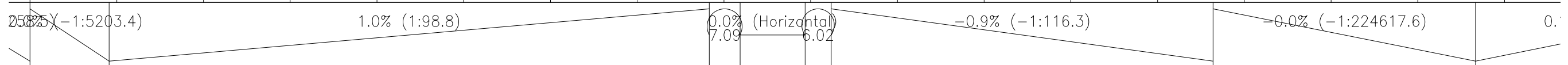
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FIG No.



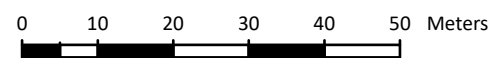
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1060.00	28.67	28.67	28.87	29.08	29.28	29.48	29.68	29.89	30.08	30.09	29.93	29.76	29.59	29.42	29.31	29.31	29.31	29.31
1080.00	0.01	0.23	0.38	0.55	0.62	0.74	0.83	0.91	0.90	0.73	0.51	0.28	0.11	1.35	3.41	2.13	0.00	
1100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1120.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1140.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1160.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1180.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
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NOTES:

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PROJECT No. 1017353.2301

DESIGNED ANCA 12/23
DRAWN
CHECKED

CLIENT Hawkes Bay Regional Council

PROJECT Land Catagorisation-Omahu

TITLE Cross Section- Raised Taihape Road

APPROVED DATE

SCALE (A3) 1:1000

FIG No. 1 of 2

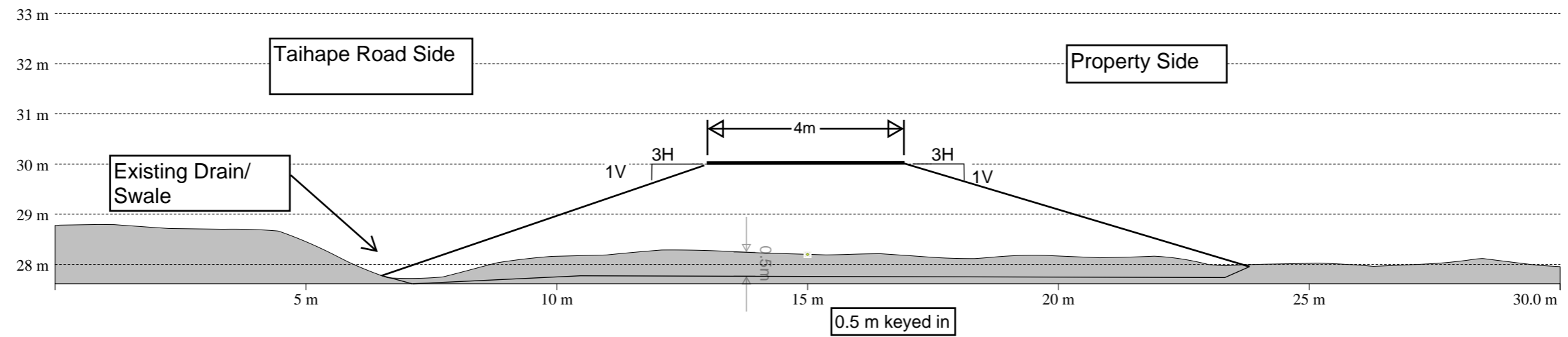
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 Checked by:

