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Te Puna Industrial Park
297 Te Puna Station Road

Stormwater Management and Flood Modelling Review

Bay of Plenty Regional Council

Document Information

Client	**Bay of Plenty Regional Council**
Site Location	297 Te Puna Station Road, Te Puna
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Contents

Figures

Tables

1 Introduction

The purpose of this report is to present the outcomes of a technical review of the Stormwater Management and Flood Modelling provided to Bay of Plenty Regional Council to support the Te Puna Industrial Park Ltd application for resource consent for works in a flood plain and stormwater discharge.

CKL has been engaged by Bay of Plenty Regional Council (BoPRC) to undertake a technical review of the information provided to support the resource consent applications.

1.1 Background information

This assessment has been undertaken based on the following information:

- Site visit undertaken on 15th April 2024
- Section 92 response information, Momentum Planning and Design, dated 26th January 2023
    - Addressed to Marcia Christian, BoPRC

Stormwater Management Assessment information:

- Te Puna Station Road, Preliminary Pond Sizing, memo, dated 29th May 2024, from Ronan Kelly & Danny Curtis, Harrison Grierson, to Vincent Murphy, Momentum Planning and Design Ltd.
- Te Puna Industrial Limited s92 Response Report, WSP New Zealand Ltd
    - Dated 1 February 2023, revision 3.
    - Dated 17 August 2023, revision 5.

Flood assessment information:

- Floodplain Assessment, 297 Te Puna Station Road, RD6, Tauranga, Version 1, May 2024, prepared by Golovin Ltd, Dr Steven Joynes
    - Draft issue
    - Final issue
- Email response by Dr Steven Joynes, to initial CKL findings, dated 14 June 2024 at 1.30am, to Marcia Christian, BoPRC
- Technical information from Western Bay of Plenty District Council (WBoPDC):
    - Email titled: TPIL Application - Engineering Review Outcomes and Update - Flooding report.
        - From Mark Pennington – Tonkin and Tayler to Heather Perring and James Abraham dated 31st May 2024
- Western Bay of Plenty Flood Mapping – Model Build Report, Version 4, 19th February 2021, prepared for Western Bay of Plenty District Council by Tonkin and Taylor Ltd.
- Hydrological and Hydraulic Guidelines, August 2012, Prepared by Environmental Hazards Group, Bay of Plenty Regional Council

Drawings:

- WSP Civil drawings, not dated:
    - C200 Rev C; Existing contour plan
    - C201 Rev C, Finished contour plan.
    - C202 Rev C, Cut-Fill contour plan.
    - C300 Rev D, Site Layout Plan
    - C301 Rev C, Intersection Layout and Vehicle Turning Paths Plan
    - C302 Rev C, Intersection Layout Plan

- C310 Rev C, Longsection Road 1 and Typical section
- C400 Rev C, Stormwater layout plan
- C600, Rev B, Water supply layout

- Momentum Planning and Design Ltd (MPAD)drawings:
  - Dwg 002 Landscape concept plan, Rev 2, 28/05/2024
  - Dwg 011, TPBP SW plan, Rev 2, 17th August 2023
  - Dwg 012, TPBP SW plan alternative, Rev 2, 17th August 2023
  - Dwg 013 Finished contour plan, Rev 1, 05/06/2024
  - Dwg 014 Cut fill contour plan, Rev 1, 05/06/2024
  - Dwg 015 Site layout plan, Rev 1, 05/06/2024
  - Dwg 016 Stormwater layout plan, Rev 1, 05/06/2024
  - Dwg 017 -Earthworks in floodplain, Rev 2, 05/06/2024
- RPC Land surveyors
  - Site plan of PT3 DP22158 & Sec 3 SO61751 ref 7998 B dated 30 April 2021
  - Site plan of PT3 DP22158 & Sec 3 SO61751 ref 7998 C dated 30 April 2021

2 Proposed Development

Te Puna Industrial Ltd (TPIL) propose to develop the land at 297 Te Puna Station Road, legally described as Pt 3 DP 22158 & Sec 3 SO 61751, for the establishment and operation of yard-based industrial activities, with associated earthworks and discharge to water within the site[1].

