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memorandum

TO	Will Dorset	FROM	Gianmarco Tolomei
	Pukerua Property Group LP	DATE	14 November 2025
RE	Assessment of proposed roundabout on SH59 on water quality of Taupo Stream		

1.0 Introduction

Classic Developments Limited on behalf of Pukerua Property Group LP (the Applicant) are seeking to obtain fast-track consent for the development of a residential subdivision near Pukerua Bay in an area known as Mount Welcome. The Mount Welcome site is located at 422 State Highway 59, near Pukerua Bay. To provide access to the proposed development, the construction of a new roundabout on SH59 is necessary. To create enough space for the roundabout, approximately 110 m of the Taupo Stream would need to be culverted (see Figure 1).

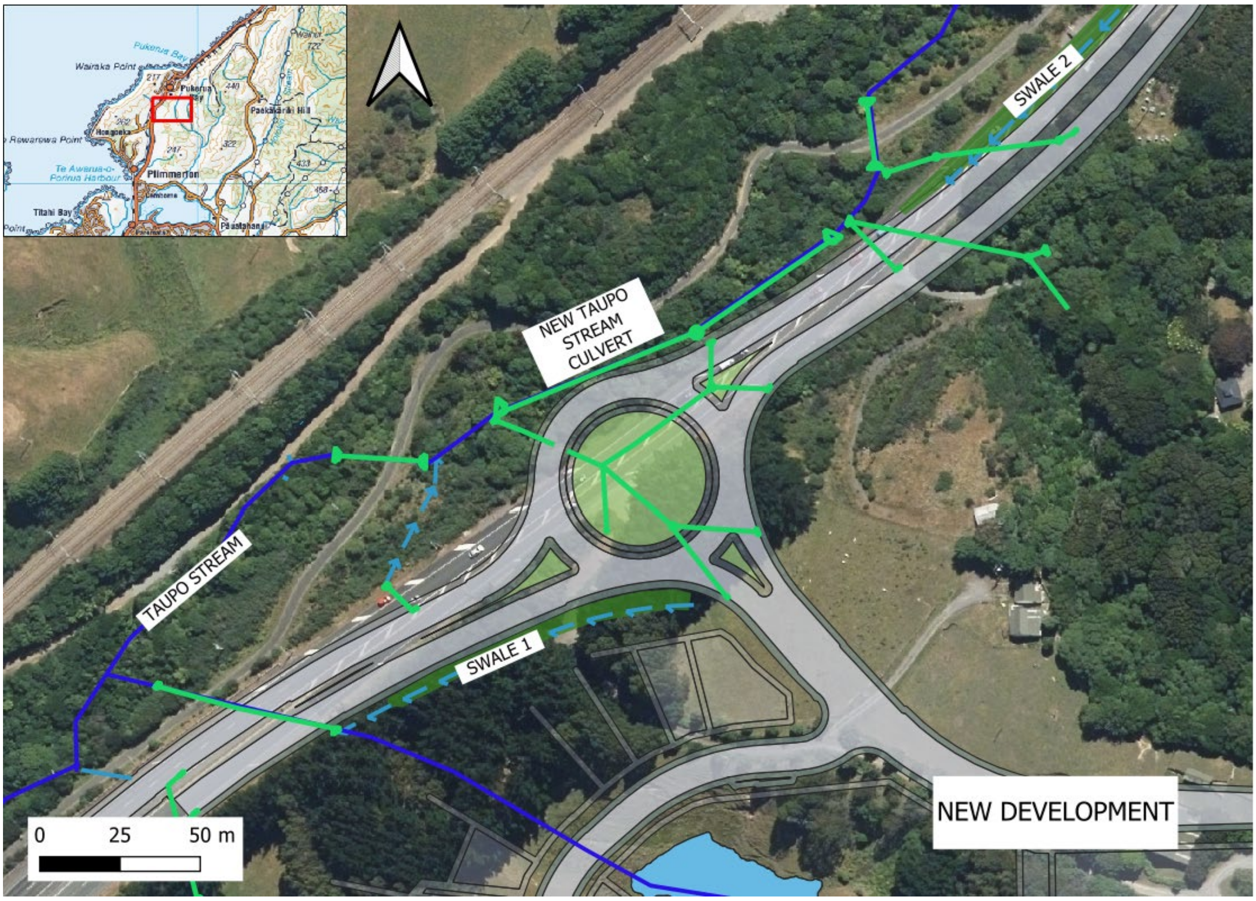

Figure 1: Proposed roundabout on SH59 with stormwater infrastructure (draft)