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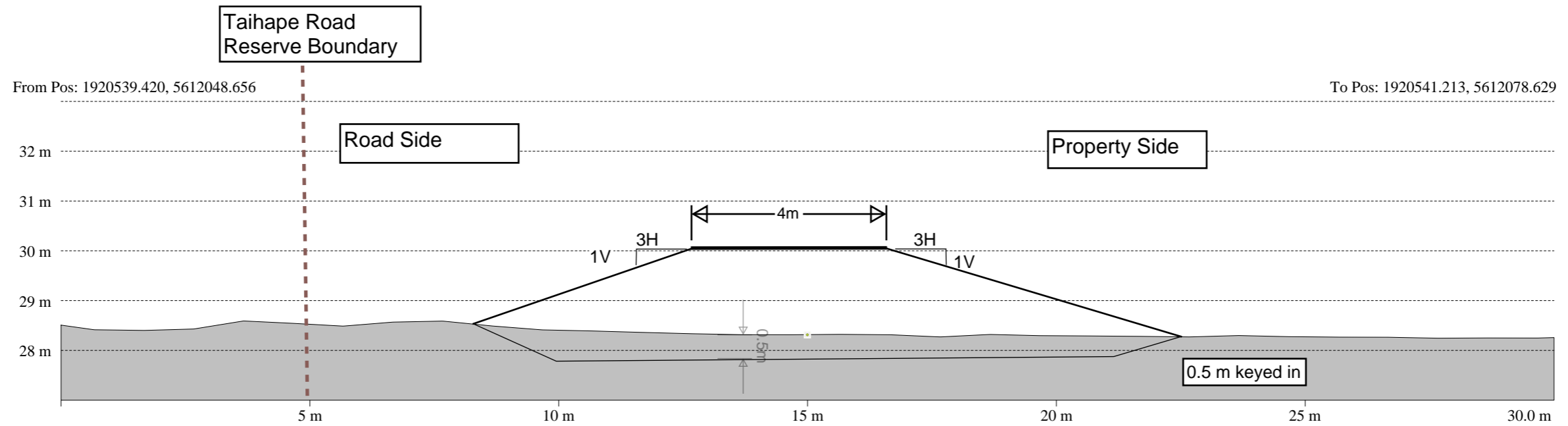
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2. VERTICAL DATUM: NZVD 2016
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Drawn by: AMJE
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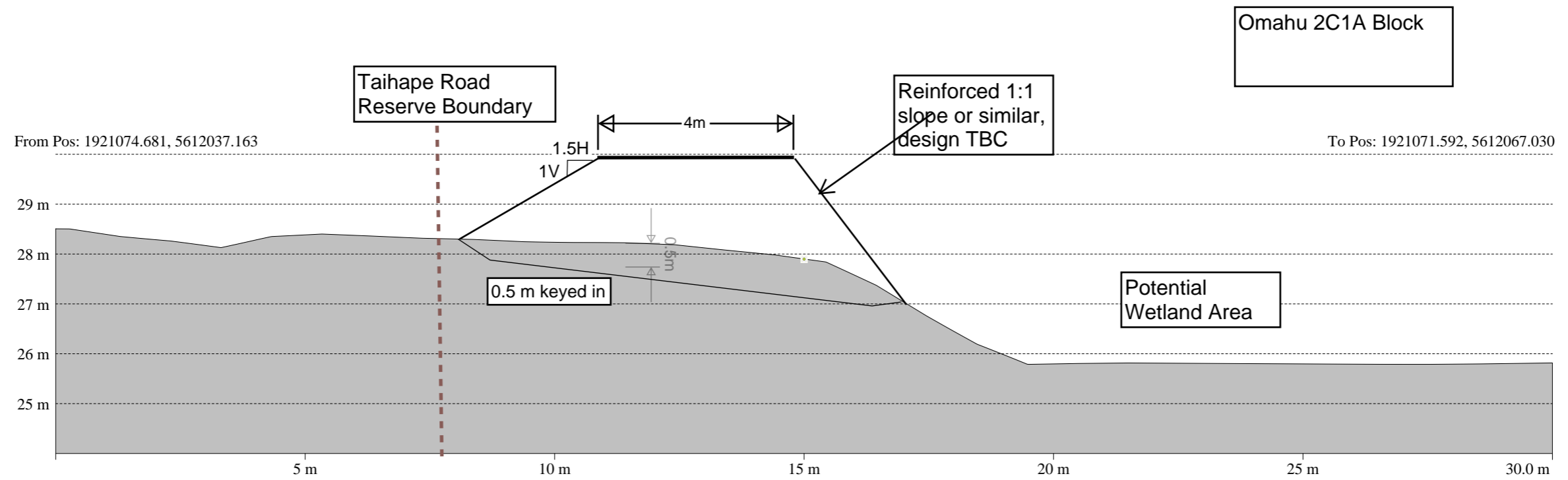


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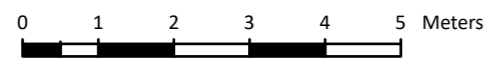
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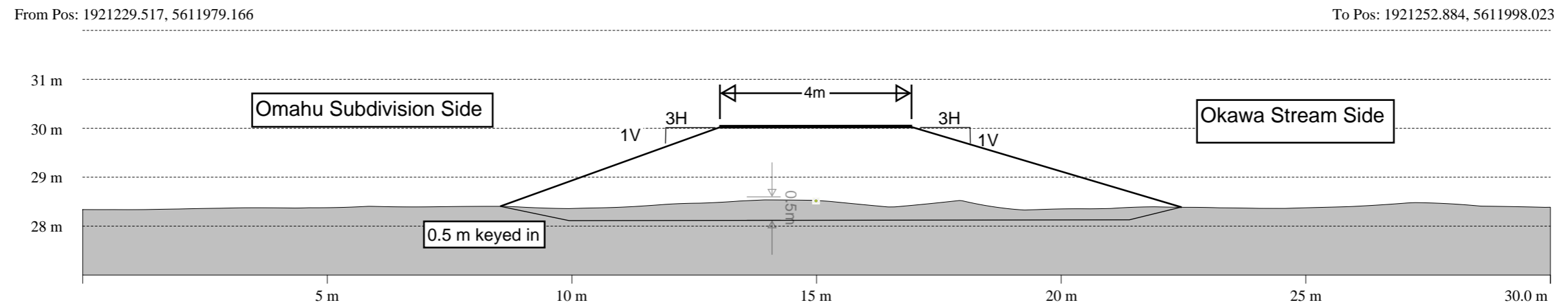


