Report to the Hearing Committee on a notified resource consent application

Summary of application

Activity:	To undertake construction works associated with the Pinehaven Stream Improvement flood mitigation works in the bed of the Pinehaven Stream.
File Reference:	WGN200083
Applicant:	Upper Hutt City Council
Consents Sought:	**[36459]: Discretionary Activity** Land use consent to undertake works in the bed of the Pinehaven Stream involving the placement, replacement and removal of structures; and the construction of naturalised channel banks, in relation to the Pinehaven Stream Improvement flood mitigation works, including associated disturbance and deposition to the streambed. **[36460]: Discretionary Activity** Land use consent to undertake soil disturbance activities within 5m of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works. **[36461]: Discretionary Activity** Water permit to undertake the temporary damming and diversion at numerous locations of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works. **[36825]: Discretionary Activity** Discharge permit to temporarily discharge sediment-laden water associated with the construction of the Pinehaven Stream Improvement works to the Pinehaven Stream; and to temporarily discharge sediment-laden runoff from earthworks within 5m of the Pinehaven Stream to land where it may enter water (Pinehaven Stream).

[36829]: Discretionary Activity
Land use consent to reclaim a 78m stretch of the Pinehaven Stream at 26 and 28 Blue Mountains Road.

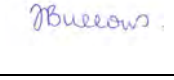
[36830]: Discretionary Activity
Water permit for the permanent realignment and diversion of the Pinehaven Stream at 26 and 28 Blue Mountains Road; and to construct a flood diversion wall at Willow Park outside of the bed of the Pinehaven Stream which permanently divert flood waters of the Pinehaven Stream.

Location: Pinehaven Stream, between 48 Whitemans Road and Pinehaven Reserve

Map Reference: Between at or about map reference NZTM 1768992.5442638 and NZTM 1769016.5441755

Legal Descriptions: See Appendix 1

Recommendation: I recommend that the above consents be **granted** subject to conditions recommended in Appendix 2, for the reasons outlined in this report.

Report prepared by:	Josephine Burrows	Resource Advisor, Environmental Regulation		13/07/2020
Report peer reviewed by:	Claire McKevitt	Senior Resource Advisor, Environmental Regulation		13/07/2020
Report approved by:	Kirsty van Reenen	Team Leader, Environmental Regulation		13/07/2020

Qualifications of reporting officer

My name is Josephine Burrows and I have been working as a Resource Advisor at Greater Wellington Regional Council (GWRC) since March 2018. I hold a Bachelor of Science with Honours (first class) in Geography from the University of Otago. I also worked as an Environmental Scientist at Beca Limited for two and a half years prior to joining GWRC.

Contents

Pinehaven Stream Improvement works

1. Purpose of this report

This report provides an assessment of the resource management issues in respect of a resource consent application made by Wellington Water Limited (WWL) on behalf of Upper Hutt City Council (UHCC, the applicant) to Greater Wellington Regional Council (GWRC) on 19 September 2019.

The proposal involves physical improvements in the stream channel and surrounding land to increase the flood capacity of the Pinehaven Stream. The objectives of the project are to:

- Provide improved capacity and effective functioning stormwater infrastructure in the stream and its tributaries to a 1-in-25-year (4% annual exceedance probability, AEP) flood event, and contribute to the management of flood risk to habitable floor levels up to the peak 1-in-100-year (1% AEP) flood event;

- Reduce risk of injury or harm from fast or deep flowing water in the Pinehaven Stream and its tributaries;

- Integrate overland flow paths into the wider stormwater network; and

- Enable efficient and effective construction and ongoing maintenance of all structures and stream improvements.

The applicant jointly applied to GWRC and UHCC for the resource consents and a Notice of Requirement required for the proposal. This report relates only to the resource consents required from GWRC. The application for a Notice of Requirement to UHCC is considered in a separate report prepared by UHCC processing planner, Mr James Beban, Director/Planner at Urban Edge Planning Limited.

The assessment and recommendations contained in this report are not binding on the Commissioners. This report has been prepared without knowledge of the content of any evidence or submissions that will be made at the hearing; consequently it cannot be assumed that the Commissioners hearing the application will reach the same conclusions as those provided in this report.

2. Background to the proposal

2.1 History of flooding

The application describes that the Pinehaven Stream has a long history of flooding, with significant events occurring in 1976, 2004, 2005 and 2009. The 2009 event and subsequent modelling demonstrated that the stream channel capacity is likely less than a 1-in-5 year flood event. A further flood event occurred on 8 December 2019 (following lodgement of this consent application). This event was determined to be a 1-in-30 year event.

The three main factors that contribute to flooding in the Pinehaven Catchment are rainfall, urban development and forestry activities in the upper catchment. Structures in and over the stream (including private bridges, retaining structures, pipe inlets, a dwelling, utility crossings and two large road crossing culverts at Pinehaven Road and Sunbrae Drive) exacerbate flooding.

2.2 Pinehaven Stream Floodplain Management Plan

UHCC are responsible for the Pinehaven Stream catchment and tributaries upstream of the Pinehaven Reserve, while GWRC is responsible from the Pinehaven Reserve to its confluence with Hulls Creek.

As the stream is jointly managed, the Pinehaven Stream Floodplain Management Plan (PSFMP) was developed through a partnership between UHCC and GWRC. The PSFMP sets out a combination of methods to manage flooding in the catchment, including:

- Structural works – the physical works that are the subject of this consent application (and also the replacement of the Sunbrae Drive and Pinehaven Road culverts which have been consented under GWRC consent WGN200101);

- Non-structural works – planning controls for development (UHCC Plan Change 42), community awareness and preparedness, and emergency procedures; and

- River management – maintenance of the stream to avoid blockages, maintain capacity and minimise erosion.

The final PSFMP was endorsed by the Councils in June 2016 following an independent review of the hydraulic modelling, which confirmed the modelling was fit for purpose.

3. Location of the proposed works

3.1 Surrounding area

The location of the proposed works is within and adjacent to the Pinehaven Stream, which is located to the southwest of the main urban area of Upper Hutt.

Land use in the proposed area of works is largely residential. Other land use in the area includes the Pinehaven Reserve at the upstream end of the works, Willow Park at the lower end of the works, and the Silverstream Reformed Church located on Blue Mountains Road. A business/commercial area, Silverstream Park and Silverstream School are located downstream of the proposed works.

For the purpose of the proposed structural works, the stream has been split into the following three reaches, much of which is located within private property (see Figure 1):

- Reach 1 – 48 Whitemans Road to Sunbrae Drive culvert;
- Reach 2 – Sunbrae Drive culvert to Pinehaven Road culvert; and
- Reach 3 – Pinehaven Road culvert to Pinehaven Reserve.

3.2 Pinehaven Stream and downstream environments

The Pinehaven Stream discharges into Hulls Creek near Whitemans Road, which discharges into the Hutt River (Te Awa Kairangi) to the south of the Western Hutt Road Bridge.

The Pinehaven Stream is referenced in only one Schedule of the Proposed Natural Resources Plan, as a tributary of the Hutt River in the Ngāti Toa Rangatira Claims Settlement Act Statements of Association. Neither the Pinehaven Stream nor Hulls Creek are listed in any other Schedules of the Proposed Natural Resources Plan as having any other specific values.

The Hutt River around the confluence of Hulls Creek is identified in Schedule B (Ngā Taonga Nui a Kiwa to Ngāti Toa Rangatira and Taranaki Whānui ki te Upoko o te Ika), Schedule D1 (Port Nicholson Block (Taranaki Whānui ki Te Upoko o Te Ika) Claims Settlement Act 2009), Schedule F1 (river with significant indigenous ecosystems – threatened or at risk fish habitat and migratory fish habitat), Schedule H1 (significant primary contact recreation river), Schedule I (trout fishery river, trout spawning river), and Schedule M1 (surface water drinking water supply river)

The Pinehaven Stream is not identified in any of the Appendices of the Regional Freshwater Plan. Hulls Creek is identified in Appendix 4 as having important trout habitat, while the Hutt River (around the confluence of Hulls Creek) is identified in Appendix 4 as having important trout habitat and Appendix 5 as a water body with regionally important amenity and recreational values.

Figure 1: Reaches 1, 2 and 3 of Pinehaven Stream (from consent application documents)

4. Proposal

4.1 Description of proposed works

The applicant proposes to undertake physical improvements in the stream channel and surrounding land to increase the flood capacity of the Pinehaven Stream.

Throughout the processing of this application, the applicant has proposed a number of changes to the original proposal that was lodged with GWRC on 19 September 2019. Following a review of the proposed changes, I am comfortable that they are within scope of the original application. The final proposal is described in the following documents provided by the applicant:

- Revised Appendix 2 of letter from Helen Anderson to Josie Burrows dated 23 April 2020; and
- General Arrangement Plans IZ089000-SP3-400-CD-DRG-3100 through to -3106 revision C, provided to GWRC on 11 June 2020.

Listed below and described in detail in the following sections 4.1.1 – 4.1.9, are the parts of the proposal requiring regional resource consent:

- Construction of vertical retained channel walls – 58 Whitemans Road; 4 Blue Mountains Road; Willow Park; 10A Blue Mountains Road; 14 Blue Mountains Road; 4 Sunbrae Drive; river corridor (Lot 8 DP 32985); 30, 32, 34, 36, 38, 48 and 50 Blue Mountains Road; and 8, 10, 10A, 11 and 12 Birch Grove.

- Construction of naturalised channel banks (trapezoidal channels) – Willow Park; river corridor (Lot 8 DP 32985); 13, 15 and 17 Deller Grove; and 24, 26, 28 and 48 Blue Mountains Road.

- Replacement of existing bridges: 4 Blue Mountains Road (pedestrian), 50 Blue Mountains Road (one pedestrian bridge); 12 Birch Grove (pedestrian); and 10B Birch Grove (culvert to be replaced with bridge, providing access to 10A, 10B and 10C Birch Grove).

- Removal of existing bridges: Willow Park (pedestrian); 28, 30, 32, 34 and 36 Blue Mountains Road (pedestrian and vehicular); and 10A Birch Grove.

- Construction of new bridges: Willow Park (4 Sunbrae Drive and 10A Blue Mountains Road, pedestrian/cycle); 28 and 30 Blue Mountains Road (and providing access to 32 Blue Mountains Road, vehicular); and 34 and 36 Blue Mountains Road (vehicular).

- Upgrade debris screens at inlet structures (outside 48 Whitemans Road and 58 Whitemans Road bypass structure).

- Relocation of utility services (including six wastewater pipelines and private utilities at 8 Blue Mountains Road; 24, 26 and 28 Blue Mountains Road; 12 Birch Grove; and 10B Birch Grove).

- Construction of a low flood protection wall on the boundary of Willow Park and 10A Blue Mountains Road.

- Installation of bank stabilisation works including use of Redi-Rock and a geotechnical stabilisation approach of self-drilling bar to secure geomat to a slope (three locations at 50 Blue Mountains Road).

- Installation of riprap scour protection (various locations along the Pinehaven Stream, including around proposed structures, at individual locations and at the stormwater outlet structure at 15 Clinker Grove).

- Realignment of the stream at 26 and 28 Blue Mountains Road (reclamation of the existing channel and creation of a new channel).

- Removal of a house (48 Blue Mountains Road) located over the streambed.

Post-construction maintenance (the applicant has advised that consent is not required for the post-construction maintenance works, however they have been included in the proposal description and rules assessment for completeness).

4.1.1 Construction of vertical retained channel walls

At locations where the area surrounding the stream is constrained by existing development, the channel walls will be retained using either contiguous pile walls or a block wall system. See Figure 2 below from the applicant's landscape plans which gives an indication of what the works may look like.

Figure 2: Landscape plan giving indication of what the proposed works may look like 10 years after construction (from consent application Appendix F)

The retaining walls will be benched in areas depending on their overall height. The existing low flow channel will be maintained (with stream widening only occurring above this channel), and the area adjacent to the low flow channel will be benched and planted.

For all of these structures, freeboard of 300mm has been allowed (from design peak water surface level to the top of bank/wall).

4.1.2 Construction of naturalised channel banks

At sections of the stream which are not constrained by existing development, the streambanks will be widened and shaped to form a naturalised channel (also referred to as trapezoidal channel in the application documents).

The existing low flow channel will be maintained (stream widening only occurring above this channel), and the area adjacent to the low flow channel will be benched and planted.

At Willow Park, the proposal involves widening the channel to provide a floodplain area, construction of a boardwalk to provide all-weather access, and a significant amount of planting of the currently grassed area with riparian plants.

4.1.3 Installation of scour protection

The applicant proposes native planting, geotextile fabrics and the use of riprap for scour protection upgrades at various locations along the full length of the works.

4.1.4 Removal, replacement and construction of private access crossings

The proposal involves the removal, replacement and construction of a number of private access bridges and culverts (vehicle and pedestrian) with raised standardised bridges to match the widened channel.

For bridges shorter than 7 metres, a flat slab will be used. For longer bridges, a double tee bridge will be used. Both types will sit on abutments with driven timber piles.

Freeboard of 600mm (from design peak water surface level to the underside of the bridge deck) is included in the designs for these crossings.

4.1.5 Relocation of utility services

Utility services (including wastewater pipelines and private utilities) cross the stream at a number of locations. They will be disturbed during works and in some cases will be relocated or realigned to reduce the potential to cause blockages and exacerbate flooding.

4.1.6 Construction of a low wall

A low wall is proposed along the southern boundary of Willow Park and 10A Blue Mountains Road (now owned by UHCC), for flood protection and floodwater diversion purposes. The wall will be approximately 300mm high with a 1.8m high timber fence on top.

4.1.7 Reclamation and realignment of the stream at 26 and 28 Blue Mountains Road

The existing stream alignment at 26 and 28 Blue Mountains Road will be reclaimed and realigned to remove the existing right angle bends. This will result in a full reclamation of 78m of streambed. The proposed new alignment is through 26 Blue Mountains Road (privately owned) and 28 Blue Mountains Road (owned by GWRC). The current channel is 6.8m wide with retained banks, however the new channel will have naturalised banks.

The existing house at 28 Blue Mountains Road will be demolished. The new stream alignment will be constructed, then the diversion and connection of the existing streamflow will occur. Following this, the existing streambed will be filled in.

4.1.8 Removal of a house (48 Blue Mountains Road) from over the streambed

The proposed works involve the removal of a dwelling constructed over the stream at 48 Blue Mountains Road (this property is owned by GWRC).

4.1.9 Post-construction maintenance of the stream channel

The applicant proposes to continue maintenance of the stream channel following completion of the proposed works. This will involve maintaining stream flow and reducing the chance of blockages occurring (clearing of the stream channel of vegetation and litter), and maintaining the new structures and planting.

4.2 Pinehaven Road and Sunbrae Drive culvert replacements

WWL (on behalf of UHCC) applied separately to GWRC on 8 October 2019 for resource consent to replace the existing culverts under Sunbrae Drive and Pinehaven Road to increase the flood carrying capacity of the culverts.

The applicant applied for these works separately as the effects were no more than minor (and therefore the application for these works did not need to be publicly notified) and due to budget constraints they needed to commence works on those aspects of the proposal as quickly as possible.

GWRC granted consent for these works under resource consent WGN200101 on 5 March 2020.

4.3 Construction methodology

The applicant provided an updated Erosion and Sediment Control Plan (ESCP, revision 5) with their section 92 response dated 21 February 2020. This updated ESCP revision 5 addressed concerns and questions raised by GWRC in the section 92 request for further information dated 3 December 2019, and supersedes the initial ESCP provided with the application and aspects of the construction methodology referred to in the application document.

The applicant proposes to complete the works across 12 construction stages (identified in Table 1 of the ESCP revision 5). The stages will not be undertaken in any particular consecutive order (i.e. upstream/downstream), and

more than one stage may be open at one time. The proposed construction works are anticipated to occur over approximately two years.

The guiding principle of the construction methodology is that the streamworks be undertaken 'off-line', in a 'dry' works environment. This will be achieved by installing a temporary piped stream diversion for the majority of the stages of work. The ESCP revision 5 provides the methodology for the piped stream diversions, which I have described below.

In the sections below I have described the main construction methodology components that comprise the proposed works. Stage specific proposed construction methodologies are outlined in Appendix B of the ESCP revision 5.

4.3.1 Enabling works and site establishment

A range of enabling works are required prior to commencing the stream improvement works. As described in section 6.2.4 of the application document, these include:

- Setting up site offices (potentially at Willow Park or properties owned by GWRC);
- Removal and relocation or demolition of dwellings at properties owned by GWRC (including 4 Sunbrae Drive, 28 Blue Mountains Road and 48 Blue Mountains Road). Some structures may not be removed immediately if they could be used by the project, such as for site offices.
- Temporary fencing will be installed generally along the designation boundary and entry/exit points to the site for each stage.
- Realignment of existing sewer mains crossing the stream downstream of the Sunbrae Drive Culvert and from 15 Deller Grove to 24 Blue Mountains Road.
- Setting up a working area adjacent to the proposed bridges for the cranes. The working area will be 8m x 8m and will likely extend onto public roads. Temporary ground levelling may be required to provide a flat working platform.

4.3.2 Establishing erosion and sediment controls

Erosion and sediment controls are outlined in the ESCP revision 5 document. They are to be established before works commence on site and include (but are not limited to):

- Site management controls – e.g. topsoil management, temporary stockpiling, machinery management, vehicle tracking controls;
- Physical controls – e.g. silt fencing, filter socks, stormwater inlet protection;

- Site stabilisation requirements – e.g. tracking and topsoiling, short term stabilisation, revegetation, mulching, coconut matting; and

- Maintenance, monitoring and reporting on the performance of the controls.

4.3.3 Piped stream diversion

Following advice from GWRC, the applicant has amended their construction methodology from an 'instream' works methodology to a temporary 'piped diversion' methodology.

The piped diversion methodology (described in section 4.2.1 of ESCP revision 5) allows for the range of streamworks to be undertaken in a 'dry' environment and will result in reduced turbidity and sediment discharges to the stream.

As such, I have not specifically described how all works (e.g. retaining walls, construction of bridges, and removal of structures over the streambed) will be undertaken as they will be within the 'dry' work environment provided for by the temporary piped diversion. They are also described in Appendix B of the ESCP revision 5.

The piped stream diversion has a capacity of $0.5m^3$/second. Table 3 of the ESCP revision 5 identifies triggers as to when works are able to continue in the streambed by using a pump to control the water flow, and triggers for rainfall events outside of working hours or when the capacity of the pump is exceeded when the machinery and dam will need to be removed from the streambed. In the event that the dam will be removed from the streambed, damming and diversion activities may need to occur numerous times for a single section of works.

The applicant has advised the proposed methodology is consistent with the temporary waterbody diversion set out in the GWRC Erosion and Sediment Control Guidelines (2002), except that the water will be piped instead of flowing within a secondary open channel. The piped diversion methodology is shown in Figure 3 below.

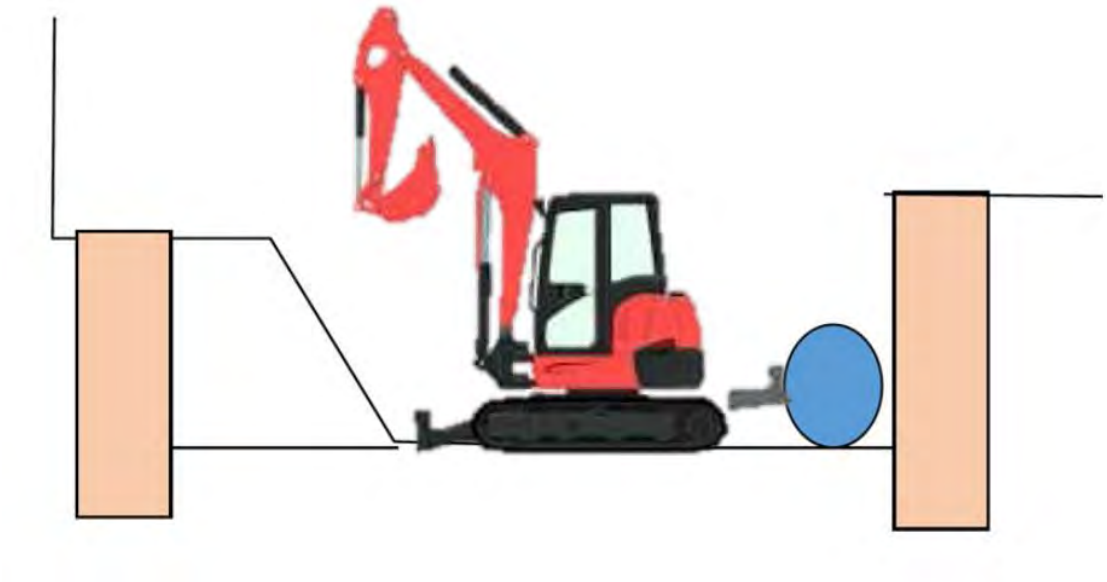


Figure 3: Example of piped diversion arrangement (from ESCP revision 5)

The typical construction sequence for the installation of the piped diversion (summarised from section 4.2.1 and Appendix B of the ESCP revision 5) is:

1. Construction of a temporary access ramp into the streambed.

2. Installation of inlet/outlet dams (likely sandbags and/or driven sheet piles). These works will be undertaken from within the flowing stream where required.

3. Transfer of all remaining fish and eels from within the works area to suitable habitat (fish rescue will have been undertaken prior to commencing installation of the piped diversion).

4. Installation of a 630mm diameter diversion pipe at a 1.15 gradient, and a pump where required to supplement gravity flow. The pipe outlet will be directed to a stabilised area with an energy dissipater (e.g. riprap or geotextile) to reduce erosion.

5. Installation of a 'dirty water' sump pump near the downstream dam within the dry works area to 'dewater' any stream water entering the works area (note, this is referred to as stream 'dewatering' throughout this report, however is not technically dewatering as per the definition in the Proposed Natural Resources Plan (PNRP) as it is surface water not groundwater). Dirty water will be treated through a sediment curtain or settlement tank (with the potential for flocculant to be used) prior to being discharged downstream.

6. Excavation of the first bank of the stream and construction of the retaining wall (with machinery operating from the bank due to lack of space within the streambed).

7. Relocation of the pipe to lie against the newly constructed wall, and installation of access ramp over pipe.

8. Excavation of second bank from the dry streambed and construction of the wall (machinery operating from the bed).

9. Completion of re-instatement works within and adjacent to the stream, and removal of ramp and any remaining materials from the streambed.

4.3.4 Stream livening

The applicant has proposed to undertake a stream livening exercise to reduce the potential for sediment entrainment when the piped stream diversion is removed (see section 4.2.1.1 of ESCP revision 5).

This will likely involve allowing some water to flow into the works area (following stream compaction mitigation activities), which will then be pumped out and treated by a settlement tank prior to being discharged downstream.

Following this, the dams will be fully removed as quickly as possible to allow the streamflow to flush out the remaining sediment accumulated in the works area.

4.3.5 Willow Park

The ESCP revision 5 identifies two potential methodologies for completing the works at Willow Park, which the applicant has advised will be confirmed during enabling works and will be documented in the relevant Site-specific Environmental Management Plan.

The potential methodologies described are the use of an earth bund and diversion channels (4.2.2.1 of ESCP revision 5) or installation of two decanting topsoil bunds (4.2.2.2 of ESCP revision 5).

4.3.6 Stage 3: 50 Blue Mountains Road

The methodology for this site will, in principle, be the same as the others however water will be diverted in a piped or mechanical diversion, likely using a pump/suction hose arrangement. The works will be undertaken in a dry streambed.

5. Adaptive Management Plan approach

In the ESCP revision 5, the applicant proposed a management plan framework and an adaptive management approach.

5.1.1 Management plan framework

The management plan framework (shown in Figure 4 below) outlines the hierarchy of the proposed management plans and how they interact. Broadly, there will be one overarching Construction Management Plan (CMP), under which sits an overarching Erosion and Sediment Control Plan (ESCP, which will be based on ESCP revision 5), the Pinehaven Kaitiaki Monitoring Strategy (PKMS) and other documents.

Site–specific Environmental Management Plans (SEMPs) will be written for each of the 12 stages of the works, and these will give effect to the higher order documents.

Those documents relating to matters of GWRC control (being the CMP, ESCP, SEMP, PKMS) will be submitted for certification by GWRC prior to works commencing on site, or for the SEMPs prior to works commencing on the relevant stage.

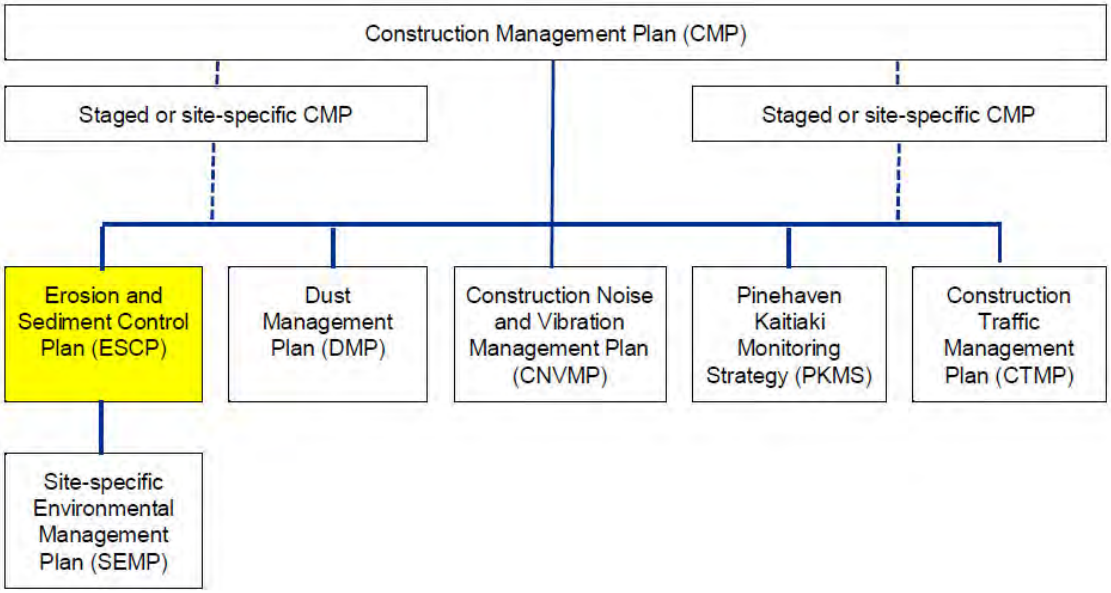


Figure 4: Pinehaven Stream Improvements Management Plan Framework (from ESCP Revision 5, provided by the applicant in section 92 response dated 21 February 2020)

5.1.2 Adaptive management approach

The applicant has proposed an adaptive management approach to address the potential sediment discharges from the proposed works (an overview diagram of the approach is provided in Appendix A of the ESCP revision 5).

This approach is consistent with the consent that was recently granted by GWRC for the replacement of the Pinehaven Road and Sunbrae Drive culverts (WGN200101). It will be implemented through the SEMP development and certification process, which will provide a feedback loop for lessons learned in

the initial stages of works which can be implemented in the later stages (thus ensuring the best practicable option is used at each stage of works).

The applicant has advised that they will take the lessons that are learnt from the Pinehaven Road and Sunbrae Drive culvert replacement works into their construction methodology, trigger limits and responses in the SEMPs for the works proposed in this consent application.

5.2 Proposed conditions as part of the application

The applicant has put forward a number of conditions as part of their application to undertake the proposed works, which form part of the proposal (see Appendix D of the section 92 response dated 21 February 2020). Those that relate to mitigating effects of the proposed works on the environment are described in the relevant sections of the assessment of environmental effects below (Section 10). As such, I have not repeated the proposed conditions here.

6. Statutory reasons for requiring resource consents

Under sections 9, 13, 14 and 15 of the Resource Management Act 1991 (the Act), the proposed activities are governed as follows:

- Section 9 – restrictions on use of land;
- Section 13 – restriction on certain uses of beds of lakes and rivers;
- Section 14 – restrictions relating to water; and
- Section 15 – discharge of contaminants into the environment.

The activities proposed by the applicant are not permitted as of right under these sections of the Act or by the regional plans; therefore resource consent is required.

A full rules assessment under the Proposed Natural Resources Plan (PNRP) and the Operative Regional Freshwater Plan (RFP) is included in Appendix 3 of this report. The following sections describe the current status of the regional plans, and list the activities for which resource consent is required.

6.1 Proposed Natural Resources Plan

The Council's decision on the Proposed Natural Resources Plan was publicly notified on 31 July 2019. All rules in the PNRP (decisions version) have immediate legal effect under section 86B(1) of the Act. As the application was lodged after 31 July 2019, the PNRP (decisions version) is relevant to determining the resource consents required, their activity status, and the substantive assessment of the proposal under section 104(1)(b) of the Act. Note, the provisions of the PNRP as notified on 31 July 2015 have been superseded by the decisions version of the PNRP for assessing this proposal.

These requirements are in addition to any consents required under the operative plans, noting that under section 86F if there are no appeals on a relevant rule, the rule in the PNRP is treated as operative and the rule in the operative plan is treated as inoperative. As the majority of the relevant rules in the PNRP for this proposal have been appealed, both the operative and the proposed plans need to be considered.

Under the PNRP, resource consent is required for the following activities:

- The use of the streambed for the vertical retained channel walls (discretionary activity under Rule R129);
- The use of the streambed for the naturalised channel banks (discretionary activity under Rule R129);
- The use of the streambed for the placement of riprap erosion and scour protection (discretionary activity under Rule R129);

- The reclamation and realignment/permanent diversion of the stream at 26 and 28 Blue Mountains Road (discretionary activity under Rules R129 and R131);

- The use of the streambed for the replacement of existing structures, including gabion baskets, private vehicle and pedestrian bridges, a stormwater outlet, Whitemans Road stormwater inlet and bypass debris screens (discretionary activity under Rule R129);

- The use of the streambed for the construction of new bridges (discretionary activity under Rule R129);

- The use of the streambed for the removal or demolition of existing structures that are not being replaced (discretionary activity under Rule R129);

- The use of the streambed for the relocation of utilities (discretionary activity under Rule R129);

- The use of the streambed for the tracking of machinery (discretionary activity under Rule R129);

- The use of the streambed for the removal of plants (discretionary activity under Rule R129);

- The permanent diversion of floodwaters by the proposed flood diversion wall at Willow Park (discretionary activity under Rule R135);

- The temporary damming and diversion of the Pinehaven Stream associated with the piped stream diversion methodology (discretionary activity under Rule R131);

- The discharge of contaminants (sediment-laden runoff including flocculant) to the Pinehaven Stream associated with the construction works and the discharge of stream 'dewatering' water (discretionary activity under Rule R68); and

- The use of land for earthworks and discharge of sediment-laden runoff to the Pinehaven Stream (discretionary activity under Rule R101).

6.2 Operative Plans

The only operative plan of relevance to this proposal is the Operative Regional Freshwater Plan. Under the RFP, resource consent is required for the following activities:

- The use of the streambed for the vertical retained channel walls (discretionary activity under Rule 49);

- The use of the streambed for the naturalised channel banks (discretionary activity under Rule 49);

- The use of the streambed for the placement of riprap erosion and scour protection (discretionary activity under Rule 49);

- The reclamation of the stream at 26 and 28 Blue Mountains Road (discretionary activity under Rule 49);

- The use of the streambed for the replacement of existing structures, including gabion baskets, private vehicle and pedestrian bridges, a stormwater outlet, Whitemans Road stormwater inlet and bypass debris screens (discretionary activity under Rule 49);

- The use of the streambed for the construction of new bridges (discretionary activity under Rule 49);

- The use of the streambed for the relocation of utilities (discretionary activity under Rule 49);

- The use of the streambed for the tracking of machinery (discretionary activity under Rule 49);

- The permanent diversion of floodwaters by the proposed flood diversion wall at Willow Park (discretionary activity under Rule 16); and

- The discharge of contaminants (sediment-laden runoff including flocculant) to the Pinehaven Stream associated with the construction works and the discharge of diverted stream 'dewatering' water (discretionary activity under Rule 5).

6.3 Overall activity status

Overall, the activity must be assessed as a **Discretionary Activity** under the Operative Regional Freshwater Plan and a **Discretionary Activity** under the Proposed Natural Resources Plan.

7. Other consents and approvals required

The applicant has applied to UHCC for a Notice of Requirement to create a designation to allow for the Pinehaven Stream structural works to be undertaken. The requiring authority for these works would be UHCC. This Notice of Requirement is being processed concurrently with the GWRC applications for resource consent.

The applicant will also require:

- Land access agreements with properties where works are being undertaken or access through the property is required;

- Relevant permits from the Department of Conservation (DoC), Ministry for Primary Industries (MPI) and/or Fish and Game New Zealand (F&G), for the works involving capture and relocation of fish species and temporary blocking of fish passage; and

- Building consents (if required).

8. Notification and submissions

8.1 Notification

The applicant requested that the application be publicly notified once lodged with GWRC. GWRC recommended that technical peer reviews be completed prior to public notification, as this would allow the public to read the full application, independent technical reviews of the proposal, and any further information received via a request issued under section 92(1) prior to making their submission.

Due to the applicant's desire to progress quickly to notification, the consent was notified prior to the technical peer reviews being completed and section 92 request for further information being issued by GWRC.

The application was publicly notified in the Hutt News on 19 November 2019 and the Dominion Post and Upper Hutt Leader on 20 November 2019. In addition, two signs were installed at the site (Willow Park and Pinehaven Reserve) and notice of the application was served on 72 affected/interested parties, including:

- All residents and landowners within the proposed designation boundary;
- Properties where inlet blockage works are proposed;
- Port Nicholson Block Settlement Trust;
- Te Rūnanga o Toa Rangatira Inc;
- Department of Conservation;
- Fish and Game; and
- Forest and Bird.

The applicant has described the consultation which they undertook prior to lodging their application in section 9 of their application documents.

8.2 Submissions

At the close of submissions 12 submissions had been received. A further three submissions were received after the close of submissions.

A total of 15 submissions were received. Ten submissions were received in support or conditional support of the proposal and five submissions were received in opposition. No neutral submissions were received.

A summary of all submissions received and the issues raised is attached as Appendix 4 to this report and briefly described in sections 8.4.1 and 8.4.2 of this report.

8.3 Late submissions

As identified in Section 8.2 of this report three late submissions were received.

Under section 37(1)(b) of the Act, a consent authority may waive a requirement to comply with a time limit for the service of documents (e.g., submissions). In making such a waiver, the consent authority is required by section 37A(1) of the Act to take into account:

a) The interests of any person who, in its opinion, may be directly affected by the waiver;

b) The interests of the community in achieving adequate assessment of the effects of any proposal, policy statement or plan;

c) Its duty under section 21 to avoid unreasonable delay.

All three late submissions (submissions 13, 14 and 15) were received on 18 December 2019 (day of submissions closing) after the closing time of 4.30pm (at 4.35pm, 7.44pm and 8.23pm respectively). These late submissions were accepted under section 37(1)(b) of the Act.

8.4 Matters raised by submissions

In this section I have raised only those matters (in support and opposition) which relate directly to works requiring resource consent under the regional plans.

Those matters that were considered out of scope for consideration by GWRC included loss of trees outside of the riparian zone, the visual and privacy effects as a result of loss of trees, the effects on the goose that lives at Willow Park, comments on halting development on the Pinehaven Hill area, and privacy effects as a result of cleanfill disposal to Silverstream Reformed Church (this has since been removed from the scope of proposal).

8.4.1 Matters raised by submissions in support

Ten parties submitted in support of this application for resource consent. Eight of the submitters specifically identified in their submission that they live in close proximity to the works and/or have been impacted by the flooding of the Pinehaven Stream.

To summarise the views of those submissions in support of the application, it was considered that the proposed works are a well-planned, common-sense approach to a long term issue and are essential to the safety of people, property and community. Flood events cause significant damage to property and stress to members of the community, and the proposed works will enhance Pinehaven and Silverstream as a place to live.

Some submitters consider that it is a shame it has taken such a long time to get to this stage of the project programme, and would like works to progress now. One submission highlighted their concern that a few people can hold up the process, and considers council has an obligation to protect properties which until the project is completed is not being met.

Submitter 4 highlighted concerns about effects on stream ecology as a result of the removal of old trees, and another commented that they were happy with the restoration of the native corridor alongside the stream channel. Please see sections 10.4 and 10.5 where I address effects on aquatic and riparian ecology in response to these concerns.

Generally, the sentiment is that there is an understanding why the works need to be done, and that the submitters are happy to work with the parties involved in regard to disruptions that will occur during the construction works.

8.4.2 Matters raised by submissions in opposition

Five parties submitted in opposition of this application for resource consent. Two of the submitters specifically identified in their submission that they live in close proximity to the works and/or have been impacted by the flooding of the Pinehaven Stream.

There were a range of matters raised by those submissions in opposition to this consent application. I have started by addressing those related to specific concerns about the locational design, stream ecology and deposition of cleanfill on the Silverstream Reformed Church site. Following that, I have combined the views of those submissions which oppose the consent on the grounds that there is an error in the flood modelling.

Submissions related to specific concerns

Submitter 7 highlighted that the application proposed works within the submitter's property, however no details had been provided to them at notification and the submitter considers they couldn't comment or agree to something they had not yet been advised of.

Submitter 1 raised concerns about the effects on stream ecology, particularly in relation to eels, native fish, trout and removal of trees from fencelines. Please see sections 10.4 and 10.5 where I address effects on aquatic and riparian ecology in response to these concerns.

Submitter 9 raised concerns about the proposed disposal of excavation material from the streamworks onto the Silverstream Reformed Church site, and opposed the application until three requested items were addressed. The applicant advised in the section 92(1) response dated 26 February 2020 that these works had been removed from the scope of the application. Submitter 8 confirmed they were comfortable with this and no longer wished to be heard at a hearing. As such, I have not addressed this issue further in this report.

Submissions related to flood modelling concerns

Three submissions (from submitters 7, 10 and 11) were received that in principle supported the stream improvement works, but opposed the resource consent application due to concerns with the reliability and accuracy of the flood model which has been used to assess the effects of flooding and as a basis for the design works.

The submissions identify a number of specific issues, which I have summarised here, and can be found in full (along with referenced reports) in the submission documents.

RJ Hall and Associates Limited were commissioned by submitter 11 to undertake a review of the Jacobs' (2016) re-workings of GWRC's Pinehaven flood modelling (note, Jacobs have been engaged by WWL for this project). The submitter also commissioned a further technical specialist, Macky Fluvial Consulting Limited, to peer review Mr Hall's report.

Mr Hall's review found that Jacobs had not corrected the future development hydrology error by SKM (2010) in GWRC's Pinehaven flood modelling, and the inflated flood extents are due to GWRC modelling the forested hills in the upper catchment as impervious. The technical review concluded that GWRC's Pinehaven flood modelling and mapping is not fit for purpose and cannot be relied upon. They considered that this can be remedied by rejecting the hydrological and hydraulic modelling to date, and doing it again using representative runoff hydrographs for pre- and post-development scenarios.

The submitters also noted that the 8 December 2019 event (1-in-30-year rainfall event) flood extents were far less than the GWRC 1-in-10-year flood. Further, the majority of the Pinehaven Stream channel coped with the peak flow of the rain event of 8 December 2019, which indicates that much of the Pinehaven Stream already has a 1-in-25-year flow capacity. This indicates that the flood maps are exaggerated and too conservative (because the modelling has treated the catchment as bare).

These submitters consider that due to the errors in the model, the proposed design is over-engineered for the 1-in-25-year flood event. They consider this could actually allow bigger floods to occur more regularly in Pinehaven and Silverstream, due to large volumes of extra stormwater runoff from future development on the Pinehaven hills (e.g. steel roofs, asphalt roads, concrete drives etc. that will replace forest and bush, and won't be detected because the model already assumes the hills to be covered with concrete).

These submissions consider the streamworks could be reduced in size, as the proposed works are excessive, creating unnecessarily disruption and public cost. Further, they are concerned that flood protection works for the upper reach have been ignored.

The submitters requested the following as part of their submission:

1. That the hydrological model be recreated using inputs that are representative of the actual catchment, in particular, with infiltration losses representative of the forested and bush-clad hills in their current condition as they were in 2008 when the original modelling was done (i.e. not as they are now when recent harvesting of the pine forest has changed the hydrologic characteristics);

2. New hydrological modelling be done based on high infiltration rates in forest and bush clad hills, determined by field tests;

3. Hydraulic model and flood hazard extent maps be redone using hydrographs from the corrected hydrological model;

4. The stream improvements be reassessed based on the corrected hydrological and hydraulic models, so that the flood extents witnessed in the 1-in-30 year rain event on Sunday 8 December 2019 are all addressed, as well as any flooding issues in the upper catchment; and

5. The improvements address the undersized culvert at 122 Pinehaven Road and the problem of overflowing sewage mixing with stormwater during flooding (e.g. sewer manhole in footpath on Pinehaven Road opposite Pinehaven School hall). Note: These issues are outside the scope of this consent application - the culvert at 122 Pinehaven Road is outside of the project works area, and WWL are required to obtain resource consent for the discharge of wastewater to freshwater from network overflows through a separate consenting process.

I issued a second section 92(1) request on 23 January 2020 to gain clarification from the applicant on a number of issues that were highlighted in the submissions. I specifically address these issues relating to the flood modelling in Section 10.1 of this report.

8.4.3 Further information and meetings

The applicant advised during the early processing of this consent that they would undertake individual consultation with parties rather than a formal pre-hearing meeting. On 6 April 2020 the applicant advised that they would like GWRC to organise a pre-hearing (video-conference) meeting for those submitters that wished to attend.

(a) Pre-hearing meeting, 20 April 2020

GWRC and UHCC held a video-conference pre-hearing meeting on 20 April 2020, which was facilitated by Mr Lindsay Daysh (Director, Incite). The pre-hearing meeting was attended by eight individuals (belonging to five submissions) with seven of those individuals belonging to the Save Our Hills group. The minutes of this meeting (for the purpose of fulfilling S 99(7) of the Act) are provided in Appendix 5.A of this report. These minutes comprise a brief set of minutes produced by GWRC on behalf of the chair, as well as a more detailed set of minutes produced by Save Our Hills who are concerned that their views had not been accurately represented in the GWRC minutes.

The key issues discussed related to effects of flooding on one submitter's property, concerns with the flood model (specifically the hydrological inputs relating to the infiltration rate) and associated over-engineering of the proposed works, and concerns that no streamworks are proposed for the upper catchment. No resolution on any issues was reached by the parties.

The actions that arose from this pre-hearing meeting are listed below:

- The applicant to respond to specific information requests from Save Our Hills members, including:

a) Modelled stream flows (m^3/s), not just design annual exceedance probabilities;

b) Clarity as to the works proposed on Mr and Mrs Ross' property, and confirmation whether the proposed width through their property is necessary;

c) Consideration of requests made by Save Our Hills to be included in to scope of the model re-run;

d) Save Our Hills requests about the flood model comparison with the December 2019 event; and

e) Clarification as to what infiltration rate has been used in the hydrological model, why this is appropriate and realistic of the baseline (and not future development).

- The applicant undertakes the discussed hydraulic model updates;
- The updated model results and related flood hazard assessment is shared;
- The pre-hearing meeting for Save Our Hills (submitter 11) and the flood experts is arranged; and
- Expert conferencing is undertaken to clarify matters of contention in the model (if any).

The applicant provided a response to Save Our Hills in relation the specific information requests (a) – (e) above via GWRC on 12 May 2020 (letter dated 11 May 2020 and attached as Appendix 5.B).

a) The applicant advised that the hydraulic model was used to simulate flood flows in the catchment for both 'baseline' and 'with project' scenarios, and was modelled for the 1-in-25-year and 1-in-100-year event. I do not consider this response addresses Save Our Hills question about the modelled stream flows in m^3/s.

b) The applicant advised the letter would not address the requests for information relating to the works on Mr and Mrs Ross' property as they stated it would be discussed with the landowners directly.

c) The applicant has provided the scope of the model re-run as an attachment to the letter, and addressed the specific requests directly.

d) The applicant advised they do not intend to model the December 2019 event as the hydraulic model was found to be fit for purpose by the GWRC technical review.

e) The applicant provides reference to the section 92 response dated 26 February 2020, which explains that the model uses the Initial Loss – Continuous Loss model to represent the infiltration capacity of the catchment. It assumes that, during a storm event, the first 5mm of rainfall will not contribute to runoff/flood flows, but after that any rainfall in

excess of 2mm per hour will become stormwater runoff (and eventually stream/flood flows).

(b) Proposed second pre-hearing meeting for Save Our Hills

An outcome of the pre-hearing meeting on 20 April 2020 was to arrange a second pre-hearing meeting for Save Our Hills, with flood experts present. It was anticipated that the applicants flood expert Mr Peter Kinley and GWRC/UHCC flood expert Mr Michael Law would be present, and that Save Our Hills would be welcome to invite their flood expert Mr Hall if they wished.

At the time of writing this report, possible dates for a second pre-hearing meeting for Save Our Hills were being discussed.

9. Matters for consideration

The requirements of the Act that relate to the decision making process are contained within sections 104-116. The sections of particular relevance to this application are listed below.

9.1 Section 104 – Consideration of applications

The matters to which a consent authority shall have regard when considering applications for resource consents and submissions are set out in section 104(1) of the Act as follows:

> *When considering an application for resource consent and any submissions received, the consent authority must, subject to Part 2, have regard to –*
>
> *(a) any actual and potential effects on the environment of allowing the activity; and*
>
> *(b) any relevant provisions of –*
>
> *i. a national environmental standard,*
>
> *ii. other regulations,*
>
> *iii. a national policy statement*
>
> *iv. a New Zealand coastal policy statement,*
>
> *v. a regional policy statement or proposed regional policy statement; and*
>
> *vi. a plan or proposed plan; and*
>
> *(c) any other matters the consent authority considers relevant and reasonably necessary to determine the application.*

The provisions of section 104 are all subject to Part 2 of the Act, which means that the purpose and principles of the Act are paramount.

The actual and potential effects on the environment of allowing the activities are addressed in Section 10 of this report. The relevant provisions of section 104(1)(b) are addressed in Section 11 of this report. Other matters relevant to this application are considered in Section 12 of this report.

9.2 Section 105 – Matters relevant to certain applications

Section 105(1) of the Act lists additional matters that a consent authority must have regard to when considering applications for a discharge permit that would contravene section 15 of the Act. The nature of the discharge and sensitivity of the receiving environment is thoroughly addressed in Section 10.3.1 of this report.

The nature of the discharge and sensitivity of the discharge can be summarised as the discharge of sediment-laden water (potentially treated with flocculant) as a result of proposed works to the Pinehaven Stream, which is not recognised as being highly sensitive in the regional planning documents. The ultimate receiving environment (Hulls Creek and the Hutt River) have been recognised as having significant values under the regional planning documents.

Due to the nature of the proposed works being within the stream corridor, and the constraints of the surrounding environment, the applicant has stated they require a discharge permit to be able to undertake the proposed flood mitigation project, as discharging to a different receiving environment (e.g. land) is not practicable.

Section 105(2) of the Act states for resource consent applications for reclamation, the consent authority must also consider whether an esplanade reserve or esplanade strip is appropriate. Section 229 of the Act outlines the purpose of these reserves.

The reclamation is located across two properties – 26 Blue Mountains Road (privately owned) and 28 Blue Mountains Road (owned by GWRC). I do not consider an esplanade reserve at these locations would contribute to the protection of conservation values. In the case of the privately owned property, I do not consider it is appropriate to enable access to the stream or enable public recreational use on their property. In relation to the property owned by GWRC, an esplanade strip would not contribute to the protection of the conservation values listed in section 229(a) (noting the full site is to be used for mitigating natural hazards), nor would it provide appropriate access along the stream (it would only provide access along approximately 60m of stream before it enters private property.

9.3 Section 107 – Restriction on grant of certain discharge permits

Section 107(1) of the Act places restrictions on the grant of resource consents for the discharge of contaminants into water if they cause the following adverse effects in receiving waters after reasonable mixing:

> *"(c) the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials:*
>
> *(d) any conspicuous change in the colour or visual clarity:*

(e) any emission of objectionable odour:

(f) the rendering of fresh water unsuitable for consumption by farm animals:

(g) any significant adverse effects on aquatic life."

The proposal involves discharging sediment-laden water at a quantity that may result in a conspicuous change in visual clarity beyond the zone of reasonable mixing (determined for these works to be 50m downstream of each stage based the definition in the PNRP for permitted activities, matters in the relevant policies and the monitoring distance proposed by the applicant). Specifically the applicant requested an allowance for an increase of 150g/m^3 suspended sediment concentrations (SSC) at a distance of 50m downstream of the stage of works, and that the installation and removal of dams is excluded from this limit for a period of up to 24 hours.

As detailed in section 10.3.1 below, Mr Gregor McLean advised that an increase of 150g/m^3 of SSC beyond the zone of reasonable mixing could result in a conspicuous change in the clarity of the water, if the baseline water quality was clear. However, if there was already sediment present in the water (e.g. after a rain event) the increase may not result in a conspicuous change in clarity. Allowing an increase of 150g/m^3 at all times as initially requested by the applicant could potentially, in clear weather conditions, allow a discharge that contravenes clause 107(d) for the duration of the consent.

Due to this, and as detailed further in section 10.3.1 below, I have proposed conditions which allow for the following discharges of sediment-laden water (as an increase in SSC between the upstream baseline site and downstream zone of reasonable mixing):

a) SSC of up to 50g/m^3 at all times during the construction works, except for the occasions listed in (b) and (c) below;

b) SSC of up to 150g/m^3 during and for up to 24 hours after heavy rainfall conditions;

c) SSC limit as agreed to in the SEMP for the specific site for excavator movements within the stream for the construction and removal of the temporary piped diversion and dam.

Mr McLean has advised that discharges under the proposed condition (a) would be unlikely to result in a conspicuous change in visual clarity. Discharges under the proposed conditions detailed in (b) and (c) have the potential to result in a conspicuous change in visual clarity, however these occurrences would be intermittent (associated only with heavy rain events and specified construction activities), and temporary (the recommended conditions requiring that exceedances would last no longer than 24 hours, or for 24 hours after heavy rainfall ceases).

It is also worth noting that discharges during heavy rainfall would be unlikely to result in a conspicuous change in clarity, as the stream flow would likely have a higher SSC at that time.

Under **section 107(2)** of the Act, a consent authority may grant a discharge permit that would contravene section 15 that may allow the effects described in section 107(1) above, if it is satisfied that it meets any of the requirements listed (a) – (c) below.

> *"(a) that exceptional circumstances justify the granting of the permit; or*
>
> *(b) that the discharge is of a temporary nature; or*
>
> *(c) that the discharge is associated with necessary maintenance work"*

In relation to 107(2)(b), there is no definition of 'temporary' in the Act. I understand that case law says it is 'to be lasting only for a limited period or not permanent', 'not permanent, provisional. Lasting only a short time and 'connotes a short period of time. What is short depends on the circumstances'.

When determining temporary, case law has looked at the proposed time period in the context of the maximum term for the consents (being 35 years for a discharge permit). Case law determined one year to be temporary in the 2013 *Fonterra Co-operative Group Ltd v Manawatu-Wanganui Regional Council* case, and two years to be temporary in the 2015 *Horowhenua District Council* case.

In determining whether the duration of the discharge is temporary, it is the recommended consent duration that must be looked at and not the proposed construction period (two years in this case). I have recommended a consent duration of five years from the commencement of construction for the discharge permit, to allow sufficient contingency in the event that works are delayed after commencing.

In light of the case law direction, I consider that the discharges allowed under (b) and (c) above which allow SSC to exceed 50g/m^3 and may result in a conspicuous change in visual clarity, are intermittent (associated only with heavy rain events and specified construction activities) and temporary (a limited period of approximately 24 hours) over a period of five years.

Further, I consider the proposal to be consistent with the purpose of the Act, in that the use and development of the Pinehaven Stream for flood improvement measures provides for the social, economic and cultural well-being and health and safety of the community. While the construction effects will have short-term adverse effects on water quality and aquatic ecology, the life-supporting capacity of the water and ecosystems will be safeguarded and long-term adverse effects on the environment will be avoided, remedied and mitigated through the proposed conditions of consent.

9.4 Section 108 and 108AA – Conditions of resource consents

Under **section 108** of the Act, a resource consent may be granted on any condition of a kind referred to in section 108(2). In the event that this consent is granted, I have recommended conditions that are consistent with this section of the Act.

Section 108AA of the Act outlines the requirements for conditions of resource consents. I consider that the recommended conditions meet the requirements of this section.

10. Assessment of actual and potential effects 104(1)(a)

This section provides an assessment of actual and potential effects of the proposal on the environment. My assessment is based on information provided in the resource consent application (AEE and appended expert reports), further information provided by the applicant in response to section 92 requests and advice from GWRC technical experts. I engaged the following technical experts to advise on the effects of this consent application:

- Mr Michael Law, Senior Associate – Water Resources, Beca Limited. Mr Law has expertise in flood risk assessment and hydraulic modelling. He was engaged to review the model, modelling report and Flood Hazard Assessment, and provide advice on whether the model was suitable and the Flood Hazard Assessment adequate to assess the effects of the proposed works on flooding. Mr Law's advice is provided in Appendix 6 of this report.

- Ms Sharyn Westlake, Senior Engineer, Flood Protection Department, GWRC. Ms Westlake reviewed the consent application and provided advice with respect to effects on erosion, scour and flooding, whether the structures were appropriate, and recommended conditions of consent with respect to managing such effects of the proposal. Ms Westlake's advice is provided in Appendix 7 of this report.

- Mr Gregor McLean, Director / Environmental Consultant, Southern Skies Environmental Limited. Mr McLean has expertise in erosion and sediment control and was engaged to review the application and provide advice on the construction methodology, erosion and sediment control measures and recommend conditions of consent with respect to managing the effects of the proposal. Mr McLean's advice is provided in Appendix 8 of this report.

- Dr Evan Harrison, Senior Environmental Scientist, Environmental Science Department, GWRC. Dr Harrison reviewed the consent application, in particular the assessment undertaken by EOS Ecology, and provided advice with respect to effects of the works on aquatic ecology. Dr Harrison recommended conditions of consent with respect to managing effects of the proposal on aquatic ecology. Dr Harrison's advice is provided in Appendix 9 of this report.

- Ms Frances Forsyth, Senior Ecologist, Wildland Consultants Limited. Ms Forsyth reviewed the application in regards to effects of the proposal on riparian ecology for GWRC (and land-ward ecology aspects for UHCC), and provided advice on managing the effects of the proposal. Ms Forsyth's advice is provided in Appendix 10 of this report.

The assessment undertaken by the technical experts is discussed with respect to the effects of the proposal in the sections below.

10.1 Effects on flooding

Works and structures within the bed and banks of rivers and streams have the potential to exacerbate flooding effects by altering the cross sectional alignment and hydraulic properties of the stream, and therefore the height and extent of flooding. Works in the bed and banks of rivers and streams can also result in floodwaters being diverted, and reduce the ability of the stream to convey flood waters.

The purpose of the proposed works is to improve the capacity of the stream and its tributaries to a 1-in-25-year flood event, which will also contribute to managing flood risk to habitable floors up to the peak 1-in-100-year event.

10.1.1 Existing environment – flooding

The Pinehaven Stream drains a catchment of approximately 4.5km^2, and is fed by three main tributaries from the vicinity of Wyndham Road, Pinehaven Road and Elmslie Road. The stream flows in a single channel from the Pinehaven Reserve to the Whitemans Road/Dowling Grove intersection, following which it is piped to the confluence with Hulls Creek near Whitemans Road. There are two stream bypasses, located at Whitemans Road and Pinehaven Road.

Section 2.1 of this report describes the 'existing environment' for flooding effects in the Pinehaven catchment. The flooding issues have been addressed through the preparation of the PSFMP, of which the proposed works form part of the structural component of this plan (excluding Sunbrae Drive and Pinehaven Road culverts which have been consented separately under WGN200101).

10.1.2 Flood model

(a) Introduction to flood model

The Pinehaven flood model was originally developed in 2010 by Sinclair Knight Merz (SKM, now Jacobs) for UHCC and GWRC for the 2010 Flood Hazard Assessment which was used to inform the PSFMP. This model included the main stream channel and significant tributaries, major culverts, road bridges and parts of the pipe network that were identified as being key components of the stormwater system.

For background, flood models comprise hydrological and hydraulic modelling inputs. In this case, the hydrological modelling refers to calculating the flow time-series, which are described as a (flow) hydrograph. The hydrographs are calculated from rainfall depths over time, and catchment parameters. The catchment parameters include the catchment shape, slope and land cover, and these are used to calculate how much of the rainfall is released as runoff (flow) during a storm, and how quickly.

These hydrographs are used as inputs to the hydraulic model, which uses well-established hydraulic calculations to distribute the water though the model. The speed that water moves through the model is dependent on the slope, roughness of the ground/channel, and any structures. The outputs of the hydraulic model are generally water levels, velocities and extents.

The Pinehaven flood model was updated for the purposes of the engineering design required for this consent application. The update included topographical information for the floodplain produced by Light Detection and Radar (LiDAR), information from a detailed survey of the stream undertaken in 2015, and further topographical survey data for certain points of the stream in 2019. These updates formed the 'Revised Updated Existing Case Model', which going forward is referred to as 'the model'.

The applicant has advised that modelling for this project has assessed the existing environment only (and not future developments with the potential for impacts on flooding in Pinehaven, as this will be managed through the Plan Change 42 UHCC District Plan provisions and any subsequent plan changes required).

I engaged Mr Michael Law (Beca Limited) to provide expert advice in relation to whether:

- the model is suitable for providing flood predictions to inform the design of the flood improvement works;

- the model is suitable for use in undertaking an assessment of effects of the proposed works on flooding; and

- the Flood Hazard Assessment is adequate and correct in terms of assessing the effects of the proposed works on flooding.

(b) Initial expert review of the flood model (Technical Review versions 1 and 2)

The review of the model commenced with a meeting between Mr Law and Mr Elliot Tuck (both Beca Limited) and the applicant's flood modellers Mr Peter Kinley and Mr Jarad Sinni (both Jacobs, at the time of the meeting) on 22 October 2019 to go over the models (updated base model and design solution model), the results and supporting data. During this meeting the need to update the climate change allowance to align with the Ministry for the Environment (MfE) 2018 guidance was discussed. The minutes of this meeting were provided to GWRC on 29 October 2019, and are attached in Appendix 6.A.

The applicant provided a proposal to address the MfE 2018 guidance to GWRC on 4 November 2019. I discussed their proposal with Mr Law and Ms Sharyn Westlake (GWRC), and advised the applicant that:

- GWRC are comfortable with using a 20% factor for increase due to climate change (to 2120), which is consistent with both GWRC and WWL's policies; and

- GWRC considers that climate change is a design factor and that the modelled water level would include the allowance for climate change. We would not support climate change factors being accommodated within the full design freeboard. A change in the design freeboard (if less than

300mm) or a change to the design return period is something that would need to be discussed (and accepted) as part of the design standard.

Due to the tight time constraints imposed by the applicant regarding notification of this consent application, Mr Law issued a draft Technical Review on 11 November 2019 to raise awareness of the issues and questions raised in his review of the model.

The applicant responded to the issues and questions in Mr Law's draft Technical Review on 13 November 2019 and provided a draft Flood Hazard Assessment (FHA) Addendum Report addressing the effect of climate change under the current MfE guidelines on 14 November 2019. Mr Law issued version 2 of his Technical Review on 18 November 2019 (subsequently updated on 21 November 2019 in relation to minor edits), which identified one item remained unresolved, and that was whether the model is fit for use (relating to the roughness value used for the culverts).

(c) Applicant response to initial expert review (Technical Review versions 1 and 2)

The applicant updated the model using a roughness value of n=0.015. Mr Law considered this to be too low and a roughness of about n=0.025 would be more appropriate. Following discussions between Beca and Jacobs regarding the proposed culvert sizes, surfaces and bed material, it was agreed that the flood model should be re-run with a culvert roughness of n=0.020.

The applicant provided (via email) details of the model runs using n=0.015 (Iteration 9) and n=0.025 (Iteration 10). They compared the two iterations to show the increases in peak water levels as a result of the increased culvert roughness value. Beca agreed that the results for the n=0.020 could be inferred from Iterations 9 and 10, until such a time as a model run using n=0.020 could be completed.

The final FHA Addendum Report was issued by Jacobs on 27 November 2019 addressing the reassessment of the effect of climate change on rainfall depths in accordance with the MfE 2018 guidance, (20% increase in extreme rainfall depth through to 2120) and to investigate the effects of interim scenarios for the Pinehaven Road and Sunbrae Drive culverts (this relates to resource consent WGN200101 and is not relevant to this consent application).

Mr Law commented that the FHA indicates that there is a relative increase in water level as a result of increasing the climate change allowance. I have not summarised the conclusions of the FHA Addendum Report, as it has since been superseded.

(d) Expert review of applicant's response and issue of Technical Review version 3

Mr Law issued version 3 of his Technical Review on 2 December 2019 (edits addressing agreement on culvert roughness, revised commentary on the FHA Addendum Report provided on 27 November 2019 and an updated conclusion; provided in Appendix 6.B of this report). Below I have discussed only those areas where concerns were raised by Mr Law.

It is important to note that Mr Law identified that 'increasing the culvert roughness value would be expected to increase water levels, and so checks would be required to confirm whether water level design criteria have been met'. He considered that the results based on a culvert roughness of n=0.020 should be used to inform the application.

Mr Law identified some additional issues which I requested further detail on in the section 92 request dated 3 December 2019. These issues specifically related to whether the detailed design drawings were available, whether sufficient design freeboard has been provided at the top of the bank, whether the water level design criteria have been met when using a culvert roughness of n=0.020, and questions around blockage testing, water level results and flood extents to confirm hydraulic performance.

(e) Applicant's response to questions raised in Technical Review 3

The applicant responded to the questions raised in Technical Review 3 in the section 92 response dated 21 February 2020, and Mr Law provided an assessment of their response in the memo dated 15 March 2020 (attached as Appendix 6.C of this report).

The applicant advised that detailed design on the 20% climate change modelling scenario was underway and expected to be available in mid-2020, which has meant that it has not been possible to compare the model to the design drawings at this time. As proposed by the applicant, I have recommended a condition requiring the consent holder submit a final Detailed Hydraulic Design Memorandum to the Manager to confirm compliance and consistency with the information provided in the application. Mr Law agrees this is appropriate.

(f) Questions raised by submissions and flood event on 8 December 2019

On 23 January 2020 I issued a second section 92 request for further information, to address questions which had arisen in the submissions (including in relation to the flood model) and questions relating to the flood event on 8 December 2019. The applicant responded to these questions on 26 February 2020.

Specifically, in relation to the submission points raised by submitters 7, 10 and 11, I requested further information on:

- Details of the 8 December 2019 flood event, and a comparison of that flood event with the model outputs for a comparable flood;
- Explanation of the infiltration capacity of the model, including why it has been used and why it is appropriate, whether the catchment had been treated as 'bare' and what the curve number (CN) value for the pre-development hydrology was; and
- Whether the hydrological input into the model needed to be re-done and the model re-run to ensure the infiltration capacity of the catchment is accurate.

Below I have summarised the applicant's responses to these questions and where relevant, the ongoing correspondence between the applicant and Mr Law;

- The applicant responded that the 8 December 2019 event was a 1-in-30-year event for the two hour duration. Mr Law agreed with this.

- The applicant advised that there were no model outputs for a directly comparable flood, so they compared the flooding observations to the modelled 1-in-10-year and 1-in-100-year events as presented in the PSFMP.

  Mr Law commented the focus of the assessment was on flood extents with no mention of flood levels along the stream. He considered that if post-flood surveys of trash marks, flood photographs and anecdotal reports were conducted by the council's or WWL then they should have been compared to the modelled water levels. The applicant has advised that no post-flood surveys or trash markings were undertaken by WWL. Mr Law noted he was disappointed that there was no post-flood survey undertaken against which to calibrate the model.

  Mr Law commented that the annotated maps appear to be overlain on the PSFMP maps, which hampers direct comparison (due to climate change allowances). He requested Jacobs run the Pinehaven model to provide a comparison with the December 2019 event. He noted this could be done with the December 2019 event hydrology, or (as that would be highly resource intensive) he later suggested it would be possible to use the 1-in-10-year with climate change design rainfall scenario which would be comparable to the December 2019 event. The applicant provided this to GWRC in the updated Flood Hazard Assessment on 15 June 2020, and it is discussed further in subsections (h) and (i) below.

- The applicant noted that the Pinehaven Stream flood model's hydrological method used the Initial Loss – Continuous Loss model to represent the infiltration capacity of the catchment, and the catchment had not been treated as 'bare'. This hydrological method used does not use a CN value, and there were some concerns raised by the way the back-calculation in Mr Hall's report (which formed part of submission 11) had been undertaken.

  Mr Law generally agreed with the applicant's comments. In relation to the validation of the model he considers the 8 December 2019 event provides an opportunity for additional detailed validation.

- The applicant did not consider that the hydrological input into the model needed to be re-done and model re-run and commented that '*the hydrological input to the model is from a calibrated and validated model of the rainfall-runoff processes in the catchment. While no model is perfect… MWH have demonstrated that the inputs to the hydraulic model are robust and suitable for the purposes of the Pinehaven Stream Improvements project'*.

Mr Law agreed that the hydrological inputs to the model did not need to be revisited solely for this project, noting that 'the key purpose of modelling is to demonstrate the relative effects (and betterment) of the streamworks over the existing condition', while bearing in mind his comments about the 8 December 2019 storm event being an opportunity to collect data for further model calibration.

The outcome of the pre-hearing meeting on 20 April 2020 indicated that a number of submitters were still concerned with the infiltration capacity that has been used as an input to the model. At the time of writing this report, the applicant had not closed out this concern with the relevant submitters. A second pre-hearing meeting with SOH and the applicants and consent authority's flood experts was being arranged.

(g) Question raised about whether changes to the proposal impact the flood modelling and Flood Hazard Assessment

Following identification of the differences between the general arrangement plans in the initial application and those provided in the section 92 response dated 21 February 2020, I asked the following question of the applicant:

To 'confirm whether the changes to the proposal (e.g. the bridges that were to be replaced are now to be retained and vice versa) have any impact on the flood modelling and the Flood Hazard Assessment that was provided with the original application documents'.

The applicant advised in the letter dated 25 March 2020 (Request for clarification on proposed works and changes to original application) that the design changes made since the original application was submitted have not impacted on the conclusions of the flood modelling and the Flood Hazard Assessment that was provided with the original documents.

Mr Law commented that the response sounded reasonable in that he wouldn't expect the changes to have a large effect locally and/or extend far upstream. He noted, however, that it flags an issue with the modelling approach for bridges dating back to when SKM built the original model, stating that '*representing the hydraulic effects of bridges and other obstructions in the channel using an increased roughness coefficient is a reasonable approach for catchment scale models, and especially for smaller water courses and where survey is prohibitive .... A combination of these issues in the Pinehaven catchment meant that the approach was, and generally still is, appropriate for the catchment flood model*.'

However, Mr Law considers that the '*downside of this approach is that it is harder to model the effects of adding, removing or changing individual structures along the channel*', so it relies upon professional judgement to assess the effects.

Mr Law stated he would expect the Jacobs modeller to quantify the effects of changing the crossings (possibly by incorporating the bridges and bank works at 54 and 56 Whitemans Road in the model re-run or by providing hand calculations for the individual crossings) for the pre-hearing discussions, expert

conferencing and hearing so as to provide confidence in their response. Mr Law confirmed that while both methods are acceptable, if hand calculations are used then Jacobs would need to transpose those effects to the surrounding properties.

Mr Law's comments were provided to the applicant and I requested that they been addressed. The applicant provided this to GWRC in the updated Flood Hazard Assessment (FHA) on 15 June 2020, and it is discussed further in subsections (h) and (i) below.

(h) Model re-run and Updated Flood Hazard Assessment

In order to address the outstanding concerns of GWRC, the applicant undertook a re-run of the flood model (1-in-10-year, 1-in-25-year and 1-in-100-year events) and prepared an updated FHA. The scope of the flood model re-run and updated FHA prepared by the applicant was reviewed by Mr Law, who confirmed it would be sufficient to address his concerns. The scope is attached as Appendix 6.D to this report.

The applicant provided the model files directly to Mr Law on 9 June 2020, and (at Mr Law's request) provided the model result files on 10 June 2020. The Updated FHA based on this model re-run was provided to GWRC on 15 June 2020.

The updated FHA describes that the model simulations for the baseline represents the current channel configuration (with no physical works or changes to the stream environment and the same culvert roughness value as used for the PSFMP). The model simulations for the proposed works represent the proposed modified stream environment (including the addition, removal and replacement of various local access bridges, and culvert roughness of n = 0.020). It notes that the reported water levels do not include an allowance for freeboard.

The updated FHA also provides a short comparison of the baseline model outputs with the flood extents for the 1-in-30-year event that occurred on 8 December 2019. This is done by comparing the 1-in-10-year event (including a 20% allowance for the effect of climate change on rainfall), which Mr Law has advised is considered to be comparable to a 1-in-30-year event, with the observations for the flood event.

(i) Expert review of the model re-run and issue of Technical Review (version 4)

Mr Law issued Technical Review version 4 to GWRC on 30 June 2020 (see Appendix 6.E), which provided an assessment of the re-run flood model and the Updated FHA.

In terms of the model re-run, Mr Law was comfortable with the changes to the cross sections, culvert roughness, culvert blockage and water levels (i.e. these aspects of the review are considered 'closed').

Mr Law provided an assessment of the model re-run (section 6 of his Technical Review), which highlighted that the model re-run was generally done in

accordance with the scope. He noted, however, that the model and results were not provided for the 1-in-10-year event, there was no explicit explanation of the proposed changes at 54 and 56 Whitemans Road, and the representation of bridges had not changed within the model. He considered that the explanation for, and results of, modelling the 1-in-10-year event (to compare model performance against the 8 December 2019 flood event) did not add anything to the report and should either be expanded or removed (with explanation provided). Mr Law has advised that if it was expanded or removed it would not alter his conclusions on the fitness of the model.

Overall, Mr Law's review found the model is fit for use to describe the changes in flood level and confirm a reduction in the number of properties affected by flooding.

(j) Summary of the flood model

Based on the advice of Mr Law, I consider that the 2020 flood model that has informed the updated Flood Hazard Assessment (June, 2020) is fit for purpose in assessing the effects of flooding for this resource consent.

