To:	**Harbour View Heights LP**	**Date:**	21 December 2023
Attention:	**Fei Lin, Russell Baikie**	**Ref:**	66548
Subject:	**28, 30, and 66,76 Crestview Rise and 170 Settlement Road – Freshwater Ecological Constraints 2**		

1. INTRODUCTION

Harbour View Heights LP engaged Bioresearches to undertake a freshwater ecological constraints assessment for a proposed rezoning application at 28, 30, 66,76 Crestview Rise and 176 Settlement Road, Papakura, Auckland (hereafter referred to as the 'site') (Figure 1). As part of the application, the applicant proposes to also amend the current rural urban boundary. Land at 28,30 and 66 Crestview Rise is proposed to be rezoned to urban with a planning precinct over the entire land holdings. This memorandum provides a high-level assessment of the freshwater ecological constraints which relate to the proposal. This report does not address the detailed resource or development consents that may eventually be required, should resource consents be sought, nor does it contain an ecological effects assessment for the subdivision or development enabled by the proposed plan change.

The site is zoned as Rural – Countryside Living Zone. Auckland Council's GIS viewer[1] identified minor overland flow paths within the site, and a permanent stream located within the southern portion of the site (Figure 1). The site is not associated with a Significant Ecological Area (SEA).

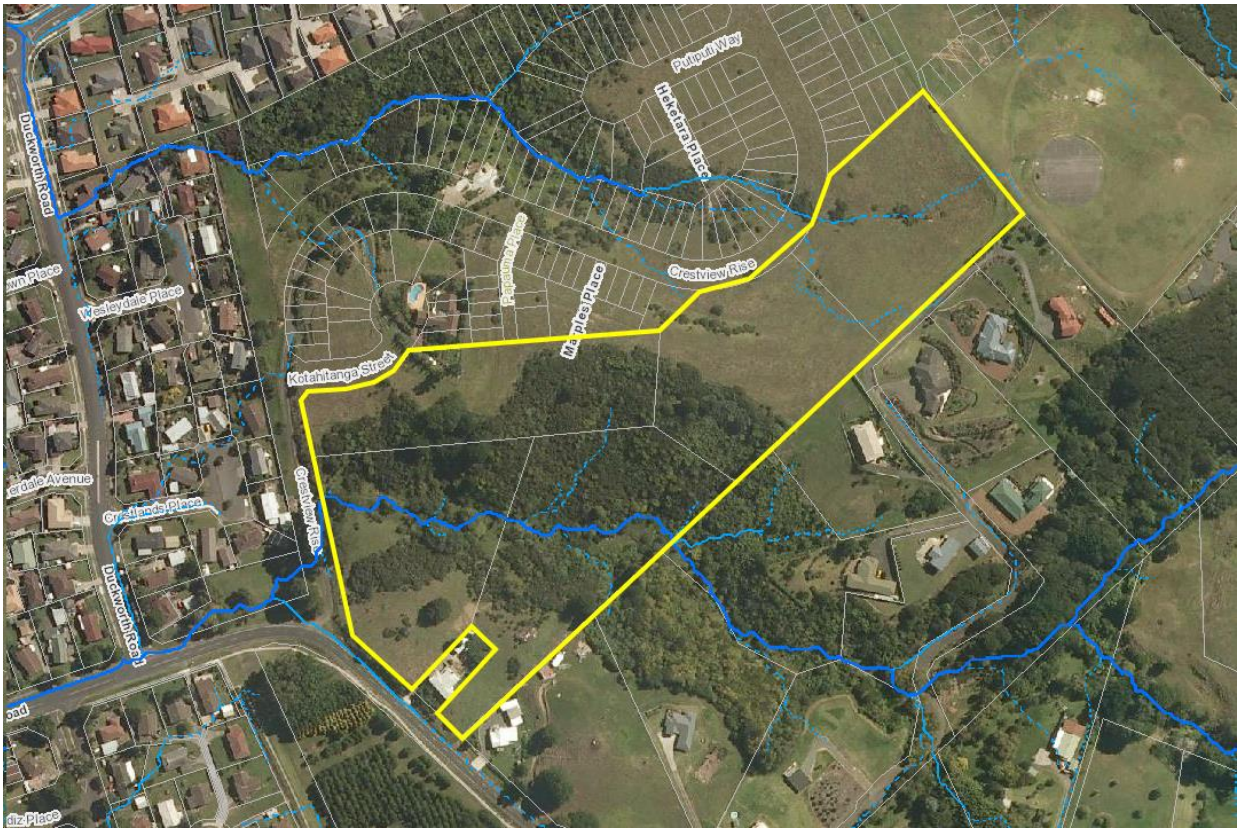

Figure 1. Map of the site (yellow polygon) and the predicted overland flow paths present within the site and surrounding area. Image sourced from Auckland Council Geomaps GIS viewer.

[1] https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html

2. DEVELOPMENT LAYOUT

A topographic ridge line bisects the western portion and partially the central portion of the site, of which only the north facing slope will be developed (Figure 2). A stormwater reserve is proposed within the most western portion of the site. This will comprise a raingarden and stormwater attenuation pond. A scruffy dome within the attenuation pond will drain stormwater into a public stormwater connection along Crestview Rise, which will then discharge into a stream located at 76 Crestview Rise.

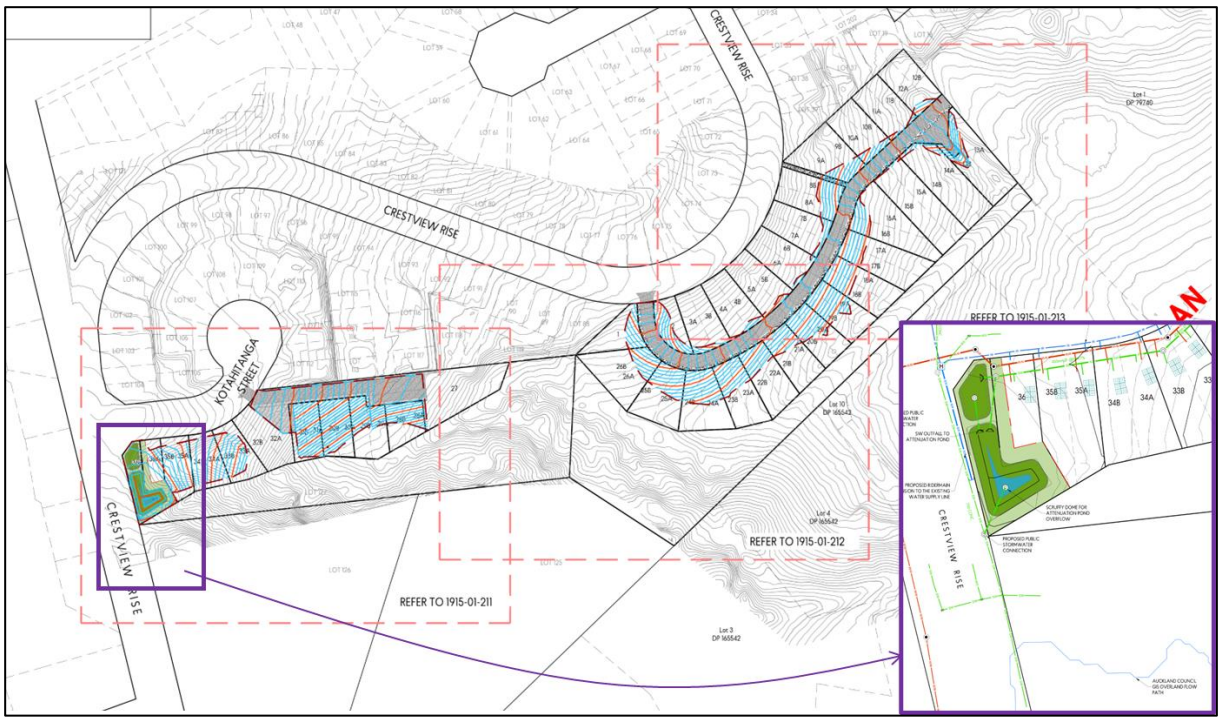

Figure 2.Draft development layout (Envelope Engineers. November 2023).