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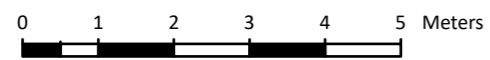
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Cross-section 5

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Checked by:

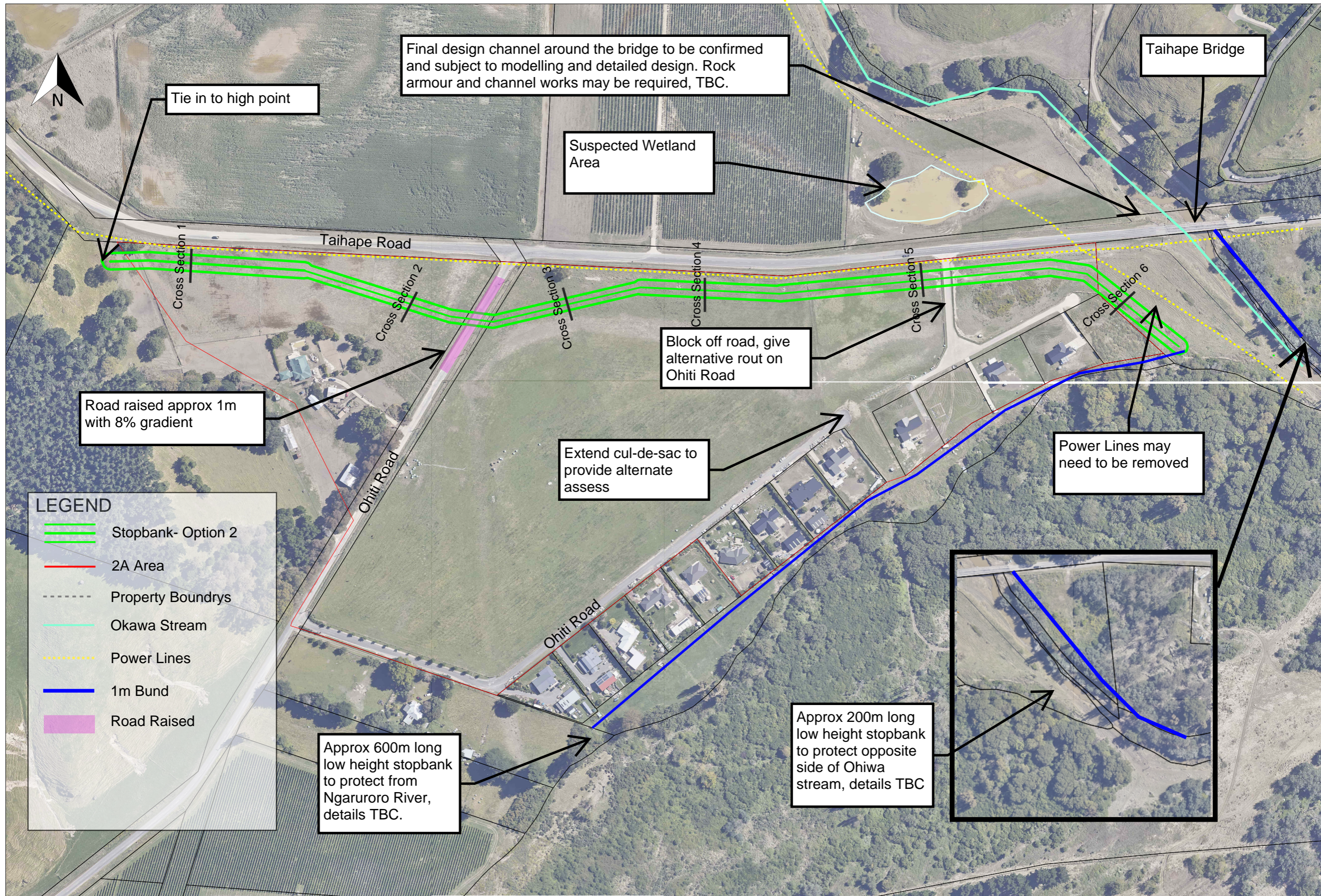


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2. VERTICAL DATUM: NZVD 2016
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Final design channel around the bridge to be confirmed and subject to modelling and detailed design. Rock armour and channel works may be required, TBC.