While I consider the flood model is fit for purpose based on the advice of Mr Law, I understand there are submitters who have outstanding concerns. As described in section 8.4.3(b) above, Save Our Hills have been offered a second pre-hearing meeting with flood experts present. At the time of writing this report arrangements for this meeting were being made.

10.1.3 Flood Hazard Assessment

The applicant provided a Flood Hazard Assessment (FHA) as Appendix U to the application documents. Mr Law provided comment on the FHA and FHA Addendum Report in Technical Review version 3 (issued on 2 December 2019).

However, based on the required changes to the model relating to the culvert roughness and climate change factor, and the changes to the proposal as identified in the section 92 response dated 21 February 2020, Mr Law advised that the model should be re-run and the FHA be updated in light of the revised model outputs to represent the design as it currently stands.

As described in section 10.1.2 above, the updated FHA (based on the outputs of the 2020 model re-run) was provided to GWRC on 15 June 2020. In the updated FHA, the model has been used to simulate the 1-in-25-year flood event and the 1-in-100-year flood event for both the baseline condition and the proposed works, providing an assessment of the benefits and impacts during these events. Mr Law has reviewed the updated FHA and advised on the effects on properties in his Technical Review version 4, issued to GWRC on 30 June 2020.

In the subsections below, I discuss the effects of the proposed works on flooding during a 1-in-25-year and 1-in-100-year events.

(a) Effects during the 1-in-25-year flood event

Figure 5 below shows the modelled extent of flooding (in blue) during the 1-in-25-year event for the baseline/current scenario (left) and with the proposed works (right), clearly indicating a reduction in flood extents during this event.

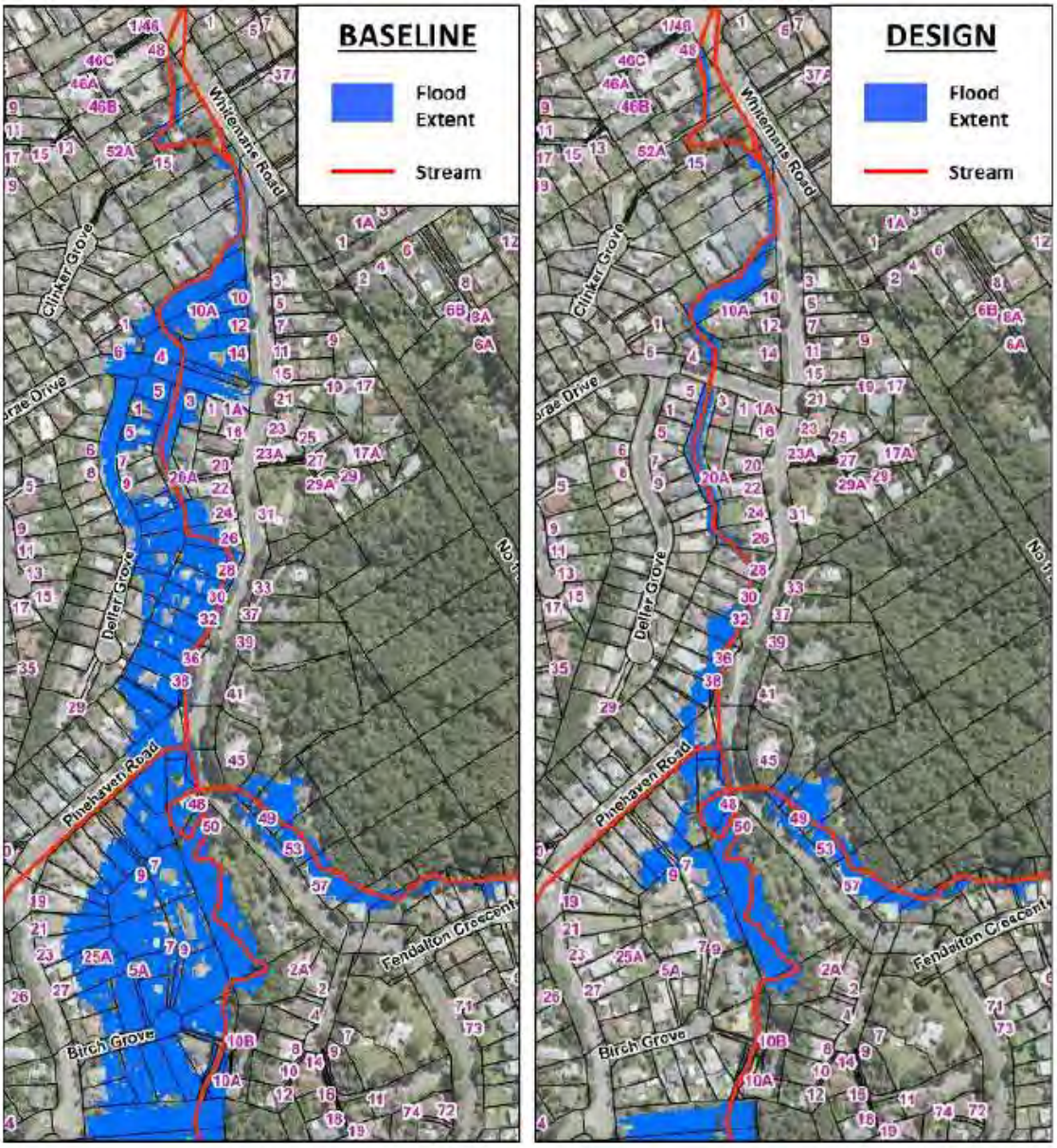


Figure 5: Modelled extent of flooding during the 1-in-25-year event for the baseline/current scenario (left) and design scenario (right) (from the Updated FHA dated 15 June 2020)

In regard to the effects of the works on Reaches 1 and 2 of the Pinehaven Stream (note the location of the three reaches are shown in Figure 1 of this report), the proposed works are modelled to contain the flood flow entirely within the stream. The applicant notes that this will alter the flood water levels within the Pinehaven Stream (increasing in some parts and decreasing in others).

At Reach 3, the model indicates positive effects for a number of properties which I acknowledge but will not assess further in this section. The model does, however, indicate there may be some adverse effects for properties within Reach 3 (in relation to flood depth and flood extent). I have assessed the effects on these properties in Table 1 below, with references to the depth difference map provided in Mr Law's review (and included as Figure 6 of this report).

Table 1: Determination of the level of adverse flooding effects during the 1-in-25-year event on properties within Reach 3

Property address	Description of effects	Outcome of WWL consultation with landowner	Level of adverse effect
48 Blue Mountains Road	The flooding at 48 Blue Mountains Road will increase in depth and extent, in particular due to ground levels being reduced.	Not required because this property is owned by GWRC.	Not assessed because property is owned by GWRC.
50 Blue Mountains Road	There is anticipated to be an increase in flood extent and flood water levels at the south of the site and a reduction at the north. Overall, this equates to a net increase of 184m^2 to the floodplain area at the property and flood water levels will be higher by an average of 0.02m. Mr Law has advised that the property has a long frontage on the Pinehaven Stream, so the change in floodplain area equates to an increase in floodplain width of approximately <2m. Figure 6 shows that the flooding extent is contained within a highly vegetated part of the property, and does not extend to the house or impact access to the house.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred after the model re-run and updated FHA had been produced. The applicant advised that the property owner did not raise any concerns with the proposed level of effect.	Based on the information provided in the updated FHA, Mr Law's review, the location of the increase to the floodplain area and flood depth, and the comments of the landowner, I consider that the adverse effects of flooding during the 1-in-25 year event on 50 Blue Mountains Road are no more than minor.
2A Freemans Way	There is a net increase in the floodplain area of 12m^2, and maximum increase in water levels of 0.26m. The updated FHA advises that the flood levels are below the level of any buildings on the property. Figure 6 shows the increased flood area is in the southern vegetated part of the property, away from the house and will not impact access to the house.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred after the model re-run and updated FHA had been produced. The applicant advised that the property owner said they would review the letter but did not	Based on the information provided in the Updated FHA, Mr Law's review, the location of the increase to the floodplain area and flood depth, and the initial view of the landowner, I consider that the adverse effects of flooding during the 1-in-25 year event on 2A Freemans Way are no more than minor.

Property address	Description of effects	Outcome of WWL consultation with landowner	Level of adverse effect
		appear to have any concerns. The applicant has not advised of any final comments from the property owner.	
7 Pinehaven Road	The spill from the Pinehaven Stream at 50 Blue Mountains Road will enter 7 Pinehaven Road. Mr Law has advised that overall the proposed works will be positive for this site and reduce the depth and extent of flooding on this property, however 8m^2 of land on this property (located near the boundary of 50 Blue Mountains Road) will have an increase in peak water level of up to 0.09m. Figure 6 shows that the small area of property that may experience an increase in flood depth is located on the northern side of the property, and does not appear that it would affect access to the dwelling.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred after the model re-run and updated FHA had been produced. The applicant advised that WWL were unable to reach the property owner but had emailed them a copy of the letter. The applicant has not advised of any final comments from the property owner.	Based on the information provided in the Updated FHA, Mr Law's review and assessing the part of the property affected by the potential increase in flood depth, I consider that the adverse effects of flooding during the 1-in-25 year event on 7 Pinehaven Road are no more than minor.
9 Birch Grove	The spill from the Pinehaven Stream at 50 Blue Mountains Road will enter 9 Birch Grove. Mr Law has advised that overall the proposed works will be positive for this site and reduce the depth and extent of flooding on this property, however 20m^2 of land on this property (located near the boundary of 50 Blue Mountains Road) will have an increase in peak water level of up to 0.14m. Figure 6 shows that the small area of property that may experience an increase in flood depth is located on the northern side of the property, and does not appear that it would affect access to the dwelling which is from Birch Grove to the south-west.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred after the model re-run and updated FHA had been produced. The applicant advised that the property owner did not raise any concerns with the proposed level of effect.	Based on the information provided in the updated FHA, Mr Law's review, the location of potential increased flood levels on the property, and the comments of the landowner, I consider that the adverse effects of flooding during the 1-in-25 year event on 9 Birch Grove are no more than minor.

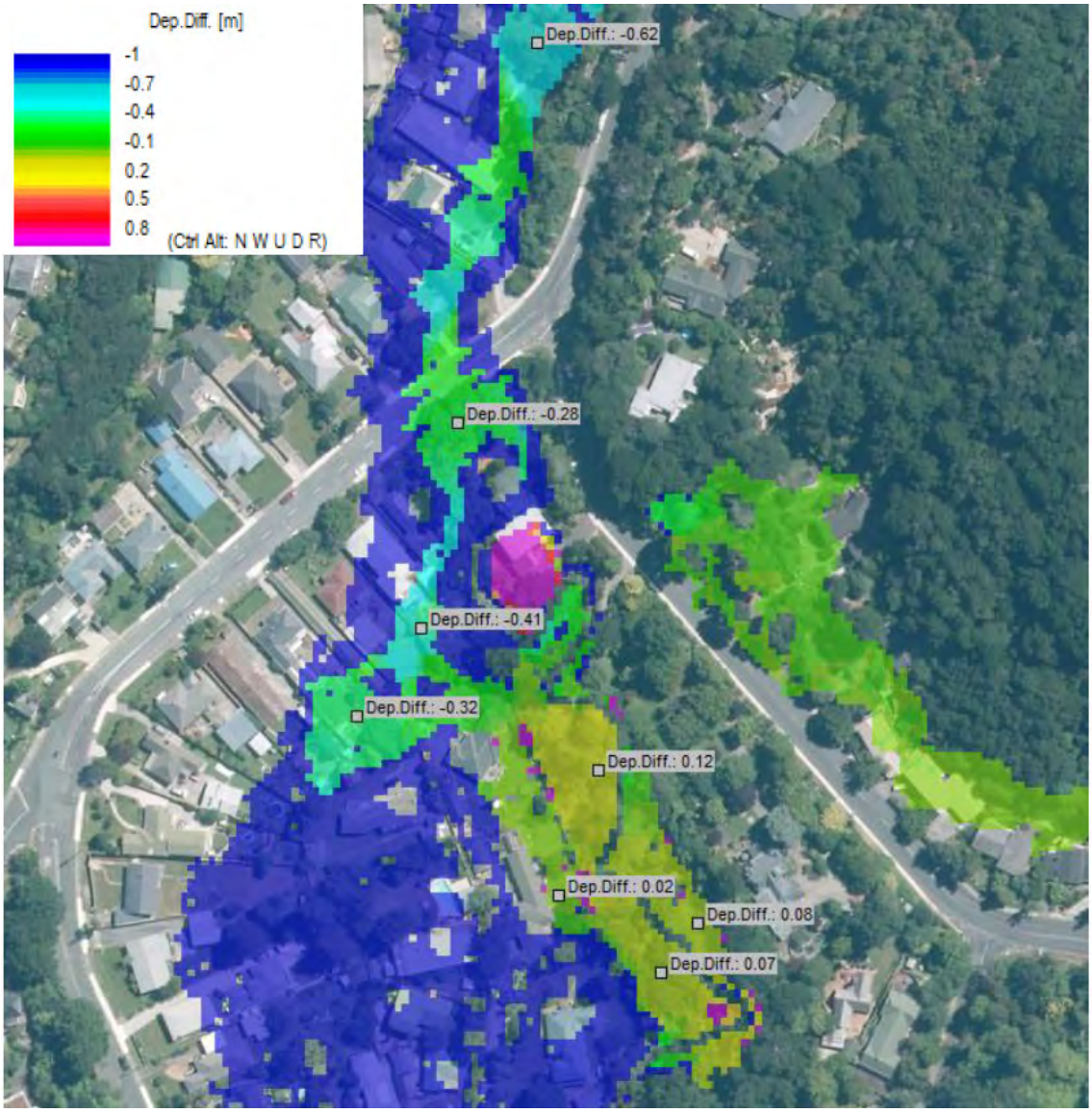


Figure 6: Map showing flood depth difference (from Technical Review revision 4 by Mr Law)

For the reasons detailed above, I consider that the adverse effects of flooding during the 1-in-25-year event (based on the 2020 model re-run outputs and updated FHA) are no more than minor.

(b) Effects during the 1-in-100-year flood event

Figure 7 below shows the modelled extent of flooding (in blue) during a 1-in-100-year event for the baseline/current scenario (left) and with the proposed works (right), clearly indicating a reduction in flood extents once the works are undertaken during this event.

In relation to the objectives of the proposed works as described in Section 1 of this report, they are to contribute to the management of flood risk to habitable floor levels up to the peak 1-in-100-year flood event. I have included the definition of habitable and non-habitable floors below:

Habitable Floor – A building that may contain habitable space as defined in the Building Regulations, based on a desktop assessment to identify buildings with a floor area greater than 40m^2.

Non-Habitable Floor – A building that is not expected to contain habitable space as defined in the Building Regulations, based on a desktop assessment to identify buildings with a floor area equal to or less than 40m^2.

Figure 7: Modelled extent of flooding during the 1-in-100-year event for the baseline/current scenario (left) and design scenario (right) (from the Updated FHA dated 15 June 2020)

(c) Reach 1

In regard to the effects of the works on Reach 1, the proposed improvement works will reduce the number of habitable floors that will be inundated in the 1-in-100-year event from 11 to six, and non-habitable floors from four to one.

Of the six habitable floors in Reach 1 that remain within the 1-in-100-year flood extent, the model indicates that the proposed works will reduce flood levels for four of the habitable floors.

The model indicates that the proposed works will increase flood levels experienced at two habitable floors located within Reach 1 (54 Whitemans Road and 56 Whitemans Road). I have assessed the level of adverse flooding effects on these properties in Table 2 below.

Table 2: Determination of the level of adverse flooding effects during the 1-in-100-year event on properties within Reach 1

Property address	Description of effect	Outcome of WWL consultation with landowner	Level of adverse effect
54 Whitemans Road	The model anticipates the flood levels at the habitable floors at 54 Whitemans Road will increase by 0.03m, in the southern corner of the property. The Updated FHA does not provide a clear assessment on the effects of the increased flood depth on the habitable floors of this property (e.g. whether the increased flood level is below floor or at/above floor levels). I have requested this information from the applicant (outstanding). The property is accessed from the northern side of the property, so I don't consider this increased flood depth is likely to impact access to the house.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred after the model re-run and updated FHA was produced. The applicant advised that WWL did not have the contact details for the new owners of this property, however had left a letter in the letterbox. The applicant has not advised of any final comments from the property owner.	Based on the information that I currently have, I consider that the adverse effects of flooding during the 1-in-100 year event on 54 Whitemans Road are likely to be no more than minor. Whilst I have requested further information to confirm my assessment, I consider that a change of flood depth of approximately 3cm during the 1-in-100-year event is likely to be no more than minor, due to the small change in depth and the infrequency of the event.
56 Whitemans Road	The model anticipates the flood levels at the habitable floors at 56 Whitemans Road will increase by 0.02m, along the north-western side of the property. The Updated FHA does not provide a clear assessment on the effects of the increased flood depth on the habitable floors of this property (e.g. whether the increased flood level is below floor or at/above floor levels). I have requested this information from the applicant	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred following the model re-run and updated FHA being	Based on the information that I currently have and the comments of the landowner, I consider that the adverse effects of flooding during the 1-in-100 year event on 56 Whitemans Road are likely to be no more than minor. Whilst I have

Property address	Description of effect	Outcome of WWL consultation with landowner	Level of adverse effect
	(outstanding). The property is accessed via Clinker Drive to the south-west, so I don't consider this increased flood depth is likely to impact access to the dwelling.	prepared. The applicant advised that the property owner did not raise any concerns with the proposed level of effect.	requested further information to confirm my assessment, I consider that a change of flood depth of approximately 2cm during the 1-in-100-year event is likely to be no more than minor, due to the small change in depth, the infrequency of the event, and the comfort of the landowner.

(i) Reach 2

In Reach 2, the proposed improvement works will reduce the number of habitable floors that will be inundated in the 1-in-100-year event from 24 to ten, and non-habitable floors from 18 to six. The flood water levels following the proposed works will be lower than the baseline water levels throughout Reach 2 for the 1-in-100-year event.

(ii) Reach 3

In Reach 3, the proposed improvement works will reduce the number of habitable floors that will be inundated in the 1-in-100-year event from 40 to six, and non-habitable floors from 15 to five. Of the six habitable floors that remain in the 1-in-100-year flood extent in Reach 3, the model indicates that the proposed works will reduce flood levels at four of the habitable floors.

The model indicates that the proposed works will increase flood levels experienced at two privately owned habitable floors within Reach 3 (7 Pinehaven Road and 9 Birch Grove) and also at 48 Blue Mountains Road (owned by GWRC). I have assessed the level of adverse flooding effects on these properties in Table 3 below.

Table 3: Determination of the level of adverse flooding effects during the 1-in-100-year event on properties within Reach 3

Property address	Description of effect	Outcome of WWL consultation with landowner	Level of adverse effect
7 Pinehaven Road	The proposed works are anticipated to increase flood level by up to 0.05m (from a depth of 0.05m to 0.10m), and increase the flood extent on the property by an area of 12m^2. The Updated FHA advised that the floor levels at this property will be above peak water level by 0.70m, so the proposed works will not have an effect on habitable floor flooding at this location. Mr Law advised that overall the implications of the works at this property are beneficial, and flood levels remain below habitable floor levels.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred following the model re-run and updated FHA being prepared. The applicant advised that WWL were unable to reach the property owner but had emailed them a copy of the letter. The applicant has not advised of any final comments from the property owner.	Based on the information provided in the updated FHA and Mr Law's review (specifically that the increase peak water level will not have an effect on habitable floor flooding), I consider that the adverse effects of flooding during the 1-in-100 year event on 7 Pinehaven Road are no more than minor.
9 Birch Grove	The proposed works are anticipated to increase flood levels by up to 0.06m in a new area of 4m^2. The Updated FHA advised that the floor levels at this property will be above peak water level by 0.55m, so the proposed works will not have an effect on habitable floor flooding at this location. Mr Law advised that overall the implications of the works at this property are beneficial, and flood levels remain below habitable floor levels.	No submission was directly linked with this property. The effects on this property differed to the notified version of the FHA, so I requested the applicant provide the outcome of consultation with the landowner that occurred following the model re-run and updated FHA being prepared. The applicant advised that the property owner did not raise any concerns with the proposed level of effect.	Based on the information provided in the updated FHA and Mr Law's review (specifically that the increase peak water level will not have an effect on habitable floor flooding), and the landowners comments, I consider that the adverse effects of flooding during the 1-in-100 year event on 9 Birch Grove are no more than minor.
48 Blue Mountains Road	The model indicates that flooding at this property will increase in depth, due to the lowering of ground levels following demolition of the house.	Not required because this property is owned by GWRC.	Not assessed, because property is owned by GWRC.

For the reasons detailed above, I consider that the adverse effects of flooding during the 1-in-100-year event (based on the 2020 model re-run outputs and Updated FHA) are likely to be no more than minor.

10.1.4 Summary

Overall, the proposed works will significantly reduce the effects of flooding during a 1-in-25-year and 1-in-100-year flood events from the Pinehaven Stream (an overall significant positive effect). There are some properties that will experience adverse flooding effects (e.g. an increase in flood depth or flood extent), which I have assessed to be, or are likely be, no more than minor.

Note: I am awaiting further information to confirm this assessment for two properties (54 and 56 Whitemans Road) from the applicant, however considering the scale of flood level increase and infrequency of the event, my assessment is unlikely to change.

10.2 Effects on erosion and scour

Any structure placed in the bed or banks of a stream has the potential to cause erosion and scour of the stream bed and banks, particularly at the ends of the structure and the stream bed at the toe of the structure. Areas that are disturbed during construction are highly vulnerable to erosion and scour and need to be managed appropriately.

The applicant has not specifically assessed the effects of the proposed works on erosion and scour. However, the proposed mitigation for erosion and scour involves the installation of erosion/scour protection in the form of native plantings, geotextile fabrics and the use of riprap.

I sought advice from Ms Sharyn Westlake (GWRC) in relation to the potential effects of the proposed in-stream structures on erosion and scour. Ms Westlake's initial review questions are provided in Appendix 7.A and her final review dated 13 March 2020 is attached in Appendix 7.B of this report.

Ms Westlake notes that the design details are yet to be finalised, and they will need to ensure the works are appropriately designed for the stream conditions (e.g. sufficient embedment depth) and address the potential for erosion and scour. Ms Westlake is comfortable with the level of detail that has been provided to date and has no outstanding concerns.

The design process involves a number of internal reviews and approvals prior to release, and the applicant has proposed a condition (which I have recommended) requiring the Construction Management Plan include 'methods for ensuring that earthworks take into account anticipated ground conditions, contingency plans for unanticipated ground conditions and are designed and undertaken in a manner that ensures the safety of the public and stability of the surrounding land, buildings and structures'

I have also recommended as part of the SEMP condition (which will be certified by GWRC) that the consent holder provide construction drawings and design reporting to demonstrate that the design is appropriate for the stream conditions (e.g. sufficient embedment depth) and the potential for erosion and scour has been appropriately addressed.

Ms Westlake considers that these mitigation measures will ensure the design is appropriate, fit for purpose, and addresses the potential for erosion and scour.

She is comfortable that this level of detail be addressed during the development and review of the SEMP.

Further, I have recommended GWRC's standard streamworks conditions requiring the consent holder to:

- Stabilise any areas of disturbed stream bank areas as soon as practicable;
- Maintain the works so that any erosion, scour or instability attributed to the works is remedied by the consent holder;
- Ensure that the structural integrity of all structures remain sound in the opinion of a Professional Chartered Engineer; and
- Remove the structure if any of the works are no longer required, maintained or sustain irreparable damage.

Ms Westlake commented that she was comfortable with how future maintenance would be undertaken on the structural works. However as the applicant has advised that the maintenance works are a permitted activity, I have not addressed the effects of this further.

Overall, I consider that provided the recommended conditions of consent are adhered to, the effects of the works on erosion and scour of the Pinehaven Stream will be appropriately mitigated.

10.3 Effects on water quality

10.3.1 Sediment discharges

The proposed instream works and earthworks will result in sediment discharges to the Pinehaven Stream, which if not managed appropriately could have significant adverse effects on the water quality of the Pinehaven Stream and potentially downstream waterbodies (Hulls Creek and the Hutt River), and in turn the aquatic ecology of these waterbodies (discussed further in Section 10.4).

The applicant completed baseline monitoring of water quality in the Pinehaven Stream, which was provided to GWRC in the section 92 response dated 21 February 2020, and can be used to determine the 'existing environment' of sediment concentrations within the Pinehaven Stream. The monitoring showed that all suspended sediment concentrations (SSC) during dry weather events were below $10g/m^3$, and that natural SSC reach at least $138g/m^3$ following rainfall.

The applicant has proposed a number of measures in their application and section 92 response dated 21 February 2020 (specifically ESCP revision 5 which was updated to address GWRC concerns and queries) to mitigate the effects of increased turbidity and sedimentation of the Pinehaven Stream. These are:

- Erosion and sediment control measures which will be set out in an overarching Erosion and Sediment Control Plan (ESCP, to be consistent

with ESCP revision 5) and Site-specific Environmental Management Plans (SEMPs) to be certified by GWRC. These include site management measures and also details on the physical controls to be used;

- Division of works into 12 stages to limit open areas and allow for progressive stabilisation;

- Undertaking the works 'offline' in a 'dry' streambed using a temporary piped stream diversion, including treating water from within the works area prior to discharge (see Section 4.3.3);

- Stream livening protocol to capture and treat the 'first flush' of sediment to reduce potential for sediment entrainment when the stream diversion is removed (see Section 4.3.4);

- A limit of an increase of 150g/m^3 of SSC between the upstream monitoring site and downstream zone of reasonable mixing during streamworks (except the installation and removal of the temporary piped diversions which are explicitly excluded). This will be monitored using a continuous turbidity meter (which will provide a proxy for SSC), with exceedances triggering adaptive management requirements. Note: I have made changes to these limits in the proposed conditions as discussed in my section 107 assessment (see section 9.3) and discussed below;

- A time duration of 24 hours for undertaking the explicitly excluded works when the SSC limit does not have to be complied with. At 24 hours, the suspended sediment concentration must have returned to baseline or within 20% of the baseline levels when levels are <20NTU. If this isn't met, adaptive management requirements are triggered.

I have sought advice from Mr Gregor McLean (Southern Skies Environmental Limited) regarding erosion and sediment control measures and the construction methodology for the proposed streamworks. Mr McLean's initial review memo dated 21 October 2019 and final review memo dated 1 March 2020 are provided in Appendices 8.A and 8.B of this report.

Mr McLean confirmed ESCP revision 5 provided a consistent methodology for the instream works based around works being isolated from the stream flows, which is considered to be industry best practice.

Mr McLean advised that an increase of 150g/m^3 of SSC beyond the zone of reasonable mixing could result in a conspicuous change in the clarity of the water. If the baseline water quality was clear, the increase would likely result in a conspicuous change in clarity, however if there was already sediment present in the water (e.g. after a rain event) the increase may not result in a conspicuous change in clarity.

On this advice (and to meet the requirements for the section 107 assessment), I discussed construction-related sediment discharge limits further with the applicant. The applicant has advised (and I agree) that the stream diversion should mean there are no or very little sediment discharges while the diversion

is in place, however they highlighted concerns with sediment discharges during high rainfall events.

Following these discussions, I have proposed alternative conditions which allow for the following discharges of sediment-laden water (as an increase in SSC between the upstream and downstream zone of reasonable mixing) and address the applicants concern about increased discharges during heavy rainfall events.

- SSC of up to 50g/m^3 at all times during the construction works, except for the occasions listed below. Note: this is unlikely to cause a conspicuous change in water clarity at the zone of reasonable mixing.
- SSC of up to 150g/m^3 during and for 24 hours after heavy rainfall conditions
- SSC as agreed to in the SEMP for any specific site required for excavator movements within the stream for the construction and removal of the temporary piped diversions and dam.

Mr McLean considered it appropriate that monitoring be undertaken at 50m downstream of each stage (which I have determined to be the zone of reasonable mixing). The purpose of having a zone of reasonable mixing and monitoring at each stage of the works (rather than just one zone of reasonable mixing at the downstream end of the works) is to ensure that all stages of works are complying with the agreed upon increase in SSC, and the effects of increased SSC are not 'lost' between the upper stages of works and the reasonable mixing zone. In the event that the zone of reasonable mixing being 50m downstream of a stage of works is not practicable (e.g. if there is a downstream stage of works being undertaken at 50m downstream, or 50m downstream is part of a piped/culverted network), the zone of reasonable mixing shall be confirmed in the relevant SEMP, with an explanation as to why it is appropriate.

Mr McLean considered that the applicant needed to address the risk of undertaking streamworks in the winter, and recommended the inclusion of the standard winter works conditions. The winter works conditions require that no works are undertaken during the 'winter period' of 1 June to 30 September, unless approved by the Manager. The SEMP's for works during the winter period should consider contingencies for the winter conditions and incorporate learnings from the monitoring of the previous stages to address the increased risks.

The applicant responded to this in the letter dated 25 March 2020 (Request for clarification on proposed works and changes to original application), by stating that they intend to do works during the winter period, and the winter works condition could constrain their ability to do so. They considered that given the management plans (CMP, ESCP and SEMP) need to be certified by GWRC it was not necessary to include the condition.

Mr McLean considered that by including the winter works conditions, there is still scope for the consent holder to undertake works during the winter period, and it will give GWRC the ability to have a greater influence and ensure that

the learnings of previous stages (especially those undertaken during winter) are taken into account for works during the high-risk winter period. As such, I have recommended conditions to this effect.

To provide background in relation to the winter works requirements, the applicant would need to seek approval from GWRC to undertake works during winter. The approvals are given for one month at a time, with an opportunity for sites to extend this period provided that the first month of winter works is conducted to a high standard with no incidents or environmental concerns. The applicant would need to provide the information specified in the relevant winter works application which would likely include details of the works, timeline of works, updated plans showing the erosion and sediment control devices and maintenance schedule to ensure they work efficiently during the winter period. GWRC considers many factors when assessing winter works applications, including the nature of the site and disturbance proposed, compliance history of the site/operator, sensitivity of the receiving environment, effectiveness of the existing/proposed erosion and sediment controls and seasonal/local soil and weather conditions.

Mr McLean commented that the Adaptive Management Approach provided in the ESCP revision 5 is appropriate, in that as monitoring detects an increase in downstream sediment levels, triggers and actions in response have been established. He recommended the inclusion of reporting the cause and remedial actions to the condition proposed by the applicant (I have included this).

The details provided in Appendix A of the ESCP revision 5 outline that there will be continuous field turbidity monitoring (NTU) which will be used as a proxy for SSC. Throughout the works, periodic grab samples and samples during exceedances of trigger limits will be analysed at the lab for turbidity and SCC, which will be used to build and verify the correlation between SSC and the continuous turbidity monitor.

Mr McLean stated that the success of adaptive management is dependent on the parties involved assessing the monitoring results and reacting in a positive manner where an adverse effect may have occurred or where additional resources are required to rectify or improve a situation. Mr McLean notes that this approach can have significant cost and time implications for a project.

Mr McLean recommended that conditions relating to the management of flocculant be included in the consent conditions in the event that flocculation is required to treat the settlement tanks. I have recommended conditions relating to certification of a flocculation management plan and associated monitoring.

I have recommended conditions of consent to reflect the applicants proposed mitigation measures and the advice sought from Mr McLean. Provided the recommended conditions of consent are adhered to, I consider the effect of sediment on water quality in Pinehaven Stream and in turn the downstream receiving environments of Hulls Creek and the Hutt River can be managed to an acceptable standard.

10.3.2 Other contaminants

The proposed works involve the use of machinery, which has the potential to release contaminants into the environment (e.g. fuel, oil grease). The works also involve the use of concrete in close proximity to the stream. Concrete washwater and uncured cement products can be extremely harmful to aquatic life as they cause rapid changes in pH and the discharge of ammonia.

The applicant has proposed a number of measures in their application documents to mitigate the effects of increased turbidity to and sedimentation of the Pinehaven Stream, these are:

- All sites where wet cement products are to be used must be isolated from flowing water and have sufficient emergency measures in place to safely pump and remove any contaminated water in the event of an accident;

- A high level of machinery maintenance and cleanliness for those working from the streambed, including regular checking of machinery (e.g. for leaks, sediment, lubricants, seeds/plant material) and use of biodegradable hydraulic fluids.

- Ensuring a spill kit is in close proximity to machinery and staff are trained to use it.

I have recommended conditions of consent to reflect the applicants proposed mitigation measures**.** Provided the recommended conditions of consent are adhered to, I consider the effects of other contaminants on the water quality of the Pinehaven Stream will be appropriately mitigated.

10.4 Effects on aquatic ecology

The proposed works have the potential to adversely affect fish and benthic fauna present in the Pinehaven Stream if not managed appropriately. Activities associated with the proposal that have the potential to affect aquatic ecology include the: permanent placement of structures in the streambed, temporary diversion of surface water associated with construction activities, permanent reclamation of the stream at 26 and 28 Blue Mountains Road and construction of a new channel at this location, and the discharge of contaminants (sediment-laden water or other contaminants).

Dr Evan Harrison (GWRC) and I noted that the linkages between the 'Assessment of Freshwater Ecological Effects' prepared by Dr Alex James (EOS Ecology) for Jacobs and the relevant section in the AEE in the application documents (Section 10.7) were not clear. The AEE did not cover all proposed works and it was not obvious whether all of Dr James' recommendations for mitigating the effects of the works formed part of the application. The applicant confirmed in the section 92 response dated 21 February 2020 that all of Dr James' recommendations are being proposed as part of the application.

Dr Harrison's initial advice on this application dated 10 October 2019, final review memo dated 4 March 2020, and close-out response to clarification

questions dated 31 March 2020, have been attached as Appendices 9.A, 9.B and 9.C to this report.

The Department of Conservation were directly notified of this application, however opted not to submit. They advised me on 20 December 2019 that whilst they noted that there were some issues with the application, they felt they had been adequately addressed through the section 92 request for further information to the applicant.

10.4.1 Existing environment – aquatic ecology

The applicant's ecologist Dr James has provided a description of the existing environment in relation to aquatic ecology values of the Pinehaven Stream in the technical report 'Assessment of Freshwater Ecological Effects: Main Works'. Dr Harrison was satisfied with how Dr James described the habitat and ecology of the Pinehaven Stream. I have summarised Dr James' description of the existing environment below.

Overall, Dr James determined the area of the proposed works within the Pinehaven Stream to be of 'moderate ecological value', with a Stream Ecological Valuation (SEV) indicating 'relatively poor ecological function'.

This moderate ecological value is consistent with the PNRP and RFP as the stream has not been recognised in either planning document as providing high ecological value (see Section 3.2).

Macroinvertebrates

Dr James described the macroinvertebrate community of the Pinehaven Stream as dominated by taxa that prefer or tolerate degraded habitat and/or water quality conditions (e.g. snails, amphipods, worms), but still retains several EPT (Epemeroptera – mayflies, Plecoptera – stoneflies, Trichoptera – caddisflies) and other 'cleanwater' taxa that require relatively good habitat and/or water quality conditions. Waikoura (freshwater crayfish) were also noted to be present. The macroinvertebrate community of the proposed works area is indicative of fair to good habitat and/or water quality conditions, despite having modified banks and receiving urban stormwater.

Fish

There are seven fish species known to be in the greater Hulls Creek/Pinehaven Stream catchment (data from a fish survey completed by Jacobs in 2015), with four of these species confirmed as being within the area of the proposed works (giant kokopu, shortfin eel, longfin eel, common bully). This is considered to be relatively low fish diversity. The longfin eel and giant kokopu are an 'at risk – declining' fish species. Migration and spawning periods of the fish species and freshwater crayfish present in the proposed works area cover the entire year.

Habitat

The Pinehaven Stream through the proposed works area has been modified by urban development, including straightening, deepening and concrete lining of banks in some places. The instream habitat is still relatively natural with stony bed substrate and riffle-run-pool habitat present. The bed substrate is predominantly small and small-medium gravels, with a significant silt/sand component (ranging 16-27%).

Fish passage

The lower 500m of the Pinehaven Stream down to its confluence with Hulls Creek is piped, and has a perched outlet which is likely a barrier to some fish species. Within the project area, there are various small grade control weirs which may impede the passage of some fish species.

10.4.2 Effects of water quality (turbidity and sedimentation)

Any increase in suspended sediment in the water column (turbidity) can reduce water quality. Ongoing discharges can degrade the quality of habitat for aquatic animals including fish and invertebrates. Direct impacts can include clogging of gills of fish and invertebrates, reduced visibility of the water, reduced feeding ability and loss of habitat.

Where sediment settles on the river bed (sedimentation) it can fill the spaces between gravel and cobble particles which results in the smothering of stream bed habitat and aquatic life and decreases the spawning areas for many fish species and the habitat for macroinvertebrates.

Dr James advises that "in general, many common New Zealand native fish species are relatively tolerant of elevated turbidity for short periods". Dr James considers that while many aquatic biota are relatively tolerant of at least short-term increases in suspended sediment, the deposition on the streambed is a major stressor on waterway ecosystems through altering physical habitat, altering food resources and degrading sites used for egg laying.

He considers that if the project was to result in fine sediments covering relatively lean stony substrates within and downstream of the project area, this would result in significant adverse effects on aquatic ecology. Dr James noted that a large increase in deposited sediment within and downstream of the project area would likely have the greatest impact on those macroinvertebrate taxa that prefer hard substrates that are relatively free of fine sediment cover and embedment. Dr Harrison agreed with this assessment.

To mitigate the water quality (turbidity and sediment deposition) effects of the proposed works on aquatic ecology, the applicant has proposed the below mitigation measures as part of their application. I have recommended conditions to their effect:

- Use of appropriate erosion and sediment controls, Site-specific Environmental Management Plans and suspended sediment concentration (SSC) limits, as described in Section 10.3;

- Monitoring of fine sediment (turbidity and deposition), with exceedances triggering specific actions, such as a review of erosion and sediment control methods.

10.4.3 Effects of compaction

Machinery working from the bed of the stream has the potential to compact the bed substrate, thereby reducing interstitial spaces used by invertebrates and smaller fish, and killing organisms that cannot get away in time.

Dr James considers that macroinvertebrates will recolonise disturbed and 'dewatered' sections of streambed quickly (within weeks) from the relatively good habitat upstream of the project area. Dr Harrison agreed with this statement.

To mitigate the compaction effects of the proposed works on aquatic ecology, the applicant has proposed the following mitigation measures as part of their application and section 92 response dated 21 February 2020:

- Monitoring and remediation of streambed compaction:
  - The monitoring will involve a qualitative assessment prior to, during and after works by an appropriately qualified person using the 4-point scale (Harding *et al.*, 2009); and
  - In the event the aforementioned monitoring indicates undue compaction (a shift in compaction rating from 1 or 2 (loose/mostly loose) to 4 (tightly compacted), then remediation will be undertaken. Remediation will involve loosening the upper gravels either by machine (if it will not cause undue resuspension of sediment) or by hand (rake/fork).
  - Where possible work will be conducted from the bank (e.g. Willow Park) or offline (28 Blue Mountains Road – construction of new channel).

Dr Harrison was satisfied with the proposed methods for monitoring and remediating streambed compaction. He disagreed with the applicant's definition of 'undue compaction', and recommended that remediation be undertaken if there is an increase in compaction rating of two categories (e.g. from 1 to 3 or 4, or from 2 to 4). Dr Harrison also recommended that the bed compaction be remediated back to its initial compaction rating (or as agreed with the Manager, Environmental Regulation, GWRC if this can't be done for some reason). I have recommended conditions to address Dr Harrison's recommendations.

I have recommended conditions requiring this monitoring and remediation is completed.

10.4.4 Effects on aquatic habitats

The extensive bank works may permanently remove existing bank features that provide cover for fish and macroinvertebrates (such as undercuts, holes and

crevices). Further, it is anticipated the works will require infilling of pools to allow a flat safe surface for operating machinery.

To mitigate the effects of the proposed works on aquatic habitats, the applicant has proposed the following measures as part of their application and section 92 response dated 21 February 2020:

- Re-creation of bank habitat complexity through use of embedded pipes (fish/eel 'hotels'), installation of stable undercuts, and placement of marginal boulders to provide fish cover; and

- Proposed to reinstate all pools that are infilled to their original dimensions – this will require a survey of pools prior to construction to measure their dimensions and take photos to guide their reinstatement.

I have recommended conditions requiring both of these mitigation measures, and that the details of each are provided in the SEMP.

Note: the remediation of riffle areas primarily involves compaction monitoring and management as assessed in Section 10.4.3.

10.4.5 Effects of stream reclamation and diversion 26 and 28 Blue Mountains Road

The proposal involves the reclamation of a section of stream approximately 78m in length at 26 and 28 Blue Mountains Road, and construction of approximately 61m of new channel. This reclamation will result in the permanent loss of existing freshwater habitat of 17m.

Dr James considers that, provided the channel is appropriately designed with an ecologists input, it is more than likely to have permanent positive effects on Pinehaven Stream. This is because it removes a highly modified confined reach with vertical concrete walls and grade control weirs which are barriers to fish passage.

To mitigate the stream reclamation and loss of habitat effects of the proposed works, the applicant has proposed the following mitigation measures as part of their application:

- Construction of a new channel at 26 and 28 Blue Mountains Road with a 'naturalised' profile, streambank complexity and riparian plantings; and

- The design of the new channel will include input from a suitably qualified freshwater ecologist to ensure the ecological benefits are maximised (e.g. zones of runs, riffles, pools, meanders, etc.).

Dr Harrison considers that the proposed reclamation and construction of a new channel will result in a positive outcome, as the habitat that will be gained will be better than that which is lost. Dr Harrison commented he would like to review the proposed design for the proposed reach before it is constructed to confirm there is sufficient streambank complexity, bed complexity (e.g. pools,

runs and riffles) and riparian planting to mitigate the effects. I have recommended a condition to this effect.

10.4.6 Effects on fish passage

(a) Construction effects

The proposed construction methodology of piped diversions will result in fish passage being blocked during the construction works. The applicant has proposed to focus on completing the works as quickly as possible (i.e. not avoiding any specific periods of fish migration/spawning).

The reasoning for this is that the faster that the works can be completed, the faster the project area can begin recovering. Dr James considers that the works have the potential to disrupt up to two migration/spawning cycles, which is unlikely to adversely affect the fish present in the Pinehaven Stream in the long term, especially noting the current fish passage restraints. Dr Harrison agrees with this approach for this situation and location.

The construction methodology also involves stream 'dewatering' the remaining water within the temporary piped stream diversion, which has the potential to result in mortality of fish and macroinvertebrates.

To mitigate the fish passage effects of these proposed construction works, the applicant has proposed that fish relocation and recovery will be undertaken prior to each stage of bed disturbance works commencing. I have recommended a condition requiring a Fish Relocation and Recovery Programme be prepared for certification by GWRC, with all fish rescue being undertaken in accordance with the certified plan and reported on following completion of work stage.

(b) Operational effects

The proposed construction works will likely result in the removal of the existing grade control weirs, which can be barriers to fish passage. The applicant notes that if these are deemed to be required, they will be re-instated. The proposal also involves the upgrade of debris arresters (which can make the passage of large eels difficult if the bars are too close together).

To mitigate the fish passage effects of these proposed structures, the applicant has proposed the following mitigation measures as part of their application, which I have recommended conditions to the effect of:

- Any grade control weirs that are removed during construction should only be reinstated if necessary for the protection of infrastructure. If reinstated, they must be fully passable by all fish species and should take the form of rock ramp weirs (rather than any design that results in rapid flow over a vertical surface). The design shall include input from a suitably qualified freshwater ecologist.

- The design of any debris arrestors will include input from a suitably qualified freshwater ecologist, to ensure they do not adversely affect the passage of fish; and

- The downstream fish barrier at the confluence of Pinehaven Stream and Hulls Creek is remediated to maximise the benefits of the project and compensate for some ecological disturbance. This may look like the installation of a stable rock ramp to remove the perched drop and baffles on the concrete ramp to slow water velocities.

Dr Harrison was supportive of the removal of the potential fish barrier at the confluence with Hulls Creek, and the removal or redesign of the weir structures to allow for fish passage. He stated all fish passage improvements should be done in accordance with the New Zealand Fish Passage Guidelines (NIWA and DoC, 2018), and the guidelines should be referenced in the relevant conditions. He recommended I include a condition requiring GWRC review of the proposed remediation works at the Hulls Creek fish passage barrier, which I have addressed through the recommendation of a Fish Passage Remediation Plan to be to the satisfaction of the Manager.

Dr Harrison also recommended that fish passage be assessed and, where required, provided for at those grade control weirs that are not being impacted by construction works to ensure the benefits of the fish passage improvements that are proposed are achieved. He noted this could be as simple as installing a fish passage measure such as a spat rope. I have recommended a condition requiring this.

10.4.7 Summary of effects on aquatic ecology

Overall, the applicant's ecologist Dr Alex James considered that without mitigation measures, the construction phase of the proposed works would have an overall 'moderate' level of adverse effect on the aquatic ecology of the Pinehaven Stream. He considered that with the implementation of the proposed mitigation measures, the adverse effects could be reduced to a 'minor adverse effect'.

Dr James considered that once the wetted channel has recovered from the disturbance and the riparian vegetation has re-established, the magnitude of the effect of the proposed works will be negligible to potentially positive (net gain) and (in RMA terminology) 'less than minor adverse effects' or 'nil effects'.

Dr Harrison agreed with Dr James' overall assessment of the level of effects on aquatic ecology. I consider that the issues around effects on stream ecology raised by submitters 1 and 4 have been adequately addressed.

Dr Harrison asked whether there would be an assessment of the effectiveness of the works, with post construction monitoring through the monitoring plan. The applicant has responded to this by proposing a condition requiring post-construction monitoring. I have recommended a condition requiring the submission of a Post-construction Freshwater and Riparian Ecological Monitoring Plan (PFREMP) to be certified by GWRC, and the provision of a report outlining the results of the monitoring.

Provided the recommended conditions of consent are adhered to, I consider the effects of the proposed works on the aquatic ecology of the Pinehaven Stream will be appropriately mitigated as far as practicable.

10.5 Effects on riparian ecology

Dr James' report describes the riparian ecology of the Pinehaven Stream as generally consisting of exotic and native shrubs, exotic trees, and various residential garden plantings. The degree of shading is variable, but generally considered to be moderate to low shading.

The removal of the existing riparian vegetation will expose the stream to more sunlight until the replacement riparian vegetation re-establishes. This temporary reduction in shading could cause an increased growth of periphyton and higher water temperatures, which in turn can have adverse effects on stream fauna depending on the magnitude of any increase and species-specific tolerances.

To mitigate the effects of the proposed works on riparian ecology, the applicant has proposed the following mitigation measures:

- Extensive revegetation of the riparian zone and new 'floodplain' areas following completion of the bank works;

- Stepped retaining structures with planting in the terraces, and planting in retaining walls (that are not Redi-rock) with creepers and climbers; and

- Monitoring and maintenance (and potentially a successional plan) to be implemented over many years.

I sought advice from Ms Frances Forsyth (Wildland Consultants Limited). Ms Forsyth's advice dated October 2019 is attached as Appendix 10 of this report.

In her review, Ms Forsyth commented that there was no indication of the linear or aerial extent for each type of riparian planting, and also the species selected for planting were generally inappropriate (will either fail to grow or would be ineffective at providing bank protection).

To address Ms Forsyth's concerns and recommendations, I have recommended the following conditions of consent:

- Submission of a Riparian Planting Plan, in general accordance with the draft planting plan provided as Appendix J of the s92 response dated 21 February 2020, to be certified by GWRC. This plan shall include:

    - Planting of bank-holding species including, but not limited to:

        - Upper storey (rarely wet riparian zone) – tī kōuka/cabbage tree (*Cordyline australis*), mānuka (*Leptospermum scorparium*), whekī (*Dicksonia squarrosa*), kōwhai (*Sophora Microphylla*) and tutu (*Coriaria arborea*), rangiora (*Brachyglottis repanda*) and *Olearia rani*; and

        - Understory – hook grass (*Uncinia uncinata*), shining spleenwort (*Austroderia fulvida)*, rarauhe (bracken fern *Pteridium esculentum*), *Asplenium oblongifolium*, and rarely whaririki

(*Phormium cookianum*) reaching down into the lower part of the bank.

- Planting of *Libertia grandiflora*, *Libertia ixioides*, rarauhe, *Haloragis erecta* subspecies *erecta* on and around concrete structures, where appropriate; and

- No planting in the active channel area which is inundated in all except very light rainfall events (as it reduces galaxiid spawning habitat and encourages deposition of fine sediment).

- Submission of a Post-construction Freshwater and Riparian Ecological Monitoring Plan (PFREMP), and the provision of a report outlining the results of the monitoring.

Provided the recommended conditions of consent are adhered to, I consider the effects of the work on the riparian ecology of the Pinehaven Stream will be appropriately mitigated.

10.6 Effects on cultural values

The site of the proposed works falls within the rohe of two iwi groups – Te Rūnanga o Toa Rangatira Inc (Ngāti Toa) and of Te Atiawa Taranaki Whānui, represented by Port Nicholson Block Settlement Trust (PNBST).

10.6.1 Te Rūnanga o Toa Rangatira Inc

The Ngāti Toa Rangatira Claims Settlement Act 2014 (Schedule D2 of the PNRP) includes in the Statements of Association the 'Hutt River and its tributaries', of which the Pinehaven Stream is a tributary. The Hutt River is identified in PNRP Schedule B (Ngā Taonga Nui a Kiwa) to Ngāti Toa Rangatira.

The applicant did not consult with Ngāti Toa prior to or post-lodgement of the consent application. They noted in the section 92 response dated 21 February 2020 that the public notification process provided an opportunity for Ngāti Toa to submit on the proposal.

Ngāti Toa were advised when the application was received by GWRC via the standard GWRC Te Wāhi notification process, and also directly notified when the consent was publically notified, however no submission was received in relation to this consent application.

10.6.2 Port Nicholson Block Settlement Trust

The Port Nicholson Block (Taranaki Whānui ki Te Upoko o Te Ika) Claims Settlement Act 2009 (Schedule D1 of the PNRP) includes in the Statements of Association the 'Hutt River'. The Hutt River is identified in PNRP Schedule B (Ngā Taonga Nui a Kiwa) to Taranaki Whānui ki Te Upoko o Te Ika, and tributaries are referenced in listed attributes in the right-hand column.

The applicant consulted with Port Nicholson Block Settlement Trust prior to lodging the application, and stated in the application that 'the Pinehaven catchment was identified as having significance as a waterway, but is not

known to be an area of historic cultural significance, or current cultural significance to Māori'.

Port Nicholson Block Settlement Trust, who have advised they hold a neutral position on the application, released a position statement on behalf of Te Atiawa Taranaki Whānui, stating (in relation to the Pinehaven Stream and Hutt River/Te Awa Kairangi):

'Alongside their mauri, they have an interconnected kawa. Over time people have trampled on this kawa through building walls, straightening riverbanks and augmenting the true and natural state of our Awa. However there has come a general realisation by some that we must work with our Awa and that it is easier to abide by their kawa then is to apply the traditional conventions of command and control by man.

In applying our relationship with our Awa, we must understand that their Kawa does not have us – the humans at the centre. Our water ways were not created 'for us'. Our waterways, according to our tradition were a gift from our ancestors – 'Ngā Wai Tuku Kiri mai ngā mātua tupuna'. Our obligation as Taranaki Whānui and as ngā tāngata tiaki of these water bodies is to honour that gift.

Therefore, in abiding the kawa of these Awa we must act in a manner that sees us manage people for the benefit of our Awa – this is not about managing our Awa. Our role as tangata tiaki is to develop a renewed collective responsibility for our human impacts on our Awa and respond to the impacts we can foresee.

The 'The Pinehaven Stream Improvements' (The Project) presents a situation where the applicant is making a significant effort to return the Pinehaven Stream back to its more natural state'

In their position statement, Port Nicholson Block Settlement Trust requested a number of considerations, including being involved in the development of all relevant management plans and the development and implementation (at the cost of the applicant) of a Pinehaven Kaitiaki Monitoring Strategy.

The applicant has proposed a condition requiring a Pinehaven Kaitiaki Monitoring Strategy (PKMS), which I have recommended as a condition of consent. I have added a note to the management plans condition requiring that the consent holder involve PNBST in the development of all relevant management plans, with the intention that PNBST identify to the consent holder which management plans would be relevant for them to be involved in the development of.

I provided a copy of these draft conditions to PNBST for review, and they advised that they have no concerns with them.

Provided the recommended conditions of consent are adhered to, I consider the effects of the work on the cultural values of the Pinehaven Stream will be appropriately mitigated.

10.7 Summary of effects on the environment

Overall, I consider that the adverse effects of the proposal on flooding, erosion and scour, water quality, aquatic ecology, riparian ecology and cultural values can be appropriately mitigated through consent conditions.

11. Objective and policies of the relevant planning instruments 104(1)(b)

The following planning instruments and documents are relevant to this application:

- National Policy Statement for Freshwater Management 2014;
- Regional Policy Statement for the Wellington Region 2013;
- Regional Freshwater Plan for the Wellington Region 1999;
- Proposed Natural Resources Plan 2019 (decisions version); and
- Upper Hutt District Plan 2004.

The relevant provisions of the above-mentioned planning instruments are assessed in the sections below. The exception is the provisions of the Upper Hutt District Plan which is addressed in a separate s42A report by Mr Beban for UHCC.

11.1 National planning instruments

The National Policy Statement for Freshwater Management 2014 (NPSFM) took effect on 1 August 2014, with amendments that took effect on 7 September 2017. The NPSFM sets out objectives and policies that direct local government to manage water in an integrated and sustainable way, while providing for economic growth within set water quantity and quality limits. The NPSFM is an important step to improve freshwater management at a national level.

The key purpose of the NPSFM is to set enforceable water quality and quantity limits. This is a fundamental step to achieving environmental outcomes and creating the necessary incentives to use fresh water efficiently, while providing certainty for investment. The intent of this NPSFM is that any more than minor potential adverse effects of activities, in relation to water takes, water use, damming and diverting, and discharges, are thoroughly considered and actively managed.

Full implementation of the NPSFM (including water quality and quantity limits) is not required immediately, with the due date for the implementation of the NPSFM set down as 31 December 2025. The only interim requirement in the NPSFM is to include Policies A4 and B7 in operative and proposed Plans.

For this application, the NPSFM is given effect to through two transitional policies which have been inserted into the RFP (Policies 5.2.10A and 6.2.4A) and Policies P66 and P110 of the PNRP relating to stream diversions and discharges. These provisions require GWRC to consider specific criteria when making decisions on resource consent applications.

As the proposal involves the discharge of sediment-laden water to water and diversion of surface water, I have provided an assessment against those policies which give effect to the NPSFM in Sections 11.2.2 and 11.2.3 below. I

consider the application to be consistent with the objectives and policies of the NPSFM.

11.2 Regional planning instruments

The relevant regional planning instruments are the Regional Policy Statement (RPS), operative Regional Freshwater Plan (RFP) and Proposed Natural Resources Plan (PNRP) (decisions version), for the Wellington region, which all have legal effect.

The applicant's proposal has been assessed against the relevant objectives and policies in these documents. The full wording of the relevant objectives and policies is contained in Appendix 11 to this report.

11.2.1 Regional Policy Statement (RPS)

The RPS outlines the resource management issues of significance to the region and provides a framework for managing the natural and physical resources of the region in a sustainable manner. Further to this, the RPS identifies objectives, policies and methods which are designed to achieve integrated management of the natural and physical resources of the whole region.

The relevant chapter of the RPS to this application is Chapter 4, specifically section 4.2, which contains policies that are considered when processing and deciding on a resource consent application. My assessment of the application against the relevant policies of the RPS is set out below.

Infrastructure

Policy 39: *Recognising the benefits from renewable energy and regionally significant infrastructure – consideration*

The RPS defines regionally significant infrastructure as including 'the local authority wastewater and stormwater networks, systems and wastewater treatment plants'. The applicant has stated that the 'territorial authority stormwater networks are defined as regionally significant infrastructure. The Pinehaven Stream is part of the wider stormwater network…'.

I do not consider the proposed works for which consent is sought to meet the definition of regionally significant infrastructure. The proposed works are located within the Pinehaven Stream. While stormwater discharges into the Pinehaven Stream, it is a stream and not stormwater network infrastructure. As such, I do not consider that this policy is relevant to the application.

Fresh water and indigenous ecosystems

Policy 40: *Maintaining and enhancing aquatic ecosystem health in water bodies*

Policy 43: *Protecting aquatic ecological function of water bodies*

The Pinehaven Stream is not identified in any schedules or appendices of the regional plans as having specific or significant aquatic or biodiversity values.

However, as outlined in Section 10.4, the Pinehaven Stream is deemed to be of 'moderate ecological value' with 'relatively poor ecological function', and a number of native species have been identified as living in the reaches of the proposed works.

The applicant has provided an Erosion and Sediment Control Plan (ESCP revision 5) which describes how effects on water quality will be managed, with a Site-specific Environmental Management Plan (SEMP) to be provided for GWRC certification outlining the specific erosion and sediment control details for each stage (discussed further in the assessment of policy 41 below).

I have recommended conditions that allow and manage an increase in suspended sediment concentration of 50g/m^3 between the upstream monitoring site and the downstream zone of reasonable mixing during the construction works; 150g/m^3 during and for up to 24 hours after a heavy rainfall event; and a limit as agreed in the SEMP for the construction/removal of the temporary piped diversion and dams being for a period of 24 hours.

The proposal involves the remediation of a number of fish passage barriers currently present in the stream as well as extensive riparian planting along the margins and at Willow Park, which will contribute to improving the ecological function of the Pinehaven Stream. The new stream channel at 26 and 28 Blue Mountains Road will provide better habitat than is currently present. The proposal also involves the remediation of compaction to restore riffles and the rehabilitation of pools that are filled in during works, which will maintain the natural flow regimes and habitats of the affected reach. Bank habitat complexity and riparian vegetation will be reinstated.

As a result of the streambed disturbance and sediment discharges, the proposal is anticipated to have minor adverse effects on aquatic ecology during the construction period. Once the wetted channel has recovered from the disturbance and the riparian vegetation has re-established the effects are considered to be less than minor or nil adverse effects (and potentially net positive effects).

As the construction effects are temporary, and the proposal involves measures which improve the ecological function of the Pinehaven Stream, I consider the proposal to be consistent with these policies.

Policy 41: *Minimising the effects of earthworks and vegetation disturbance*

The applicant proposes to undertake relatively minor earthworks, significant streamworks and vegetation disturbance in order to complete the proposed works.

The applicant has provided an Erosion and Sediment Control Plan (ESCP revision 5), which sets out the overarching details of how erosion and sediment will be managed on site during the works. They have proposed to provide Site-specific Environmental Management Plans (SEMPs) for each stage of the works, which will be certified by GWRC. These SEMPs will provide the

specific details of the erosion and sediment controls that will be implemented for that stage.

The guiding principle of the construction methodology is that the works be undertaken 'off-line', in a 'dry' works environment. This will be achieved by installing a temporary piped stream diversion for the majority of the stages of work. This methodology is considered to be 'industry best practice'.

The ESCP revision 5 also outlines a stream livening procedure which will reduce the 'first flush' of sediment discharges when the temporary piped diversion is removed, and describes how the sites will be stabilised following completion of each stage of the works. Dirty water will be 'dewatered' from the stream and treated through a sediment curtain or settlement tank prior to being discharged downstream.

I have recommended consent conditions which state suspended sediment concentration limits at the zone of reasonable mixing for different circumstances (standard works, heavy rainfall event and installation/removal of the temporary dam and diversion).

Overall, I consider that, subject to the applicant's mitigation measures and the recommended conditions of consent, the proposal will effectively minimise the effects of the earthworks, streamworks and vegetation disturbance, so that healthy aquatic ecosystems are sustained, and are therefore consistent with this policy.

Tangata whenua

Policy 48: *Principles of the Treaty of Waitangi*

Policy 49: *Recognising and providing for matters of significance to tangata whenua*

I consider the proposal has given regard to the principles of the Treaty of Waitangi, as the application has been publicly notified and with specific notice sent to the two local iwi groups – Te Rūnanga o Toa Rangatira Inc (Ngāti Toa) and Te Atiawa Taranaki Whānui, represented by Port Nicholson Block Settlement Trust (PNBST).

The applicant consulted with Port Nicholson Block Settlement Trust prior to lodging the application, and has proposed a condition requiring a Pinehaven Kaitiaki Monitoring Strategy (PKMS) to mitigate effects on cultural values of PNBST, which will also provide an opportunity for PNBST to exercise kaitiakitanga.

The applicant did not consult directly with Ngāti Toa prior to or post-lodgement of the consent application. They noted in the section 92 response dated 21 February 2020 that the public notification process provided an opportunity for Ngāti Toa to submit on the proposal. No submission was received from Ngāti Toa in relation to this consent application.

Natural hazards

Policy 51: *Minimising the risks and consequences of natural hazards*

Policy 52: *Minimising adverse effects of hazard mitigation measures*

Policy 51 requires that when considering an application for resource consent, the risk and consequences of natural hazards shall be minimised, and lists matters regard must be given to in order to determine whether an activity is appropriate. Policy 52 outlines matters particular regard must be given to for hazard mitigation measures. I have assessed against those relevant matters below:

- The proposed works are designed to increase the capacity of the stream to a 1-in-25-year flood event and contribute to the management of flood risk to habitable floor levels up to the peak 1-in-100-year flood event (thus reducing the frequency and magnitude of natural hazards to the Pinehaven catchment).

- The applicant has advised that the design will appropriately allow for the potential effects of climate change on rainfall depths (20% increase) through to the year 2120, in accordance with the MfE 2018 guidance. This has been addressed in the re-run of the model and updated FHA.

- The proposed works are hazard mitigation works will reduce the potential for injury, loss of life, social disruption, and emergency management and civil defence implications.

- Through the PSFMP process, the applicant has looked at and proposed a combination of methods to manage flood risk from the Pinehaven Stream (including structural, non-structural plan changes and river management and maintenance options). I consider the proposed works to be appropriate in the high flood risk environment of the Pinehaven Stream.

- Ms Westlake has confirmed through her review that where 'hard-engineering' methods are proposed, it is highly unlikely that more 'natural' measures (e.g. non-structural or soft engineering) would be successful.

Policy 51(e) and Policy 52(e) relate to giving particular regard to risks or consequences of the proposed works. As described in Section 10.1.3, the updated FHA indicates that there are some residual and adverse effects on some properties (i.e. the proposed works do not stop all flooding and in some cases there is increased flood depth or extent). I have assessed the severity of these effects based on the changes to flood effects, advice from Mr Law and applicant consultation with the various landowners. I have concluded that the adverse effects of the proposed works are no more than minor, and consider that the proposed works are not inappropriate.

The purpose of the proposed works is to reduce flooding to the area surrounding the Pinehaven Stream, so I consider that it is consistent with these policies.

Public access

Policy 53: *Public access to and along the coastal marine area, lakes and rivers – consideration*

This policy requires that when considering an application for land use consent on public land, particular regard shall be given to enhancing public access to and along specific locations. The Pinehaven Stream does not meet the criteria of these locations.

The policy explanation, however, describes that it does not limit other efforts to enhance access. The applicant has proposed redevelopment works in Willow Park, which involves planting an area that is currently grass with riparian species. Public access to this location will be closed while works on this stage are being completed, however this will be short-term. In the long term the proposed changes are intended to enhance the public's engagement with the natural values of the Pinehaven Stream at Willow Park.

I consider the proposal is consistent with this policy.

Summary of assessment against the Regional Policy Statement

Overall, I consider the proposal to be consistent with the provisions of the RPS.

11.2.2 Operative Regional Freshwater Plan

I have reviewed the provisions of the RFP in relation to this application. The key chapters of the plan which are relevant to this proposal are Chapter 4 (General Objectives and Policies), Chapter 5 (Water Quality and Discharges to Fresh Water), Chapter 6 (Water Quantity and Taking, Use, Damming or Diversion of Fresh Water) and Chapter 7 (Use of the Beds of Rivers and Lakes and Development on the Floodplain).

The relationship of tangata whenua with fresh water – Objectives 4.1.1, 4.1.2 and 4.1.3; Policies 4.2.1, 4.2.2 and 4.2.7

These provisions require the relationship of tangata whenua and their culture and traditions with freshwater to be recognised and provided for, the mauri of water bodies and river beds be protected, and the principles of the Treaty of Waitangi be taken into account.

PNBST identified that, whilst the Pinehaven Stream is not known to be an area of historic or current cultural significance to Māori, the catchment has significance as a waterway. Further, both iwi have Statements of Association to the Hutt River, and in the case of Ngāti Toa also the tributaries of the Hutt River.

I consider the proposal has had regard to the principles of the Treaty of Waitangi, as the application has been publicly notified and with specific notice sent to the two local iwi groups.

The applicant consulted directly with PNBST, however did not consult directly with Ngāti Toa. The applicant noted in the section 92 response dated 21 February 2020 that the public notification process provided an opportunity for Ngāti Toa to submit on the proposal (no submission was received from Ngāti Toa).

As a result of consultation with PNBST, the applicant has proposed (and I have recommended) a condition requiring a Pinehaven Kaitiaki Monitoring Strategy (PKMS) to mitigate effects on cultural values of PNBST. This will allow tangata whenua to actively participate in the monitoring of effects on cultural values.

The construction methodology uses 'industry best practice' methods of a temporary piped diversion, to reduce the effects of the works on the mauri of the Pinehaven Stream.

I consider the application to be consistent with these provisions.

Natural values – Objectives 4.1.4 and 4.1.5; Policies 4.2.9, 4.2.11 and 4.2.14

These provisions aim to protect the natural character of rivers from inappropriate use and development, to safeguard the life supporting capacity of water and ecosystems, and protect significant habitats of fresh water fauna.

The section of the Pinehaven Stream subject to the proposed works has a varying degree of natural character. There are some sections where natural components are evident, and in other sections the stream has been highly modified with retaining walls and concrete blocks.

Objective 4.1.4 requires the natural character of rivers and their margins be preserved and protected from inappropriate use and development, and Policy 4.2.9 lists the characteristics to have regard to, while Objective 4.1.5 relates to safeguarding the life-supporting capacity of water and ecosystems and Policy 4.2.11 lists the matters to have regard to.

I have had regard to the listed characteristics (see specifically Sections 10.3 and 10.4 of this report relating to water quality and aquatic habitat), and consider that whilst the proposed works will have adverse effects on some of the listed matters during the construction period, the effects on natural character in the long-term will be nil or potentially positive (e.g. restoration works at Willow Park and planting within the retaining walls, re-creation of aquatic habitat complexity and improvements to fish passage).

Policy 4.2.14 relates to effects on important trout habitat. Whilst the Pinehaven Stream is not identified as trout habitat, the downstream Hulls Creek and Hutt River have been. With the proposed mitigation measures, particularly those around water quality, the effects of the works should not extend to those water bodies if undertaken in accordance with the recommended conditions.

I consider the proposal to be consistent with these provisions.

Amenity value and access – Objectives 4.1.7 and 4.1.8; Policies 4.2.16 and 4.2.17

These provisions require that amenity and recreational values, and quality of lawful public access to and along rivers is maintained and where appropriate enhanced.

I consider the proposal to be consistent with these provisions. In the long-term there will be no change to the amount of public access to the stream. The applicant has proposed redevelopment works in Willow Park, which involves planting what is currently grass with riparian species. Public access to this location will be temporarily closed while works on this stage are being completed, however this will be short-term. In the long term the proposed changes intend to enhance the public's engagement and recreational values with the Pinehaven Stream at that location by restoring natural character to the modified stream.

Flood mitigation – Objective 4.1.9 and 4.1.10; Policies 4.2.18, 4.2.20, 4.2.21 and 4.2.22

These objectives and policies aim to ensure the risk of flooding to human life, health and safety is at an acceptable level and the adverse effects on natural values and physical resources (including people's property) are at an acceptable level.

I consider there is sufficient information about the flood hazards in the Pinehaven catchment through the previously developed PSFMP and flood model to ensure that flooding in this catchment is mitigated to an acceptable level. There is considerable community awareness of the flood hazards and flood mitigation works, through the development of the PSFMP and the public notification of this consent application.

Overall, the aim of the proposed works is to address the current adverse effects of flooding, and they will have significant positive effects on flooding in the Pinehaven catchment, reducing the risk to human life, health and safety.

However, as described in Section 10.1.3, in relation to the adverse effects on flooding associated with the proposal, the updated FHA indicates that six privately owned properties may have increased flooding effects.

Objective 4.1.10 notes that 'An acceptable level of risk… is one that balances the benefits and costs of flood hazard reduction measures, taking into account non-monetary costs, community aspirations and the statutory responsibilities of relevant authorities. Public input is required to determine the level of acceptable risk'. Further, policy 4.2.18 promotes the avoidance or mitigation of the potential adverse effects of flooding. In Section 10.1.3, I have assessed the level of these effects, based on the changes to flood effects, advice from Mr Law and applicant consultation with the landowner. I concluded that the adverse effects of the proposed works on flooding on these properties are no

more than minor, and consider they are an acceptable level of risk, especially when noting the positive flood effects that will be experienced by these properties and the surrounding community.

Use and development – Objectives 4.1.11, 4.1.12, 4.1.13, 4.1.15 and 4.1.17; Policies 4.2.23, 4.2.27, 4.2.28, 4.2.30, 4.2.31, 4.2.34, 4.2.35, 4.2.36, 4.2.37 and 4.2.38

I consider that the proposal provides for the social, economic and cultural wellbeing and health and safety of the Pinehaven community, and I have had regard to these benefits when assessing the proposal.

As a result of the streambed disturbance and sediment discharges, the proposal is anticipated to have minor adverse effects on aquatic ecology during the construction period. However once the wetted channel has recovered from the disturbance and the riparian vegetation has re-established there will be less than minor or nil adverse effects (and potentially net positive effects). Further, the proposal involves the remediation of a number of fish passage barriers currently present in the stream as well as extensive riparian planting along the margins and at Willow Park, which will enhance the Pinehaven Stream.

The consent application was publicly notified, which has provided an opportunity for people and the community to be involved in the decision making process. PNBST has provided advice and I have recommended a condition requiring a Kaitiaki Monitoring Strategy.

I have recommended conditions of consent as a means of avoiding, remedying and mitigating adverse effects on characteristics of the matters listed in 4.2.34. I have had regard to the matters listed in Policies 4.2.35 and 4.2.36 when recommending conditions.