This site will require earthworks and land development services, which includes stormwater management, to support the delivery of the business-based activities. The proposed layout is presented in the site layout plan, drawing 015, as shown in Figure 1 below.

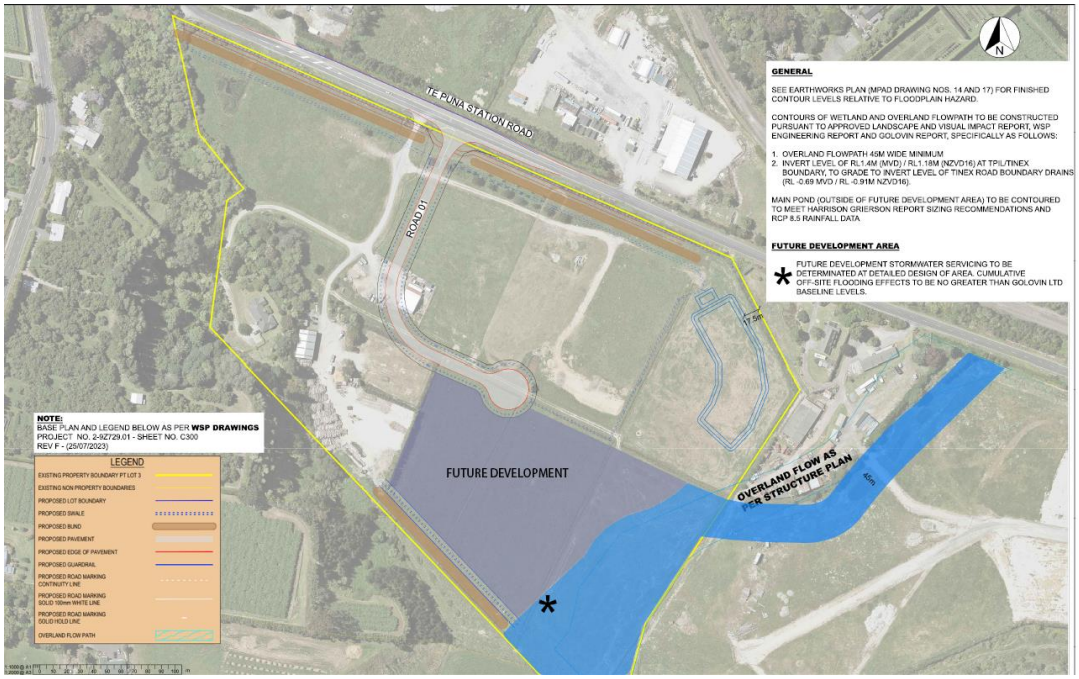

Figure 1: Site Layout[2]

[1] Ref to section 1.0 applicants AEE (Version 3) by Momentum Planning and Design ltd, dated 25/01/22.
[2] Reference: MPAD dwg 15 Rev 1, dated 5/6/2024

3 Stormwater Management Review

The proposed stormwater management for the TPIL site development has been presented within the WSP and Harrison Grierson (HG) information. With the latest stormwater management layout presented in the following Figure 2:

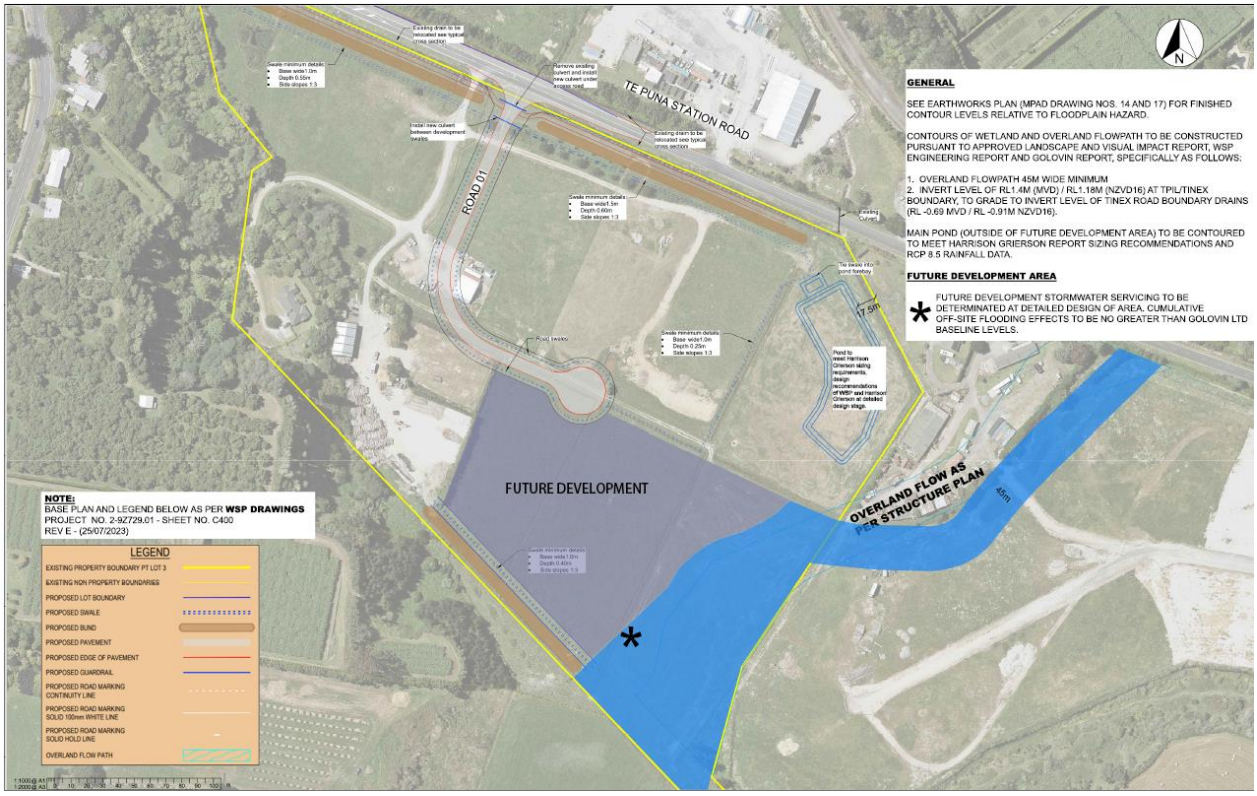

Figure 2: Stormwater layout[3]

The HG stormwater management input responds to the further information requests by WBoPDC and BoPRC. HG design also refers to and builds on the technical information provided by WSP to support the TPIL site development and resource consent applications (to both WBoPDC and BoPRC).

As such this review is based on information provided to BoPRC from HG and, where appropriate, WSP.

3.1 Parameters and assumptions

BoPRC require the effects of the development's stormwater runoff to be mitigated, with respect to quality and quantity, prior to discharge to the receiving environment.

The current stormwater management relies on the following system to operate effectively:

- Swales for conveyance and treatment
- Wetland for treatment and attenuation

3.2 Treatment and Attenuation

Treatment of runoff, prior to discharge, is to occur in swales and a communal wetland. The swales will provide a limited level of treatment whilst the wetland will undertake the "bulk" of the treatment provisions. Therefore, the focus of this treatment review has been the provision of a communal wetland.

[3] Reference Stormwater layout MPAD dwg 16 Rev 1, 5/6/2024

The wetland has a dual purpose of attenuation of runoff prior to discharge. The HG report states the attenuation parameters, which for the smaller events are not provided. The attenuation parameter for the 100yr ARI runoff is to discharge at 80% of 100yr predevelopment rates. It is noted that this attenuation of flow is not provided within the flood modelling, therefore this parameter has not been justified, or tested, that it is required as best practice.

