Bioresearches
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109 Beachlands Road, Beachlands: Assessment of Ecological Effects

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Cover Illustration: The site at 109 Beachlands Road (photo taken May 2019).

CONTENTS

1. INTRODUCTION

Bioresearches was engaged by Neil Construction Ltd, to undertake an ecological assessment for a proposed development at 109 Beachlands Road, Beachlands (Site, Figure 1).

The Site is zoned Residential - Single House Zone under the Auckland Unitary Plan Operative in Part (AUP OP) and is characteristic of peri- urban pastoral land. The site is within the Hunua Ecological District of the Auckland Ecological Region. The vegetation on the site has not been identified as a Significant Ecological Area (SEA) in the AUP OP.

The approximately 16.3ha site currently consists predominately of pasture grasses. Multiple tributaries are predicted to flow through the Site.

This report describes the existing terrestrial and freshwater ecological values of the Site, assesses the potential effects of the proposed development on those values, and provides recommendations to avoid, minimise and mitigate for any adverse effects where appropriate.

Figure 1. The Site at Beachlands Road (red polygon), showing predicted overland flow paths (blue lines) from Auckland Council's GIS viewer.

2. METHODOLOGY

Site assessments were undertaken by experienced ecologists on 28th January and 17th July, 2020 to evaluate aquatic and terrestrial habitats, including any areas of potential wetland. Prior to the field surveys, a map of the site was created from Auckland Council GeoMaps GIS viewer (GIS viewer), which defined the predicted overland flow paths of the watercourses, contours of the property and any statutory ecological overlays (Figure 1). Site walkovers were used to ground truth these areas and identify any features not identified on the GIS viewer or District Plan map overlays.

2.1 Terrestrial Ecology

Botanic values recorded included native and exotic vascular vegetation and notes were made on the quality and extent of vegetation present on site. Fauna habitats were assessed, considering the quality and extent of habitat potentially suitable for indigenous lizards and birds.

2.2 Wetland Ecology

Wetland and riparian vegetation areas were identified and assessed for their ecological attributes including (species, prevalence and dominance), standing water characteristics, wetland size and shape, habitat availability and habitat quality for wetland birds and aquatic fauna. Characteristics of the existing surrounding catchment were also assessed.

Six potential wetland areas within the Site were identified (Figure 4) and assessed to ascertain whether these areas should be classified as natural wetlands as per the definition in the Resource Management Act 1991 (RMA).

At each area, a 2m x 2m sample plot was established within the representative vegetation and assessed using the Clarkson (2013) methodology for wetland delineation on 17th July, 2020.

All native and exotic vegetation within the plots were recorded, as was the approximate percentage cover of each species. The Dominance Test and Prevalence Index were used to determine if the area was a natural wetland as per the RMA definition.

The Dominance Test involves a subset of just the 'dominants' within in each sample plot. Dominate species are the most abundant plant species that, in descending order, individually or together account for more than 50% of the total coverage of vegetation within in each sample plot, plus any additional species that, by themselves, comprises at least 20% of the total coverage. The Dominance Test threshold is then met if more than 50% of the dominants are obligate, facultative wetland or facultative species (i.e. the plant community consist predominately of aquatic and wetland plants (hydrophytic)).

The Prevalence Index weights the abundance of each plant species on a scale of 1 (obligate wetland species) to 5 (obligate upland species[1]). The Prevalence Index threshold is met if ≤ 3.0 (i.e. the vegetation is considered hydrophytic).

[1] Species which almost always occur in non-wetland areas.

2.3 Freshwater Ecology

2.3.1 Stream Classification and Characteristics

Watercourses were classified under the Auckland Unitary Plan Operative in Part (AUP OP) to determine, in accordance with the definitions in the AUP OP, the ephemeral, intermittent or permanent status of these watercourses.

During each site assessment, the presence and extent of water was noted, a number of width and depth measurements were recorded, reference photos were taken and freshwater habitats were marked using a handheld GPS unit. 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.

2.3.2 Stream Ecological Valuation

The SEV methodology (Storey *et al.*, 2011) enables the overall function of the streams to be assessed and compared to the quality of other streams in the Auckland Region. The SEV procedure involves the collection of habitat data (e.g. stream depth, substrate type, riparian cover), and sampling of fish communities and macroinvertebrates (e.g. insect larvae, snails), the latter being recognised indicators of habitat quality. SEV data are then entered into a SEV calculator to calculate a SEV value.

SEVs, including the fish and macroinvertebrate surveys were undertaken on July 17th, 2020, along two representative reaches within the Site (Figure 4).

2.3.3 Macroinvertebrates

Macroinvertebrates were sampled from instream habitats along two representative reaches within the Site to obtain semi-quantitative data in accordance with the Ministry for the Environment's current "Protocols for Sampling Macroinvertebrates in Wadeable Streams" (Stark *et al*., 2001). Hard substrate was very limited, and absent in most of the watercourse or covered in silt. As such, root mats/macrophytes/bankside vegetation were targeted for macroinvertebrates utilising Protocol 'C2: soft-bottomed, semi-quantitative'. Coarse woody debris were also sampled where present.

The samples were preserved in isopropyl alcohol and sent to the laboratory. They were sorted using total count to the lowest practical macroinvertebrate taxonomical level. The results were then used to calculate the Macroinvertebrate Community Index (MCI). The MCI is based on the average sensitivity score for individual taxa recorded within a sample. MCI scores of:

- ≥120 are indicative of excellent habitat quality,
- 100 - 119 are indicative of good habitat quality,
- 80 – 99 are indicative of fair habitat quality; and
- < 80 are indicative of poor habitat quality.

(Stark *et al.*, 2001).

2.3.4 Native Fish

To sample fish communities, electric fishing was carried out along two representative reaches within the Site using an EFM300 backpack electric fishing machine. The electric fishing machine temporarily stuns the fish, allowing them to be captured. All fish captured were identified, their size estimated and counted before being returned to their habitats. An Index of Biotic Integrity (IBI) was calculated for each site based on fish species present, altitude and distance inland (Joy & Henderson, 2004).

3. EXISTING ENVIRONMENT

3.1 Background and Ecosystem Classification

Historically, as indicated by the Auckland Council GIS Viewer, the area would have comprised the forest ecosystem type of kauri, podocarp, broadleaved, beech forest (WF12[2]), which has a regional IUCN threat status of "Endangered". Earliest historical aerials available, indicate that the majority of the Site and much of the surrounding landscape had been cleared of native vegetation by at least 1939, to develop the land for agricultural purposes (Figure 2).

