



Belmont Quarry Development – Part B

Substantive Application
Appendix B.5.D - Hydrology wetland offset
memorandum
Winstone Aggregates

25 September 2026

Technical Memorandum



To: Shalini Sanjeshni, Project Coordinator From: Dr Jack McConchie

Company: Winstone Aggregates

Landscape Dynamics Ltd

cc:

Date: 24 September 2026

RE: Hydrology of proposed 'Offset Wetland'

Background

As part of the ecological offset requirements for the Belmont Quarry OBDA Project, Winstone Aggregates (Winstone) are proposing to create new wetland within Belmont Regional Park. The proposed site is approximately 2km south-west of the quarry (**Figure 1**).

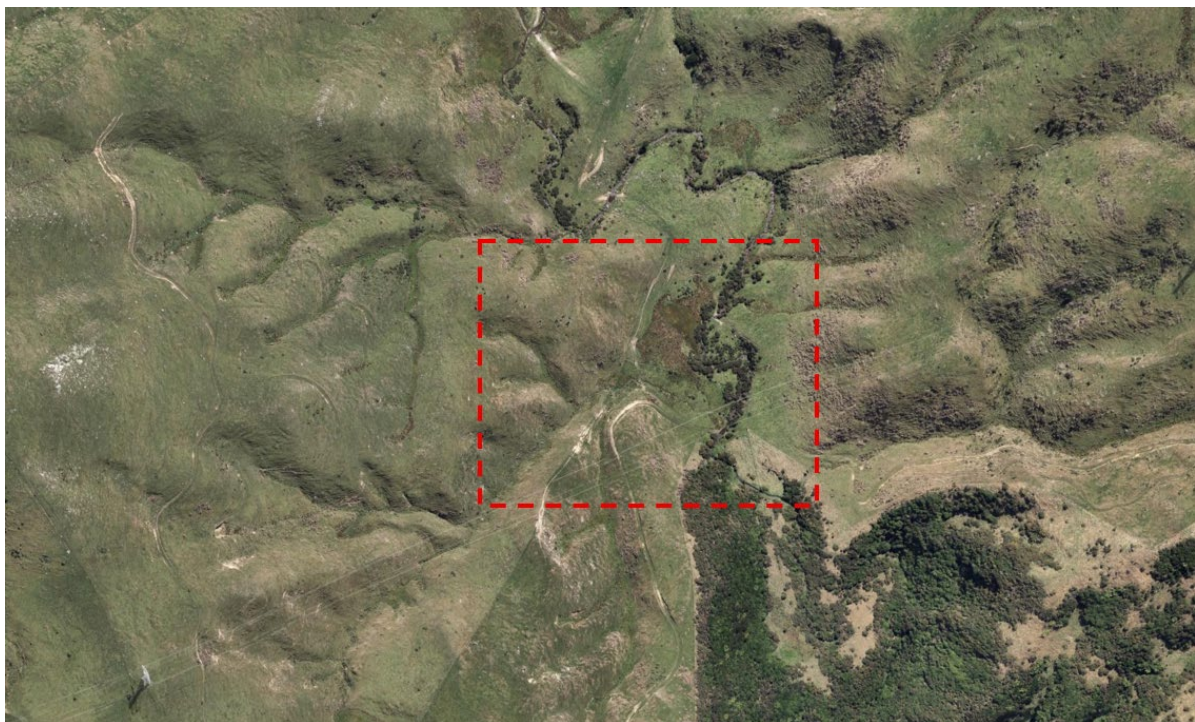


Figure 1: Area within Belmont Regional Park where the creation of wetland is proposed.

The proposal is to create 0.2ha of new wetland on the terraces in the 'throats' of two gullies on either side of Speedys Stream. The proposed 'Western' wetland, on the true right of the stream, will be adjacent to a larger and existing wetland to the north. A small tributary of Speedys Stream runs adjacent to, but at lower elevation and buffered from this proposed wetland.