The wetland sizing is provided by WSP, and HG rely on this information within their reporting. The wetland is located above the flood plain as stated in the Golovin flood modelling reporting however below the flood level in the HG report and plans. Notwithstanding, there are some fundamental operational aspects as to the success of a wetland in the location shown in HG and Golovin reports. The wetland in HG report is located at a level of circa RL1.5m, whereas flood modelling has the top of the wetland at least RL3.0m. This outcome then brings the question of how attenuation is to be delivered if the wetland is fully inundated during the flood events.

The following technical aspects need attention to ensure mitigation of effects of stormwater discharge to the receiving environment is achieved:

- Location of the wetland in relation to ground water table.
    - Observed water level in the drain to which this wetland will discharge is circa 0.5m below ground surface level (April 2024)
- Attenuation within wetland in relation to the top water levels during rainfall events from the catchment (flood levels at the site[4])
    - 10yr TWL 2.36mRL
    - 50yr TWL 2.87mRL
    - 100yr TWL 2.99mRL
- Wetland design parameters:
    - Permanent water depth 0.5m
    - Attenuation volume depth 0.5m
    - Emergency spillway provisions
    - Hydraulic connectivity to discharge point.
        - Tailwater effects
    - Lining wetland to provide separation to groundwater table.

The stormwater layout plan shows Future development in the southern portion of the TPIL site with an indicative location of a stormwater management device. There is no indication as to the design parameters or indeed the ability to deliver a device in this location. Based on the review of the anticipated communal wetland, above, the same technical aspects would need to be considered.

3.3 Primary system

The primary system provides conveyance for runoff generated from a 10yr annual recurrence interval (ARI) rainfall event. This system has been described as swales which provide both conveyance and treatment prior to discharge to a centralised wetland.

The swales have an internal gradient of up to 2% for treatment and conveyance, however likely to be 1% based on the distance of up to 500m from the northern portion of the site to the location of the wetland.

There is no earthworks model that provides context of the successful operation of swale conveyance.

[4] Ref Table 3.1 Golovin report

3.4 Secondary system

The secondary system within the site will provide for the runoff generated during the larger rainfall events up to and including 100yr ARI, including the effects of climate change.

Given that the site is to be elevated above the 100yr ARI flood plain, within the information provided by Golovin flood modelling report, the site would need to ensure the effective conveyance during this rainfall event.

However, within the HG information the site is not (totally) elevated above the 100yr flood level as such would need to accommodate for the flood plain within the surface design.

3.5 Assessment outcomes

The wetland's attenuation and discharge of treated runoff has limited information within WSP and HG technical reporting. However, based in information provided and cross reference to flood modelling results the stormwater management system is unlikely to provide the necessary controls, such as treatment of runoff and attenuation of flows, to mitigate effects.

It is likely that the suggested 10yr conveyance system will meet the needs of the WBoPDC code of practice and BoPRC objectives should the proposed earthworks provide successful design outcomes. The earthworks proposed within the application documentation does not provide enough detail to comment further on this aspect.

There has been no information provided for the anticipated future development area's stormwater management, as such this review cannot pass comment on the ability for this to meet BoPRC objectives.

4 Flood Risk Assessment

The flood modelling undertaken with respect to assessing effects of the TPIL site development has been presented within the Golovin report and subsequent emailed response from Dr Steven Joynes[5]. The flood modelling has relied on the building platform and other design features presented in the Golovin report, shown in the following figure, Figure 3:

[5]Ref: Email response by Dr Steven Joynes, to initial CKL findings, dated 14 June 2024 at 1.30am, to Marcia Christian, BoPRC