2.0 Purpose and exclusions

The purpose of this memorandum report is to assess the change in water quality in the Taupo Stream due to the discharge of road runoff from the proposed roundabout on SH59. This report does not cover the following:

- The effects on the water quality due to the discharge from the development have been addressed in PDP Report Mount Welcome - Water Quality Assessment (2025) and are not included in this report.
- The ecological offset for the culverting of the Taupo Stream and clearance of existing vegetation are described in the Mt Welcome Station Ecology (BlueGreen Ecology 2025) and do not form part of this report.
- Changes in hydrology have not been addressed in this report and are addressed in PDP Mt . Welcome Hydrology Assessment (PDP 2025).

3.0 Literature review - contaminant load

According to the NZTA traffic count monitoring site at Taupo Swamp (see Figure 2), since the opening of the Transmission Gully Motorway (Te Aranui o Te Rangihaeata) in March 2022 — which diverted much of the through traffic away from the coastal route — the annual average daily traffic (AADT) recorded was 8,401 in 2023, increasing to 9,321 in 2024. At the monitoring site "North of Waikara Bay," the AADT was 7,786 in 2023, rising to 8,138 in 2024 (source: NZTA State Highway Traffic Monitoring – Annual Average Daily Traffic, ArcGIS application).

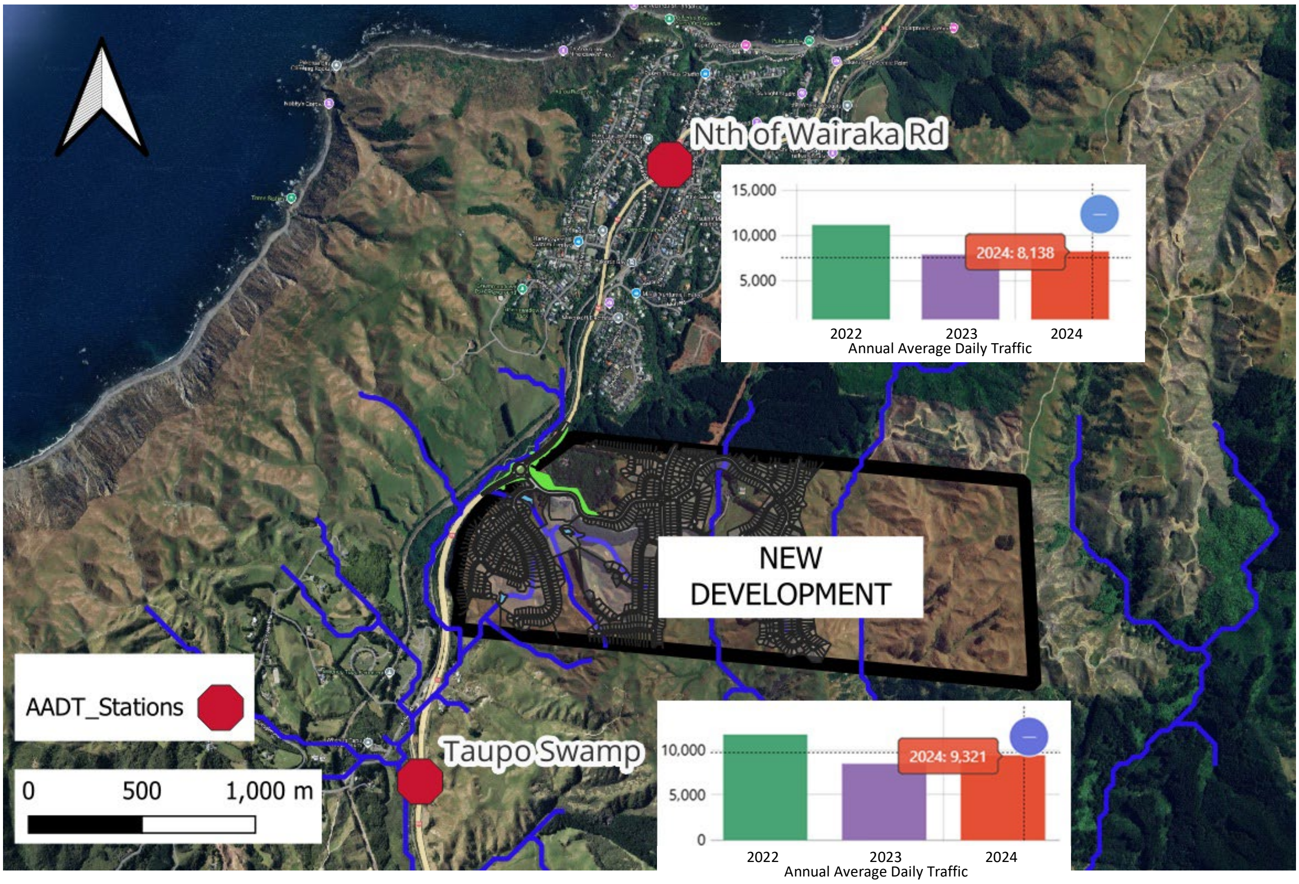

Figure 2: Location of AADT monitoring station along SH59

According to Table 5-5 of the *NZTA Stormwater Treatment for State Highway* document (2010), traffic volumes between 5,000 and 20,000 vehicles per day are associated with the contaminant loads presented in Table 1 below. Runoff concentrations for various stormwater pollutants are based on the Parsons Brinckerhoff study (*Ecological Engineering*, 2003), as reported in the NZTA guidance and presented in Table 2.

Table 1: Contaminant Loads for Various Daily Traffic Counts