Currently, the site consists of two farm sheds and pasture, indicating that the Site has been largely devoid of vegetation and manged as agricultural land for over at least 80 years.

The Auckland Council GIS Viewer classifies an approximately 840m^2 area, located the south-east corner of the Site, as an 'Open Water' ecosystem type. The remainder of the site has no current ecosystem type classification. The Site is not subject to any SEA overlay.

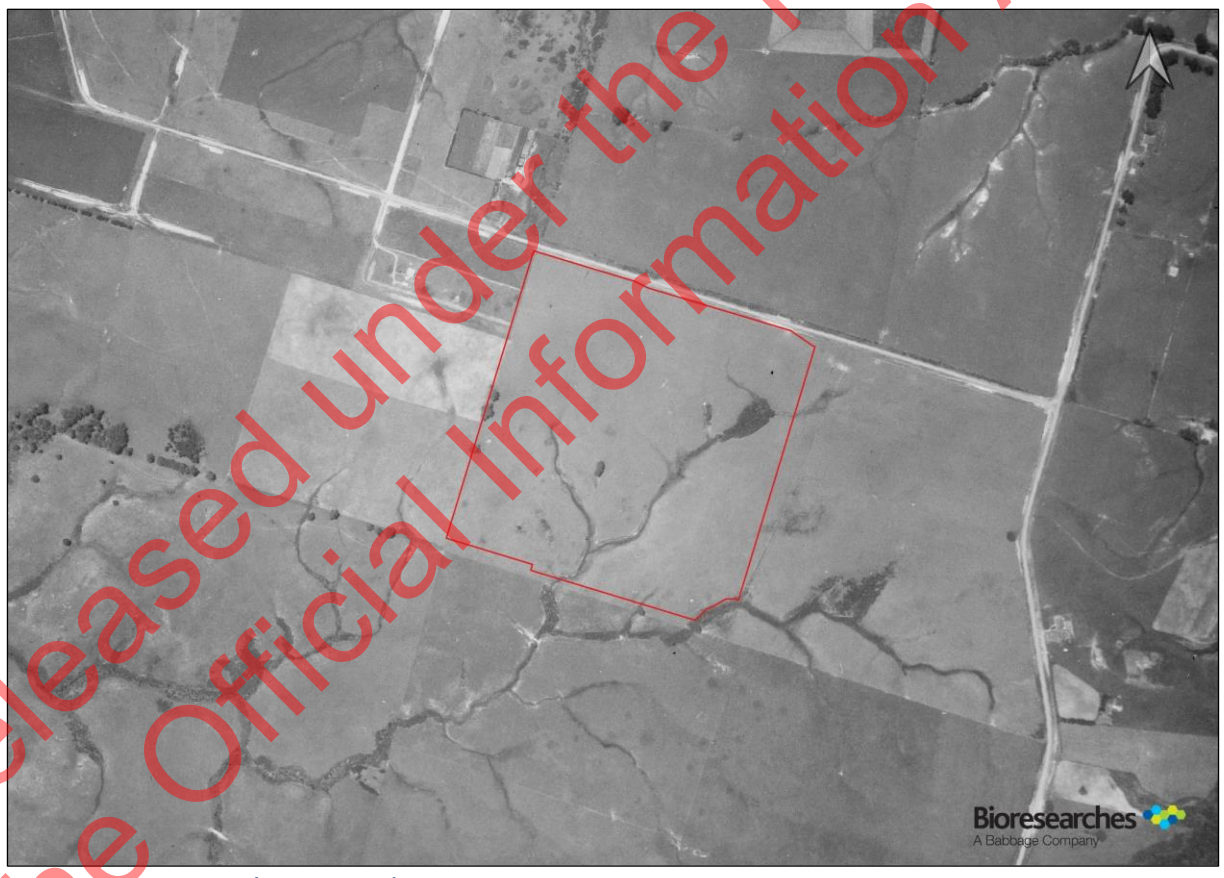

Figure 2. The Site (red polygon) with a 1939 aerial overlay.

[2] Singers N., Osborne B., Lovegrove T., Jameison A., Boow J., Sawyer J., Hill K., Andrews J., Hill S, and Webb C. (2017). Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council.

3.2 Vegetation

The predominate vegetation type within the Site was pasture. During the first site assessment (January 2020) riparian vegetation was present along the watercourses within the southern half of the Site (Photo 1). During the second site assessment (July 2020) it was observed that all the riparian vegetation had been cleared (Photo 2), with the exception of the riparian vegetation associated with the watercourse in the south-west corner of the Site (S6, Figure 4). The cleared riparian vegetation had consisted of exclusively of gorse (*Ulex europaeus*), blackberry (*Rubus fruiticosus agg.*), plumeless thistle (*Carduus acanthoides*) and woolly nightshade (*Solanum mauritianum*), all of which are considered pest plants. Pest plant removal is a permitted activity under the AUP OP (Table E15.4.1 (A6)) and as such this riparian vegetation removal is not further assessed within this report.

Photo 1. Riparian vegetation observed in January, 2020.

Photo 2. Same reach observed in Photo 1 following vegetation clearance (July, 2020).

The riparian vegetation associated with S6 consisted of fairly recently (approximately 4 years) planted native restoration plantings (Photo 3). The upper reach of this watercourse, in particular, had a high abundance of pest plant species, namely gorse and pampas (*Cortaderia selloana*).

Outside of this riparian vegetation, the only other vegetation of note were three mature trees grouped together but isolate from any other vegetation (Photo 4).

Due to the lower diversity of native species, the younger age of the trees and the moderate weed abundance, the riparian vegetation associated with S6 was considered to have a low current botanical value. Outside of this riparian vegetation, the remaining vegetation was of negligible botanical value.

Photo 3. Riparian vegetation associated with the Watercourse S6.

Photo 4. Three mature trees in background..

3.3 Avifauna

For native birdlife, it is important to have a healthy, dense and diverse range of native vegetation present to provide year-round sources of food and habitat. The native avifauna that occurred on the property were recorded opportunistically during each site visit. The only native brides observed within the Site were spur-winged plovers (*Vanellus miles*) and pūkeko (*Porphyrio porphyrio*). Both of these species were only observed in January, no native birds were observed or heard in July, 2020.

Currently, no 'At Risk' or 'Threatened' species are likely to utilise the property, even on an intermittent basis.