Despite the proximity of the proposed wetlands to tributaries of Speedys Stream, no works are required in the streams to facilitate the development of the wetlands. Also, because the bases of the wetlands will be higher than the beds of the adjacent tributaries, and buffers will exist, there will be no hydraulic interaction or effect on the flow regimes of these streams.

The proposal takes advantage of the low-lying topography, little relative relief, and existing impeded drainage, but will moderate and attenuate direct rainfall and subsurface drainage from the contributing sub-catchments. To create the new wetland, and enhance the attenuation of rainfall and drainage, the existing topography will be lowered in some areas by up to 300mm. This will create a topographic depression in the elevated terraces above Speedys Stream that will concentrate and attenuate direct rainfall and subsurface drainage. The area will then be planted with wetland species. A high-level schematic and concept plan are shown in **Figure 2**.

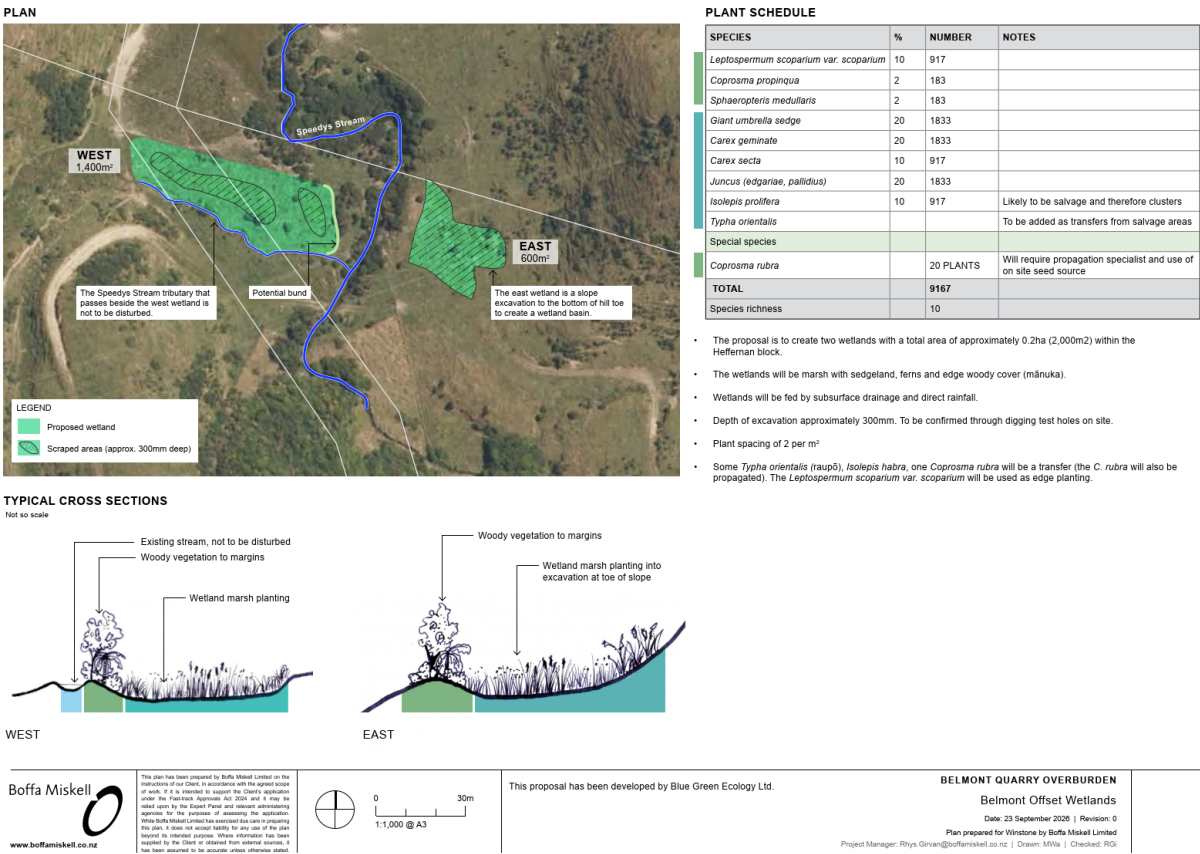


Figure 2: High-level schematic and concept plan for the proposed wetland.

