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Dear Katherine

## **SCOPING OF ISSUES OF PROPOSED MONORAIL (TE ANAU – MARAROA AREA) ON FRESHWATER ENVIRONMENTS**

In accordance with your brief of 29 January 2004 we have carried out a desktop exercise to scope the likely issues associated with the Riverstone Holdings Limited (RHL) Fiordland Link project as they apply to freshwater environments. We have subdivided this scoping into two subject areas; wetlands and rivers and we have mainly focussed on the effects of the project on these environments. It is noted that floods could affect the monorail structure as well and we have, therefore, also covered issues related to flooding.

To understand the issues we have first considered the characteristic values and significance of the environments that the proposed monorail route traverses. We have then considered the potential issues in terms of effects during both the construction and operation of the monorail. We have identified where issues are likely and where it is unlikely that there will be significant impacts. We have then identified where mitigation measures are likely to be needed and what types of measures may be required. Finally we have indicated where insufficient information is currently available to make a thorough determination of the issues and what type of further investigation is necessary, in our opinion, to adequately support a concession application.

## **RIVER ENVIRONMENTS**

### **Environmental characteristics and values**

The project area lies entirely within headwater tributaries of the Waiau River catchment and includes the: Kiwi Burn, Whitestone River, Upukeroa River, Dunton Creek, Moranic Creek and Retford Stream. To review the available information on instream values, a search was made of NIWA's New Zealand Freshwater Fish Database (FFDB), by selecting co-ordinates covering the area that included both the "proposed route" and "alternative route", and which also encompassed a wider area to enable fish distributions to be viewed within a more regional context. Thus our study area was defined as 45.0 to 45.45 °S and 167.7 to 168.2 °E.

A total of 82 survey sites are recorded in the FFDB (see Figure 1). Not unexpectedly, there are no sites for the more remote reaches of the study area i.e. upper Whitestone and Upukerora Rivers. For a full assessment of effects, it is suggested that the applicant would be well advised to have additional survey data from these rivers. The fish recorded from the

study area are listed in Table 1 by sub-catchments. The number of records of each species can be regarded as a proxy of relative abundance (as numbers of fish are not available for all records).

The fish communities are dominated by introduced salmonids, especially brown trout (this species was recorded at 67 % of all sites). A total of 5 introduced species are present including: brown and rainbow trout (widespread), brook trout (localised populations in headwater reaches of rivers as downstream distribution is often adversely affected by the presence of brown trout), Atlantic salmon (in New Zealand, this species is found *only* in the upper Waiau catchment), and perch (widespread in New Zealand). In relation to the study area, none of these species require access to the sea – while Atlantic salmon are usually a diadromous species (i.e., require access to the sea to complete their life history), in this instance the population is “land-locked” (i.e. able to use a nearby lake as a surrogate for the sea, and live its entire life in fresh water).

The native species community is best considered in three groups: Obligatory diadromous species (must have access to the sea), usually diadromous species (diadromous species that have formed land-locked populations, and now do not require access to the sea and non-diadromous species (don't require access to the sea). These three groups are considered in turn below.

The obligatory diadromous species comprise two species: longfin and shortfin eels. Longfin eels were the most frequently encountered native species (39 % of sites; Table 1). Both eel species spawn in the tropical Pacific and juvenile eels arrive in rivers during spring. They make their way upstream over successive summers. Shortfins do not penetrate as far inland as longfins, and the numbers of both species can be adversely affected by operation of the Mararaoa weir. Presently, juvenile eels are trapped at the weir and released upstream. The lamprey is one obligatory diadromous species that has not been recorded but is almost certain to be present. This species spawns in fresh water, and is considered likely to be able to negotiate the Mararaoa weir; adults are secretive, and juveniles are found in selected silty habitats only.

The usually diadromous species comprise: koaro, giant kokopu, common smelt, and common bully. These species normally have a marine life stage, but in this instance have adapted to a purely freshwater life history, and all will be associated with a lake (e.g., Te Anau, Mavora).