The applicant has undertaken significant consultation with the directly affected community in relation to the proposed works and generally identified in the application how the adverse effects might be avoided, remedied or mitigation.

Policy 4.2.38 outlines that there are circumstances where placing conditions on resource consents may not be sufficient to adequately avoid, remedy or mitigate the adverse effects of a proposal, and that in such circumstances a consent application will be declined. I consider that conditions of consent are sufficient to adequately avoid, remedy or mitigate the adverse effects of the proposal.

Water quality – Objective 5.1.1 and 5.1.2; Policies 5.2.6, 5.2.8, 5.2.10, 5.2.10A and 5.2.11

These provisions provide a framework for managing the quality of water in water bodies. With regard to this proposal, the requirement is to manage the water quality of the Pinehaven Stream for aquatic ecosystem purposes (Policy 5.2.6).

The proposal will result in adverse effects on water quality during the construction period. With respect to the water quality guidelines in Appendix 8

of the RFP, there will be an intermittent and temporary change in the visual clarity of the water and an increase in the deposition of sediment on the streambed, at or beyond the zone of reasonable mixing (50m downstream of each stage of works).

I have recommended conditions that allow and manage an increase in suspended sediment concentration of 50g/m^3 between the upstream monitoring site and the downstream zone of reasonable mixing during the construction works; 150g/m^3 during and for up to 24 hours after a heavy rainfall event; and a limit as agreed in the SEMP for the construction/removal of the temporary piped diversion and dams being for a period of 24 hours.

As the proposal cannot meet the water quality guidelines in Appendix 8 (required by Policy 5.2.8), Policy 5.2.10 which allows for discharges which do not meet the relevant policies in certain situations is relevant. With the recommended conditions of consent, this proposal may cause discharges that result in a conspicuous change in clarity at the zone of reasonable mixing. The effect would be intermittent (associated only with heavy rain events and specified construction activities), and temporary (the recommended conditions requiring that exceedances would last no longer than 24 hours, or for 24 hours after heavy rainfall ceases). As such, I consider the discharge can meet the requirements of this policy and I consider the application is consistent with the purpose of the Act.

Policy 5.2.10A was inserted into the RFP to give effect to the NPSFM. It requires that when considering an application, regard is given to a number of matters. The construction phase of the proposed works (which includes the discharge as well as bed disturbance) is anticipated to have a 'minor adverse effect' on aquatic ecosystems. To assess the extent to which it is feasible or dependable that more than minor adverse effects be avoided, I consider that the applicant has proposed an 'industry best practice' method for conducting the streamworks (temporary piped diversion) in order to minimise discharges from the proposed works, as well as use of appropriate mitigation measures (e.g. those relating to sedimentation such as the settling tank and stream-livening protocol). There is no alternative to the discharge, as the proposed works are in the bed of a stream. All construction-related discharges will be temporary in nature. Due to this, I consider the application to be consistent with this policy.

Policy 5.2.11 requires that reasonable mixing zones on discharge consents have regard to a number of matters. I have had regard to those matters, and have recommended a condition that the reasonable mixing zone be 50m downstream of each stage of works (or as agreed to in the SEMP where this is not practicable). The purpose of the reasonable mixing zones and monitoring is to ensure that all stages are complying with the suspended sediment limits.

The proposal is **inconsistent** with Policy 5.2.8, however inconsistencies with this policy are provided for by Policy 5.2.10 (with which the proposal is consistent).

Water quantity – Objectives 6.1.1; Policies 6.2.2, 6.2.4A 6.2.14 and 6.2.15

These provisions enable people and communities to take, use, dam or divert water, while ensuring the water levels are sufficient to maintain the values of the waterbodies. The proposed temporary piped diversion is non-consumptive, whereby the water is diverted straight through the works area and discharged directly back to the Pinehaven Stream, and so will not reduce the overall stream flows or water levels. The proposed permanent diversion at 26 and 28 Blue Mountains Road, and the permanent diversion of floodwaters will not alter the water levels in a way that will impact values of the Pinehaven Stream.

Policy 6.2.4A gives effect to the NPSFM, and requires that when considering an application, regard is given to a number of matters. The temporary piped diversion, the permanent diversion at 26 and 28 Blue Mountains Road, and the permanent diversion of flood waters will not adversely affect the life-supporting capacity of the stream and ecosystem.

Policy 6.2.14 specifically provides for minor and temporary diversions of water that are associated with authorised works (as are the diversions proposed). The damming and diversion will not give rise to significant adverse effects on those matters listed in 6.2.15(2).

Fish passage will be blocked for the duration of the temporary diversions. The applicant has proposed to focus on completing the works as quickly as possible (i.e. not avoiding any specific periods of fish migration/spawning). Considering the current fish passage impediments within this section of the stream and the two year duration of the works this is unlikely to adversely affect the fish population of the Pinehaven Stream.

I consider the proposal to be consistent with these provisions.

Uses of beds of rivers and lakes and development on a floodplain – Objectives 7.1.1, 7.1.2, 7.1.4; Policies 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.6, 7.2.9, 7.2.12, 7.2.13, 7.2.14 and 7.2.15

These provisions provide for appropriate uses of the beds of rivers and floodplains, while avoiding, remedying or mitigating adverse effects. I consider the proposal to be consistent with these objectives and policies, for the reasons highlighted below.

Policy 7.2.1 states that structures for flood mitigation or erosion protection purposes are an appropriate use of a river bed, and as such I consider that all of the proposed works are appropriate. Policy 7.2.2 requires that structures which have adverse effects on the listed matters are not to be allowed. I am comfortable that the proposal will not have adverse effects on the matters listed.

The proposed works are consistent with the values of tangata whenua, with PNBST commenting that the applicant is making a significant effort to return the Pinehaven Stream to a more natural state. Although we have not received comment on the proposal from Ngāti Toa, I do not consider the proposal to be

inconsistent with their values of the Hutt River and its tributaries as detailed in Schedule B of the PNRP.

An overall objective of the works is to reduce flood risk to the surrounding properties. Whilst the proposed works are having significant positive benefits to flood risk for the majority of properties within the catchment, in relation to policy 7.2.3 and as described in Section 10.1.3 of this report, the updated FHA indicates that there may be some adverse effects on particular properties. In Section 10.1.3 I assess the level of adverse effects of flooding on these properties based on the changes to flood effects, advice from Mr Law and applicant consultation with the landowner. Overall, I consider that the adverse effects of the proposed works on private property are no more than minor, and the proposal is consistent with policy 7.2.3.

The proposed works form the structural component of the Pinehaven Floodplain Management Plan (excluding the Sunbrae Drive and Pinehaven Road culvert upgrades which were consented separately under WGN200101), which I have had regard to, and the applicant has provided the relevant flood hazard assessment. They are not *ad hoc* measures.

The proposal involves the removal of existing structures, as well as vegetation and bed material to allow room for the proposed works to be undertaken. The applicant has proposed sufficient mitigation measures in relation to erosion and flood hazard effects associated with those works. The introduction of plants will be managed through the certification of a riparian planting plan.

Policy 7.2.15 requires that reclamation of a river is only carried out in certain circumstances. I consider that the reclamation provides significant benefits to the community, through the reduction in flood risk as it contributes to the outcomes of the PSFMP flood objectives. I also consider it is consistent with Policy 4.2.10 because the proposed new section of stream provides better habitat values than the existing section of stream (further described in Section 10.4.5 of this report).

Summary of assessment of the Operative Regional Freshwater Plan

Overall, I consider the proposal to be consistent with the provisions of the RFP.

11.2.3 Proposed Natural Resources Plan

I have reviewed the provisions of the PNRP in relation to this application. The PNRP contains objectives and policies aimed at avoiding, remedying and mitigating the potential adverse effects of the use and development of water bodies, water quality, aquatic and riparian ecology and natural hazards.

Ki uta ki tai: mountains to the sea – Objectives O1, O2, O3 and O4

These objectives relate to the holistic management of resources and recognising the intrinsic values of freshwater to the social, economic and cultural wellbeing of the community. I consider that the proposal is consistent with these provisions.

Beneficial use and development – Objectives O9 and O10; Policies P9 and P16

These provisions require that recreational values and public access to rivers is maintained and enhanced. Whilst recreational values and public access will be disrupted temporarily during the construction works, the proposal maintains the existing public access and involves the re-development of public land at Willow Park. These works intend to enhance the public's recreational values with the Pinehaven Stream at that location.

Policy 16 requires that the social, cultural, economic and environmental benefits of new catchment based flood and erosion risk management activities are recognised. The proposed works will result in significant benefits to the Pinehaven community due to improved flood protection, which I have recognised while processing this consent.

I consider the proposal to be consistent with these provisions.

Māori relationships – Objectives O14 and O15; Policies P17, P19, P20, P21

These objectives and policies recognise the relationships of Māori. The applicant consulted directly with PNBST, and the public notification of the application was sent directly to both PNBST and Ngāti Toa. No submission was received from either iwi.

PNBST stated that whilst the Pinehaven Stream is not known to be an area of historic or current cultural significance, the catchment does have significance as a waterway.

The construction methodology uses 'industry best practice' methods including a temporary piped diversion, to reduce the effects of the works on the mauri of the Pinehaven Stream, and the applicant has proposed (and I have recommended) a condition requiring a Pinehaven Kaitiaki Monitoring Strategy (PKMS) to provide for the role of kaitiaki and mitigate effects on cultural values of PNBST.

I have had regard to the statutory acknowledgements of PNBST and Ngati Toa while assessing this application. I consider the proposal is consistent with the provisions listed above.

Natural character, form and function – Objective O17 and Policy P24

The section of the Pinehaven Stream subject to the proposed works has a varying degree of natural character. There are some sections where natural components are evident, and in other sections the stream has been highly modified with retaining walls and concrete blocks.

Significant adverse effects on natural character will be avoided, and adverse effects on natural character will be avoided, remedied or mitigated. The proposed works include planting of riparian margins with native plants which will help restore natural character to the modified stream. I consider that the

proposed works are consistent with this policy, and will in some areas enhance the natural character of the Pinehaven Stream.

Natural hazards – Objectives 20 and 21; Policies P27, P28 and P29

These provisions relate to ensuring the risk from natural hazards and adverse effects of climate change on people, the community and infrastructure are acceptable, including that inappropriate use in high risk areas (streambeds) is avoided.

I have assessed the application against the matters listed in Policy P27 below in relation to the development of hazard mitigation measures in a streambed.

There is a functional need for the use and development of the stream improvement works to be located within a high risk area (the bed of the Pinehaven Stream). In general, the development significantly reduces flood risk in the surrounding area, and does not cause or exacerbate natural hazards in other areas (e.g. downstream of the proposed works area), however, the works may increase flood levels at specific properties within the proposed works area (discussed further below). The proposal is not anticipated to cause adverse effects on natural processes of the Pinehaven Stream, noting that the Pinehaven Stream is already highly modified and aspects of the proposal involve improving and naturalising habitats.

Whilst the proposed works are having significant positive benefits to flood risk for the majority of properties within the catchment, in relation to Objective O20 (that the residual hazard risks are acceptable) and Policy P27 (residual hazard risk is low) and as described in Section 10.1.3, the updated FHA indicates that for some properties the modelling undertaken shows that the depth of flooding will increase for the 1:25 or the 1:100 year flood events. As described in the assessment of effects in Section 10.1.3, I consider that the hazard risk and residual hazard risk from flooding is low (the adverse effects are no more than minor) and in terms of Objective O21 I consider this to be acceptable.

Policy P28 requires that hard hazard engineering mitigation and protection methods be avoided, except where necessary to protect existing development from unacceptable hazard risk. The proposed works are part of a hazard risk management strategy (PSFMP), and are to protect existing development from the current unacceptable flooding risk (the stream channel capacity is likely less than a 1-in-5 year flood event).

Ms Westlake has advised that the applicant has looked at and proposed a combination of methods to manage flood risk from the Pinehaven Stream (including structural, non-structural plan changes and river management and maintenance options). She considered that, in terms of the engineered structures, it was highly unlikely that more ‘natural’ measures could be used due to the constrained space and hydraulic conditions the designs need to meet. As such, I consider the proposal to be consistent with Policy P28.

In regards to Policy P29, the proposal is consistent with this policy as it has taken into consideration erosion and scour, and potential changes and effects due to climate change in accordance with the MfE 2018 guidance through to 2120.

Water quality – Objectives O23 and O24; Policy P66

These provisions require that water quality is maintained or improved. As the Pinehaven Stream is not identified as a site with significant mana whenua values and Nga Taonga Nui a Kiwa in the PNRP (O24 (b)(i)), nor is it a coastal site (O24(b)(ii)), it must meet at a minimum the secondary contact recreation objectives in Table 3.2. Table 3.2 sets minimum standards for *E. coli* levels, cyanobacteria and Maori customary use.

The proposal will not affect *E. coli* levels in the stream, however, it may have an effect on cyanobacteria and Māori customary use due to the discharge of sediment. During the construction phase, the proposed works will have temporary adverse effects on the quality of water in the Pinehaven Stream. The proposal involves riparian planting along the stream corridor which in the long-term may improve the water quality from the urban area, and a Kaitiaki Monitoring Strategy (PKMS) to monitor, manage and mitigate effects on Māori customary use. Due to the effects on water quality being temporary and that in the long-term water quality will be maintained or improved at this location, I consider the proposal to be consistent with these provisions.

Policy P66 gives effect to the National Policy Statement for Freshwater Management, and requires consideration of a number of matters when considering an application. The construction phase of the proposed works (which include the discharge as well as bed disturbance) are anticipated to have a ‘minor adverse effect’ on aquatic ecosystems. To assess the extent to which it is feasible or dependable that more than minor effects be avoided, I consider that the applicant has proposed an ‘industry best practice’ method for conducting the streamworks (temporary piped diversion) in order to reduce to the maximum possible extent the discharges from the proposed works, as well as appropriate mitigation measures (e.g. those relating to sedimentation such as the settling tank and stream-livening protocol). All construction-related discharges will be temporary in nature. Further, the contaminants in the discharge will be sediment which may be treated with flocculant, thereby will not have an adverse effect on the health of people and communities through their contact with the stream. I have recommended conditions with limits for standard works, heavy rainfall events and the installation and removal of the temporary piped diversions. Overall, I consider the proposal to be consistent with this policy.

Biodiversity, aquatic ecosystem health and mahinga kai – Objectives O25, O27, O29, O30; Policies P31, P32, P34 and P35

These provisions require that biodiversity, aquatic ecosystem health and mahinga kai in freshwater bodies are safeguarded. The proposal is anticipated to have minor adverse effects on aquatic ecology during the construction period, however once the wetted channel has recovered from the disturbance

and the riparian vegetation has re-established there will be less than minor or nil adverse effects (and potentially net positive effects). The effects of the proposed works on aquatic ecology are discussed in depth in Section 10.4.

In relation to Table 3.4 of Objective O25, Dr Harrison has advised that the Pinehaven Stream is River Class 2. He considers the objective relating to fish in Table 3.4 is not currently met given there is a downstream barrier, but the objective relating to macroinvertebrates is met. There is insufficient information to make an assessment against the objectives relating to macrophytes and periphyton. The proposal will contribute to improving these values in the Pinehaven Stream over time, in particular due to the proposed improvements on fish passage and aquatic and riparian habitat. As such, I consider the proposal to be consistent with this objective.

Policy P31 lists values of biodiversity, aquatic ecosystem health and mahinga kai that shall be maintained or restored by managing the effects of development. Water quality will be maintained to meet the objectives of Objective O25 (maintain biodiversity aquatic ecosystem health and mahinga kai). I have recommended conditions to maintain or restore aquatic habitat diversity (e.g. pools, runs, riffles, bank habitat complexity with undercuts and 'fish/eel hotels'). The proposal will maintain and restore riparian habitats, and the plants to be used and their arrangement will be approved through a Riparian Planting Plan.

In relation to the construction effects on fish passage and the direction of Policy P31 to minimise adverse effects on aquatic species at times of migration, the proposed construction methodology of temporary piped diversions will result in fish passage being blocked during the construction works. The applicant has proposed to focus on completing the works as quickly as possible (i.e. not avoiding any specific periods of fish migration/spawning). Whilst **inconsistent** with Objective O29, and Policies P31(f) and P34, I consider that it is appropriate for this proposal given the current fish passage impediments and because there is no practical way of providing for fish passage while undertaking the works, and because the faster that the works are completed, the faster the area can recover. Working year round for two years is unlikely to adversely affect the fish population in the long term.

In relation to the operational effects on fish passage, the applicant has proposed a number of positive aspects to their proposal including remediation of the downstream potential fish passage barrier at the confluence of Pinehaven Stream and Hulls Creek to restore fish passage and connections between the fragmented habitats. The applicant has also proposed to address fish passage at the debris arrestors and when reinstating grade control weirs. At Dr Harrison's advice, I have also recommended a condition requiring the applicant address fish passage at those grade control weirs that are to be retained. I consider the proposal to be consistent with Policy P35.

The applicant proposes to manage the adverse effects of the proposal as per the requirements of Policy P32, firstly looking to avoid significant adverse effects (e.g. construction methodology of a temporary piped diversion), followed by minimising adverse effects (e.g. treating sediment laden water through a

settlement tank), and where adverse effects cannot be avoided or minimised they are remedied (e.g. compaction remediation, replanting of disturbed banks, construction of the new stream channel). No significant residual adverse effects remain, so offsetting is not required or proposed.

Objective O30 relates to maintaining or improving the habitat of trout. Whilst the Pinehaven Stream is not identified as trout habitat, the downstream Hulls Creek and the Hutt River have been. With the proposed mitigation measures, particularly around water quality, the effects of the works will not extend to those water bodies.

Discharges to land and water – Objective O47; Policies P67, P71, P72 and P98

These provisions relate to maintaining or improving water quality and minimising the amount of sediment-laden runoff entering water.

Policy P67 requires that discharges of contaminants to water be minimised by adopting the outlined hierarchy. The proposed works are unable to avoid the production of sediment-laden water, due to the nature of the proposal (works in the bed of a stream). Therefore, the proposal involves reducing and minimising the discharge through the various means discussed in Section 10.3 and proposed in the ESCP revision 5. Discharging to land is not practicable in relation to this proposal due to the nature of the works (instream) and the constraints of the surrounding built environment. I have recommended conditions of consent recommending sediment limits at the zone of reasonable mixing, and requiring erosion and sediment controls to be managed in accordance with the current guidelines to minimise the effects of the discharge of sediment-laden water to the Pinehaven Stream.

Policy P72 requires that the zone of reasonable mixing be minimised, but determined on a case-by-case basis, and that in determining the zone of reasonable mixing particular regard be given to the matters listed. I have had regard to the matters listed, the definition for zone of reasonable mixing in the PNRP for permitted activities (seven times the width of the wetted channel but not less than 50m), and the monitoring distance as proposed by the applicant. Due to this, I consider a zone of reasonable mixing of 50m is appropriate.

I have recommended a zone of reasonable mixing for each stage. In the event that the zone of reasonable mixing being 50m downstream of a stage of works is not practicable (e.g. if there is a downstream stage of works being undertaken at 50m downstream, or 50m downstream is part of a piped/culverted network), the zone of reasonable mixing shall be confirmed in the relevant SEMP.

Policy P70 is relevant for this proposal because an objective of Table 3.4 in Objective O25 is not met. This policy states that point source discharges are inappropriate if they would cause the Pinehaven Stream to decline in relation to that objective. The objective of Table 3.4 that is not met relates to fish passage due to the downstream barrier at the confluence of the Pinehaven Stream with

Hulls Creek. The proposed discharge will not result in further decline to fish passage of the Pinehaven Stream.

Whilst the proposed works do result in fish passage being blocked during construction, as described above, I consider this is appropriate because the faster that the works are completed, the faster the area can recover. Undertaking works in this manner is considered unlikely to adversely affect the fish population in the long term. Further, the proposal involves remediation of the downstream potential fish passage barrier at the confluence of Pinehaven Stream and Hulls Creek, and also addressing fish passage at the debris arrestors and grade control weirs.

I consider the proposal to be consistent with Policy P98, in that the applicant has proposed and I have recommended conditions requiring the good management of erosion and sediment control, site stabilisation and revegetation.

Riparian vegetation – Policies P101 and P106

The proposal involves significant riparian planting, to enhance the ecology and also provide erosion and scour protection. The riparian planting will not increase flood or erosion risk (noting that roughness for planting has been included in the model). I have recommended a condition requiring a Riparian Planting Plan, to ensure that the proposed planting is appropriate (species, density, location, etc) as the initial proposal does not include, in the opinion of Ms Forsyth, appropriate species. I have also recommended a condition requiring ongoing monitoring and maintenance of the riparian planting for five years to ensure that it is established and maintained in a way to ensure effectiveness.

Activities in the beds of lakes and rivers – Policies P102, P110 and P129

Policy P102 relates to reclamation of streambeds, and states that reclamation shall be avoided except in certain circumstances, noting that the Pinehaven Stream is not identified in Schedule A or C of the PNRP. Condition (b) allows for partial reclamation of a river bank for the purposes of flood prevention or erosion control, however in this case, the proposal involves the full reclamation of a 78m section of the stream bed. Regardless, I still consider this to be appropriate for flood prevention purposes. In relation to condition (d), the reclamation is associated with the creation of a new river bed and does not involve piping the existing stream. In relation to condition (f), given the existing location of the stream, the reclamation of the stream provides the flood mitigation required for the adjacent property, and there are no other practicable alternatives in this location. Based on the assessment above, I consider that the proposed reclamation is consistent with this policy.

Policy P110 gives effect to the National Policy Statement for Freshwater Management, specifically in terms of the taking, damming and diversion of freshwater. Policy P110 requires consideration of a number of matters when assessing an application. The temporary piped diversion will not adversely affect the life-supporting capacity of the stream and ecosystem after the initial

construction period once removed. The damming and diversion of water is non-consumptive, and will not reduce flows or water levels in the Pinehaven Stream. The proposed permanent diversion at 26 and 28 Blue Mountains Road, and permanent diversion of floodwaters will not alter the water levels in a way that will adversely affect the values of the Pinehaven Stream.

In relation to Policy P129, the proposed temporary piped diversion is non-consumptive, whereby the water is diverted straight through the works area and discharged directly back to the Pinehaven Stream, and so will not reduce the overall stream flows or water levels in the stream. Therefore, there is no requirement to assess the proposal against the minimum flows/water levels in the whaitua chapters of the PNRP.

Summary of assessment of the Proposed Natural Resources Plan

While I consider the proposal to be inconsistent with Policy P31(f) and P34, given the reasons outlined above I consider the undertaking of works which will temporarily block fish passage to be appropriate in this situation.

On balance, after considering all of the relevant provisions, I consider the proposal to be generally consistent with the provisions of the PNRP.

11.2.4 Weighting of the RFP and PNRP

As the conclusion reached under the operative Regional Freshwater Plan assessment is consistent with that reached under the Proposed Natural Resources Plan, there is no need to undertake a weighting exercise between the two plans.

12. Other relevant matters 104(1)(c)

This section of the Act requires the consent authority to, subject to Part 2, have regard to any other matter the consent authority considers relevant and reasonably necessary to determine the application.

The application indicated a number of documents were relevant, including the GWRC Long Term Plan 2015-2025, draft Natural Hazards Management Strategy for the Wellington Region, draft Environmental Code of Practice and Monitoring Plan for Flood Protection Activities, UHCC Long Term Plan 2015-2025 and Upper Hutt City Council Land Use Strategy.

I also consider the following documents to be relevant to this proposal:

- Pinehaven Stream Floodplain Management Plan (2016);
- The Port Nicholson Block (Taranaki Whānui ki Te Upoko o Te Ika) Claims Settlement Act 2009; and
- The Ngāti Toa Rangatira Claims Settlement Act 2014.

The purpose of the proposed works is to give effect to part of the structural component of the Pinehaven Stream Floodplain Management Plan, so it is consistent with this document.

The cultural associations of PNBST are recognised in a Deed of Settlement as set out in the PNBST Claims Settlement Act 2009. In this deed, PNBST have a statutory acknowledgement with respect to the 'Hutt River'. The legislation requires GWRC to have regard to the statutory acknowledgements in forming an opinion on affected party status. The PNBST were directly notified of the application, and the applicant had consulted directly with them. No submission was received from the iwi authority, however the comments they provided to the applicant have been incorporated in my assessment of effects on cultural values and recommended conditions.

The cultural associations of Ngāti Toa are recognised in a Deed of Settlement as set out in the Ngāti Toa Claims Settlement Act 2014. In this deed, Ngāti Toa have a statutory acknowledgement with respect to the 'Hutt River and its tributaries'. The legislation requires GWRC to have regard to the statutory acknowledgements in forming an opinion on affected party status. Ngāti Toa were directly notified of the application. No submission was received from the iwi authority. The effects of the proposal on the Pinehaven Stream (being a tributary of the Hutt River) have been considered throughout this report.

13. Part 2 of the Act

Consideration of an application under section 104 of the Act is subject to Part 2. 'Subject to' gives primacy to Part 2 and is an overriding guide when applying the provisions of the Act.

Part 2 of the Act sets out the purpose of the Act, which is to promote the sustainable management of natural and physical resources, and in sections 6, 7 and 8 sets out matters that consent authorities should consider when exercising their functions under the Act.

13.1 Section 5 – Purpose and Principles

Section 5 defines 'sustainable management' as:

'managing the use, development, and protection of natural and physical resources in a way, or at a rate, which enable people and communities to provide for their social, economic, and cultural wellbeing and for their health and safety while-

(a) sustaining the potential of natural and physical resources (excluding minerals) to meet the reasonably foreseeable needs of future generations; and

(b) safeguarding the life-supporting capacity of air, water, soil and ecosystems; and

(c) avoiding, remedying, or mitigating any adverse effects of activities on the environment.'

13.2 Section 6 – Matters of National Importance

In exercising its powers and functions under the Act, GWRC is required to recognise and provide for the matters of national importance listed in section 6 of the Act. I have identified the following matters to be of relevance to this application and have addressed the effects of the proposal on that basis.

6(a) – *the preservation of the natural character of … rivers and their margins, and the protection of them from inappropriate subdivision, use and development:*

The section of the Pinehaven Stream subject to the proposed works has a varying degree of natural character. There are some sections where natural components are evident, and in other sections the stream has been highly modified with retaining walls and concrete blocks.

I consider that the proposed works will preserve and in some areas enhance the natural character of the Pinehaven Stream, and do not consider that the proposed works are an inappropriate use of the stream.

6(d) – *the maintenance and enhancement of public access to and along … rivers:*

Much of the Pinehaven Stream that is subject to the proposed works is located on private property, where it is not appropriate to maintain or enhance public access.

The applicant has proposed redevelopment works in Willow Park, which involves planting what is currently grass with riparian species. Public access to this location will be closed while works on this stage are being completed, however this is will be short-term. The proposed changes intend to enhance the public's engagement with the natural values of the Pinehaven Stream at Willow Park.

6(e) – *the relationship of Māori and their culture and traditions with their ancestral lands, water, sites, wāhi tapu and other taonga:*

The Pinehaven Stream has significance to Māori as a waterway, but is not known to be an area of historic or current cultural significance. The applicant has consulted directly with PNBST and has proposed a Kaitiaki Monitoring Strategy (PKMS) to provide for the role of kaitiaki and mitigate effects on cultural values of PNBST. Ngāti Toa were directly notified of this consent application.

6(h) – *the management of significant risks from natural hazards*

The proposed works give effect to the structural component of the Pinehaven Floodplain Management Plan (excluding the Sunbrae Drive and Pinehaven Road culvert replacements which have been consented separately under WGN200101), which was developed to address the significant risks from flood hazards in the Pinehaven catchment.

13.3 Section 7 – Other Matters

The other matters to which GWRC must have particular regard in relation to managing the use, development, and protection of natural and physical resources are listed in section 7 of the Act. Section 10 of this report (assessment of actual and potential effects) specifically addresses the relationship of the proposed Pinehaven Stream Improvement works to a number of these matters, namely:

(a) *– kaitiakitanga and* ***(aa)*** *the ethic of stewardship*

The proposal involves a Kaitiaki Monitoring Strategy, to be undertaken by PNBST.

(b) – *the efficient use and development of natural and physical resources*

The proposal makes efficient use of the available space in the constrained Pinehaven Stream and surrounding land to minimise the flood risks to the Pinehaven catchment.

(d) – *the intrinsic values of ecosystems*

I have had particular regard to the intrinsic values of ecosystems throughout my assessment, particularly in relation to water quality and effects on aquatic and riparian ecology (see Sections 10.3, 10.4 and 10.5 above).

(f) – *maintenance and enhancement of the quality of the environment*

The proposal will reduce the risk of flooding from the Pinehaven Stream on the surrounding area, which constitutes an enhancement to the environment (which includes people and communities). The works also involve extensive riparian planting and aquatic habitat and fish passage improvements to the Pinehaven Stream.

(h) – *the protection of the habitat of trout and salmon*

The proposed mitigation measures, particularly around water quality, will ensure the effects of the works will not extend to those water bodies identified as trout habitat (Hulls Creek and the Hutt River).

(i) – *the effects of climate change*

The design will appropriately allow for the potential effects of climate change on rainfall depths (20% increase) through to the year 2120, in accordance with the MfE 2018 guidance.

I do not consider that the other matters listed in section 7 are of relevance to this application.

13.4 Section 8 – Principles of the Treaty of Waitangi

Section 8 of the Act requires GWRC to take into account the principles of the Treaty of Waitangi (Te Tiriti o Waitangi) when considering applications for resource consent. The Waitangi Tribunal and Courts continue to establish the principles of the Treaty of Waitangi and it is recognised that the principles are continuing to evolve. The two key principles that are of relevance to this application are active protection of Māori interests and consultation.

The principle of active protection has been described as a 'guarantee to Māori to continue a relationship with resources that was as much about their use as about their conservation' *NZ Cooperative Dairy Company Limited v Commerce Commission* (1991). In the context of this application, active protection must be taken into account when considering the tangata whenua relationship with their ancestral land, water, wāhi tapu and other taonga.

The general requirements of 'consultation' have been well established by the judiciary and Courts both within and outside the Act. Consultation should facilitate tangata whenua understanding of the effects of a proposal on their relationship with the area in question to a point where the applicant can consider how those effects might be avoided, remedied or mitigated. GWRC requires this kind of information to be able to assess how the Council can meet its statutory responsibilities.

The applicant has consulted directly with PNBST and has proposed a Kaitiaki Monitoring Strategy (PKMS) to provide for the role of kaitiaki and mitigate effects on cultural values of PNBST. The applicant did not consult with directly with Ngāti Toa. Ngāti Toa was directly notified of the public notification of the application, and no submission was received.

13.5 Summary of Part 2 assessment

My overall conclusion in respect of Part 2 matters is that the proposal will promote the sustainable management of natural and physical resources. The Pinehaven Stream Improvement works will reduce the risk of flooding to the Pinehaven community, which will enable people and communities to provide for their social and economic wellbeing and for their health and safety. Although there are some adverse effects on the environment, provided that the recommended conditions of consent are adhered to, I consider that the adverse effects will be avoided, remedied or mitigated to an acceptable level.

14. Recommendation

Overall, in making my recommendation on this application I have considered the actual and potential effects on the environment arising as a result of the proposal, the concerns raised by submitters and the mitigation measures proposed by the applicant. I have also considered Part 2 of the Act, sections 104, 105, 107 and 108 of the Act, the NPSFM and the relevant objectives and policies of the RPS, RFP and PNRP.

I recommend, pursuant to sections 104B, 105, 107 and 108 of the Act, that the following resource consents be **granted** subject to the conditions in Appendix 2 of this report:

- [36459] Land use consent to undertake works in the bed of the Pinehaven Stream involving the placement, replacement and removal of structures; and the construction of naturalised channel banks, in relation to the Pinehaven Stream Improvement flood mitigation works, including associated disturbance and deposition to the streambed.

- [36460] Land use consent to undertake soil disturbance activities within 5m of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works.

- [36461] Water permit to undertake the temporary damming and diversion at 12 locations of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works.

- [36825] Discharge permit to temporarily discharge sediment-laden water associated with the construction of the Pinehaven Stream Improvement works to the Pinehaven Stream; and to temporarily discharge sediment-laden runoff from earthworks within 5m of the Pinehaven Stream to land where it may enter water (Pinehaven Stream).

- [36829] Land use consent to reclaim a 78m stretch of the Pinehaven Stream at 26 and 28 Blue Mountains Road.

- [36830] Water permit for the permanent realignment and diversion of the Pinehaven Stream at 26 and 28 Blue Mountains Road; and to construct a flood diversion wall at Willow Park outside of the bed of the Pinehaven Stream which permanently divert flood waters of the Pinehaven Stream.

15. Duration of consents

The applicant requested a condition requiring that the consents expire five years from the date of commencement of construction, and that the consents lapse within five years if they have not been given effect to.

Section 116 of the RMA states that, except as provided in the specified subsections, '*every resource consent that has been granted commences:*

> *(a) when the time for lodging appeals against the grant of the consent expires and no appeals have been lodged; or*
>
> *(b) when the Environment Court determines the appeals or all appellants withdraw their appeals—*
>
> *unless the resource consent states a later date or a determination of the Environment Court states otherwise.'*

I am comfortable recommending the resource consents commence on the day that the first Site-specific Environmental Management Plan is certified (i.e. after certification of the CEMP and ESCP).

I recommend the following consent durations, to commence on the day of the first Site-specific Environmental Management Plan being approved under this consent, for the reasons below:

- Section 123(c) of the Act allows for a land use consent to do something that would otherwise contravene section 13 to be granted for a period not exceeding 35 years. I consider that a duration of 35 years is appropriate for the consent related to permanent stream structures (WGN200083 [36459]), as the structures are permanent. This duration is consistent with other consents for streamworks structures granted by GWRC.

- In relation to the construction-related consents (WGN200083 [36460] – earthworks, WGN200083 [36461] – diversion and WGN200083 [36825] – discharges), under section 123(d), the maximum duration the consents could be granted for is up to 35 years. In line with the applicants requested duration, I consider a duration of 5 years is appropriate for the construction-related permits. This duration will allow sufficient time for the works to be completed, with contingency in the event that they are delayed.

- Section 123(a) of the Act allows for a land use consent in respect of reclamation to be granted in perpetuity, unless otherwise specified in the consent. I consider granting the consent for the reclamation of the bed of the Pinehaven Stream (WGN200083 [36829]) in perpetuity to be appropriate, as the reclamation is permanent.

- Section 123(d) of the Act allows for a maximum period of 35 years for water permit WGN200083 [36830] to permanently realign and divert the stream associated with the reclamation above; and to permanently divert the floodwaters of the stream. I consider a duration of 35 years is

appropriate for this permit, as the diversion is permanent. The Act does not allow a water permit to be granted in perpetuity.

In line with section 125 of the Act and the request of the applicant, I recommend a lapse date of five years from the date of granting of this resource consent. I consider that is an appropriate lapse period as it allows sufficient time for the works to commence, with contingency in the event that they are delayed. Consents will be considered to have been given effect to once the first Site-specific Environmental Management Plan has been certified.

I have opted not to recommend the consent durations and lapse date in the conditions, as requested by the applicant, as I do not think that it is necessary to further replicate as it will be stated on the front of the consent certificate, and they could not be subject to a change of conditions under section 127.

16. Overview of recommended consent conditions

I have summarised below how I anticipate compliance with the consent conditions that I have recommended be undertaken. Please note, this section provides just an overview, and the consent holder must comply with all conditions of consent.

It is required that the location, design, implementation and operation of the works is in accordance with the consent application. If there are changes, then a new resource consent relating to those changes, or a change of conditions to this consent, would be required. In the event that any artefacts are discovered, they shall follow the procedures outlined in the condition (which is a standard GWRC condition to which all parties have agreed)

The consent holder shall keep a register of complaints and incidents, and notify GWRC as required by those conditions. They shall keep all consent documents on site and provide copies to each operator and contractor.

Overall, it is important to note that no works shall commence until the relevant plans have been certified by GWRC. Whilst the conditions state that the management plans need to be provided, for example, 20 working days prior to commencing works, if the management plans are not able to be certified in this timeframe then works shall not commence. The speed in which management plans can be certified depends on their quality and consistency with the documents provided in the application.

All works shall be undertaken in accordance with the certified management plans. In the event that the consent holder wishes to make changes, they shall go through the amendment process that is outlined (changes must be confirmed in writing and to the satisfaction of the Manager).

Prior to commencing works, the consent holder is required to:

- Submit a Construction Management Plan and Erosion and Sediment Control Plan for certification (at least 20 working days prior to works commencing);

- Submit the Pinehaven Kaitiaki Monitoring Strategy, prepared in consultation with iwi representatives, for certification (at least 20 working days prior to works commencing);

- Submit the Detailed Hydraulic Design Memorandum (at least 20 working days prior to works commencing);

- Submit a Fish Relocation and Recovery Programme for certification (at least 20 workings days prior to works commencing).

- Submit the relevant Site-specific Environmental Management Plan for certification (at least 20 working days prior to works commencing on that stage);

- Hold a pre-construction site meeting (with notice for this meeting issued to GWRC at least 10 days prior to the meeting) and give notice of the works commencing (at least two working days prior to works commencing);

- If deemed to be required (e.g. due to inability to meet water quality triggers) and the consent holder opts to chemically treat the water using flocculant, the Flocculation Management Plan shall be submitted for certification (at least 10 working days prior to the use of flocculant); and

- Provide a certificate from a suitably qualified engineer stating that the erosion and sediment controls have been constructed in accordance with the relevant certified management plans (required for each stage of works)

During works, the consent holder is required to:

- Prior to reclamation of the stream at 26 and 28 Blue Mountains Road, submit a Reclamation Design Report for certification (at least 20 working days prior to the reclamation works commencing);

- Prior to riparian planting commencing, submit a Riparian Planting Plan for certification (at least 20 working days prior to riparian planting commencing);

- Undertake all monitoring, management and reporting (e.g. water quality, erosion and sediment controls, use of flocculant) in accordance with the certified management plans. In the event that trigger levels are exceeded, they will undertake the required adaptive management actions;

- Undertake weekly audits of the erosion and sediment controls, and provide those results to GWRC;

- Progressively stabilise disturbed areas, with each stage of works being stabilised on completion;

- For works during the winter period, the consent holder shall submit a request for each stage of works proposed during this period. This could be undertaken as an addendum to the relevant SEMP;

- Complete fish relocation and recovery prior to commencing works on each stage;

- Survey and re-instate all pool habitat, survey and remediate compaction, and monitor and respond appropriately to sedimentation (through adaptive management changes to methodologies);

- Ensure appropriate fish passage at all debris arrestors, and the retained and reinstated grade control weirs; and

- Manage the effects on dust in accordance with the Construction Management Plan.

After completion of works, the consent holder is required to:

- Submit the Fish Passage Remediation Plan for certification (within 20 working days of commencing the remediation of this structure), outlining how the fish passage barrier at the confluence of Pinehaven Stream and Hulls Creek will be remediated, and complete those works within six months of completing the final stage of works;

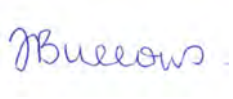
- Submit a Post-construction Freshwater and Riparian Ecological Monitoring Plan for certification (within 20 working days of completion of the final stage of works) and complete monitoring in accordance with this plan;

- Submit a Post-construction Monitoring Report within 14 months of the completion of the final stage of construction works;

- If monitoring targets in the Post-construction Freshwater and Riparian Ecological Monitoring Plan are not met, the submission of an Ecology Action Plan to the satisfaction of the Manager; and

- Ongoing maintenance of the structures to ensure any erosion, scour or instability is remedied, any adverse effects on fish passage is remedied, and the works remain structurally sound.

Report prepared by:



Josie Burrows
Resource Advisor, Environmental Regulation
Regulation

Recommendation approved by:

Kirsty van Reenen
Team Leader, Environmental

Appendix 1 – Legal Descriptions

Road reserve – Blue Mountains Road, Deller Grove, Blue Mountains Road, Pinehaven Road, Birch Grove

Pinehaven Reserve – Lot 30 DP 15346

River corridor – Lot 8 DP 32985, Lot 1 DP 45182

Willow Park – Lot 42 DP 43710

13 Clinker Grove – Lot 4 DP 44269

14 Clinker Grove – Lot 3 DP 44269

15 Clinker Grove – Lot 2 DP 44269

48 - 50 Whitemans Road – Pt Lot 1 DP 17067, Pt Lot 1 DP 11499

54 Whitemans Road – Lot 1 DP 24812

4 Blue Mountains Road – Lot 1, 2 & 3 DP 26272

8 Blue Mountains Road – Lot 2 DP 5336

10A Blue Mountains Road – Lot 1 DP 40536

1 Tapestry Grove – Lot 43 DP 43710

4 Sunbrae Drive – Lot 1 DP 29885

5 Sunbrae Drive – Lot 6 DP 27402

14 Blue Mountains Road – Lot 2 DP 29885, Lot 3 DP 27402

5 Deller Grove – Lot 8 DP 27402

7 Deller Grove – Lot 9 DP 27402

13 Deller Grove – Lot 12 DP 27402 and Lot 1 DP 32931

15 Deller Grove – Lot 2 DP 32931

17 Deller Grove – Lot 14 DP 27402

20A Blue Mountains Road – Lot 6 DP 32985

22 Blue Mountains Road – Lot 7 DP 32985

24 Blue Mountains Road – Lot 19 DP 16738

26 Blue Mountains Road – Lot 18 DP 16738

28 Blue Mountains Road – Lot 17 DP 16738

30 Blue Mountains Road – Lot 16 DP 16738

32 Blue Mountains Road – Lot 15 DP 16738

34 Blue Mountains Road – Lot 14 DP 16738

36 Blue Mountains Road – Lot 13 DP 16738

38 Blue Mountains Road – Lot 1 DP 33010

48 Blue Mountains Road – Lot 2 DP 45182

50 Blue Mountains Road – Lot 3 DP 45182

1 Pinehaven Road – Lot 1 DP 15346

3 Pinehaven Road – Lot 2 DP 15346

7 Pinehaven Road – Lot 4 DP 15346

9 Pinehaven Road – Lot 5 DP 15346

8 Birch Grove – Lot 1 DP 43185

9 Birch Grove – Lot 20 DP 15346

10 Birch Grove – Lot 1 DP 27100

10A Birch Grove – Lot 2 DP 422324

10B Birch Grove – Lot 1 DP 33755

10C Birch Grove – Lot 1 DP 422324, Lot 3 DP 422324

11 Birch Grove – Lot 21 DP 15346

12 Birch Grove – Lot 22 DP 15346

2A Freemans Way – Lot 1 DP 32105, Lot 3 DP 31536

Appendix 2 – Recommended conditions of consent for WGN200083

[36459] Land use consent to undertake works in the bed of the Pinehaven Stream involving the placement, replacement and removal of structures; and the construction of naturalised channel banks, in relation to the Pinehaven Stream Improvement flood mitigation works, including associated disturbance and deposition to the streambed.

[36460] Land use consent to undertake soil disturbance activities within 5m of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works.

[36461] Water permit to undertake the temporary damming and diversion at 12 locations of the Pinehaven Stream, associated with the construction of the Pinehaven Stream Improvement works.

[36825] Discharge permit to temporarily discharge sediment-laden water associated with the construction of the Pinehaven Stream Improvement works to the Pinehaven Stream; and to temporarily discharge sediment-laden runoff from earthworks within 5m of the Pinehaven Stream to land where it may enter water (Pinehaven Stream).

[36829] Land use consent to reclaim a 78m stretch of the Pinehaven Stream at 26 and 28 Blue Mountains Road.

[36830] Water permit for the permanent realignment and diversion of the Pinehaven Stream at 26 and 28 Blue Mountains Road; and to construct a flood diversion wall at Willow Park outside of the bed of the Pinehaven Stream which permanently divert flood waters of the Pinehaven Stream.

Note relating to specific condition durations:

The following consent conditions relate to resource consent IDs [36459] [36830] and [36829] and therefore have a duration of 35 years/perpetuity, depending on the consent that they relate to (stream structures – 35 years; reclamation – perpetuity):

- *Condition 1 (consistency with application and documents),*
- *Condition 8 (review condition),*
- *Condition 58 (maintenance of fish passage),*
- *Condition 59 (maintenance of any debris arrestor),*
- *Conditions 64 - 69 (riparian planting requirements),*
- *Conditions 70 - 74 (post-construction ecological monitoring),*
- *Conditions 75 – 76 (maintenance of works).*

All conditions that are not identified above have a consent duration of five years from the certification of the first Site-specific Environmental Management Plan.

Interpretation

Wherever used in the conditions below, the following terms shall have the prescribed meaning:

Canopy cover means the percentage of ground area covered by planted native vegetation as viewed from vertically above the planted area. It includes all plant tiers (that is, it may be a mix of low growing species plus tree and shrub species).

Compliance Officer means any Enforcement, Compliance or Duty Officer, Environmental Regulation, Greater Wellington Regional Council.

Notification or notice means email of notification to notifications@gw.govt.nz. Please include the consent reference number (WGN200083) and the name and phone number of a contact person responsible for the proposed works.

Stabilised means inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of basecourse, colluvium, hydroseeding, grassing, mulch, or another method to the reasonable satisfaction of the Manager and as specified in Wellington Regional Council's *Erosion and Sediment Control Guidelines for the Wellington Region*, September 2002. Where seeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once, on reasonable visual inspection by the Manager an 80% vegetative cover has been established.

The Manager means the Manager, Environmental Regulation, Greater Wellington Regional Council.

General conditions

1. The location, design, implementation and operation of the activity/structure shall be in general accordance with the consent application and its associated plans and documents lodged with the Greater Wellington Regional Council on:

    a) 19 September 2019 (application documents);

    b) 27 November 2019 (Flood Hazard Assessment addendum);

    c) 21 February 2020 (section 92 response to GWRC relating to questions raised during technical reviews, including updated General Arrangement Plans IZ089000-SP3-400-CD-DRG-3100 through to -3106 rev B (since superseded), and Erosion and Sediment Control Plan revision 5);

    d) 26 February 2020 (section 92 response to GWRC relating to questions raised by submissions);

    e) 25 March 2020 (letter to GWRC responding to request for clarification on proposed works and changes to original application);

    f) 23 April 2020 (letter to GWRC with revised Table 2 outlining changes to the proposal since the original application and consent notification);

    g) 11 June 2020 (updated General Arrangement Plans IZ089000-SP3-400-CD-DRG-3100 through to -3106 rev C);

    h) 15 June 2020 (updated Flood Hazard Assessment report)

    Where there may be contradiction or inconsistencies between the application and further information provided by the applicant, the most recent information applies. In addition, where there may be inconsistencies between information provided by the applicant and conditions of the consent, the conditions apply.

    Note: Any change from the location, design concepts and parameters, implementation and/or operation may require a new resource consent or a change of consent conditions pursuant to section 127 of the Resource Management Act 1991.

2. The consent holder shall give the Manager a minimum of **two working days** (48 hours) notice prior to the works commencing on each stage of works.

    Note: The works have been separated into 12 stages, as set out in ESCP revision 5 provided with the section 92 response dated 21 February 2020.

3. The consent holder shall provide a copy of this consent and any documents and plans referred to in this consent to each operator or contractor undertaking the works authorised by this consent, prior to the works commencing.

Note: It is recommended that the contractors be verbally briefed on the requirements of the conditions of this consent, and made aware of the location of the consent documents on site, prior to works commencing.

4. The consent holder shall ensure that a copy of this consent and all documents and plans referred to in this consent, are kept on site at all times during construction works and presented to any Compliance Officer on request.

Complaints and incidents

5. The consent holder shall maintain a written record of any complaints received alleging adverse effects that have or could have resulted in a condition or conditions of this consent being contravened for the duration of works authorised by this consent. This record shall include:

    a) The name and address of the complainant;

    b) The date and time that the complaint was received;

    c) Details of the alleged event;

    d) Weather conditions at the time of the complaint; and

    e) Any measures taken to mitigate the complaint.

    The consent holder shall give notice and the written record to the Manager within **one working day** of receiving the complaint.

6. The consent holder shall notify the Manager **immediately** if any contaminants (including sediment) or material are released during works and enter the Pinehaven Stream due to any of the following:

    a) Discharges from non-stabilised areas that are not treated by erosion and sediment control measures required under this consent;

    b) Failure of any erosion and sediment control measures; or

    c) Any other incident (e.g. spills or leaks) which either directly or indirectly causes, or is likely to cause, adverse ecological effects in the Pinehaven Stream.

    If any of these incidents listed under (a) to (c) above occur, the consent holder shall:

    d) Re-establish erosion and sediment control measures as soon as practicable;

    e) Liaise with the Manager to establish what remediation or rehabilitation is required;

f) Carry out any remedial and/or mitigation action as required by, and to the satisfaction of, the Manager;

g) Maintain a permanent record of incidents at the site (including date and time of the incident; the nature, manner and cause of the contaminants; weather conditions at the time of the incident; and the steps taken to contain any further release of contaminants and to remedy any adverse effects on the watercourse); and

h) Provide a written report to the Manager covering the above matters (d)-(g) within **five working days** of the incident, or another timeframe agreed to in writing by the Manager.

Note 1: This notification shall be emailed to notifications@gw.govt.nz, and phoned into the GWRC Environmental Hotline on 0800 496 734.

Note 2: The Greater Wellington Regional Council may investigate any incidents or breaches associated with this consent or the Resource Management Act 1991, and may also undertake enforcement action depending on the circumstances.

Discovery of artefacts

7. If kōiwi, taonga, wāhi tapu or other archaeological material is discovered in any area during the works, work shall immediately cease and the consent holder shall notify Greater Wellington Regional Council, Port Nicholson Block Settlement Trust, Te Rūnanga o Toa Rangatira Inc and Heritage New Zealand as soon as possible, but within **twenty-four hours**. If human remains are found, the New Zealand Police shall also be contacted **immediately**.

The consent holder shall allow the above parties to inspect the site and in consultation with them, identify what needs to occur before work can resume.

Notification must be emailed to;

a) Greater Wellington Regional Council, notifications@gw.govt.nz;

b) Heritage New Zealand, information@heritage.org.nz;

c) Port Nicholson Block Settlement Trust, taiao@portnicholson.org.nz; and

d) Te Rūnanga o Toa Rangatira Inc, resourcemanagement@ngatitoa.iwi.nz.

Heritage New Zealand must also be contacted by phone on 04 472 4341 (National Office).

No works may resume on site until the consent holder has received written notification that consultation with the parties identified above has been undertaken to the satisfaction of the Manager.

Note: Evidence of archaeological material may include burnt stones, charcoal, rubbish heaps, shell, bone, old building foundations, artefacts and human burials.

Review condition

8. Greater Wellington Regional Council may review any or all conditions of this consent by giving notice of its intention to do so pursuant to section 128 of the Resource Management Act 1991, within one month of each anniversary of the commencement of this consent, for any of the following reasons:

    a) To review the adequacy of any plan and/or monitoring requirements, and if necessary, amend these requirements outlined in this consent;

    b) To deal with any adverse effects on the environment that may arise from the exercise of this consent; and which are appropriate to deal with at a later stage;

    c) To require the implementation of Best Practicable Options, in respect to new methodologies for the undertaking of the works to avoid, remedy or mitigate any significant adverse effect on the environment arising from the works; or

    d) To enable consistency with any relevant Regional Plans or any National Environmental Standards or Regulations.

    The review of conditions shall allow for the deletion or amendment of conditions of this consent; and the addition of such new conditions as are shown to be necessary to avoid, remedy or mitigate any significant adverse effects on the environment.

    Note: For the purposes of this condition the "exercise of the consent" is deemed to be once the works authorised by this consent have commenced.

Notes:

A. A resource management charge, set in accordance with section 36(2) of the Resource Management Act 1991 shall be paid to the Greater Wellington Regional Council for the carrying out of its functions in relation to the administration, monitoring, and supervision of resource consents and for the carrying out of its functions under section 35 (duty to gather information, monitor, and keep records) of the Act.

B. The Greater Wellington Regional Council shall be entitled to recover from the consent holder the costs of any review, calculated in accordance with and limited to GWRC's scale of charges in force and applicable at that time pursuant to section 36 of the Resource Management Act 1991.

C. Please note that the granting of this resource consent does not provide you with the right to access private properties. Landowner entry requirements need to be gained and be in place before you may exercise this consent.

Pre-works conditions

Pre-construction site meeting

9. The consent holder shall arrange and conduct a pre-construction site meeting prior to any work authorised by this consent commencing on site and invite, with a minimum of **ten working days**' notice, the Greater Wellington Regional Council and the contractor undertaking the works.

   The consent holder shall provide minutes of the meeting to GWRC within five working days of the pre-construction meeting being held.

   Note: In the case that Greater Wellington Regional Council does not attend this meeting, the consent holder will have complied with this condition, provided the invitation requirement is met.

Detailed Hydraulic Design Memorandum

10. The consent holder shall submit a final **Detailed Hydraulic Design Memorandum (DHDM)** to the Manager, at least **20 working days** prior to works commencing. The purpose of the DHDM is to confirm compliance and consistency with the information provided in the application.

    The DHDM shall be prepared by a suitably qualified and experienced hydrologist or hydraulic modelling specialist, and shall confirm that the 25-year and 100-year return period flood event level project objectives are achieved in the final design.

    The consent holder shall not commence works until the DHDM has been confirmed in writing by the Manager as complying with this condition, in writing.

Pinehaven Kaitiaki Monitoring Strategy

11. The consent holder shall engage a suitably qualified and experienced person to prepare, in consultation with appropriate iwi representatives of Port Nicholson Block Settlement Trust, a **Pinehaven Kaitiaki Monitoring Strategy (PKMS).** The PKMS shall be submitted to the Manager for certification at least **20 working days** prior to the works commencing.

    The purpose of the PKMS is to ensure the potential effects of construction to the mana and mauri of the Pinehaven Stream are appropriately managed and mitigated. The PKMS shall include, but not be limited to:

    a) Identification of tohu (attributes) of the Pinehaven Stream;

    b) Identification of mahinga kai and Māori customary use of the Pinehaven Stream;

c) Methods to monitor effects on tohu, mahinga kai and Māori customary use; and

d) Management and mitigation of effects on tohu, mahinga kai and Māori customary use.

Where applicable, findings from the PKMS shall be incorporated into the relevant construction-related management plans.

Fish Relocation and Recovery Programme

12. The consent holder shall engage a suitably qualified ecologist to prepare a **Fish Relocation and Recovery Programme (FRRP)** for native and sports fish located within the works area. The FRRP shall be submitted to the Manager for certification at least **20 working days** prior to construction works commencing.

The FRRP shall apply to both native and sports fish, and shall include but not be limited to:

a) Where sufficient water is present, use of gee-minnow traps and fyke nets at appropriate distances overnight;

b) Several electric fishing runs of the watercourse each day using the electric fishing machine (EFM400);

c) Capture and relocation of any remaining fish during stream 'dewatering' processes;

d) Checking of any sediment removed from the stream for fish;

e) Relocation of all native and sports fish on the same day to a suitable similar habitat immediately downstream of the works area and within the same catchment;

f) Fish transfer in closed, cool containers;

g) Humane euthanizing and disposal of any exotic non-sports fish.

Note: It is the responsibility of the consent holder to ensure they hold all relevant permits relating to undertaking fish rescue and temporary blocking fish passage.

Certification of management plans

Certification of construction-related management plans

13. The consent holder shall not commence works until the relevant management plans have been certified by the Manager. For all works, that shall include certification of:

a) **Construction Management Plan (CMP)** as required by condition 16 of this consent – for the full project;

b) **Erosion and Sediment Control Plan (ESCP)** as required by condition 18 of this consent – for the full project;

And prior to commencing each stage of the works, in addition to the management plans listed under (a) and (b) above, the:

c) Relevant **Site-specific Environmental Management Plan (SEMP)** as required by condition 21 of this consent; and

The consent holder shall involve Port Nicholson Block Settlement Trust in the development of all relevant management plans.

These management plans shall be in general accordance with any draft management plan included as part of the application or further information provided.

The consent holder shall provide the certified CMP and ESCP to Upper Hutt City Council for their information.

Note 1: The SEMPs are required to be certified prior to works commencing on each stage, they are not all required to be certified at the start of works commencing under this consent.

Note 2: In the case that Port Nicholson Block Settlement Trust does not take up the offer to be involved in the development of plans the consent holder will have complied with this condition, if sufficient time and opportunity is provided to be conducive to PNBST's involvement.

14. All construction works authorised under this consent shall be carried out in accordance with the certified management plans.

Amendments to Management Plans

15. Any amendments proposed to the certified management plans shall be confirmed in writing by the consent holder and be to the satisfaction of the Manager prior to the implementation of any amendments proposed.

Note: Depending on the scale of amendment proposed, this could be done as an addendum rather than complete update to the management plan.

Construction Management Plan

16. The consent holder shall prepare, in consultation with the contractor undertaking the works, a **Construction Management Plan (CMP)**. The CMP shall be submitted to the Manager for certification at least **20 working days** prior to the works commencing.

The CMP shall set out the management procedures and construction methods to avoid, remedy or mitigate potential adverse effects arising from the construction activities, and shall include (but not be limited to):

a) Roles, responsibilities and contact details for construction management staff, including the manager responsible for erosion and sediment control;

b) The name of the consent holder's representative on the project;

c) General site layout;

d) An outline of the Project's construction programme;

e) Methods for ensuring that the works take into account anticipated ground conditions and contingency plans for unanticipated ground conditions;

f) Methods for ensuring the works are designed and undertaken in a manner that ensures the safety of the public and stability of surrounding land, buildings and structures;

g) Vehicle/machinery maintenance and cleaning procedures, particularly for machinery entering the stream channel;

h) Measures for addressing spills (including fuels, oils, grease, hydraulic fluids and cement products) and location of spill kits;

i) An outline of how monitoring and reporting on all relevant conditions will be undertaken;

j) Procedures and timing for review and/or amendment to the CMP;

k) Details for responding to the discovery of unrecorded archaeological sites in accordance with condition 7 of this consent; and

l) Methods for managing dust in accordance with condition 77 and 78 of this consent.

17. Where minor enabling works or isolated works are to be undertaken prior to commencement of the main construction works, at the discretion of the Manager, the consent holder may submit a **Site-specific Construction Management Plan** commensurate with the scale and effects of the proposed works at least **15 working days** prior to commencing works to the Manager for certification.

Erosion and Sediment Control Plan

18. The consent holder shall prepare, in consultation with the contractor undertaking the works, a final **Erosion and Sediment Control Plan (ESCP)**. The ESCP

shall be submitted to the Manager for certification at least **20 working days** prior to the works commencing.

The final ESCP shall, as a minimum, be prepared in general accordance with ESCP revision 5 (submitted with the section 92 response to GWRC on 21 February 2020) and the current *Erosion and Sediment Control Guidelines for the Wellington Region*. It shall include, but not be limited to:

a) A description of the works proposed and anticipated timetable;

b) Details of all principles, procedures and practices that will be implemented to undertake erosion and sediment control and minimise the potential for sediment discharges from the site (including the temporary piped diversion and stream livening protocol);

c) The design criteria and dimensions of all erosion and sediment control measures;

d) Plan(s) of an appropriate scale clearly identifying:

    i) The locations of waterways and stormwater inlets;

    ii) Staging sequence of erosion and sediment control measures;

    iii) Areas and cross sections of all streamworks, cut and fill;

    iv) The extent of soil disturbance and vegetation removal;

    v) Any ‘no go’ and/or buffer areas to be maintained undisturbed;

    vi) Locations of topsoil stockpiles;

    vii) All key erosion and sediment control measures;

    viii) The boundaries and area of catchments contributing to all stormwater impoundment structures;

    ix) The locations of all specific points of discharge to the environment; and

    x) Any other relevant site information.

e) Timetable and nature of progressive site rehabilitation and re-vegetation;

f) Details of the adaptive management approach to addressing sediment discharges, including trigger levels for the installation and removal of the temporary piped diversion in accordance with condition 28 of this consent;

g) Maintenance procedures and frequency for erosion and sediment controls;

h) Details for determining the downstream zone of reasonable mixing where 50m downstream of a stage of works is not practicable;

i) Details of erosion and sediment control and water quality monitoring procedures and frequency, as required by condition 19 and in accordance with condition 20 of this consent, including the relationship between turbidity (NTU) and suspended sediment concentrations (SSC);

j) Reporting procedures and frequency, including trigger exceedance reporting (time of trigger; time samples were collected; pH, SSC and turbidity results; cause of exceedance; remedial actions undertaken)

k) Rainfall triggers, response and contingency measures, including procedures to minimise adverse effects in the event of heavy rainfall events and/or the failure of any key erosion and sediment control structures;

l) Procedures and timing for review and/or amendment to the ESCP;

m) Decommissioning methodology for all erosion and sediment control measures;

n) Procedures for re-instating erosion and sediment control measures at the end of each working day, where applicable; and

o) Any other relevant matters to ensure compliance with all consent conditions.

19. The erosion and sediment control and water quality monitoring (required by condition 18(i) of this consent) shall include:

a) Pre-construction monitoring;

b) Rainfall monitoring;

c) Routine device monitoring;

d) Trigger device monitoring;

e) Pinehaven Stream baseline water quality monitoring (upstream of works); and

f) Pinehaven Stream receiving environment water quality monitoring at the zone of reasonable mixing locations;

20. The Pinehaven Stream baseline and receiving environment water quality monitoring shall include the following parameters, which shall be developed

with reference to the Australia and New Zealand Marine and Freshwater Quality Guidelines where applicable:

a) Turbidity – NTU;

b) Suspended Sediment Concentrations (SSC) – g/m^3;

c) pH; and

d) Total ammonia – mg/L (when wet cementitious products are being used within the streambed).

Site-specific Environmental Management Plan

21. The consent holder shall prepare, in consultation with the contractor undertaking the works, a **Site-specific Environmental Management Plan (SEMP)** for each stage of the works. The SEMP shall be submitted to the Manager for certification at least **20 working days** prior to the works on that stage commencing.

The SEMPs shall be consistent with the CMP and ESCP certified under conditions 16 and 18 of this consent. They shall include, but not be limited to:

a) Identification of the construction zones and construction support areas;

b) Identification of the proposed works, construction methodology and anticipated timeline of works;

c) Construction drawings and design reporting (including review records) to demonstrate that:

i) the design is appropriate for the stream conditions (e.g. sufficient embedment depth); and

ii) the potential for erosion and scour has been appropriately addressed.

d) Details of the specific erosion and sediment control measures that will be implemented (including location, dimensions and capacity, where appropriate);

e) A plan showing the boundaries of the works and control measures;

f) Details of the stream livening protocol;

g) Methods for ensuring contracting staff are aware of the erosion and sediment controls employed and do not remove them without appropriate approval;

h) Timing and duration of construction and operation of control works (in relation to the staging and sequencing of works);

i) Details relating to the management and stabilisation of exposed areas;

j) Identification of upstream monitoring site and downstream zone of reasonable mixing monitoring sites (GPS coordinates and a map) in accordance with condition 23 of this consent;

k) A description of how the SEMP implements the best practicable option for limiting discharges of sediment to the Pinehaven Stream, and responds to the effectiveness of any measures already carried out pursuant to any previous SEMP's (including further actions in relation to sedimentation exceedances under conditions 55 of this consent);

l) Contain interim sediment monitoring triggers and actions in the event that triggers are exceeded for stream works undertaken in accordance with conditions 28, which are in accordance with the adaptive management principles set out in the certified ESCP;

m) Contain a detailed methodology outlining how water quality monitoring will be undertaken to ensure compliance with conditions 24, 25, 26, 27 and 28 of this consent.

n) Methods for a fish recovery and relocation programme for native and sports fish located within the works area prior to any diversion of water (in accordance with the Fish Relocation and Recovery Programme certified under condition 12 of this consent) and who will be responsible for doing this.

o) Survey details of any pools in the works area that will require reinstatement at the completion of works, required under conditions 50 and 51 of this consent.

p) Details for assessment and remediation of any stream bed compaction, required under conditions 52 and 53 of this consent.

q) Details of bank habitat complexity that will be constructed, including embedded pipes (fish/eel 'hotels'), installation of stable undercuts, and placement of marginal boulders to provide fish cover, required under condition 49 of this consent;

r) Details of the pre-construction fine deposited sediment survey results, required under condition 54; and

s) Any other relevant matters to ensure compliance with all consent conditions.

Flocculation Management Plan

22. If the use of flocculant is required, the consent holder shall prepare, in consultation with a suitably qualified person with experience in flocculant management, a final **Flocculation Management Plan (FMP).** The FMP shall be submitted to the Manager for certification at least **ten working days** prior to the use of flocculant.

Use of flocculant on site shall not commence prior to receiving written confirmation that the FMP is to the satisfaction of the Manager.

The FMP shall include, but not be limited to:

a) Confirmation of the flocculant to be used, the method of flocculation to be used, and any alternatives if that method is found to be ineffective (including timeframes for making the change between methods);

b) Details of how the flocculation dosage will be triggered;

c) Details of optimum dosage rate calculated from the soils in the catchment (including details of the calculation including bench testing results);

d) Details of when flocculant batch dosing may be required;

e) Details of protocols to be followed when implementing batch dosing to ensure that the dose rate or application methodology will not cause any adverse environmental effects;

f) Identification of NTU or SSC trigger levels and procedures to be undertaken if the trigger levels are exceeded;

g) Procedures for the storage of flocculation chemical(s) onsite;

h) A flocculation chemical spill contingency plan;

i) Details of the monitoring programme including frequency of monitoring and reporting of results and testing of the following parameters:

i) pH;

ii) Turbidity (NTU);

iii) Suspended Sediment Concentration (SSC) (g/m^3); and

iv) Dissolved aluminium (g/m^3).

j) Details of the water quality monitoring points for the above parameters;

k) Details of rainfall event based monitoring;

l) Methods and responsibilities for monitoring and maintenance of the system;

m) Identification of a suitably qualified and experienced person and their specific responsibilities for ensuring the operation, monitoring and maintenance of the chemical flocculation system to ensure that it is operating as outlined in the FMP;

n) Responsibilities and contact details of any other parties that are involved in the operation, monitoring and maintenance of the chemical flocculation system, any batch dosing or any other contingencies; and

o) A plan for the decommissioning of flocculated device(s).

Water quality and construction-related monitoring

Zone of reasonable mixing and effects

23. The zone of reasonable mixing shall be 50m downstream of each stage of works. In the event that this is not practicable e.g. if there is a downstream stage of works being undertaken at 50m downstream, or 50m downstream is part of a piped/culverted network, the zone of reasonable mixing shall be confirmed in the relevant SEMP.

24. The discharge shall not give rise to any of the following effects in the Pinehaven Stream after a reasonable mixing zone of 50m downstream of the relevant stage of works (or in the event that this distance is not practicable the distance agreed upon in the relevant SEMP):

a) The production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials (excluding suspended sediment); or

b) Any emission of objectionable odour; or

c) The rendering of fresh water unsuitable for consumption by farm animals; or

d) Any significant adverse effects on aquatic life.

25. The discharge may give rise to the following effect in the Pinehaven Stream on a temporary and intermittent basis, if the discharge is in compliance with conditions 27 (effects of heavy rainfall) or condition 28 (installation/removal of the temporary piped diversion and dam):

e) Any conspicuous change in the colour or visual clarity.

Suspended sediment concentration water quality limits

Note: These conditions allow and manage the effects of sediment discharges in three scenarios - standard construction works (condition 26), heavy rainfall events (condition 27) and the installation/removal of the temporary piped diversion and dam (condition 28). In the event of any exceedances, the response required is outlined in condition 29.

26. The consent holder shall ensure any discharges (except those managed by conditions 27 and 28 of this consent) from each stage of the works directly or indirectly to freshwater, do not result in an increase in suspended solids (measured as SSC) in the Pinehaven Stream at the zone of reasonable mixing of 50g/m³ above the concentration measured at the upstream baseline monitoring site.

    The method for monitoring water quality for the purposes of assessing compliance with this condition shall be in accordance with the method and locations in the certified SEMP for the relevant stage.

    Note: The zone of reasonable mixing for the purpose of this consent is defined in condition 23.

    Note: Recording and reporting of this monitoring will be set out in the ESCP certified under condition 18 of this consent.

27. The consent holder shall ensure that during, and for 24 hours after heavy rainfall conditions, any discharge from each stage of the works directly or indirectly to freshwater, does not result in an increase in suspended solids (measured as SSC) in the Pinehaven Stream at the zone of reasonable mixing of 150g/m³ above the concentration measured at the upstream baseline monitoring site.

    The method for monitoring water quality for the purposes of assessing compliance with this condition shall be in accordance with the method and locations in the certified SEMP for the relevant stage.

    Note: Heavy rainfall conditions are considered to be 20mm in a 24-hour period or a rainfall event with an intensity equal to or greater than 6mm/hour as measured at the GWRC Pinehaven Stream Site at Pinehaven Reservoir and/or the site rain gauge located at the main construction yard.

    Note: The zone of reasonable mixing for the purpose of this consent is defined in condition 23.

    Note: Recording and reporting of this monitoring will be set out in the ESCP certified under condition 18 of this consent

28. The consent holder shall manage discharges from the excavator movements within the stream for the construction and removal of the temporary piped diversion and dams through the following steps:

a) Prior to commencing works in the stream to install the temporary dams, the consent holder shall collect instream turbidity data using a continuous data logger from the upstream monitoring site(s) identified in the ESCP (required by condition 18 of this consent) for at least 2 weeks.

The monitoring data shall, in conjunction with the findings of the culvert construction works under WGN200101, be used to establish a turbidity trigger level to be applied at 50 metres downstream of the temporary dam. This trigger level shall be provided with the SEMP required by condition 21 of this consent;

b) During the construction or removal of the temporary dam works, the consent holder shall collect instream turbidity data at the zone of reasonable mixing for the relevant stage, every hour. Measurements shall be taken using a continuous data logger.

c) In the event that the downstream turbidity value at the zone of reasonable mixing for the relevant stage fails to return to the trigger level or within 20% of the baseline levels where levels are <20NTU, within 24 hours of the temporary piped dam or diversion being installed or removed, the consent holder shall undertake response actions as detailed in condition 29.