3. METHODS

The site was assessed via a desktop review and site visit. The desktop assessment noted factors such as changes in vegetation and surface water on current and historical aerial images, and a review of data such as the Current Biodiversity layers, predicted watercourses and contours on Auckland Council's Geomaps was undertaken.

During the site assessment, undertaken on the 13th of December 2023, the presence and extent of wetlands, streams and other freshwater habitats within the site were noted, and the quality of any freshwater habitat was visually assessed as described below.

3.1 Streams

During the site assessment, the presence and extent of water was noted, reference photos were taken, and freshwater habitats were marked using a handheld GPS unit. Watercourses were classified under the Auckland Unitary Plan (AUP) to determine, in accordance with the definitions in these plans, the ephemeral, intermittent or permanent status of these watercourses (Table 1). In addition, these watercourses were assessed as to whether they were natural or artificial, in accordance with AUP definitions, using information from both the desktop review and site visit.

Table 1. AUP criteria for permanent, intermittent rivers and streams and ephemeral streams[2]

Criteria	Definition
Permanent Stream	
1	The continually flowing reaches of any river or stream, excluding ephemeral reaches
Intermittent or ephemeral stream*	
1	Evidence of natural pools
2	Well defined banks and bed
3	Retains surface water present more than 48 hours after a rain event
4	Rooted terrestrial vegetation not established across channel
5	Organic debris from flooding present on floodplain
6	Evidence of substrate sorting, including scour and deposition
***If three or more of the six assessment criteria can be met with confidence, the watercourse is considered intermittent. If at least three criteria cannot be met, the watercourse is considered ephemeral.**	

The quality of the aquatic habitat was assessed, noting ecological aspects such as channel modification, hydrological heterogeneity, riparian vegetation extent, substrate type and any fish or macroinvertebrate habitat observed. Riparian and catchment information was also reviewed.

3.2 Natural Inland Wetlands

Potential natural inland wetlands were assessed following the Ministry for the Environment's (MfE) wetland delineation protocols (MfE, 2022) to ascertain if the area presented with the physical characteristics to be considered an RMA wetland (Figure 3), which is defined as:

> *'permanently or intermittently wet areas, shallow water, and land water margins that support a natural ecosystem of plants and animals that are adapted to wet conditions'.*

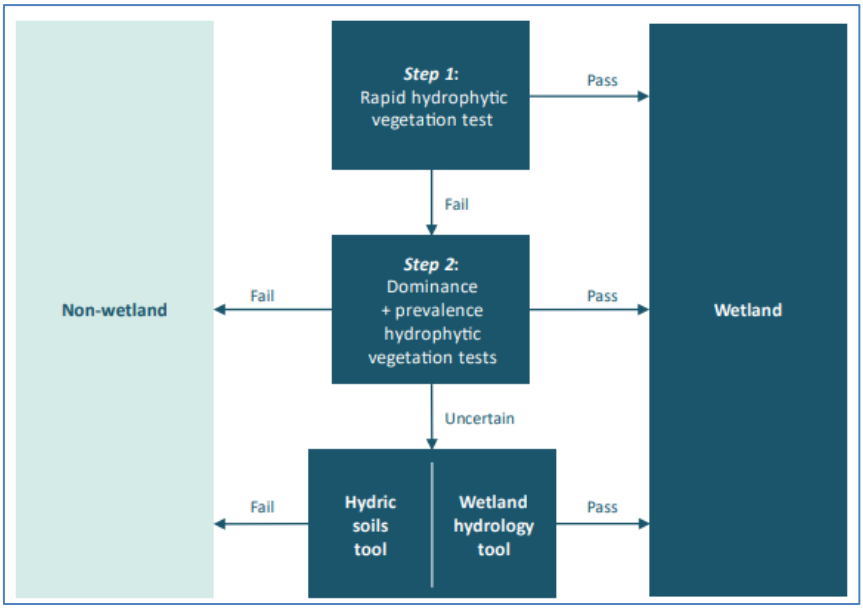

Figure 3. Simple flow chart of steps for determining an RMA wetland using the hydrophytic vegetation, hydric soils and wetland hydrology tools. Reproduced from MfE (2022).