Hydrological effects

As described above, the formation of the wetland will take advantage of the natural topography and impeded drainage in the area but enhance both these elements to create hydrological conditions conducive for a wetland. No works are required in either tributary of Speedys Stream, and all the existing runoff processes will be maintained. The only effect on the hydrology of the area will be to moderate and attenuate direct rainfall and subsurface drainage in two areas to create zones of impeded drainage that will support the development of the wetland.

It is apparent from a digital terrain model, derived from high-resolution LiDAR topographic data, that the two areas to be developed as wetlands lie on elevated terraces above Speedys Stream (**Figure 3**). These terraces are low lying, have little relative relief, and are backed by small gullies. These gullies form local sub-catchments that contribute subsurface drainage to the terraces and proposed wetlands. Neither of these terraces has a direct surface hydraulic connection to Speedys Stream.



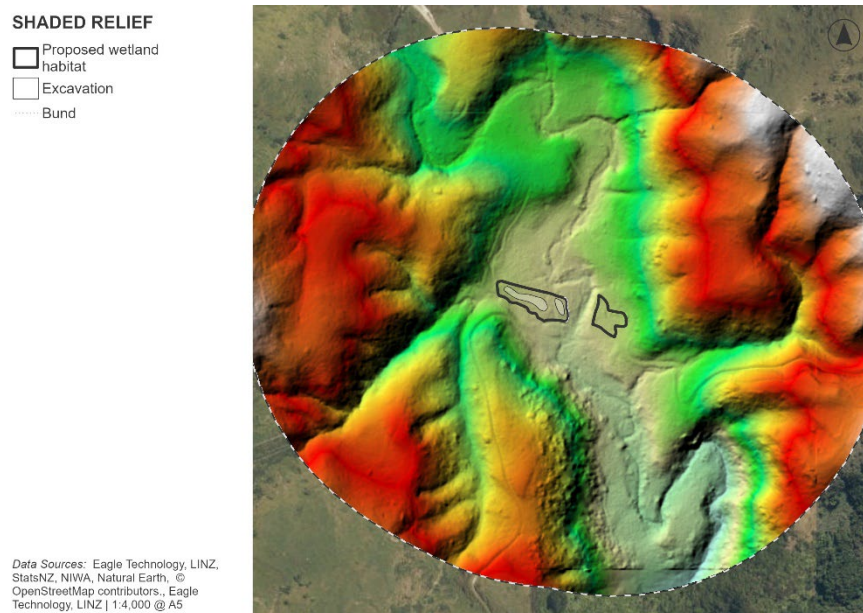


Figure 3: Digital terrain model derived from high-resolution topographic data obtained using LiDAR.

Because of the lack of empirical hydrological data from the area, the high resolution DTM was used to derive potential drainage lines and watercourses (**Figure 4**). It is assumed that any water flows from cells at higher elevation into cells at lower elevation. Flow accumulates downslope as more cells receive water from upslope until some threshold defined for the commencement of concentrated flow i.e., 'streamflow', is reached.