Vehicles/day	Sediment ($g/m^2/yr.$)	Zinc ($g/m^2/yr.$)	Copper ($g/m^2/yr.$)	Total Petroleum Hydrocarbons ($g/m^2/yr.$)
5,000 – 20,000	150	0.537	0.1744	2.68

Table 2: US Highway Runoff Concentrations for Various Stormwater Pollutants in g/m^3 vs toxicant default guideline values for freshwater quality (Guidelines for fresh & marine water quality ANZ 2018)

Pollutant	Event Mean Concentration for highways < 30,000 vehicles/day (g/m^3)	Trigger Values for Freshwater (g/m^3) Level of Protection (95 % species)	Trigger Values for Freshwater (g/m^3) Level of Protection (99 % species)
Total Suspended Solids	41	-	-
Copper	0.022	0.0014	0.001
Lead	0.08	0.0034	0.001
Zinc	0.08	0.008	0.0024

As shown in the comparison between event mean road runoff concentrations of selected contaminants and the trigger values for freshwater protection (ANZ 2018), estimated contaminant concentrations in highway runoff could consistently exceed the threshold values for freshwater protection. According to the *NZTA Stormwater Treatment Standard for State Highway* document, the critical factor in determining the need for treatment is the pathway the run-off takes to reach the receiving environment. The nature of this pathway — including its length, infiltration potential, and connectivity — plays a key role in influencing the potential impact on water quality. Therefore, decisions around treatment must account for both contaminant levels and the characteristics of the run-off pathway and receiving environment.

According to 7.1.6 of the *Stormwater Treatment Standard for State Highway Infrastructure*, water quality for downstream receiving stream environment is high priority. However, as per the flow chart in Figure 7-3 of the NZTA State Highway Guidelines for Stormwater Treatment, for existing State Highways in rural areas the implementation of treatment measures is a case-by-case decision. This area is considered rural because the proportion of impervious surfaces in the total upstream catchment amounts to less than 10% post-development.

