Appendix F

Ecological Assessment

Aquatic Ecology

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Dear Bruce

Ecological values in two Rolleston Blocks (Rolleston West Residential Ltd.)

Thank you for your email dated 3rd November.

I have undertaken a desktop consideration of ecological values, as it pertains to aquatic values, in the vicinity of the two described lots, described below as the Holmes Block and the Skellerup Block. Both are currently zoned as Rural Residential and are proposed to be rezoned to Living Z. I have accessed the New Freshwater Fish Database, the Paparoa Irrigation raceway network (Agriculture N.Z. Ltd 1997), and our own recent ecological investigations in the vicinity.

Waterways in both blocks are fed by a large (43000 Ha) constructed historic (1887) irrigation system originally for stock water, and more recently for irrigation (Agriculture N.Z. Ltd 1997). The water rises from a large, screened intake fed from the mainstem of the Waimakariri River at the end of Intake Road. In turn, these 2 blocks, and the raceway along Tennyson Street, Rolleston, are fed by a major irrigation race with flows southwards along Sandy Knolls Road (App. I. Fig. i).

Holmes Block

The irrigation raceway passes through the Holmes Block in the west corner of the property before it turns west and crosses into land owned by Selwyn District Council (App. I. Fig. ii). The raceway has recent (March 2020) Google Streetview® photos available, looking downstream from SH1 (Main South Road) (App. I. Fig. iii), and another recent Streetview® photo is available looking upstream from Burnham School Road (App. I. Fig. iv). In addition, a recent site visit provided photos presented in App. II. The raceway appears to be within the swinging arc of a pivot irrigator. To prevent impediment of the irrigator the waterway appears to be unfenced and has a buffer of a few metres of grassy vegetation (App. II, Fig. i). The raceway is shallow and has a gravel base in most reaches (App. II, Fig. ii), and culverted where it corners by 90^{o} within the Block.

This raceway is likely to have similar water chemistry as the parallel raceway which flows along the roadside of Tennyson Street, 3.5 km to the north-east, and appears to be of a similar width and nature of flow. A c. 340 m reach of the Tennyson St raceway was subjected to fish removal in February 2020, prior to piping (Downer contract). The fish catch over this reach is tabulated below (Table 1). I have digitally measured the length of channel which flows through the west corner of the Holmes Block (c. 458 m). I would expect the fish fauna to be similar to that in the Tennyson Street raceway and may be composed of as many as 151 fish, none of which have a significant conservation status. The shallow stony nature would particularly suit upland bully, which would spawn on the local cover substrate, and use them for refuge (Jowett & Boustead 2001). The lack of overhanging bank cover would restrict numbers of juvenile brown trout to a possibly lower catch projection than in Table 1.

Of these fish, the shortfin eel is a sea migrant, with juveniles which will be entrained through the fish screen at Intake Road, on the Waimakariri River. The upland bully probably the most common and well-distributed freshwater fish in New Zealand (McDowall 1990), and does not require sea access or therefore passage through the Waimakariri intake. Instead, it will spawn on cobbles and other hard items in its resident habitat. The common bully can adopt either a sea-migratory life-stage, or within inland ponds and lakes, a non-migratory lifecycle. Based on my experience, brown trout are well-distributed in the Paparua Irrigation Raceway network, especially where there is fast flow and hard substrates. It is likely the fish spawn in gravel reaches where these are available. The maximum size of brown trout in the raceway complex will be limited by the small size of available habitats.

Ecological values centred around aquatic invertebrates, certainly in terms of biodiversity, are likely to be already compromised by existing issues related to the habitats use as a raceway. These include dispersal issues caused by road culverts, the lack of riparian vegetation to support flighted lifestages, excessive weed removal and bed dredging, adjacent herbicide and pesticide use, and lack of physical habitat variation (Hudson & Harding 2004).

Table 1. Fish census in a nearby raceway, and approximate numbers in a selected reach in the Holmes Block (yellow ring in App. I. Fig. ii).