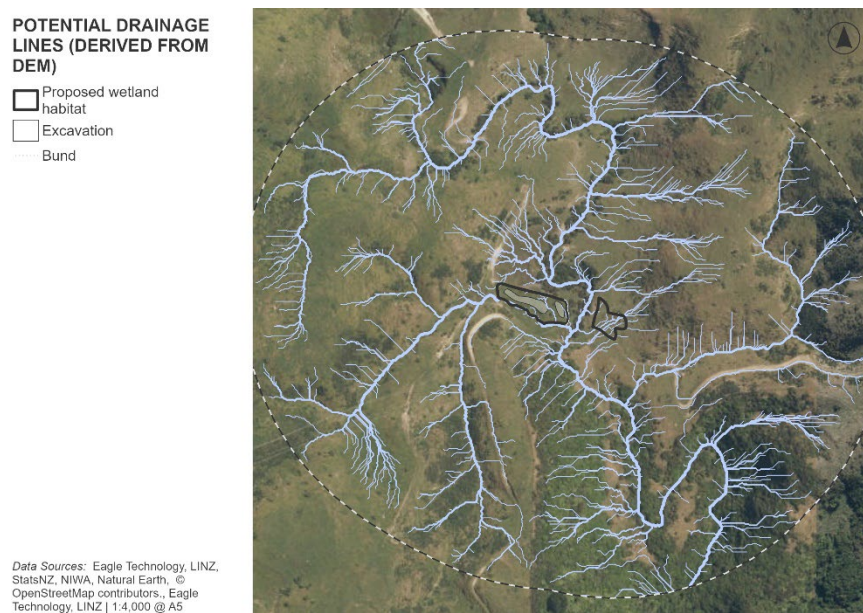


Figure 4: Drainage lines inferred from a high-resolution digital terrain model.

The drainage lines derived from analysis of the DTM are therefore a function solely of the topography. There is no consideration of any rainfall-runoff relationship, and it is assumed that the ground surface is both bare of vegetation and impermeable. Consequently, the actual rainfall-runoff processes operating within the catchment are simplified greatly.



Analysis of the terrain model and inferred drainage lines shows that the two proposed wetlands are likely to receive, in addition to direct rainfall, significant inflow from their contributing sub-catchments. For the 'Eastern' wetland, there are two major sub-catchments (**Figure 5**) with a combined area of about 0.24ha (**Table 1**). The 'Western' wetland has three contributing sub-catchments (**Figure 6**), with a combined area of 0.13ha (**Table 1**). The contributing sub-catchments are likely to provide significant inflow to the respective wetlands, increasing the moisture content and duration of saturation, while reducing the depth to saturated ground i.e., enhanced conditions for the development of wetland.

**POTENTIAL WATERSHEDS
(DERIVED FROM DEM)**

-  Proposed wetland habitat
-  Upstream catchment analysis
-  Catchment 1
-  Catchment 2

0 5 10 m

Data Sources: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors., Eagle Technology, LINZ | 1:1,000 @ A5

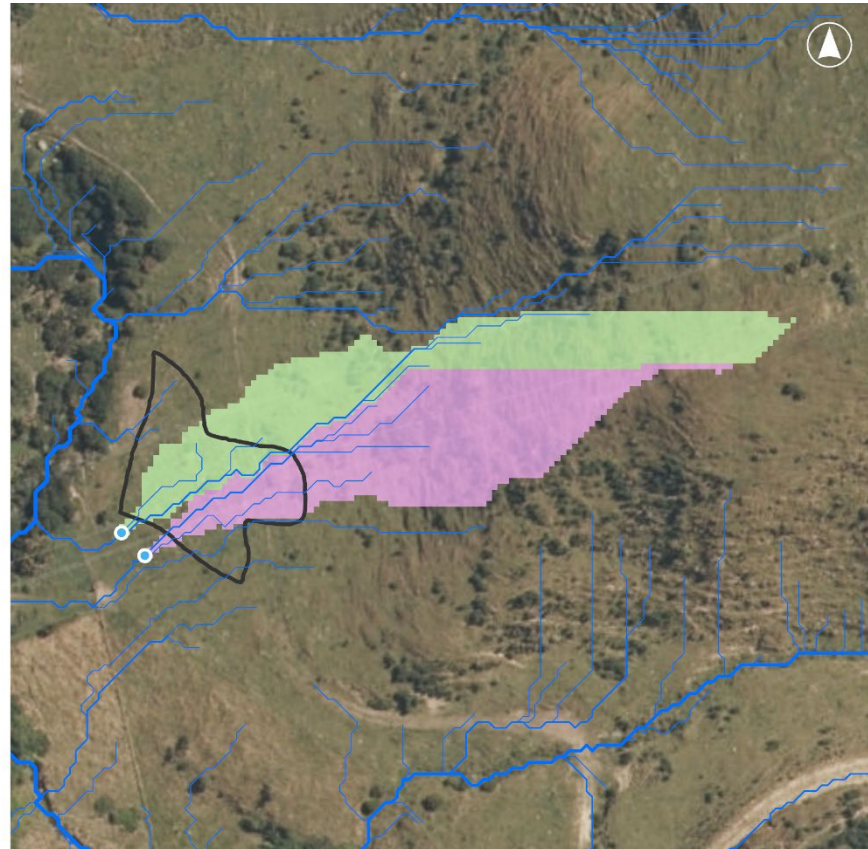


Figure 5: Contributing catchments to the 'Eastern' wetland.