[2] Table reproduced from: https://content.aucklanddesignmanual.co.nz/regulations/practice-notes/Documents/RC%203.3.17%20Stream%20Classification.pdf

When following this process, if the rapid test was not appropriate for determining if an area was an RMA wetland, vegetation assessment in accordance with Clarkson (2013) was undertaken; based on the dominance and prevalence of plant species assigned the following 'wetland plant indicator ratings' within a vegetation plot:

- Obligate wetland vegetation (OBL) – almost always a hydrophyte, rarely in uplands;
- Facultative wetland (FACW) – usually a hydrophyte, but occasionally found in uplands;
- Facultative (FAC) – commonly occurs as either a hydrophyte or non-hydrophyte;
- Facultative upland (FACU) – occasionally a hydrophyte but usually in uplands; and
- Upland (UPL) – rarely a hydrophyte, almost always in uplands.

Where the dominance and/or prevalence tests applied to the vegetation plot results showed unclear results, hydric soils and hydrology tests were undertaken in accordance with the associated protocol (Ministry for the Environment, 2021; Fraser *et al.,* 2021).

If the area did meet the definition of an RMA wetland, then the definition of a Natural Inland Wetland (as published in the National Policy Statement for Freshwater Management (NPS-FM)) was applied to ascertain if the area could also be considered a 'natural inland wetland'. This definition is as follows:

> ***natural inland wetland*** *means a wetland (as defined in the Act) that is not:*
> *a) in the coastal marine area; or*
> *b) a deliberately constructed wetland, other than a wetland constructed to offset impacts on, or to restore, an existing or former natural inland wetland; or*
> *c) a wetland that has developed in or around a deliberately constructed water body, since the construction of the water body; or*
> *d) a geothermal wetland; or*
> *e) a wetland that:*
> *(i) is within an area of pasture used for grazing; and*
> *(ii) has vegetation cover comprising more than 50% exotic pasture species (as identified in the National List of Exotic Pasture Species using the Pasture Exclusion Assessment Methodology (see clause 1.8)); unless*
> *(iii) the wetland is a location of a habitat of a threatened species identified under clause 3.8 of this National Policy Statement, in which case the exclusion in (e) does not apply.*

4. HISTORICAL OVERVIEW

Historically (pre-1900's), the site would have been vegetated with taraire, tawa, podocarp forest (WF9) and kauri, podocarp, broadleaved, beech forest (WF12) [3,4] limited to the most northern part of the site. Mature vegetation had been mostly removed since by 1930 (the date of the earliest historic aerial imagery available for the site; Figure 4), with vegetation limited to the southern area of the site. Since then, the site and the surrounding land have undergone numerous changes and have been extensively modified, primarily for agricultural purposes.

[3] Maps of potential ecosystem extents obtained from Auckland Council Geomaps: https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html
[4] Ecosystem Classifications from Singers *et al*. (2017).

As per Figure 4, in 1930 the site was largely devoid of native vegetation, with vegetation limited to the central portion of the site. The vegetated gully within the central portion of the site appears to host a watercourse. This watercourse appears more obvious in the 1960 aerial photograph. In 2018, earthworks commenced within and around the site, eventually leading to the residential development north of the site (Figure 5). Latest aerial imagery depicts the site to be covered by low growing shrub and grass, with the mature vegetation still present within the southern portion of the site (Figure 5).