The only avifauna habitat of note was the riparian vegetation associated with S6, which was considered to be of low avifauna habitat value, due to due to the age and diversity of the vegetation. Outside of this riparian vegetation, the remaining area of the Site was considered of negligible avifauna habitat value.

3.4 Herpetofauna

Herpetofauna (reptiles and amphibians) comprise a significant component of New Zealand's terrestrial fauna. There is currently 104 endemic herpetofauna taxa recognised in New Zealand (Hitchmough *et al.*, 2016) and more than 80% are considered 'Threatened' or 'At Risk'. All indigenous reptiles and amphibians are legally protected under the Wildlife Act 1953, and vegetation and landscape features that provide significant habitat for native herpetofauna are protected by the Resource Management Act 1991. Statutory obligations require management of resident reptile and amphibian populations where they or their habitats are threatened by disturbance such as land development.

The only vegetation of note is the riparian vegetation associated with S6. Due to the young age, lack of diversity, lack of complexity, lack of ecological connection and lack of close existing remnant vegetation, the riparian vegetation was considered to be of low herpetofauna habitat value. Outside of this riparian vegetation, the remaining area of the Site was considered of negligible herpetofauna habitat value, due to the lack of complex vegetation and the current intensive grazing.

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3.5 Connectivity and Ecological Function

Connectivity between areas of vegetation is important to facilitate ecological function. Edge communities are heavily influenced by increased exposure to light, drying winds and competitive weeds. This 'edge effect' restricts some native flora and fauna to forest interiors. Patch fragmentation increases the edge effect and decreases the availability of habitat for interior species. Loss of connectivity can also impair reproductive function for both flora and fauna.

The Site is currently predominately surrounded by urban development (Figure 3). The riparian vegetation associated with S6 is the only vegetation currently present and connects to the contiguous riparian vegetation to the south. This riparian vegetation, which consist of restoration planting and is predominantly continuous, extends 2km downstream until it reaches the coast. However, this vegetation while long, is narrow in shape creating higher edge effects.

The remaining area of the Site has negligible ecological connectivity, due to the lack of vegetation. However, this area, particularly the additional riparian areas, have potential to have ecological connectivity value if planted and connected to the existing vegetation.

Connectivity between freshwater environments is important for migrating fish species, drifting invertebrates and connectivity for fauna between habitats. Currently there is freshwater connectivity with the watercourses within the Site to the catchment downstream. However, this connectivity is limited, predominately due to the lack of riparian vegetation causing a decrease in aquatic habitat quality and the highly modified nature of the catchment.

As such, the existing riparian vegetation and associated watercourses within the Site is considered of moderate ecological connectivity and functioning, while the remaining area of the Site is considered of negligible ecological connectivity and functioning.

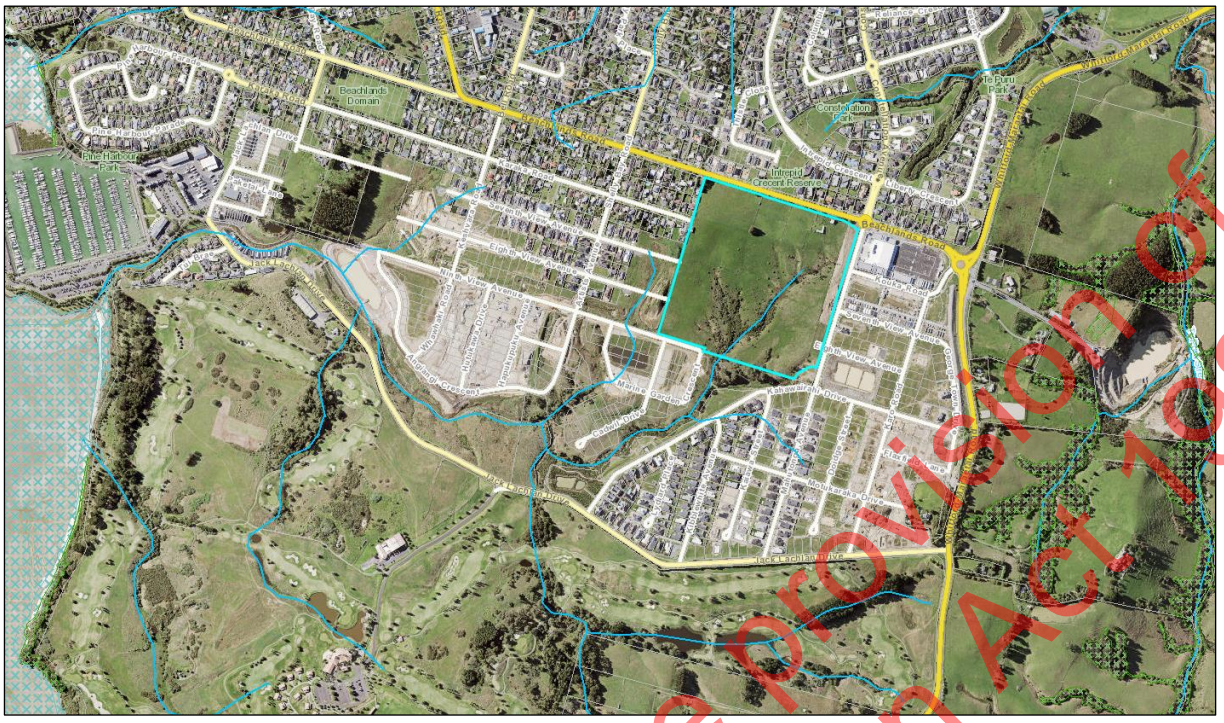

Figure 3. The Site where (light blue polygon), SEAs (green & blue hatch) and main streams (blue lines)..

3.6 Wetland Ecology

There are no SEAs, Wetland Management Areas or Natural Stream Management Areas identified on the AUP OP maps within the Site. Wetlands are not specifically defined in the AUP OP, which relies on the primary definition in the Resource Management Act 1991 (RMA). The RMA defines wetlands as:

Includes 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

To meet this definition there first has to be prolonged retention of water, permanently or intermittently enabling development of a wetland ecosystem with its characteristic species assemblages. Intermittent retention of water may lead to boggy ground developing but water retention would need to be frequent enough for a natural wetland ecosystem to develop i.e. for **wetland inherent species to be predominantly present**.