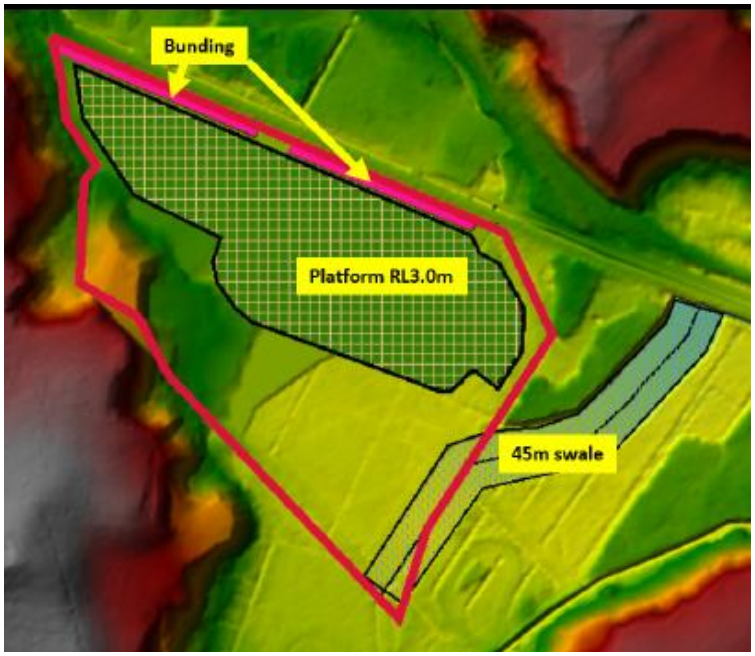

Figure 3: Proposed site features[6]

The future development shows possible filling in the flood plain; however, this has not been considered within the flood modelling undertaken by Golovin. The future development area is shown in MPAD drawing 13, which is in the southern portion of the site, as presented in the following figure.