The non-diadromous species comprise: flathead galaxias, roundhead galaxias, upland bully, koura (freshwater crayfish). The complete life-history of these species is carried out in freshwater, usually close to the area where they were collected as they are not strongly migratory within catchments. Although flathead galaxias and roundhead galaxias were recorded from only 2 and 5 % of sites respectively, the taxonomy of these species has only been recently finalised, and the ‘unspecified galaxids’ will be mainly a mixture of these species.

As mentioned, Atlantic salmon are found only within the upper Waiau catchment, and consequently their presence is of more significance than are the other salmonid species. It is likely that the Southland Fish and Game Council would want to see any habitats of this species protected from impacts.

Among the native species, giant kokopu are a species that are widespread but have significant conservation value as their wetland habitat has diminished throughout New Zealand. Both the giant kokopu and longfinned eel are presently gazetted by the Department of Conservation as ‘species in gradual decline’, and hence both have significant conservation value. The flathead

galaxias and roundhead galaxias are confined to the Otago and Southland regions, but are considered locally common within this broad range.

### **Potential Issues**

There are sufficient data to characterise the fish communities in the more accessible reaches of rivers within the study area, but insufficient data from the more remote regions; for example, the alpine galaxias has been recorded from a tributary of the Maraora River above the North Mavora Lake, and it would be important (but not imperative) to know whether it occurs within the study area. Regardless, some additional sampling would certainly be of benefit for any subsequent Assessment of Environmental Effects.

None of the presently recorded fish are regarded as rare or endangered, although some have restricted distributions. The abundance of the diadromous species may be affected by operation of the Mararoa Weir and this structure, therefore, lessens to some extent the potential effects of the monorail proposal on the environmental values of the rivers. However, the river habitats could be compromised by the ingress of any substantial quantities of silt, which affects both feeding and spawning opportunities. Thus, any instream or near-stream construction would need to ensure that adequate preventative measures are incorporated. Likewise, operation practices of the monorail would need to ensure that potential contaminants like diesel and oil do not enter waterways.

### **Mitigation measures**

As there are several migratory fish species within the study area, continued access for fish, both upstream and downstream, is essential. Because some fish movements will occur almost all year round (e.g. juvenile eels migrate upstream during summer, adults downstream in autumn, adult lampreys upstream in spring-summer), access also needs to be assured year-round. Hence any river crossings and construction works, must be carried out in such a way that allows for continuous fish access. If the monorail is entirely supported by piers, without the need for culverts or other structures that affect the river bed, there are unlikely to be obstructions to fish movement as a result of the project.