In regards to the RMA definition, the focus should be on **natural** ecosystems, which in a New Zealand context, to be 'natural' it needs to contain a significant proportion of flora and fauna species that are typically only, or predominantly, found in wetland areas. To determine whether an area has a significant proportion of naturally occurring wetland flora and/or fauna, and whether it should be classified as a wetland, the Clarkson (2013) methodology was used. Six potential riparian margin areas (Figure 4) were assessed using the Clarkson (2013) methodology. No wetland assessment was undertaken within the area surrounding S6, as this area has always been proposed for retention (Figure 4, Appendix IV).

Figure 4. Bioresearches stream classification, SEV locations and vegetation plots within the Site.

The results for the Dominance Test and Prevalence Index for the determination of wetlands are presented in Table 1, with the full Dominance Test and Prevalence Index calculations presented in Appendix I.

Table 1. Results for the Dominance Tests & Prevalence Indices.

Plot	Dominance Test %	Hydrophytic Vegetation? *	Prevalence Index	Hydrophytic Vegetation? †	Likely Wetland?
A	100	Yes	3.09	No	No
B	66.7	Yes	3.18	No	No
C	0	No	3.88	No	No
D	50	No	3.62	No	No
E	100	Yes	3.24	No	No
F	50	No	3.18	No	No

*The Dominance Test threshold is met if > 50%

†The Prevalence Index threshold is met if ≤ 3.0 (i.e. the vegetation is considered hydrophytic).

For Areas C, D and F, the Dominance Test and the Prevalence Index were both not met. Both tests need to be met for an area to be considered likely a wetland (Clarkson, 2013). As such, Areas C, D and F were not considered wetlands as per the RMA definition.

For Areas A, B and E the Prevalence Index was not met but the Dominance Test was met. As mentioned, both tests need to be met for an area to be considered likely a wetland. If only one test is

met than further assessment or interpretation of the data should be undertaken including the consideration of non-dominant plant species.

Within Plots A, B and E by far the most the dominant species (30-90% coverage) was creeping buttercup (*Ranunculus repens*) which is considered a 'Facultative' (FAC) species. Clarkson (2013) advises that caution should be exercised where there are strong elements of FAC species, as FAC species can commonly occur as either a hydrophyte or non-hydrophyte (equally likely in wetlands or non-wetlands). Creeping buttercup is frequently found in poorly drained lawns, pastures, waste areas and orchards, and also sometimes in crops and gardens[3]. As such, the presence of creeping buttercup is not a good indication of a wetland and the dominance of this species is more associated with degraded pasture.

The other dominant species within these plots was soft rush (*Juncus effusus*) (10-20% coverage), which is considered a 'Facultative Wetland' (FACW) species. FACW species are usually a hydrophyte but are also found in uplands (non-wetland). Soft rush is a highly abundant and widely distributed species found commonly throughout degraded pasture.

No other FACW or 'Obligate Wetland' species were identified but four 'Facultative Upland' and 'Obligate Upland' species (usually or almost always found in uplands) were identified within the plots.

Furthermore, no surface aquatic habitat was present and no fish, birds or aquatic macrofauna adapted to wet conditions were present in any of the areas. The lack of habitat, the lack of native plant species and the high abundance of exotic plant species provides for very low ecological values.

As noted earlier, the land has been cleared and farmed for at least 80 years. The Site has been mown, grazed or sprayed at various times, which frequently occurs as part of farming activities. Damper areas provide summer grazing, when there is minimal grass on the higher and drier areas and are currently maintained as improved pasture for stock. Stock access to the streams has resulted in extensive pugging which has caused the stream margins and floodplains to be modified and degraded. Although modified hydrology can lead to some potential wetland like features appearing periodically in the farming cycle, these degraded riparian margins have been induced by farming practices (e.g. stock access) and represent pugged floodplains and/or stream margins rather than wetlands, which is reflected in their ecological values.

In summary Areas A, B and E:

- Did not meet the Prevalence Test.
- Were dominated by creeping buttercup, a FAC species commonly found outside of wetlands.
- Only contained one FACW species (soft rush) at relatively low coverages, which is also commonly found in non-wetland areas.
- No other FACW of Obligate Wetland species were identified.
- A number of 'Facultative Upland' and 'Obligate Upland' species were identified.

[3] https://www.massey.ac.nz/massey/learning/colleges/college-of-sciences/clinics-and-services/weeds-database/creeping-buttercup.cfm

- no surface aquatic habitat was present and no fish, birds or aquatic macrofauna adapted to wet conditions were present.
- Represent pugged floodplains and/or stream margins rather than wetlands.
- Are currently maintained as improved pasture for stock.

As such, it was determined that Areas A, B and E did not support a significant proportion of natural occurring wetland flora and/or fauna and consequently fail to meet the criteria of a wetland under the RMA.

Photo 5. Vegetation Plot A.

Photo 6. . Vegetation Plot B.

Photo 7. Vegetation Plot C.

Photo 8. . Vegetation Plot D.

Photo 9. Vegetation Plot E.

Photo 10. . Vegetation Plot F.

3.7 Freshwater Ecology

Prior to the field survey, a map of the site was created from the Auckland Council GeoMaps GIS viewer, which identifies predicted overland flow paths (Figure 1). Within the site, the GIS viewer indicated multiple tributaries of unnamed stream which drains westward to the Tāmaki Strait.

The catchments within the Site have been modified and degraded through historical and continued farming practices. Stock has access to the majority of watercourses resulting in highly pugged bed and banks which has flattened and widened channels and reduced the hydrological heterogeneity to long runs. Soft silt sediment was the predominant substrate type, with occasional macrophytes growing within the channel. Aquatic habitat diversity and abundance for fish and macroinvertebrates were both very poor, with a lack of hard substrates such as woody debris or cobbles, and no undercut banks or deep pools evident. Root mats from grasses and macrophytes would provide some low-quality habitat for tolerant macroinvertebrates and fish such as shortfin eel (*Anguilla australis*). It is not expected that more sensitive species would inhabit the watercourses.

With the exception of S6, riparian vegetation was made up predominately of short, grazed grass. All riparian vegetation functions such as filtration, shading, organic matter input and bank stability were substantially reduced and of very poor quality. One culvert was identified directly below the confluence of S1 and S4 (Figure 4).

Overall, the watercourses were considered of very low current ecological value due to the poor aquatic habitat quality and abundance, lack of riparian vegetation functions and stock access that had degraded the stream. Figure 4 presents the ground-truthed watercourse classifications undertaken by Bioresearches.