Taihape Bridge

Suspected Wetland Area

Tie in to high point

Taihape Road

Cross Section 1

Cross Section 2

Cross Section 3

Cross Section 4

Cross Section 5

Cross Section 6

Block off road, give alternative rout on Ohiti Road

Road raised approx 1m with 8% gradient

Extend cul-de-sac to provide alternate assess

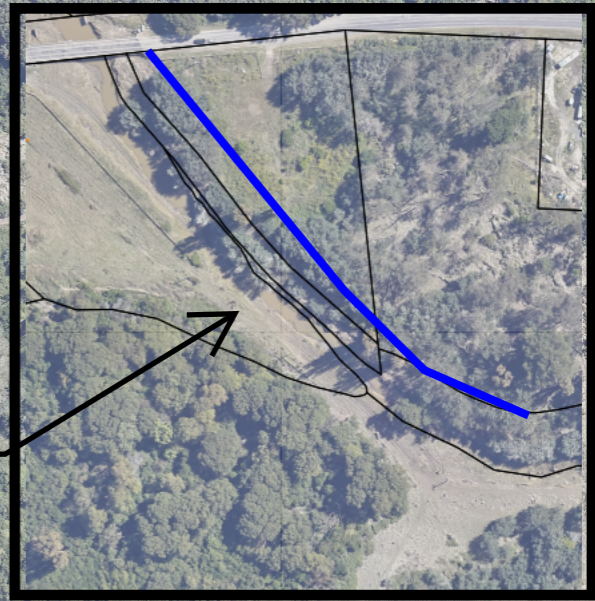
Power Lines may need to be removed

LEGEND

- Stopbank- Option 2
- 2A Area
- - - Property Boundrys
- Okawa Stream
- - - Power Lines
- 1m Bund
- Road Raised

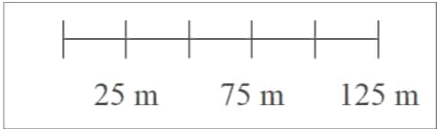
Approx 600m long low height stopbank to protect from Ngaruroro River, details TBC.

Approx 200m long low height stopbank to protect opposite side of Ohiwa stream, details TBC



NOTES:

Scale 1:3000

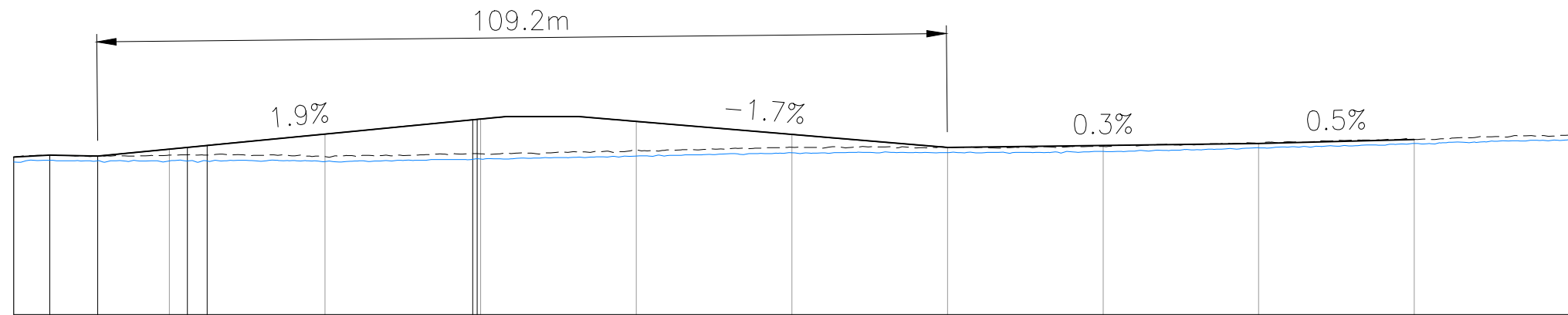


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PROJECT No. 1017353.2301	
DESIGNED	AMJE
DRAWN	-WEB-
CHECKED	

CLIENT	Hawkes Bay Regional Council
PROJECT	Land Catagorisation-Omahu
TITLE	Option 2- Proposed Stopbank Alignment

datum 25.00



CUT/FILL	0.00	0.16	0.58	0.89	0.73	0.33	0.00	0.03	0.00	0.00	
PROPOSED LEVEL	29.05	29.25	29.64	30.03	29.97	29.63	29.29	29.35	29.40	29.50	
EXISTING LEVEL	29.05	29.10	29.06	29.13	29.24	29.30	29.29	29.32	29.40	29.50	
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00
VERTICAL GEOMETRY	1.1% (1:90.9)		1.9% (1:51.8)		0.0% (Horizontal)		-1.7% (-1:59.6)		0.3% (1:380.1)		0.5% (1:194.8)

29.61

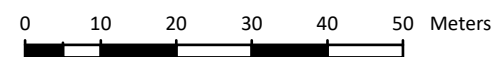
OHITI ROAD



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NOTES:

A3 SCALE 1:1,000



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PROJECT No. 1017353.2301

DESIGNED	ANCA	12/23
DRAWN		
CHECKED		

CLIENT Hawkes Bay Regional Council

PROJECT Land Catagorisation-Omahu

TITLE Cross Section- Raised Ohiti Road

APPROVED DATE

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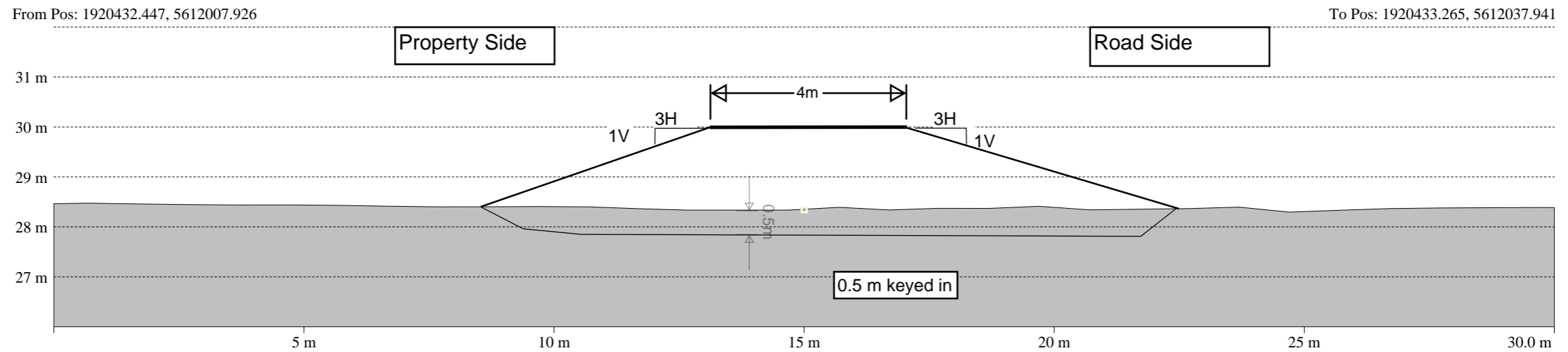
FIG No. 2 of 2

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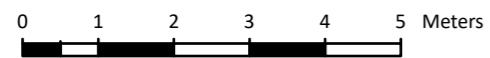
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Date: 27/10/23
Checked by:



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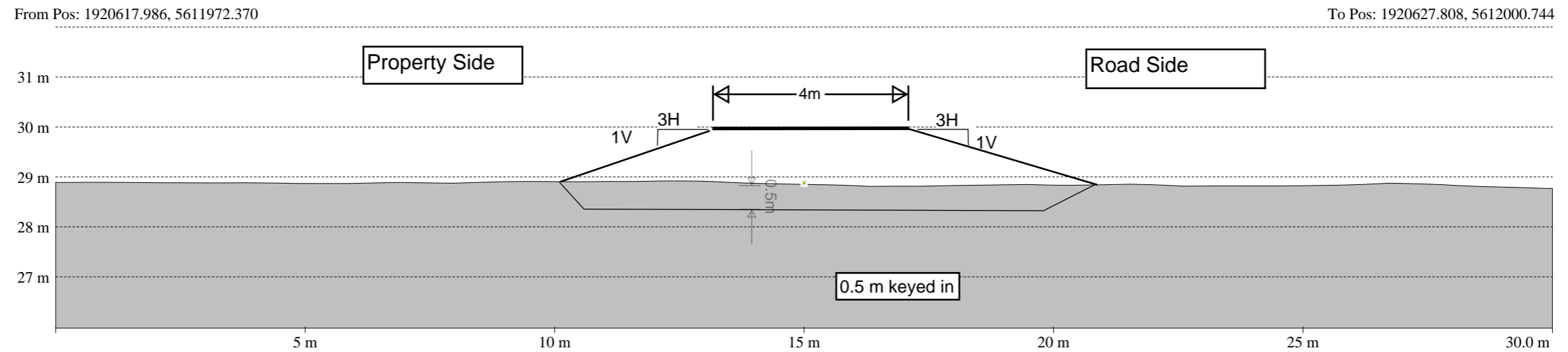
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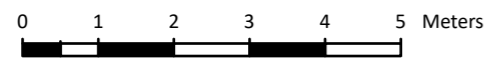
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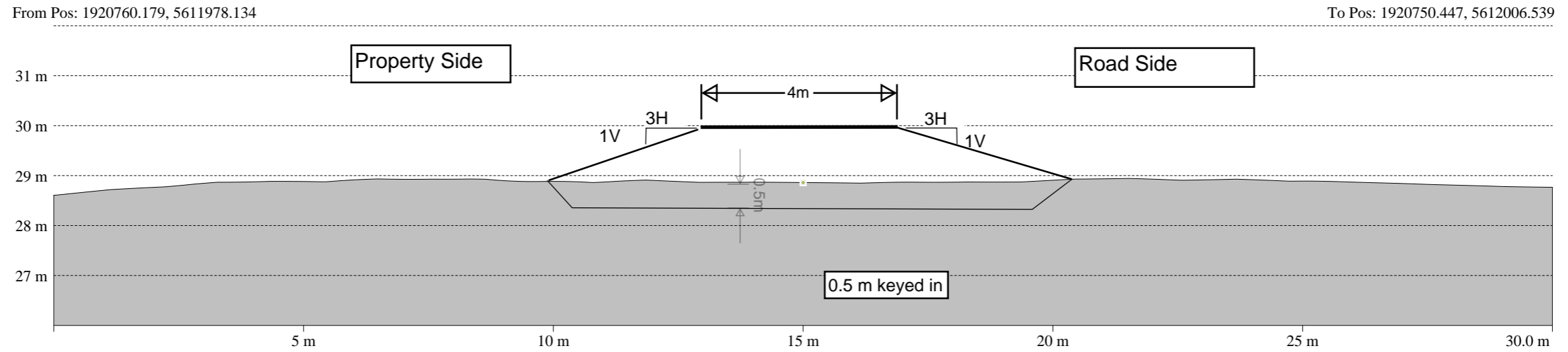
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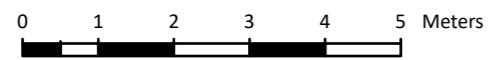
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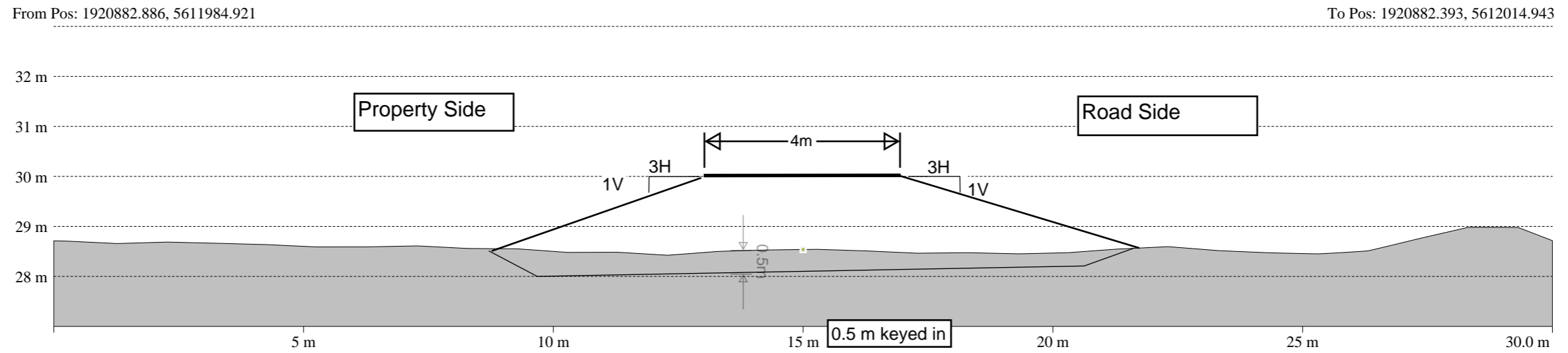
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Cross-section 4



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Date: 27/10/23
Checked by:



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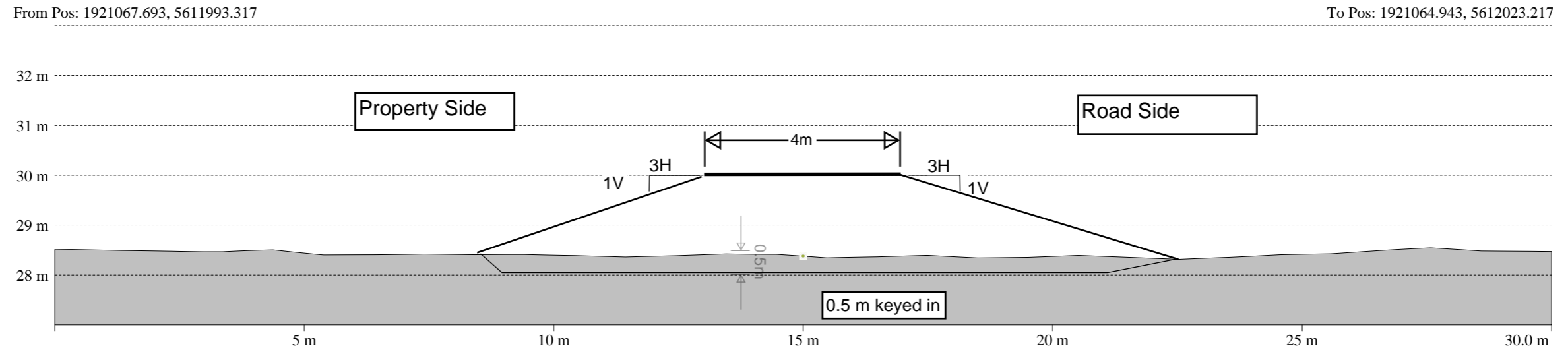