Exceedance of suspended sediment concentration water quality limits

29. In the event that a discharge does not comply with the limits set by conditions 26, 27 or 28, the consent holder shall take the following actions:

a) Immediately notify the Manager that the exceedance has occurred;

b) Immediately undertake onsite investigations to determine the cause of the exceedance and what changes can be made to onsite management to prevent re-occurrence;

c) Record details of the onsite investigations and actions taken or to be taken to prevent re-occurrence;

d) Within **five working days** of the exceedance being recorded provide the information required by (c) above to the Manager; and

e) Where appropriate, update the SEMP in relation to adaptive management learnings from the exceedance.

Note 1: A discharge of an unauthorised contaminant is deemed to be non-compliance. The Greater Wellington Regional Council may investigate any incidents or breaches associated with this consent or the Resource Management Act 1991, and may also undertake enforcement action depending on the circumstances.

Note 2: Any amendments to certified management plans shall be done in accordance with condition 15 of this consent.

Flocculation monitoring

30. In the event that flocculation is used, the consent holder shall sample and record the following parameters at the locations and frequency specified in the FMP after a rainfall event of greater than 7mm in 1 hour or 20mm in a 24 hour period as measured at the GWRC Pinehaven Stream site at Pinehaven Reservoir gauge:

    a) pH;

    b) Turbidity (NTU);

    c) Suspended Sediment Concentration (SSC) (g/m^3); and

    d) Dissolved aluminium.

    The consent holder shall submit the results of this monitoring to the Manager within five working days of the date the sampling being undertaken.

31. In the event that any monitoring results required under condition 30 indicates that the pH of any chemically-treated sediment retention device outflow is at or below 5.5 or above 8.5 and/or turbidity NTU values increase above 150, the consent holder shall cease dosing of that device with flocculant and notify the Manager immediately.

    The consent holder shall liaise with the Manager on an appropriate course of action.

Erosion and sediment control

Erosion and sediment control treatment requirements

32. The consent holder shall ensure that all stormwater contaminated with sediment from the site is treated by erosion and sediment control measures as detailed in the ESCP, SEMP and (where required) FMP certified under conditions 18, 21 and 22 of this consent.

33. The consent holder shall ensure that prior to the completion of operations each working day, all necessary erosion and sediment control measures are reinstated as detailed in the ESCP, SEMP and (where required) FMP certified under conditions 18, 21 and 22 of this consent.

34. The consent holder shall remain responsible for all erosion and sediment control measures, and no erosion and sediment control measures shall be removed prior to receiving written confirmation that the relevant phase is stabilised to the satisfaction of the Manager.

35. The consent holder's requirements under the ESCP, SEMP and (where required) FMP certified under conditions 18, 21 and 22 of this consent shall cease when the catchment has been completely stabilised and the sediment retention devices decommissioned or with the written authorisation of the Manager.

Progressive stabilisation

36. The consent holder shall progressively stabilise any disturbed areas as they complete each stage of work to minimise sediment runoff. The progressive stabilisation shall be undertaken in accordance with the SEMP certified under condition 21 of this consent, and be to the satisfaction of the Manager.

37. The maximum area of disturbed earth open at any one time shall not exceed the calculated capacity of the sediment treatment devices.

Fill material

38. The consent holder shall ensure all fill material used on site is:

    a) Restricted to natural material, such as clay, soil and rock and other inert materials as detailed in the definition of cleanfill material in section 2.2 of the Ministry for the Environment publication '*A guide to the Management of Cleanfills, 2002*'; and

    b) Restricted to those materials listed as acceptable in table 4.1 of the Ministry for the Environment publication '*A guide to the Management of Cleanfills, 2002'*

39. The consent holder shall place and compact all fill material so as to avoid erosion and instability. Any erosion of soil (including failure of cut and fill batters) that is attributable to the works shall be contained, remedied and mitigated by the consent holder to the satisfaction of the Manager.

Winter works

40. No works authorised by this consent shall take place during the period of 1 June to 30 September inclusive each year unless approved by the Manager.

41. All open works areas shall be stabilised during the period 1 June to 30 September (inclusive) each year, unless a later date or winter works is approved in writing by the Manager. The stabilised surface is to be maintained to the satisfaction of the Manager.

    Note: Requests for winter works could be undertaken as an addendum to the relevant SEMPs.

Certification and site auditing of erosion and sediment controls

42. Prior to works commencing on each stage, the consent holder shall provide to the satisfaction of the Manager, a certificate signed by an appropriately qualified

and experienced engineer to certify that the erosion and sediment controls have been constructed in accordance with the ESCP, SEMP and (where required) FMP certified under conditions 18, 21 and 22 of this consent, and the current version (at the time of submission of the ESCP) of the '*Erosion and Sediment Control Guidelines for the Wellington Region'* as a minimum standard.

Certification shall include, but not be limited to, the following:

a) As-built plans of the erosion and sediment controls measures; and

b) Any other details that will facilitate assessment of compliance with the authorised ESCP, SEMP and (where required) FMP, and the current '*Erosion and Sediment Control Guidelines for the Wellington Region'*.

43. The consent holder shall ensure that the site is audited by a suitably qualified and experienced person on a minimum of a **weekly basis** to ensure that the erosion and sediment control methods are being maintained in accordance with the ESCP, SEMP and (where required) FMP certified under conditions 18, 21 and 22 of this consent.

The weekly audits shall include, but not be limited to, the following information:

a) Date;

b) Name of auditor;

c) Site condition;

d) Weather conditions;

e) Sediment management (including identification of problem areas that are not being treated by sediment control measures, and any measures put in place to treat these areas);

f) Runoff control (check of diversion channels and check sediment retention devices);

g) Condition of sediment control measures;

h) Maintenance required and the date by which this will be completed;

i) Contractor responsible for the maintenance; and

j) General comments.

The frequency of the audits may be reduced if agreed to in writing by the Manager.

44. The results of the audits as required by condition 43 of this consent shall be provided to the Manager within **five working days** of being undertaken.

Reducing construction-related effects on water quality

45. The consent holder shall ensure that:

    a) All machinery is free of vegetation, seeds or contaminants prior to entering the water body;

    b) No contaminants (including but not limited to oil, petrol, diesel, hydraulic fluid and sediment) are released into water, or to land where it may enter water, from equipment being used for the works;

    c) All contaminant storage or re-fuelling areas are bunded or contained to prevent the discharge of contaminants to water or to land where it may enter water; and

    d) No equipment is cleaned, stored or refuelled within 10 metres of any waterbody or stormwater system.

46. The consent holder shall ensure that prior to entering a water body that all vehicles and equipment are inspected for the presence of invasive or pest aquatic species including *Didymosphenia geminata* (didymo).

    In the event that an invasive or pest aquatic species is discovered upon any vehicle or equipment it shall be cleaned, to the satisfaction of the Manager.

    Note: The machinery shall be cleaned in accordance with the Ministry for Primary Industries cleaning methods which can be found at http://www.mpi.govt.nz/travel-and-recreation/outdoor-activities/check-clean-dry/.

47. The consent holder shall ensure that no dry cement product, unset concrete, concrete wash water or any water contaminated with concrete enters water as a result of the works.

48. The consent holder shall remove all excess material from the bed and banks of the stream and dispose of it in an appropriate manner, to the satisfaction of the Manager.

Managing effects on aquatic and riparian ecology

Habitat complexity

49. The consent holder shall recreate bank habitat complexity through the installation of stable undercuts, use of embedded pipes and placement of marginal boulders to provide fish cover.

    The construction of all bank habitat complexity shall be detailed in the relevant SEMP under condition 21 of this consent and constructed prior to the stream being livened and to the satisfaction of the Manager.

50. The consent holder shall engage a suitably qualified ecologist to survey all pools within the project stage prior to commencing works in that stage. The survey shall include, but not be limited to:

    a) Pool width, length and depth;

    b) Substrate of the base of pool; and

    c) Any other relevant details.

    Note: This information is reported in the SEMP for that stage under condition 21(o).

51. The consent holder shall reinstate pools to their original dimension in a suitable location, determined in consultation with a suitably qualified ecologist. All reinstatement of pools shall be detailed in the relevant SEMP under condition 21 of this consent and constructed to the satisfaction of the Manager.

Compaction

52. The consent holder shall engage a suitably qualified person who shall, in consultation with a suitably qualified ecologist, undertake a compaction survey before, during and after each stage of the construction works.

    The compaction survey shall be undertaken to the satisfaction of the Manager, and comprise a visual qualitative assessment of the stream bed, and compaction shall be measured using the 4-point scale outlined on page 63 of Harding *et al.* (2009).

    The results of the compaction survey shall be provided to the Manager within **five working days** of the works stage being completed.

53. In the event that undue compaction is identified, the consent holder shall remediate the compacted bed to the initial compaction rating, or as agreed with the Manager.

    The consent holder shall engage a suitably qualified ecologist to confirm remediation has been completed to a satisfactory standard.

    Remediation must occur in a dry stream bed before the stream is re-livened, and must not lead to the exceedance of any SSC limits of this consent.

    Note: Undue compaction is defined as an increase in compaction rating of two categories (e.g. from 1 to 3 or 4, or from 2 to 4.

Sedimentation

54. The consent holder shall engage a suitably qualified ecologist to undertake fine deposited sediment monitoring before and after each stage of the construction works.

    The fine deposited sediment monitoring shall be undertaken in accordance with the '*Sediment Assessment Method 2 (SAM-2) – In-stream visual estimate of % sediment cover*' by Clapcott *et al.* (2011).

    Note: The pre-construction sediment survey results shall be reported in the SEMP for that stage under condition 21(r).

55. In the event that the fine deposited sediment cover increases by more than 10% between the monitoring events, the consent holder shall immediately notify the Manager, and commence a review of the erosion and sediment control methods and construction methodology for works within the streambed.

    The review shall assess the adequacy and appropriateness of the existing controls and methodologies, and shall identify whether any further actions should be implemented for future stages of works. Further actions could include, but are not limited to:

    a) Further staging of earthworks;

    b) Stabilisation of key at-risk areas;

    c) Amendment to existing erosion and sediment controls;

    d) Installation of further erosion and sediment controls;

    e) Alternative construction methodologies for works occurring within the streambed; and

    f) Use or alternatives to flocculation.

    The review shall be provided to the satisfaction of the Manager within **five working days** of the fine deposited sediment cover exceedance.

Fish relocation and recovery

56. The consent holder shall engage a suitably qualified ecologist to undertake fish rescue in accordance with the FRRP certified under condition 12.

    Fish rescue shall be undertaken for at least 48 hours prior to the commencement of works on each stage, and again in the event that a fish movement barrier is breached, until the ecologist is satisfied that no fish remain within the works area.

57. The consent holder shall provide a **Fish Relocation and Recovery Report (FRRR)** to the satisfaction of the Manager, for fish rescue undertaken in accordance with conditions 12 and 57 for each stage of the works and within **20 working days** of the completion of each stage of works.

    The FRRR shall include an excel spreadsheet presenting the number, species and size classes of native and exotic fish that were relocated prior to and during the works.

    The consent holder shall also upload this data to the NIWA New Zealand Fish Database: https://niwa.co.nz/information-services/nz-freshwater-fish-database

Fish passage

58. The consent holder shall ensure that fish passage is maintained at all times after construction.

59. The consent holder shall ensure the design, construction and maintenance of any debris arrestor is be done in consultation with an appropriately qualified ecologist.

60. The consent holder shall ensure that the reinstatement of any grade control weirs occurs only where necessary for flood control purposes, and the design of any reinstated weirs shall be in consultation with an appropriately qualified ecologist and designed, constructed and maintained in accordance with the New Zealand Fish Passage Guidelines (NIWA and DOC, 2018) or to the satisfaction of the Manager.

61. The consent holder shall assess, and where required, remediate fish passage barriers at the retained grade control weirs within the project extent.

    The design of any fish passage measures at the retained grade control weirs shall be in consultation with an appropriately qualified ecologist and designed, constructed and maintained in accordance with the New Zealand Fish Passage Guidelines (NIWA and DOC, 2018) or to the satisfaction of the Manager.

62. The consent holder shall prepare a **Fish Passage Remediation Plan (FPRP)** for the remediation of the fish passage barrier at the confluence of Pinehaven Stream and Hulls Creek, and submit to the satisfaction of the Manager at least **20 working days** prior to commencing remediation of the structure.

    The FPRP shall be prepared in consultation with an appropriately qualified ecologist and show how it will be designed, constructed and maintained in accordance with the New Zealand Fish Passage Guidelines (NIWA and DOC, 2018) or to the satisfaction of the Manager.

    The consent holder shall undertake the remediation in accordance with the certified FPRP within six months of the completion of the main stream works.

Note: This remediation may involve removing the perched drop and installing baffles on the concrete ramp.

Reclamation Design Report

63. The consent holder shall prepare, in consultation with an appropriately qualified freshwater ecologist, a **Reclamation Design Report (RDR).** The RDR shall be submitted to the Manager for certification at least **20 working days** prior to the works commencing on the reclamation at 26 and 28 Blue Mountains Road. No reclamation works shall commence until the consent holder has received written notice that the RDR has been certified by the Manager.

    The RDR shall demonstrate that the reclamation results in no net loss of ecological value and shall include, but not be limited to:

    a) Details of the proposed bed substrate and complexity

    b) Details of the proposed bank habitat complexity; and

    c) Details of the proposed riparian planting.

Riparian planting

64. The consent holder shall engage a suitably qualified ecologist to prepare a **Riparian Planting Plan (RPP).** The RPP shall be submitted to the Manager for certification at least **20 working days** prior to the riparian planting works commencing.

    The RPP shall be generally consistent with the draft planting plan provided as Appendix J of the section 92 response dated 21 February 2020, and include, but not be limited to:

    a) A detailed description of riparian planting goals;

    b) Plan(s) to scale showing the location, lengths and widths of all proposed areas to be planted and proposed species mix, and fencing;

    c) The native species that are proposed to be planted (in accordance with condition 65 of this consent), the size of the plants and the density of planting;

    d) Details of eco-sourcing and how plants are appropriate to the locality;

    e) A detailed timeline for proposed planting;

    f) Details of pre-planting site preparation (clearing, mulching, fertilising);

    g) Details of the on-going maintenance of the planting including, but not limited to, the replacement of plants, future management, and eradication of pest plants;

h) Details of enrichment and replacement planting, including timeframes to ensure a plant success rate of at least 80% canopy cover is achieved within 5 years;

i) Details of how plants will be protected from pest animals; and

j) Details of the proposed monitoring regime.

Note: For the purpose of this condition, eco-sourcing refers to plants that have been sourced and propagated from those that grow naturally in the same ecological district.

65. The riparian planting outlined in the RPP shall include, but not be limited to:

a) Planting of bank-holding species including:

i) Upper storey (rarely wet riparian zone) – tī kōuka/cabbage tree (*Cordyline australis*), mānuka (*Leptospermum scorparium*), whekī (*Dicksonia squarrosa*), kōwhai (*Sophora Microphylla*) and tutu (*Coriaria arborea*), rangiora (*Brachyglottis repanda*) and *Olearia rani*; and

ii) Understory – hook grass (*Uncinia uncinata*), *Austroderia fulvida*, rarauhe (bracken fern *Pteridium esculentum*), shining spleenwort (*Asplenium oblongifolium)*, and rarely whararikī (*Phormium cookianum*) reaching down into the lower part of the bank.

b) Planting of *Libertia grandiflora, Libertia ixioides*, rarauhe, *Haloragis erecta* subspecies *erecta* on and around concrete structures, where appropriate; and

c) No planting in the active channel area which is inundated in all except very light rainfall events (as it reduces galaxiid spawning habitat and encourages deposition of fine sediment).

66. Any amendment proposed to the RPP certified under condition 64 of this consent shall be submitted for approval, in writing, to the Manager. Implementation of any amendment shall only occur once the amendment has been certified in writing by the Manager.

67. The consent holder shall complete the planting as required in the RPP certified under condition 64 of this consent as soon as practicable, and within 18 months of completion of works approved by this consent, or other timeframe approved by the Manager.

68. The consent holder shall notify the Manager when the planting as required by the RPP approved under condition 64 of this consent is complete.

69. All riparian planting must be maintained for 5 years or until 80% canopy cover over the relevant mitigation area is achieved.

Post-construction monitoring of effects on aquatic and riparian ecology

70. The consent holder shall submit a **Post-construction Freshwater and Riparian Ecological Monitoring Plan (PFREMP)** to the Manager for certification within **20 working days** of completion of the final stage of works.

    The PFREMP shall be prepared by a suitably qualified ecologist and include, but not be limited to, details and procedures for:

    a) Assessment of the fish passage remediation of the Pinehaven Stream outlet to Hulls Creek, to ensure it is performing as anticipated and in accordance with the NZ Fish Passage Guidelines (NIWA and DoC, 2018);

    b) Assessment of all re-instated and existing grade control weirs and debris arrestors, to ensure they are performing as anticipated and in accordance with the NZ Fish Passage Guidelines (NIWA and DoC, 2018);

    c) Assessment of fish passage at the debris arrestors;

    d) Assessment of any artificial and re-created habitat features to ensure they are providing the habitat as anticipated;

    e) Assessment of riparian vegetation performance, in accordance with the RPP certified under condition 64 of this consent;

    f) Targets for freshwater and riparian ecology values;

    g) Regime for post-construction freshwater and riparian ecological monitoring against the targets identified above. The monitoring shall include, but not be limited to, aquatic habitat, macroinvertebrates and fish.

    h) Format for which the data will be reported in (e.g. excel tables, written report, etc.)

71. The consent holder shall undertake all post-construction freshwater and riparian ecology monitoring in accordance with the PFREMP certified under condition 70 of this consent.

72. Any amendment proposed to the PFREMP certified under condition 70 of this consent shall be submitted for approval, in writing, to the Manager. Implementation of any amendment shall only occur once the amendment has been certified in writing by the Manager.

73. The consent holder shall, within 14 months of the completion of the construction works, provide a **Post-construction Monitoring Report (PMR**) outlining the

results of the monitoring required under conditions 70 and 71 of this consent to the Manager.

74. In the event that the targets of the PFREMP certified under condition 70 of this consent have not been met, as reported in the PMR provided under condition 73 of this consent, the consent holder shall engage a suitably qualified ecologist to prepare an **Ecology Action Plan (EAP)** outlining how these targets will be achieved, associated timeframes, and further monitoring and reporting required. The EAP shall be to the satisfaction of the Manager.

Managing ongoing effects on erosion, scour and flooding

Maintenance and removal of the works

75. The consent holder shall remain responsible for all works authorised under this consent, and shall maintain the structure(s) to the satisfaction of the Manager so that:

    a) Any erosion, scour or instability of the stream bed or banks that is attributable to the works carried out as part of this consent is remedied by the consent holder;

    b) Any adverse effects caused by the presence of the structure that limit or restrict fish passage shall be rectified by the consent holder; and

    c) The structural integrity of the works remains sound in the opinion of a Professional Chartered Engineer.

    Note: Maintenance does not include any works outside of the scope of the application. Any additional works (including structures, reshaping or disturbance to the bed of the watercourse) following completion of the construction works as proposed in the application, may require further resource consents.

76. If any of the works authorised under this consent are no longer required, and/or the structure(s) is not being maintained in accordance with condition 75 of this consent, or sustains irreparable damage then the structure shall be removed, within a timeframe that is to the satisfaction of the Manager.

    Note: Rule 33 of the Regional Freshwater Plan and Rule R118 of the Proposed Natural Resources Plan provide for the removal of structures as a permitted activity if certain conditions are met. Prior to the removal of the structure the consent holder must ascertain whether the removal of the structure can comply with the conditions of these rules. If not, a resource consent will be required from the Wellington Regional Council.

Managing effects on dust

77. The consent holder shall manage the work sites consented under this consent in such a way as to keep fugitive dust emissions to a minimum. This may include,

but is not limited to, the use of a water cart or other dust suppressant methods as outlined in the CMP required under condition 16.

78. The consent holder shall ensure that there are no discharges to air resulting from the exercise of this consent that are noxious, dangerous, offensive or objectionable in the opinion of a Compliance Officer at or beyond the construction site boundary.

Managing effects on network utilities

79. The Consent Holder shall ensure that construction work does not adversely impact on the safe and efficient operation of network utilities. The scope and timing of necessary utility relocation and protection works shall be developed and agreed between the Consent Holder and network utility providers to mitigate any safety hazards for the required works.

Appendix 3 – Rules Assessment

1. Statutory reasons for requiring resource consents – rules assessment

1.1 Proposed Natural Resources Plan

RMA section	Plan	Rule	Status	Comments
Construction of vertical retained channel walls (including planting of benches)				
13	PNRP	R117	Permitted	Rule R117 permits the placement of new structures that are not captured by another specific rule in the plan (such as the vertical retained channel walls), if all conditions of the rule are met. The applicant has advised that the following conditions may not be complied with: • condition (g) of the general conditions which states that the change in horizontal visibility in the water from sediment must not be greater than 30% may not be met, and • condition (i) of Rule R117 which requires that the structures do not exceed a bed area of 10m^2. The use of the streambed for the retained channel walls is a **discretionary activity** under Rule R129.
		R129	Discretionary	
13, 14, 15		R123	Permitted	Rule R123 permits the introduction of plants to the bed of a stream (including disturbance of the bed, deposition on the bed, diversion of water and discharge of sediment to water), if all conditions of the rule are met. The applicant has advised that all conditions will be met, and noted that the planting will meet condition (h) as they are identified in the Pinehaven Stream Floodplain Management Plan.
Construction of naturalised channel banks (including planting)				
13	PNRP	R129	Discretionary	There are no relevant rules in the PNRP for the construction of naturalised channel banks, so the use of the streambed for this activity is a **discretionary activity** under Rule R129.
13, 14, 15		R123	Permitted	Rule R123 permits the introduction of plants to the bed of a stream (including disturbance of the bed, deposition on the bed, diversion of water and discharge of sediment to water), if all conditions of the rule are met. The applicant has advised that all conditions will be met, and noted that the planting will meet condition (h) as the planting will be in accordance with a specified planting program in the Pinehaven Stream Floodplain Management Plan.
Placement of riprap erosion and scour protection				

RMA section	Plan	Rule	Status	Comments
13	PNRP	R117	Permitted	Rule R117 permits the placement of new structures that are not captured by another specific rule in the plan (such as the riprap erosion and scour protection), if all conditions of the rule are met. The riprap will likely exceed a bed area of $10m^2$, and as such the use of the streambed for the riprap is a **discretionary activity** under Rule R129.
		R129	Discretionary	
Realignment and reclamation of the stream at 26 and 28 Blue Mountains Road				
13	PNRP	R127	Non-complying	The realignment of the stream at this location requires the reclamation of the existing channel, creation of a new channel and diversion of water through the new channel. Rule R127 relates to the reclamation of the bed of streams identified in schedule A1, A2 or C where the reclamation is necessary for regionally significant infrastructure. The Pinehaven Stream is not identified in any of these schedules, so requires resource consent for a **discretionary activity** under Rule R129.
		R129	Discretionary	
14		R131	Discretionary	There are no permitted activity rules for the diversion of water that is not associated with the activities identified in Rules R112, R114 – R119, R121 - 123 and R140. The proposed permanent diversion associated with the realignment of the Pinehaven Stream at 26 and 28 Blue Mountains Road is able to meet conditions (a) and (b) and is therefore a **discretionary activity** under Rule R131.
Replacement of existing structures				
13	PNRP	R112	Permitted	The proposal involves the replacement of existing structures (including gabion baskets, private vehicle and pedestrian bridges, a stormwater outlet, Whitemans Road stormwater inlet and bypass debris screens and Pinehaven reserve downstream diversion debris screen). Rule R112 permits the replacement and upgrade of lawfully established structures if a number of conditions are met. The applicant has advised that the discharge of sediment during construction may result in a horizontal visibility change in the water of greater than 30% (thus not meeting general condition (g)), and that as the replacement bridges are to be standardised they may be in excess of 5% of the plan or cross sectional area of the existing structure. As such, the replacement of the existing structures are a **discretionary activity** under Rule R129.
		R129	Discretionary	

RMA section	Plan	Rule	Status	Comments
Construction of new bridges				
13	PNRP	R114	Permitted	The application involves the construction of three new bridges. Rule R114 permits the placement or construction of bridges if a number of conditions are met. The applicant has advised that whilst it is anticipated the general conditions in section 5.5.4 will be met, the discharge of sediment during construction may result in a horizontal visibility change in the water of greater than 30% (thus not meeting general condition (g)). As such, the construction of the new bridges is a **discretionary activity** under Rule R129.
		R129	Discretionary	
Removal or demolition of structures				
13	PNRP	R118	Permitted	The application involves the removal of a number of existing structures that are not being replaced or upgraded (including retaining walls, private bridges, service crossings, and a dwelling). Rule R118 permits the removal or demolition of a structure (including the disturbance of the bed, deposition on the bed, diversion of water and discharge of sediment to water) if all conditions of the rule are met. The applicant has advised that condition (g) of the general conditions (which states that the change in horizontal visibility of the water must not be greater than 30%) and condition (f) of the rule (which states that the removal shall disturb less than $10m^2$ of bed material) may not be met. The removal and of the existing structures that are not being replaced or upgraded is therefore a **discretionary activity** under Rule R129.
		R129	Discretionary	
Relocation of utilities				
13	PNRP	R117	Permitted	Rules R117 and R118 permit the placement of new structures (such as utilities) and removal of existing structures, if all conditions are met. The applicant has advised that the relocation of utilities may result in the release of sediment exceeding the general conditions, and as such has applied for resource consent under Rule R129 as a **discretionary activity**.
		R118	Permitted	
		R129	Discretionary	
Entry and passage through the streambed				
13	PNRP	R124	Permitted	Rule R124 permits the entry or passage across the bed of a stream. The proposal involves tracking up and down the streambed (not across), so this rule is not relevant.
		R129	Discretionary	

RMA section	Plan	Rule	Status	Comments
				Resource consent is required for a **discretionary activity** under Rule R129.
Removal of vegetation				
9	PNRP	R100	Permitted	Rule R100 permits vegetation clearance of up to 2ha per property per 12 month period on erosion prone land (slope exceeding 20 degrees) if a number of conditions are met. The site is not considered to be erosion prone land so this rule is not relevant.
13		R122	Permitted	Rule R122 permits the trimming or removal of vegetation from the bed of a stream (including any disturbance of the bed, deposition on the bed, diversion of water and discharge of sediment to water). The applicant has assessed against this rule in regards to the removal of riparian plants from the bed during the proposed works, and does not consider all conditions will be met (specifically condition (e) relating to sediment discharges). Resource consent is required for a **discretionary activity** under Rule R129.
		R129	Discretionary	
Permanent diversion of floodwaters by a structure				
14	PNRP	R113	Permitted	Rule R113 permits the diversion of floodwaters by existing structures. The proposed flood diversion wall at Willow Park is not an existing structure. As such, resource consent is required for this structure as a **discretionary activity** under Rule R135.
		R135	Discretionary	
Construction methodology – constructing the temporary dam and piped stream diversion, including the associated streamworks and dewatering				
14	PNRP	R131	Discretionary	There are no permitted activity rules for the damming or diversion of water that is not associated with the activities identified in Rules R112, R114 – R119, R121 - 123 and R140. The proposed temporary damming and piped diversions are able to meet conditions (a) and (b) and is therefore a **discretionary activity** under Rule R131.
15		R42	Permitted	Rule R42 permits the discharge of contaminants to water provided a number of conditions are met. The proposed construction works in the streambed and the construction of the temporary dam and piped diversion are likely to exceed a total suspended solids concentration of 100g/m^3. Further, the applicant has advised that whilst the dewatering water will be treated through a settlement tank, it may have a total suspended solids concentration exceeding 100g/m^3, and therefore not meet
		R68	Discretionary	

RMA section	Plan	Rule	Status	Comments
				condition (c)(i)(2). Resource consent is therefore required for discharges associated with the construction works in the bed of the stream and the discharge of dewatering water to the Pinehaven Stream as a **discretionary activity** under Rule R68.
Earthworks and discharge of construction phase stormwater				
9, 15	PNRP	R99	Permitted	Rule R99 permits the use of land and associated discharge of sediment laden runoff to water from earthworks, if a number of conditions are met. The proposed soil disturbance is located within 5m of the Pinehaven Stream, so will not meet condition (e). The soil disturbance and discharge of sediment laden runoff to water therefore requires resource consent for a **discretionary activity** under Rule R101.
		R101	Discretionary	
Maintenance of channel works				
13, 14, 15	PNRP	R122	Permitted	Rule R122 permits the trimming or removal of vegetation from the bed of a stream (including any disturbance of the bed, deposition on the bed, diversion of water and discharge of sediment to water). The applicant has assessed against this rule in regards to the maintenance of the plants in the streambed associated with these stream improvement works. The applicant considers all conditions are likely to be met, and no consent is required for vegetation removal at this stage.
		R119	Permitted	Rule R119 permits the clearance or removal of flood debris on the bed of a river (including any disturbance of the bed, deposition on the bed and discharge of sediment to water). The applicant has assessed against the conditions of this rule in relation to the clearance of flood debris during the operation and maintenance of the stream improvement works. The applicant has advised that all conditions are able to be met, and no consent is required for the removal of flood debris.

1.2 Operative Regional Freshwater Plan

RMA section	Plan	Rule	Status	Comments
Construction of vertical retained channel walls (including planting of benches).				
13	RFP	49	Discretionary	There are no relevant permitted activity rules which allow for the construction of vertical retained channel walls (e.g. pile or block walls). The use of the stream

RMA section	Plan	Rule	Status	Comments
				bed for the retained channel walls is therefore a **discretionary activity** under Rule 49.
13, 14		41	Permitted	Rule 41 permits the introduction of plants to the bed of a river (including disturbance and deposition on the bed and temporary diversion of water) to remedy or mitigate the adverse effects of flooding, erosion, non-point source discharges or to restore habitat, if a number of conditions are complied with. The applicant has advised these conditions will be met
Construction of naturalised channel banks (including planting)				
13	RFP	37	Permitted	The disturbance and recontouring of any part of the bed that is not covered by water to remedy or mitigate adverse effects of flooding or erosion is a permitted activity if a number of conditions are met. The applicant advised in their application that condition (4) would not be met as there will be machinery in the streambed covered by water. Through discussions, the applicant has amended their construction methodology to involve works only being undertaken with a temporary piped stream diversion in place (and therefore in the 'dry'). As such, I consider the applicant is now able to meet the conditions of this rule and the disturbance and recontouring of the bed is a permitted activity.
		49	Discretionary	
13, 14		41	Permitted	Rule 41 permits the introduction of plants to the bed of a river (including disturbance and deposition on the bed and temporary diversion of water) to remedy or mitigate the adverse effects of flooding, erosion, non-point source discharges or to restore habitat, if a number of conditions are complied with. The applicant has advised these conditions will be met.
Placement of riprap erosion and scour protection				
13	RFP	48	Controlled	Rule 48 allows for the placement of impermeable rock riprap which is an integral part of any Floodplain Management Plan as a controlled activity. The applicant has taken a precautionary approach and applied for resource consent under Rule 49 for a **discretionary activity**.
		49	Discretionary	
Realignment and reclamation of the stream at 26 and 28 Blue Mountains Road				
13	RFP	50	Non-complying	The realignment of the stream at this location requires the reclamation of the existing channel, creation of a new channel and diversion of water through the new channel. Rule 50 relates to the reclamation of any stream bed that is included in Policy 4.2.10. The Pinehaven Stream is not identified in this policy. As such, the
		49	Discretionary	

RMA section	Plan	Rule	Status	Comments
				reclamation of the streambed at this location is a **discretionary activity** under Rule 49.
14		9/9A	Permitted	Rule R131 of the PNRP was not appealed and is now operative. As such, these rules are no longer operative and do not require assessment.
		17-19B	Non-complying	
		16	Discretionary	
Replacement of existing structures				
13	RFP	22	Permitted	The proposal involves the replacement of existing structures (including gabion baskets, private vehicle and pedestrian bridges, a stormwater outlet, Whitemans Road stormwater inlet and bypass debris screens and Pinehaven reserve downstream diversion debris screen). Rule 22 permits the maintenance of structures that meet a number of conditions, and Rule 43 allows for the maintenance of structures as a controlled activity if all conditions are met. The applicant has taken a precautionary approach and applied for resource consent under Rule 49 for a **discretionary activity**.
		43	Controlled	
		49	Discretionary	
Construction of new bridges				
13	RFP	31	Permitted	The application involves the construction of three new bridges. Rule 31 permits the erection of small bridges if a number of conditions are complied with. The bridges will be greater than 6m so will not meet condition (1) Rule 47 allows for the placement and use of river crossings as a controlled activity if a number of conditions are met. The applicant has advised that it is likely that more than $20m^3$ of river bed material will be disturbed, which will not comply with condition (2). The proposed bridges are a **discretionary activity** under Rule 49.
		47	Controlled	
		49	Discretionary	
Removal or demolition of structures				
13, 14	RFP	33	Permitted	The application involves the removal of a number of existing structures that are not being replaced or upgraded (including retaining walls, private bridges, service crossings, dwelling). Rule 33 permits the removal or demolition of a structure (including the disturbance of the bed, deposition of the bed and temporary diversion of water) if a number of conditions are met. The applicant has advised all conditions will be met, and the removal/demolition works will be a **permitted activity** under Rule 33.
Relocation of utilities				

RMA section	Plan	Rule	Status	Comments
13	RFP	28	Permitted	Rule 28 permits the laying of pipes, cables and ducts across the bed of an intermittently flowing stream. The Pinehaven Stream is permanently flowing so this rule is not relevant. Rule 45 allows for the laying of cables and Rule 46 allows for the laying of pipelines and ducts as a **controlled activity** if all conditions are met. The applicant did not provide an assessment against this rule as requested in the section 92 request (question JB20), and instead advised that these works would be captured by the consent sought under Rule 49 as it is an inherent part of the proposed works. I consider that the works still need to be assessed on an activity by activity basis under the relevant rules, however as no assessment has been provided, I conclude that resource consent is required for the relocation of utilities as a **discretionary activity** under Rule 49.
		45	Controlled	
		46	Controlled	
		49	Discretionary	
Entry and passage through the streambed				
13	RFP	35	Permitted	Rule 35 permits the entry or passage across the bed of a stream. The proposal involves tracking up and down the streambed (not across), so this rule is not relevant. Resource consent is required for a **discretionary activity** under Rule 49.
		49	Discretionary	
Removal of vegetation				
13, 14	RFP	40	Permitted	Rule 40 permits the trimming and removal of vegetation (including disturbance of the bed, deposition on the bed and temporary diversion of water) to avoid or mitigate the adverse effects of flooding or erosion, if a number of conditions are met. The applicant considers all conditions of Rule 40 will be met, and the vegetation trimming and removal can be done under this **permitted activity** rule.
Permanent diversion of floodwaters by a structure				
14	RFP	9 and 9A	Permitted	Rule R131 of the PNRP was not appealed and is now deemed operative. As such, these rules are no longer operative and do not require assessment.
		16	Discretionary	
Construction methodology – constructing the temporary dam and piped stream diversion, including the associated streamworks and dewatering				
14	RFP	9 and 9A	Permitted	Rule R131 of the PNRP was not appealed and is now deemed operative. As such, these rules are no longer operative and do not require assessment.
		17-19B	Non-complying	

RMA section	Plan	Rule	Status	Comments
		16	Discretionary	
15		1	Permitted	Rule 1 permits the discharge of water and minor contaminants as a permitted activity. The applicant considers the water discharged from the works may have sediment concentrations which exceed those allowed by condition (4) of this rule (50g/m^3). They have applied for resource consent to discharge dewatering water as a **discretionary activity** under Rule 5.
		5	Discretionary	
Earthworks and discharge of construction phase stormwater				
15	RFP	2	Permitted	As a precaution, the applicant has assumed that the limits of Rule 2 for the discharge of construction phase stormwater cannot be met, and has applied for resource consent for a **discretionary activity** under Rule 5.
		5	Discretionary	
Maintenance of channel works				
13, 14	RFP	22	Permitted	Rule 22 permits the maintenance (among other things) of existing lawful structures as a permitted activity if a number of conditions are met. The applicant has advised that all conditions will be met.
13, 14		40	Permitted	Rule 40 permits the trimming and removal of vegetation (including disturbance of the bed, deposition on the bed and temporary diversion of water) to avoid or mitigate the adverse effects of flooding or erosion, if a number of conditions are met. The applicant considers all conditions of Rule 40 will be met, and the vegetation trimming and removal during maintenance of the works can be done under this permitted activity rule.
13		36	Permitted	Rule 36 permits the disturbance of the bed for the clearing of flood debris that poses a flood or erosion hazard or for the purpose of protecting structures. The applicant has assessed against the conditions of this rule in relation to the clearance of flood debris during the operation and maintenance of the stream improvement works. The applicant has advised that all conditions are able to be met, and no consent is required for the removal of flood debris.

Appendix 4 – Summary of Submissions

Submitter Number	Submitter Name	Support Oppose Neutral	Heard Yes/No	Grant Decline Conditional	Submission Summary
1	Karyn Mills	Oppose	Yes	Decline	> Submitter lives in close proximity to the works. > WWL have previously removed two trees which has caused erosion and slumping of back yard and fence. > Willow Park is a beautiful area used by many people. It has also been home to a goose for about a year. Concerned the willows are being cut down and no replacement apple or plum trees are being planted, and the plans for concrete areas. > Doesn't agree with plans for new concrete areas, new playground or that a local walkway will disappear. Would like council to sign a document where no development takes place on Pinehaven hill area. > Submitter is concerned that the ecology of the stream is under threat - the thin finned eels have been fished out, no concern for eels, native fish, spotted trout, and removal of trees from fenceline. > Considers there is no reason to complete major works.
2	Lloyd May	Support	No	Grant	> Submitter lives in close proximity to the works and considers it is a well-planned, common-sense approach to a long-term issue.
3	Jayne Roberts	Support	Yes	Grant	> Submitter lives in close proximity to the works and has experienced flooding on their property. > Works should be done now, it is a shame it has taken so long to get to this point. > Proposed improvements will enhance Pinehaven/Silverstream as a place to live.
4	Deborah Griffiths	Support	No	Grant	> Submitter lives in close proximity to the works and has experienced flooding on their property. > Agrees with the widening of the stream to accommodate flooding that may occur as a result of further development and logging up the Pinehaven catchment. > Proposed works includes removal of many small trees and three 70 year old specimens of sentimental significance (oak, ash, black beech) from submitter's property. Removal of these trees will have visual effects on the submitter's aspect to the west, remove view and privacy. Removal of old trees will have serious effect on bird and fish life along the stream. > Submitter has engaged an arborist who disagrees that the black beech tree is unsafe (reason for proposed removal), and considers it a healthy and safe specimen with no reason to be removed. They also commented it was appalling the ash tree was to be removed as it is a magnificent specimen. > Submitter requests WWL revisit planning to save the black beech tree which is a protected species.
5	Graeme McCarthy	Support	Yes	Grant	> Submitter lives in close proximity to the works and has experienced flooding and flood damage on their property. Flood events causing stress. > Want project to go ahead, happy to work with parties to sort whatever disruptions will occur during the project.
6	Steve and Kate Hunt	Support	No	Grant	> Submitter owns home (now rented out) in close proximity to works, has experienced flooding on their property. > Want works to progress now to see flood mitigation work underway. > Happy with neccessary impacts on their property and restoration of native green corridor along stream channel, which will maintain the green character of the environment. > Strongly supports application and considers work to be essential to safety of people, property and community.
7	Peter and Rosalyn Ross	Oppose	Yes	Decline	> Submitter lives in close proximity to the works and has experienced flooding on their property. > Described events on property during 8 December 2019 flood, which was supposedly a 1 in 30 year flood event. Considers that this event indicates the flood maps are exaggerated and too conservative (treating the catchment as bare). Using this baseline, considers the size of the flood relief requirements are 'over engineered' for a 25 year flood. > Application proposes 'secure overland flow path along driveway' and 'channel walls' within the Submitters property , however no details provided as yet regarding the actual overland flow path works (if any) and the channel geometry. Submitter considers they cannot comment on or agree to something they are yet to be advised of. > Submitter considers that the plans are excessive and will cause public disruption and additional ratepayer expense than is necessary. Submitter requests flood basline be recalculated and peer reviewed by an independant company with experience with a heavily wooded catchment. Does not agree with the current plans.
8	Sharlene Olsen	Support	Yes	Grant	> Submitter lives in close proximity to the works and has experienced flooding on their property. > Would like flooding to cease due to substantial damage and stress caused.
9	David Kyle	Oppose	Yes	Decline - conditional	> Submitter is concerned about proposed disposal of excavations from streamworks onto the Silverstream Reformed Church site and opposes consent until these items are addressed: 1. Whether stormwater runoff from the newly elevated ground will affect neighbouring properties 2. Identification of the amount of excavations to be dumped and expected height of the section after dumping 3. Consultation with neighbouring properties regarding the change in land use and how this may affect neighbouring properties (e.g. privacy).

10	Alexander Ross	Oppose	Yes	Decline	> Submitter opposes application, however does not oppose stream improvements in principle when further work is done on the model. > Submitter considers the flood modelling is flawed due to the hydrological model not taking into account the high infiltration of the forest and bush areas of the catchment (thus leading to over-estimation of the 25year stream works). > Flood protection works for the upper reach of the catchment has been ignored. > Submitter considers the rain event on 8 December 2019 was close to a 30 year event and the majority of the stream channel coped with the peak flow. > Submitter has provided maps comparing the modelled 25-year event (GWRC document), 25-year event (UHCC document), 10-year (unreferenced document), with the observed flooding from 8/12/2019. Submitter notes the 10% map shows more inundation, 4% map shows less inundation and the observed storm map shows less again - the discrepency renders the flood modelling suspect and does not give confidence in the hydraulic modelling. > Submitter considers the works are probably well over designed for the 4% flood due to ignoring the high infiltration capacity of the forested and bush clad hills reducing the peak flow that the works need to accommodate. Streamworks could be reduced in size, with consequent saving in environmental damage and council funds. Submitter has carried out field testing in catchment that showed forest and bush clad sections has a large infiltration capacity. > Reference to RJ Hall and Associates review and review by BECA. Catchment characteristics have not been revisited since model developed in 2008. Model is out of date and needs to be revisited to quantify the pre- and post-development catchment characteristics. > Submitter requests: 1. The base hydrological model is fixed to incorporate increased infiltration on the forest and bush catchment areas 2. Flood model is re-run with above parameters to work out new design flood flows 3. Hydraulic model and calculations are re-run to redesign the channel works and reassess the need for culvert/bridge upgrades for a 25-year storm 4. The overtopping at 122 Pinehaven Road is addressed with a suitably sized culvert and vegetation clearance work.
11	Save Our Hills	Oppose	Yes	Decline	>Submitter strongly supports objective of the application in principle, however, considers that the basis on which the proposed stream improvements have been assessed is flawed because the base hydrology is not correct. >Submitter therefore opposes this application because the proposed improvements have been assessed incorrectly. >In the 1 in 30 year rainfall event that occurred in Pinehaven on the 8 December 2019 the flood extents were far less than GWRC's 1 in 10 year flood maps (i.e. this indicates GWRC's flood maps are grossly inflated) - see the Storm Report and "Flood Extent Maps" included in this submission. > Submitter commissioned a technical review by R J Hall and Associates Ltd of the Jacobs' (2016) reworkings of GWRC's Pinehaven flood modelling. RJ Hall's review found that Jacobs did not correct the future development hydrology error by SKM (2010) in GWRC's Pinehaven flood modelling. RJ Hall found that (contrary to Beca's 2015 audit) GWRC's Pinehaven flood modelling and mapping is not fit for purpose and cannot be relied upon. >The RJ Hall report also found that GWRC's inflated flood extents are due to GWRC modelling the forested hills in the upper catchment as impervious, i.e. as if they are covered with concrete. > The RJ Hall report concludes: "The results of the earlier studies by MWH, SKM, Beca and Jacobs were used to provide and validate hydrological inputs to hydraulic models in order to demonstrate the likely scale of effects on the distribution and passage of flood water arising from an ARI 100 year rainstorm in the Pinehaven catchment. "Given the substantive discrepancies in those earlier studies in the hydrologica pre- and post-development runoff values for peak flow and runoff volume that have been revealed in this present study, no reliance should be placed on the efficacy of the flood mapping results that were associated with that earlier work by MWH, SKM, Beca and Jacobs. "We conclude Jacobs' error [in the Pinehaven flood modelling] can only be remedied by rejecting the hydrological and hydraulic modelling to date and doing it again using reasonable and representative runoff hydrographs for pre- and post-development situations." > Submitter commissioned a peer review of the RJ Hall report. The peer reviewer wrote, "I have carried out calculations to check [Mr Hall's] results … I concur with Mr Hall's conclusions that … [GWRC's] hydrological model … assumed an exceptionally impervious catchment." >Submitter considers that because the GWRC/MWH hydrological model of stormwater runoff is wrong, then so is the SKM/Jacobs hydraulic model of flood extents (grossly inflated). These models were used to determine the stream improvements, therefore the stream improvements are also incorrect (over-engineered). >WWL claim the improvements are required to increase the stream channel from less than a 5-year capacity to a 25-year capacity, however the 8 December 2019 storm demonstrated that much of the Pinehaven Stream already has a 25-year flow capacity. > Submitter considers building extra capacity would normally be a good thing if the base model was accurate, however the outcome of GWRC's unreliable baseline model is that it will actually allow bigger floods to occur more regularly in Pinehaven and Silverstream due to large volumes of extra stormwater runoff from future development on the Pinehaven hills. GWRC's baseline model will fail to control this extra runoff because GWRC's baseline model already assumes the hills to be covered with concrete, therefore it won't detect extra runoff from steel roofs, asphalt roads, and concrete driveways and footpaths that will replace forest and bush. >The submitter considers the solution is that GWRC's baseline hydrological model and hydraulic model must both be done again. >Submitter requests the following: 1.Hydrological model be done again using inputs that are representative of the actual catchment, in particular, with infiltration losses representative of the forested and bush-clad hills in their current condition as they were in 2008 when the original modelling was done (i.e. not as they are now when recent harvesting of the pine forest has changed the hydrologic characteristics) 2.New hydrological modelling be done based on high infiltration rates in forest and bush clad hills, determined by field tests 3.Hydraulic model and flood hazard extent maps be done again using hydrographs from the corrected hydrological model 4.The stream improvements be reassessed based on the corrected hydrological and hydraulic models, so that the flood extents witnessed in the 1-in-30 year rain event on Sunday 8 December 2019 are all addressed, and including addressing any flooding issues in the upper catchment. 5. The improvements address the undersized culvert at 122 Pinehaven Road and the problem of overflowing sewerage mixing with stormwater during flooding (e.g. sewer manhole in footpath on Pinehaven Road opposite Pinehaven School hall).
12	Elaine Alsop	Support	No	Grant	> Submitter lives in close proximity to the works and has experienced flooding on their property. > A large amount of bamboo on the stream banks which results in loss of sun. > In favour and look forward to project being completed
13	Bob [unknown surname]	Support	No	Grant	> In favour of works going ahead.
14	Robyn Hickson	Support	Yes	Grant	> Submitter lives in close proximity to the works and has experienced flooding on their property, causing significant damage and stress. > Submitter is concerned that a few people can hold up the process, and considers council has an obligation to protect the properties which is not being met.
15	Bryan Powell	Support	No	Grant	> Submitter understands why the work has to be done.

Appendix 5 – Pre-hearing meeting, 20 April 2020

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

FILE NOTE

DATE 20 April 2020

AUTHOR Claire McKevitt

SUBJECT Pinehaven pre-hearing notes

FILE NUMBER WGN200083

On 20 April 2020 at 7pm a virtual pre-hearing meeting for the Pinehaven Streamworks Improvement Resource consent and Notice of Requirement was held.

Attendees:

Lindsay Daysh – Facilitator

Kirsty Van Reenen – Team Leader, Greater Wellington Regional Council
Josie Burrows – Resource Advisor, Greater Wellington Regional Council
Claire McKevitt – Senior Resource Advisor, Greater Wellington Regional Council

James Beban – Consultant Planner for Upper Hutt City Council

Tristan Reynard – Project Director, Wellington Water Ltd
Ben Fountain – Stormwater Advisor, Wellington Water Ltd
Nicky McIndoe – Counsel, Dentons for Wellington Water Ltd
Helen Anderson – Planner, GHD for Wellington Water Ltd

Submitters
Steven and Sue Pattinson
Peter and Rosalyn Ross
Alex Ross
Bob Hall
Robyn Hickson
Darryl Longstaffe

Key Issues discussed

- One submitter whose property is regularly affected by the flooding would like the project to proceed as quickly as possible. The existing flooding is causing undue stress, both due to financial and health implications. In their opinion, over engineering is not necessarily a concern as it is better than no stream works upgrades being undertaken.
- Save Our Hills (SOH) members are concerned that the changes to the hydraulic model that the applicant is about to undertake will not address their issues which are with the hydrological

model. The issue they have with the hydrological model is that the infiltration rate used assumes no infiltration, too much rain and an oversized catchment, resulting in over engineering of the stream upgrades.

- The concern SOH members have with over-engineering of the model is that if future development is to go ahead within the catchment (ie. the Guildford Development), the developers would not be required to undertake additional storm water mitigation as the stream upgrade would already provide enough flow for that development.
- This means by undertaking these works at this scale now the UHCC (funded by the ratepayers), is compensating future private development.
- Further, because no streamworks are proposed for the upper catchment, there is fear that should new development occur higher up in the catchment, this may exacerbate the existing flood issues in the upper catchment. Noting that these aren't currently as bad as the flooding issues in the lower catchment which this project is to target.
- SOH members would like expert conferencing to go ahead, but only if it's multi-disciplinary, including the flood modellers/hydrologists as well as urban design experts to account for infiltration from hypothetical development.

Specific Information requests

- SOH members would like to see modelled stream flows, not just designed AEP's. In particular for a 1 in 25 year flood event.
- Peter and Rosyln Ross would like clarity as to what works are being undertaken on their property, with updated drawings. They also questioned whether the proposed width of the stream through their property was necessary.
- SOH sent Kirsty an email with requests to be included in the scope of the re-run of the hydraulic model. This was provided to the applicant. The applicant will consider these requests and provide a response.
- WWL to provide a response (via GWRC/UHCC) to SOH in regard to their requests about the flood model comparison to the December 2019 flood event.
- Clarification is required from WWL as to what infiltration has been used in the hydrological model, why this is considered appropriate and realistic of the baseline (and not future development).

Recommended Next Steps

- The applicant undertakes the discussed hydraulic model updates
- The updated model results and related flood hazard assessment is shared.
- The pre-hearing meeting for SOH and the flood experts is arranged.
- Expert conferencing is undertaken to clarify matters of contention in the model if any.

Pinehaven Streamworks
Submitter Questions Unanswered at Pre-Hearing Meeting held 20 April 2020, 7-9pm

Present: (Meeting held on Zoom)
Lindsay Daysh (LD) – Planner (Facilitator)
James Beban (JBn) – Planner (Urban Edge Planning Ltd, contracting to UHCC)
Helen Anderson (HA) – Planner (GHD, contracting to Wellington Water Ltd)
Claire Baldwin (McKevitt) (CMcK) – Planner (GWRC, Environmental Regulation)
Kirsty van Reenen (KvR) – Planner (GWRC, Team Leader, Environmental Regulation)
Josephine Burrows (JBs)– Environmental Scientist (GWRC, Resource Advisor)
Tristan Reynard (TR) – Civil Engineer (Wellington Water Ltd, Project Manager)
Ben Fountain (BF) – Environmental Engineer (Wellington Water Ltd, ex-SKM/Jacobs)
Nicky McIndoe (NMcD) – Lawyer, Dentons Kensington Swan (for Wellington Water Ltd)

Submitters:	Stance/Request:
Robyn Bruce (Hickson) (RH) - Resident, Silverstream	Support/Grant application
Peter and Rosalyn Ross (PR, RR) - Residents, Pinehaven	Oppose/Decline application
Alex Ross (AR) - Resident, Pinehaven	Oppose/Decline application
Darryl Longstaffe (DL) - Resident, Pinehaven (SOH)	Oppose/Decline application
Steve, Sue Pattinson (StP)(Sue)-Residents Pinehaven (SOH)	Oppose/Decline application

Bob Hall (BH) - Civil & Structural Engineer, R J Hall & Assoc. Ltd (for SOH)

Introduction:
Refer to email 24 April 2020 to CMcK (GWRC) from submitters StP, Sue, DL, AR, PR and RR explaining why we prepared this record of the meeting. We weren't able to contact RH (her contact details are redacted in her written submission) so we haven't included her concerns. However, we did listen carefully in the meeting to her concerns and we understand them.

The Agenda for this pre-hearing meeting which submitters received 17/4/20 was:
1. Welcome/Introductions
2. Purpose of pre-hearing meeting and ground rules
3. Discussion on key issues raised from submissions
4. Next steps/options
5. Closing and agreed actions

LD (Facilitator) read out an official 3-fold purpose for this pre-hearing meeting:
1. To explain procedural and substantive matters (?)
2. To clarify what the proposal entails
3. Opportunity for Applicant/Councils to better understand submitters' concerns

The meeting started 7:08pm (approx.) due to time taken for everyone to log into Zoom. During the first 1/2 hour of the meeting we heard from LD, BF and NMcD about procedural matters, why the project is needed, what the proposal entails, and the Consenting Authority (GWRC) request to the Applicant (UHCC) for 'further information' requiring re-run of model.

NB: WWL is the Agent for UHCC. WWL is represented tonight by TR, BF, HA and NMcD. UHCC is also represented by JBn, and the Consenting Authority (GWRC) by CMcK, JBs, KvR.

Key quotes - submitters Pinehaven Streamworks Pre-Hearing Meeting 20-4-20:

"We've been living here for nearly 40 years, so we've seen floods lots of times. We thought the size of the channel [WWL] discussed with us on site must be for a 100-year flood! But it is only for a 25-year flood. The 8th December was a 25-year flood, and [the stream] only just overtopped the existing banks. … The overtopping is mainly caused by the water channel being narrowed through the vertical concrete block [stream channel] walls built by the residents of No 12 Birch Grove. When the increased current hits their vehicle bridge it causes the water trapped by the bridge to then gush out underneath it and overflow our bank."

Peter and Rosalyn Ross, Pinehaven

"[Your] analysis for the engineering of the streamworks is wrong. It has been over-engineered. What we've found out about the hydrology right back at the very beginning of the [Pinehaven flood management] project is that [stormwater runoff in the catchment] is grossly exaggerated. And the reason it is grossly exaggerated - the runoff is grossly exaggerated - is because the inputs [in the hydrological model] assume the catchment is 'exceptionally impervious'.

[GWRC modelled] the catchment, the existing forest - the catchment is 80% forest - as if it's impervious. The forest is not impervious. The forest has a massive infiltration rate, which we know because we have done infiltration tests in the forest. It has a very high infiltration rate. But the [hydrological] modelling that's been done by … MWH [for GWRC] assumes virtually no infiltration, just a tiny, tiny bit of infiltration, with the bulk of the rainwater running off the hills.

So [the hydrological model] doesn't represent the existing situation at all correctly. [Your re-running of the hydraulic model now] is all just a waste of time [and money], all this tinkering with the hydraulics, because the inputs right at the very beginning in the hydrological model [are seriously wrong]."

Stephen Pattinson, M. Arch ANZIA Registered Architect [Save Our Hills]

"The hydrology is a major issue. … [You] can avoid making the same mistake again. … The value [in the hydrological] model is 2mm/hr for infiltration [in the forested hills] in the catchment. I've done tests up [in the forested hills] in the Pinehaven catchment and the [infiltration] is something like 500mm/hr. Are you going to fix the hydrology before you re-run the model? … [Response: No]
So, you're telling me the model is going to be re-run using those wrong [infiltration] parameters. … If the modellers are not going to look at those parameters, what's the point of re-running the model?"

Alex Ross, Pinehaven, Retired Civil Engineer

"Why wouldn't you be [willing to look at the hydrology]? There's millions of dollars at stake here, there's people's properties at stake here, there's flood[ing], so why would you not be willing to [look at the hydrology]? … We want more transparency … multi-disciplinary discussion … why are [you] people so afraid of that?"

Susan Pattinson, Pinehaven (Save Our Hills)

The following table lists submitters' concerns / questions raised at the meeting (listed generally in the order they were raised), and responses received from the Applicant.

	Question / Concern from Submitters	Applicant Response
1	(PR) What size flood is the streamworks designed for, a 100-year flood or a 25-year flood?	BF: a 25-year flood
2	(AR) (StP): the model re-run; are you re-running the hydrological model, or the hydraulic model, or both?	JBn: just the hydraulic model (not the hydrological model). *NB: we can't accept JBn's response – the subject matter is outside his area of expertise, and his response seems contradictory. On the one hand he said the re-run involves increasing climate change allowance [which involves an adjustment to rainfall in the hydrological model], but on the other hand he said they are not re-running the hydrological model. JBn is not qualified to answer the question, and so it remains unanswered.*
3	(AR) (StP) Objected strongly to NMcD's comment that submitters concerns about hydrology have already been addressed in the 'further information' responses [notified Feb 2020] and therefore will not be addressed in the modelling re-run. AR / StP said that the notifed 'further information' fudged the issues and does not address our concerns at all: **the hydrology is still a major issue. The hydrology of the catchment is not modelled correctly** – infiltration is too low, so runoff is too large, therefore flood extents are inflated, consequently the streamworks are over-engineered and unnecessarily expensive for ratepayers. It all begins with the hydrology. If the hydrology is wrong then everything that follows is wrong. Tinkering with the hydraulic model does not fix the hydrology. In the hydrological model the catchment is assumed to be "exceptionally impervious" – it isn't. It has very high infiltration capacity, determined by field tests. **Will you be fixing the hydrology BEFORE you re-run the model(s)?**	(LD) Will the submitter's concerns [about the hydrology] be addressed in the model re-run? (NMcD) – No.

4	(AR) – So you're saying the model is going to be re-run using the wrong parameters. The [hydrological] model is an 'intial loss' and 'continuing loss' model – it assumes only 5mm and 2mm/hr repsectively. AR has done infiltration tests up in the forest and the continuing losses are something like 500mm/hr. If the modellers aren't going to look at the infiltration inputs then what's the point of re-running the model? Why make the same mistake again?	(NMcD) These are matters for the modeller to discuss. *We don't accept this response. Representing the hydrology of the catchment correctly is not optional.*
5	(LD) What is the scope of the modelling re-run? *Does JBn's reponse give the full scope of the re-run of the model? Please advise/confirm.*	(JBn) – to look at the impact of doing the following:- • Adjusting the climate change allowance • Moving bridges • Adjusting some culvert roughness coefficients • Adjusting some banks
6	(Sue) Why would you not be willing to talk about the hydrology? There's $millions at stake here; peoples' properties at stake; flooding; so why would you not be willing to talk about getting the hydrology right?	(no response)
7	(StP) The RC Appn & NoR document [p109, **Figure 26: Difference in Flood Depth in a 1% AEP Event Following Completion of the Project]** indicates significant reduction in flooding due to the stream improvements, but the public was informed by GWRC, at a 2014 meeting in Pinehaven, the streamworks will make no difference to the 1-in-100 year flood maps. Can you clarify this?	(no response)
8	(StP) Why aren't you quantifying the flows that you are designing the channel capacity for? Sure, use % AEP for insurance puposes, but you should be transparent about the flows (in m^3/s) that you have designed the channel capacity for. We can't find anywhere in the notified documentation flows and channel capacities quantified in m^3/s. Can you make this transparent by quantifying channel flows?	(no response)
9	(StP) The forested hills have been modelled as being impervious, as if they are covered in concrete. Because of this serious flaw in the hydrological model the flood maps have been created on the assumption that virtually all the rainfall runs off the hills, which it doesn't, and so the flood maps are grossly inflated. (RH) Why is that your concern? (StP) Becasue this is the baseline model that will be used to assess future dvelopment on the hills for hydraulic neutrality. (StP) strongly objected to BF's suggestion.	(BF) Suggested to get an undertaking from UHCC / GWRC / WWL that the existing hydrological model will not be used by them to assess future development for hydraulic neutrality. They will get the developer to do their own pre- and post-development run-off assessment.

10.	(StP) What is the point of UHCC and GWRC having just spent $millions of ratepayers' money creating a baseline hydrological model and then not use it?	(BF) We'll get the developer to do a baseline model at their own cost.
11	(StP) So you're saying the $millions already paid by ratepayers for a baseline model will be for nothing?	(no response)
12	(StP) You've produced a baseline model at ratepayers expense that is seriously flawed, it is grossly inflated, and needs to be corrected. Until you correct it the PC42 hydrauic neutrality rules will not be effective – the inflated baseline model will mask huge quantities of additional unmitigated runoff from large-scale future development on the hills, relieving the developer of huge stormwater management costs, and affecting everybody in the catchment – bigger floods, more regular floods, and bigger slips. When SKM modelled the impact on flooding from unmitigated runoff from 1,665 new houses on the hills in the upper catchment in their 'future case scenario', how did they come up with the answer that there would be almost no increase in flooding?	*StP expressed this all as a statement, but we are now putting this to the Councils as a question: how did SKM / GWRC / Jacobs come up with the answer in their 'future case scenarios' that the impact on flooding from unmitigated runoff from new houses on the hills in the upper catchment would be almost nothing, that there'd be no significant increase in flooding?*
13	(AR) Why are the streamworks not addressing flooding issues in the upper catchment, eg • Undersized culvert at 122 Pinehaven Rd • Several other issues in upper catchment that are not being looked at – the streamworks only start at the bottom of Pinehaven Reserve (StP) – No, the upper catchment is part of this project. Its our rates [ratepayers in upper catchment] you are using on this project too [the cost of which has stealthily jumped from $10M to over $40M]. *BF's answer is unacceptable. In public open days (2012 and 2014) on proposed streamworks, we were told that when the streamworks are done, our problems in the upper catchment will go away. But they are not going away in this streamworks plan, so why aren't they being fixed? There has certainly been no previous indication from GWRC the streamworks were only to benefit the lower catchment.* So why are the streamworks not addressing flooding issues in the upper catchment?	(BF) This project is from Pinehaven Reserve down. An upgrade in the upper catchment would need to be a separate project.
14	(AR) There's been 4, 5 maybe 6 significant floods in the Pinehaven Stream since you did your modelling [in 2008 – 2010]. But nowhere have you have a flood	(no response)

	gauge keeping records of flood volumes of the water coming down so that you could look at the gauge and see what the actual flow was. You need to do better research before you spend ratepayers money. (StP) You had a depth gauge in the stream but GWRC took it out in 2013. You've missed 7 years of data, stream flow record. Why did you remove the gauge?	(no response)
15	(PR) There is a lack of clarity in the [streamworks] drawings. For instance, where the channel passes through our property the drawings just say "Details of channel geometry to be confirmed". So I don't even know what you are doing on my property. How can I say if I'm objecting to it or approving it if I can't see what you are doing? *[Jacobs' 'Typical Cross-Section' drawing (CH 0 - 120) of the proposed channel through PR's property shows vertical sides which are to be constructed with "sheet piles" (trapezoidal profile steel interlocking sheets). But PR was informed on site by WWL representatives that the channel on his property will be 'riprap' (raking banks covered with rocks). Furthermore, the drawing has no dimensions on it and no 'Scale Bar', just a footnote saying "Scale 1:100 @ A3 size" which may be unclear to many people. At A3 size the channel on PR's property scales at about 6.4m wide (up from the existing width of about 2.5m)]* (SP) It seems to me WWL is not being clear about the channel geometry and construction because they don't want to be transparent about the volume of flow they have designed the channel capacity for.	(BF) We will do everyhting we can to provide clarity to you. To which PR replied: If you know what the channel is, and you've determined it, then why don't you upgrade your drawings? (no response)
16	(LD) There is a disparity between what the submitters are saying and what we have heard from the Applicant ... there is a feeling [from submitters] that the model isn't 'fit for purpose'. ... we [need to] get the hydrological experts together to discuss whether the model is 'fit for purpose' ... (Sue) We request expert conferencing to be multi-disciplinary ... (Sue) It's not the Pattinson's request, its Save Our Hills [SOH] and the wider community ... who have had 300 and 400 [strong] submissions and petitions thrown out [by the Councils] and taken no notice of. We [the community] have been treated appallingly ...	(NMcD) I've already said that we would support technical flood modelling expert witness conferencing (NMcD) I heard the Pattinson's request for multidisciplinary conferencing – I wouldn't support that.

	So we would like a lot more transparency than expert conferencing [behind closed doors]. (StP) The issues are multidisciplinary (impervious footprints of various development scenarios, and the stormwater runoff from impervious precentages of pre- and post- development land use) so the discussion needs to be multidisciplinary, and that doesn't have to be expert conferencing. Why not an 'Alternative Dispute Resolution' process / mediation?	(no response)
17	(StP) [in response to suggestions that the issue is about future Guildford development that currently has no planning status and therefore no bearing on the present Application, or that we are trying to change UHCC's already-adopted Plan Change 42] Our core issue is <u>not</u> about Guildford, and it is <u>not</u> about PC42. We want you to get the hydrology right. (StP) Right at the core of our submission is a piece of work which GWRC did called the 'future case scenario' (2010, 2016). It looked at development on the hills, and what the effect of that would be on flooding down here in the valley. ... It was a hypothetical exercise that revealed a gross flaw in the baseline model. (StP) ... those flood experts [will be] talking away in their own bubble about hydrology and hydraulics, but can't talk about the hypothetical developments that are [generating the inputs] they are mulling over [because the various configurations of hypothetical developments are outside flood engineers expertise] ... it's the hypothetical developments that revealed the hills hvae been modelled as if they are sheathed with concrete or as if they are sheathed with plastic. Now why wouldn't you fix that? (StP) We have put peer-reviewed expert evidence [that shows that it is true] in front of the Councils and they have refused to sit down and talk about it. We've given to the Commissioners a log of the last 6 months of all the attempts we have made to talk with the Councils about this expert evidence, which has been peer-reviewed by another expert, but the Councils refuse to engage. (StP) Yes, so you can restrict discussion to [one half of the expertise required to understand the problem	(LD) And to get the right baseline model, you get the right hydrological experts together ... (JBn) We've always been happy to put the expert witnesses in a room and have expert conferencing. (LD) Look, BF told us before that that isn't true! (JBn) That's why we want to have expert conferencing now [for flood engineers] ... We're all for it.

	and keep the other half out of the discussion so that the problem won't be fully investigated and resolved] Will you look at that hypothetical future development exercise to see what the problem is with the baseline model?	
18	(Sue) Will all the experts meet with us before the hearing so we can discuss our findings and reports and ground-truthing information? (StP) What Sue is asking about is that we understand we are having our own separate pre-hearing meeting with the experts. (StP) It has already been agreed [see KvR's email]. We ask that you bring a hydrologist, a hydraulic engineer, an urban designer or architect or someone familiar with multi-unit development. (StP) That's the problem ... the [modelling and] re-modelling [WWL] is doing ... you're just tinkering with stuff in the hydraulic model ... ... if you don't come to our separate pre-hearing meeting willing to engage on the issues that we have made very clear to you about the hydrology then what is the point of holding a pre-hearing meeting? (StP) Its a very limited offer. ... I can see why you are limiting it, because you don't want to talk about the real issue.	(LD) That is really up to the Applicant to agree. (NMcD) Those people aren't going to be involved. We'll have WWL's flood modeller who undertook/supervised the flood modelling [for the stream improvements] (LD) I think WWL has made the offer to have a meeting with you with the experts involved – that would be beneficial I think <u>after</u> this latest round of modelling has been run. Now that needn't be confined to the outcomes of that modelling. You can discuss your wider concerns ... that the modelling in your view doesn't have the right inputs. ... If there are still concerns between the experts about the model they should conference. (NMcD) That's the offer.

	Will WWL's stream improvements modeller(s) be familiar with MWH's hydrology (2008/2009), SKM's 'future case scenario' modelling error (2010), Beca's investigation of that error (2013) & Jacobs' reworking of that error (2016) which WWL have inherited?	(NMcD) the concerns you've got about the hydrology inputs into the model, [WWL's] modelling experts can discuss them with you.
19	(StP) What is the point of comparing flood extents on 8 December 2019 with GWRC's 10-year and 100-year modelled flood extents? (StP) According to the Application, the streamworks are designed for a 25-year flood, so why would you not compare flood extents on 8 December 2019, which was a 25-year event or thereabouts, with your modelled 25-year flood extents? (StP) Could you please include a comparison with modelled 25-year flood extents so we can see how your 25-year modelled extents compare with what actually happened in the 8 December 2019 event? (AR) Will you do this before you re-run the model? (StP) If not, then could you please provide an explanation as to why not, because the streamworks is for a 25-year event?	(no response) (no response) (NMcD) We have passed that request on to our flood modelling expert and we will get back to you on that. (NMcD) We're happy to provide a response ... about whether that modelling can occur or not. We're trying to work out whether that should be within the scope of the model re-run which is going to occur. (LD) That sounds reasonable (NMcD) Yes
20	(Sue) The processes are not friendly to the community. If you're hearing a bit of frustration ... it's becasue it's not a level playing field, its not equal power ... There has been zero engagement from the Councils [UHCC and GWRC]. (Sue) Its not just about saying you've given us a chance to be heard ... will you provide a more transparent process, and more engagement with submitters by the Councils?	(LD) Its a common issue that is raised by a lot of people ... the RMA process can be intimidating, there's a feeling you're not being heard ...