A search of the NIWA's New Zealand Freshwater Fish Database (NZFFD) showed no records of this catchment containing native fish species, however three exotic species were identified. The closet records were from an unnamed tributary of Shelly Bay, approximately 550m north, which had a total of three records from 2001 and 2003 and only identified shortfin eel and the introduced gambusia (*Gambusia affinis*).

3.7.1 Stream 1

Stream 1 was the main watercourse within the Site which has been significantly modified from its natural state through farming practices. In January the stream was dry with no flow, while in July a steady flow was evident, defining it as an intermittent stream. Where riparian vegetation (predominantly gorse, Photo 1) was previously present along the lower reach the watercourse had a defined channel as the vegetation and the topography limited stock access. Where vegetation previously was not present along the middle and upper reaches the channel was less defined and the stream margins pugged. The average wetted width of Stream 1 was 0.77m.

The substrate consisted of entirely silt, with unnatural loading of fine silt and anaerobic indicators (bubbling and odour) in places. Hydrologic heterogeneity was low, limited to predominately a single run with a few shallow pools (Photo 2). Aquatic habitat diversity and abundance was also very low with limited rooted aquatic vegetation and the few shallow pools. Riparian vegetation consisted

predominately of pasture providing no effect shading. Other riparian vegetation present included soft rush, water forget-me-not (*Myosotis scorpioides*) and creeping buttercup, these plant species naturally grow either in streams as macrophytes or in wet soils along stream margins. Additional macrophytes within the stream were observed primarily starwort (*Callitriche stagnalis*).

The macroinvertebrate community sampled had a very low taxa diversity of 8 with no EPT taxa. The macroinvertebrate community was dominated by the pollutant tolerant amphipod; *Paraleptamphopus subterraneus* which was reflected in the 'Poor' MCI score of 63 and 'Fair' SQMCI score of 4.93. Further detailed macroinvertebrate data is presented in Appendix II.

No fish were caught or observed during the fish survey. It is likely that only shortfin eels would utilise the current habitat available.

Stream 1 had a low SEV score of 0.31, indicating extensive modification. Summary SEV data is presented in Appendix III. Overall, Stream 1 was considered of low current ecological value due to lack of; riparian vegetation, aquatic habitat, hydrological heterogeneity, native fish as well as the poor macroinvertebrate community present.

Photo 11. Stream 1 middle reach.

Photo 12. Stream 1 upper reach & location of SEV.

The Auckland Council GIS Viewer indicated multiple tributaries draining to the upper reach Stream 1. These watercourses had no; defined channel, natural pools or evidence of substrate sorting processes. Additionally, the watercourses had terrestrial vegetation established across their widths. As such, these watercourses were classified as ephemeral under the AUP OP definitions.

Photo 13. Ephemeral reach associated with Stream 1

Photo 14. Ephemeral reach associated with Stream 1.

3.7.2 Stream 2

Stream 2 has been significantly modified from its natural state through farming practices. Excess slash from previous vegetation clearance covered much of the stream. When the slash was moved a stream flow was evident in a defined channel. In January the stream was dry with no flow, defining it as an intermittent stream. Assessments based on the January and July site visits showed that the substrate consisted of entirely silt, with unnatural loading of fine silt and anaerobic indicators (bubbling and odour) in places. Hydrologic heterogeneity was very low, limited to a single run. Aquatic habitat diversity and abundance was also very low limited to woody debris. Current riparian vegetation consisted entirely of pasture providing no effect shading. No macrophytes were observed. No macroinvertebrate or fish surveys were undertaken but aquatic fauna communities are likely to be very similar to those found within Stream 3. The average channel width of Stream 2 was 0.5m

The upper reach of Stream 2 had no; defined channel, natural pools or evidence of substrate sorting processes. Additionally, the upper reach had terrestrial vegetation established across its widths. As such, the upper reach was classified as ephemeral under the AUP OP definitions.

Overall, Stream 2 was considered of very low current ecological value due to the almost complete lack of; riparian vegetation, aquatic habitat and hydrological heterogeneity.

Photo 15. Mid reach of with Stream 2.

Photo 16. Upper reach with ephemeral reach in background of Stream 2.

3.7.3 Stream 3

Stream 3 has been significantly modified from its natural state through farming practices. Excess slash from previous vegetation clearance covered much of the stream. When the slash was moved a stream flow was evident in a defined channel. In January the stream was dry with no flow, defining it as an intermittent stream. Assessments based on the January and July site visits showed that the substrate consisted of entirely silt, with unnatural loading of fine silt and anaerobic indicators (bubbling and odour) in places. Hydrologic heterogeneity was very low, limited to a single run. Aquatic habitat diversity and abundance was also very low limited to woody debris. Current riparian vegetation consisted entirely of pasture providing no effect shading. No macrophytes were observed but periphyton was present. The average wetted width of Stream 3 was 0.42m.

The upper reach of Stream 3 had no; defined channel, natural pools or evidence of substrate sorting processes. Additionally, the upper reach had terrestrial vegetation established across its widths. As such, the upper reach was classified as ephemeral under the AUP OP definitions.

The macroinvertebrate community sampled had a very low taxa diversity of 7 with a very low overall abundance (49) and no EPT taxa. The macroinvertebrate community was dominated by the pollutant tolerant amphipod; *Paraleptamphopus subterraneus* which was reflected in the 'Poor' MCI score of 79. The SQMCI score of 5.12 which is indicative of a 'Good' score, but cautioned is advised when interpreting this score due to the overall low abundance. Further detailed macroinvertebrate data is presented in Appendix II.

No fish were caught or observed during the fish survey. It is likely that only shortfin eels would utilise the current habitat available.

Stream 3 had a low SEV score of 0.34, indicating extensive modification. Summary SEV data is presented in Appendix III. Overall, Stream 3 was considered of low current ecological value due to lack of; riparian vegetation, aquatic habitat, hydrological heterogeneity, native fish as well as the poor macroinvertebrate community present.

Photo 17 Lower-mid reach of Stream 3.

Photo 18. Upper reach with ephemeral reach in background of Stream 3.

3.7.4 Stream 4

Stream 4 has been significantly modified from its natural state through farming practices. The stream appears to have been straightened. In January the stream was dry with no flow, while in July a steady flow was evident, defining it as an intermittent stream. However, in much of the channel the flow was subterranean and only evident within tomos. Additionally, old clay drainage pipes were evident in places, indicating that the stream was once historically drained through subsurface drainage. The average wetted width of Stream 4 was 0.28m.