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Cross-section 5

Drawn by: AMJE
Date: 27/10/23
Checked by:



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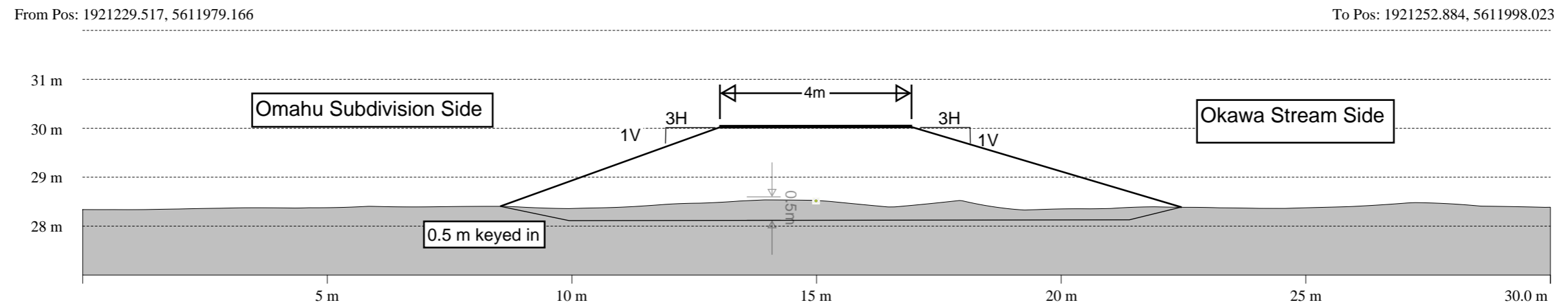


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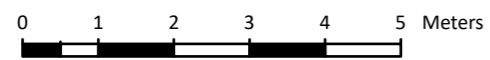
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Cross-section 6

Drawn by: AMJE
Date: 27/10/23
Checked by:



A3 SCALE 1:100



DRAWING NOTES:

1. COORDINATE DATUM: NZGD2000, NEW ZEALAND TRANSVERSE MERCATOR (NZTM2000).
2. VERTICAL DATUM: NZVD 2016
3. LIDAR DERIVED DEM FROM LINZ DATA SERVICE. DATA NAME: "Gisborne and Hawke's Bay - Cyclone Gabrielle River Flood LiDAR 1m DEM (2023)"

Appendix B Preliminary planning assessment

Draft

The sections below set out a preliminary analysis of the statutory planning provisions that could be relevant to the two options. Further detailed statutory analysis of the proposed activities will be required once an option is selected, the final activities are confirmed and as part of the resource consent and Assessment of Effects on the Environment (AEE) report preparation process.

A1 Relevant RMA statutory documents

The following statutory documents are relevant to the proposed works:

- Hawkes Bay Regional Council (HBRC) Resource Management Plan, including the TANK Plan Change (under appeal);
- Hastings District Council (HDC) District Plan; and
- Resource Management (National Environmental Standards for Freshwater) Regulations 2020 (NES-F).

The zoning and planning notations that apply to the site are outlined below in Table C1.1.

Table C1.1: Zoning and planning notations

Zoning/planning notation	Description
HBRC Resource Management Plan	
Schedule VIII Riparian Protection	The Ngaruroro River at this location is identified as a river with a high use for recreation and a river considered for riparian recreation.
Schedule IV Productive Aquifer Systems and Figure 3 Aquifer Systems	The site is within the Heretaunga-Ruataniwha Confined Aquifer System.
Schedule II Land Cover	The site is identified 'Primarily Pastoral'. This overlay is not relevant to the proposed works.
Schedule II Sustainable Land Use Capability	Parts of the stopbank are identified as 'horticulture'. This overlay is not relevant to the proposed works.
Schedule IV Productive Aquifer Systems	The site is underlain by an unconfined aquifer system.
Schedule V Contamination Vulnerability	The site is identified as 9 on the ten-point scale, with 1 being the least vulnerable to contamination.
Schedule X Rule 7	Applies to the site. Areas within this overlay do not need to comply with rule 7 permitted activity standard C, specifically vegetation clearance must be setback 5 m from a river, lake or wetland.
Schedule XIV Heretaunga Plains Sub-Region	The site is located within the Heretaunga Plains sub-region.
TANK Plan Change Schedule 26 Surface Water Quality	The site is with the Ngaruroro surface water quality area.
TANK Plan Change Schedule 27 Priority catchments	The site is within a 'medium priority' area for sediment yield and 'medium priority' for phosphorus yield. The site is a 'medium priority' for nitrogen yield. The Ngaruroro River and the immediate surrounds are identified as a 'Priority Oxygen Risk Area'.
TANK Plan Change Schedule 30 Water Quantity	The site is within the Ngaruroro surface water quantity area. As water takes are not proposed this overlay is not relevant to the proposal.