Submitted questions for which we are still awaiting answers:

- *We would like to suggest ... having our own **multi-disciplinary** pre-hearing meeting or **mediation** (without all the other submitters) with UHCC, GWRC and their hydrological and hydraulic engineering experts to discuss our particular technical concerns with them to see whether we can **resolve specific flood modelling issues with respect to various future development scenarios, baseline model and hydraulic neutrality**, and the various technical reports we have submitted.*
  Stephen Pattinson (SOH) email 9th April 2020 to Josie Burrows (GWRC)

- *Submissions on the Pinehaven Streamworks have not been made available by GWRC online to the public ... Why is this?*
  Stephen Pattinson (SOH) email 15th April 2020 to Kirsty van Reenen and Josie Burrows (GWRC)

- *A few questions about the model re-run:*

  1) *Regarding the "re-run of the flood model", do they mean the underlying hydrological model, or just the hydraulic model, or both?*

  2) *What model inputs are they intending to change?*

  3) Since Bob Hall has visited the catchment (twice) and carefully investigated the hydrological modelling, Alex Ross lives in Pinehaven and has done an "Infiltration Report" for the catchment, Peter and Ros Ross have first-hand experience over many years of the effects of flooding on their property, and SOH members (all of whom live in the catchment) have engaged in depth with many local residents about their historical experiences of flooding in this catchment, could we participate in discussions with GWRC/UHCC regarding the proposed new parameters/inputs before the model is re-run? We are suggesting that GWRC/UHCC check first that everyone is happy with the revised parameters before the model/s are re-run.
  Stephen Pattinson (SOH) email 15th April 2020 to Kirsty van Reenen (GWRC)

- *How much time will be provided:*
  1. *before the pre-hearing meeting for SOH/Alex Ross/Peter and Ros Ross' to review the "further information" after it is issued?*
  2. *between the issuing of the "further information" and the hearing?*

  Stephen Pattinson (SOH) email 16th April 2020 to Kirsty van Reenen (GWRC)

- *We would like to suggest that in addition to the 10-year and 100-year design hydrology, that Jacobs also run the Pinehaven model with the 25-year design hydrology for a 2019 climate (with no allowance for climate change) since the 4% AEP (1-in-25 year) event is the basis for determining the stream improvements, and would also be useful for comparing with the 8 Dec 2019 event in Pinehaven/Silv.*
  Stephen Pattinson (SOH) email 17th April 2020 to Kirsty van Reenen (GWRC

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Attention: Kirsty van Reenen

Our Ref: WWA001/2003

11 May 2020

Dear Kirsty

Pinehaven Stream Improvements Project – Information requested during pre-hearing meeting

1 Purpose of this letter

1.1 This letter responds to requests for information made during the pre-hearing meeting which occurred on 20 April 2020.

1.2 The file note of that pre-hearing meeting recorded five specific information requests. Four of those requests related to information sought by the Save Our Hills ('**SOH**') members. This letter responds to those requests. The final request was for information relating to works on the property of Peter and Roslyn Ross. That matter will be discussed with the landowners directly.

1.3 The four SOH information requests were:

- *SOH members would like to see modelled stream flows, not just designed AEPs. In particular for a 1 in 25 year flood event.*
- *SOH sent Kirsty an email with requests to be included in the scope of the re-run of the hydraulic model. This was provided to the applicant. The applicant will consider these requests and provide a response.*
- *WWL to provide a response (via GWRC/UHCC) to SOH in regard to their requests about the flood model comparison to the December 2019 flood event.*
- *Clarification is required from WWL as to what infiltration has been used in the hydrological model, why this is considered appropriate and realistic of the baseline (and not future development).*

Lee International ► Kensington Swan ► Bingham Greenebaum ► Cohen & Grigsby ► Sayarh & Menjra ► Larraín Rencoret ► Hamilton Harrison & Mathews ► Mardemootoo Balgobin ►HPRP ► Zain & Co. ► Delany Law ► Dinner Martin ► For more on the firms that have joined Dentons, go to dentons.com/legacyfirms

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2 Modelled stream flows for the 1 in 25 year flood event

2.1 The Pinehaven Stream Improvement Flood Hazard Assessment (September 2019) ('**FHA**') is included as Appendix U to the Assessment of Environmental Effects. The FHA describes how a hydraulic model of the Pinehaven Stream and stormwater network in the Pinehaven catchment has been used to assess flood hazards. The FHA explains that the hydraulic model was used to simulate flood flows in the catchment for both 'baseline' and 'with Project' scenarios. The model has been used to simulate both a 4% AEP (1 in 25 year flood event) and 1% AEP (1 in 100 year flood event) floods.

2.2 An addendum to the FHA was prepared in November 2019 to describe the outcomes of additional modelling that was requested during the modelling review carried out for Greater Wellington Regional Council. Requested changes to the model included an increased climate change factor and assessment of interim scenarios where upgraded culverts are installed before the main stream channel upgrades commence. This addendum also considered the effects of the Project for the 4% AEP (1 in 25 year flood event) and 1% AEP (1 in 100 year flood event) floods.

3 Requests from SOH in email dated 17 April 2020

3.1 This email sought the following information:

a That the model rerun include the '*25 year design hydrology for a 2019 climate (with no allowance for climate change) since the 4% AEP (1 in 25 year) event is the basis for determining the stream improvements, and would also be used for comparing with the 8 December 2019 event in Pinehaven/Silverstream*.'

b Is the legend on Figure 3 on page 31 of the Assessment of Environmental Effects incorrect? Should the reference to the Q100 instead be a reference to the Q25?

c Can figures be made clearer by using different colours rather than graduations of blue?

d Could a flood hazard map be produced, showing hazard as a product of depth multiplied by velocity, in 3 shades of blue (light, medium and dark blue) for low, medium and high hazard, or alternatively a 6 tier hazard classification?

Question (a) – model rerun

3.2 The scope of works for the model rerun is attached as **Appendix A**. The model is not being rerun for a '*2019 climate (with no allowance for climate change)*'. This is because:

a The model's primary function in this project is to undertake a relative assessment of effects of the planned works. The model has already been used to assess the effects of the proposed works for the 4% AEP and 1% AEP design events with 16% and 20% climate change recommendations.

b Further verification of the model against the December 2019 event will not assist with relative assessment of effects.

c There is uncertainty of the Average Recurrence Interval (ARI) of the December 2019 flood event which is influenced by factors such as antecedent conditions, storm temporal patterns and channel blockages. Wellington Water Limited ('**WWL**') cannot confirm that the 8 December

2019 event was the same as the modelled 4% AEP design hydrology. Appendix A to the section 92 response dated 26 February 2020 stated that *'based on data from a rain gauge in the Pinehaven Stream catchment (Pinehaven Stream at Pinehaven Reservoir), the average recurrence interval (ARI) of the rainfall in this event at the gauge location was 10-20 year for a 20-minute duration and 30-40 year for a 60-minute duration.'* That Appendix provides a comparison of the 8 December 2019 event with model outputs.

d WWL does not have a hydrograph for the December 2019 event for the Pinehaven catchment.

e The photos and first-hand accounts of flooding in the December 2019 event confirmed the locations being targeted for improvement by the proposed works (Birch Grove, Sunbrae Drive, Blue Mountains Road etc) as flood prone areas.

f The Project is being designed for the future climate, and it is therefore appropriate to design for climate change effects and future rainfall.

Question (b) - Legend on Figure 3

3.3 The legend for figure 3 is incorrect. The reference should be to the Q25CC than the Q100CC.

Question (c) – change of colours

3.4 Changing the colours of the maps is more expensive and difficult than it may appear. If the flood expert for SOH has any questions about the interpretation of these maps, these could be discussed during expert witness conferencing.

Question (d) - Flood hazard map

3.5 Flood Hazard Maps for the Pinehaven Stream are available on the Greater Wellington Regional Council website: https://www.gw.govt.nz/pinehavenstream/

3.6 As the primary focus of the Project is on conveying flood waters in the Stream channel during the 4% AEP, it is not necessary to prepare the maps requested.

4 Flood model comparison to the December 2019 flood event

4.1 As noted above, WWL does not intend to model the December 2019 flood event. The Project hydraulic model was found to be fit for purpose by the technical review carried by Beca for Greater Wellington Regional Council (2 December 2019).

5 Infiltration used in the hydrological model

5.1 Information regarding infiltration is contained in the section 92 response dated 26 February 2020. This explains that the model uses the Initial Loss – Continuous Loss model to represent the infiltration capacity of the catchment. The model assumes that, during a storm event, the first 5mm of rainfall will not contribute to runoff/flood flows, but after that any rainfall in excess of 2mm per hour will become stormwater runoff (and eventually stream/flood flows).

5.2 In reality, the amount of stormwater runoff generated by a storm event will differ each time, depending on matters such as how saturated the soils already are, how heavy the rain is, how long

the storm event continues for, soil type, topography, and the percentage of impervious surface in the catchment.

5.3 As noted above, a more precise hydrological model is unnecessary when used as an input to a hydraulic model which has a primary purpose of assisting with a relative assessment of effects.

Yours faithfully

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Appendix A – modelling scope of works

Pinehaven

Flood Model Re-run Scope

The Pinehaven flood model will be re-run as follows:

1. The "with project" model should include:
    a. The removal/addition/replacement of local access bridges proposed (as described in 25 March 2020 letter to the Councils);
    b. Bank works at 54 and 56 Whitemans Road (if proposed);
    c. Culvert roughness of n=0.020;
    d. Climate change allowance of 20% increase in extreme rainfall events;
    e. 20% blockage;
    f. No allowance for freeboard. i.e. the reported results are the modelled water levels and flood extents, and dynamic freeboard has not been applied

2. The "without project" model should include:
    a. No physical works or changes to the stream environment;
    b. Culvert roughness values from the FMP model;
    c. Climate change allowance of 20% increase in extreme rainfall event;
    d. 20% blockage;
    e. No allowance for freeboard.

3. The "with project" and "without project" models should both be run for the:
    a. 1:10 year ARI event; and
    b. 1:25 year ARI event; and
    c. 1:100 year ARI event.

Output from the Flood Model re-run:

As per the email from James Beban dated 15 April 2020, the output from the Flood Model re-run will be as follows:

4. An updated flood hazard assessment which:
    a. Describes the changes to the flood model, including how the removal, addition, or replacement of local access bridges is undertaken as this is a change in modelling approach reflecting the property-scale (rather than catchment-wide) nature of this use of the Pinehaven model.
    b. Addresses the effects of the changes to the flood model (including maps showing flood levels and extents and assessment of the level of effects on all properties where there is an increase or decrease in flood level/extent) for the 1:25 year and 1:100 year ARI events. Where there is an increase in flood water depths, clarification on where on the properties this flooding occurs. If the increased in flood depths occurs around any respective dwelling, then property floor levels relative to flood depths should be provided to allow for the impacts on these dwellings to be determined.

Provision of the information described in 1 to 4 above, will provide the basis to be able to provide clarification to the following enquiries.

5. Confirmation on where the increased flood depths on 9 Birch Grove and 7 Pinehaven Road are occurring (for example, in the river channel or on the property) in the 1:100 year event and whether these increased depths affect the dwellings on these properties. If so, what are the resulting effects on the dwellings?

6. Clarification on where the increased flood depths on 54 and 56 Whitemans Road are occurring in the 1:100 year event and whether these increased depths affect the dwellings on these properties. Clarify what works at the top of these banks is occurring to protect these properties as reference in the flood hazard assessment. Will these have downstream effects? Do these require resource consent? Should they be included in the flood model?

7. If the modelling indicates increased flooding occurring on any other properties, the extent and depth of flooding will be reported, as will whether these increased depths affect the dwellings on these properties.

8. Present the 1:100 year flood information in the same table format as is the case for the 1:25 year event, namely flood levels. This allows for comparison between the events to be made. It would also allow for some explanation on what the increased flood depths occurring in the 1:100 year flood event are acceptable.

9. Comment on the results of the 1:10 year (including climate change) flood modelling in comparison to observed flooding resulting from the December 2019 flood event.

10. Confirmation on whether any discussions have occurred with the owners of 9 Birch Grove or 7 Pinehaven Road regarding their increased flood depths and what their comments were.

Appendix 6 – Mr Michael Law's Advice

From: Michael Law <Michael.Law@beca.com>
Sent: Tuesday, 29 October 2019 2:57 PM
To: Kinley, Peter; Elliot Tuck; Jarad.Sinni@jacobs.com
Cc: Josie Burrows; James Beban
Subject: GWRC-WW Pinehaven stream works model review

Peter and Jarad

Thank you for coming into the Beca office last week to discuss the review of the Pinehaven model. From our perspective, it was useful to understand the development of the baseline model since the July 2015 review, and then to consider what changes have been made to represent the proposed stream works.

Summary of 22 October meeting:

- Beca explained our understanding of the review requirements

- Jacobs:
  - Described the two separate consents being sought; for stream channel improvements and two culverts. Modelling covers both consents.
  - Two model scenarios have been modelled:
    - Base model, based on the updated version of the model reviewed in 2015.
    - Full works (model run 'detailed design Rev 7'. *Brief discussion on the issue of the hydraulic effects of the culverts being installed but the stream works not proceeding.*
  - Explained that they had inherited the SKM model and there was an expectation that model should be used (with appropriate updates)
  - The 'MWH' hydrology has been retained, noting the corrections made following the July 2015 review. That includes adjustments for climate change based on MfE 2008 guidance. *We discussed the need to update the climate change allowance in line with MfE 2018 guidance. Peter and Mike spoke on the phone on 24 October, where peter indicated that Jacobs would be adjusting the hydrology to account for MfE 2018.*
  - Provided Beca with 'final' versions of the model, reports, documents, etc so as not to swamp Beca with information. However, draft or other information can be provided as requested, and especially if it helps to close out any issues raised.

- Discussion on model updates and design, including:
  - Input locations for hydrology
  - Size of sub-catchments
  - Grid size, and grid not mesh.
  - 2013 LiDAR update
  - 2015 and 2018/9 topo survey and cross-section updates. *No works below 200 mm above channel bed. Existing control weirs to be retained*
  - Change in channel alignment, and effect on model chainages. *Jarad to provide Elliot with a list of adjusted chainages.*
  - Floodplain and channel roughness coefficients. No change to base model, but 'full works' model roughness has been updated to reflect channel changes
  - Culvert blockage parameters, and the tasks associated with modelling blockage.
  - The bypass weir; how it controls flow into the bypass and how it is modelled, noting that the weir is not being lowered as part of these design work.

- Elliot and Jarad navigated through the model so that Elliot is aware of the model layout (and sections of stream that are effected by the proposed works) and confirmed where to find the latest model parameters.

Elliot and I will have the draft review of the model completed and provided to GWRC by 8 November. However, we'll give you a call if there are any questions that we think can be answered with a brief conversation and note that in the review. As with the 2015 review, we will use a 'traffic light' system to show whether there are any issues with the model parameters that we review.

Regards

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Pinehaven Structural Works - Technical Review - Flooding

Peer Review

Prepared for Greater Wellington Regional Council
Prepared by Beca Limited

2 December 2019

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Contents

Revision History

Revision Nº	Prepared By	Description	Date
1.0	**Michael Law**	Draft for Modeller comment	11 November 2019
2.2	**Michael Law**	Reviewer response to Modeller comments	21 November 2019
3.0	**Michael Law**	Response to further Reviewer and Modeller comments	2 December 2019

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Elliot Tuck and Michael Law**		2 December 2019
Reviewed by	**Michael Law**		2 December 2019
Approved by	**Michael Law**		2 December 2019
on behalf of	Beca Limited		

1 General information

This document summarises our review of the 2019 flood model for the Pinehaven catchment in Upper Hutt. The review process should not be considered complete until any issues identified have been suitably addressed and closed by the reviewer (See sections 4 to 7).

The model may be updated as part of an ongoing process of model use, improvement and review through the project.

2 The scope of our review

We have been provided a hydraulic model, developed by Jacobs (summary information in Figure 2-1). The hydraulic flood model and associated hydrological model were originally developed by Sinclair Knight Merx and MWH respectively between 2008 and 2010 for Greater Wellington Regional Council's (GWRC) Flood Management Plan for Pinehaven. The models were audited in 2015[1] by Beca for GWRC.

Our scope is to review the current version of the hydraulic flood model and associated information. We have undertaken a review of the model assumptions, the model logic and the results based on the information provided. We have not undertaken a review of the hydrological model used to provide the input hydrographs to the hydraulic model, as this was not part of the scope. The focus has been on the modelling of the stream between Pinehaven Reserve and the Bypass Weir as this is the reach subject to the proposed works. The review has not revisited the hydraulic modelling of catchment upstream of Pinehaven Reserve.

Figure 2-1 Review information

Job name	**Pinehaven Structural Works - Technical Review - Flooding**
Model description and purpose	The model is a 2-way coupled (MIKE11 and MIKE21) model adapted to represent the proposed stream works in Pinehaven Stream. The model was previously constructed to quantify flood risk in the catchment.
Model developed by	Jacobs
Modeller's name(s)	Peter Kinley and Jarad Sinni
Reviewer's name(s)	Michael Law and Elliot Tuck
Review date	11 November 2019
Model software/platform and file	Hydraulic flood model - MIKE by DHI
Key features	• Pinehaven Stream and instream structures represented in 1D • Floodplain represented in 2D, developed using LiDAR
Model report file name & date	Pinehaven Stream Improvements, Flood Hazard Assessment, written by Jacobs for Wellington Water Ltd. 19 September 2019.

[1] ***Pinehaven Stream – Flood Mapping Audit,*** Beca Ltd for GWRC. 13 July 2015 (Beca 2015)

3 Our review methodology

Our model review rating scheme provides a standardised approach to our review and makes it clear where action is required (Figure 3-1). This also allows us to suggest areas for more general improvement; these can be addressed as part of this work or incorporated into similar models in the future.

Our rating scheme assigns a score of 0-3 for each item reviewed.

- Scores of 0 and 1 are generally for information only and are unlikely to impact the modelling outcomes.
- A score of 2 is classed as a major issue. However, one which could be accepted if addressed or if more detail is provided. The issue may be closed and be considered fit for use for this project, even though an un-resolved issue remains.
- A score of 3 is a fatal flaw that is likely to require a reasonable amount of investigation/rework to be accepted or may invalidate the model findings.

Figure 3-1 Review framework

Description	Review Rating	Fit for use[2]
No issue: The element or parameter being reviewed is modelled acceptably	**0**	**Yes**
Minor issue: There is an issue, but it is unlikely to significantly affect model results.	**1**	**Yes**
Major issue: Failure to resolve the issue compromises the model and should be rectified but may be resolved by explanation or acceptance of model limitations.	**2**	**Yes, No or Review.** *Issue may be closed or remain open*
Fatal flaw: Failure to resolve this issue severely compromises the model and should be rectified before the model is accepted.	**3**	**No**

The review is tabulated in Section 4 and includes room for the Modeller to respond to the Reviewer's comments, and for the Reviewer to close out each issue.

[2] The 'fit for use' categorisation refers to the use of the model for the stream works project only, and does not reflect its suitability for other purposes or future modelling.

4 Model review

4.1 Information Received

The following information has also been received from the modeller

- Catchment shapefile: Lidar_Catchments_Pinehaven_Backup.shp
- Reports:
  - ***Pinehaven Stream Improvements, Flood Modelling Draft Flood Modelling Report***. Jacobs for Wellington Water Ltd, December 2017 (Jacobs 2017).
  - ***Pinehaven Stream Improvements, Flood Hazard Assessment***. Jacobs for Wellington Water Ltd, September 2019 (Jacobs 2019a).
- Memorandum
  - ***Addendum to the Pinehaven Stream Improvement Works, Pinehaven Road Culvert and Sunbrae Drive Culvert Flood Hazard Assessment Reports.*** From Peter Kinley (Jacobs) to Josie Burrows (GWRC), James Beban (UHCC), and Mike Law (BECA). 27 November 2019. (Jacobs 2019b). *The 14 November draft version of the addendum was reviewed in the 21 November version of this report.*
- Response to draft review culverts; ***Jacobs Response to Beca Modelling Review Draft Report - 13-11-2019.xlsx***, emailed to Josie Burrows (GWRC), James Beban (UHCC), and Mike Law (BECA) by Helen Anderson (Jacobs). 13 November 2019.
- MIKE model files listed in Figure 4-1,

Figure 4-1 Model files

Model	Mike 11	Mike 21	Results
U2_0 Base Case	• Pinehaven_U2_0_Q25_CC.sim • Pinehaven_U2_0_Q100_CC.sim • Pinehaven_U2_HB.hd11 • U2_Q25CC_CC_2hr_HB.bnd11 • U2_Q100CC_2hr_HB.bnd11 • Pinehaven_U2_0.nwk11 • Pinehaven_U2_0.xns11 • Final_Q25_CC_2hr.dfs0 • Final_Q100CC_CE_2hr.dfs0	• Pinehaven_U2_0_Q25_CC.m21 • Pinehaven_U2_0_Q100_CC.m21 • DD_GWRC_TrA_2m_NZMG_Clip4.dfs2 (A number of versions delivered but this appears to be the one used) • InitialDD_GWRC_TrA_2m_NZMG_Clip4.dfs2 (A number of versions delivered but this appears to be the one used) • Pinehaven_NZMGClip_2m_resistance1.dfs2	• Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CC.dfs2 • Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CC.re11 • Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CCHDAdd.res11 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CC.dfs2 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CC.res11 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CCHDAdd.res11

Model	Mike 11	Mike 21	Results
Detailed Design Rev7 (50 BMR Flood wall removed)	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.sim • Pinehaven_DetDesign_Iteration7_Q100_CC_0.sim • Pinehaven_PrelimDesign_PVR04_STAGE2_HB_0.hd11 • UG1_PVR04_STAGE2_Q25CC_CC_2hr_HB.bnd11 • UG1_PVR04_STAGE2_Q100CC_CC_2hr_HB.bnd11 • Pinehaven_DetDesign_Iteration7_0.xns • Pinehaven_DetDesign_Iteration7_0.nwk11 • Final_Q25_CC_2hr.dfs0 • Final_Q100CC_CE_2hr.dfs0	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.m21 • Pinehaven_DetDesign_Iteration7_Q100_CC_0.m21 • Bathy_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2 • Initial_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.dfs2 • Pinehaven_DetDesign_Iteration7_Q25_CC_0.res11 • Pinehaven_DetDesign_Iteration7_Q25_CC_0HDAdd.res11 • Pinehaven_DetDesign_Iteration7_Q100_CC_0.dfs2 • Pinehaven_DetDesign_Iteration7_Q100_CC_0res11 • Pinehaven_DetDesign_Iteration7_Q100_CC_0HDAdd.res11

4.2 Hydrological Model

The hydrological modelling for the Pinehaven model was developed outside of Mike by DHI using Hydstra software in 2008[3]. Jacobs informed us that the hydrological model has not changed since the models were reviewed in 2015. Therefore, this section of the review relating to the hydrological modelling underlying the hydraulic flood model review is truncated, and does not differ substantially from the 2015 model and mapping review.

[3] ***Pinehaven Stream Flood Hydrology***, report prepared by MWH for Greater Wellington Regional Council. 4 November 2008

Figure 4-2 Hydrological model review

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Software	The hydrological modelling was undertaken using Hydstra software. Hydstra is a standard software package that incorporates a catchment runoff model. It was appropriate for this level of analysis at the time of model development. However, the original model files are not available and so the hydrological modelling cannot be updated to reflect updates in rainfall inputs, allowances for climate change and changes in rainfall-runoff modelling techniques. Future hydrological modelling could be undertaken within the MIKE software.	Acknowledged that Hydstra approach appropriate for time of model development. In consultation with Wellington Water, hydrological modelling not revised to retain consistency with previous modelling. The original model files are understood to sit with GWRC, and Jacobs do not know if they can be made available. While future hydrological modelling could be undertaken outside HYDSTRA, this is a decision that would affect future projects and the review suggested is not necessary at this point.	The reviewer's understanding is that the location of the model files is not known. The hydrological modelling should be updated when resources allow, but OK for this project. **CLOSED**	2	Yes
Rainfall inputs	As noted above, no rainfall files were delivered for review. Therefore, there is no opportunity to update rainfall inputs to reflect data collected over the last ten years. Though probably not likely to result in a major adjustment of design rainfall, it would be prudent to update the rainfall inputs to the hydrological modelling.	For consistency with modelling used to support plan change and public consultation, hydrology used in preliminary modelling not updated for design modelling, in consultation with Wellington Water.		2	Yes

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Climate change	As with the rest of the hydrological modelling, the allowance for climate change has not been updated since the models were reviewed in 2015. At that time, the flow hydrograph inputs to the hydraulic flood model were increased by 16% in line with the 2008 guidance from Ministry for Environment (MfE). This was in the model provided to Beca for this review. MfE updated the climate change guidance in 2018, and this update has not been included directly in the modelling being reviewed. However, discussions with Jacobs' modellers propose to update the modelling sing a 20% increase in flows. We have discussed with GWRC and agreed that it is appropriate for this study.	In response to s92 request, 2120 climate change factor of 20% agreed with GWRC and WW. Models have been reassessed with 20% climate change factor and addendum to main works and culvert FHAs is being prepared to summarise differences between 16% and 20% climate change factors.	Jacobs provided an addendum memo dated 27 November that included a summary of the effects of increasing the climate change allowance. The memo has been reviewed. It reports there is no increase in "habitable floor polygons" inundated in the 'with culvert and stream works' modelled scenario when the climate change allowance is increased from +16% to +20%. While the results reported in the addendum are in line with what might be expected, Beca has not reviewed the model run files used to generate the results reported in the addendum. **CLOSED**	1	Yes
Catchments	Figure 4-3 shows the catchments used in the hydrological modelling. The catchments range from 0.735km² to 0.1397km². Catchments of this size are large for a detailed design model, but given the lack of detail in the hydraulic model (e.g. no stormwater pipe network) these are appropriate. Based on the 2D surface supplied with the model they appear to be delineated appropriately.	Findings and comments on catchment size acknowledged. Agreement with appropriateness of catchment size and delineation, based on resolution and detail of base model.	**CLOSED**	1	Yes

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Summary	The issues with the hydrological modelling identified in the 2015 model review persist. The hydrological model has not been updated, and allowances for climate change have been (and are being) made by factoring the output flow hydrographs rather than updating the hydrological model and inputs. Though the hydrographs used as inputs for the hydraulic flood model are still acceptable for the current stream works project, we recommend that the hydrological modelling should be updated either as part of this project or in the next couple of years. This is for the following reasons: • The hydrological modelling is ten years old, and does not account for additional rainfall records, changes in recommended allowances for climate change, and updates to hydrological methods. • The original hydrological model files are not available. • The hydrological modelling could be incorporated within the MIKE hydraulic flood model	Acknowledged that Hydstra approach appropriate for time of model development. In consultation with Wellington Water, hydrological modelling not revised to retain consistency with previous modelling. Support the recommendation to update the hydrological modelling in the next couple of years.	As per previous comments, issue closed but recommendation that the hydrological model is updated when resources allow. **CLOSED**	2	Yes

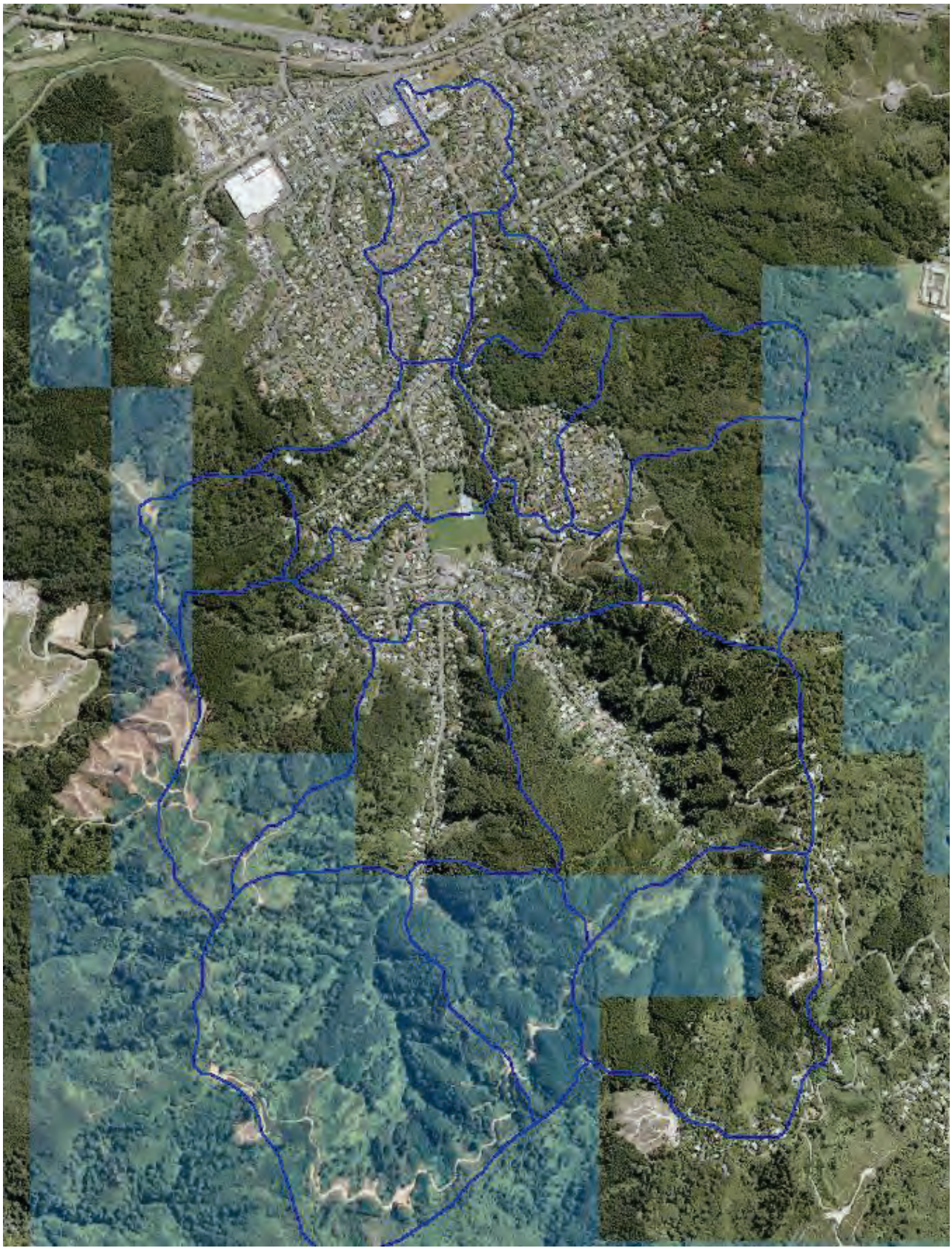

Figure 4-3 Hydrological catchments

4.3 Hydraulic Model

The hydraulic flood model has been built within MIKE by DHI software, with MIKE21 (2D) and MIKE11 (1D) elements. The review considers the MIKE21 elements first, then MIKE11 and finally the results

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
MIKE21					
Grid/Mesh	• Model includes two gridded surfaces; representing Base (pre) and Design (post) proposed stream works • Model updated with 2013 LiDAR • The model uses a grid of 2x2 m. This is an appropriate level of detail, and more refined than the 5x5 m grid reviewed in 2015. • The extent of the grid is such that the flood plain is covered. This is confirmed by the 100-year ARI results showing that that no water is glass-walling at the edges of the grid. • The Pinehaven Stream between Pinehaven Reserve and Whitemans Rd has been blocked out of the grid where M11 is present to prevent double counting. • The blocking out has been increased in areas of stream widening (this matches changes to the M11 cross-sections) as indicated by the red areas in Figure 4-4. • The stream centreline and mesh blockout at 28 Blue Mountains Rd between the Design model and Base model is slightly different.	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**

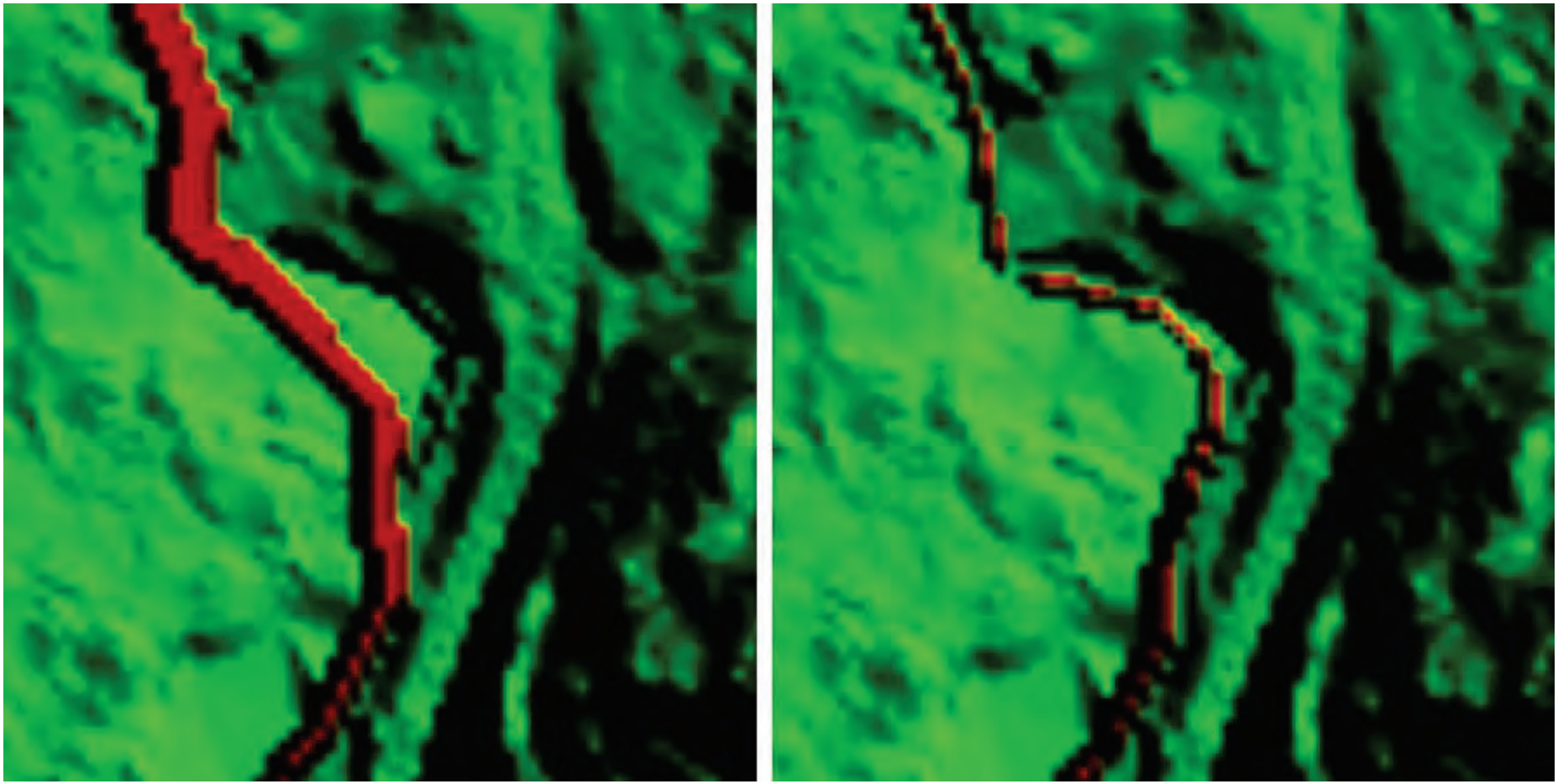

Figure 4-4 Changes to DEM – Design model on the left and Base model on the right

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
MIKE21 (continued)					
Roughness	A resistance map has been used for both models. Roads = 50 / 0.020n Parks = 28.57 /.035n Bush = 6.67 / 0.150n Residential = 10 / 0.100n These resistance values are appropriate	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Flood/Drying	Drying = 0.01 Flooding = 0.02.	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Timestep	0.5 second	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Initial Surface elevation	This looks appropriate, but the origin of the initial surface should be noted.	Agreement with findings and comments noted.	**CLOSED**	1	Yes
MIKE 11					
Runoff input	See review of hydrological inputs above. Catchment runoff hydrographs have been applied directly to the stream (MIKE11) at the locations listed in Figure 4-5. Where appropriate the catchments, or portions of, have been distributed along a length of channel or as a point source. This is standard practice but may not account for network discharges and local topography. Has the proportioning considered overland flow paths and/or pipe network discharges?	See comments on review of hydrology above. Allocation of loads to the network has not been changed from the previous model. The design may have an effect on the allocations, but any effect will not be significant or measurable.	Reviewer agrees that allocation of loads is not likely to have a material effect on the relative effect of the proposed stream works given that the design events are greater than the expected capacity of the stormwater network. **CLOSED**	**1**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Other boundary conditions	Downstream boundary conditions have been applied to Hull Creek (at both eastern and western ends). One is a Q/H table and the other a fixed water level (44.22mRl). What event does the fixed water level represent, and please state whether the model results in the stream works reach are sensitive to the downstream boundary conditions.	Due to the steepness of the catchment and distance from the downstream extent to the project reach, the model results within the project reach are not expected to be sensitive to the downstream boundary conditions. The variability of water levels in the Hulls Creek branch was checked and found to vary by up to 5mm for the events studied, with a median value of 2mm. This is within the limits that the software can predict water levels and shows the model is not sensitive to the boundary condition at Hulls Creek.	The reviewer agrees with the modeller's response. CLOSED	**1**	**Yes**

	Boundary Description	Boundary Type	Branch Name	Chainage	Chainage	Gate ID	Boundary ID
1	Open	Q-h	HULL_CREEK	1078	0		Dummy_Boundary
2	Open	Water Level	HULL_CREEK	0	0		Dummy_Boundary
3	Open	Inflow	ELMSLIE_RD	0	0		Catchment_A
4	Distributed Source	Inflow	ELMSLIE_RD	0	853		Catchment_F
5	Point Source	Inflow	ELMSLIE_RD	994	0		1/3_Catchment_H
6	Open	Inflow	JOCELYN_CRES	0	0		Catchment_E
7	Point Source	Inflow	JOCELYN_CRES	334	0		1/3_Catchment_H
8	Point Source	Inflow	JOCELYN_CRES	522	0		1/3_Catchment_H
9	Open	Inflow	WYNDHAM_RD	0	0		Catchment_I
10	Open	Inflow	FENDALTON_CRE	0	0		Catchment_G
11	Distributed Source	Inflow	FENDALTON_CRE	117	296		Catchment_K
12	Distributed Source	Inflow	FENDALTON_CRE	340	680		Catchment_L
13	Open	Inflow	PINEHAVEN	0	0		Catchment_B
14	Open	Inflow	UPPER_PINEHAVE	0	0		Catchment_C
15	Distributed Source	Inflow	PINEHAVEN	135	1029		Catchment_D
16	Distributed Source	Inflow	PINEHAVEN	1365	1866		1/2_Catchment_J
17	Distributed Source	Inflow	PINEHAVEN	1949	2426		Catchment_M
18	Point Source	Inflow	PINEHAVEN	2432	0		Catchment_N
19	Point Source	Inflow	PINEHAVEN	2599	0		1/4_Catchment_O
20	Point Source	Inflow	PINEHAVEN	2734	0		1/4_Catchment_O
21	Point Source	Inflow	LOWER_PINEHAV	64	0		1/4_Catchment_O
22	Point Source	Inflow	LOWER_PINEHAV	268	0		1/4_Catchment_O
23	Distributed Source	Inflow	WYNDHAM_RD	130	771		1/2_Catchment_J

Figure 4-5 Hydrograph input locations

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Cross-sections	• Design drawings of the proposed cross-section have not been received and therefore we cannot comment on the representation of these in the model. We are limited to comparing the design cross sections to those in the Base case model. • The stream works detailed in the *Pinehaven Stream Improvements* report appear in model chainages Ch 1488 – 1604 inclusive; and Ch 1838 – 2430 inclusive (2017 12d design). An example is shown in Figure 4-6 for cross-section 1496. • The lower ~200mm of channel has been left the same as the Base model representing no modification to this portion of the cross-section • The design cross-sections contain vertical walls (approx1.5m high). Note that if these can't be achieved due to stability etc any changes to the side slopes would need to be re-modelled as it may result in a loss in conveyance.	Additional survey was collected to update the quantity and resolution of stream cross-sections from what was represented in the preliminary models. Proposed cross-sections included reference to updated survey information where applicable. In vertical cross sections, up to a 2-inch per row of blocks may be integrated into the proposed design. Following completion of final design of the block walls, if a batter is proposed, a check will be performed on all cross sections to confirm that the effective flow area is not decreased (it is noted this may extend top of bank extents by a nominal amount).	We agree with the modeller's response. Checks should be made to the final design cross-sections to confirm that the hydraulic performance meets the performance of the reviewed model. **CLOSED**	1	Yes

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Roughness	• The edges of some design cross-sections have had roughness increased to represent walls, though the material is not stated. Ch1838-1847 has High/low roughness zones, whereas CH.1854-1883 does not. Without a set of drawings/design can't comment if these are appropriate. • 0.035n Global roughness in both models Fresh plains (extensions of the channel below the bank level to accommodate 'fresh flows') / planted benches appear to have been created in some of the design cross-sections, including cross-section 1854 (Figure 4-7). If they are to be planted, then no account has been taken of the change in model roughness. Modeller to confirm whether changes in roughness have been, or need to be, made.	Comments acknowledged. Where roughness was used to represent existing private bridges, walls or other structures in the model, appropriateness of the roughness factors was confirmed with Wellington Water. It is expected that the final planting plan and recommended maintenance practices will be consistent with roughness factors used in the model in 'fresh plains' areas below the proposed top of bank and that changes to roughness represented in the model will not be required. The roughness values used were reviewed internally and with our client to confirm they are appropriate.	The channel roughness factor used are appropriate for the stage of design. The modeller should confirm that the appropriate roughness is used when the "final planting plan and recommended maintenance practices" are confirmed. **CLOSED**	**2**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Stream works					
Culverts	• A replacement culvert is included in the design model at Pinehaven Rd 4.05m x 1.81m (existing is 2.96m x 1.54m). Inlet loss applied but we can't confirm if this is correct without inlet details. • A new culvert at Sunbrae Dr has been included as 6 m x 1.5m (existing is 1.785m dia). Again, the appropriateness of the inlet loss is to be confirmed. • If the culverts are to have natural bed materials (to facilitate fish passage) then the roughness should be increased on the base? Modeller to confirm	13/11/19 - The replacement culvert at Pinehaven Road is 4.0m x 2.5m (including 700mm embedment) and the replacement culvert for Sunbrae Drive is 6.0m x 2.0m (including 500mm of embedment). Inlet losses have been adopted from the previous modelling. As the design is likely to improve inlet efficiency the parameter values adopted are likely to be conservative. The roughness values used were reviewed internally and with our client to confirm they are appropriate.	Updated 29/11/19 Noting that the culverts are embedded, the Reviewer questioned whether the culvert roughness used of n=0.015 was too low, and suggested that n=0.025 may be more appropriate if the whole width of the channel was a natural bed. Subsequent discussion with the modeller confirmed that only the middle third of the channel would be natural. It was agreed that a culvert roughness of n=0.020 was appropriate, and that results based on this should be used to inform the consent application. The effects of using n=0.020 could be interpolated from the Iteration 9 and Iteration 10 model runs, which used culvert roughness of n=0.015 and 0.025 respectively. If the latter approach is taken, then the model must be run with the appropriate culvert roughness at the final/detailed design stage of the culvert and stream works to confirm compliance with design criteria. On the bases of these discussions, the issue has been addressed to the Reviewer's satisfaction, and the model considered fit for use once run with a culvert roughness of n=0.020. The issue can be **CLOSED** once that is done. *Note that the Reviewer has not commented on whether a change in water levels (as a result of increasing the culvert roughness) changes whether the proposed design meets freeboard performance criteria in the design events.*	**2**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Bridges	Bridges in the model have been modelled as culverts. Given their scale this is appropriate.	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
Other structures	The modelling of the bypass weir has been updated since 2015 review. In speaking with Jacobs, the weir length has been adjusted to account for actual length and then adjusted for effective length. Doesn't change between Base and Design models	Noted, agreement with comment. No changes have been made to the bypass weir between the (updated) Base and Design models.	**CLOSED**	**0**	**Yes**
Initial water level/flow	Initial water depths remain the same between the two models	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
MIKE Flood					
Lateral coupling	Coupling is the same between base and design models using default setting. A combination of left and right (or both) coupling depending on the location. All seems appropriate.	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
Coupling parameters	Default figures have been used	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**

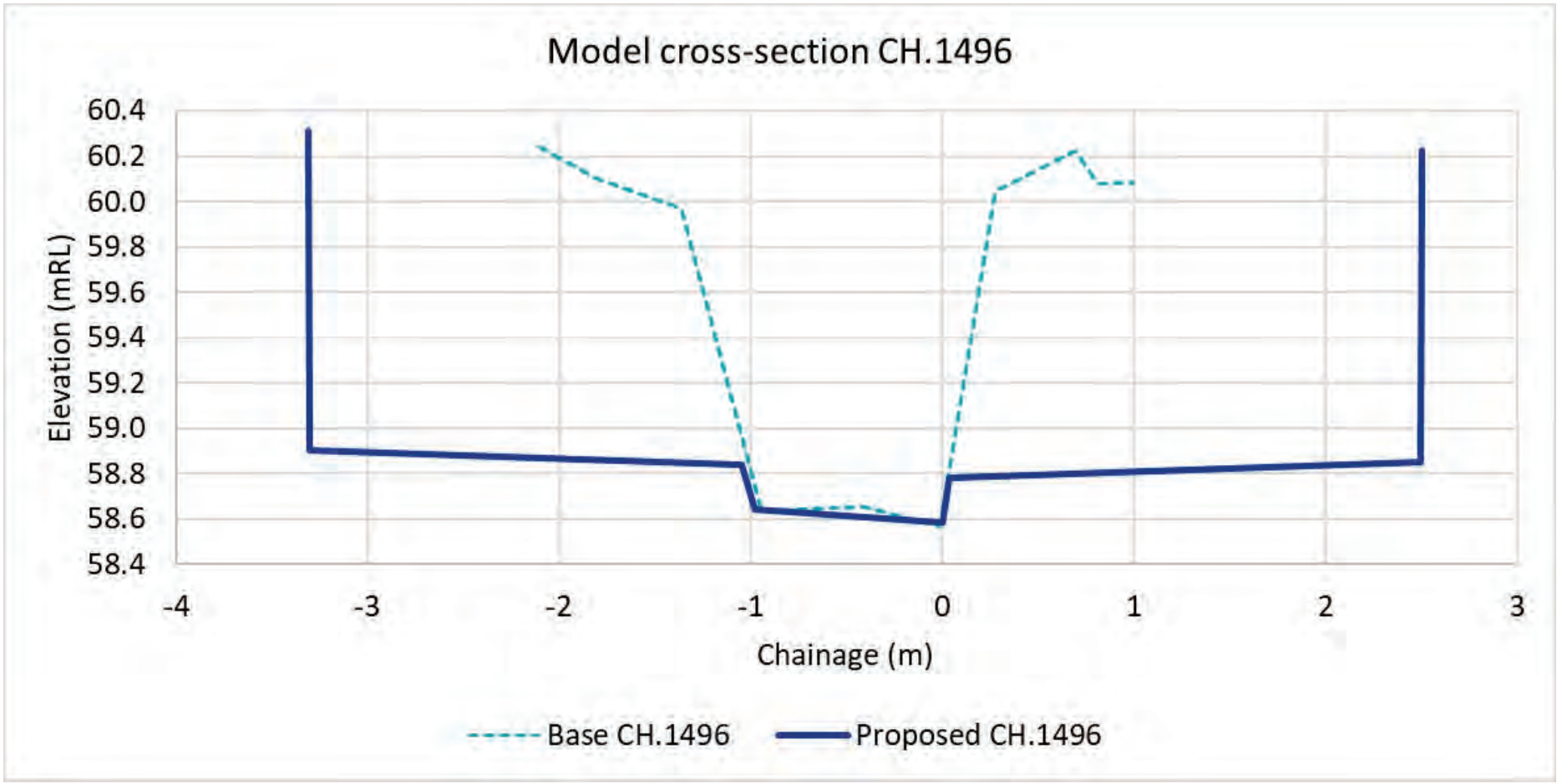

Figure 4-6 Cross-section 1496

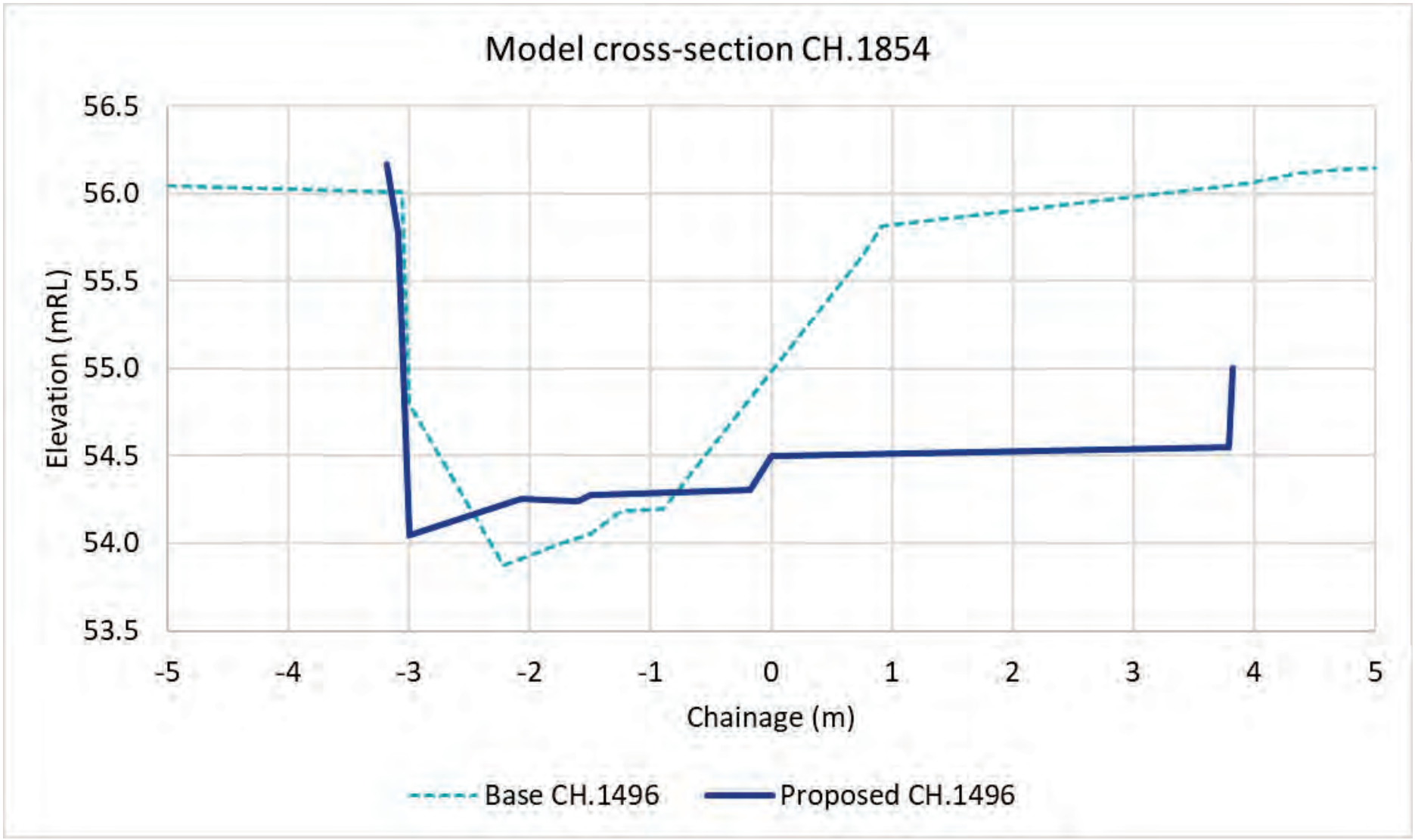

Figure 4-7 Cross-section 1854

4.4 Results

We note that there is a significant reduction in flooding downstream of Pinehaven reserve.

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Blockage testing	No blockage testing appears to have been undertaken. It would be appropriate to test the sensitivity of the existing Base case culverts/bridges and Design culverts to blockage. This could be done using a method such as developed for ARR that accounts for the availability and mobility of debris, and the size of the culvert in setting an appropriate amount of blockage to model.	Blockage assessments for the base scenario and for the Pinehaven Road and Sunbrae Drive culverts were completed and results can be provided, however there have been changes to the design since this blockage analysis was completed and we have not assessed whether the findings are still valid. A blockage assessment for the design will be provided once it is complete.	This issue is not expected to adversely affect the relative effects of the stream works, and so does not materially affect the 'fit for use' categorisation. However, the Reviewer notes that testing is ongoing and so the issue will remain open until that is completed. **OPEN**	2	Yes
MIKE11 Water levels	The HGL plot in Figure 4-8 and Figure 4-9 shows that the 100-year ARI event water levels are reduced in most stretches of the stream due to the stream widening and larger culverts. Two sections have increased in water level. • The piped section in and upstream of Pinehaven Reserve. This is unexpected, as we assumed that there were no changes in this reach and do not expect it to be affected by the stream works. Is the modeller able to explain this? • A short section at Ch.1600. Near 2A Freemans Way (as stated in the executive summary of the Flood Hazard Assessment report)	The piped section in Pinehaven Reserve was not checked because it is outside the area of main channel works. Differences in water level do not affect containment within the channel (as this is a piped section) or habitable floor flooding (as the area is a reserve). Near 2A Freemans Way there are no channel works proposed. The differences are thought to be due to a combination of channel works upstream directing more flow into this reach instead of entering the Birch Grove area and a slight change in timing of the flood peak.	Uncertainty over the cause of the raised water levels through the reserve is not expected to adversely affect the relative effects of the stream works, and so does not materially affect the 'fit for use' categorisation. However, the Reviewer notes that the issue is not resolved and so the issue will remain open **OPEN**	2	Yes
MIKE21	Downstream of Pinehaven reserve there is a significant reduction in flood levels. These are replicated in both the M11 water levels and the M21 results (Figure 4-10).	Noted; agreement with comment.	**CLOSED**	0	Yes

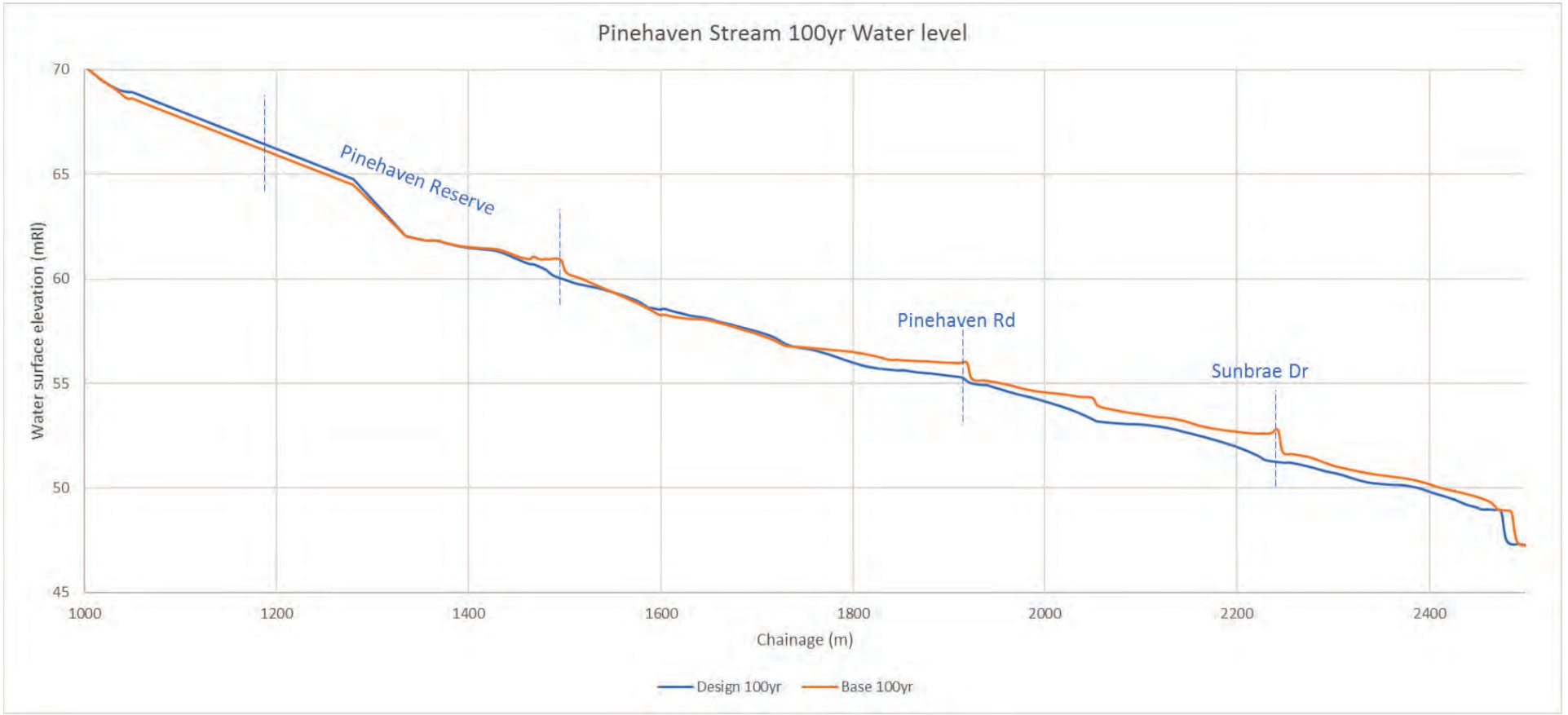

Figure 4-8 100-year ARI long-section

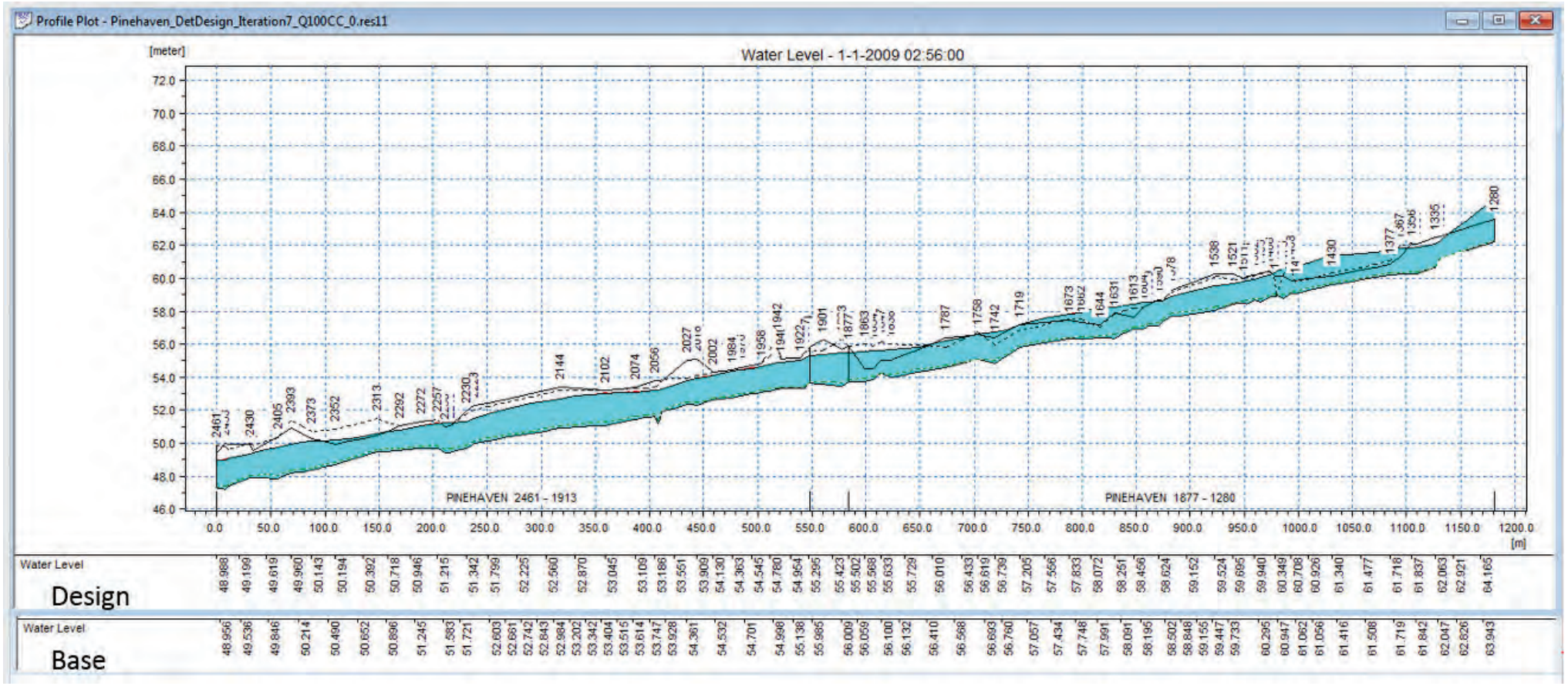

Figure 4-9 100-year ARI hydraulic grade line (Clip from MIKE View)

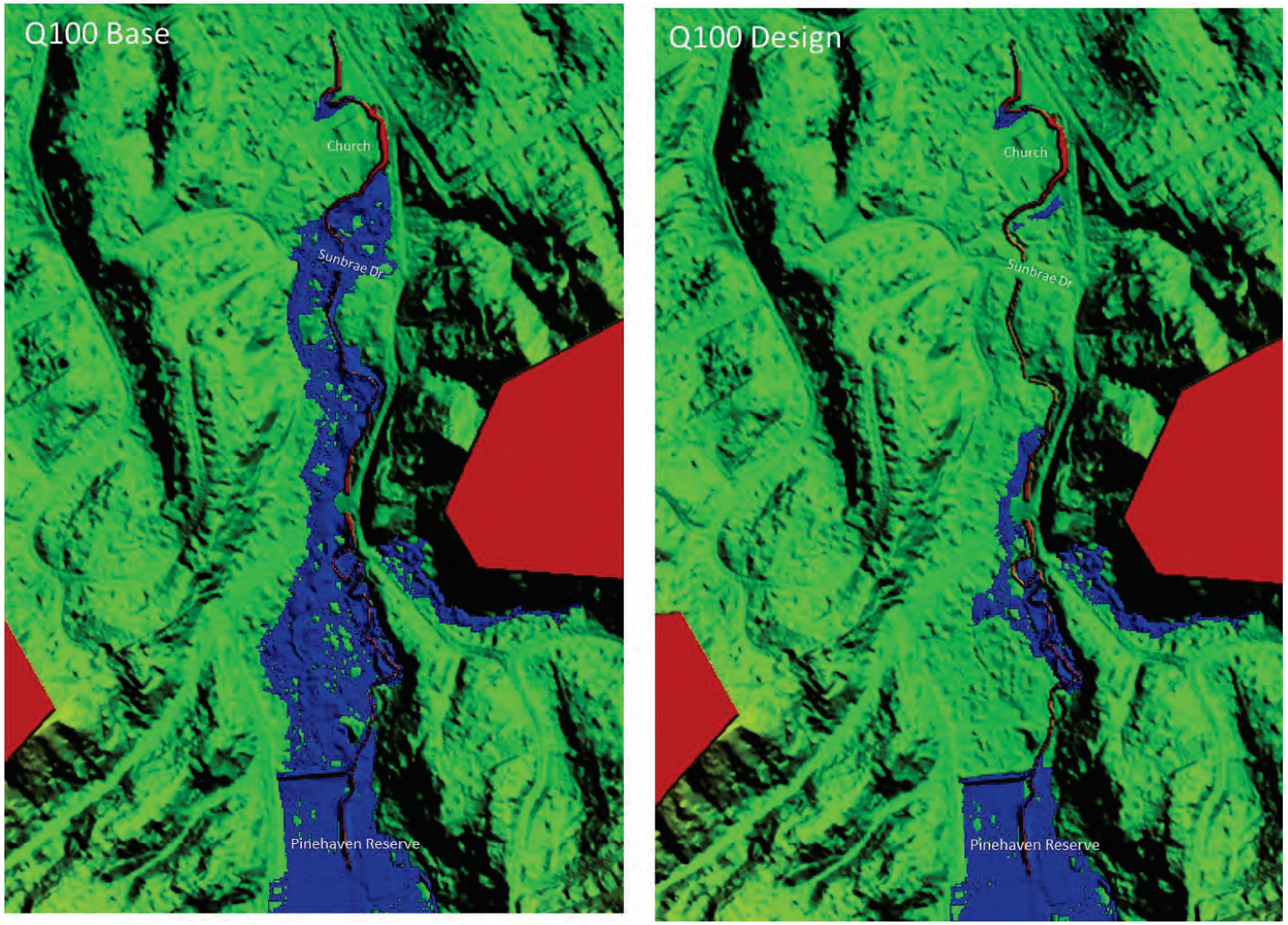

Figure 4-10 100-year ARI MIKE21 (2D) flood extents.

5 Commentary on reports

Beca were provided with three reports to provide background and update information on the recent flood modelling.

5.1 Draft Flood Modelling Report (Jacobs 2017)

This report describes the updates to the 2009/2010 Existing Case Model to incorporate new LiDAR and channel cross-section information, and the modelling of preliminary design options as they were in 2017. We note that the channel cross-sections were only updated for the reach between Pinehaven Reserve and Whitemans Road; the reach that is to be subject to stream widening.

The changes to the Existing Case Model are reported to have generally reduced peak flooding depths and levels (and the number of properties affected by flooding), and explained in Section 5 of the report as:

> *"The difference in flooding depths can be explained by two factors. Firstly, the smaller grid size which means the Updated Existing Case Model incorporates increased definition of both low-lying and raised areas. Secondly, the cross-sections from the 2015 survey provided more channel capacity in some locations which reduced the overland flooding."*

We note that:

- The two improvements to model definition are in line with recommendations made in Beca's 2015 audit of the flood modelling and mapping (Beca 2015).
- The report confirms that the hydrological inputs were unchanged from the 2009/2010 Existing Case Model, which meant that the allowance for climate change was based on MfE's 2008 guidance.
- An assessment of freeboard was not included in the report, though it is noted that this is to be carried out at detailed design stage.
- The 2017 preliminary designs for the Pinehaven Road and Sunbrae Drive culverts described in the report are different from the culvert designs presented in 2019.
- The Preliminary Design of channel widening, and replacement road culverts, reduces the number of properties affected by flooding. The modelling described does not consider the effect of modelling the culvert upgrades in isolation.
- Though two years old, the report is flagged as Draft. We assume that a Final version of the report has not been produced.

Though we have not reviewed the 2017 model, the report provides a fair reflection of the updates noted in the 2019 version of the Existing Case Model. We did not note any obvious errors in the report.

5.2 Flood Hazard Assessment Report (Jacobs 2019a)

The Flood Hazard Assessment Report does not describe the changes in the modelling that are described in Jacob 2017. Rather, the report summarises the objectives of the Pinehaven Stream Improvements Project, the proposed works, the results (in terms of flood levels and properties affected by flooding) and an assessment of the effects. This is appropriate for the target audience of the report, but does require the report to reference a current version of the Flood Modelling Report.

We note that the results and effects reported are for the stream improvements including both the channel widening and replacement of road culverts. However, the road culverts are being consented separately, which could result in different effects to the combined works. We raised this with Jacobs at a meeting to kick-off this review process, and it is partially addressed in the Section 5.3.

We did not note any obvious errors in the report.

5.3 Memorandum - Addendum to the Flood Hazard Assessment Report (Jacobs 2019b)

In response to a question raised (during the initial phase of this model review) about the ongoing use of hydrology incorporating MfE's 2008 guidance on allowances for climate change, Jacobs provided an addendum to the Flood Hazard Assessment report on 27 November 2019[4]. This related to increasing the catchment flows by +20% rather than +16% to allow for climate change to represent MfE's 2018 updated guidance[5] on climate change. Separately, the addendum also summarises the effects of only upgrading the two road culverts (and not the associated channel improvements), given that these are subject to a separate consent application.

5.3.1 Increase allowance for climate change

A summary of the reported difference in water levels is provided by the following two bullet points from Page 2 of the addendum.

- *"For the 25-year flood event (4% AEP) the maximum increase in water level is 0.3 m and the median increase is 0.02 m. The highest increases in peak water level occur immediately upstream of Pinehaven Road. The maximum increase in velocity is 0.07m/s and the median increase is 0.02m/s.*
- *For the 100-year flood event (1% AEP) the maximum increase in water level is 0.11 m and the median increase is 0.03 m. The highest increases in peak water level occur at the lower end of the works, from about 20m upstream of the Bypass Inlet and downstream in the Lower Pinehaven Stream reach. The maximum increase in water level occurs at the inlet to the main Pinehaven Stream culvert in Whitemans Road. The maximum increase in velocity is 0.07m/s and the median increase is 0.03m/s."*

While those show the effect of increasing the flows on water levels and velocities, Table 2-1 on page 3 of the addendum shows that there is no increase in "habitable floor polygons" inundated in the 'with culvert and stream works' modelled scenario when the climate change allowance is increased from +16% to +20%.

While the results reported in the addendum are in line with what might be expected, Beca has not reviewed the model run files used to generate the results reported in the addendum, and the reported results pre-date the agreement on appropriate culvert roughness (n=0.020) described on page 16 of this report.

5.3.2 Installation of culvert only (no stream works)

Tables 2-2 and 2-3 on pages four and five of the addendum summarise the change in water levels due to installation of the culverts only. Water levels generally increase and at the end of page 10 of the addendum it is acknowledged that the freeboard required for the Sunbrae Drive culvert is not met in the interim (culvert only, no stream works) scenarios. Mitigation for this is proposed in the third bullet point on page 8 of the addendum.

- *"We note that there are several methods for mitigating the increased water levels downstream. For the Sunbrae Drive culvert we propose to restrict the flow into the culvert to pre-upgrade rates by installing a temporary steel plate across part of the inlet. This steel plate would be removed once the channel upgrades downstream were in place. We request that conditions around the design of the steel plate, its maintenance and the timing of its removal are included in the consent. "*

[4] A draft of the addendum had been provided on 14 November 2019, and commented on in the 21 November 2019 version of this report.

[5] ***Climate Change Projections for New Zealand – 2nd Edition***, MfE reference 1385. September 2018. https://www.mfe.govt.nz/publications/climate-change/climate-change-projections-new-zealand

As with the updated climate change scenarios, Beca has not reviewed the model run files informing these results and the model runs do not account for the revised culvert roughness.