Table 1: Areas of the various contributing sub-catchments. Sub-catchments 1 & 2 feed into the 'Eastern' wetland while sub-catchments 3, 4 & 5 are likely to contribute water to the 'Western' wetland.

Catchment ID	Area (m ²)
1	1149
2	1215
3	782
4	378
5	188



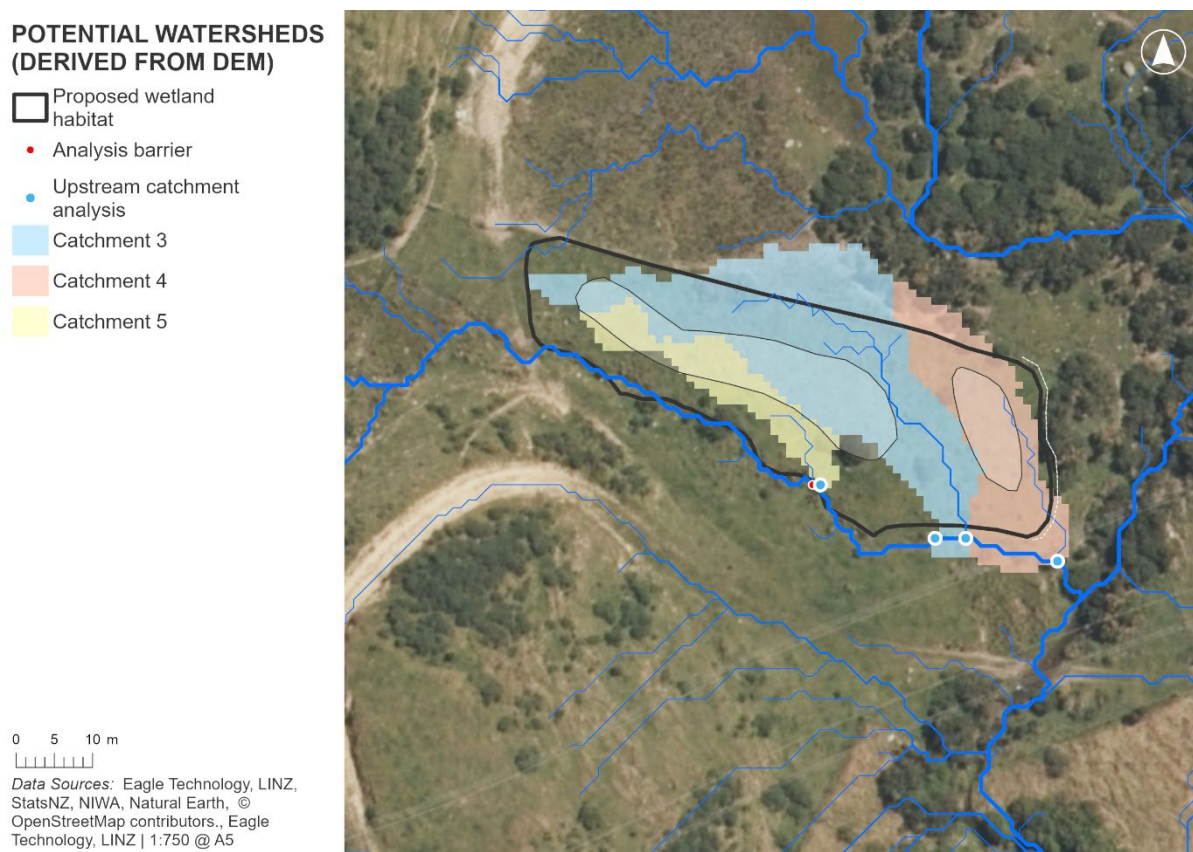


Figure 6: Contributing catchments to the 'Western' wetland. *Note: The wetland does not extend into the stream as implied. This is solely a function of the resolution of the inferred stream network intersecting with the simplified boundary of the proposed wetland.*