Fish Species	Conservation Status (Dunn *et al.* 2017)	No. caught	Population estimate for Holmes Block west corner
Upland bully	Not threatened	89	120
Brown trout	introduced	20	27
Shortfin eel	Not threatened	2	3
Common bully	Not threatened	1	1
		112	**151**

Skellerup Block

This block is at the terminus of a minor irrigation feed, with a pathway depicted in App. I. Fig. v. I understand this waterway is beyond the western boundary of the block but will provide comments anyway. There is a Google Streetview® photo where the waterway diverts away from Edwards Road (App. I. Fig. vi), which depicts a perennial channel with good fish cover elements. Based on the latest Google aerial imagery, the channel adjacent to the Skellerup Block is well fenced from dairying land use, with a vegetated buffer strip on the west bank of approximately 7 m. The raceway departs away from the Skellerup Block in the south-west corner, and apparently, goes to ground before it reaches Selwyn Road.

I would expect the fish fauna to be similar to that for the Holmes Block, with a potentially higher total fish abundance due to greater depth and fish refuge. Shortfin eel habitat, in particular, is higher, but recruitment into the reach is severely restricted by the Waimakariri intake screen. Eel recruitment to the Skellerup Block is also restricted by its location far from the intake, where entrained juveniles have adopted resident habitats further upstream and closer to the intake. If present at all, shortfin eel numbers would be greater in reaches with sluggish flow and where there is marked depth of soft sediment (Jellyman *et al.* 2003). This waterway has stable banks, and it is possible freshwater crayfish (koura) are also present.

It is my understanding that this waterway would be protected by the District Plan's 10m waterbody setback for earthworks and development and would be largely undisturbed by any potential residential development of the adjacent land.

Summary

The only aquatic habitat with potentially some ecological value is the raceway which passes through the western corner of the Holmes Block. Due to the screening of the inflow at the Waimakariri River intake, and the distance from the sea, fish diversity and abundance is expected to be low. Invertebrate biodiversity is already likely to be compromised for multiple reasons associated with the existing raceway management.

It is likely that there is a number of common fish species in the raceway reach through the Holmes Block, but these are likely to have little or no conservation value.

Overall, from a plan change/rezoning perspective, if the development adheres to the 10m waterbody setback rules the likelihood of negative ecological impacts are low.

Yours sincerely, Mark Taylor

References:

Agriculture N.Z. Ltd, G. P. L., Pattle Delamore Partners Ltd 1997. Paparua Water Race; system review. Christchurch. *No*. 83 p.

Dunn, N. R.; Allibone, R. M.; Closs, G. P.; Crow, S.; David, B. O.; Goodman, J. M.; Griffiths, M.; Jack, D.; Ling, N.; Waters, J. M.; Rolfe, J. R. 2017. Conservation Status of New Zealand freshwater fishes, 2017. Department of Conservation, Wellington. *No*. 15 p.