Proposed stormwater infrastructure and change in impervious surface

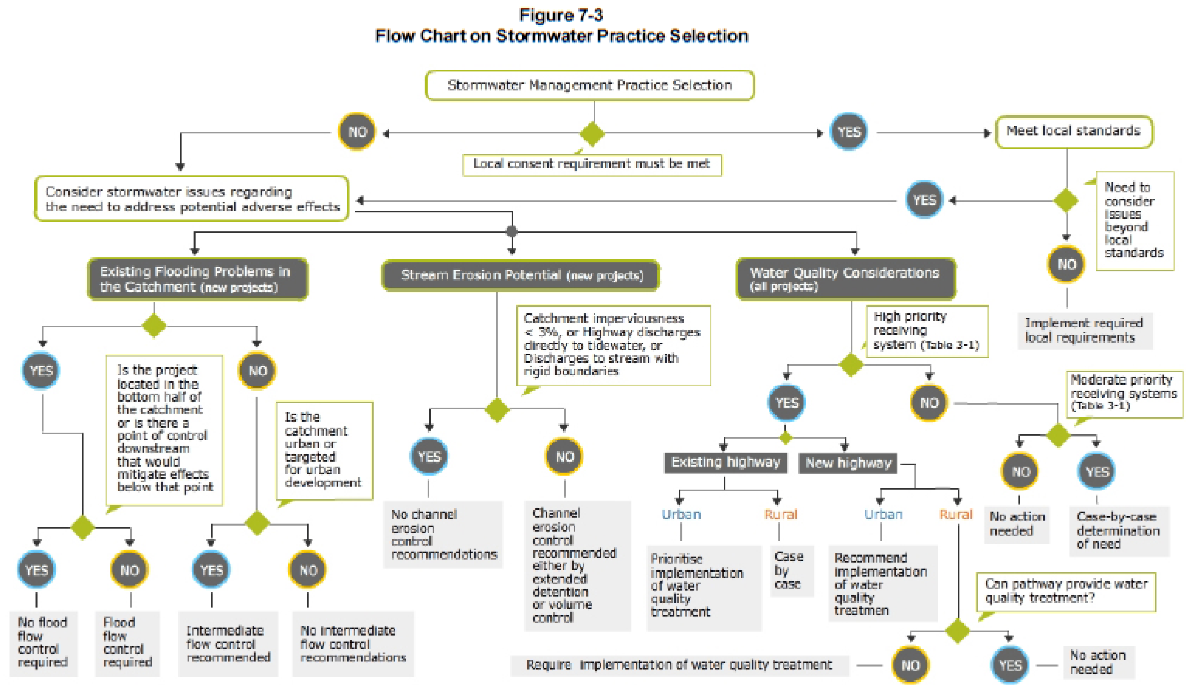

Figure 3: NZTA Flow Chart on Stormwater Practice Selection

Envelope Engineering Limited (Envelope) designed the new proposed stormwater infrastructure. Currently, road runoff from this section of SH59, covering a total area of 8,360 m², is discharged untreated into the Taupo Stream. The new design proposes collecting runoff from the roundabout area and part of the access road to the development via sumps, conveying it through kerbs and DN300 to DN450 pipes, and discharging it into the Taupo Stream (see Figure 4). The areas of the catchments shown in Figure 4 are displayed in Table 3.

Table 3: Areas of roundabout catchments

Catchments	Area impervious (m²)
North Outlet 2	480
North Outlet 1	928
South Outlet 2	1,721
South Outlet 1	1,176
Swale 2	1,250
Swale 1	1,410
Main Outlet	5,445
Total	12,410