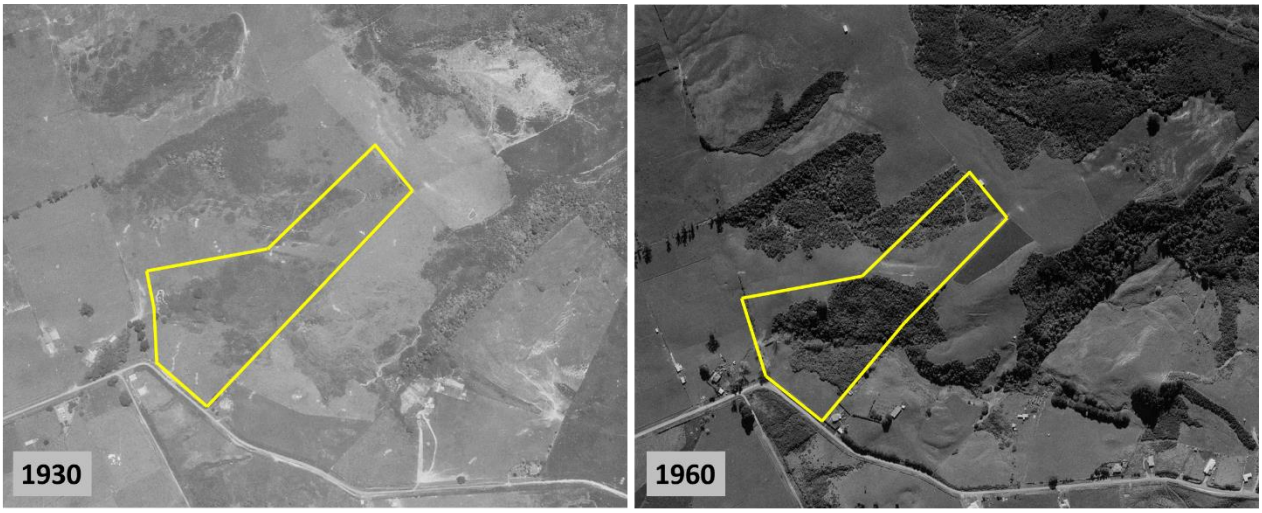

Figure 4. Historical aerial photograph of the site (yellow polygon) circa 1930 and 1960.

Figure 5. Digital satellite imagery of the site (yellow polygon) circa 2018 and 2023.

5. EXISTING FRESHWATER ECOLOGY

A permanent stream is located over 76 Crestview Rise and 17 Settlement Road. (Figure 6). No natural inland wetlands are located in the gully of the site, nor are there any natural inland wetlands identified within 100 m of the site (via desktop review).