### **Further investigation**

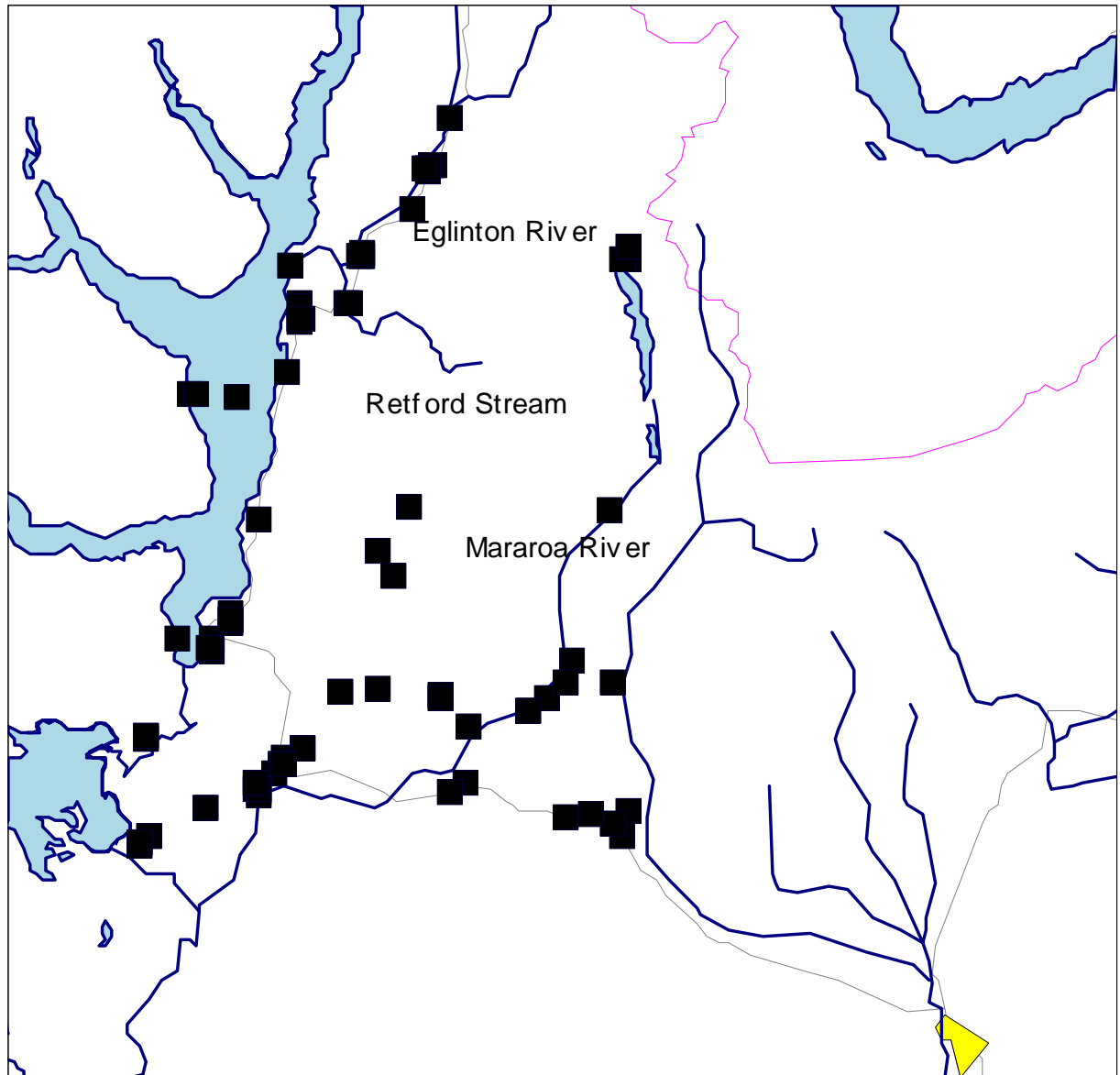
This scoping study is based on limited data that is not specific to the locations that the proposed route traverses. In our opinion, an application for a concession will need to be supported by a more detailed field assessment of the instream communities at sites that are representative of the streams and rivers that the route traverses. The purpose of this work would be to establish the actual baseline fish communities and description of the relative abundance of species so that their actual significance can be accurately assessed. We recommend that a qualitative stream survey by electric fishing methods be undertaken of representative sites in each of the major catchments that the route traverses.

## **WETLAND ENVIRONMENTS**

### **Environmental characteristics and values**

The proposed route traverses wetland areas, the most significant of which is the Dunton Swamp. Dunton Swamp is an extensive wetland occupying a valley floor that the proposed route will traverse. The route was surveyed in the early 1990s by the Department of Conservation (DoC) as part of a broader survey of 50 significant wetlands in the area, and by Landcare Research Ltd. in 1995 in connection with the earlier assessments of the monorail

proposal. These surveys were primarily qualitative vegetation surveys, with bird counts also taken in the Landcare Research Ltd. survey.