Regarding the proposed 'Western' wetland, the drainage lines inferred from the DTM do not extend into the existing wetland to the north i.e., there is a topographic and hydraulic barrier between the existing and proposed wetlands. Consequently, assuming that this barrier is not affected by the proposed lowering of the ground surface by up to 300mm, such as by leaving a 'bund' of undisturbed material, there should be no effects on the hydrology of the existing wetland.

There is unlikely to be any groundwater in the area, and if there is, it would be deeper than the proposed base of the wetlands. Any groundwater, which is considered highly unlikely, would be coincident with the water level in the adjacent reach of Speedys Stream. Consequently, even if there was groundwater, the development of the wetlands would have no effect on groundwater discharge to Speedys Stream.

Topographic control

As described above, the proposed wetlands will be formed on relatively flat, low-lying terraces adjacent to tributaries of Speedys Stream. These areas already have impeded drainage and experience generally damp conditions. Despite this, it is proposed to modify the topography slightly i.e., by lowering the ground in some areas by up to 300mm. This will alter the hydrological regime to enhance wetland conditions.



As explained, the 'Eastern' wetland, on the true left of Speedys Stream, has a relatively large sub-catchment formed in the hillslopes behind that will contribute subsurface drainage to the wetland. The area proposed for the wetland is about 5m above the adjacent stream, so lowering some of the ground by up to 300mm will have no effect on any discharge to the stream. Likewise, there will be no direct interaction between Speedys Stream and the proposed wetland (**Figure 7**). It should be noted that the drainage lines inferred from the DTM across the proposed wetland indicate preferential subsurface flow paths rather than surface runoff.