6 Our findings

1. The model represents a build that was common (and still is in some situations) when the model was built ten years ago. It is a standard grid type model, with reasonably large catchments and no pipe network. If a model were built of the catchment today it would likely have model detail included outside of the stream, including the piped stormwater network. However, that does not mean that the model is not fit for purpose.
2. The stream now has a reasonable amount of detail and has been surveyed in critical locations. Changes have been made to the Design model but without the design drawings we cannot say if they have been represented and modelled correctly, and whether sufficient freeboard has been provided to the top of the stream bank.
3. The changes to the model do represent a reduction in flood levels within the catchment but only if the design matches that represented by the model.
4. We note that the model results do not include freeboard. This is noted in the draft modelling report (Jacobs 2017) and should be recorded on outputs so as to minimise the risk of confusion with other flood extent maps and water levels for the Pinehaven catchment.
5. The modeller has provided acceptable responses to the issues raised by the two draft versions of the review (circulated on 11 and 21 November 2019). While some issues remain categorised as level 2, most do not prevent the model for being used for this project.
6. The one issue that prevented the model being considered fit for purpose after the 21 November issue was the roughness value used in the two culverts. Subsequent discussions between Jacobs modeller and the Reviewer resulted in agreement that a roughness value of n=0.020 should be used, and that results based on this should be used to inform the consent application. Increasing the culvert roughness value would be expected to increase water levels, and so checks would be required to confirm whether water level design criteria have been met.
7. The Draft Flood Modelling Report (Jacobs 2017) and Flood Hazard Assessment Report (Jacobs 2019a) provide good descriptions of the modelling undertaken and flooding results. Beyond the issues raised in the model review (Section 4) there are no significant issues raised by the reports
8. The Addendum to the Flood Hazard Assessment Report (Jacobs 2019b) addresses an interim solution to accommodating MfE's 2018 guidance on climate change. However, we recommend that the model hydrology is updated when resources allow. Information provided in the addendum acknowledges that the two road culverts are to be consented separately from the other stream works, and describes the effects of upgrading the culverts in isolation. The results presented in the addendum pre-date the agreement to revise the culvert roughness (Item 6).

7 Conclusion

The model is only considered fit for use to describe the relative changes in flood level and confirm a reduction in the number of properties affected by flooding. If absolute flood levels are required, the culvert roughness must be closed out for the model to be fit for use.

Other issues may be addressed at detailed design and as agreed with Greater Wellington Regional Council.

8 Use of this report

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

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Greater Wellington Regional Council
PO Box 11646
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New Zealand

15 March 2020

Attention: Josie Burrows

Dear Josie

Pinehaven Steam Works - Comments on S92 response

I have reviewed the information emailed by Jacobs to you at Greater Wellington Regional Council (GWRC) on 21 February 2020 and 26 February 2020. You provided all of the information to me on 26 February 2020 by forwarding the original emails from Jacobs. The information comprised:

- Email from Rory Smeaton of Jacobs to you, dated 21 February 2020. This contained two attachments:
  - *IZ089000-LT-EP-0003 Pinehaven Stream Improvements s92 Response - Submissions - GWRC Rev1 - DRAFT FOR DISCUSSION.pdf.* **(Rev1).** Letter from Helen Anderson of GHD (on Jacobs headed paper) to you, dated 21 February 2020. The letter states that there are two appendices:
    - *Appendix A:* Table 1, a tabulated draft response to the Section 92 request sent to Jacobs on 23 January 2020.
    - *Appendix B:* A comparative assessment of the 8 December 2019 event.

    Appendix A is part of the PDF, but Appendix B is not part of the PDF. However, it is attached to Rev2 (see below).
  - *IZ089000-LT-EP-0001 Pinehaven Stream Improvements s92 Response - GWRC Rev3 w Appendices.pdf.* **(Rev3).** Letter from Helen Anderson of GHD (on Jacobs headed paper) to you, dated 21 February 2020, and including six response tables to Section 92 requests sent to Jacobs on 3 December 2019. The response tables each addressed a different technical area and were attached as Appendix A to the letter. Appendices B to L provided information to support the responses in the Appendix A tables.
- Email from Rory Smeaton of Jacobs to you, dated 26 February 2020. This contained one attachment:
  - *IZ089000-LT-EP-0003 Pinehaven Stream Improvements s92 Response - Submissions - GWRC Rev2 w Appendices.pdf.* **(Rev2).** Letter from Helen Anderson of GHD (on Jacobs headed paper) to you, dated 26 February 2020. The letter is of the same format as Rev 1, with no change to Table 1, but it does include Appendix B, the comparative assessment of the 8 December 2019 event.

Below, I only provide comments on the responses that relate to issues that I have raised or that are relevant to the flood modelling. I have not provided comments on the table in Rev1, as Rev1 has been superseded by Rev2.

Comments on Rev3

Rev3 includes six tables of responses. I have only provided comments on items in Tables 3 and 4, as these relate to issues in the remit of my review. Comments are numbered in line with the numbered responses in the tables, and with reference to the additional information in appendices B to L in Rev3.

Table 3 Erosion, Scour and Flooding

- SW01 & SW02: Following Beca's model review in late 2019, Jacobs re-ran the model with rainfall increased by 20%, in line with the current recommended rainfall-runoff method for Wellington Region[1]. Jacobs' response is accepted.
- SW03: I agree that freeboard has been used in the design
- SW04: Jacobs note that the design of the bridges is ongoing, and comment that the effect on secondary flow paths is likely to be minimal. However, the effect should be checked once detailed design is provided.
- SW05: Modelled channel roughness: This was an issue raised by Beca in our model review, and in commenting on Jacobs' response to the review, we noted that "The modeller should confirm that the appropriate roughness is used when the 'final planting plan and recommended maintenance practices' are confirmed." This is an issue that will require ongoing checked between designers and modellers
- SW06: Jacobs' response accepted.
- SW07: Jacobs' response accepted.
- SW08: Jacobs' response accepted.

Table 4 Flood model and Flood Hazard Assessment

- ML01: As part of the Beca review of the modelling, we noted that we had not been able to compare the model to design drawings. That issue is still outstanding, and Jacobs' response indicates that they will not be available until the middle of the year.
- ML02: I accept Jacobs' response that this issue has been considered as part of SW03.
- ML03: Beca raised the issue of culvert roughness as part of the model review, and reached agreement with Jacobs that a roughness of n=0.020 was appropriate. Jacobs provided the results of using a roughness of 0.020, and they were in agreement with
- ML04: The Jacobs memo sent to me on 5 December 2019 was dated 4 June 2019, and from Duncan Farish (Jacobs) to Ben Fountain (Wellington Water). As such, it was using an earlier version of the Pinehaven model that did not incorporate the changes resulting from Beca's subsequent model review. However, the relative results of testing blockage will be comparable to modelling blockage using the current model.

  I note that Jacobs blocked culverts by 20%, but did not provide any reasoning in their June memo or 5 December email. Jacobs should confirm whether this is the same blockage as applied to previous modelling of the culverts for GWRC's Floodplain Management Plan. If not, the use of 20% blockage should be explained.

[1] ***Reference Guide for Design Storm Hydrology - Standardised Parameters for Hydrological Modelling***. NZ0115163 Prepared for Wellington Water Ltd by Cardno. 9 April 2019 (Cardno 2019)

Comments on Rev2

Appendix A – Table 1

Comments are numbered in line with the numbered responses in Table 1.

1 The rainfall event of 8 December did have an ARI (Average Recurrence Interval0 of about 30 years for the maximum 2 hour rainfall, so agree with Jacobs' response.

2 A comparison of the 8 December event with previously modelled design events is provided by Appendix B. As noted below, more information could have been provided.

3 Jacobs provide a reasonable explanation of the loss factors used by MWH in 2008. They are correct in stating that MWH did not use the SCS Curve Number (CN) approach, and used an initial loss and continuing loss method instead. This is appropriate if modelling a short storm, such as the 2-hour and 3-hour storms modelled by MWH. Use of SCS curve numbers is only appropriate when used in conjunction with longer storms (typically 24-hours), especially in the absence of flow records to calibrate or validate the rainfall-runoff response.

   Jacobs note that the MWH modelling was validated against the 31 July 2008 flood event that had an ARI of 2 years or less. Though better than no validation (and in this case the only recorded flow information available), this is a small event against which to calibrate the model, and the 8 December 2019 event provides an opportunity for additional detailed validation.

   With regard to whether the rainfall losses modelled by MWH were (and are) appropriate, I agree that calibration/validation would be beneficial is the MWH hydrology is to be updated. One option in the absence of a flow record for calibration would be revisit the hydrology using the current recommended rainfall-runoff method for the Wellington Region (Cardno 2019) that uses a 12-hour nested storm and SCS initial abstraction and CN losses, comparing the resulting peak flows to those modelled using MWH's methodology.

   I note the four bullet points provided by Jacobs at the end of their response, and am in general agreement with those.

4 Jacobs state that there is no requirement to redo the hydrological inputs to the Pinehaven flood model. For this stream works project, I agree. The key purpose of the modelling is to demonstrate the relative effects (and betterment) of the stream works over the existing condition.

I have no comment to make on the responses to issues 5 to 8, as they are outside the remit of my review.

Appendix B – Mapping 8 December 2019 flood event

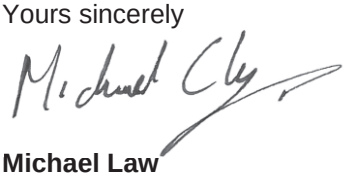
Jacobs provided a 2½ page memorandum plus annotated flood hazard maps and photos to compare the 8 December 2019 flood extents with those modelled for the modelled 10-year and 100-year ARI design events.

The focus is on flood extents, with no mention of flood levels along the stream. If post-flood surveys of trash marks, flood photographs and anecdotal reports were conducted by the councils or Wellington Water, then I would have expected the flood levels from those surveys to be compared to modelled water levels. If that information was not collected, or not made available to Jacobs, then comparing flood extents is appropriate.

The annotated maps in Attachment 2 of Appendix B appear to be overlain on GWRC's flood hazard maps from the flood management plan. Jacobs note that these maps were developed from hydrological inputs including climate change, which hampers direct comparison. Jacobs should also confirm whether those maps also include allowances from freeboard and blockage, and whether blockage was a factor during the 8 December 2019 event.

I trust that the above provides you with the information that you require. Please do not hesitate to get in touch if you have any questions, or require further clarification.

Yours sincerely



Michael Law
Senior Associate - Water Resources

on behalf of

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Pinehaven

Flood Model Re-run Scope

The Pinehaven flood model will be re-run as follows:

1. The "with project" model should include:
    a. The removal/addition/replacement of local access bridges proposed (as described in 25 March 2020 letter to the Councils);
    b. Bank works at 54 and 56 Whitemans Road (if proposed);
    c. Culvert roughness of n=0.020;
    d. Climate change allowance of 20% increase in extreme rainfall events;
    e. 20% blockage;
    f. No allowance for freeboard. i.e. the reported results are the modelled water levels and flood extents, and dynamic freeboard has not been applied

2. The "without project" model should include:
    a. No physical works or changes to the stream environment;
    b. Culvert roughness values from the FMP model;
    c. Climate change allowance of 20% increase in extreme rainfall event;
    d. 20% blockage;
    e. No allowance for freeboard.

3. The "with project" and "without project" models should both be run for the:
    a. 1:10 year ARI event; and
    b. 1:25 year ARI event; and
    c. 1:100 year ARI event.

Output from the Flood Model re-run:

As per the email from James Beban dated 15 April 2020, the output from the Flood Model re-run will be as follows:

4. An updated flood hazard assessment which:
    a. Describes the changes to the flood model, including how the removal, addition, or replacement of local access bridges is undertaken as this is a change in modelling approach reflecting the property-scale (rather than catchment-wide) nature of this use of the Pinehaven model.
    b. Addresses the effects of the changes to the flood model (including maps showing flood levels and extents and assessment of the level of effects on all properties where there is an increase or decrease in flood level/extent) for the 1:25 year and 1:100 year ARI events. Where there is an increase in flood water depths, clarification on where on the properties this flooding occurs. If the increased in flood depths occurs around any respective dwelling, then property floor levels relative to flood depths should be provided to allow for the impacts on these dwellings to be determined.

Provision of the information described in 1 to 4 above, will provide the basis to be able to provide clarification to the following enquiries.

5. Confirmation on where the increased flood depths on 9 Birch Grove and 7 Pinehaven Road are occurring (for example, in the river channel or on the property) in the 1:100 year event and whether these increased depths affect the dwellings on these properties. If so, what are the resulting effects on the dwellings?

6. Clarification on where the increased flood depths on 54 and 56 Whitemans Road are occurring in the 1:100 year event and whether these increased depths affect the dwellings on these properties. Clarify what works at the top of these banks is occurring to protect these properties as reference in the flood hazard assessment. Will these have downstream effects? Do these require resource consent? Should they be included in the flood model?

7. If the modelling indicates increased flooding occurring on any other properties, the extent and depth of flooding will be reported, as will whether these increased depths affect the dwellings on these properties.

8. Present the 1:100 year flood information in the same table format as is the case for the 1:25 year event, namely flood levels. This allows for comparison between the events to be made. It would also allow for some explanation on what the increased flood depths occurring in the 1:100 year flood event are acceptable.

9. Comment on the results of the 1:10 year (including climate change) flood modelling in comparison to observed flooding resulting from the December 2019 flood event.

10. Confirmation on whether any discussions have occurred with the owners of 9 Birch Grove or 7 Pinehaven Road regarding their increased flood depths and what their comments were.

Pinehaven Structural Works - Technical Review - Flooding

Peer Review

Prepared for Greater Wellington Regional Council
Prepared by Beca Limited

30 June 2020

make everyday better.

Creative people together transforming our world

Contents

Revision History

Revision Nº	Prepared By	Description	Date
1.0	**Michael Law**	Draft for Modeller comment	11 November 2019
2.2	**Michael Law**	Reviewer response to Modeller comments	21 November 2019
3.0	**Michael Law**	Response to further Reviewer and Modeller comments	2 December 2019
4.0	**Elliot Tuck and Michael Law**	Update following additional modelling	30 June 2020

Document Acceptance

Action	Name	Signed	Date
Prepared by	**Elliot Tuck and Michael Law**		30 June 2020
Reviewed by	**Michael Law**		30 June 2020
Approved by	**Michael Law**		30 June 2020
on behalf of	Beca Limited		

1 General information

This document summarises our review of the 2019 flood model for the Pinehaven catchment in Upper Hutt, and subsequent updates in 2020. The review process should not be considered complete until any issues identified have been suitably addressed and closed by the reviewer (See sections 4 to 9). The model may be updated as part of an ongoing process of model use, improvement, and review through the project.

We have also assessed the modelled effects of the proposed works on individual properties; Section 8.

2 The scope of our review

We have been provided a hydraulic model, developed by Jacobs (summary information in Figure 2-1). The hydraulic flood model and associated hydrological model were originally developed by Sinclair Knight Merx and MWH respectively between 2008 and 2010 for Greater Wellington Regional Council's (GWRC) Flood Management Plan for Pinehaven. The models were audited in 2015[1] by Beca for GWRC.

Our scope is to review the current version of the hydraulic flood model and associated information. We have undertaken a review of the model assumptions, the model logic and the results based on the information provided. We have not undertaken a review of the hydrological model used to provide the input hydrographs to the hydraulic model, as this was not part of the scope. The focus has been on the modelling of the stream between Pinehaven Reserve and the Bypass Weir as this is the reach subject to the proposed works. The review has not revisited the hydraulic modelling of catchment upstream of Pinehaven Reserve.

Figure 2-1 Model review information

Job name	**Pinehaven Structural Works - Technical Review - Flooding**
Model description and purpose	The model is a 2-way coupled (MIKE11 and MIKE21) model adapted to represent the proposed stream works in Pinehaven Stream. The model was previously constructed to quantify flood risk in the catchment.
Model developed by	Jacobs
Modeller's name(s)	Peter Kinley and Jarad Sinni
Reviewer's name(s)	Michael Law and Elliot Tuck
Review date	1st review - November 2019 2nd review – June 2020
Model software/platform and file	Hydraulic flood model - MIKE by DHI
Key features	• Pinehaven Stream and instream structures represented in 1D • Floodplain represented in 2D, developed using LiDAR
Model report file name & date	Pinehaven Stream Improvements, Flood Hazard Assessment, written by Jacobs for Wellington Water Ltd. 19 September 2019.

[1] ***Pinehaven Stream – Flood Mapping Audit,*** Beca Ltd for GWRC. 13 July 2015 (Beca 2015)

3 Our review methodology

Our model review rating scheme provides a standardised approach to our review and makes it clear where action is required (Figure 3-1). This also allows us to suggest areas for more general improvement; these can be addressed as part of this work or incorporated into similar models in the future.

Our rating scheme assigns a score of 0-3 for each item reviewed.

- Scores of 0 and 1 are generally for information only and are unlikely to impact the modelling outcomes.
- A score of 2 is classed as a major issue. However, one which could be accepted if addressed or if more detail is provided. The issue may be closed and be considered fit for use for this project, even though an un-resolved issue remains.
- A score of 3 is a fatal flaw that is likely to require a reasonable amount of investigation/rework to be accepted or may invalidate the model findings.

Figure 3-1 Review framework

Description	Review Rating	Fit for use[2]
No issue: The element or parameter being reviewed is modelled acceptably	**0**	**Yes**
Minor issue: There is an issue, but it is unlikely to significantly affect model results.	**1**	**Yes**
Major issue: Failure to resolve the issue compromises the model and should be rectified but may be resolved by explanation or acceptance of model limitations.	**2**	**Yes, No or Review.** *Issue may be closed or remain open*
Fatal flaw: Failure to resolve this issue severely compromises the model and should be rectified before the model is accepted.	**3**	**No**

The review is tabulated in Section 4 and includes room for the Modeller to respond to the Reviewer's comments, and for the Reviewer to close out each issue.

To make it easier to identify comments made, and issues raised, in relation to the review of the updated June 2020 model and Flood Hazard Assessment (FHA) report, background shading of these sections of the report has been used (as here).

In Section 5, we provide a commentary on reports provided with the flood modelling. For the review of the latest (June 2020) version of the Flood Hazard Assessment (FHA) Report, a tabular review format has been adopted to highlight items that should be addressed; and uses a similar traffic light format to the model review.

Section 6 is a check that the June 2020 modelling and reporting meets the scope agreed in April 2020 by Jacobs, GWRC and Beca.

Section 7 contains a summary of the reported effects at affected properties.

[2] The 'fit for use' categorisation refers to the use of the model for the stream works project only, and does not reflect its suitability for other purposes or future modelling.

4 Model review

4.1 Information Received

The following information was also been received from the modeller for the 1st review in November 2019

- Catchment shapefile: Lidar_Catchments_Pinehaven_Backup.shp
- Reports:
  - ***Pinehaven Stream Improvements, Flood Modelling Draft Flood Modelling Report***. Jacobs for Wellington Water Ltd, December 2017 (Jacobs 2017).
  - ***Pinehaven Stream Improvements, Flood Hazard Assessment***. Jacobs for Wellington Water Ltd, September 2019 (Jacobs 2019a).
- Memorandum
  - ***Addendum to the Pinehaven Stream Improvement Works, Pinehaven Road Culvert and Sunbrae Drive Culvert Flood Hazard Assessment Reports.*** From Peter Kinley (Jacobs) to Josie Burrows (GWRC), James Beban (UHCC), and Mike Law (BECA). 27 November 2019. (Jacobs 2019b). *The 14 November draft version of the addendum was reviewed in the 21 November version of this report.*
- Response to draft review culverts; ***Jacobs Response to Beca Modelling Review Draft Report - 13-11-2019.xlsx***, emailed to Josie Burrows (GWRC), James Beban (UHCC), and Mike Law (BECA) by Helen Anderson (Jacobs). 13 November 2019.
- MIKE model files listed in Figure 4-1,

Figure 4-1 Novemeber 2019 Model files

Model	Mike 11	Mike 21	Results
U2_0 Base Case	• Pinehaven_U2_0_Q25_CC.sim • Pinehaven_U2_0_Q100_CC.sim • Pinehaven_U2_HB.hd11 • U2_Q25CC_CC_2hr_HB.bnd11 • U2_Q100CC_2hr_HB.bnd11 • Pinehaven_U2_0.nwk11 • Pinehaven_U2_0.xns11 • Final_Q25_CC_2hr.dfs0 • Final_Q100CC_CE_2hr.dfs0	• Pinehaven_U2_0_Q25_CC.m21 • Pinehaven_U2_0_Q100_CC.m21 • DD_GWRC_TrA_2m_NZMG_Clip4.dfs2 (A number of versions delivered but this appears to be the one used) • InitialDD_GWRC_TrA_2m_NZMG_Clip4.dfs2 (A number of versions delivered but this appears to be the one used) • Pinehaven_NZMGClip_2m_resistance1.dfs2	• Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CC.dfs2 • Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CC.re11 • Pinehaven_U2_0_SurvBypassWeir_6.4mLength_Q25_CCHDAdd.res11 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CC.dfs2 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CC.res11 • Pinehaven_U2_0_SurvBypassWeir6.4m_Q100_CCHDAdd.res11

Model	Mike 11	Mike 21	Results
Detailed Design Rev7 (50 BMR Flood wall removed)	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.sim • Pinehaven_DetDesign_Iteration7_Q100_CC_0.sim • Pinehaven_PrelimDesign_PVR04_STAGE2_HB_0.hd11 • UG1_PVR04_STAGE2_Q25CC_CC_2hr_HB.bnd11 • UG1_PVR04_STAGE2_Q100CC_CC_2hr_HB.bnd11 • Pinehaven_DetDesign_Iteration7_0.xns • Pinehaven_DetDesign_Iteration7_0.nwk11 • Final_Q25_CC_2hr.dfs0 • Final_Q100CC_CE_2hr.dfs0	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.m21 • Pinehaven_DetDesign_Iteration7_Q100_CC_0.m21 • Bathy_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2 • Initial_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2	• Pinehaven_DetDesign_Iteration7_Q25_CC_0.dfs2 • Pinehaven_DetDesign_Iteration7_Q25_CC_0.res11 • Pinehaven_DetDesign_Iteration7_Q25_CC_0HDAdd.res11 • Pinehaven_DetDesign_Iteration7_Q100_CC_0.dfs2 • Pinehaven_DetDesign_Iteration7_Q100_CC_0res11 • Pinehaven_DetDesign_Iteration7_Q100_CC_0HDAdd.res11

Figure 4-2 shows the model files provided on 29 May and 10 June for the updated June 2020 model.

Figure 4-2 June 2020 Model files

Model	Mike 11	Mike 21	Results
PVR51 - 20% Climate Change Pinehaven_U2_0_Q10_20%CC.couple Pinehaven_U2_0_Q25_20%CC.couple Pinehaven_U2_0_Q100_20%CC.couple	Background_Image dfs0 Pinehaven_U2_0.nwk11 Pinehaven_U2_0.xns11 Pinehaven_U2_0_Q10_20%CC.sim11 Pinehaven_U2_0_Q25_20%CC.sim11 Pinehaven_U2_0_Q100_20%CC.sim11 Pinehaven_U2_HB.hd11 U2_Q10CC_20%CC_2hr_HB.bnd11 U2_Q25CC_20%CC_2hr_HB.bnd11 U2_Q100CC_20%CC_2hr_HB.bnd11 Final_Q10_CE_2hr_20%CC.dfs0 Final_Q25_CC_2hr_20%CC.dfs0 Final_Q100CC_CE_2hr_20%CC.dfs0	Bathy initial Pinehaven_U2_0_Q10_20%CC.m21 Pinehaven_U2_0_Q25_20%CC.m21 Pinehaven_U2_0_Q100_20%CC.m21 DD_GWRC_TrA_2m_NZMG_Clip4.dfs2 DD_GWRC_TrA_2m_NZMG_Clip4.gsf InitialDD_GWRC_TrA_2m_NZMG_Clip4.dfs2 InitialDD_GWRC_TrA_2m_NZMG_Clip4.gsf Pinehaven_NZMGClip_2m_resistance1.dfs2 Pinehaven_NZMGClip_2m_resistance1.gsf	NZMG Pinehaven_U2_PVR51_Q25_20%CC.cfg2 NZMG Pinehaven_U2_PVR51_Q25_20%CC.wrr Pinehaven_U2_PVR51_Q25_20%CC.cfg2 Pinehaven_U2_PVR51_Q25_20%CC.dfs2 Pinehaven_U2_PVR51_Q25_20%CC.res11 Pinehaven_U2_PVR51_Q25_20%CC.wrr Pinehaven_U2_PVR51_Q25_20%CCHDAdd.res11 q25 difference.cfg2 Q25 difference.wrr Pinehaven_U2_PVR51_Q100_20%CC.cfg2 Pinehaven_U2_PVR51_Q100_20%CC.dfs2 Pinehaven_U2_PVR51_Q100_20%CC.res11 Pinehaven_U2_PVR51_Q100_20%CC.wrr Pinehaven_U2_PVR51_Q100_20%CCHDAdd.res11
PVR51 - 20%CC .020 roughness at culverts Pinehaven_DetDesign_Iteration10_Q10_CC_0.couple Pinehaven_DetDesign_Iteration10_Q25_CC_0.couple Pinehaven_DetDesign_Iteration10_Q100_CC_0.couple	Background_Image dfs0 Pinehaven_DetDesign_Iteration10_0.nwk11 Pinehaven_DetDesign_Iteration10_0.xns11 Pinehaven_DetDesign_Iteration10_Q10_CC_0.sim11 Pinehaven_DetDesign_Iteration10_Q25_CC_0.sim11 Pinehaven_DetDesign_Iteration10_Q100_CC_0.sim11 Pinehaven_PrelimDesign_PVR04_STAGE2_HB_0.hd11 UG1_PVR04_STAGE2_Q10CC_20%CC_2hr_HB.bnd11 UG1_PVR04_STAGE2_Q25CC_20%CC_2hr_HB.bnd11 UG1_PVR04_STAGE2_Q100CC_20%CC_2hr_HB.bnd11 Final_Q10_CE_2hr_20%CC.dfs0 Final_Q25_CC_2hr_20%CC.dfs0 Final_Q100CC_CE_2hr_20%CC.dfs0	Bathy initial Pinehaven_DetDesign_Iteration10_Q10_CC_0.m21 Pinehaven_DetDesign_Iteration10_Q25_CC_0.m21 Pinehaven_DetDesign_Iteration10_Q100_CC_0.m21 Bathy_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2 Bathy_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.gsf Initial_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.dfs2 Initial_DetDes_Wall50BlueMtRemoved_2m_NZMG_0.gsf Pinehaven_NZMGClip_2m_resistanceUG1.dfs2 Pinehaven_NZMGClip_2m_resistanceUG1.gsf	NZMG Pinehaven_DetDesign_Iteration10_Q25_CC_PVR51.cfg2 NZMG Pinehaven_DetDesign_Iteration10_Q25_CC_PVR51.wrr Pinehaven_DetDesign_Iteration10_Q25_CC_PVR51.cfg2 Pinehaven_DetDesign_Iteration10_Q25_CC_PVR51.dfs2 Pinehaven_DetDesign_Iteration10_Q25_CC_PVR51.wrr Pinehaven_DetDesign_Iteration10_Q25CC_PVR51.res11 Pinehaven_DetDesign_Iteration10_Q25CC_PVR51HDAdd.res11 NZMG.cfg2 NZMG.wrr Pinehaven_DetDesign_Iteration10_Q100_CC_PVR51.cfg2 Pinehaven_DetDesign_Iteration10_Q100_CC_PVR51.dfs2 Pinehaven_DetDesign_Iteration10_Q100_CC_PVR51.wrr Pinehaven_DetDesign_Iteration10_Q100CC_PVR51.res11 Pinehaven_DetDesign_Iteration10_Q100CC_PVR51HDAdd.res11

4.2 Hydrological Model

The hydrological modelling for the Pinehaven model was developed outside of Mike by DHI using Hydstra software in 2008[3]. Jacobs informed us that the hydrological model has not changed since the models were reviewed in 2015. Therefore, this section of the review relating to the hydrological modelling underlying the hydraulic flood model review is truncated, and does not differ substantially from the 2015 model and mapping review.

Figure 4-3 Hydrological model review

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Software	The hydrological modelling was undertaken using Hydstra software. Hydstra is a standard software package that incorporates a catchment runoff model. It was appropriate for this level of analysis at the time of model development. However, the original model files are not available and so the hydrological modelling cannot be updated to reflect updates in rainfall inputs, allowances for climate change and changes in rainfall-runoff modelling techniques. Future hydrological modelling could be undertaken within the MIKE software.	Acknowledged that Hydstra approach appropriate for time of model development. In consultation with Wellington Water, hydrological modelling not revised to retain consistency with previous modelling. The original model files are understood to sit with GWRC, and Jacobs do not know if they can be made available. While future hydrological modelling could be undertaken outside HYDSTRA, this is a decision that would affect future projects and the review suggested is not necessary at this point.	The reviewer's understanding is that the location of the model files is not known. The hydrological modelling should be updated when resources allow, but OK for this project. **CLOSED**	2	Yes
Rainfall inputs	As noted above, no rainfall files were delivered for review. Therefore, there is no opportunity to update rainfall inputs to reflect data collected over the last ten years. Though probably not likely to result in a major adjustment of design rainfall, it would be prudent to update the rainfall inputs to the hydrological modelling.	For consistency with modelling used to support plan change and public consultation, hydrology used in preliminary modelling not updated for design modelling, in consultation with Wellington Water.		2	Yes

[3] ***Pinehaven Stream Flood Hydrology***, report prepared by MWH for Greater Wellington Regional Council. 4 November 2008

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Climate change	As with the rest of the hydrological modelling, the allowance for climate change has not been updated since the models were reviewed in 2015. At that time, the flow hydrograph inputs to the hydraulic flood model were increased by 16% in line with the 2008 guidance from Ministry for Environment (MfE). This was in the model provided to Beca for this review. MfE updated the climate change guidance in 2018, and this update has not been included directly in the modelling being reviewed. However, discussions with Jacobs' modellers propose to update the modelling sing a 20% increase in flows. We have discussed with GWRC and agreed that it is appropriate for this study.	In response to s92 request, 2120 climate change factor of 20% agreed with GWRC and WW. Models have been reassessed with 20% climate change factor and addendum to main works and culvert FHAs is being prepared to summarise differences between 16% and 20% climate change factors.	Jacobs provided an addendum memo dated 27 November that included a summary of the effects of increasing the climate change allowance. The memo has been reviewed. It reports there is no increase in "habitable floor polygons" inundated in the 'with culvert and stream works' modelled scenario when the climate change allowance is increased from +16% to +20%. While the results reported in the addendum are in line with what might be expected, Beca has not reviewed the model run files used to generate the results reported in the addendum. **CLOSED**	1	Yes
Catchments	Figure 4-4 shows the catchments used in the hydrological modelling. The catchments range from 0.735km² to 0.1397km². Catchments of this size are large for a detailed design model, but given the lack of detail in the hydraulic model (e.g. no stormwater pipe network) these are appropriate. Based on the 2D surface supplied with the model they appear to be delineated appropriately.	Findings and comments on catchment size acknowledged. Agreement with appropriateness of catchment size and delineation, based on resolution and detail of base model.	**CLOSED**	1	Yes

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Summary	The issues with the hydrological modelling identified in the 2015 model review persist. The hydrological model has not been updated, and allowances for climate change have been (and are being) made by factoring the output flow hydrographs rather than updating the hydrological model and inputs. Though the hydrographs used as inputs for the hydraulic flood model are still acceptable for the current stream works project, we recommend that the hydrological modelling should be updated either as part of this project or in the next couple of years. This is for the following reasons: • The hydrological modelling is ten years old, and does not account for additional rainfall records, changes in recommended allowances for climate change, and updates to hydrological methods. • The original hydrological model files are not available. • The hydrological modelling could be incorporated within the MIKE hydraulic flood model	Acknowledged that Hydstra approach appropriate for time of model development. In consultation with Wellington Water, hydrological modelling not revised to retain consistency with previous modelling. Support the recommendation to update the hydrological modelling in the next couple of years.	As per previous comments, issue closed but recommendation that the hydrological model is updated when resources allow. **CLOSED**	2	Yes

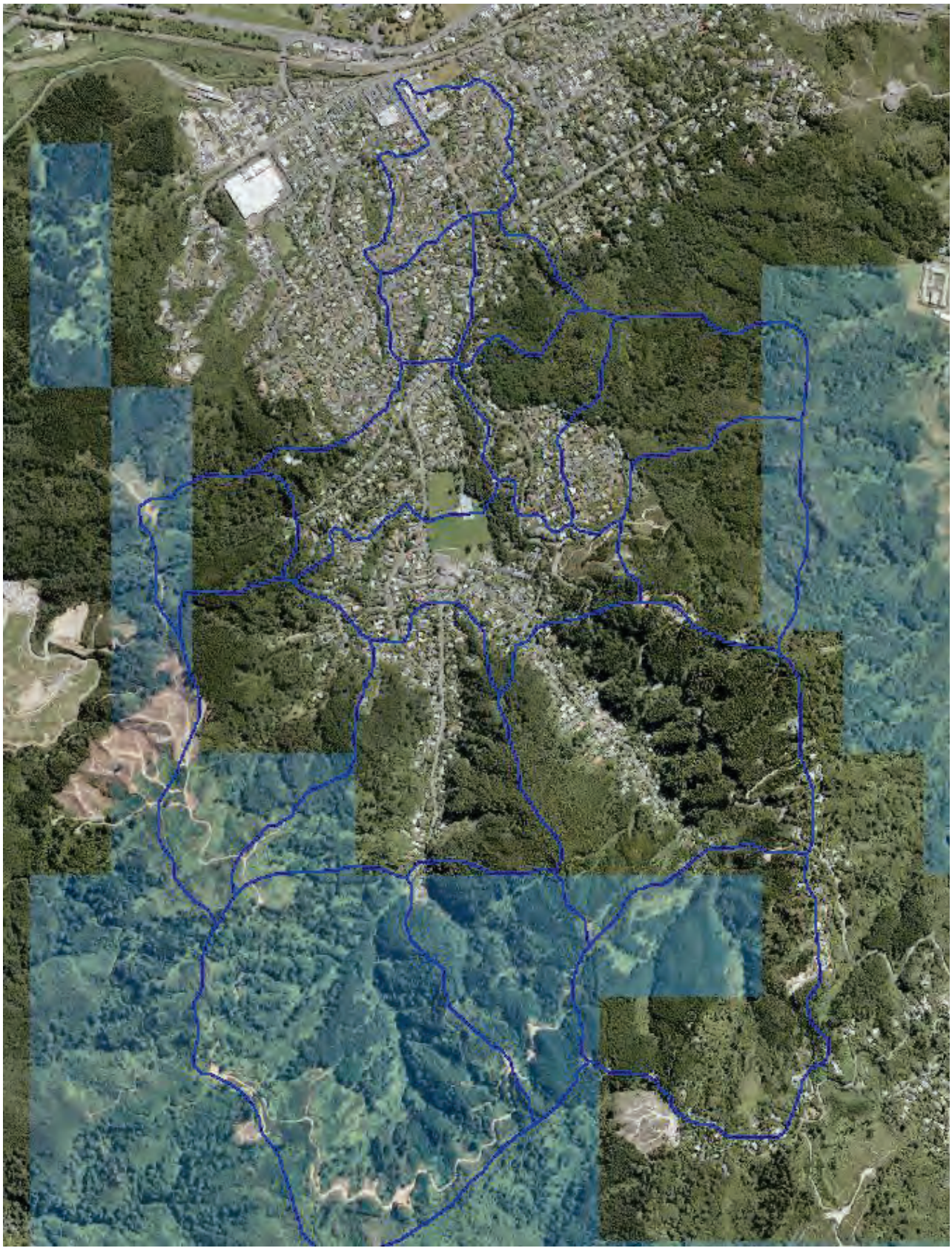

Figure 4-4 Hydrological catchments

4.3 Hydraulic Model

The hydraulic flood model has been built within MIKE by DHI software, with MIKE21 (2D) and MIKE11 (1D) elements. The review considers the MIKE21 elements first, then MIKE11 and finally the results

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
MIKE21					
Grid/Mesh	• Model includes two gridded surfaces; representing Base (pre) and Design (post) proposed stream works • Model updated with 2013 LiDAR • The model uses a grid of 2x2 m. This is an appropriate level of detail, and more refined than the 5x5 m grid reviewed in 2015. • The extent of the grid is such that the flood plain is covered. This is confirmed by the 100-year ARI results showing that that no water is glass-walling at the edges of the grid. • The Pinehaven Stream between Pinehaven Reserve and Whitemans Rd has been blocked out of the grid where M11 is present to prevent double counting. • The blocking out has been increased in areas of stream widening (this matches changes to the M11 cross-sections) as indicated by the red areas in Figure 4-5. • The stream centreline and mesh blockout at 28 Blue Mountains Rd between the Design model and Base model is slightly different.	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**

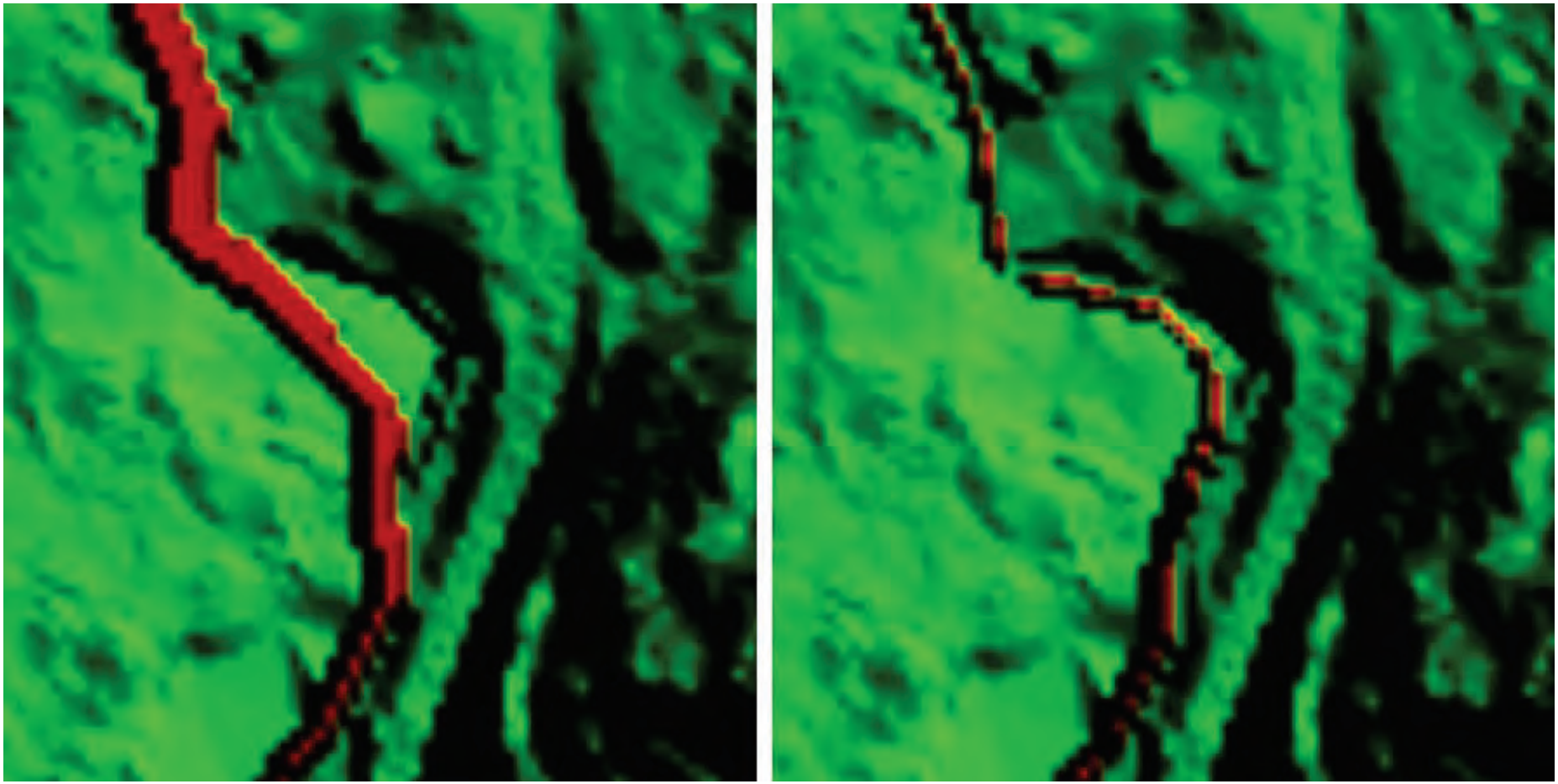

Figure 4-5 Changes to DEM – Design model on the left and Base model on the right

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
MIKE21 (continued)					
Roughness	A resistance map has been used for both models. Roads = 50 / 0.020n Parks = 28.57 /.035n Bush = 6.67 / 0.150n Residential = 10 / 0.100n These resistance values are appropriate	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Flood/Drying	Drying = 0.01 Flooding = 0.02.	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Timestep	0.5 second	Agreement with findings and comments noted.	**CLOSED**	**0**	**Yes**
Initial Surface elevation	This looks appropriate, but the origin of the initial surface should be noted.	Agreement with findings and comments noted.	**CLOSED**	1	Yes
MIKE 11					
Runoff input	See review of hydrological inputs above. Catchment runoff hydrographs have been applied directly to the stream (MIKE11) at the locations listed in Figure 4-6. Where appropriate the catchments, or portions of, have been distributed along a length of channel or as a point source. This is standard practice but may not account for network discharges and local topography. Has the proportioning considered overland flow paths and/or pipe network discharges?	See comments on review of hydrology above. Allocation of loads to the network has not been changed from the previous model. The design may have an effect on the allocations, but any effect will not be significant or measurable.	Reviewer agrees that allocation of loads is not likely to have a material effect on the relative effect of the proposed stream works given that the design events are greater than the expected capacity of the stormwater network. **CLOSED**	**1**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Other boundary conditions	Downstream boundary conditions have been applied to Hull Creek (at both eastern and western ends). One is a Q/H table and the other a fixed water level (44.22mRl). What event does the fixed water level represent, and please state whether the model results in the stream works reach are sensitive to the downstream boundary conditions.	Due to the steepness of the catchment and distance from the downstream extent to the project reach, the model results within the project reach are not expected to be sensitive to the downstream boundary conditions. The variability of water levels in the Hulls Creek branch was checked and found to vary by up to 5mm for the events studied, with a median value of 2mm. This is within the limits that the software can predict water levels and shows the model is not sensitive to the boundary condition at Hulls Creek.	The reviewer agrees with the modeller's response. CLOSED	**1**	**Yes**

	Boundary Description	Boundary Type	Branch Name	Chainage	Chainage	Gate ID	Boundary ID
1	Open	Q-h	HULL_CREEK	1078	0		Dummy_Boundary
2	Open	Water Level	HULL_CREEK	0	0		Dummy_Boundary
3	Open	Inflow	ELMSLIE_RD	0	0		Catchment_A
4	Distributed Source	Inflow	ELMSLIE_RD	0	853		Catchment_F
5	Point Source	Inflow	ELMSLIE_RD	994	0		1/3_Catchment_H
6	Open	Inflow	JOCELYN_CRES	0	0		Catchment_E
7	Point Source	Inflow	JOCELYN_CRES	334	0		1/3_Catchment_H
8	Point Source	Inflow	JOCELYN_CRES	522	0		1/3_Catchment_H
9	Open	Inflow	WYNDHAM_RD	0	0		Catchment_I
10	Open	Inflow	FENDALTON_CRE	0	0		Catchment_G
11	Distributed Source	Inflow	FENDALTON_CRE	117	296		Catchment_K
12	Distributed Source	Inflow	FENDALTON_CRE	340	680		Catchment_L
13	Open	Inflow	PINEHAVEN	0	0		Catchment_B
14	Open	Inflow	UPPER_PINEHAVE	0	0		Catchment_C
15	Distributed Source	Inflow	PINEHAVEN	135	1029		Catchment_D
16	Distributed Source	Inflow	PINEHAVEN	1365	1866		1/2_Catchment_J
17	Distributed Source	Inflow	PINEHAVEN	1949	2426		Catchment_M
18	Point Source	Inflow	PINEHAVEN	2432	0		Catchment_N
19	Point Source	Inflow	PINEHAVEN	2599	0		1/4_Catchment_O
20	Point Source	Inflow	PINEHAVEN	2734	0		1/4_Catchment_O
21	Point Source	Inflow	LOWER_PINEHAV	64	0		1/4_Catchment_O
22	Point Source	Inflow	LOWER_PINEHAV	268	0		1/4_Catchment_O
23	Distributed Source	Inflow	WYNDHAM_RD	130	771		1/2_Catchment_J

Figure 4-6 Hydrograph input locations

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Cross-sections	• Design drawings of the proposed cross-section have not been received and therefore we cannot comment on the representation of these in the model. We are limited to comparing the design cross sections to those in the Base case model. • The stream works detailed in the *Pinehaven Stream Improvements* report appear in model chainages Ch 1488 – 1604 inclusive; and Ch 1838 – 2430 inclusive (2017 12d design). An example is shown in Figure 4-7 for cross-section 1496. • The lower ~200mm of channel has been left the same as the Base model representing no modification to this portion of the cross-section • The design cross-sections contain vertical walls (approx1.5m high). Note that if these can't be achieved due to stability etc any changes to the side slopes would need to be re-modelled as it may result in a loss in conveyance.	Additional survey was collected to update the quantity and resolution of stream cross-sections from what was represented in the preliminary models. Proposed cross-sections included reference to updated survey information where applicable. In vertical cross sections, up to a 2-inch per row of blocks may be integrated into the proposed design. Following completion of final design of the block walls, if a batter is proposed, a check will be performed on all cross sections to confirm that the effective flow area is not decreased (it is noted this may extend top of bank extents by a nominal amount).	We agree with the modeller's response. Checks should be made to the final design cross-sections to confirm that the hydraulic performance meets the performance of the reviewed model. **CLOSED**	1	Yes
	June 202 Update • There have been some changes to the design cross-sections (see Figure 4-6). We assume these are the final design cross-sections. Results still show flooding to be reduced (in most places) as a result of the design cross-sections (See FHA for more commentary on results).		**CLOSED**	1	Yes

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Roughness	• The edges of some design cross-sections have had roughness increased to represent walls, though the material is not stated. Ch1838-1847 has High/low roughness zones, whereas CH.1854-1883 does not. Without a set of drawings/design can't comment if these are appropriate. • 0.035n Global roughness in both models Fresh plains (extensions of the channel below the bank level to accommodate 'fresh flows') / planted benches appear to have been created in some of the design cross-sections, including cross-section 1854 (Figure 4-8). If they are to be planted, then no account has been taken of the change in model roughness. Modeller to confirm whether changes in roughness have been, or need to be, made.	Comments acknowledged. Where roughness was used to represent existing private bridges, walls or other structures in the model, appropriateness of the roughness factors was confirmed with Wellington Water. It is expected that the final planting plan and recommended maintenance practices will be consistent with roughness factors used in the model in 'fresh plains' areas below the proposed top of bank and that changes to roughness represented in the model will not be required. The roughness values used were reviewed internally and with our client to confirm they are appropriate.	The channel roughness factor used are appropriate for the stage of design. The modeller should confirm that the appropriate roughness is used when the "final planting plan and recommended maintenance practices" are confirmed. **CLOSED**	**2**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Stream works					
Culverts	• A replacement culvert is included in the design model at Pinehaven Rd 4.05m x 1.81m (existing is 2.96m x 1.54m). Inlet loss applied but we can't confirm if this is correct without inlet details. • A new culvert at Sunbrae Dr has been included as 6 m x 1.5m (existing is 1.785m dia). Again, the appropriateness of the inlet loss is to be confirmed. • If the culverts are to have natural bed materials (to facilitate fish passage) then the roughness should be increased on the base? Modeller to confirm	13/11/19 - The replacement culvert at Pinehaven Road is 4.0m x 2.5m (including 700mm embedment) and the replacement culvert for Sunbrae Drive is 6.0m x 2.0m (including 500mm of embedment). Inlet losses have been adopted from the previous modelling. As the design is likely to improve inlet efficiency the parameter values adopted are likely to be conservative. The roughness values used were reviewed internally and with our client to confirm they are appropriate.	Updated 29/11/19 Noting that the culverts are embedded, the Reviewer questioned whether the culvert roughness used of n=0.015 was too low, and suggested that n=0.025 may be more appropriate if the whole width of the channel was a natural bed. Subsequent discussion with the modeller confirmed that only the middle third of the channel would be natural. It was agreed that a culvert roughness of n=0.020 was appropriate, and that results based on this should be used to inform the consent application. The effects of using n=0.020 could be interpolated from the Iteration 9 and Iteration 10 model runs, which used culvert roughness of n=0.015 and 0.025 respectively. If the latter approach is taken, then the model must be run with the appropriate culvert roughness at the final/detailed design stage of the culvert and stream works to confirm compliance with design criteria. On the bases of these discussions, the issue has been addressed to the Reviewer's satisfaction, and the model considered fit for use once run with a culvert roughness of n=0.020. The issue can be **CLOSED (see June 2020 update)** once that is done. *Note that the Reviewer has not commented on whether a change in water levels (as a result of increasing the culvert roughness) changes whether the proposed design meets freeboard performance criteria in the design events.*	**2**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Culverts continued	**Update June 2020** • Culverts in the latest model have had the roughness changed to n=0.02 • Modelled culvert at Pinehaven Rd, 3.2m x 1.8m @5m long then into a 4m x 1.8m cross-section @20m long. The reduced entry to account for the blockage (20%). Similar to Sunbrae Rd Culvert the width has been reduced from 6m to 4.8m		**CLOSED**	**1**	**Yes**
Bridges	Bridges in the model have been modelled as culverts. Given their scale this is appropriate.	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
Other structures	The modelling of the bypass weir has been updated since 2015 review. In speaking with Jacobs, the weir length has been adjusted to account for actual length and then adjusted for effective length. Doesn't change between Base and Design models	Noted, agreement with comment. No changes have been made to the bypass weir between the (updated) Base and Design models.	**CLOSED**	**0**	**Yes**
Initial water level/flow	Initial water depths remain the same between the two models	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
MIKE FLOOD					
Lateral coupling	Coupling is the same between base and design models using default setting. A combination of left and right (or both) coupling depending on the location. All seems appropriate.	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Coupling parameters	Default figures have been used	Noted; agreement with comment.	**CLOSED**	0	Yes

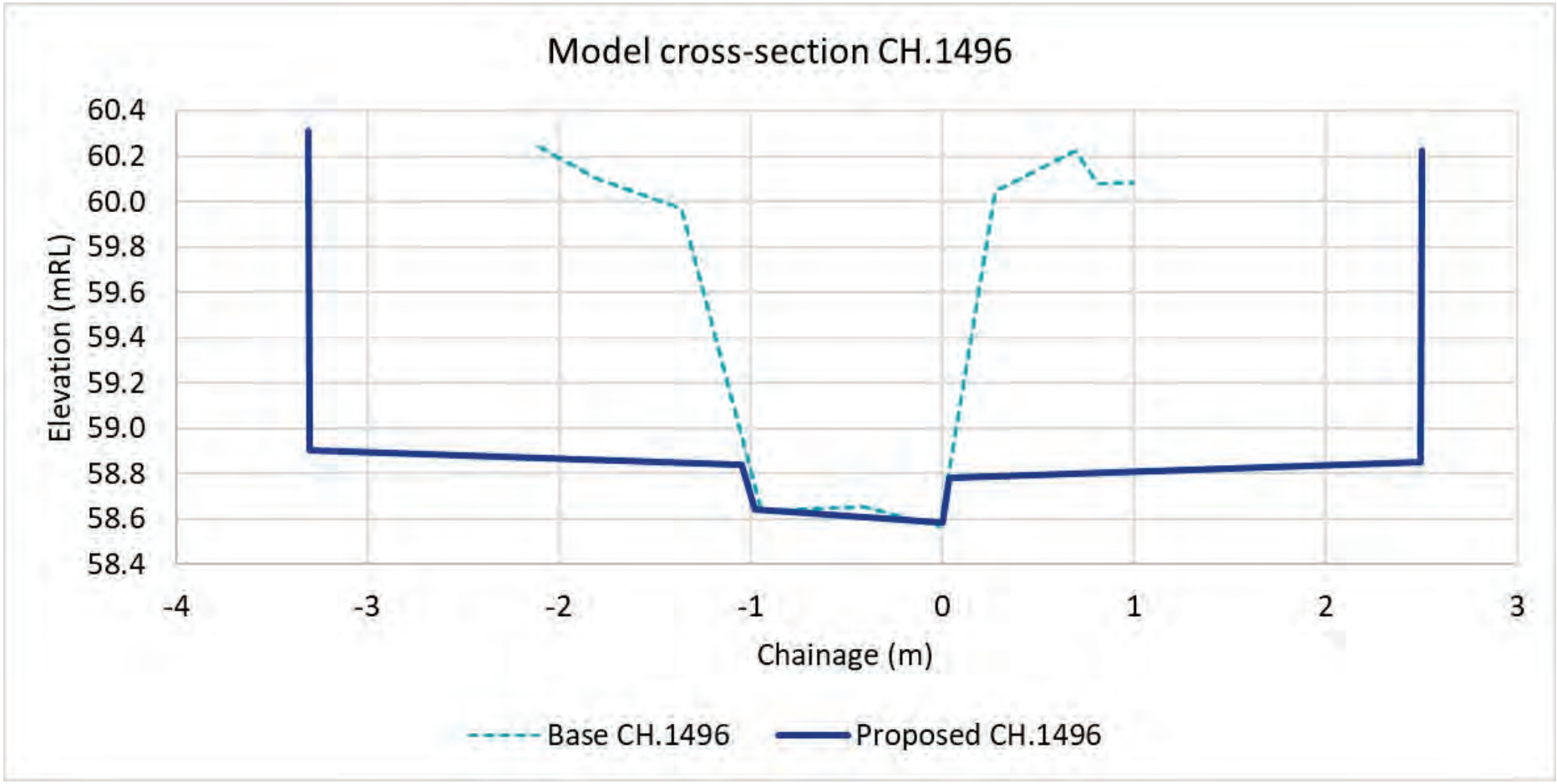

Figure 4-7 Cross-section 1496 (proposed as per June 2020)

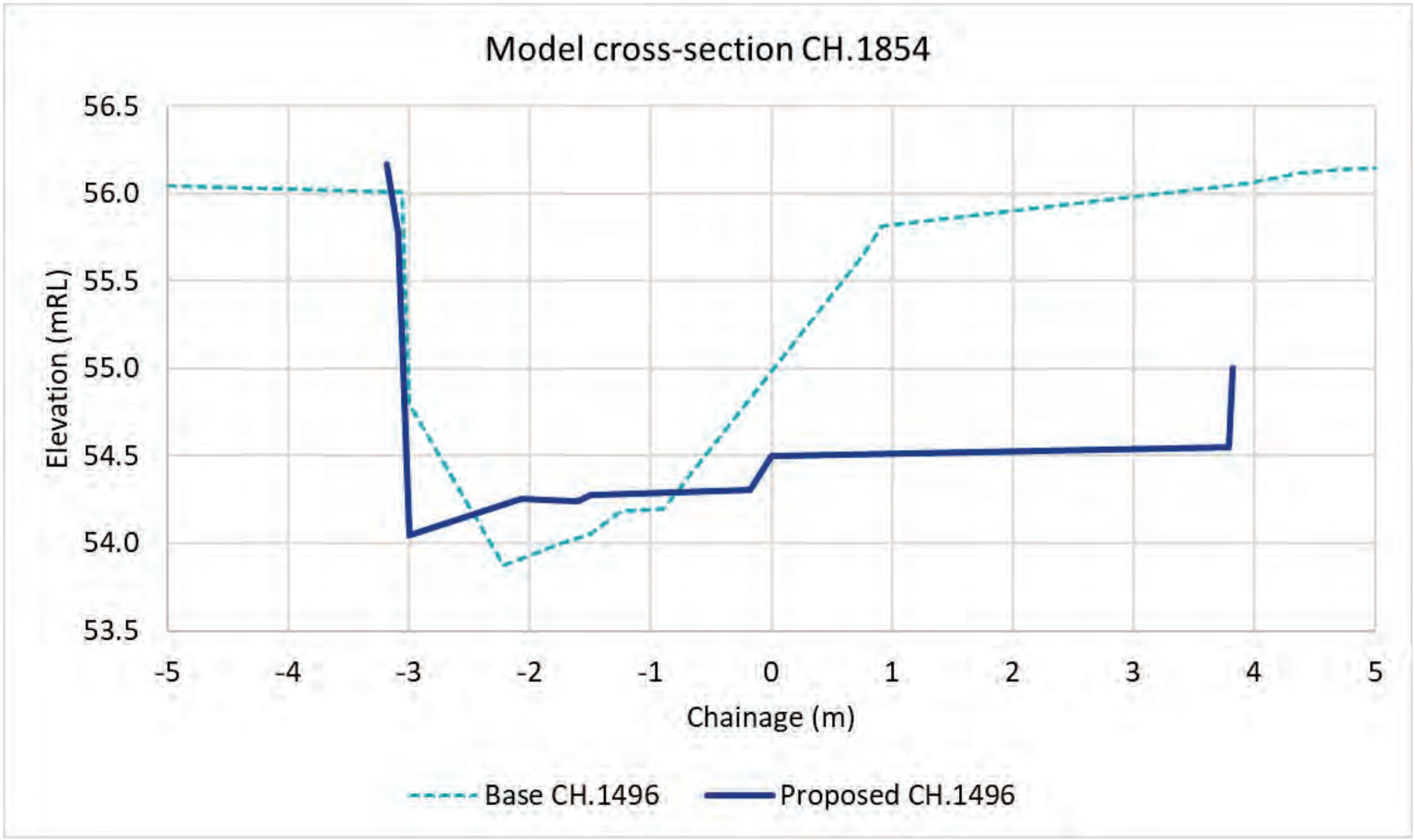

Figure 4-8 Cross-section 1854 (proposed as per June 2020)

4.4 Results

We note that there is a significant reduction in flooding downstream of Pinehaven reserve.

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
Blockage testing	No blockage testing appears to have been undertaken. It would be appropriate to test the sensitivity of the existing Base case culverts/bridges and Design culverts to blockage. This could be done using a method such as developed for ARR that accounts for the availability and mobility of debris, and the size of the culvert in setting an appropriate amount of blockage to model.	Blockage assessments for the base scenario and for the Pinehaven Road and Sunbrae Drive culverts were completed and results can be provided, however there have been changes to the design since this blockage analysis was completed and we have not assessed whether the findings are still valid. A blockage assessment for the design will be provided once it is complete.	This issue is not expected to adversely affect the relative effects of the stream works, and so does not materially affect the 'fit for use' categorisation. However, the Reviewer notes that testing is ongoing and so the issue will remain open until that is completed. **OPEN (see June 2020 update)**	**2**	**Yes**
	Update June 2020 Both culverts (Sunbrae Drive and Pinehaven Road) have had a reduction in width to account for blockage.		**CLOSED**	**0**	**Yes**
MIKE11 Water levels	The HGL plot in Figure 4-9 and Figure 4-10 shows that the 100-year ARI event water levels are reduced in most stretches of the stream due to the stream widening and larger culverts. Two sections have increased in water level. • The piped section in and upstream of Pinehaven Reserve. This is unexpected, as we assumed that there were no changes in this reach and do not expect it to be affected by the stream works. Is the modeller able to explain this? • A short section at Ch.1600. Near 2A Freemans Way (as stated in the executive summary of the Flood Hazard Assessment report) •	The piped section in Pinehaven Reserve was not checked because it is outside the area of main channel works. Differences in water level do not affect containment within the channel (as this is a piped section) or habitable floor flooding (as the area is a reserve). Near 2A Freemans Way there are no channel works proposed. The differences are thought to be due to a combination of channel works upstream directing more flow into this reach instead of entering the Birch Grove area and a slight change in timing of the flood peak.	Uncertainty over the cause of the raised water levels through the reserve is not expected to adversely affect the relative effects of the stream works, and so does not materially affect the 'fit for use' categorisation. However, the Reviewer notes that the issue is not resolved and so the issue will remain open **OPEN (see June 2020 update)**	**2**	**Yes**

Item Checked	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Fit for use
MIKE11 Water levels continued	**Update June 2020** • Water levels have again increased in the piped section but as agreed not likely to effect water levels in the area for the proposed works The HGL plot shows some minor difference from the last design iteration- Increase in water level at CH.1917, this seems to be the effect of the blockage		**CLOSED**	**1**	**Yes**
MIKE21	Downstream of Pinehaven reserve there is a significant reduction in flood levels. These are replicated in both the M11 water levels and the M21 results (Figure 4-11).	Noted; agreement with comment.	**CLOSED**	**0**	**Yes**
	Update June 2020 Figure 4-11 shows an increase in flood depth (as noted in the Flood Hazard Assessment) around 48-50 Blue Mountain Rd. Other than that, the difference shows a general reduction in flood depth. Dark Blue areas are areas that flood in the current (base) model and don't in the Design model. See comment regarding this issue in the Flood Hazard Assessment review.		**CLOSED**	**1**	**Yes**

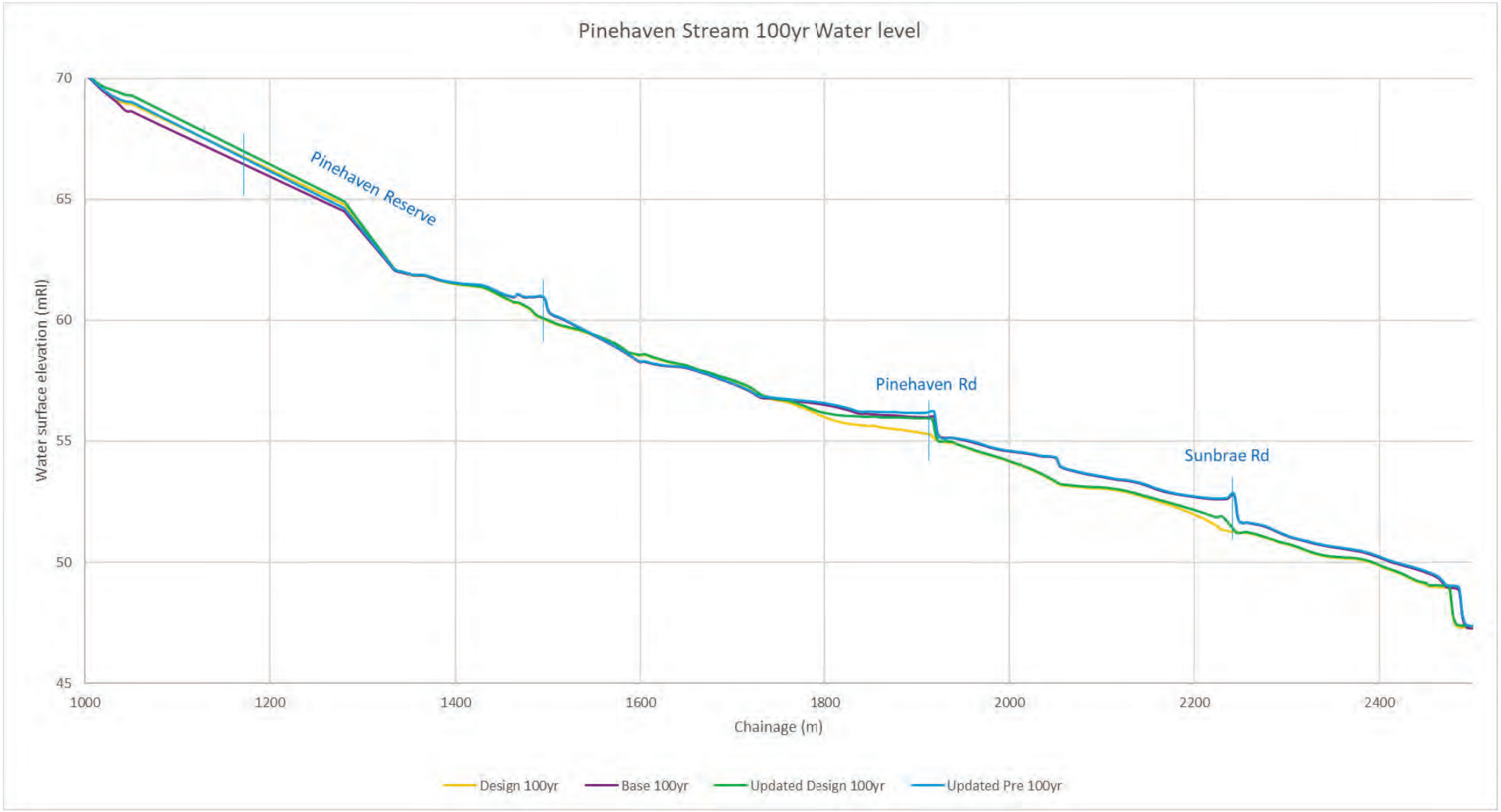

Figure 4-9 100-year ARI long-section

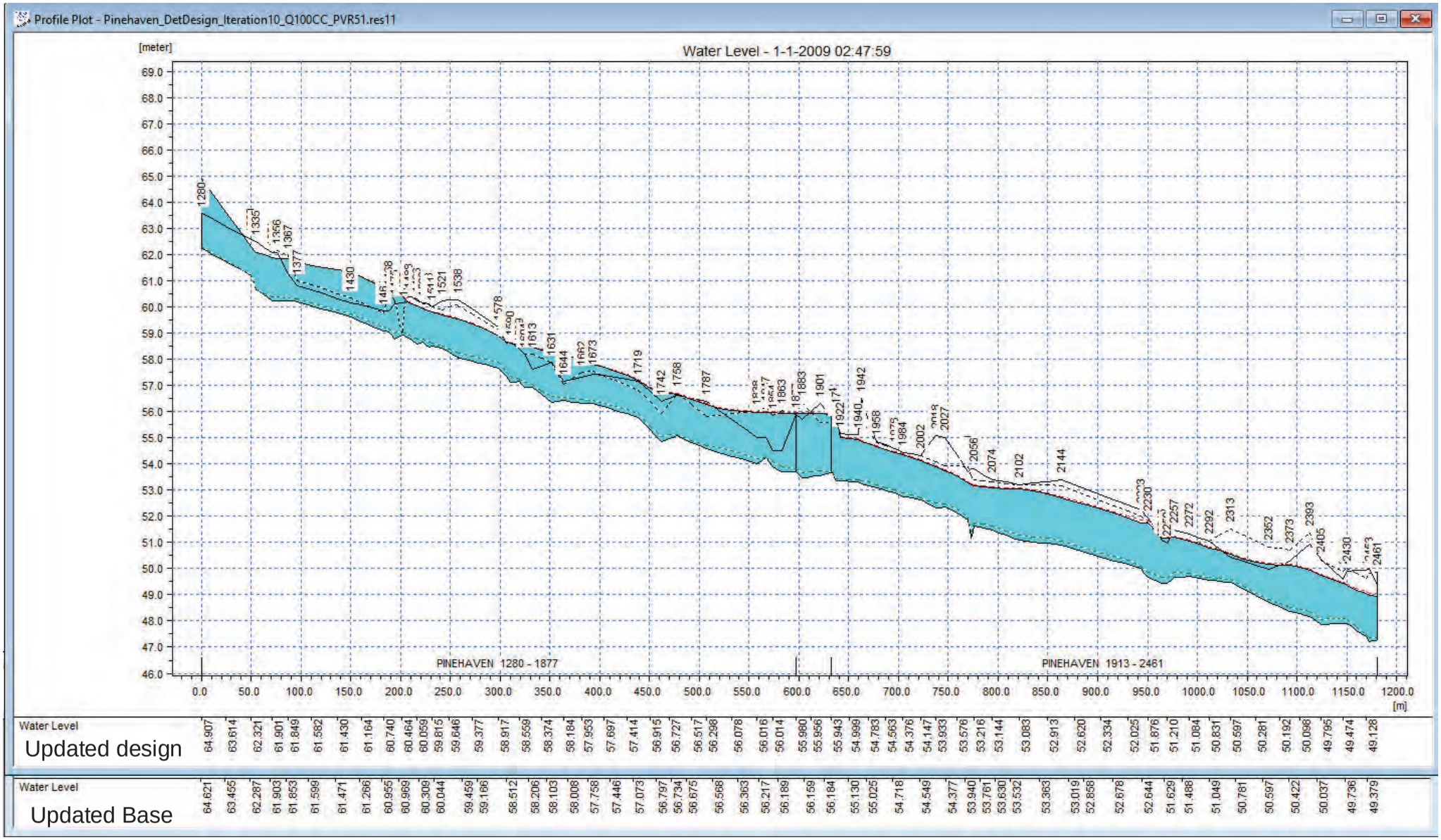

Figure 4-10 100-year ARI hydraulic grade line (Clip from MIKE View)

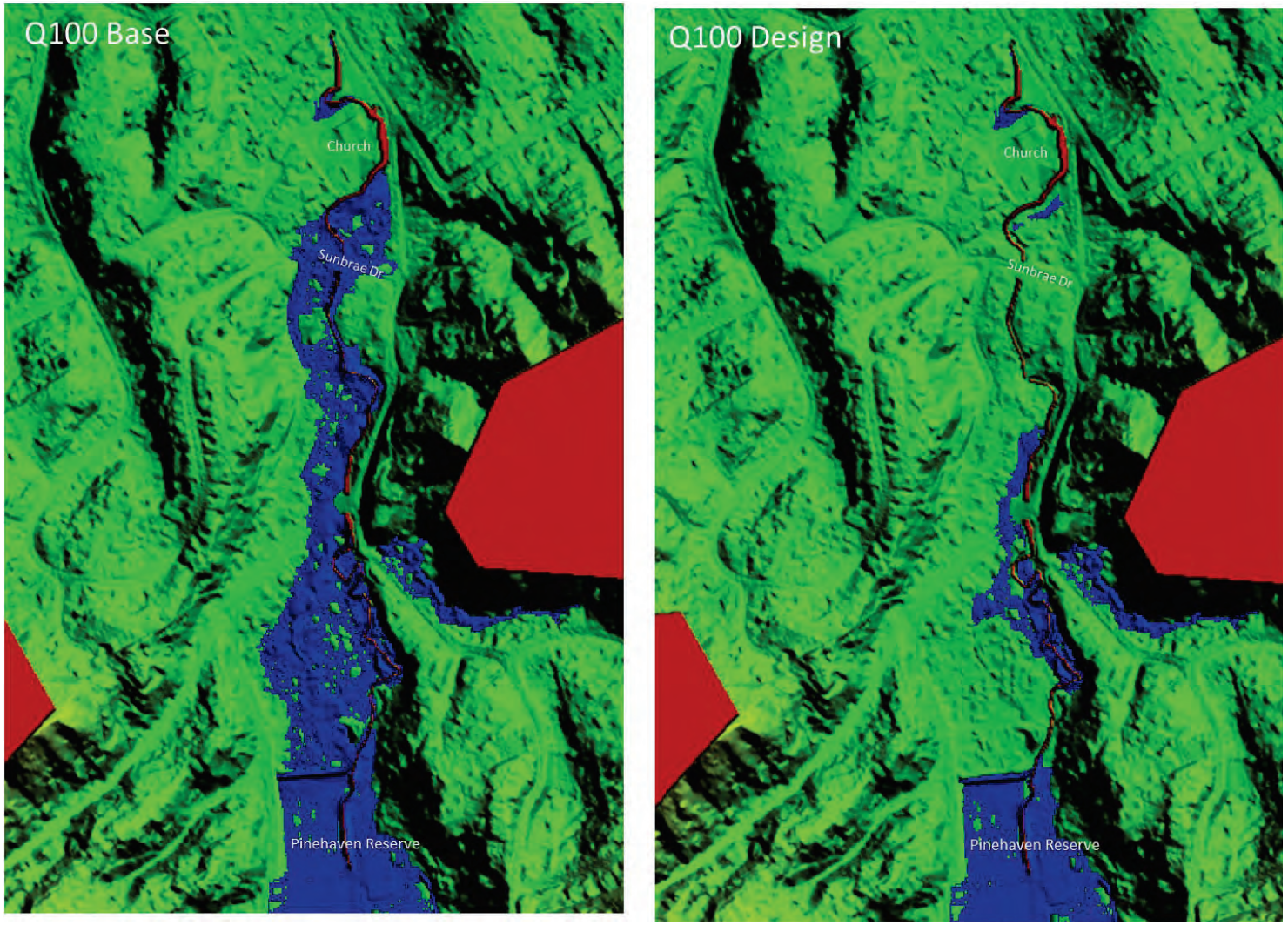

Figure 4-11 100-year ARI MIKE21 (2D) flood extents.