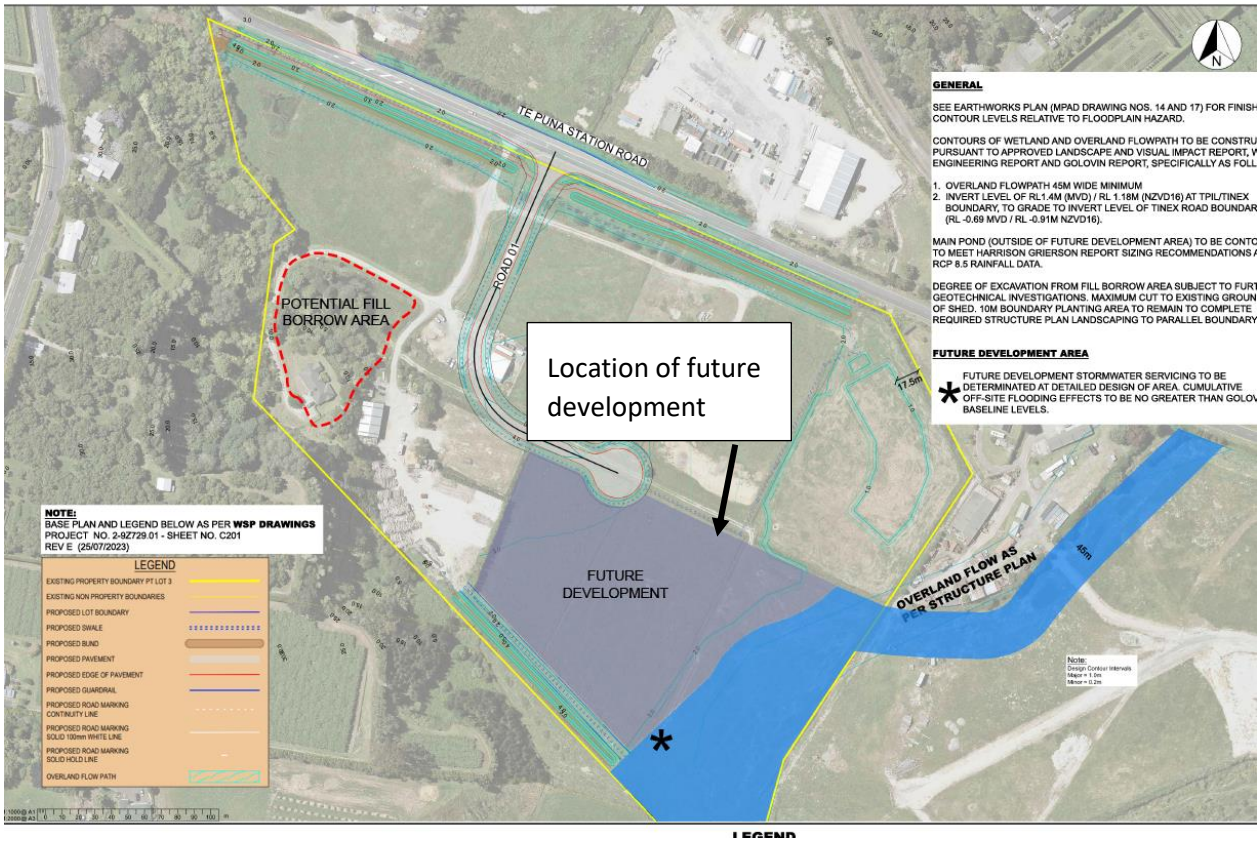

Figure 4: Future development location.

[6] Ref: Fig 4.1 Golovin report

4.1 Hydrology Analysis

The hydrological analysis was undertaken using HEC HMS and HEC Ras software, which is a common approach to flood modelling for a site and catchment such as these.

Climate change has been assessed under RCP8.5 scenario which addresses both BoPRC and WBoPDC concerns through the S92 requests.

4.2 Hydraulic Flood Modelling

The flood modelling hydraulic parameters have been presented within the Golovin report which include culverts under Teihana Road however does not include, or expressly states, the culvert under Te Puna Station Road, at 177 Te Puna Station Road, which connects the roadside drain on the southern side of the road with the northern roadside drain. This is the main discharge point for the drainage system downstream of the TPIL site and would affect the hydraulic function during smaller rainfall events as this culvert has a floodgate on the outlet.

The following photos[7] shows the location[8], opposite 177 Te Puna Station Road, and floodgate located at the outlet of this culvert:

Figure 5: Location of culvert under Te Puna Station Road

[7] Taken 15th April 2024
[8] Ref WBoPDC Mapi, accessed June 2024

Figure 6:Inlet of culvert under Te Puna Station Road

Figure 7: Floodgate on outlet.

The flood modelling also relies on the delivery of the 3rd culvert under Teihana Road, which is part of the structure plan requirements (sic). There is a question around the delivery of this additional culvert under Teihana Road without undermining KiwiRail assets and the road carriageways. Notwithstanding this, an alternative channel crossing such as bridge or large arched culvert can deliver the hydraulic function required at this flood modelling (boundary) condition.

The structure plan open overland flow path has an invert level outlined in Golovin report, section 4.1, which is below the ground water table, as observed during April 2024. Given the reliance in this area to provide volume storage during rainfall events the ground water table will influence outcomes of the flood modelling. Dr Steven Joynes has acknowledged this aspect and will investigate further[9].

The flood modelling has been presented for only one scenario for 100yr ARI, and assumed has followed the BoPRC guidelines, which are the design standard combinations for **floods and sea level** (based on Table 4.4 BOPRC's Hydrological and Hydraulic Guidelines).

Table 1: Hydrological and hydraulic guidelines Table 4.4

Table 4.4 Design standard combinations for floods and sea level.

Design Return Period	Case 1	Case 2
100-year	$Q_{100} : L_{20}$	$Q_{20} : L_{100}$
50	$Q_{50} : L_{20}$	$Q_{20} : L_{50}$
20	$Q_{20} : L_{2}$	$Q_{2} : L_{20}$
10	$Q_{10} : L_{2}$	$Q_{2} : L_{10}$

Therefore, this assessment has assumed that Case 2 scenario has been presented, with the commentary of the coastal inundation to cover Case 1 within Golovin's report. Therefore, the worst case is that the whole of the site is inundated during 100yr event to RL3.8m[10].