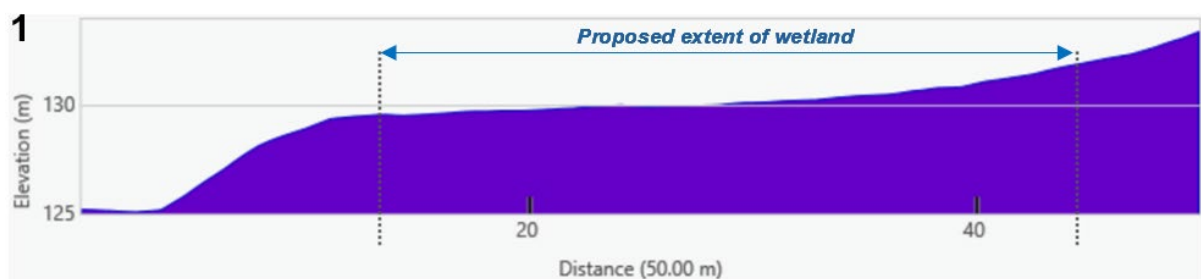
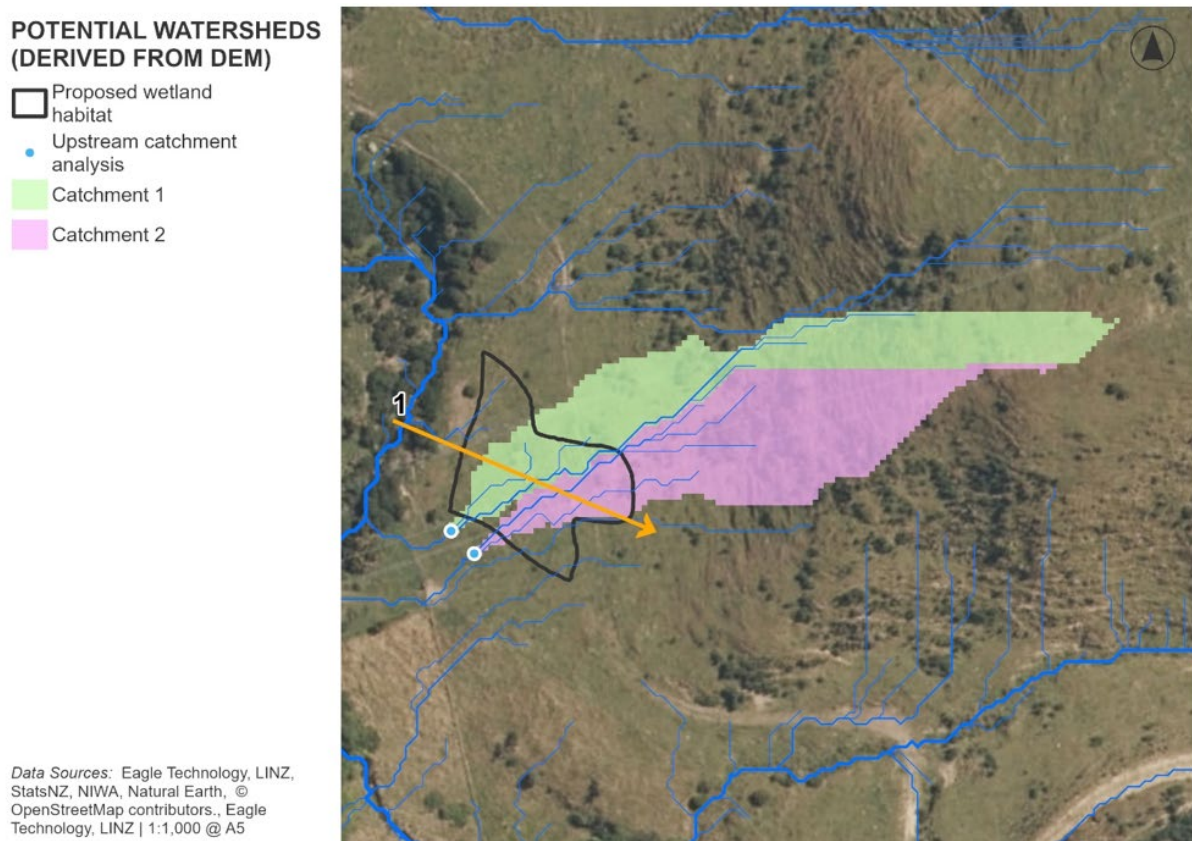
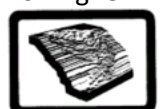


Figure 7: Topography of the 'Eastern' wetland and elevation relative to the tributary of Speedys Stream.

The topography of the 'Western' wetland also shows that the area is higher than the bed of the adjacent tributary of Speedys Stream. The base of the proposed wetland, after construction, will still be at least half a metre above the bed of the stream (**Figure 8**). It is also apparent that the proposed wetland is slightly higher than the existing wetland to the north and that a natural 'bund' of higher



ground separates the two areas. Consequently, the formation of the new wetland will have no effect on either the hydrology of the existing wetland or the flow regime of Speedys Stream.