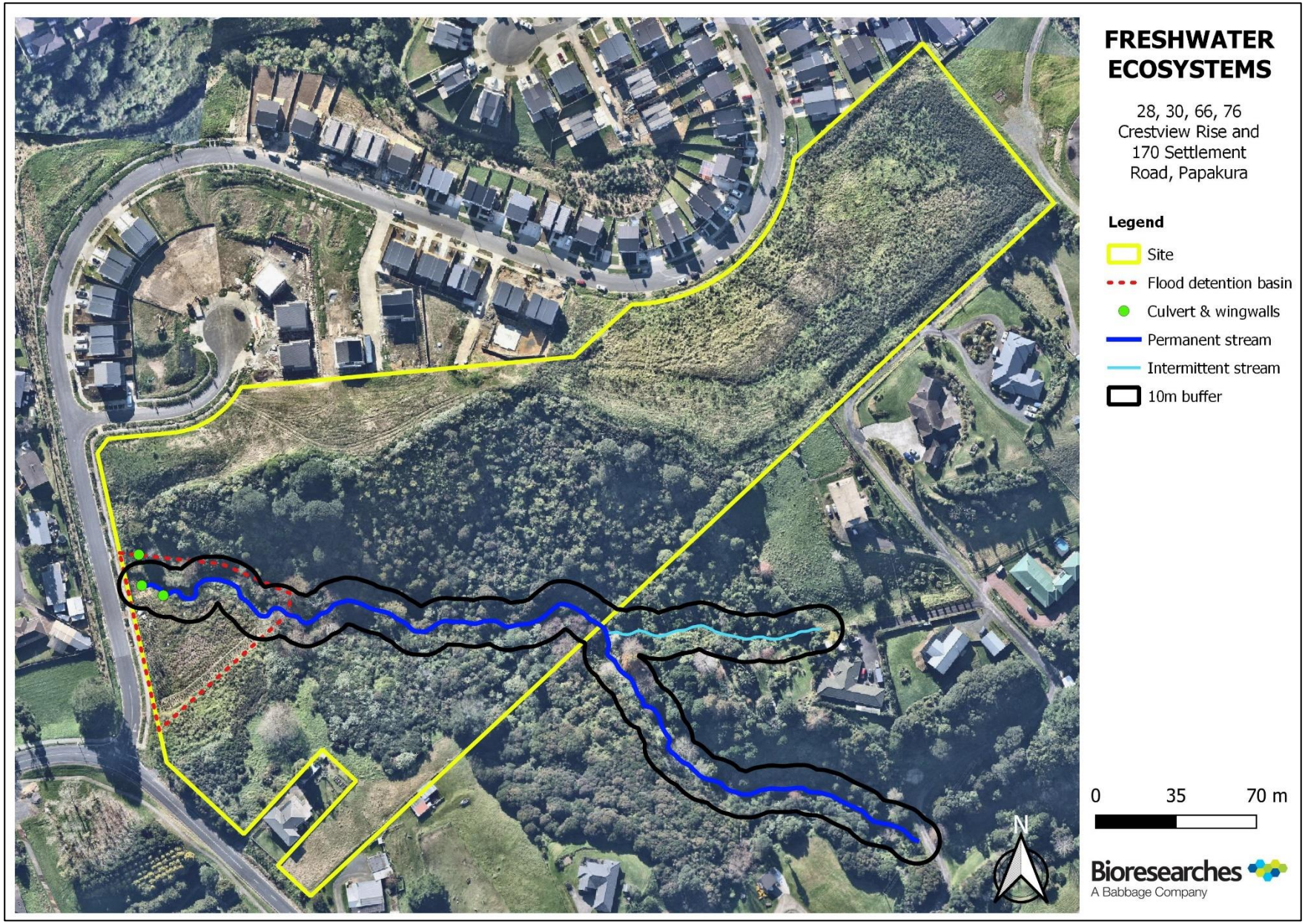

Figure 6. Map depicting the various freshwater ecological features identified surrounding the site.

This stream, which is an unnamed tributary of the Otuwairoa stream / Slippery Creek, originates in the rural area east of the site. As the catchment of this stream is approximately 39 hectares, water flows within this stream for the majority of this year, classifying this stream as a permanent stream. Due to the expansion of the Papakura urban area, the lower reach of this stream, particularly from the Slippery Creek confluence to the Crestview Rise road crossing, was piped underground. Since then, only approximately 1 km of upstream reach remains. Approximately 230 m of stream reach is located within the southern portion of the site.

During a site visit on 13 December 2023, fast-flowing water was observed in the stream, following rainfall that had occurred a few days before. The wetted width of the stream varied between 0.4 m and 1.5 m. The channel depth ranged from approximately 0.2 m to 0.8 m. The streambed is soft bottomed, with exposed clay in some areas.

The lower assessed stream extent is incised (with some undercuts noted). The riparian vegetation provides substantial shading to the stream, with only the lower reach lacking shading due to recent replanting along the true left bank and Crestview Rise road embankment. There were no identified barriers to fish passage within the assessed stream reach. Hydraulic heterogeneity is high with natural pools, riffles, and runs present.

Figure 7. Overview of the lower extent of the stream, noting recent plantings on the true left bank (left) and the stream reach draining through a forested area.

The canopy of the riparian margin is dominated by willow (*Salix sp.*) trees. Refer to the ecological assessment undertaken by Bioresearches (2023)[5] for a detailed description of the vegetation. Vegetation along the stream was dominated by exotic species such as arum lily (*Zantedeschia aethiopica*), creeping buttercup (*Ranunculus repens*), curled dock (*Rumex crispus*). Water celery (*Helosciadium nodiflorum*) dominated the lower reach of the stream where shading was limited. Overall, the riparian vegetation provides a high degree of filtration function and bank stability.