**Figure 1:** Study area showing the locations of freshwater fish sampling sites that are recorded in the FFDB.

Table 1: Number of New Zealand Freshwater Fish Database records in the study area by species in various catchments

Catchment	Brown trout	Rainbow trout	Brook trout	Atlantic salmon	Koaro	Giant kokopu	Flathead galaxias	Roundhead galaxias	Unspec. Galaxiids	Common smelt	Common bully	Upland bully	Unspec. Bully	Longfin eel	Shortfin eel	Unspec. Eel	Perch	Koura
Eglinton River and tributaries	15	9			3				4		4	1		3				
Mararoa River and tributaries	16	4			2	1	1	2	12	2	1	5	1	15			1	2
Upukerora River and tributaries	3	1		1					2		3							
Whitestone River and tributaries	12	3					1	2	10			7	1	11		1		
Lake Te Anau and tributaries	9	4	1		3	3			2	2	7			3	2			
Number of records	55	21	1	1	8	4	2	4	30	4	15	13	2	32	2	1	1	2
Proportion	67.1	25.6	1.2	1.2	9.8	4.9	2.4	4.9	36.6	4.9	18.3	15.9	2.4	39.0	2.4	1.2	1.2	2.4

Based on the vegetation descriptions in these reports and the hydrological setting (high rainfall and an array of flood channels), the site would be classified as a fen in the Ministry of the Environment wetland classification system for New Zealand, adopted in 1999. The distinctive features of fens are peat soils receiving significant amounts of water from rainfall, surface and groundwater flows, and supporting vegetation made up of species characteristic of low to moderate fertility, such as wire rushes and some sedge species. Wetlands of this type form relatively slowly in the landscape and have very slow recovery times from environmental disturbance.

In both surveys, the Dunton Swamp was recognised as a highly significant natural area of great conservation value. The 1990 DoC survey ranked it in the top 5 of the 50 sites for conservation significance, and the 1995 Landcare Research report identified it as the main ecological feature of the Upekerora section of the monorail route. The three features of particular significance of the Dunton Swamp are:

- **Size.** The site is one of the largest wetlands in the area, and larger wetlands provide a greater array of habitats for plants and animals. Fragmentation of wetlands is a national issue and large, unmodified sites with intact margins are particularly unusual. The 1995 Landcare Research Ltd. report noted the intact ecotone (transition zone) between the wetland and adjacent beech forest as a particularly significant feature. Development of surrounding land for agriculture has eliminated the ecotone of many of the remaining wetlands in New Zealand.
- **Diversity.** Both surveys identified a range of up to 6 major community types present in a complex spatial mosaic, which is unusually large for the remaining wetland habitats in New Zealand. These communities are nationally significant for their rarity, and are all associated with low fertility due to low nutrient inputs.
- **Intactness.** The absence of any pastoral grazing in the catchment and around the margins of the wetland has allowed an intact native community to persist at this site, unlike many wetlands where agriculture increases nutrient runoff into wetlands and allows trampling and grazing by stock. Nutrient runoff decreases native species diversity by encouraging a small number of productive species to displace the slower-growing species found in less fertile areas. It also encourages weed invasion, as most of the weeds that damage natural character in New Zealand wetlands are favoured by nutrient enrichment.

### Potential Issues

There are likely to be two issues that are specifically associated with the construction phase of the project: hydrological disturbance and disturbance of peat and vegetation. Wetlands only form in the landscape due to specific hydrological conditions that allow water saturation of the soil close to or at the surface for most of the growing season of plants, and that allow small seasonal fluctuations in the water table that encourage wetland plant growth. Construction activities that disturb the soil or water courses, and that increase drainage of water from wetlands, are likely to result in loss of specific wetland flora and invasion of terrestrial species. This process can be very gradual, with drainage occurring slowly and natural character being lost over many years subsequent to the activity. Hydrological disturbance can also lead to erosion of peat from the wetland.