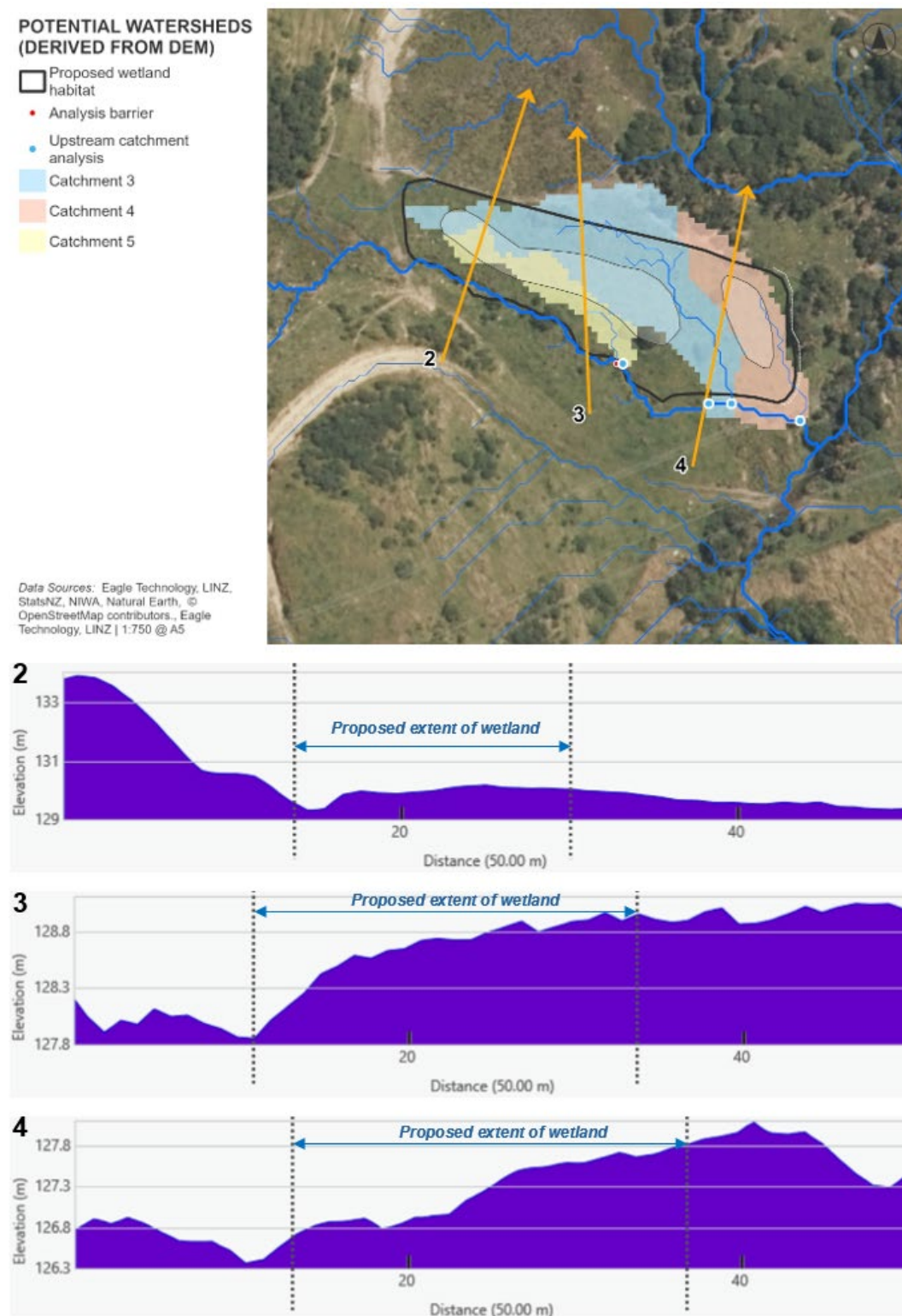


Figure 8: Topography of the 'Western' wetland and elevation relative to the tributary of Speedys Stream. Note: The wetland does not extend into the stream as implied. This is solely a function of the resolution of the inferred stream network intersecting with the simplified boundary of the proposed wetland.



Conclusions

The proposal to develop 0.2ha of wetland within Belmont Regional Park will take advantage of the existing low-lying topography, with little relative relief, of terraces adjacent to Speedys Stream. The existing impeded drainage will be enhanced by lowering the ground surface in some areas by up to 300mm. This will provide a topographic depression that will collect, moderate, and attenuate both direct rainfall and natural subsurface drainage in the area. This will provide hydrological conditions conducive to the formation of wetland. Because the base of the wetlands will be higher than the adjacent streams, there will be no interaction and they will have no effect on the flow regimes.

The proposal will therefore:

- Involve no works in any stream or watercourse;
- Will not affect the existing rainfall-runoff relationships;
- Will have no effect on the flow regimes of the adjacent streams;
- While modifying the existing pattern of throughflow through the terrace, the proposal will have no effect on groundwater, apart from potentially enhancing saturation beneath the wetland; and
- Have no effect on the hydrology of the existing wetland to the north of the proposed 'Western' wetland.