[5] Bioresearches. 2023. 28, and 60 Crestview Rise– Terrestrial Ecological Assessment. December 2023

Figure 8. (Left) lower stream reach draining into a wingwall culvert underneath Crestview Rise, indicated by blue dashed line, dominated by water celery; (Right) arum lily along stream embankments.

According to the New Zealand Freshwater Fish Database, a fish survey was conducted within the lower extent of the assessed stream (at the Crestview Rise culvert crossing), which records native species such as the shortfin eel (*Anguilla australis*) and banded kōkopu (*Galaxias fasciatus*). Additionally, a shortfin eel was observed in the stream during the site visit.

5.1 Existing stormwater inputs to the stream

An existing culvert wingwall is located immediately north of the stream, and discharges stormwater from two mega pits located within the Crestview Rise road reserve into the stream, and associated flood detention basin (refer to Section 5.2 for more detail). Stormwater from the future proposed subdivision will also be discharged into the stream through this culvert outlet.

On site investigations reveal erosion and scouring of the banks adjacent to the wingwall. Due to an embankment approximately 3 m in front of the wingwall, stormwater from the outlet structure makes a 90-degree change of direction before eventually flowing into the stream. According to the engineering assessment by Envelope Engineering (2023[6]), only 3-4 m of riprap was installed, whereas the original design requires a 12 m long riprap apron, which was not fully installed.

Currently, stormwater is scouring and eroding the riprap apron and the opposite embankment; however, no erosion of the stream itself has been observed. There is sediment deposition between the wingwall outlet and the stream, providing a substrate for water celery.

[6] Enveloope Engineering. December 2023. Memo – Settlement Road. Assessment of existing wingwall outlet.

Figure 9. Existing culvert wingwall structure. The light blue dashed line indicated the stormwater flow path (including a 90 degree direction change) into the stream (dark blue line).

5.2 Constructed waterbodies

A flood detention basin is situated within the site along the western boundary of the site (along Crestview Rise road). Stormwater overflows from this basin discharge into the stream via a wingwall structure. Figure 5 illustrates the development of this detention basin from 2018. Since then, the basin has been vegetated with pūrei (*Carex secta*). Due to the intentional construction of this waterbody, it is excluded from the definition of a 'natural inland wetland' under the NPS-FM (exclusion (c); refer to Section 3.2).

Figure 10. Stormwater detention basin located immediately south of the stream, and east of Crestview Rise road.

6. CONCLUSION

This report provides a comprehensive analysis of the freshwater ecological features that could potentially constrain development within the site. A permanent stream is located towards the southern boundary of the site, into which stormwater from the proposed future development will eventually discharge. A 10 m riparian yard regulation applies to the identified stream (Figure 6), but no earthworks are proposed within this setback area. No natural inland wetlands are located within 100 m of the site, as indicated by a desktop review.

Since the flood detention basin is an intentionally constructed waterbody, it falls outside the definition of a 'natural inland wetland' according to the NPS-FM. Therefore, it is not afforded protection and does not pose a constraint to future development within the site.

Based on the proposal, no Auckland Unitary Plan natural resource rules are triggered that would otherwise require a future resource consent, although some may potentially be applicable for stormwater discharges into the stream. Given that the stormwater will be treated (polished) before discharging into the stream, it is not expected to affect the surface quality of the stream or its hydrological functioning. Additionally, the stormwater will be released into the lowest part of the natural stream reach before flowing into an underground piped reach, so the ecological effects on surface quality and quantity are expected to be negligible.

Remedial works will likely be required to prevent further scouring at the existing stormwater wingwall structure (Figure 9) It is highly recommended that the riprap apron (remedial works) be extended to allow for improved scour protection and to avoid further sediment deposition in the stream.

Regards,
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