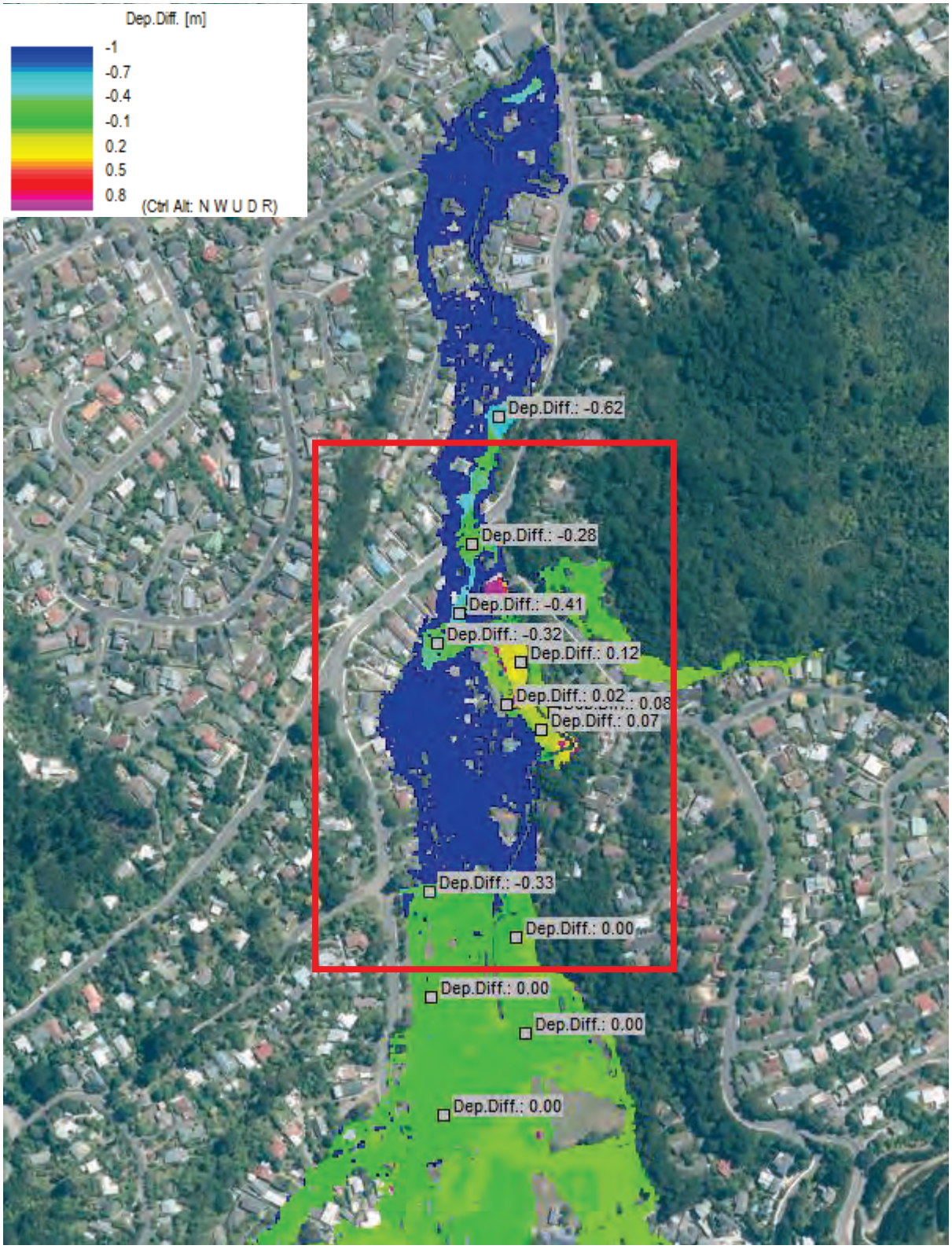

Figure 4-11 Q25 flood depth difference. Negative depths represent a reduction in flood level, Positive values represent an increase in flood depth (zero is no change).

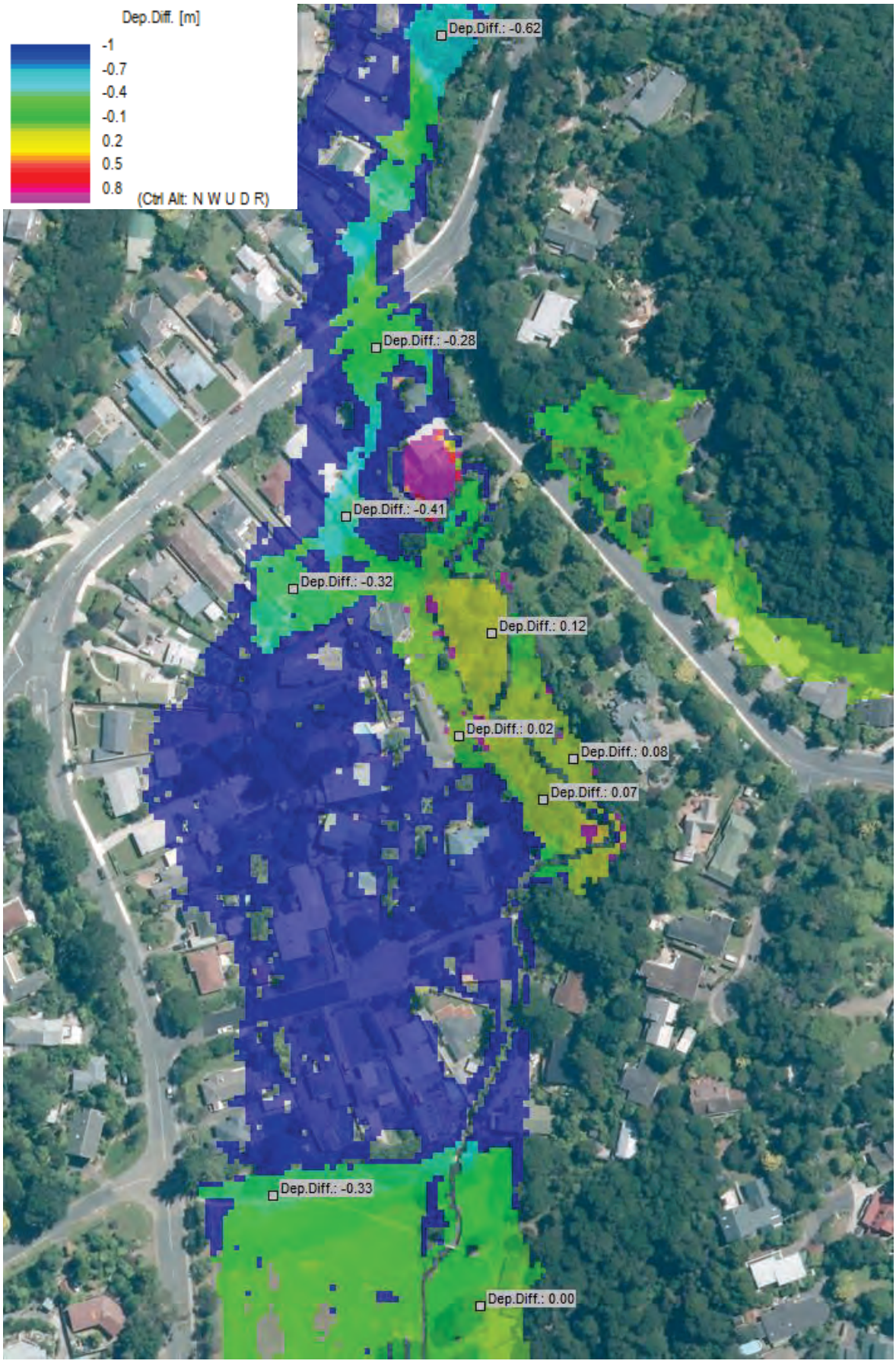

Figure 4-11 Zoom in of Q25 flood depth difference. Negative depths represent a reduction in flood level, Positive values represent an increase in flood depth (zero is no change).

5 Commentary on reports

Prior to the November 2019 review, Beca were provided with three reports to provide background and updated information on the recent flood modelling. Our comments on these three reports are made in Sections 5.1, 5.2 and 5.3. These comments have been retained for completeness, but have been superseded by the comments in Section 5.4, which is the review of the June 2020 update to the Flood Hazard Assessment Report.

5.1 Draft Flood Modelling Report (Jacobs 2017)

This report describes the updates to the 2009/2010 Existing Case Model to incorporate new LiDAR and channel cross-section information, and the modelling of preliminary design options as they were in 2017. We note that the channel cross-sections were only updated for the reach between Pinehaven Reserve and Whitemans Road; the reach that is to be subject to stream widening.

The changes to the Existing Case Model are reported to have generally reduced peak flooding depths and levels (and the number of properties affected by flooding), and explained in Section 5 of the report as:

> *"The difference in flooding depths can be explained by two factors. Firstly, the smaller grid size which means the Updated Existing Case Model incorporates increased definition of both low-lying and raised areas. Secondly, the cross-sections from the 2015 survey provided more channel capacity in some locations which reduced the overland flooding."*

We note that:

- The two improvements to model definition are in line with recommendations made in Beca's 2015 audit of the flood modelling and mapping (Beca 2015).
- The report confirms that the hydrological inputs were unchanged from the 2009/2010 Existing Case Model, which meant that the allowance for climate change was based on MfE's 2008 guidance.
- An assessment of freeboard was not included in the report, though it is noted that this is to be carried out at detailed design stage.
- The 2017 preliminary designs for the Pinehaven Road and Sunbrae Drive culverts described in the report are different from the culvert designs presented in 2019.
- The Preliminary Design of channel widening, and replacement road culverts, reduces the number of properties affected by flooding. The modelling described does not consider the effect of modelling the culvert upgrades in isolation.
- Though two years old, the report is flagged as Draft. We assume that a Final version of the report has not been produced.

Though we have not reviewed the 2017 model, the report provides a fair reflection of the updates noted in the 2019 version of the Existing Case Model. We did not note any obvious errors in the report.

June 2020 update – An updated version of the Flood Modelling Report has not been provided for review.

5.2 Flood Hazard Assessment Report (Jacobs 2019a)

The Flood Hazard Assessment Report does not describe the changes in the modelling that are described in Jacob 2017. Rather, the report summarises the objectives of the Pinehaven Stream Improvements Project, the proposed works, the results (in terms of flood levels and properties affected by flooding) and an assessment of the effects. This is appropriate for the target audience of the report, but does require the report to reference a current version of the Flood Modelling Report.

We note that the results and effects reported are for the stream improvements including both the channel widening and replacement of road culverts. However, the road culverts are being consented separately,

which could result in different effects to the combined works. We raised this with Jacobs at a meeting to kick-off this review process, and it is partially addressed in the Section 5.3.

We did not note any obvious errors in the report.

5.3 Memorandum - Addendum to the Flood Hazard Assessment Report (Jacobs 2019b)

In response to a question raised (during the initial November 2019 phase of this model review) about the ongoing use of hydrology incorporating MfE's 2008 guidance on allowances for climate change, Jacobs provided an addendum to the Flood Hazard Assessment report on 27 November 2019[4]. This related to increasing the catchment flows by +20% rather than +16% to allow for climate change to represent MfE's 2018 updated guidance[5] on climate change. Separately, the addendum also summarises the effects of only upgrading the two road culverts (and not the associated channel improvements), given that these are subject to a separate consent application.

5.3.1 Increase allowance for climate change

A summary of the reported difference in water levels is provided by the following two bullet points from Page 2 of the addendum.

- *"For the 25-year flood event (4% AEP) the maximum increase in water level is 0.3 m and the median increase is 0.02 m. The highest increases in peak water level occur immediately upstream of Pinehaven Road. The maximum increase in velocity is 0.07m/s and the median increase is 0.02m/s.*
- *For the 100-year flood event (1% AEP) the maximum increase in water level is 0.11 m and the median increase is 0.03 m. The highest increases in peak water level occur at the lower end of the works, from about 20m upstream of the Bypass Inlet and downstream in the Lower Pinehaven Stream reach. The maximum increase in water level occurs at the inlet to the main Pinehaven Stream culvert in Whitemans Road. The maximum increase in velocity is 0.07m/s and the median increase is 0.03m/s."*

While those show the effect of increasing the flows on water levels and velocities, Table 2-1 on page 3 of the addendum shows that there is no increase in "habitable floor polygons" inundated in the 'with culvert and stream works' modelled scenario when the climate change allowance is increased from +16% to +20%.

While the results reported in the addendum are in line with what might be expected, Beca has not reviewed the model run files used to generate the results reported in the addendum, and the reported results pre-date the agreement on appropriate culvert roughness (n=0.020) described on page 16 of this report.

5.3.2 Installation of culvert only (no stream works)

Tables 2-2 and 2-3 on pages four and five of the addendum summarise the change in water levels due to installation of the culverts only. Water levels generally increase and at the end of page 10 of the addendum it is acknowledged that the freeboard required for the Sunbrae Drive culvert is not met in the interim (culvert only, no stream works) scenarios. Mitigation for this is proposed in the third bullet point on page 8 of the addendum.

- *"We note that there are several methods for mitigating the increased water levels downstream. For the Sunbrae Drive culvert we propose to restrict the flow into the culvert to pre-upgrade rates by installing a temporary steel plate across part of the inlet. This steel plate would be removed once the channel*

[4] A draft of the addendum had been provided on 14 November 2019, and commented on in the 21 November 2019 version of this report.

[5] ***Climate Change Projections for New Zealand – 2nd Edition***, MfE reference 1385. September 2018. https://www.mfe.govt.nz/publications/climate-change/climate-change-projections-new-zealand

upgrades downstream were in place. We request that conditions around the design of the steel plate, its maintenance and the timing of its removal are included in the consent. "

As with the updated climate change scenarios, Beca has not reviewed the model run files informing these results and the model runs do not account for the revised culvert roughness.

June 2020 update – The installation of the 'culverts only' has not been considered in the June 2020 version of the Flood Hazard Assessment (FHA) Report, and so the relative effects described above are the most recent explanation provided. Model files and results for this option have not been reviewed as part of the June 2020 update to this report.

5.4 Flood Hazard Assessment Report (Jacobs 2020)

The table below contains Beca review comments on the June 2020 version of the Flood Hazard Assessment (FHA) Report prepared by Jacobs, and notes any responses to comments raised regarding the 2019 reports. A similar rating system to that for the model review is used, with a column a column titled 'Action' indicating what response is required for the item to be closed. In some cases that will require changes to the report, while in others (especially where differences between the November 2019 and June 2019 reports are noted) it might be appropriate to provide an explanation that is included in the **Modeller's response** column below, and not in the FHA report.

Report item or section	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Action
Page 5 Executive summary and Table 2 Section 6	Why are there fewer affected habitable floors for the base case model run reported in the June 2020 FHA report than in the November 2019 Addendum. The changes in the design results are explained, but not why there is a change in base case.			2	Explain
Pages 9 Figure 1	The image is poor quality and too small to be read clearly			1	Improve
1.5	Climate change. The report states that the modelling included allowances for climate change based on MfE's 2018 ***Climate Change Projections for New Zealand*** report, whereas it was agreed that flows should be increased by 20%, which is more in line with Wellington Water Limited's 2019 ***Reference Guide for Storm Hydrology***. This should be corrected in the text.			2	Update
Pages 11 Figure 2	The image is poor quality and too small to be read clearly			1	Improve
Page 12 Section 2.1.2	▪ Typo - Replace "with" with "within" in first paragraph.			1	Correct
	▪ The water level at Sunbrae Drive is referred to. Is that upstream or downstream of the culvert?			1	Confirm

Report item or section	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Action
Page 12 Section 2.3.1	Note that since the November 2019 report, that the text has been altered to report that the flood extents are reduced, rather than that the 4% AEP flow is contained in the channel. Is this due to a change in the model parameters, a correction of the text, or a change in the design modelled?			1	Confirm
Page 12 Section 2.3.2	1st paragraph. Checking model results confirms that this occurs in the base and design cases but flooding is less in the design case. Therefore, comment required on how this meets (or not) the statement on page 9 (below Figure 1) about the *"increasing the size of the river channel to convey the 4% AEP flood entirely within the stream…".*			2	Clarify
Section 2.3.2 and Section 4	We note that Table 1 in Section 2.3.2 from the November 2019 report has been removed. This table summarised changes in flood depths and area at two properties. To some extent, it has been replaced by a new Table 1 in Section 4 that summarises changes in water levels between the current and previous modelling. However, it is not directly possible to compare the changes between baseline and design cases			1	Include
Pages 14-16 Section 3	The onus of the explanation in this section is on inundation of habitable floors, rather than changes in flood depth, extent or level. As with the previous comment, it would be useful to see a comparative table of flood levels.			1	Include
Page 17 Section 4	It is unclear whether all the changes in model performance are the differences between the baseline and design cases or between previous and current design cases. Simple clarification needed.			1	Clarify

Report item or section	Findings & Comments	Modeller's response	Reviewer close out comments	Rating	Action
Page 18 Section 5	The explanation for, and results of, modelling the 10% AEP event do not add anything to the report. Beca's understanding of the purpose of modelling the 10% AEP event was to compare the model performance against the 8 December 2019 flood event. No evidence is provided to confirm the performance of the model. Unless this section is expanded, it should be removed, and explanation provided by the modeller at the Hearing.			3	Expand or remove
Page 19 Section 6	Last bullet point of commentary on 4% AEP results ends with "…" suggesting an unfinished sentence or section. Needs to be checked.			1	Check
	Table 2 is split across two pages. For clarity it should be contained on one page.			2	Edit
Page 20 Section 6	In the 3rd bullet point, it is reported that it is acceptable for flood levels to increase at 50 Blue Mountains Road and 2A Freemans Way as no additional habitable floors are flooded. Is the acceptability of this a decision for planners rather than modellers?			1	Check
Section 6	Either in Section 6, or elsewhere in the report, it would be useful to have a table (similar to Table 1) summarising the change in water levels between the baseline and design cases.			1	Consider
Other item	The November 2019 Addendum report included an assessment of the effects on flood risk if the culverts were upgraded in isolation of the stream works. This is not included in the updated FHA report. Is this still required?			2	Include, if required

The review raises some questions that need resolving, and suggestions to improve the readability or presentation of information. With the exception of the inadequate section on the 10% AEP model run and comparisons to the 8 December 2019 flood, the report is a fair reflection of the outcomes of the flood modelling undertaken to inform the proposed Pinehaven Stream works. See the following section for a review as to whether the June 2020 modelling and FHA report met the scope defined in April 2020.

6 Review against 'Flood Model Re-run Scope

In agreement with GWRC and Beca, Jacobs confirmed the scope of the June 2020 modelling on 22 April 2020.

The model re-run scope items are listed in the table below, along with a colour-coded indication of whether the scope item was completed; green for done, and amber for items not included or incomplete.

Scope item	Review comments
The Pinehaven flood model will be re-run as follows:	
1) The "with project" model should include:	
a) The removal/addition/replacement of local access bridges proposed (as described in 25 March 2020 letter to the Councils)	Representation of bridges not changed between 2019 and 2020 models. Difference expected.
b) Bank works at 54 and 56 Whitemans Road (if proposed);	No explicit explanation provided of proposed changes.
c) Culvert roughness of n=0.020;	Done
d) Climate change allowance of 20% increase in extreme rainfall events;	Done
e) 20% blockage;	Done
f) No allowance for freeboard. i.e. the reported results are the modelled water levels and flood extents, and dynamic freeboard has not been applied	Done
2) The "without project" model should include:	
a) No physical works or changes to the stream environment;	Done
b) Culvert roughness values from the FMP model;	Done
c) Climate change allowance of 20% increase in extreme rainfall event;	Done
d) 20% blockage;	Done
e) No allowance for freeboard.	Done
3) The "with project" and "without project" models should both be run for the:	
a) 1:10 year ARI event; and	Model and results not provided or reported
b) 1:25 year ARI event; and	Done
c) 1:100 year ARI event.	Done

Scope item	Review comments
Output from the Flood Model re-run:	
As per the email from James Beban dated 15 April 2020, the output from the Flood Model re-run will be as follows:	
4) An updated flood hazard assessment which:	
a) Describes the changes to the flood model, including how the removal, addition, or replacement of local access bridges is undertaken as this is a change in modelling approach reflecting the property-scale (rather than catchment-wide) nature of this use of the Pinehaven model.	No description included in the updated FHA report of how the local access bridges have been modelled to represent how the effect on flood risk of changes in the number of bridges can be quantified.
b) Addresses the effects of the changes to the flood model (including maps showing flood levels and extents and assessment of the level of effects on all properties where there is an increase or decrease in flood level/extent) for the 1:25 year and 1:100 year ARI events. Where there is an increase in flood water depths, clarification on where on the properties this flooding occurs. If the increased in flood depths occurs around any respective dwelling, then property floor levels relative to flood depths should be provided to allow for the impacts on these dwellings to be determined.	▪ Flood maps are at too small a scale to allow property-specific effects to be assessed. ▪ No table provided of habitable floor levels and flood levels to allow assessment of site-specific effects.
Provision of the information described in 1 to 4 above, will provide the basis to be able to provide clarification to the following enquiries.	
5) Confirmation on where the increased flood depths on 9 Birch Grove and 7 Pinehaven Road are occurring (for example, in the river channel or on the property) in the 1:100 year event and whether these increased depths affect the dwellings on these properties. If so, what are the resulting effects on the dwellings?	Written description provided (FHA page 13), but no site-specific mapped output or annotation of overland flow paths.
6) Clarification on where the increased flood depths on 54 and 56 Whitemans Road are occurring in the 1:100 year event and whether these increased depths affect the dwellings on these properties. Clarify what works at the top of these banks is occurring to protect these properties as reference in the flood hazard assessment. Will these have downstream effects? Do these require resource consent? Should they be included in the flood model?	Increase in level reported (FHA page 15), but not in comparison to habitable floor level.
7) If the modelling indicates increased flooding occurring on any other properties, the extent and depth of flooding will be reported, as will whether these increased depths affect the dwellings on these properties.	As per item 5), the FHA provides written descriptions of flood increases, but no site-specific mapped output or annotation of overland flow paths, or comparison to habitable floor levels.
8) Present the 1:100 year flood information in the same table format as is the case for the 1:25 year event, namely flood levels. This allows for comparison between the events to be made. It would also allow for some explanation on what the increased flood depths occurring in the 1:100 year flood event are acceptable.	Table 1 (4% AEP flood depths) removed in June 2020 FHA report. No equivalent table provided for flood levels for either the 4% or 1% AEP in the 2020 FHA report.

Scope item	Review comments
9) Comment on the results of the 1:10 year (including climate change) flood modelling in comparison to observed flooding resulting from the December 2019 flood event.	FHA Section 5 makes passing reference to the 10% AEP event and makes two high level statements about performance. The opportunity has not been taken to compare model results against photographs and observations taken during the event (including those provided by Submitters).
10) Confirmation on whether any discussions have occurred with the owners of 9 Birch Grove or 7 Pinehaven Road regarding their increased flood depths and what their comments were.	There is no reference to any discussions or conversations with property owners reported in the FHA report.

7 Our findings

1. The model represents a build that was common (and still is in some situations) when the model was built ten years ago. It is a standard grid type model, with reasonably large catchments and no pipe network. If a model were built of the catchment today it would likely have model detail included outside of the stream, including the piped stormwater network. However, that does not mean that the model is not fit for purpose.
2. The stream now has a reasonable amount of detail and has been surveyed in critical locations. Changes have been made to the Design model but without the design drawings we cannot say if they have been represented and modelled correctly, and whether sufficient freeboard has been provided to the top of the stream bank. It is appropriate that the model results are reported without the addition of freeboard.
3. The changes to the model do represent a reduction in flood levels within the catchment but only if the design matches that represented by the model.
4. We note that the model results do not include freeboard. This is noted in the draft modelling report (Jacobs 2017) and should be recorded on outputs to minimise the risk of confusion with other flood extent maps and water levels for the Pinehaven catchment.
5. The modeller has provided acceptable responses to the issues raised by the two draft versions of the review (circulated on 11 and 21 November 2019, and combined into the December version of this review document). While some issues remain categorised as level 2, they do not prevent the model for being used for this project.
6. The one issue that prevented the model being considered fit for purpose after the 21 November issue was the roughness value used in the two culverts. Subsequent discussions between Jacobs modeller and the Reviewer resulted in agreement that a roughness value of n=0.020 should be used, and that results based on this should be used to inform the consent application. Increasing the culvert roughness value would be expected to increase water levels, and so checks would be required to confirm whether water level design criteria have been met.

   We have reviewed this issue in the June 2020 version of the flood model, and are satisfied that the culverts are modelled appropriately.
7. The Draft Flood Modelling Report (Jacobs 2017) and Flood Hazard Assessment Report (Jacobs 2019a) provided good descriptions of the modelling undertaken and flooding results. Beyond the issues raised in the model review (Section 4) there are no significant issues raised by the reports.

   However, the review of the June 2020 updated Flood Hazard Assessment Report raise some questions that need resolving, and suggestions to improve the readability or presentation of information.
8. The Addendum to the Flood Hazard Assessment Report (Jacobs 2019b) addresses an interim solution to accommodating MfE's 2018 guidance on climate change. However, we recommend that the model hydrology is updated when resources allow. Information provided in the addendum acknowledges that the two road culverts are to be consented separately from the other stream works, and describes the effects of upgrading the culverts in isolation. The results presented in the addendum pre-date the agreement to revise the culvert roughness (Item 6).

   The June 2020 updated Flood Hazard Assessment Report supersedes the Addendum to the Flood Hazard Assessment Report (Jacobs 2019b). However, no commentary is provided on the effects of the culvert works being undertaken in isolation, and so the explanation provided in the Addendum is the latest information on this issue.
9. The review of the June 2020 information provided against the April 2020 scope (Section 6) shows that while the modelling generally meets the scope, the RFA report does not include all the information required by the April 2020 scope; changes in how access bridges are modelled and reported is not included, and the reporting of the 10% AEP is inadequate. See Section 6 for more information.

8 Property scale flood assessment

Below is a summary of the effects of the proposed works at each property, gleaned from the information provided in the June 2020 FHA report. Given the modelling and reporting scope agreed in April 2020, we would have expected the FHA report to contain a similar summary to this.

Property	Flood	Effects of the proposed works (from updated FHA).	Implications
▪ 2 Pinehaven Road ▪ 4 Pinehaven Road ▪ 40 Blue Mountains Road ▪ 38A Blue Mountains Road ▪ 38B Blue Mountains Road ▪ 36 Blue Mountains Road ▪ 34 Blue Mountains Road ▪ 32 Blue Mountains Road	4% AEP (25-year ARI)	Currently, flooding of properties occurs due to a spill over Pinehaven Road at a low point immediately to the west of the Pinehaven Road culvert. The FHA Section 2.2.2 advises that there will be a 0.62 m decrease in flood levels but does not report where in the reach this occurs or the effect on flood extents on these properties, though from the small scale flood maps there is a reduction in area. FHA maps show some residual flooding on these properties after the works, which is close to building footprints.	Flood levels decrease so works provide net benefit.
	1% AEP (100-year ARI)		
▪ 48 Blue Mountains Road	4% AEP (25-year ARI)	Ground levels will be reduced which will result in increased depth and extent of water.	Increase in flood risk to the site and property, but property is owned by GWRC, so negative impact of works accepted.
	1% AEP (100-year ARI)	Increase in flood depth at the habitable floor	
▪ 2A Freemans Way	4% AEP (25-year ARI)	Floodplain area net increase of 12 m^2. Maximum increase in water levels of 0.26 m. FHA section 2.3.2 reports flood levels to be below building level	Increase in flood levels/extent is a negative impact of the works, but habitable floors reported as not affected in the 1% AEP event.
	1% AEP (100-year ARI)	No commentary in the FHA on the effects in this event.	
▪ 50 Blue Mountains Road	4% AEP (25-year ARI)	Increase in flood extent and water levels at south of site and reduction at north. Floodplain net increase of 184m^2. Long (100 m) frontage on to the river, so 184 m^2 increase in flood extent, equates to <2 m increase in floodplain width. Flood water levels are higher by an average of 0.02m.	Increase in flood levels/extent on southern part of the property is a negative impact of the works, but habitable floors reported as not affected in the 1% AEP event.
	1% AEP (100-year ARI)	Changes in levels and flood extents not reported in the FHA	

Property	Flood	Effects of the proposed works (from updated FHA).	Implications
▪ 7 Pinehaven Road	4% AEP (25-year ARI) and 1% AEP (100-year ARI)	First part of FHA section 3.3.2 is confusingly worded, but the interpretation is that the proposed works will reduce depth and extent of flooding overall in both the 4% and 1% AEP events. However, 8 m^2 (in the 45 AEP) and 12 m^2 (1% AEP) of land near boundary of 50 BMR will have an increase in peak water level of up to 0.10 m. Elsewhere on the site, the flood levels and extents will reduce. Floor levels have been surveyed and survey results show that floor levels will be 0.7 m above peak water level once the proposed works are completed so there is no effect on habitable floor flooding.	Despite a small part of the site seeing an increase in flood levels and extent post-works, flood levels remain below habitable levels. Overall the implications of the works are beneficial.
▪ 9 Birch Grove	4% AEP (25-year ARI) and 1% AEP (100-year ARI)	Overall, the proposed works will reduce depth and extent of flooding except 20m^2 of land will have an increase in peak water level of up to 0.14m (near 50 BMR). Design water levels are higher than baseline for the habitable floor at this property by up to 0.06m in a small area (4m^2) of new flooding. Floor levels have been surveyed and survey results show that floor levels will be 0.55m above peak water level once the proposed works are completed so there is no effect on habitable floor flooding.	
▪ Pinehaven Road at culvert	4% AEP (25-year ARI) and 1% AEP (100-year ARI)	Flooding of Pinehaven Road due to the spill from the upstream side of the culvert will be up to 0.05 m (4% AEP) and 0.12 m (1% AEP) deep at the crown of the road in the post-works case. For both events this is a reduction of 0.21 m compared to the base case. The length of the road that will be flooded is 26m in the 4% AEP event.	Depth of flooding reduced due to works, so benefit to road usability. Road owned by UHCC.
▪ 54 Whitemans Road ▪ 56 Whitemans Road	4% AEP (25-year ARI) and 1% AEP (100-year ARI)	Flood level increases of 0.03 m at No.54 and 0.04 m at No.56 in the 4% AEPO event, but flow remains in channel. Habitable floor levels not affected. Habitable floor levels of properties not flagged in FHA report as being flooded in the 1% AEP event, and flood extent map indicates that flow remains the channel.	Though minor increase in flood levels, habitable floors are not affected.

9 Conclusion

The model is considered generally fit for use to describe the changes in flood level and confirm a reduction in the number of properties affected by flooding. However, the model and information provided in the Flood Hazard Assessment (FHA) report do not fully meet the scope of the modelling and reporting agreed in April 2020.

The effect of the limited of information provided in the FHA report is that information on the effects of the works on individual properties has been extracted directly from the model results in some cases. However, as reported in Section 8, the effects of the works on individual properties is generally positive with no indication that any additional habitable floors will be affected by flooding. The onus is on the applicant to confirm this.

10 Use of this report

This report has been prepared by Beca on the specific instructions of our Client. It is solely for our Client's use for the purpose for which it is intended in accordance with the agreed scope of work. Any use or reliance by any person contrary to the above, to which Beca has not given its prior written consent, is at that person's own risk.

Should you be in any doubt as to the applicability of this report and/or its recommendations for the proposed development as described herein, and/or encounter materials on site that differ from those described herein, it is essential that you discuss these issues with the authors before proceeding with any work based on this document.

Appendix 7 – Ms Sharyn Westlake's Advice

Sharyn Westlake (Senior Engineer, Greater Wellington Regional Council) initial review questions

1. The 2008 MfE recommendations have been used for climate change of 2 degrees warming by 2080 and 16% increase in rainfall intensities. Given the report is dated September 2019, the latest MfE recommendation should be used. Why have they not been, and what are the design impacts?

2. I would expect that the projected timeframe for climate change would be to 2120 rather than 2080. Why is it not the case, and what are the impacts on design and capacity of the design if you extend the timeframe to 2120?

3. Has freeboard been included for the design? If not, why not? I note that freeboard does not appear to be discussed in either the modelling report or the application except with regard to maybe being included in replacement of private access crossings (p 64 section 6.1). This has potential implications for the design capacity.

4. With regard to the replacement of private access crossings, has the effect of raised approaches on overflow paths been modelled? If this modelling was completed, I would expect that the effect on overflow paths of raising bridge approaches to have been established.

5. Has the proposed vegetation to be planted on the banks been taken into account in the hydraulic modelling? Is the effect of this significant?

6. Has the flow restricting effect of providing these inlet structure blockage screens been established and designed for?

7. 6.1.1 page 65 states "At the Reformed Church of Silverstream, the existing school field will be utilised as a cleanfill site for material for the project. This material will then be able to be used by the school as a base for redeveloping their sports field in the future." Is there any effect of removing this area from flood storage?

8. 6.1.3 page 66 states "Along the boundary of 50 Blue Mountains Road, regrading of the land may be required to manage overland flow from the Pinehaven stream towards Birch Grove properties." Do these earthworks trigger any rules in the regional plans? If not, how are they going to cover this off? Is it through an outline plan process later?

9. 6.1.3 page 66 states "Widening of the channel between 2A Freemans Way and 50 Blue Mountains Road will occur. And localised erosion protection may occur at the driveway of 50 Blue Mountains Road and along the stream channel." What are the erosion protection works along this section of stream channel?

10. 6.2.1 page 67 states "Standard design types will be used for the various situations (as detailed in the cross-sections attached at Appendix E) rather than detailed design for the entire stream channel." What if ground conditions require a non-standard approach? How will this be addressed?

11. 6.2.3 page 67 states "The proposed works are intended to be completed in stages. The stages may not be sequential, with the possibility that multiple construction crews may be used at any one time to reduce the overall construction timeframes. The number of stages could increase, and the duration of works for each stage will ultimately be a function of detailed design; however, the completion of sections before moving along the stream will be fixed as will the activity based individual teams." What is the process for peer review and approval of

the detailed design? Is this information to be included in the CMP which is provided to GWRC for approval?

12. 6.2.3 page 67 states “Vegetation planting will occur after the last stage and all aspects of stream bank re-profiling are complete.” And “It is anticipated that construction for stream improvement works will occur over 70 weeks but may take up to 2 years, depending on weather and subject to meeting conditions of consent requirements.” This seems to be a very long time to leave the site unvegetated, and why not replant stages during the growing seasons as the works are completed, as weed control will likely become an issue?

13. 3/3 page 69 “The section of stream between the house at 48 Blue Mountains Road and the downstream end of improvements behind Birch Grove is excluded from channel works, however some observed stream erosion in this area has been identified for mitigation. Potential grading on properties west of 50 Blue Mountains Road to reinstate access areas, improve local drainage and mitigate overland flow from the Stream (subject to agreement with property owners).” What is the proposed design for the stream erosion repair? Do the earthworks for grading on properties trigger any rules in the regional plans? If not, how are they going to cover this off? Is it through an outline plan process later?

14. 8.2.1.5 page 95 The scour protection option chosen is native planting and geotextile matting “given the high velocity resilience of matting, and the riparian habitat advantages of native plantings.” Although implied to be sufficient, no information is provided on the velocities this to withstand, and whether this protection will be sufficient to withstand velocities in the 1% AEP flood, so I am unable to provide comment.

15. 10.7.2.2.2 page 124 states “A natural stabiliser will be applied to prevent the risk of sediment runoff into the stream.” How long is this stabiliser expected to work for, given 12. above?

16. 10.7.2.2.5 page 125 states “The weirs will be investigated during detailed design as to whether removal or reinstatement preferable in terms of potential adverse effects. Downstream of the project area a partial fish barrier exists at the confluence of Pinehaven Stream and Hulls Creek. To maximise the benefits of the project and compensate to some extent for the ecological disturbance of the project it is proposed that this barrier be remediated.” What is the process for design, review and assessment of effects of the proposed remediation for the partial fish barrier at the confluence of Pinehaven Stream and Hulls Creek, and possible removal or reinstatement of any other weirs? Do they trigger any rules in the regional plans? ? If not, how are they going to cover this off? Is it through an outline plan process later?

17. 11.3 Condition 17 page 144 “At least 15 Working Days prior to works commencing, the Consent Holder shall submit a final detailed hydraulic design to GWRC. The purpose of the final detailed hydraulic design is to confirm compliance and consistency with the information provided with the application and the conditions of the consent. The final hydraulic design shall be prepared by a suitably qualified hydrologist or hydraulic modelling specialist to ensure the Q25 flows are contained within the designed stream channel and flood hazard depths and velocities are maintained for Q100 design events.” What is meant by ‘final detailed hydraulic design’? What is the review process for the design of works? What is the process for post-construction sign-off?

18. Concept plan and typical section information only is included in the application. Design details have not been included, such as retaining wall design, sheet pile wall design, redi-rock retaining wall design, giving embedment details, end design etc. I am therefore unable to comment on effects on the environment in regard to erosion, scour and flooding.

19. 11.3 Condition 50 page 148. States ”Any grade control weirs that are removed during construction should only be reinstated if absolutely necessary, and in consultation with the project freshwater ecologist.” Who, along with the project ecologist, decides if reinstatement is necessary? And what the design of the reinstated weir should be?

20. 10.14 An operational designation over the stream and works is to remain in place to allow for maintenance to be carried out by UHCC. I assume that UHCC is satisfied that they can support the level of maintenance required for these works.

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

MEMO

TO Josie Burrows

FROM Sharyn Westlake

DATE 13 March 2020

WGN200083 - Pinehaven Stream Improvements Consent, Flood Protection Comments

Hi Josie

With regard to the Pinehaven Stream Improvements Consent, you have asked for responses from GWRC Flood Protection to questions about the Consent. In responding to your questions, I have looked through the 21 February 2020 response from Jacobs provided to your S92 and also referred to the Consent Application documents.

My responses to your questions (in italics) for the Pinehaven Stream Improvements Consent are as follows:

1. *Has the applicant provided sufficient detail to understand the proposed structures and effects on the environment in regards to erosion, scour and flooding? If not, what further information and/or assessment is required?*

   I am satisfied that the applicant has provided sufficient detail within the AEE and supplementary information to understand the proposed structures and effects on the environment in regards to erosion, scour and flooding. The information provided includes the flood hazard assessment reports and addendum.

   Design details have yet to be finalised and these will need to ensure that the works are appropriately designed for stream conditions, including that the proposed retaining walls are sufficiently embedded below the stream bed. The design processes in place (from Jacobs S92 response) are that "design packages are 'checked' by a senior engineer, cross discipline checks are then undertaken (if complex), the design is then 'reviewed' by a Technical Leader. The design deliverable is then 'approved' by the Project Director prior to external issue." Additionally, the applicant has proposed a condition requiring that the CMP include "Methods for ensuring that earthworks take into account anticipated ground conditions, contingency plans for unanticipated ground conditions, and are designed and undertaken in a manner that ensures the safety of the public and the stability of surrounding land, buildings, and structures." (Proposed condition 22e, Jacobs S92 response). I consider that the design process and the above condition should ensure that

the design is appropriate and 'fit for purpose' and I do not consider that further information and/or assessment is required for the consenting process.

2. *Do you consider the capacity and design of the proposed works to be appropriate for this location?*

The objectives of the Pinehaven Stream Improvements Project (from the AEE) are:

- "To provide improved capacity and effective and efficient functioning stormwater infrastructure in the stream and its tributaries to a 4% AEP (1 in 25 year return period) flood event level, which will also contribute to the management of flood risk to habitable floor levels up to the predicted peak 100 year flood level.

- To reduce the risk of injury or harm from fast or deep flowing water in Pinehaven Stream and its tributaries;

- To integrate overland flow paths into the wider stormwater network; and

- To enable efficient and effective construction and ongoing maintenance of all structures and stream improvements.

The first objective recognises that the purpose of the works are to provide capacity in the stream for a 1 in 25 year return period flood event, and that while this will also contribute to a reduction in the risk of flooding in a 1 in 100 year return period flood event, the risk of flooding in a 1 in 100 year event will not be eliminated for all properties."

These objectives set out the design capacity that the project is to achieve through the works. The capacity of these proposed works was established through the Pinehaven Stream Floodplain Management Plan (FMP), using the FMP process. The project objectives are consistent with the FMP outcomes. These resulted from community feedback to arrive at a comprehensive and long-term approach for managing flood risk from the Pinehaven Stream, taking account the specific geomorphology and current development around the Pinehaven Stream and its floodplain.

The capacity and design for the project was also looked at by the Pinehaven Stream Improvements Project hydraulic modellers, to test the impact of updated climate change and a 2120 timeframe. With regard to climate change impacts, the number of habitable and non-habitable floor levels affected at the 16% with design compared to the 20% with design does not change (16 habitable floors and 23 non-habitable floors are affected in both scenarios). The modelling concluded that using the latest MfE recommendations would not have any material design impact.

I am satisfied that the capacity and design of the proposed works are appropriate in terms of meeting the outcomes from the FMP for the Pinehaven Stream.

3. *Has the applicant suggested adequate and appropriate methods to avoid, remedy or mitigate the effects on erosion/scour from operational effects of the structures? If not, what further information/assessments are required (and specify which structures you have concerns with).*

The design of the structural flood mitigation works for the project include a suite of measures for managing the stream and its floodwater to provide for a 25-year channel capacity. These include:

- Creation of naturalised channel sections with suitable riparian planting;
- Construction of vertically sided lined stream sections;
- Securing secondary flow paths;
- Replacing private vehicle crossings;
- Blockage reduction for inlet structures;
- A low wall is proposed along southern boundary of Willow Park and 10a Blue Mountains Road
- Construction of a private road to access 28 and 32 Mountains Road and 34 and 36 Blue Mountains Road; and
- Relocation of utilities which cross the stream to avoid blockages

This combination of measures has been selected to meet the project objectives, taking into account the stream and flood conditions. In carrying out the hydraulic modelling, vegetation has been modelled as part of the surface roughness. The surface roughness in the hydraulic model was reviewed against the proposed design to confirm appropriateness of roughness coefficients and revisions to the design were made where appropriate (for example at Willow Park).

Detailed design work is still being carried out, and I am satisfied that the design of the works and combination of measures including riparian planting are adequate and appropriate methods to avoid, remedy or mitigate the effects on erosion/scour from the operational effects of the structures. Additionally, UHCC will be responsible for maintenance of the works and will provide for ongoing operation and maintenance of the project when completed.

4. *Do you agree with the applicants overall assessment of the effects of the structures on erosion and scour once constructed?*

The design of the works has taken into account the potential for erosion and scour. This will be confirmed through finalisation of the design details (see 1. above), and the design changed as required through the final design process.

5. *Could the applicant consider more 'natural' methods in place of engineered structures? If so, which structures would these be and what sort of methods could be employed?*

The FMP sets out a combination of methods to manage flood risk from the Pinehaven Stream across structural, non-structural and river management options. This project addresses many of the physical works as recommended in the FMP and proposes a combination of methods for stream management. In terms of the current proposed engineered structures, I am comfortable that the FMP process worked through appropriate options. I consider it highly unlikely that more 'natural' measures could be used due to the constrained space and hydraulic conditions the designs need to meet. If the stream is not constrained by structural measures, such as rock walls, then natural movement of the stream, including erosion of the banks, is expected. Through most of its length there is insufficient room to allow natural stream movement to happen without existing houses, roads etc. being threatened.

6. *Does the application provide sufficient detail on the maintenance that will be required and how it will be undertaken?*

Design is being carried out to meet the design conditions. These include the project design life of 2120 including the effects of climate change. The engineering design process generally includes consideration of maintenance, including how it will be carried out and if it can be reduced through design detailing e.g. final design of the debris screens will incorporate multiple considerations including blockage, 'self-cleaning', and safety (e.g. limiting access to culverts).

Maintenance is also considered in the proposed conditions e.g. the effectiveness of enhancement planting, which could potentially be damaged or removed in a flood event, will be monitored and maintained for a period of 5 years following planting being undertaken, as per proposed designation condition 26 which addresses the replacement of enhancement planting damaged or removed in a significant flood event. Proposed consent condition 40B(c) also addresses this matter.

One of the other main issues with maintenance is around access. Following construction, the designation extent will be reduced to allow for maintenance access at the top of bank on either side of the channel.

UHCC will be the owners and operators of the Pinehaven Stream flood mitigation assets. As they are the Applicant, and will also be operating and maintaining these works into the future I consider that they have the knowledge and resources to adequately do this. They also have a mandated responsibility to the Pinehaven Community and statutory

asset management responsibilities that will carry beyond the life of this consent. I see no issue with future maintenance and how it will be undertaken.

7. *Do you have any comments on the proposed conditions of consents? Are amendments or additions required to manage erosion/scour from the structures once constructed?*

   I have no comments on the proposed conditions of consent. I support the proposed amendments especially with regard to conditions 5, 17 and 22

8. *Any other comments?*

   I have no other comments.

I am happy to discuss further if you would like.

Sharyn Westlake
Senior Engineer, Strategy and Advisory Specialist
Flood Protection

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sharyn.westlake@gw.govt.nz

Appendix 8 – Mr Gregor McLean's Advice

MEMORANDUM

To: Josie Burrows

From: Gregor McLean

Date: 21 October 2019

Subject: Pinehaven – ESCP review - WGN200083

1. **Has the applicant provided sufficient detail to understand the proposed construction, erosion and sediment control methodology and effects on water quality? If not, what further information and/or assessment is required?**

   The application provides an Erosion and Sediment Control Plan (Appendix W) that was initially discussed during pre-application meetings with the Applicant's agents.

   Appendix A and Appendix D of the ESCP contains Downers draft ESCP's. These were reviewed and comments provided during the pre-application meetings. These document have not been modified since those meetings and still contains 'draft' comments from Downers when it was prepared. In addition they do not contain consistent information nor have taken on any pre-application advice.

   The ESCP contains two methodologies for undertaking the works, sheet-piling and piped diversion. It was communicated at the pre-application meetings that the preferred methodology for the works was for the piped diversion and that sheet piling and subsequent tracking of construction machinery within the stream could not be supported.

   The ESCP needs to contain consistent information that is in line with the pre-application advice from GWRC.

   It is noted that the removal of the two bridges (56-48 Whitemans) requires the excavator to be within the stream. It is noted that the pre-application discussions regarding these works was to keep the excavator out of the stream. It was also noted that the design of the bridges had not been determined and therefore the methodology could not be confirmed.

   The application states that the piped diversion has been designed for 0.5 cumecs flow, which corresponds approximately to the 95% rainfall gauge readings. The discussions regarding the piped diversion was to relate this back to a return period storm event which would then allow triggers to be set in terms of forecast and actual rainfall. These triggers would then result in certain onsite actions being taken, for example stabilising the instream works,

removal of construction equipment. It is suggested that further work on this aspect is undertaken.

2. **Is the proposed construction, erosion and sediment control methodology appropriate and the best practicable option for the proposed works at this location?**

   Refer comments above regarding the instream works methodologies.

3. **Does the application provide sufficient detail on the monitoring and maintenance of erosion and sediment control devices that will be undertaken, how it will be undertaken and how effects on water quality will be managed?**

   The water quality monitoring is proposed to be undertaken after 6mm/hr or 20mm/24hour rainfall event. It is noted that the monitoring proposed is only in relation to the earthworks components of the project rather than the streamworks, which is the major component of this project.

   The monitoring needs to be modified to include appropriate parameters and triggers for the streamworks aspects and in rain events which exceed the design capacity of the piped diversion.

   Table 6.1 does not contain any maintenance actions for the instream works and will need to include this information.

4. **Has the applicant proposed an appropriate monitoring plan, trigger and cease work triggers in relation to sedimentation of the stream?**

   No – refer comments above.

   Also note that the ESCP has set a provisional guidelines to trigger stormwater management investigation and response, with a water quality trigger of a total change in suspended sediment from upstream to downstream monitoring not exceeding a 30 percent increase of the baseline concentration. It is unclear what the baseline concentration refers to, this would need to be provided.

5. **Do you have any comments on the proposed consent conditions relating to erosion and sediment controls? What amendments or additions are required?**

   Proposed condition 12 states:

   Submitted management plans will be deemed to be certified if no correspondence from the CMO has been received on the specific management plan within 15 Working Days.

   This should be deleted.

Condition 31 refers to the two construction methodologies. This should be modified to include only the preferred methodology.

Condition 32 includes flocculation monitoring however the application states that this will not be required. It is considered however that the use flocculation should not be discounted and therefore should remain within this condition. It is therefore also considered that a condition should be proposed requiring a Chemical Treatment Plan (if required due to monitoring).

There are no conditions relating to works during winter and I would suggest that the standard conditions are imposed. It is noted that works during these months have a higher risk of increased streamflows, groundwater levels and subsequent sediment discharges are more likely.

The conditions refer to a CMP and ESCP however the application and ESCP refers to SEMP/ SSEMP's. Consistency in terminology will be required throughout the conditions and documents.

Gregor McLean
SouthernSkies Environmental Limited

MEMORANDUM

To: Josie Burrows

From: Gregor McLean

Date: 1 March 2020

Subject: Pinehaven – ESCP review - WGN200083

1. **Has the applicant provided sufficient detail to understand the proposed construction, erosion and sediment control methodology and effects on water quality? If not, what further information and/or assessment is required?**

   The applicant has now proposed a consistent methodology for the instream works. The works methodology is based around working in the 'dry', in that each section of works will be isolated from the upstream flows by temporary dams and stream flows will be conveyed through/ around the works via a temporary pipe. Pumps will be provided as a contingency to supplement the capacity of the temporary pipe.

   A suite of management plans are proposed, including an Erosion and Sediment Control Plan, based on the draft supplied with the application, and Site-specific Environmental Management Plans (SEMP's) for each area of work. These plans will be submitted for certification by GWRC prior to works commencing.

   An adaptive management approach is proposed in relation to monitoring of the works.

2. **Is the proposed construction, erosion and sediment control methodology appropriate and the best practicable option for the proposed works at this location?**

   The proposed construction methodology is based on each section of works being isolated from the stream flows via temporary dams and a diversion pipe. Undertaking streamworks in the dry is considered to be industry best practice and the applicants methodology meets this requirement.

   The risk of undertaking streamworks in the winter as proposed should be addressed and I recommend that this is included as a condition of consent.

3. **Does the application provide sufficient detail on the monitoring and maintenance of erosion and sediment control devices that will be undertaken, how it will be undertaken and how effects on water quality will be managed?**

   The monitoring and maintenance of the erosion and sediment controls devices is adequate and sufficient detail is provided within the responses.

4. **Has the applicant proposed an appropriate monitoring plan, trigger and cease work triggers in relation to sedimentation of the stream?**

   The applicant proposes an adaptive management approach in relation to monitoring of the works. Adaptive management enables a 'plan-do-check-act' approach to be undertaken whereby the ongoing monitoring and reporting that is proposed creates a continuous feedback loop from the effects being created, allowing for the most appropriate solution to be utilised or change of method made for any particular environmental effect.

   The success of this adaptive management approach is entirely dependent on the acceptance of the parties involved to assess the monitoring results and react in a positive manner where an adverse effect may have occurred or where additional resources are required to rectify or improve a situation. This approach can have significant cost and time implications for a project.

   It is considered that the Adaptive Management Approach provided in the Preliminary Erosion and Sedimentation Plan - Appendix A for the 'During Piped Diversion Operation' is appropriate in that as the monitoring detects an increase in downstream sediment levels, triggers and actions have been established.

   These triggers and actions are not proposed during the installation and the removal of the instream dams For consistency, the approach for the recently consented culverts should be adopted for this activity.

   When monitoring, if a stop works trigger >150g/m^3 for 2 hours is identified, the Preliminary Erosion and Sedimentation Plan requires reporting to GWRC, which includes:
   - Time of trigger and stream SSC
   - Time samples collected
   - pH, SSC and turbidity results for each sample

   The reporting should also include the cause and any remedial actions, as this will be necessary from an adaptive management approach to ensure that the learnings are adopted elsewhere on the project. I have recommended that conditions are included in this regard.

5. **Do you have any comments on the proposed consent conditions relating to erosion and sediment controls? What amendments or additions are required?**

   Condition 31 includes flocculation monitoring however at this stage the use of flocculation is not proposed. It is considered however that the use flocculation should not be discounted and therefore should remain within this condition. It is therefore also considered that a condition should be proposed requiring a Chemical Treatment Plan (if required due to monitoring).

   As works are proposed during both summer and winter months I would suggest that the standard winters works conditions are imposed. It is noted that works during these months have a higher risk of increased streamflows and groundwater levels therefore subsequent sediment discharges are more likely. The SEMP's for works during this period should consider contingencies for those conditions and incorporate any learnings from the monitoring of the previous stages to address the increased risk of these works.

   Trigger exceedance reporting will need to be included as a condition as currently the requirements in the Preliminary Erosion and Sedimentation Plan does not contain adequate detail, specifically around cause and remedy.

Gregor McLean
SouthernSkies Environmental Limited

Appendix 9 – Dr Evan Harrison's advice

greater WELLINGTON
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MEMO – Pinehaven stream improvements consent application review

TO	Josie Burrows, Resource Advisor
COPIED TO	Dr Megan Oliver, Team Leader Marine and Freshwater
FROM	Dr Evan Harrison, Senior Environmental Scientist (Freshwater)
DATE	10/10/19
FILE NUMBER	WGN200083

This memo identifies areas where I require additional information from the applicant to assess the Pinehaven Steam improvements consent in relation to the effects on water quality and aquatic ecology. Below in response to your questions I have outlined where I require further information from the applicant. I'm happy to discuss any of the below with yourself or the applicant before completing my review.

1. **Has the applicant provided sufficient detail to understand the proposed structures and effects on the environment in regards to effects on aquatic habitats and fish passage? If not, please list the further information and/or assessment required.**

   Yes I'm satisfied with the information provided. I am supportive of the removal of the potential fish barrier at the confluence with Hulls Creek and removal or redesign of the weir structures within the works site to allow for fish passage. This should be done according to the NZ Fish Passage Guidelines and approved by a freshwater ecologist. The NZ Fish Passage Guidelines should be referenced in conditions referring to fish passage remediation (e.g. proposed conditions 50 and 51).

2. **Has the applicant adequately described and accurately assessed (with appropriate methods) the aquatic habitat and ecology at Pinehaven Stream? If not, what further information/ assessments is required?**

   Yes I'm satisfied with how Dr Alex James from EOS Ecology has described the habitat and ecology of Pinehaven Stream. Dr James' assessment has been based on previously collected information to inform his assessment. I am satisfied with this approach, because the information from the Jacobs (2017) and Kingnett Mitchell (2005) studies is still relevant.

3. **Has the applicant provided an adequate assessment of effects of the construction effects on the aquatic habitat and ecology of the Pinehaven Stream, Hulls Creek and the Hutt River? If not, what further information is required?**

How will the sheet piles be driven into the bed and what controls are in place for this to manage ecological and water quality effects (e.g. will this be in a dry bed)? From the application I couldn't tell from the information provided.

4. **Has the applicant provided an adequate assessment of effects of the ongoing operational effects of the structures on the aquatic habitat and ecology of the Pinehaven Stream? If not, what further information is required?**

   Yes I'm satisfied with the information provided.

5. **Do you agree with the applicant's overall assessment of level of effects on aquatic ecology during construction and post construction?**

   Yes I'm satisfied with the assessment.

   One minor question I have is can it be confirmed in what direction the works will one occur. One part of the application says upstream to downstream and another says the opposite (page 123 sections 10.7.2.1.3 and 10.7.2.1.6)

6. **Has the applicant proposed appropriate measures to remediate compaction of the stream bed as a result of works?**

   No. Can this question please be put back to the applicant?

   Can more information please be provided on the method for remediating stream compaction and how the sediment effects will be controlled from any remediation works?

7. **Has the applicant proposed an appropriate monitoring plan, trigger and cease work triggers in relation to manage sediment effects on ecological values during works?**

   The potential effect on ecology will be from sediment and possibly concrete/grout wash

   Can more information please be provided for:

   What is the logic behind the 30% increase between upstream and downstream sites from the baseline concentration (I could not find any information on this)?

   Proposed condition 32g reference the ANZECC Guidelines for trigger levels. It should be noted that these guidelines have now been updated (https://www.waterquality.gov.au/anz-guidelines) and are called the Australian and New Zealand Guidelines for Marine and Fresh and Marine Water Quality. Can the applicant please confirm if these guidelines will be used to set trigger values or if they are using the 30% increase between upstream and downstream sites as the trigger value?

   Will pH level just be measured with a field metre or confirmed in the lab as well with a water sample (field metres can sometimes be unreliable)?

In the application it says TSS will be measured with a field metre. Does the applicant mean turbidity for an indication of the sediment level and TSS will be measured in the lab with a water sample?

Given that there is a risk of fine sediment deposition which will have a long term ecological impact downstream of the workshop any monitoring should include observations of fine sediment deposition. Could the applicant propose methods and triggers for this?

Will ammonia also be measured with water samples given the risk with concrete runoff (as outlined in the ecological assessment)?

8. **Has the applicant suggested adequate and appropriate methods to avoid, remedy, mitigate or offset the effects on aquatic habitat and ecology from the construction and operational effects of structures? If not, what other methods could be used (i.e. could be placed on the consent as conditions)?**

Yes I'm satisfied with what has been provided in terms of fish rescue and fish barrier remediation options for mitigating the effects of the construction in the report produced by Dr Alex James. Post works it is likely that macroinvertebrate from good quality habitat upstream will recolonise the area.

In terms of the fish rescue this has been referenced in proposed conditions 40-44. Some minor questions I have on the fish rescue are:

-If a fish exclusion screen breaks will fishing start again?

-In the application it is stated that fish are expected to leave the area. Can it please be confirmed that fishing will take place until the ecologist is satisfied no fish remain?

-Will sports fish also be relocated (there is a small chance they may be present at the site even though not captured previously)?

-Will any sediment removed from the river during construction be checked for fish?

The application hasn't clearly outlined linkages with the report by Dr Alex James. For example in section 10.7.2.1.6 can more detail please be provided on:

-How fish passage will be maintained/impacted during construction? It is noted in the application when damming occurs this will be short in duration. Can more details please be provided on how long this will be?

- It is also noted that if works are to occur in fish migration periods manual trap and transfer will be undertaken. Can this please be confirmed because in Dr James' report the it shows that the works will always be occurring in spawning/migration periods. Is the proposed mitigation for this following construction the remediation of the downstream fish barrier?

-How does monitoring of fine sediment mitigate impacts (e.g. what actions are needed)?

- How will habitat reinstatement be done? More details need to be provided here such as what will be done in riparian, pool and riffle areas, as well as compaction management. I note that some details are provided in proposed conditions 45 – 51.

-For modifications to the riparian area can more details (e.g. maps/cross sections) be provided to show locations of planting within rock walls to show planting post construction?

Any other comments?

Will there be an assessment of the effectiveness of the works with post construction monitoring through the monitoring plan?

As per my comments above in places the linkages between the report by Dr Alex James and the application assessment of environmental effects aren't clear. Can it pleased be confirmed if all his recommendations are being implemented?

In the application there is no mention of the new channel being constructed or bank habitat. Can more details be provided on these designs in terms of ecology and instream habitat values?

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MEMO – Pinehaven stream improvements consent application review

TO	Josie Burrows, Resource Advisor
COPIED TO	Dr Megan Oliver, Team Leader Marine and Freshwater
FROM	Dr Evan Harrison, Senior Environmental Scientist (Freshwater)
DATE	17/3/20
FILE NUMBER	WGN200083

This memo forms my final review of the Pinehaven Steam improvements consent in relation to the effects on water quality and aquatic ecology. Below I have refined my responses to your questions following the Section 92 responses by the applicant in response to my questions on 10/10/19. I'm happy to discuss any of the below with yourself.

1. **Has the applicant provided sufficient detail to understand the proposed structures and effects on the environment in regards to effects on aquatic habitats and fish passage? If not, please list the further information and/or assessment required.**

   Yes I'm satisfied with the information provided. I am supportive of the removal of the potential fish barrier at the confluence with Hulls Creek and removal or redesign of the weir structures within the works site to allow for fish passage. This should be done according to the NZ Fish Passage Guidelines and approved by a freshwater ecologist. I am now satisfied with the reference to Guidelines in the proposed condition

2. **Has the applicant adequately described and accurately assessed (with appropriate methods) the aquatic habitat and ecology at Pinehaven Stream? If not, what further information/ assessments is required?**

   Yes I'm satisfied with how Dr Alex James from EOS Ecology has described the habitat and ecology of Pinehaven Stream. Dr James' assessment has been based on previously collected information to inform his assessment. I am satisfied with this approach, because the information from the Jacobs (2017) and Kingnett Mitchell (2005) studies is still relevant.

3. **Has the applicant provided an adequate assessment of effects of the construction effects on the aquatic habitat and ecology of the Pinehaven Stream, Hulls Creek and the Hutt River? If not, what further information is required?**

   From the responses provided the use of sheet piles is no longer beings used and a piped diversion is being used. I am now satisfied with the information that has been provided.

4. **Has the applicant provided an adequate assessment of effects of the ongoing operational effects of the structures on the aquatic habitat and ecology of the Pinehaven Stream? If not, what further information is required?**

   Yes I'm satisfied with the information provided.

5. **Do you agree with the applicant's overall assessment of level of effects on aquatic ecology during construction and post construction?**

   Yes I'm satisfied with the assessment and the extra information that has been provided regarding the direction of works (work will neither be upstream nor downstream, as works will occur across different reaches and/or section at various times).

6. **Has the applicant proposed appropriate measures to remediate compaction of the stream bed as a result of works?**

   I am now satisfied with the proposed condition (48) and associated methods for remediating any stream compaction. It should also be added to 48e that any remedial actions should occur in a dry stream bed before reintroducing water.

7. **Has the applicant proposed an appropriate monitoring plan, trigger and cease work triggers in relation to manage sediment effects on ecological values during works?**

   The potential effect on ecology will be from sediment and possibly concrete/grout wash and I am satisfied with the extra details I have requested.

   Following the further information that has been provided I am satisfied with the information presented for the setting of the SSC 150 g/m^3 trigger and the use of an adaptive management approach with several trigger levels for action before reach the 150 limit. I am supportive of turbidity monitoring using continuous data loggers to calculate SSC using the relationship from the pilot study.

   In the response and proposed conditions the applicant has proposed an exclusion for the 150 trigger for:

- Excavator movements within the stream for the construction of the temporary piped diversion dam and pipe;

- Excavator movements within the stream to remove the temporary piped diversion dam and pipe.

   This approach is not in-line with the approach being taken with the consent for the culverts where turbidity monitoring using continuous loggers is taking place two weeks before the works to inform baseline conditions within the stream before the works to inform a limit. If a limit isn't set it won't be possible to take an adaptive management approach, because adaptive management requires targets to assess monitoring against.

In response EH05 it says that the Australian and New Zealand Guidelines for Marine and Fresh and Marine Water Quality Guidelines will not be used to set site specific triggers. Does this also include pH and Ammonia? The Guidelines are still referenced in proposed condition 31g. Does this mean that site specific guidelines will be set using the methods outlined in the Guidelines? In any conditions the ANZECC guidelines if referenced should be referred to as the 2018 Australian and New Zealand Guidelines for Marine and Fresh and Marine Water Quality (their new name following the 2018 revision).

I am satisfied with the confirmation that pH will be measured in the field and lab. I am also satisfied with the measurement of ammonia.

It is good to see the addition of the condition and limit regarding fine deposition sediment. I am satisfied with the proposed condition.

8. **Has the applicant suggested adequate and appropriate methods to avoid, remedy, mitigate or offset the effects on aquatic habitat and ecology from the construction and operational effects of structures? If not, what other methods could be used (i.e. could be placed on the consent as conditions)?**

Yes I'm satisfied with what has been provided in terms of fish rescue and fish barrier remediation options for mitigating the effects of the construction in the report produced by Dr Alex James. Post works it is likely that macroinvertebrate from good quality habitat upstream will recolonise the area.

I am satisfied with the extra information and additions provided in regards to fish rescue methods, the addition of recommendations by Dr Alex James's recommendations, fine sediment mitigation, planting methods within rock walls, and site remediation of the channel and fish passage.

Any other comments?

I am satisfied with the response regarding effectiveness monitoring post construction and am glad to hear there will be a monitoring plan and post construction monitoring

The extra details provided on the creation of the new channel and the associated ecology have provided enough details for me to be satisfied and I can now see that Dr Alex James' recommendations have been taken on board.

greater WELLINGTON
REGIONAL COUNCIL
Te Pane Matua Taiao

MEMO – Pinehaven stream improvements consent application review

TO	Josie Burrows, Resource Advisor
COPIED TO	Dr Megan Oliver, Team Leader Marine and Freshwater
FROM	Dr Evan Harrison, Senior Environmental Scientist (Freshwater)
DATE	31/3/20
FILE NUMBER	WGN200083

This memo forms my response to the replies to my questions on the Section 92 response. I'm happy to discuss any of the below with yourself.

- *Regarding EH05, the section 92 response says that the Australian and New Zealand Guidelines for Marine and Fresh and Marine Water Quality Guidelines will not be used to set site specific triggers. Does this also include pH and Ammonia? The Guidelines are still referenced in proposed condition 31g. Does this mean that site specific guidelines will be set using the methods outlined in the Guidelines?***.**

I'm satisfied with the response that the guidelines will be referenced for pH and Ammonia. In the conditions they should be referred to as the Australian and New Zealand Guidelines for Marine and Fresh and Marine Water Quality Guidelines.

- *In the response and proposed conditions the applicant has proposed an exclusion for the 150 trigger for:*
  - *Excavator movements within the stream for the construction of the temporary piped diversion dam and pipe;*
  - *Excavator movements within the stream to remove the temporary piped diversion dam and pipe.*
  - *This approach is not in-line with the approach being taken with the consent for the culverts.*

  Is your intention that the response was not in line with the conditions for the culvert consent? If so, why?

I am satisfied with the response that pre works continuous turbidity monitoring will take place similar to the culvert consent and the conditions will be amended to reflect this. I also support results from the culvert monitoring being used to inform the main works.

Appendix 10 – Ms Frances Forsyth's advice

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REVIEW OF TERRESTRIAL EFFECTS AND PROPOSED MITIGATION FOR PROPOSED IMPROVEMENTS ALONG THE PINEHAVEN STREAM

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Wildlands

R5212

REVIEW OF TERRESTRIAL EFFECTS AND PROPOSED MITIGATION FOR PROPOSED IMPROVEMENTS ALONG THE PINEHAVEN STREAM

DRAFT

Contract Report No. 5212

October 2019

Project Team:
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CONTENTS

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Reviewed and approved for release by:

W.B. Shaw
Director/Principal Ecologist
Wildland Consultants Ltd

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1. INTRODUCTION

Urban Edge Planning Ltd is processing a Notice of Requirement application for Upper Hutt City Council and Greater Wellington Regional Council for stream improvements along the Pinehaven Stream (see Figure 1) and require a review of the following:

- Ecological effects associated with vegetation removal: two reports, one by Forbes Ecology (2019) on vegetation and one by Aristos Consultants (2017) on birds. A summary of these reports is also provided by Jacobs New Zealand Ltd.
- Suitability of proposed replanting (from the stream bank edge landward).
- Suitability of the proposed riparian planting plan, monitoring and maintenance (this is for Greater Wellington Regional Council).

Figure 1: Designation extent overview of the proposed works corridor (DCM Urban 2019).

The review is set out using headings similar to above, as well as using headings from the assessment of terrestrial ecology by Forbes Ecology (2019) and Aristos Ecology (2017). This review provides advice as to whether the terrestrial ecological effects relating to vegetation removal and associated with the different council jurisdictions are going to be mitigated appropriately.

2. ECOLOGICAL EFFECTS ASSOCIATED WITH VEGETATION REMOVAL

2.1 Forbes Ecology Report

1. INTRODUCTION

This section describes the broad scope to the works planned and describes vegetation within the works corridor as being generally planted within private gardens. It states that planted vegetation is beyond the scope of an assessment of ecological effects, and that the report is focussed only on mature or remnant indigenous trees which cannot, or are unlikely to be avoided by the stream improvement works. The report does not address potential effects on indigenous birds as this has been covered in a separate report (Aristos Consultants 2017).

The report does not assess the ecological significance of the planted garden vegetation as habitat for significant indigenous fauna, such as lizards and insects. It is highly likely that lizards, including threatened species, will be utilising this habitat.

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2. METHODS

2.1 Site visits

This section seems appropriate.

2.2 Ecological values assessment

This section briefly describes the Environment Institute of Australia and New Zealand (EIANZ) 2018 guidelines for evaluation of the ecological significance of mature or remnant indigenous trees within the works corridor.

This section seems to be appropriate.

2.3 Ecological significance assessment

This section describes Policy 23 of the Wellington Regional Policy Statement (RPS). This is a statutory document and Policy 23 sets out criteria for classification of significant indigenous ecosystems and habitats. It does not describe the rules in the Upper Hutt District Plan regarding urban trees and urban tree groups.