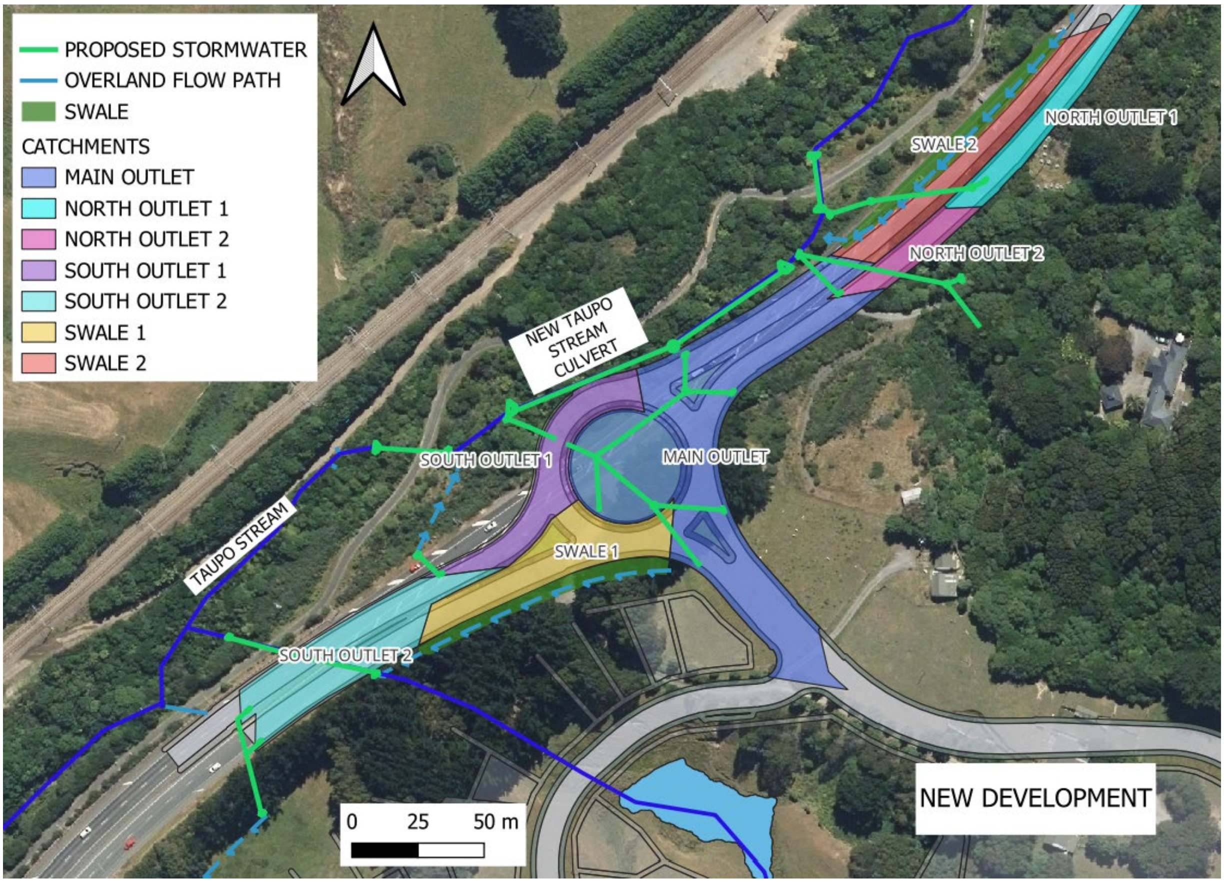

Figure 4: Roundabout catchments and proposed stormwater infrastructure

The designed stormwater system works as follows:

- The catchments named “Main Outlet”, “North Outlet 1”, and “North Outlet 2” discharge directly into the Taupo Stream without any treatment. Due to space constraints, treatment options for these catchments are not feasible, with the only potential exception being the “Main Outlet,” where treatment could theoretically be implemented within the centre of the roundabout. However, this option was dismissed due to the operational challenges and safety risks associated with accessing the infrastructure for maintenance.
- The catchment “South Outlet 1” discharges into the bush adjacent to the Taupo Stream via an overland flow path of approximately 40 m, as indicated by the contours showing water being conveyed back to the stream.
- Swale 1 conveys water to a culvert beneath the State Highway and discharges into the Taupo Stream downstream.
- Swale 2 collects and treats runoff from the northwestern section of the highway and discharges to the Stream through an existing overland flow path.
- “South Outlet 2” discharges on the opposite (development) side of SH59, where water flows south for approximately 70 m through a vegetated overland flow path before being conveyed through an existing culvert beneath SH59 and into the Taupo Stream (outside the extent of Figure 4).

For the purpose of assessing the effects of these discharges on the water quality of the Taupo Stream, these catchments were further subdivided according to the treatment provided (see Table 4).

Table 4: Catchment areas classified by water treatment type

Final Outlet	Area impervious (m^2)
Direct Discharge (untreated)	6,853
Pathway through bush/vegetated OLFP	2,897
Swale 1 and 2	2,660

According to Table 8.1 of the NZTA Standard for Stormwater treatment, the following removal rate for pollutants can be achieved with swales.