Peat soils form over periods of tens to thousands of years, but oxidise and break down rapidly when exposed to the atmosphere. Any disturbance of peat during construction is likely to take

many years to repair. Plants in low-nutrient wetlands of this type are also slow growing and require prolonged recovery periods to recover from disturbance.

Most of other probable impacts are likely to be issues both during construction and after establishment of the monorail and comprise weed and pest invasion, fire and nutrient enrichment. During construction, equipment and machinery brought to the site are likely to be a source of weed propagules. Human activities always encourages the spread of weeds into previously undisturbed wetlands. Post-construction, the structure may continue to encourage weeds. Pylons are ideal sites for invasion of weeds into wetlands, as they are usually areas of localised disturbance and nutrient enrichment. Any emergency access route would also provide an accessway for roadside weed movement into the system. Access routes also provide pathways for greater access by pest animals such as mustelids, possums and deer, increasing the possibility of damage by browsing and trampling, and predation of native birds.

Despite their high water content, wetlands are often damaged by fires, which can spread through the relatively dry leaf litter, through flammable plants such as turpentine bushes, and even through peat, which is combustible under some conditions. During construction, the greatest risk of fire comes from machinery (engine heat, exhaust sparks) or negligence by construction workers (e.g. rubbish fires). Post construction, sparks from the operation of the monorail are one possible source of fire. The most frequent cause of fire in wetlands is deliberate vandalism, the risk of which increases once the presence of significant wetlands becomes more generally known.

Disturbance of soils, especially around the margins, is likely to increase nutrient input to wetlands, as are the monorail structure and any access routes in the site. This site appears to be relatively infertile and is likely to be susceptible to changing nutrient status even with relatively small increases in nutrient input. Disturbance of the hydrological regimes by drainage or diversions of watercourses is also likely to have impacts of the wetland by lowering water levels or increasing increases in nutrient input respectively.

### **Mitigation measures**

The following impact minimisation and mitigation measures should be addressed:

1. Consideration of how to minimise the impingement of the monorail into the wetland area or its margins.
2. Construction methodology that minimises overturning and exposure of peat and peat-based vegetation, and that minimises disturbance by tracking of machinery and equipment through the wetland.
3. Protocols to avoid fires and discharges of pollutants at site during construction and by operation of the monorail after construction.
4. Avoidance of hydrological disturbance.
5. Weed and pest survey and eradication proposals, including post-construction monitoring.

### **Further Investigation**

For the purposes of carrying out a complete assessment of environmental effects we consider the following should be carried out:

1. There is some qualitative information at present on plant species composition. This should be re-surveyed using quantitative sampling methods that would provide a

baseline for assessing impacts. Surveying should include identification of community types using the new MfE wetland condition methodology adopted in 2003, which is now the standard for NZ wetlands.

2. The condition assessment protocol also includes methods for establishing nutrient status of wetlands, which should also be applied to identify current nutrient status to allow any nutrient enrichment effects of the development to be identified.
3. The application should include specific methods for minimising and mitigating the impacts that have been discussed above and include a methodology for monitoring impacts post-construction, such as hydrological disturbance and weed invasion.

## **FLOOD HYDROLOGY**

The monorail route crosses a large number of streams and relatively large rivers including the Kiwi Burn, Whitestone River, Upukeroa River, Dunton Creek, Moranic Creek and Retford Stream. The cross sectional area of the waterway at all crossings should be designed for the appropriate design flood (e.g., 100 year flood) plus a suitable freeboard to allow for possible obstruction of the waterway by debris. Standards for such structures are likely to be set by Transit New Zealand along with a specific method for calculating the flood flow.

Because the monorail will be supported across all waterways on piers, it will be necessary for these to also be designed for a design flood (including loading caused by possible debris). This design would need to be carried out when an exact route has been established and the design waterway area (i.e., the active waterway area in a design flood) can be estimated.

Yours sincerely



Ton Snelder