The report recognises the RPS significance process as binary (significant or not significant) but fails to recognise the potential of planted gardens to provide habitat for significant indigenous species. There are a number of urban tree groups within the works area (Figure 2).

Figure 2: Urban Tree Groups from the Upper Hutt District Plan. The arrows show two groups which lie along the stream[1].

2.4 Ecological effects significance

This section describes the EIANZ guidelines relating to assessing level of ecological effects.

This section seems to be appropriate.

2.4.1 Ecological management response

This section describes EIANZ guidance on determining levels of effects.

This section seems to be appropriate.

3. INDIGENOUS VEGETATION AND HABITATS

3.1 Ecological values

3.1.1 Indigenous trees

This section describes trees which may potentially be affected by the proposed works including: eight kōwhai (*Sophora microphylla*), three black beech

[1] https://www.upperhuttcity.com/Services/Tree-Management

(*Fuscospora solandri*), and one kahikatea (*Dacrycapus dacrydioides*). All but one of the trees are described as having low ecological value, based on their conservation status. One black beech is described as having moderate ecological value due to its age. This tree has protected status in the Upper Hutt District Plan.

It would be useful if the following further information could be provided:

- The size (DBH) and approximate heights of each of these trees.
- The species and DBH of all large exotic trees likely to be removed and whether or not they are listed in the District Plan as an Urban Tree or part of an Urban Tree Group.
- Whether the trees stand alone, or are part of an area of regenerating vegetation.
- The habitat values of the individual trees.
- A description of each of the vegetation types to be affected and their relative ecological value, based on the likelihood that they provide habitat for rare fauna species as per RPS Policy 23(b).
- A map of all the vegetation types likely to be affected by works, including exotic and planted vegetation.
- A table indicating the area of each vegetation type to be affected.

3.1.2 Exotic trees

A number of oaks and firs, and one *Prunus* sp. are listed with the addresses where they were observed but without any further detail regarding what size or species they were. These trees are described as having negligible ecological value and were therefore not assessed in terms of ecological effects.

It would be useful if the following further information could be provided:

- The species and DBH (and approximate heights) of all large exotic trees likely to be removed.

4. ECOLOGICAL SIGNIFICANCE ASSESSMENT

4.1 Assessment of GWRC RPS Policy 23

The trees have been assessed from a botanical and vegetation type perspective but not in terms of ecological habitat provision and the fauna species which could potentially utilise the habitat. Only black beech trees were determined to be significant and this was due to black beech forest being classified as Regionally Vulnerable under the Threatened Environment classification for New Zealand (Walker *et al*. 2015).

The value of the vegetation as habitat for rare fauna has not been discussed c.f. RPS Policy 23(b).

5. VEGETATION CLEARANCE EFFECTS

5.1 Clearance or modification of Indigenous vegetation and habitats

5.1.1 Magnitude of adverse effects

Tree removal is recognised as being irreversible and of permanent duration. No effects are anticipated beyond the physical loss of the affected trees. For a larger than individual property scale, the magnitude of these losses is described as being negligible.

It would be useful if the habitat value of all of the vegetation to be lost, particularly for lizards, was assessed.

5.1.2 Levels of adverse effects

The level of effects relating to tree removal is described as low. Effects during the construction period are not addressed.

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It would be useful if all other effects relating to habitat loss were addressed.

6. EFFECTS MANAGEMENT

6.1 Mitigation and offsetting principles and frameworks

6.1.1 The mitigation hierarchy

This section describes the Business and Biodiversity and Offsets Programme (2012[1]) good practice measures to manage effects using the mitigation hierarchy.

This section seems adequate.

6.2 Management of effects

This section describes efforts made during the design stage to avoid the loss of trees. It states that the loss of remaining trees can be managed on the basis of rehabilitation/restoration plantings. A replacement ratio of 3:1 is suggested for the eight kōwhai that will be removed, 10:1 for the three black beech trees, and 5:1 for the single kahikatea.

It is usual for the compensation ratio to refer to the area of vegetation/habitat lost, rather than the number of trees. It appears that this is the only mitigation being recommended in the report.

[1] http://bbop.forest-trends.org/

6.3 Proposed rehabilitation/restoration treatments

Plant provenance is discussed in this section.

This section is adequate.

6. CONCLUSION

This section summarises the rehabilitation/restoration treatment and concludes that if it follows the recommended replanting ratios it will adequately compensate for the loss of thirteen indigenous trees.

This section should be revised to address the further information requests above.

SUMMARY COMMENTS ON THE FORBES ECOLOGY REPORT

This report would benefit from consideration of the values of indigenous and introduced vegetation, including planted vegetation, as habitat for indigenous fauna, and the effects of removal of those habitats on fauna, particularly lizards. A full description of the various vegetation types that will be lost from the works corridor would be helpful along with a quantification of the area of each vegetation type.

There is a high likelihood that terrestrial skinks will be adversely affected by the project. Exotic rank grasslands, flaxes, and other ground cover will likely contain lizard populations. These lizards are most likely to be terrestrial skinks, especially the northern grass skink (*Oligosoma polychroma*, Not Threatened[1]) and copper skink (*O. aeneum*, Not Threatened). However, ornate skink (*O. ornatum*, At Risk-Declining) are possibly also present.

Arboreal geckos are less likely to be affected by the removal of trees, as they are typically in poor abundance in urban / peri-urban environments. The most likely arboreal geckos are the ngāhere gecko (*Mokopirirakau* 'southern North Island', At Risk-Declining) and barking gecko (*Naultinus punctatus*, At Risk-Declining). There are records of all these species in Pinehaven and adjacent suburbs and foothills. A lack of records for the works corridor does not necessarily mean that lizards are not present.

A lizard survey of the works corridor should be required as a condition of consent:

- To assist with the preparation a lizard management component in the Ecological Management Plan if lizards are found to be present.
- To secure a Wildlife Act Authority (Wildlife permit) for the project, if lizards are present.

Please note that processing of a Wildlife Act permit application typically requires at least three months. If lizards are not found to be present during the survey there is no need to undertake any further work nor secure a Wildlife Act permit for lizards.

[1] Hitchmough *et al.* 2016

2.2 Aristos Consultants report

1. INTRODUCTION

This provides an introduction to the proposed works.

This section seems appropriate.

2. BACKGROUND

2.1 Pinehaven catchment and bird habitat

This describes the locale surrounding the stream.

This section seems appropriate.

2.2 Proposed stream works

This section is very brief and contains a note to the effect that it will be updated once engineering plans have been finalised.

This section does not contain any reference to the area of land likely to be affected or the proportion of this which may provide habitat for birds.

3. METHODS

3.1 Field survey

This contains information on the sites and dates of all bird counts undertaken and a map showing the sites.

This section seems appropriate.

3.2 Literature search and other information sources

This section describes various databases consulted and anecdotal evidence of birds in the locale.

This section seems appropriate.

3.3 Data analysis

This section describes data and restrictions on analysis which mean that sites cannot be compared but the data as a whole provides a baseline for future monitoring.

This section seems appropriate.

4. RESULTS AND DISCUSSION

4.1 Field survey

This section provides a generalised description of bird habitat along the works corridor and presentation of bird count data.

This section seems appropriate.

4.2 Bird records from Pinehaven catchment

4.2.1 Wi Tako Reserve

This section provides a description of bird habitat and bird count data for the reference site, Wi Tako Reserve.

This section seems appropriate.

4.2.2 Pinehaven catchment

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This section provides a description of bird habitat and bird records from desktop research.

This section seems appropriate.

4.3 Bird species diversity and relative abundance

This section compares results from each of the bird count stations.

This section seems appropriate.

4.4 Effects of proposed structural works on bird ecology

As well as describing the works proposed for each section, and the effects of the works on birds, this section also covers suggestions for avoidance and mitigation. The report states that when vegetation utilised by birds for food is removed during the works, birds will switch to other sources. A table is provided listing large introduced and indigenous trees that lie within the proposed works footprint. This is based on the Jacobs NZ Ltd plans from September 2017.

It would be useful to have the following further information:

- A map and photographs showing points of reference would be useful, including Willow Park, Sunbrae Drive culvert, vegetation, and any other relevant features.
- Whether Aristos Consultants recommend the avoidance of vegetation removal during the nesting season?
- An assessment of the total area of bird habitat to be lost in the medium-term as a result of the proposed works and a discussion regarding the pressure that this will place on remaining bird habitat in the valley.

4. SUMMARY AND RECOMMENDATIONS

This section summarises information from previous sections including descriptions of the locale, the works corridor, bird species for both the locale and the corridor and conclusions regarding the overall effect of the works on birds in the works corridor. Effects are described as being minor to less than minor despite medium-term loss of seasonal food supply and loss of habitat until vegetation is re-established. Sites additional to the works corridor are suggested for enhancement planting and pest plant and animal control.

This section has been mis-numbered and should be Section 5.

It would be useful to have further information on the following:

- Quantification of the total area of vegetation/habitat loss and how this will affect bird populations in Pinehaven in the medium term.
- Is pest animal control recommended to increase the carrying capacity of the remaining bird habitat in Pinehaven in the medium-term to mitigate the loss of habitat along the works corridor and if so where should it be undertaken and for how long?
- What area of land is available for additional mitigation planting outside of the works corridor?

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SUMMARY COMMENTS ON THE ARISTOS ECOLOGY REPORT

This report was produced in 2017 and would benefit from the inclusion of information about the areas of the various vegetation types which will be lost as a result of the proposed works. This would allow a better assessment of the medium-term effects of this on the bird populations at Pinehaven.

2.3 Jacobs NZ Ltd summary assessment of environmental effects

10.7 Ecology

10.7.1 Terrestrial ecology

Flora

This section refers to individual, large indigenous trees only.

There is no vegetation and habitat section here or in the Forbes ecology report this was taken from.

Avifauna

This section implies that there will be gaps along the works corridor created by the removal of specific trees.

Conversely, the landscape planting plans in Appendix F of the Application appear to show that almost all vegetation is likely to be removed from the works corridor.

Lizards

As neither of the ecological reports addresses lizards it is unclear where this section on the likelihood of lizards being present has come from, or what justification there is for the statement.

This section is not supported.

Bats

Neither of the ecological reports mention bats so it is unclear where this opinion on the likelihood of bats being present has come from.

No surveys have been undertaken in this area. However, there is habitat for bats to roost in higher up the catchment and also in Witako Reserve. Larger trees in the project area could possibly be potential bat roosts. It is known that bats like to hunt insects along streams with riparian vegetation.

Construction Phase

This section states that the proposed works will significantly disturb the riparian environment but that this disturbance will be temporary and is considered to be a minor adverse effect.

The following further information is required:

- An explanation of how disturbance to terrestrial habitat during construction will be mitigated in order to reduce the effects from significant to minor.

3. SUITABILITY OF PROPOSED LANDWARD REPLANTING

The resource consent application (DCM Urban Design; Appendix F) includes landscape planting plans and a plant schedule. The length of stream to be affected by the works is about one kilometre in length and flows along a narrow *c.*15 metres wide corridor in a residential area. The works will generally be undertaken on private property in a flood protection designated corridor.

The plan divides the planting schedule into five vegetation types: specimen trees, buffer species, climbers, riparian rarely wet, and riparian partially wet.

The list of specimen trees includes 86 plants of species which grow to heights of well over 20 metres and in time up to 50 metres tall. Along one 35 metre property boundary there are plans to plant six large podocarp trees. Twenty-one tree species are listed in the plant schedule including two exotic species. However, 47 tree species are listed in

a plant check list for nearby Wi Tako Reserve[1] and many of those are of smaller stature than those in the schedule.

The plan includes large numbers of kāpuka (*Griselinia littoralis*) (337) whaririki (*Phormium cookianum*) (168), and harakeke (*Phormium tenax*) (505). None of these species is present on any plant checklists for the area and kāpuka and harakeke are inappropriate for streamside planting in this area.

The following further information is required:

- Are there alternative sites where large stature trees might better be sited than close to dwellings?
- What area of land in the works corridor will be planted with indigenous and introduced tree species to mitigate the long-term loss of vegetation and habitat for fauna.

The following should be required as a condition of consent:

- Extended specimen and buffer planting schedules including a larger proportion of small trees and a higher diversity of species to provide year-round food for birds, and excluding kāpuka, whaririki, and harakeke, and any other indigenous trees which do not already occur locally.

4. SUITABILITY OF PROPOSED STREAMSIDE RIPARIAN REPLANTING

The DCM Urban Design (2019) landscaping plans and plant schedule include areas labelled riparian rarely wet and riparian partially wet. Examples of cross sections for these planting types are shown in Figures 3 and 4. The streambank planting plans include a mix of species that will not grow so tall as to densely shade neighbouring houses. However, the L3 Riparian 2 list includes nine species, only two of which (*Austroderia fulvida* and *Veronica stricta* var. *atkinsonii*) are naturally-occurring in the catchment. *Ficinia nodosa* and *Muehlenbeckia astonii* are both coastal species and unlikely to be successful alongside what will, at times, be a fast-flowing stream, and the *Carex* species are likely to be overwhelmed by weeds such as *Tradescantia fluminensis*. Short-stature, sun-loving species that hold the stream banks along with appropriate flood-resistant understorey species are required for this area.

In at least one area there are existing concrete structures in the stream (Plate 1). It is unclear whether or not more of such structures are planned. The planting plan (Figure 4) attempts to use plants to soften these structures. However, only extremely hardy species will survive in these arid, but occasionally inundated places. Species requiring a cool moist root run such as *Clematis paniculata* and *Metrosideros carminea* are inappropriate for such sites.

[1] See www.nzpcn.org.nz/factsheet_index.aspx

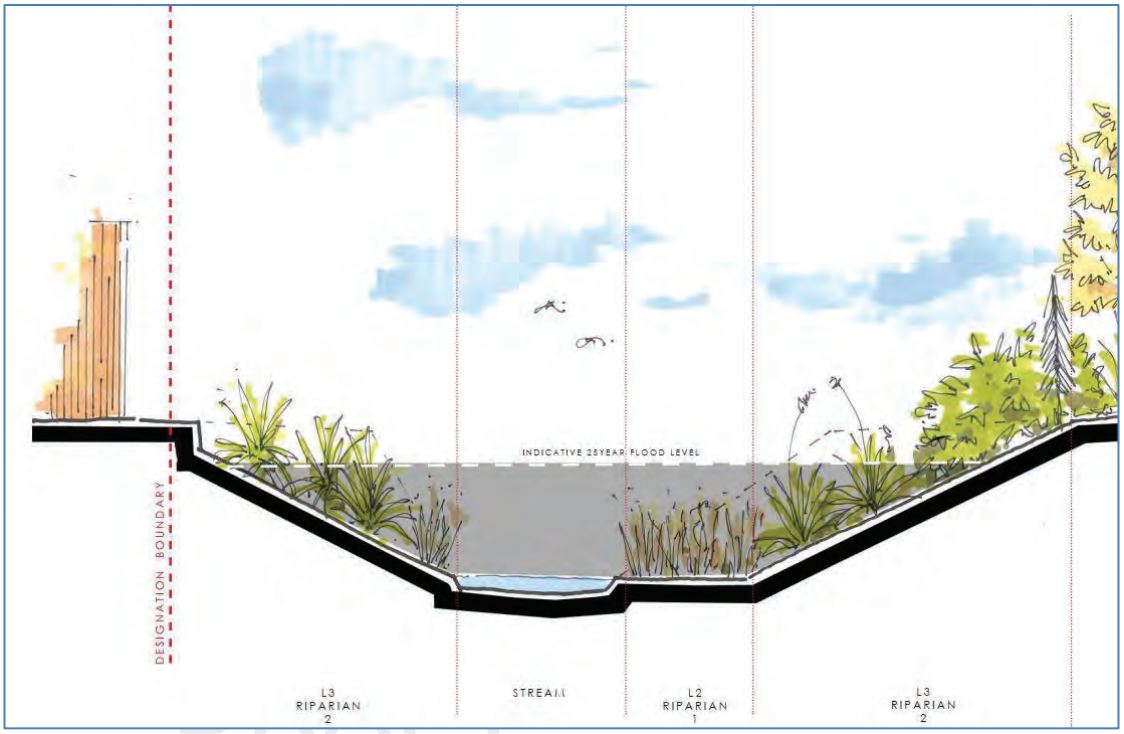

Figure 3: Planting of indigenous riparian species in the stream corridor which can tolerate wet conditions (DCM Urban Design Page 18).

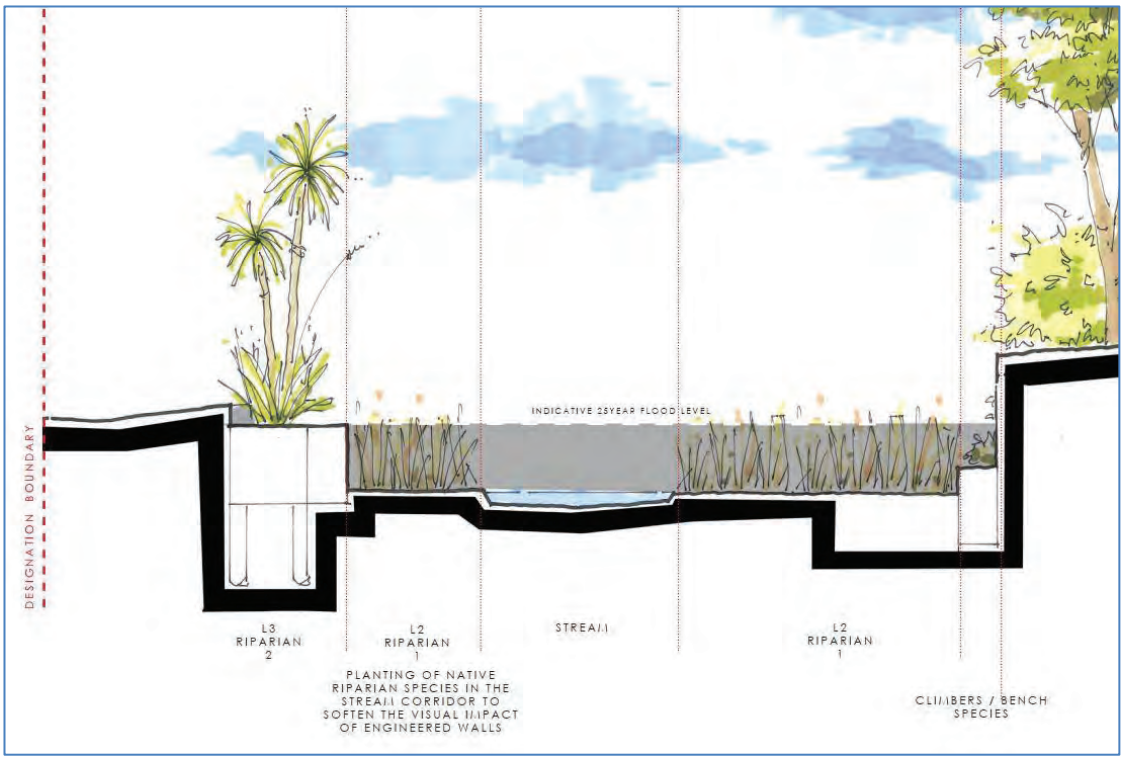

Figure 4: Planting of indigenous riparian species in the stream corridor to soften the visual impact of engineered walls (DCM Urban Design Page 30).

Plate 1: Existing concrete structures in Pinehaven Stream (DCM Urban Design Page 14).

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DCM Urban Design cross sections (Figures 4 and 5) show planting in the active channel of the stream close to the water's edge. This is inappropriate because it reduces galaxiid spawning habitat and would encourage the deposition of fine sediment.

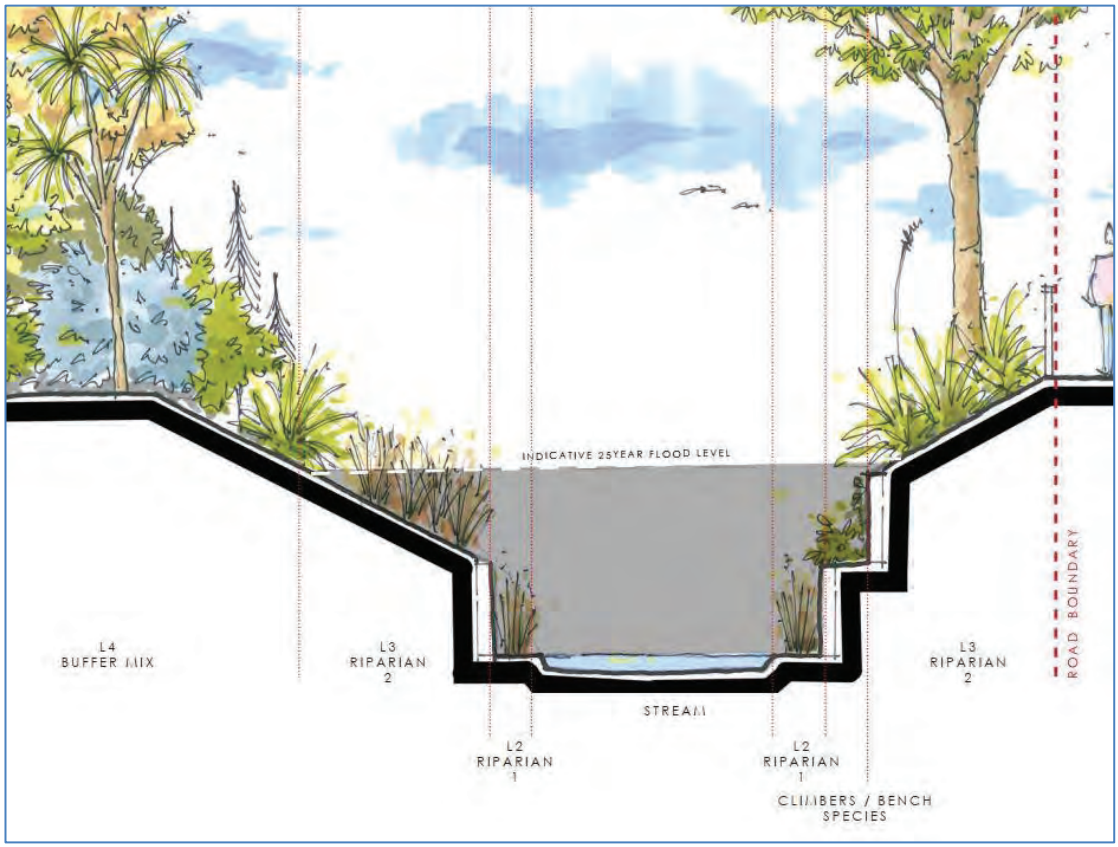

Figure 5: Planting of indigenous riparian species in the stream corridor (DCM Urban Design Page 16).

Whaririki has been proposed for areas which are rarely wet. This species is prone to sudden collapse disease and should never be planted in massed groupings. The disease is caused by a phytoplasma (a bacterium), transmitted by the native flax plant hopper[1].

The following further information is required:

- How many areas of existing concrete structures require amenity planting?
- Are any additional planted structures planned?

The following should be required as a condition of consent:

- Bank-holding species, including tī kōuka/cabbage tree (*Cordyline australis*), mānuka (*Leptospermum scorparium*), whekī (*Dicksonia squarrosa*), kōwhai (*Sophora Microphylla*) and tutu (*Coriaria arborea*), should be planted on the upper parts of the rarely wet riparian zone along with rangiora (*Brachyglottis repanda*) and *Olearia rani*; with a sparse understorey of hook grass (*Uncinia uncinata*), *Austroderia fulvida*, rarauhe (bracken fern *Pteridium esculentum*), *Asplenium oblongifolium*, and, rarely, whaririki reaching down into the lower part of the bank.
- *Libertia grandiflora*, *Libertia ixioides*, *Uncinia uncinata*, rarauhe and *Haloragis erecta* subsp. *erecta* could be planted on and around concrete structures.
- No planting should be undertaken in the active channel, an area inundated during all, except very light, rainfall events.

Note: Indigenous species only have been recommended for stream banks as these provide the greatest amount of habitat for indigenous fauna, including insects for drift-feeding galaxiid fish.

5. SUMMARY AND CONCLUSIONS

Review of Assessment of Effects Reports

The **Forbes terrestrial ecology report** lacks descriptions of types and area of all vegetation likely to be affected by the works. Until further information is provided it is not possible the assess whether the planting proposed is adequate mitigation for the vegetation to be lost.

The following further information is required:

- A description of each of the vegetation types to be affected and their value based on the likelihood that they provide habitat for rare species of fauna as in RPS Policy 23(b).

[1] www.nzpcn.org.nz

- A map/s of all the vegetation types likely to be affected by works, including exotic and planted vegetation.
- A table indicating the area of each vegetation type to be affected.
- An assessment of the value of the various vegetation types as habitat for rare fauna including lizards and bats following RPS Policy 23(b), including both canopy trees, understorey and groundcover.
- The size (DBH and approximate heights) of each of the large individual trees to be lost and whether or not they are listed in the District Plan as an Urban Tree or part of an Urban Tree Group.
- The species, DBH, and approximate heights of all large exotic trees likely to be removed and whether or not they are listed in the District Plan as an Urban Tree or part of an Urban Tree Group.
- Whether the trees are stand alone, or are part of an area of regenerating vegetation.
- The habitat values of the individual trees.
- A description of the effects of the proposed works on all vegetation, including canopy, understorey and ground cover.
- An explanation of how the long-term effects of removal of all types of vegetation/ habitat will be mitigated by the proposed planting.

The following should be required as a condition of consent:

- Undertake a lizard survey across the works corridor. If lizards are found:
  - Prepare a Lizard Management Plan.
  - Secure a Wildlife Act Authority for the project.

The **Aristos report** discusses the relative value of vegetation as habitat for birds, and the following further information is required:

- An evaluation of whether vegetation clearance should be avoided during the bird nesting season, and if not why not?
- An assessment of the total area of bird habitat to be lost as a result of the proposed works and evaluation of the pressure that this will place on remaining habitat in the valley.
- Comments on any mitigation that might be required.

The following should be required as a condition of consent:

- Undertake intensive pest animal control in Wyndham Park and Fendalton Reserve for five years to mitigate the short-term loss of bird habitat along the works corridor. Note: this is similar to what was recommended for medium-term loss of bird habitat at Kiwi Point Quarry in the Ngauranga Gorge.

The **Jacobs NZ Ltd summary report** discusses lizards and bats, and construction effects, subjects which were not covered in either of the other reports. The following further information is required:

- Information on the potential habitat value for bats of the existing stream channel and riparian vegetation.
- An explanation of how significant disturbance to terrestrial habitat during construction will be mitigated in order to reduce the effects from significant to minor.

Suitability of Proposed Landward Replanting

The **DCM Urban Design plans** have been drawn up to include some replacement trees for those to be lost during the proposed works. Other plantings are largely appropriate for amenity purposes but there is no indication as to how they will mitigate for the loss of all vegetation types and for the loss of habitat for indigenous fauna. The following further information is required:

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- An assessment of whether there are alternative sites in Pinehaven, along Hulls Creek, or along the Hutt River, where large stature trees might better be sited than close to dwellings?
- The area of land in the works corridor to be planted with indigenous and introduced tree species required to mitigate the long-term loss of vegetation, and habitat for fauna.

The following should be required as a condition of consent:

- Extended specimen and buffer planting schedules including more small trees and a higher diversity of species to provide year-round food for birds; and excluding kāpuka, whararikiki, and harakeke and any other indigenous trees which do not already occur locally.

Suitability of Proposed Streamside Riparian Replanting

The **DCM Urban Design plans** indicate significant areas of streamside riparian planting. None of the reports, however, indicates linear or areal extent for each type of riparian planting. Neither is there any indication that some of the existing riparian may be permanently lost as a result of hard-engineered streambanks.

Species selected for planting in this area are generally inappropriate and would either fail to grow or would be ineffective at providing bank protection.

The following further information is required:

- An evaluation of how many areas of existing concrete structures require amenity planting?
- Are any additional planted structures planned?

The following should be required as a conditions of consent:

- Bank-holding species including, but not limited to, tī kōuka/cabbage tree (*Cordyline australis*), mānuka (*Leptospermum scorparium*), whekī (*Dicksonia squarrosa*), kōwhai (*Sophora Microphylla*) and tutu (*Coriaria arborea*), should be planted on the upper parts of the rarely wet riparian zone along with rangiora (*Brachyglottis repanda*) and heketara (*Olearia rani*); with a sparse understorey of hook grass (*Uncinia uncinata*), *Austroderia fulvida*, rarauhe (bracken fern *Pteridium esculentum*), *Asplenium oblongifolium*, and, rarely and singly, whararikī, reaching down into the lower part of the bank.

- *Libertia grandiflora*, *Libertia ixioides*, rarauhe, and *Haloragis erecta* subsp. *erecta* could be planted on and around concrete structures.

- No planting should be undertaken in the active channel, an area inundated during all, except very light, rainfall events.

Note: Only indigenous species have been suggested for stream banks as these provide the greatest amount of habitat for indigenous fauna, including insects for drift-feeding galaxiid fish.

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Appendix 11 – Relevant Objectives and Policies

1. Regional planning instruments

1.1 Regional Policy Statement

Policy 39: Recognising the benefits from renewable energy and regionally significant infrastructure – consideration

When considering an application for a resource consent, notice of requirement or a change, variation or review of a district or regional plan, particular regard shall be given to:

(a) the social, economic, cultural and environmental benefits of energy generated from renewable energy resources and/or regionally significant infrastructure; and

(b) protecting regionally significant infrastructure from incompatible subdivision, use and development occurring under, over, or adjacent to the infrastructure; and

(c) the need for renewable electricity generation facilities to locate where the renewable energy resources exist; and

(d) significant wind and marine renewable energy resources within the region.

Policy 40: Maintaining and enhancing aquatic ecosystem health in water bodies – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a regional or district plan, particular regard shall be given to:

(a) requiring that water quality, flows and water levels and aquatic habitats of surface water bodies are managed for the purpose of safeguarding aquatic ecosystem health;

(b) requiring, as a minimum, water quality in the coastal marine area to be managed for the purpose of maintaining or enhancing aquatic ecosystem health; and

(c) managing water bodies and the water quality of coastal water for other purposes identified in regional plans.

Policy 41: Minimising the effects of earthworks and vegetation disturbance – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a regional or district plan, particular regard shall be given to controlling earthworks and vegetation disturbance to minimise:

(a) erosion; and

(b) silt and sediment runoff into water, or onto or into land that may enter water, so that healthy aquatic ecosystems are sustained.

Policy 43: Protecting aquatic ecological function of water bodies – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a district or regional plan, particular regard shall be given to:

(a) maintaining or enhancing the functioning of ecosystems in the water body;

(b) maintaining or enhancing the ecological functions of riparian margins;

(c) minimising the effect of the proposal on groundwater recharge areas that are connected to surface water bodies;

(d) maintaining or enhancing the amenity and recreational values of rivers and lakes, including those with significant values listed in Table 15 of Appendix 1;

(e) protecting the significant indigenous ecosystems and habitats with significant indigenous biodiversity values of rivers and lakes, including those listed in Table 16 of Appendix 1;

(f) maintaining natural flow regimes required to support aquatic ecosystem health;

(g) maintaining fish passage;

(h) protecting and reinstating riparian habitat, in particular riparian habitat that is important for fish spawning;

(i) discouraging stock access to rivers, lakes and wetlands; and

(j) discouraging the removal or destruction of indigenous wetland plants in wetlands.

Policy 48: Principles of the Treaty of Waitangi – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a district or regional plan, particular regard shall be given to:

(a) the principles of the Treaty of Waitangi; and

(b) Waitangi Tribunal reports and settlement decisions relating to the Wellington region.

Policy 49: Recognising and providing for matters of significance to tangata whenua – consideration

When preparing a change, variation or review of a district or regional plan, the following matters shall be recognised and provided for:

(a) the exercise of kaitiakitanga;

(b) mauri, particularly in relation to fresh and coastal waters;

(c) mahinga kai and areas of natural resources used for customary purposes; and

(d) places, sites and areas with significant spiritual or cultural historic heritage value to tangata whenua.

Policy 51: Minimising the risks and consequences of natural hazards – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review to a district or regional plan, the risk and consequences of natural hazards on people, communities, their property and infrastructure shall be minimised, and/or in determining whether an activity is inappropriate particular regard shall be given to:

(a) the frequency and magnitude of the range of natural hazards that may adversely affect the proposal or development, including residual risk;

(b) the potential for climate change and sea level rise to increase the frequency or magnitude of a hazard event;

(c) whether the location of the development will foreseeably require hazard mitigation works in the future;

(d) the potential for injury or loss of life, social disruption and emergency management and civil defence implications – such as access routes to and from the site;

(e) any risks and consequences beyond the development site;

(f) the impact of the proposed development on any natural features that act as a buffer, and where development should not interfere with their ability to reduce the risks of natural hazards;

(g) avoiding inappropriate subdivision and development in areas at high risk from natural hazards;

(h) the potential need for hazard adaptation and mitigation measures in moderate risk areas; and

(i) the need to locate habitable floor areas and access routes above the 1:100 year flood level, in identified flood hazard areas.

Policy 52: Minimising adverse effects of hazard mitigation measures – consideration

When considering an application for a resource consent, notice of requirement, or a change, variation or review of a district or regional plan, for hazard mitigation measures, particular regard shall be given to:

(a) the need for structural protection works or hard engineering methods;

(b) whether non-structural or soft engineering methods are a more appropriate option;

(c) avoiding structural protection works or hard engineering methods unless it is necessary to protect existing development or property from unacceptable risk and the works form part of a long-term hazard management strategy that represents the best practicable option for the future;

(d) the cumulative effects of isolated structural protection works; and

(e) residual risk remaining after mitigation works are in place,

so that they reduce and do not increase the risks of natural hazards.

Policy 53: Public access to and along the coastal marine area, lakes and rivers – consideration

When considering an application for a subdivision consent, or a coastal or land use consent on public land, or a change, variation or review of a district plan to address subdivision or rezoning, particular regard shall be given to enhancing public access to, and along:

(a) areas of the coastal marine area, and lakes and rivers with:

> (i) places, sites and areas with significant historic heritage values identified in accordance with policy 21;
>
> (ii) areas of indigenous ecosystems and habitats, and areas with significant indigenous biodiversity values identified in accordance with policy 23;
>
> (iii) outstanding natural features and landscapes identified in accordance with policy 25;
>
> (iv) special amenity landscapes identified in accordance with policy 27;
>
> (v) places, sites and areas with high natural character identified in accordance with policy 36; and
>
> (vi) the rivers and lakes identified in Table 15 of Appendix 1;

(b) Wellington Harbour and Porirua (Onepoto Arm and Pauatahanui Inlet) Harbour;

Except where there is a need to protect:

(c) sensitive indigenous habitats of species;

(d) the health or safety of people;

(e) sensitive cultural and historic heritage values; and/or

(f) the integrity and security of regionally significant infrastructure.

1.2 Operative Regional Freshwater Plan

The relationship of tangata whenua with fresh water

Objective 4.1.1 The relationship of tangata whenua and their culture and traditions with fresh water, and with ancestral sites, waahi tapu and other taonga within the beds of rivers and lakes, is recognised and provided for.

Objective 4.1.2 The mauri of water bodies and river and lake beds is protected.

Objective 4.1.3 The principles of the Treaty of Waitangi are taken into account in the management of the Region's water bodies and river and lake beds.

Policy 4.2.1 To manage sites of special value to the tangata whenua in water bodies and river and lake beds so that the cultural values of those sites are not adversely affected.

Policy 4.2.2 To encourage applicants to consult directly with affected tangata whenua when making an application for a resource consent which is for an activity within, upstream, or immediately downstream of any identified site of special value to the tangata whenua. As part of this consultation the applicant should determine:

(1) Whether granting the resource consent could have any adverse effects on the special values of the site.

(2) How any potential adverse effects that might result from the activity could be avoided or remedied.

Policy 4.2.7 To encourage and support, where appropriate, tangata whenua participation in monitoring the effects of activities that may potentially adversely affect sites or values of importance to the tangata whenua.

Natural values

Objective 4.1.4 The natural character of wetlands, and lakes and rivers and their margins, is preserved and protected from inappropriate subdivision, use and development.

Objective 4.1.5 The life-supporting capacity of water and aquatic ecosystems is safeguarded from the adverse effects of any subdivision, use and development.

Policy 4.2.9 To have regard to the following characteristics of wetlands, and lakes and rivers and their margins, when considering the protection of their natural character from the adverse effects of subdivision, use, and development:

- ecosystems, habitats and species; and
- water quality; and
- the natural flow characteristics and hydraulic processes (such as sediment transport) of rivers or the pattern and range of water level fluctuations that occur naturally in wetlands or lakes; and
- the topography and physical composition of river or lake beds and the course of the river.

Policy 4.2.11 To avoid, remedy or mitigate the adverse effects of the use and development of water bodies and river and lake beds on aquatic habitats and freshwater ecosystems by having regard to:

- the maintenance of biological and physical processes; and
- the maintenance of habitat for feeding, breeding and sheltering aquatic life; and
- the maintenance of the diversity of aquatic life; and
- the maintenance of the ability of fish to disperse and migrate; and
- the times which will least affect feeding, spawning, dispersal or migratory patterns of fish and other aquatic species; and
- the prevention of irreversible adverse effects.

Policy 4.2.14 To avoid, remedy or mitigate any adverse effects on important trout habitat in the Region, identified in Appendix 4, by:

- managing water quality so that Policy 5.2.3 is satisfied; and
- managing the flows and levels of water bodies so that Policies 6.2.1, 6.2.2, 6.2.12, and 6.2.13, whichever is (are) relevant, is (are) satisfied; and
- having particular regard to offsetting adverse effects on trout habitat; and
- having particular regard to maintaining the same, or similar, river bed configuration in the rivers identified.

Amenity values and access

Objective 4.1.7 The amenity and recreational values of wetlands, lakes, and rivers are maintained and, where appropriate, enhanced.

Objective 4.1.8 The quality of lawful public access to and along river and lake beds is maintained and, where appropriate, enhanced.

Policy 4.2.16 To ensure there is no reduction in the quality of lawful public access along the beds of lakes and rivers unless exceptional circumstances arise that make restrictions necessary, including to:

- protect any characteristic of any site or feature which gives a water body its special value or any conservation value; or
- provide for public health and safety; or
- provide for security on private property; or
- protect the rights of property owners, including the protection of crops and stock.

Policy 4.2.17 To promote lawful public access to water bodies when the subdivision, use and development of land adjacent to water bodies is being considered, particularly those water bodies which:

- have a high degree of natural character (Policy 4.2.10), are important trout habitat in the Region (Policy 4.2.14), or are regionally significant for amenity values and recreational use (Policy 4.2.15); or
- are considered by the relevant territorial authority to be of benefit to the local community for their recreational, cultural, scenic, spiritual, or other amenity values.

Flood mitigation

Objective 4.1.9 The risk of flooding to human life, health, and safety is at an acceptable level.

Objective 4.1.10 The adverse effects of flooding on natural values and physical resources, including people's property, are at an acceptable level.

Policy 4.2.18 To promote the avoidance or mitigation of the potential adverse effects associated with flooding.

Policy 4.2.20 To ensure that there is sufficient information about flood hazards to enable flooding in the Region to be mitigated to an acceptable level.

Policy 4.2.21 To encourage community awareness about flood hazards by involving people in the processes that establish acceptable levels of flood mitigation.

Policy 4.2.22 To adopt a precautionary approach when planning for and making decisions about the potential adverse effects of flooding on people and communities where information is incomplete or limited.

Use and development

Objective 4.1.11 People and communities are able to use and develop freshwater resources to provide for their social, economic, and cultural wellbeing and for their health and safety.

Objective 4.1.12 The adverse effects of the use and development of freshwater resources are avoided, remedied, or mitigated.

Objective 4.1.13 Activities that enhance freshwater resources are promoted.

Objective 4.1.15 Opportunities are provided for people and communities to be involved in decision making on significant freshwater resource management issues in the Wellington Region.

Objective 4.1.17 Conditions placed on resource consents are used as a means of avoiding, remedying or mitigating adverse effects.

Policy 4.2.23 To have regard to the benefits arising from any proposal for the use and development of a water body when assessing the proposal.

Policy 4.2.27 To encourage the restoration or rehabilitation of freshwater resources in the Region, including the establishment of wetlands, where appropriate.

Policy 4.2.28 To have regard to any relevant objectives and policies in section 4 of the Plan, when considering an application for a discharge permit to discharge to fresh water, a water permit, a land use consent to construct a bore/well, or a land use consent within a river or lake bed.

Policy 4.2.30 To work with other relevant agencies and tangata whenua in order to achieve the integrated management of fresh water.

Policy 4.2.31 To ensure that the process for making decisions relating to the management of fresh water is fair and transparent. In particular, to ensure that as far as practicable, all interested people and communities have the opportunity to be involved in freshwater resource management processes, including significant resource consents.

Policy 4.2.34 To avoid, remedy, or mitigate adverse effects which are associated with, or are a consequence of, an activity by placing conditions on resource consents, particularly where adverse effects are likely to occur on the following:

- characteristics of spiritual, historical or cultural significance to tangata whenua; or
- natural values; or
- amenity and recreational values; or
- lawful public access.

Policy 4.2.35 To have regard to the following matters when determining the nature and extent of any conditions to be placed on a resource consent:

- the significance of the adverse effects arising as a consequence of, or in association with, the proposed activity; and
- the extent to which the proposed activity contributes to the adverse effects; and
- the extent to which the adverse effects of the proposed activity can be, and have been, dealt with by other means; and
- any proposals by the applicant to avoid, remedy or mitigate adverse effects, and any agreements reached at pre-hearing meetings; and
- the monitoring proposed to be carried out by the applicant; and
- the extent to which the community as a whole benefits from the proposed activity and from any proposed conditions on a consent; and
- the financial cost of complying with any conditions on a consent; and
- the extent to which a condition placed on a consent will avoid, remedy or mitigate any adverse effects.

Policy 4.2.36 To avoid, remedy or mitigate adverse effects, conditions on a resource consent may relate to all or any of the following:

- project design and implementation, choice of materials, site improvements; or
- habitat restoration, rehabilitation, creation and improvement; or
- restocking and replanting of fauna or flora (with respect to replanting, preference will be given to the use of indigenous species, with a further preference for the use of local genetic stock); or
- works and services relating to the improvement, provisions, reinstatement, protection, restoration or enhancement of the matters listed in Policy 4.2.35; or
- the relationship between flow in a river and water quality (e.g. conditions attached to discharge permits can be flow related in respect of compliance with water quality guidelines).

Policy 4.2.37 To encourage applicants for resource consents to:

- consult and discuss with parties who may be affected by the proposal prior to applying for a consent; and
- identify in the consent application how adverse effects may be avoided, remedied or mitigated.

Policy 4.2.38 To recognise that there are circumstances where placing conditions on resource consents may not be sufficient to adequately avoid, remedy or mitigate the adverse effects of a proposal; and that in such circumstances a consent application will be declined.

Water quality and discharges to Fresh Water

Objective 5.1.1 The quality of fresh water meets the range of uses and values for which it is required while the life supporting capacity of water and aquatic ecosystems is safeguarded.

Objective 5.1.2 The quality of fresh water has the potential to meet the reasonably oreseeable needs of future generations.

Objective 5.2.6 Except for rivers and streams identified in Appendix 7, to manage the water quality of all surface water bodies in the Region for aquatic ecosystem purposes (subject to Policy 5.2.10).

Policy 5.2.8 To have regard to the relevant guidelines in Appendix 8 when deciding whether a discharge is able to satisfy Policies 5.2.1 to 5.2.7 (above) when considering applications for resource consents (subject to Policy 5.2.10).

Policy 5.2.10 To allow the discharge of contaminants to fresh water which do not satisfy Policies 5.2.1 to 5.2. 9, whichever is (are) relevant, only where:

(1) the discharge is of a temporary nature; or
(2) the discharge is associated with necessary maintenance works; or
(3) exceptional circumstances justifying the granting of a permit; or
(4) the discharge:
- was present at the time the Plan was notified; and
- is not likely to cause a decrease in the existing quality of water at that site and the person responsible for the discharge has defined a programme of work for upgrading the discharge within a specified timeframe; or

(5) that in any event, it is consistent with the purpose of the Act to allow the discharge.

Policy 5.2.10A 1. When considering any application for a discharge the consent authority must have regard to the following matters:

a) the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water and
b) the extent to which it is feasible and dependable that any more than minor adverse effect on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided.

2. When considering any application for a discharge the consent authority must have regard to the following matters:

a) the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their secondary contact with fresh water; and
b) the extent to which it is feasible and dependable that any more than minor adverse effect on the health of people and communities as affected by their secondary contact with fresh

water resulting from the discharge would be avoided.

3. This policy applies to the following discharges (including a diffuse discharge by any person or animal):

a) a new discharge or

b) a change or increase in any discharge – of any contaminant into fresh water, or onto or into land in circumstances that may result discharge of that contaminant, any other contaminant) entering fresh water.

4. Paragraph 1 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

5. Paragraph 2 of this policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2014 takes effect**]**

Mixing Zones

5.2.11 To ensure that any zones allowed on a discharge permit for reasonable mixing of contaminants or water with the receiving water are determined by having regard to:

- the purpose for which the receiving water is being managed, and any effects of the discharge on that management purpose; and
- any tangata whenua values that may be affected; and
- the volume of water or concentration of contaminants being discharged, and the area of receiving water that could potentially be affected; and
- the physical, hydraulic and hydrological characteristics of the receiving water.

Water Quantity and the Taking, Use, Damming or Diversion of Fresh Water

Objective 6.1.1 People and communities are able to take, use, dam, or divert surface water, and take and use groundwater, while ensuring that the flows in rivers, and water levels in lakes and wetlands, are sufficient to maintain the natural and amenity values of water bodies.

Policy 6.2.2 To manage the flows in rivers and streams not identified in Policy 6.2.1 by having regard to:

- the significance of natural, amenity, and tangata whenua values; and
- the scale/magnitude of any adverse effects on natural, amenity and tangata whenua values; and
- the reversibility of any adverse effects on natural, amenity and tangata whenua values.

Policy 6.2.4A

1. When considering any application the consent authority must have regard to the following matters:

(a) the extent to which the change would adversely affect safeguarding the life-supporting capacity of fresh water and of any associated ecosystem and

(b) the extent to which it is feasible and dependable that any adverse effect on the life-supporting capacity of fresh water and of any associated ecosystem resulting from the change would be avoided.

2. This policy applies to:

(a) any new activity and

(b) any change in the character, intensity or scale of any established activity – that involves any taking, using, damming or diverting of fresh water or draining of any wetland which is likely to result in any more than minor adverse change in the natural variability of flows or level of any fresh water, compared to that which immediately preceded the commencement of the new activity or the change in the established activity (or in the case of a change in an intermittent or seasonal activity, compared to that on the last occasion on which the activity was carried out).

Policy 6.2.14 To provide for minor or temporary diversions of water in any river, lake or wetland, where they are associated with authorised works and/or the exercise of a resource consent.

Policy 6.2.15 To allow the damming or diversion of water in any river, lake, or wetland, provided:
(1) adverse effects are avoided, remedied or mitigated; and
(2) significant adverse affects, which cannot be adequately offset, are avoided on:
- the values held by tangata whenua; and
- natural or amenity values; and
- water quality and flows below the dam or diversion; and
- water levels in any lake or wetland; and
- biological and physical processes; and
- fish passage; and
- sediment transport processes; and
- the quality of lawful public access along a river or lake bed; and
- the flood hazard; and
- river or lake bed or bank stability.

Use of the Beds of Rivers and Lakes and Development on the Floodplain

Objective 7.1.1 Appropriate uses of the beds of rivers and lakes are allowed while avoiding, remedying, or mitigating any adverse effects.

Objective 7.1.2 The risk of flooding or erosion is not increased by locating structures or carrying out activities in the beds of rivers and lakes or on the floodplain.

Objective 7.1.4 The uses of river and lake beds are, as far as practicable, consistent with the values of the tangata whenua.

Policy 7.2.1 To allow the following uses within river and lake beds:
- structures or activities for flood mitigation or erosion protection purposes;
- structures for transportation and network utility purposes; or
- structures for activities which need to be located in, on, under, or over the beds of rivers and lakes; or
- structures for cultural harvest (e.g., pa tuna); or
- the maintenance of any lawful structure; or
- the removal of aquatic weeds from farm drains and urban drains for drainage purposes; or
- the extraction of sand, gravel, or rock; or
- the diversion of water associated with activities that are otherwise authorised; or
- the enhancement of the natural character of any wetland, lake or river and its margins;

- provided that any adverse effects are avoided, remedied or mitigated and that the significant adverse effects identified in Policy 7.2.2 are avoided (unless the effects are of activities for the Transmission Gully Project and are addressed in accordance with Policy 4.2.33A).

Policy 7.2.2 To not allow the use of river and lake beds for structures or activities that have significant adverse effects on:

- the values held by tangata whenua; and/or
- natural or amenity values; and/or
- lawful public access along a river or lake bed; and/or
- the flood hazard; and/or
- river or lake bed or bank stability; and/orwater quality; and/or
- water quantity and hydraulic processes (such as river flows and sediment transport); and/or
- the safety of canoeists or rafters;
- unless the structures or activities are for the Transmission Gully Project and addressed in accordance with Policy 4.2.33A.

Flood and Erosion Mitigation in River and Lake Beds and on the Floodplain

Policy 7.2.3 To not allow new uses within the beds of rivers and lakes, and subdivision, use and development on the floodplain where the potential effect of flooding significantly increases the risk to human life, health, and safety; or
where the actual or potential effect of flooding has significant adverse effects on:

- private or community property; and
- flood mitigation structures and works; and
- natural values.

Policy 7.2.4 To not allow the development of *ad hoc* flood or erosion mitigation structures within river beds or on floodplains with Floodplain Management Plans or River Management Schemes; and
To discourage the development of *ad hoc* flood or erosion mitigation structures in other rivers, unless all feasible alternatives have been evaluated and found to be impracticable or have greater adverse effects on the environment.

Policy 7.2.6 To have regard to any relevant Floodplain Management Plan and the information provided in any relevant flood hazard assessment, or in connection with any River Management Scheme, when considering subdivision, use, or development within any river bed or floodplain.

Structures in River and Lake Beds

Policy 7.2.9 To encourage the removal of any structure which:

- is derelict; or
- poses a threat to the safety of people; or
- is not in active use and is not likely to be used in the future

unless its removal is not practicable or will create more adverse effects on the environment than its non-removal.

Policy 7.2.12 To ensure that the disturbance of any river or lake bed associated with the removal of vegetation:

- does not exacerbate bank erosion or the flood hazard; and/or
- maintains the drainage of farmland; and/or
- is required to be carried out either as a permitted activity or an activity for which a resource consent has been granted.

Policy 7.2.13 To ensure that the removal of sand, gravel, or rock, from any lake or river bed is located and carried out in such a way that flood or erosion hazards are reduced or there is, at least, no increase to these hazards.

Policy 7.2.14 To ensure that the deliberate introduction of plants to a river or lake bed for flood mitigation, erosion protection, habitat restoration, or for mitigating non-point source discharges of contaminants, will not result in the displacement of desirable species which are already present.

Reclamation or Drainage of River or Lake Beds

Policy 7.2.15 To ensure that the reclamation or drainage of any river or lake bed is only carried out when:

- there are no practicable alternatives which do not involve reclamation or drainage; and
- the reclamation or drainage provides significant benefits to the community; and
- the reclamation or drainage is consistent with Policy 4.2.10.

1.3 Proposed Natural Resources Plan

Ki uta ki tai: mountains to the sea

Objective O1

Air, land, fresh water bodies and the coastal marine area are managed as integrated and connected resources; **ki uta ki tai** – mountains to the sea.

Objective O2

The importance and contribution of air, land and water to the social, economic and cultural well-being of the community are recognised in the management and, where applicable, allocation of those resources.

Objective O3

Mauri, particularly the **mauri** of fresh and coastal waters is sustained and, where it has been depleted, natural resources and processes are enhanced to replenish **mauri**.

Objective O4

The intrinsic values of fresh water and marine ecosystems are recognised and the life supporting capacity of water is safeguarded.

Beneficial use and development

Objective O9

The recreational values of the coastal marine area, rivers and lakes and their margins and **natural wetlands** are maintained and enhanced.

Objective O10

Public access to and along the coastal marine area and rivers and lakes is maintained and enhanced.

Policy P9: Public access to and along the coastal marine area and the beds of lakes and rivers

Maintain and enhance the extent or quality of public access to and along the coastal marine area and the beds of lakes and rivers except where it is necessary to:

(a) protect the values of estuaries, sites with significant mana whenua values identified in Schedule C (mana whenua), sites with significant historic heritage value identified in Schedule E (historic heritage) and sites with significant indigenous biodiversity value identified in Schedule F (indigenous biodiversity), or

(b) provide access to significant surf breaks within the coastal marine area on a permanent or ongoing basis, or

(c) protect public health and safety, or

(d) provide for a temporary activity such as construction, a recreation or cultural event or stock movement, and where the temporary restrictions shall be for no longer than reasonably necessary before access is fully reinstated, and

with respect to (a) and (b), where it is necessary to permanently restrict or remove existing public access, the loss of public access shall be mitigated or **offset** by providing enhanced public access at a similar or nearby location.

Policy P16: New flood protection and erosion control

The social, cultural, economic and environmental benefits of new **catchment based flood and erosion risk management activities** are recognised.

Māori relationships

Objective O14

The relationships of Māori and their culture and traditions with their ancestral lands, water, sites, waahi tapu, and other taonga are recognised and provided for, including:

(a) maintaining and improving opportunities for **Māori customary use** of the coastal marine area, rivers, lakes and their margins and **natural wetlands**, and

(b) maintaining and improving the availability of **mahinga kai** species, in terms of quantity, quality and diversity, to support Māori customary harvest, and

(c) providing for the relationship of **mana whenua** with **Ngā Taonga Nui a Kiwa**, and

(d) protecting sites with significant **mana whenua** values from use and development that will adversely affect their values and restoring those sites to a state where their characteristics and qualities sustain the identified values.

Objective O15

Kaitiakitanga is recognised and **mana whenua** actively participate in planning and decision-making in relation to the use, development and protection of natural and physical resources.

Policy P17: Mauri

The **mauri** of fresh and coastal waters shall be recognised as being important to Māori and is sustained and enhanced, including by:

(a) managing the individual and cumulative adverse effects of activities that may impact on **mauri** in the manner set out in the rest of the Plan, and

(b) providing for those activities that sustain and enhance **mauri**, and

(c) recognising and providing for the role of kaitiaki in sustaining **mauri**.

Policy P19: Māori values

The cultural relationship of Māori with air, land and water shall be recognised and the adverse effects on this relationship and their values shall be minimised.

Policy P20: Exercise of kaitiakitanga

Kaitiakitanga shall be recognised and provided for by involving mana whenua in the assessment and decision-making processes associated with use and development of natural and physical resources including;

(a) managing activities in sites with significant **mana whenua** values listed in Schedule C (mana whenua) in accordance with **tikanga** and **kaupapa Māori** as exercised by **mana whenua**, and

(b) the identification and inclusion of **mana whenua** attributes and values in the kaitiaki information and monitoring strategy in accordance with Method M2, and

(c) identification of **mana whenua** values and attributes and their application through **tikanga** and **kaupapa Māori** in the maintenance and enhancement of **mana whenua** relationships with **Ngā Taonga Nui a Kiwa**.

Policy P21: Statutory acknowledgements

Wellington Regional Council will:

(a) include any relevant statutory acknowledgments in Schedule D (statutory acknowledgements) for public information, and

(b) have regard to any relevant statutory acknowledgment in Schedule D (statutory acknowledgements) when processing resource consent applications.

Natural character, form and function

Objective O17

The **natural character** of the coastal marine area, **natural wetlands**, and rivers, lakes and their margins is preserved and protected from inappropriate use and development.

Natural hazards

Objective O20

The **hazard risk**, and **residual hazard risk**, from natural hazards and adverse effects of climate change, on people, the community and infrastructure are acceptable.

Objective O21

Inappropriate use and development in **high risk areas** is avoided.

Policy P27: High risk areas

Use and development, including hazard mitigation methods, in **high risk areas** shall be avoided except where:

(a) they have a **functional need** or **operational requirement** or there is no practicable alternative to be so located, and

(b) the **hazard risk** to the development and/or **residual hazard risk** after hazard mitigation measures, assessed using a **risk-based approach**, is low, and

(c) the development does not cause or exacerbate natural hazards in other areas, and

(d) adverse effects on **natural processes** (coastal, riverine and lake processes) are avoided, remedied, or mitigated, and

(e) natural cycles of erosion and accretion and the potential for natural features to fluctuate in position over time, including movements due to climate change and sea level rise over at least the next 100 years, are taken into account.

Policy P28: Hazard mitigation measures

Hard hazard engineering mitigation and protection methods shall be avoided except where it is necessary to protect existing development from unacceptable **hazard risk**, assessed using the **risk-based approach**, and;

(a) any adverse effects are no more than minor, or

(b) where the environmental effects are more than minor the works form part of a **hazard risk management strategy**.

Policy P29: Effects of climate change

Particular regard shall be given to the potential for climate change to threaten biodiversity, aquatic ecosystem health and mahinga kai, or to cause or exacerbate natural hazard events over at least the next 100 years that could adversely affect use and development including:

(a) coastal erosion and inundation (**storm surge**), and

(b) river and lake flooding and erosion, aggradation, decreased minimum flows, and

(c) **stormwater** ponding and impeded drainage, and

(d) relative sea level rise, using reliable scientific data for the Wellington Region.

Water quality

Objective O23

The quality of groundwater, water in **surface water bodies**, and the coastal marine area is maintained or improved.

Objective O24

Rivers, lakes, **natural wetlands** and coastal water are suitable for contact recreation and **Māori customary use**, including by:

(a) maintaining water quality, or

(b) improving water quality in:

> (i) **significant contact recreation fresh water bodies** and sites with significant **mana whenua** values and **Ngā Taonga Nui a Kiwa** to meet, as a minimum, the primary contact recreation objectives in Table 3.1, and
>
> (ii) coastal water and sites with significant **mana whenua** values and **Ngā Taonga Nui a Kiwa** to meet, as a minimum, the primary contact recreation objectives in Table 3.3, and
>
> (iii) all other rivers and lakes and **natural wetlands** to meet, as a minimum, the secondary contact recreation objectives in Table 3.2.

Table 3.2 Secondary contact and Māori customary use recreation objectives ~~with water~~ in freshwater bodies[4]				
Water body type	*E. coli* cfu/100mL median[5]	Cyanobacteria		Māori customary use
		Planktonic[2]	Benthic	
Rivers	≤ 1,000		Low risk of health effects from exposure	Fresh water supports **Māori customary use** by the achievement of the **huanga** identified by **mana whenua**.
Lakes		< 1.8mm³/L biovolume equivalent of potentially toxic cyanobacteria OR < 10mm³/L total biovolume of all cyanobacteria		
Natural wetlands	≤ 1,000			

Policy P66: National Policy Statement for Freshwater Management requirements for discharge consents

When considering any application for a discharge the consent authority shall have regard to the following matters:

(a) the extent to which the discharge would avoid contamination that will have an adverse effect on the life-supporting capacity of fresh water including on any ecosystem associated with fresh water, and

(b) the extent to which it is feasible and dependable that any more than minor adverse effects on fresh water, and on any ecosystem associated with fresh water, resulting from the discharge would be avoided, and

(c) the extent to which the discharge would avoid contamination that will have an adverse effect on the health of people and communities as affected by their contact with fresh water, and

(d) the extent to which it is feasible and dependable that any more than minor adverse effects on the health of people and communities as affected by their contact with fresh water resulting from the discharge would be avoided.

This policy applies to the following discharges (including a diffuse discharge by any person or animal):

(e) a new discharge, or

(f) a change or increase in any discharge

of any contaminant into fresh water, or onto or into land in circumstances that may result in that contaminant (or, as a result of any natural process from the discharge of that contaminant, any other contaminant) entering fresh water.

Sections (a) and (b) of this policy do not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July

2011. Sections (c) and (d) of this policy do not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2014 took effect (1 August 2014).

Biodiversity, aquatic ecosystem health and mahinga kai

Objective O25

Biodiversity**, aquatic ecosystem health** and **mahinga kai** in fresh water bodies and the coastal marine area are safeguarded such that:

(a) water quality, flows, water levels and aquatic and coastal habitats are managed to maintain biodiversity **aquatic ecosystem health** and **mahinga kai**, and

(b) where an objective in Tables 3.4, 3.5, 3.6, 3.7 or 3.8 is not met, a fresh water body or coastal marine area is improved over time to meet that objective.

Table 3.4 Rivers and streams[13]

River class[11]		Macrophytes	Periphyton biomass[12] mg/m² chlorophyll *a*		Periphyton cover Only applies when there is no periphyton biomass data		Invertebrates[13] Macroinvertebrate Community Index		Fish	Mahinga kai species
			All rivers	Significant rivers[14]	All rivers	Significant rivers[15]	All rivers	Significant rivers[16]		
1	Steep, hard sedimentary	Indigenous macrophyte communities are resilient and their structure, composition and diversity are balanced	≤ 50	≤ 50	<40%	<20%	≥ 120	≥ 130	Indigenous fish communities are resilient and their structure composition and diversity are balanced	**Mahinga kai** species, including **taonga species**, are present in quantities, size and of a quality that is appropriate for the area[17] Huanga of mahinga kai as identified by mana whenua are achieved.
2	Mid-gradient, coastal and hard sedimentary		≤ 120	≤ 50	<20%	<20%	≥ 105	≥ 130		
3	Mid-gradient, soft sedimentary		≤ 120*	≤ 50*	<40%	<20%	≥ 105	≥ 130		
4	Lowland, large, draining ranges		≤ 120	≤ 50	<40%	<20%	≥ 110	≥ 130		
5	Lowland, large, draining plains and eastern Wairarapa		≤ 120*	≤ 50*	<40%	<20%	≥ 100	≥ 120		
6	Lowland, small		≤ 120*	≤ 50*	<40%	<20%	≥ 100	≥ 120		

Objective O27

Vegetated riparian margins are established, maintained. or restored to enhance water quality, **aquatic ecosystem health**, **mahinga kai** and indigenous biodiversity of rivers, lakes, **atural wetlands** and the coastal marine area.

Objective O29

The passage of fish and koura is maintained, and the passage of indigenous fish and koura is restored.

Policy P31: Biodiversity, aquatic ecosystem health and mahinga kai

Biodiversity, **aquatic ecosystem health** and **mahinga kai** shall be maintained or restored by managing the effects of use and development on physical, chemical and biological processes to:

Hydrology

(a) maintain or restore natural flow characteristics and hydrodynamic processes, and the natural pattern and range of water level fluctuations in rivers, lakes and **natural wetlands**, and

Water quality

(b) maintain or improve water quality to meet the objectives in Tables 3.4, 3.5, 3.6, 3.7 and 3.8 of Objective O25, and

Aquatic habitat diversity and quality

(c) maintain or restore aquatic habitat diversity and quality, including the form, frequency and pattern of pools, runs, and riffles in rivers, and the natural form of rivers, lakes, **natural wetlands** and the coastal marine area, and

(d) restore the connections between fragmented aquatic habitats, and

Critical habitat for indigenous aquatic species and indigenous birds

(e) maintain or restore habitats that are important to the life cycle and survival of indigenous aquatic species and the habitats of indigenous birds in the coastal marine area, **natural wetlands** and the beds of lakes and rivers and their margins that are used for breeding, roosting, feeding, and migration, and

Critical life cycle periods

(f) minimise adverse effects on aquatic species at times which will most affect the breeding, spawning, and dispersal or migration of those species, including timing the activity, or the adverse effects of the activity, to avoid times of the year when adverse effects may be more significant, and

Riparian habitats

(g) maintain or restore riparian habitats and restore them where practicable, and

Pests

(h) avoid the introduction, and restrict the spread, of aquatic pest plants and animals.

Policy P32: Adverse effects on biodiversity, aquatic ecosystem health, and mahinga kai

Adverse effects on biodiversity, **aquatic ecosystem health** and **mahinga kai** shall be managed by:

(a) avoiding significant adverse effects, and

(b) where significant adverse effects cannot be avoided, minimising them, and

(c) where significant adverse effects cannot be avoided and/or minimised they are remedied, and

(d) where significant **residual adverse effects** remain, it is appropriate to consider the use of **biodiversity offsets**.

Proposals for **biodiversity mitigation** and **biodiversity offsetting** will be assessed against the principles listed in Schedule G1 (**biodiversity mitigation**) and Schedule G2 (**biodiversity offsetting**).

Policy P35: Restoring fish passage

The passage of indigenous fish and kōura shall be restored where this is appropriate for the management and protection of indigenous fish and koura populations.

Objective O30

The habitat of trout identified in Schedule I (trout habitat) is maintained and or improved.

Land and water quality

Objective O47

The amount of sediment-laden runoff entering water is minimised.

Policy P67: Minimising discharges to water or land

Discharges of contaminants to water or land will be minimised by adopting the following hierarchy:

(a) avoiding the production of the contaminant,

(b) reducing the amount of contaminants, including by reusing, recovering or recycling contaminants,

(c) minimising the volume or amount of the discharge, and/or

(d) discharging to land is promoted over discharging direct to water, including using land-based treatment, constructed wetlands or other systems to treat contaminants prior to discharge.

Note

In determining if it is appropriate to discharge to land as required by clause (d), consideration must be given to the requirements of Policy P95.

Policy P70: Managing point source discharges for aquatic ecosystem health and mahinga kai

Where an objective in Table 3.4, Table 3.5, Table 3.6, Table 3.7 or Table 3.8 of Objective O25 is not met, point source discharges to water shall be managed in the following way:

(a) for an existing discharge that contributes to the objective notbeing met, the discharge is only appropriate if:

(i) an application for a resource consent includes a defined programme of work for upgrading the discharge, in accordance with good management practice, within the term of the resource consent, and

(ii) conditions on the resource consent require the reduction of adverse effects of the discharge in order to improve water quality in relation to the objective , and

(b) for a new discharge, other than a wastewater discharge, the discharge is inappropriate if the discharge would cause the affected fresh water body or area of coastal water to decline in relation to the objective.

In assessing the appropriateness of a new discharge or existing discharge, the ability to offset residual adverse effects may be considered.

Policy P72: Zone of reasonable mixing

When a discharge to water requires resource consent, the **zone of reasonable mixing** shall be minimised and will be determined on a case-by-case basis. In determining the **zone of reasonable mixing**, particular regard shall be given to:

(a) acute and chronic toxicity effects, and

(b) adverse effects on aquatic species migration, and

(c) efficient mixing of the discharge with the receiving waters, and

(d) avoiding a site with significant **mana whenua** values identified in Schedule C (mana whenua), and

(e) the identified values of that area of water, and

(f) avoiding significant adverse effects within the **zone of reasonable mixing**.

Policy P98: Land use activities, erosion and associated discharges

Earthworks, **vegetation clearance** and **plantation forestry harvesting** activities that have the potential to result in significant accelerated soil erosion, or to lead to off-site discharges of silt and sediment to **surface water bodies**, shall use measures, including **good management practice**, to:

(a) minimise the risk of accelerated soil erosion, and

(b) control silt and sediment runoff, and

(c) ensure the site is **stabilised** and vegetation cover is restored.

Riparian vegetation

Policy P101: Management of riparian margins

Maintain or restore water quality, **aquatic ecosystem health**, **mahinga kai** and natural character, and reduce the amount of contaminants entering **surface water bodies**, through the management of riparian margins including:

(a) the exclusion or restricted access of **livestock** likely to affect **riparian margin**s or water quality,

(b) appropriate set-back distances from **surface water bodies** for some land use activities,

(c) encouraging the planting of appropriate riparian vegetation, and

(d) the control of pest plants and animals.

Policy P106: Management of plants in the beds of lakes and rivers

The introduction to and removal of a plant, or part of a plant, from the beds of lakes and rivers shall be managed so that:

(a) pest plants are not introduced and their removal is enabled, and

(b) indigenous plant species are encouraged to be planted where they are appropriate for the purpose and are typical of the area and their removal (in whole or in part) is only enabled for the purpose of Māori customary use or for the reasonable use of an individual, or where it is necessary to manage flooding and erosion, and

(c) the introduction or removal of a plant, or part of a plant, does not increase flooding and erosion either at the site of introduction or removal, or across the wider river catchment, and

(d) the introduction or removal of a plant, or a part of a plant, does not adversely affect significant biodiversity values of the site.

Activities in the beds of lakes and rivers

Policy P102: Reclamation or drainage of the beds of lakes and rivers

The **reclamation** or drainage of the beds of lakes and rivers and **natural wetlands** shall be avoided, in particular those identified in Schedules A (outstanding water bodies) and C (mana whenua), except where the reclamation or drainage is:

(b) partial reclamation of a river bank for the purposes of flood prevention or erosion control, or

(b) associated with a growth and/or development framework or strategy approved by a local authority under the Local Government Act 2002, or

(c) necessary to enable the development, operation, maintenance and **upgrade** of **regionally significant infrastructure**, or

(d) associated with the creation of a new river bed and does not involve piping of the river, and

(e) for the purpose of forming a reasonable crossing point, and

(f) in respect of (a) to (e) there are no other practicable alternative methods of providing for the activity, or

(g) the **reclamation** or drainage is of an **ephemeral flow path**.

Policy P110: National Policy Statement for Freshwater Management requirements for water takes, damming and diversion

When considering any application the consent authority shall have regard to the following matters:

(a) the extent to which the change would adversely affect safeguarding the life-supporting capacity of fresh water and of any associated ecosystem, and

(b) the extent to which it is feasible and dependable that any adverse effect on the life-supporting capacity of fresh water and of any associated ecosystem resulting from the change would be avoided.

This policy applies to:

(c) any new activity, and

(d) any change in the character, intensity or scale of any established activity

that involves any taking, using, damming or diverting of fresh water or draining of any wetland which is likely to result in any more than minor adverse change in the natural variability of flows or level of any fresh water, compared to that which immediately preceded the commencement of the new activity or the change in the established activity (or in the case of a change in an intermittent or seasonal activity, compared to that on the last occasion on which the activity was carried-out).

This policy does not apply to any application for consent first lodged before the National Policy Statement for Freshwater Management 2011 took effect on 1 July 2011.

Policy P129: Minimum flows and minimum water levels

The damming or diversion of water from a **surface water body** shall not reduce flows or water levels below **minimum flows** or **minimum water levels** identified in the **whaitua** chapters of the Plan (chapters 7-11).