Table 5: Removal rate of selected pollutants achievable with swale treatment (NZTA 2010)

Treatment	TSS (%)	Nitrogen (%)	Phosphorus (%)	Zinc (%)	Copper (%)
Swales	70	20	30	75	60

Regarding discharge to overland flow paths, pollutant removal rates are not well-documented in the literature due to the non-standard characteristics of these pathways (i.e., they are not engineered systems like swales with a calculated residence time). Their performance is influenced by several factors, including gradient, length, Manning's coefficient, soil infiltration capacity, flow velocity, and maximum water depth above vegetation, among others. For the purpose of this assessment, it was assumed that 30% removal of pollutants (zinc and copper) occurs through various processes such as sedimentation, microbial decomposition, filtration, adsorption, and biological uptake during flow through the overland flow paths.

This is considered conservative, given the lengths of the paths and the fact that it is less than half the pollutant removal rates reported in the *NZTA Stormwater Treatment Standard for State Highway* document for filter strips and swales, which achieve up to 75% zinc removal and 60% copper removal. Accounting for the treatment function of the overland flow paths (OLFPs) and considering that an area of 8,360 m^2 is currently discharged untreated into the stream, the proposed construction of the roundabout reduces the untreated area by 1,507 m^2 (18.1%) to 6,853 m^2.

4.0 Assessment of change in contaminant load

Using the contaminant load in Table 2 and the removal rates from Table 5, the contaminant load from untreated stormwater discharge was combined with the residual contaminant load from impervious areas connected to swales, as well as the residual load after flow through the overland flow paths (OLFPs). This allowed for a comparison between the total contaminant load following the construction of the roundabout and the existing conditions.

This approach does not account for potential increases in contaminant load due to factors such as increased vehicle braking when approaching the roundabout or greater tyre friction resulting from road curvature, as this effect cannot be quantified at this stage. Nonetheless, the approach is considered conservative enough to accommodate such potential increases.

Moreover, the assessment is based on literature values rather than measured data; however, it provides an order-of-magnitude estimate of the expected change in contaminant load.

The assessment was performed for zinc, copper, and TSS, as literature values for both contaminant loads and removal rates in swales are available in the *NZTA Stormwater Treatment Standard for State Highway* document for these parameters and they are considered to represent the greatest risk to the freshwater quality of the stream.

The results of this assessment for zinc and copper are reported in Table 7, with the results for TSS presented and discussed in more detail below.

Table 6: Increase of contaminant load after roundabout construction according to Table 5-5 of NZTA Stormwater Treatment for State Highway

	Zinc	Copper
Contaminant load with roundabout (g/yr.)	5,126	1,734
Contaminant load existing (g/yr.)	4,489	1,458
Increase (g/yr.)	637	276
Increase (%)	14%	19%

These figures refer to the whole contaminant load generated in the highway, however, only a fraction of the contaminant load per square meter pavement would be washed away in the rainfall runoff, as part of it would remain in the sumps or be absorbed by nearby vegetation and soil. Using the event mean concentration for highways with less than 30,000 vehicles day (see Table 2) and combining this with the average annual rainfall measured at Taupo Stream at Whenua Tapu and the increased impervious surface due to the construction of the roundabout, the following figures are obtained:

Table 7: Increase of contaminant load after roundabout using data from Parsons Brinckerhoff, Ecological Engineering, 2003

	Zinc	Copper
Contaminant load with roundabout (g/yr)	802	230
Contaminant load existing (g/yr)	702	193
Increase (g/yr)	100	37
Increase (%)	14%	19%

The percentage increase remains the same as in Table 7 because the proportion of road runoff, treated area, and treatment efficiency is unchanged. As mentioned above, the results in Table 7 and Table 8 were obtained using a conservative estimate of pollutant reduction capacity in the OLFPs of 30% contaminant removal (i.e., 70% of contaminants remain in the runoff).

To test the sensitivity of the assumption, contaminant removal rates in the OLFPs ranging from 0% to 60% were considered. The resulting percentage increase in contaminants—from the existing situation to post-construction of the roundabout—ranged between 10% and 30%.