Given that the site development relies on the 50yr and 10yr flood levels there is no presentation for the outcomes of Case 1 and Case 2 for these rainfall events to ensure that the levels and top water level differences presented, in the Golovin report, are the critical levels.

4.3 Flood Risk Mitigation

The mitigation of flood risk has been proposed to ensure that the earthworks is undertaken to the level of the flood outcomes of 50yr event to meet the requirements of WBoPDC. However, this model shows the extent of earthworks platform, at RL3.0m, which does not match that of the MPAD Finished Contour Plan drawing no. 13, or WSP Finished contour plan drawing C201 rev C. This MPAD and WSP information on the finished contours is further reflected in HG stormwater management assessment. There seems to be a disconnect between the MPAD, WSP and HG design information and Golovin flood modelling which leads to the flood risk assessment having little confidence that the delivery of the site can achieve flood mitigation, for all assessed rainfall events.

The delivery of the widening of the roadside drain on the northern side of Te Puna Road has been assessed by engineers other than Dr Steven Joynes, as such this delivery of the table drain has been assumed achievable for flood mitigation.

[9] : Email response by Dr Steven Joynes, dated 14 June 2024 at 1.30am, to Marcia Christian, BoPRC
[10] Ref Section 5 final paragraph, Golovin report (Final)

The flood effects have been presented in visual context for 50yr event in Section 4.2, Golovin report, however there is very little detail on the flood depth or velocity for assessing risk. Usually flood modelling outcomes include these parameters to ensure that the development can deliver a solution that addresses risk (if risk is present).

The future development area has not been included in the flood modelling therefore the effects or requirement for mitigation has not been assessed.

4.4 Flood assessment outcomes

The responses to CKL's initial flood modelling assessment that have been provided by Dr Steven Joynes have been considered for this (reported) assessment of the flood modelling outcomes.

The Golovin report has provided outcomes of the existing 100yr flood event via a flood mapping and top water level difference mapping for 50yr event. This is then supplemented with top water level differences for 10yr, 50yr and 100yr events at 3 locations, outside of the site. These results are a synopsis of the overall flood modelling undertaken without the details of the critical recurrence assessment.

The stormwater management design for the development is reliant on the outcomes of the 50yr and 10yr flood levels. Therefore, the synergy between the flood modelling and stormwater management needs to be tested to provide certainty that the development can fully mitigate the effects on the receiving environment. For example, the wetland is shown to be located within 10yr flood levels and (assumed) extents therefore will not provide the level of treatment and attenuation required to mitigate effects.

The Future development area is located in the flood plain however this scenario has not been modelled. The effects, due to the lack of information within the flood model outcomes, have not been assessed.

5 Summary

The proposed TPIL development, at 297 Te Puna Station Road, includes provisions of stormwater management and flood mitigation. The resource consent applications' Stormwater Management and Flood Modelling has been reviewed to assess the effectiveness of the proposed development to mitigate the effects and meet BoPRC objectives of protecting the receiving environment from detrimental effects.

There seems to be a disconnect between the stormwater management, site development finished surface levels and the flood modelling outcomes. This needs to be resolved in order to achieve confidence that this site can deliver on the outcomes required by BoPRC objectives.

Whilst there are flood modelling outcomes presented, there are downstream hydraulic parameters that need to be included into the model to provide confidence in the 10yr and 50yr flood modelling outcomes. These outcomes are then relied upon by the stormwater management system, in order to deliver the communal wetland and conveyance swales which provide treatment and attenuation to mitigate effects.

The stormwater management attenuation requirement of 80% of predevelopment flows during 100yr rainfall event for the fully developed site is not reflected in the flood modelling. There is a question as to why this parameter is currently adopted, as the wetland is located within the flood plain and unable to attenuate flow if it is fully inundated.

6 Limitations

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