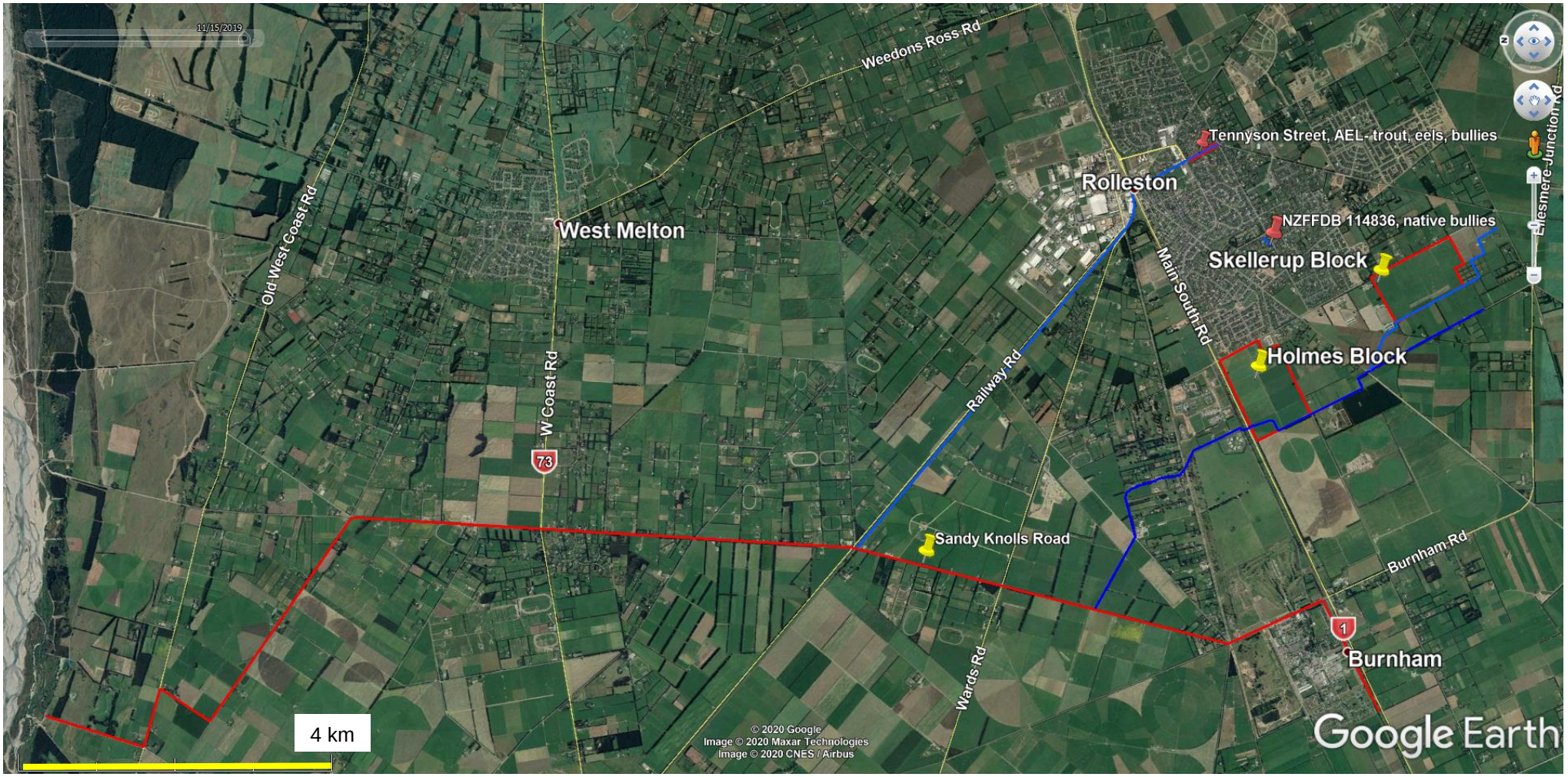
Hudson, H. R.; Harding, J. S. 2004. Drainage Management in New Zealand. Department of Conservation, *Science for Conservation No*. *No. 235*. 39 p.

Jellyman, D. J.; Bonnett, M. L.; Sykes, J. R. E.; Johnstone, P. (2003): Contrasting use of daytime habitat by two species of freshwater eel Anguilla spp. in New Zealand rivers. *In:* American Fisheries Society Symposium. Pp. 63-78.