Regarding sediment, a comparable analysis to that described above was conducted using the data in Table 1 and Table 2. The results indicate that an increase of between 5% and a maximum of 20% could be expected. However, since road runoff will be collected through baffled sumps with a minimum 450 mm separation between the bottom of the structure and the invert of the outlet pipe—according to Wellington Water Regional Specifications (drawings DR04 and DR05; see Envelope Engineering stormwater typical details)—it can be assumed that the above percentages will be further reduced. The increase of the total sediment load discharged into the stream post-construction is considered likely to be minimal, if sumps are maintained regularly in accordance with manufacturer specifications.

Stream erosion has also been addressed by Envelope. The proposed stormwater infrastructure has been designed in accordance with Wellington Water Standards and Specifications, and all outlets discharging into the stream will include rip-rap revetment to protect the stream from erosion.

The relative scale of the increase in total pollutant load in the Taupo Stream can be better understood by considering the total catchment area of the stream at the roundabout, which is approximately 91 ha. In comparison, the increase in impervious surface due to the roundabout construction is around 0.4 ha, representing only about 0.44% of the total catchment area. The proposed change is therefore expected to result in a 10 to 30% increase in contaminants within a section that accounts for just 0.44% of the overall catchment. Whilst the road areas are likely to contribute a higher proportion of contaminant run-off than pastoral areas, this is a very small change to the overall contribution to the stream.

5.0 Effects during construction

Construction activities present several potential risks to water quality, particularly through sediment runoff, hydrocarbon spills from machinery, and the release of hazardous materials such as cement and adhesives. These contaminants could affect the Taupo Stream.

To mitigate these risks, standard environmental controls will be implemented. In line with GWRC NRP requirements, fuels and chemicals will be stored away from watercourses, and any spills will be cleaned up immediately to prevent contamination.

The most significant risk is sediment discharge into waterways. This will be managed through a comprehensive Erosion and Sediment Control Plan (ESCP) developed by Envelope Engineering. The ESCP outlines specific mitigation measures, including:

- Buffer zone around the Taupo stream to restrict earthworks (where possible).
- Minimising exposed earth surfaces to reduce erosion.
- Installing sediment control devices such as silt fences, and decanting earth bunds.
- Placing sediment traps upstream of the Taupo Stream.

With these measures in place, the overall impact on water quality is expected to be less than minor.

6.0 Conclusions

Whilst water quality protection for downstream receiving environments is a high priority under section 7.1.6 of the NZTA Stormwater Treatment guidelines, the decision to implement treatment measures for existing State Highways in rural areas is made on a case-by-case basis, as outlined in Figure 7-3 of the same document. One of the main factors influencing the decision is the pathway taken by the run-off before reaching the stream.

An assessment based on both literature event mean pollutant concentration data and estimated treatment capacities was carried out to estimate the change in contaminant and sediment loads resulting from the construction of a roundabout near the Taupo Stream. The assessment indicates that the construction of the roundabout will result in a modest increase in contaminant loads in the runoff from the State Highway—ranging from 10 to 30% for copper and zinc and between 5% to 20% for sediments.

Overall, the impact on the Taupo Stream is considered less than minor, especially given the scale of the change in impervious area: the roundabout adds only 0.4 hectares of impervious surface to a 91-hectare catchment, representing just 0.44% of the total area.

7.0 References

- ANZ, 2018: Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2018.
- NZTA NZ Transport Agency, Stormwater Treatment Standard for State Highway, May 2010
- Parsons Brinckerhoff, Ecological Engineering Pty Ltd., Guidelines for Treatment of Stormwater Runoff from the Road Infrastructure, Austroads Publication No. APR232/ 03, 2003.
- Stu Farrant, Francis Leniston, Emily Greenberg, Letticia Dodson, David Wilson, Sue Ira, Wellington Water, Water Sensitive Design for Stormwater: Treatment Device Design Guideline, December 2019, Version 1.1
- NZTA State Highway Traffic Monitoring – Annual Average Daily Traffic, ArcGIS application

8.0 Limitations

This memorandum has been prepared by Pattle Delamore Partners Limited (PDP) on the basis of information provided by Pukerua Property Group LP and <others (not directly contracted by PDP for the work), including Classics Developments Limited, Envelope Engineering Limited, BlueGreen Ecology and NZRA. PDP has not independently verified the provided information and has relied upon it being accurate and sufficient for use by PDP in preparing the memorandum. PDP accepts no responsibility for errors or omissions in, or the currency or sufficiency of, the provided information.

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