The substrate consisted of entirely silt and hydrologic heterogeneity was very low, limited to a single run. Aquatic habitat diversity and abundance was also very low limited to few woody debris and rooted vegetation. Current riparian vegetation consisted entirely of pasture providing no effect shading. No macrophytes were observed. No macroinvertebrate or fish surveys were undertaken but aquatic fauna communities are likely to be very similar to those found within Stream 3.

The upper reach and true right tributary of Stream 4 had no; defined channel, natural pools or evidence of substrate sorting processes. Additionally, these reaches had terrestrial vegetation established across its widths. As such, these reaches were classified as ephemeral under the AUP OP definitions.

No SEV was undertaken with Stream 4, however due to the very similar stream characteristics between Stream 3 and Stream 4, the SEV of Stream 3 can be used as a representative for Stream 4. Overall, Stream 4 was considered of very low current ecological value due to the almost complete lack of; riparian vegetation, aquatic habitat and hydrological heterogeneity.

Photo 19 Upper reach of Stream 4 looking downstream.

Photo 20. Lower reach of Stream 4 looking upstream, showing an area of subterranean flow and an ephemeral reach (left).

3.7.5 Stream 5

Stream 5 had no; defined channel, natural pools, surface water which resulted in a stream flow 48hrs after a rain event or evidence of substrate sorting processes. Additionally, Stream 6 had vegetation established across its widths. As such, Stream 6 was classified as ephemeral under the AUP OP definitions.

Photo 21 Upper reach of Stream 5.

Photo 22. Lower reach of Stream 5.

3.7.6 Stream 6

Stream 6 was not assessed as no development or works are prosed for this area.

4. ASSESSMENT OF ECOLOGICAL EFFECTS

4.1 Terrestrial Ecology

The only vegetation and terrestrial habitat of note is the riparian vegetation associated with S6. No development or works are proposed within this area. As such no adverse effects on the terrestrial ecology values on the site are expected. Conversely, as a requirement of the I403 Beachlands 1 Precinct of the AUP OP, riparian margin areas within the stormwater management area must be planted. As such the terrestrial ecological value of the Site will be enhanced and there will be a net terrestrial biodiversity gain as a result of the development provided the stormwater management areas are planted.

4.2 Freshwater Ecology

The proposed development of the Site will involve reclamation of ephemeral and intermittent stream reaches (Appendix IV). Reclamation of streams is proposed to enable the practical and efficient use of the urban land resource in line with the I403.10.1. Beachlands 1: Precinct plan 1 of the AUP OP.

The primary adverse freshwater ecological effects of the proposed development are; the potential injury or mortality to native fish, the potential for the release of excess fine sediment to watercourses downstream of the works area and the permanent loss of aquatic habitat through stream reclamation.

4.2.1 Freshwater Fauna

Adverse effects on native fauna during streamworks should be low due to the likely low abundance and diversity of native fish and macroinvertebrates, as was found in representative reaches. Any adverse effects can be mitigated to a negligible level through the implementation of a Native Fish Relocation Plan (NFRP) or undertaking works during summer when the streams are dry.

4.2.2 Sedimentation

During streamworks, increased fine sediment input to the receiving downstream environment can reduce visual clarity, clog respiratory structures of animals (such as the gills of fish), degrade benthic habitats and may result in burial and suffocation of aquatic biota. Currently, the substrate is dominated by silt, therefore these adverse effects are not likely to permanently degrade the watercourses. Potential erosion and sediment input effects during and immediately after construction, will be addressed in the Erosion and Sediment Control Plan, working to the best practice guidance as required by Auckland Council's erosion and sediment control guide in GD05.

4.2.3 Watercourse Reclamation

The ephemeral reaches of Streams 1, 3 4 and 5 are proposed to be reclaimed. This is a permitted activity under the AUP OP (E3.4.1 (A53)) provided the activity complies with standards E3.6.11.

The reclamation of intermittent streams is proposed (Figure 5), which is a non-complying activity under the AUP OP (E3.4.1 (A49)). In total, approximately 174m of Stream 1, 67.5m of Stream 3 and 23m of Stream 4 is proposed to be reclaimed, which will result in significant residual effects. It is proposed

that the significant residual effects are appropriately offset to provide for a no net loss in biodiversity values in line with objective E3.2(3) and Policy E3.3(4) of the AUP OP.

Due to the requirement of I403 Precinct provisions that the stormwater management area must be planted, there is a limited amount of stream bed available within the Site to offset the adverse effects of the proposed reclamations. As such, offsetting, at least in part, will need to occur off-site. It is proposed that the Healthy Waters Ecobank is utilised to purchase credits to appropriately offset the total or partial proposed loss of aquatic habitat.

Stream reclamation measurements and SEV scores are presented in Table 2. Potential SEV Score assumptions are provided presented Appendix V. Copies of the SEV Excel Spreadsheet Calculator will be provided to the Auckland Council Regulatory Services to review and to Healthy Waters to allow for the calculation of Ecobank credits.

Table 2. Stream reclamation measurements and SEV scores.

	Average wetted width (m)	Reclamation Length (m)	Reclamation Area (m^2)	SEV Score
Stream 1	0.77	174	134	0.31
Stream 3	0.42	67.5	28.4	0.34
Stream 4	0.28	23	6.4	0.34*

*Stream 3 SEV score used as a representative score, see Section 3.7.4 for further details.

Figure 5. Proposed intermittent stream reclamations within the Site within the Site.

5. RECOMMENDATIONS

The following recommendations are provided to appropriately avoid, minimise and mitigate any potential adverse effects and offset the significant residual adverse effects to the ecological value of the terrestrial and freshwater environments both during the project and after its completion.