Statutory Acknowledgement Area	The bed of the Ngaruroro River and its tributaries are a statutory acknowledgement area for Heretaunga Tamatea and Ahuriri.
HDC District Plan	
Zone: Plains Production and Rural	The area to the south of Taihape Road is zoned Plains Production and the area to the north of Taihape Road is zoned Rural.
Unconfined Aquifer	An unconfined aquifer is mapped over the entire site.
River Hazard Overlay	Part of the proposed stopbank is within this overlay
Riparian Land Management – List 1	Part of the proposed stopbanks are within the ‘Riparian Land Management overlay’.

A1.1 Key potential resource consent requirements

The potential resource consent requirements and permitted activities are summarised below.

A1.1.1 Potential resource consent requirements

Resource consent is likely required from HBRC and HDC for the following activities:

HBRC:

- Discharge of cleanfill or fill containing contaminants to land (if contaminated fill is to be imported) – discretionary activity under Rule 52 of the Resource Management Plan as the site is located over an unconfined aquifer.
- Earthworks outside, but within a 100 m setback from, a natural wetland – non-complying activity under Regulation 52 of the NES-F (applies to Option 1 only).

HDC:

- Earthworks for stopbank construction – restricted discretionary activity under Rule EM6 of the District Plan.

A1.1.2 Potential permitted activities

The following activities may be a permitted activity, subject to compliance with rule conditions, and resource consent may not be required:

HBRC:

- Earthworks and vegetation clearance – permitted activity under Rule 7 of the Resource Management Plan (note that the Omāhu area is located in the Schedule X overlay). Areas within this overlay do not need to comply with Rule 7 permitted activity standard C, specifically vegetation clearance must be setback 5 m from a river, lake or wetland.
- Stream works within the Ohiwa stream for the purposes of river control and drainage works undertaken by a local authority – permitted activities under Rule 70 of the Resource Management Plan.

HDC:

- Construction of stopbanks and vegetation clearance within the River Hazard Overlay - Permitted activity under Rule 15.1.5 NH1.
- Removal of vegetation within Riparian Land Management overlay – Permitted activity under Rule 19.1.5 RM1.
- Construction noise - Permitted activity under Rule 25.1.5 NS1.

- Re-location of powerlines – Permitted activity Rule 22.1.5.1 NU2 (vi).

A1.1.3 Further information requirements

The following information is required to confirm the resource consent requirements and prepare resource consent applications:

- The vegetation clearance required.
- Final earthworks volumes, areas, and whether cleanfill or fill containing contaminants will be imported.
- The proposed Ohiwa stream works.
- Construction methodology and an erosion and sediment control plan.
- Ecological effects assessment, including an assessment of potential effects and confirmation of the presence, or lack of, natural wetlands at the site.

A2 Archaeological authority

A review of the District Plan planning maps and the NZAA 'ArchSite' archaeological database has been undertaken. No known archaeological sites have been identified within the vicinity of the works site. As such, we are not aware of any site features that require an Authority to be obtained from Heritage New Zealand prior to earthworks commencing. However, we would recommend that accidental discovery protocols are implemented during the earthworks.

Notwithstanding this, with all earthworks there is a risk that accidental discoveries may be made. Should there be a discovery, it may delay construction while the site is reviewed by Heritage New Zealand and mana whenua and any necessary Archaeological Authorities are obtained. This delay could be reduced by seeking a general archaeological authority in advance.

A3 Wildlife Act 1953

There are no overlays or notations in the District Plan that indicate that the site is ecologically sensitive. However, as there will be vegetation clearance there is the potential to disturb species that are protected under the Wildlife Act 1953 (e.g. lizards and bats). The presence, or lack of, protected species and subsequent Wildlife Act Authority requirements should be confirmed with an ecologist.

Note: The processing time for a permit from the Department of Conservation (DoC) is approximately 6-9 months.

A4 Consultation

The Ngaruroro River and its tributaries are statutory acknowledgement areas for Heretaunga Tamatea and Ahuriri. Therefore, we recommend consultation with these two parties during the preparation of the resource consent application(s) with a view to obtaining their written approval for the works.

Once the design is advanced, the surrounding landowners that should be consulted during the preparation of a resource consent application can be confirmed.