- As a condition of consent, prior to streamworks commencing, a Riparian Vegetation Management Plan for the native riparian planting, and weed control for the Site should be prepared and submitted to Auckland Council prior to earthworks commencing. The Riparian Vegetation Management Plan should include, as a minimum, details regarding: appropriate species, plant size, plant spacing, plant maintenance and weed and fencing.
- A formalised agreement with the Healthy Waters Ecobank regarding the appropriate offsetting for the reclamation of the intermittent streams (as detailed in Section 4.2.3.) should formalised prior to streamworks commencing, this may be in conjunction with potential onsite offsetting.
- An Aquatic Habitat Offset Plan should be prepared and submitted to Auckland Council for any aquatic habitat (intermittent streams) that is to be reclaimed that is not offset through the Agreement with the Healthy Waters Ecobank.
- The existing culvert within Stream 1 should be removed.
- The historic subsoil drainage within Stream 4 should be removed and the streambed recontoured to form a natural channel.
- Mortality or injury to of native fish during streamworks can be either avoided by undertaking streamworks when the watercourses are dry or mitigated for through native fish recovery and relocation, which should be formalised in a Native Fish Relocation Plan that should be submitted and approved by Auckland Council prior to the commencement of any streamworks.
- An Erosion and Sediment Control Plan should be prepared in accordance with GD05 and submitted to Auckland Council prior to any earthworks or vegetation removal commencing and remain in place until the completion of construction activities. Stringent sediment control measures should be in place near the downstream receiving environment, including progressive stabilisation of the open areas near to the stream, earthworks should be timed to avoid heavy rain and the relevant management and procedures in GD05 should be utilised as a minimum standard.

6. APPENDICES

Appendix I. Wetland Delineation Data

Plot 1:

NVS code	% coverage	Species	Rating
RANrep	90	Ranunculus repens	FAC
JUNeff	10	Juncus effusus	FACW
LOLper	10	Lolium perenne	UPL
RUMobt	5	Rumex obtusifolius	FAC

Dominance Test	
(A)	1
(B)	1
(A/B)%	100

Hyrdophytic indicators	
Dominance test greater than 50%	YES
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	NO
Morphological Adaptations	

Prevalence Index				
OBL	0	x 1 =	0	
FACW	10	x 2 =	20	
FAC	95	x 3 =	285	
FACU	0	x 4 =	0	
UPL	10	x 5 =	50	
total	115 (A)		355 (B)	
Prevalence Index (B/A) =		3.09		

Plot 2:

NVS code	% coverage	Species	Rating
HOLlan	10	Holcus lantus	FAC
AGRcap	15	Agrostis capillaris	FACU
RUBfru	10	Rubus fruiticosus ag	FACU
JUNeff	15	Juncus effusus	FACW
RANrep	30	Ranunculus repens	FAC
LOTcor	5	Lotus corniculatus	FACU
Bare ground	20	#N/A	#N/A

Dominance Test	
(A)	2
(B)	3
(A/B)%	66.66667

Hyrdophytic indicators	
Dominance test greater than 50%	YES
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	
Morphological Adaptations	

Prevalence Index				
OBL	0	x 1 =	0	
FACW	15	x 2 =	30	
FAC	40	x 3 =	120	
FACU	30	x 4 =	120	
UPL		x 5 =	0	
total	85 (A)		270 (B)	
Prevalence Index (B/A) =		3.176471		

Plot 3:

NVS code	% coverage	Species	Rating
RUMobt	5	Rumex obtusifolius	FAC
AGRcap	25	Agrostis capillaris	FACU
LOLper	25	Lolium perenne	UPL
JUNeff	10	Juncus effusus	FACW
RANrep	15	Ranunculus repens	FAC
LOTcor	40	Lotus corniculatus	FACU
Bare ground	10	#N/A	#N/A

Dominance Test		
(A)	0	
(B)	3	
(A/B)%	0	

Hyrdophytic indicators	
Dominance test greater than 50%	NO
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	
Morphological Adaptations	

Prevalence Index				
OBL			x 1 =	0
FACW	10		x 2 =	20
FAC	20		x 3 =	60
FACU	65		x 4 =	260
UPL	25		x 5 =	125
total	120	(A)		465 (B)
Prevalence Index (B/A) =			3.875	

Plot 4:

NVS code	% coverage	Species	Rating
JUNeff	15	Juncus effusus	FACW
LOLper	20	Lolium perenne	UPL
RANrep	15	Ranunculus repens	FAC
LOTcor	15	Lotus corniculatus	FACU
Bare ground	40	#N/A	#N/A

Dominance Test		
(A)	2	
(B)	4	
(A/B)%	50	

Hyrdophytic indicators	
Dominance test greater than 50%	NO
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	
Morphological Adaptations	

Prevalence Index				
OBL			x 1 =	0
FACW	15		x 2 =	30
FAC	15		x 3 =	45
FACU	15		x 4 =	60
UPL	20		x 5 =	100
total	65	(A)		235 (B)
Prevalence Index (B/A) =			3.615385	

Plot 5:

NVS code	% coverage	Species	Rating
JUNeff	20	Juncus effusus	FACW
RUMobt	5	Rumex obtusifolius	FAC
RANrep	35	Ranunculus repens	FAC
AGRcap	10	Agrostis capillaris	FACU
LOLper	15	Lolium perenne	UPL
Bare	15	#N/A	#N/A

Dominance Test		
(A)	2	
(B)	2	
(A/B)%	100	

Hyrdophytic indicators	
Dominance test greater than 50%	YES
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	
Morphological Adaptations	

Prevalence Index					
OBL			x 1 =	0	
FACW	20		x 2 =	40	
FAC	40		x 3 =	120	
FACU	10		x 4 =	40	
UPL	15		x 5 =	75	
total	85	(A)		275	(B)
Prevalence Index (B/A) =			3.235294		

Plot 6:

NVS code	% coverage	Species	Rating
JUNeff	25	Juncus effusus	FACW
LOTcor	10	Lotus corniculatus	FACU
AGRcap	30	Agrostis capillaris	FACU
HOLlan	15	Holcus lantus	FAC
Bare	20	#N/A	#N/A

Dominance Test		
(A)	1	
(B)	2	
(A/B)%	50	

Hyrdophytic indicators	
Dominance test greater than 50%	NO
Prevelence indix is ≤ 3.0	NO
Problematic hydrophytic vegetation	
Morphological Adaptations	

Prevalence Index					
OBL			x 1 =	0	
FACW	25		x 2 =	50	
FAC	15		x 3 =	45	
FACU	40		x 4 =	160	
UPL			x 5 =	0	
total	80	(A)		255	(B)
Prevalence Index (B/A) =			3.1875		

Appendix II. Macroinvertebrate Data

PHYLUM	CLASS: Order	Family	Taxa	Taxa MCI hb	Taxa MCI sb	Site 1	Site 3
ANNELIDA	**OLIGOCHAETA**		Oligochaeta	1	3.8		2
	HIRUDINEA		*Glossiphonia* sp.	3	1.2	1	
ARTHROPODA	**ARACHNIDA: Acari (mites)**		Acari	5	5.2	208	16
	CRUSTACEA: Ostracoda		Ostracoda	3	1.9	116	
	Amphipoda		*Paraleptamphopus subterraneus*	5	5.5	872	21
	INSECTA: Diptera	Tipulidae	Tipulidae	5	3.4		1
		Chironomidae	Orthcladiinae	2	3.2	2	2
			Corynoneura sp.	2	1.7	1	
		Culicidae	*Culex* sp.	3	1.2	1	1
	Collembola	Collembola .	Collembola	6	5.3	8	6
		TOTALS:	**NO. TAXA**			8	7
			NO. EPT TAXA			0	0
			NO. INDIVIDUALS			1209	49

Appendix III. Summary SEV Data

Function category	Report section*	Function	Worksheet #	Variable (code)	S1 i-C	S3 i-C	S1 i-P	S3 i-P
				Vchann	0.40	0.80	1.00	1.00
				Vlining	0.80	0.80	0.94	0.94
				Vpipe	1.00	1.00	1.00	1.00
Hydraulic	**4.1**	**NFR**		**=**	**0.53**	**0.80**	**0.98**	**0.98**
				Vbank	0.60	0.60	0.60	0.60
				Vrough	0.16	0.16	0.40	0.40
Hydraulic	**4.2**	**FLE**		**=**	**0.10**	**0.10**	**0.24**	**0.24**
				Vbarr	1.00	1.00	1.00	1.00
Hydraulic	**4.3**	**CSM**		**=**	**1.00**	**1.00**	**1.00**	**1.00**
				Vchanshape	0.90	0.40	1.00	1.00
				Vlining	0.80	0.80	0.94	0.94
Hydraulic	**4.4**	**CGW**		**=**	**0.83**	**0.67**	**0.96**	**0.96**
				Hydraulic function mean score	**0.62**	**0.64**	**0.80**	**0.80**
				Vshade	0.02	0.02	0.60	0.60
biogeochemical	**4.5**	**WTC**		**=**	**0.02**	**0.02**	**0.60**	**0.60**
				Vdod	0.45	0.50	0.68	0.75
biogeochemical	**4.6**	**DOM**		**=**	**0.45**	**0.50**	**0.68**	**0.75**
				Vripar	0.00	0.00	0.50	0.50
				Vdecid	1.00	1.00	1.00	1.00
biogeochemical	**4.7**	**OMI**		**=**	**0.00**	**0.00**	**0.50**	**0.50**
				Vmacro	0.89	0.82	0.95	0.99
				Vretain	0.20	0.60	1.00	1.00
biogeochemical	**4.8**	**IPR**		**=**	**0.20**	**0.60**	**0.95**	**0.99**
				Vsurf	0.80	0.48	0.27	0.24
				Vripfilt	0.16	0.16	0.30	0.30
biogeochemical	**4.9**	**DOP**		**=**	**0.48**	**0.32**	**0.28**	**0.27**
				Biogeochemical function mean score	**0.23**	**0.29**	**0.60**	**0.62**
				Vgalspwn	0.63	1.00	0.63	1.00
				Vgalqual	0.00	0.00	0.75	0.25
				Vgobspwn	0.10	0.10	0.10	0.10
habitat provision	**4.10**	**FSH**		**=**	**0.05**	**0.05**	**0.28**	**0.18**
				Vphyshab	0.16	0.16	0.54	0.54
				Vwatqual	0.03	0.03	0.27	0.30
				Vimperv	1.00	1.00	0.30	0.30
habitat provision	**4.11**	**HAF**		**=**	**0.34**	**0.34**	**0.41**	**0.42**
				Habitat provision function mean score	**0.19**	**0.19**	**0.35**	**0.30**
				Vfish	0.00	0.00	0.00	0.00
Biodiversity	**4.12**	**FFI**		**=**	**0.00**	**0.00**	**0.00**	**0.00**
				Vmci	0.17	0.37	0.17	0.37
				Vept	0.00	0.00	0.00	0.00
				Vinvert	0.41	0.41	0.41	0.41
Biodiversity	**4.13**	**IFI**		**=**	**0.19**	**0.26**	**0.19**	**0.26**
				Vripcond	0.08	0.08	0.30	0.30
				Vripconn	1.00	1.00	1.00	1.00
Biodiversity	**4.14**	**RVI**		**=**	**0.08**	**0.08**	**0.30**	**0.30**
				Biodiversity function mean score	**0.09**	**0.11**	**0.16**	**0.19**
Overall mean SEV score (maximum value 1)					**0.306**	**0.338**	**0.527**	**0.531**

Appendix IV. Proposed Stream Reclamation with Scheme Plan Overlay

Appendix V. Potential SEV Score Assumptions

		Potential i-P
Function Category	Variable	Assumption
Hydraulic	Vchann	Increase in naturalness through removing slash and decreasing excessive macrophytes as a result of an increase in riparian vegetation.
	Vlining	Reduction in fine sediments as a result of reduction in farming activities
	Vpipe	No additional piped stormwater discharges directly connected to impervious surfaces are anticipated as per TR2011/009
	Vbank	No change expected
	Vrough	10m riparian planting along both banks and future urban development 10m+
	Vbarr	No change expected
	Vchanshape	No data entry required – populated from other variables
Biogeochemical	Vshade	Increase in shading from riparian planting
	Vdod	Increase to sub-optimal
	Vveloc	No significant change expected
	Vdepth	No significant change expected
	Vripar	10m Riparian planting along both banks and future urban development 10m+
	Vdecid	No change expected
	Vmacro	Reduction due to increase in shading
	Vretain	No data entry required – populated from other variables
	Vsurf	No change expected with substrate, increase in leaf litter, reduction in macrophytes
	Vripfilt	Increase due to increase in riparian vegetation
Habitat provision	Vgalspwn	No change expected
	Vgalqual	Increase due to increase in shading except where slope is too steep
	Vgobspawn	No data entry required – populated from other variables. Changed with increase in wood from Vsurf
	Vphyshab	Increase in all attributives with biggest increases for channel shade and habitat values due to riparian vegetation/organic input
	Vwatqual	Slight increase in upstream/catchment shading due to riparian vegetation
	Vimperv	Overall decrease through increase in impervious (>25%) with high control
Biodiversity	Vfish	No change expected
	Vmci	No change assumed
	Vept	No data entry required – populated from other variables
	Vripcond	No data entry required – populated from other variables Changed to reflect change in riparian margins.
	Vinvert	No change expected
	Vripconn	No change expected