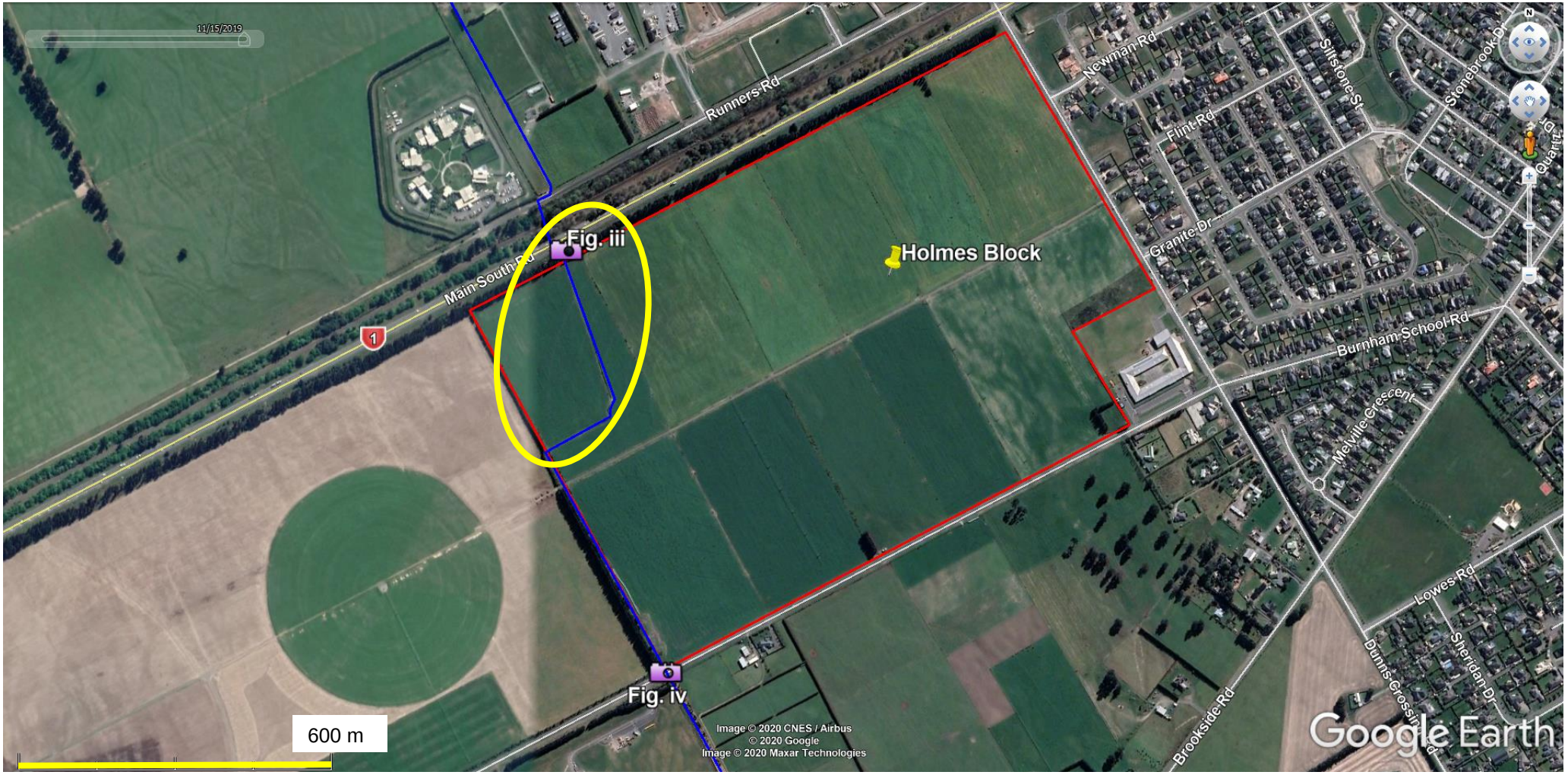
Jowett, I. G.; Boustead, N. C. 2001: Effects of substrate and sedimentation on the abundance of upland bullies (*Gobiomorphus breviceps*). *New Zealand Journal of Marine and Freshwater Research 35*: 605-613.

McDowall, R. M. 1990: New Zealand Freshwater Fishes: A Natural History and Guide. Auckland, Heinemann Reed. 553 p.

Appendix I. Recent Google Earth imagery from the Holmes and Skellerup Blocks.



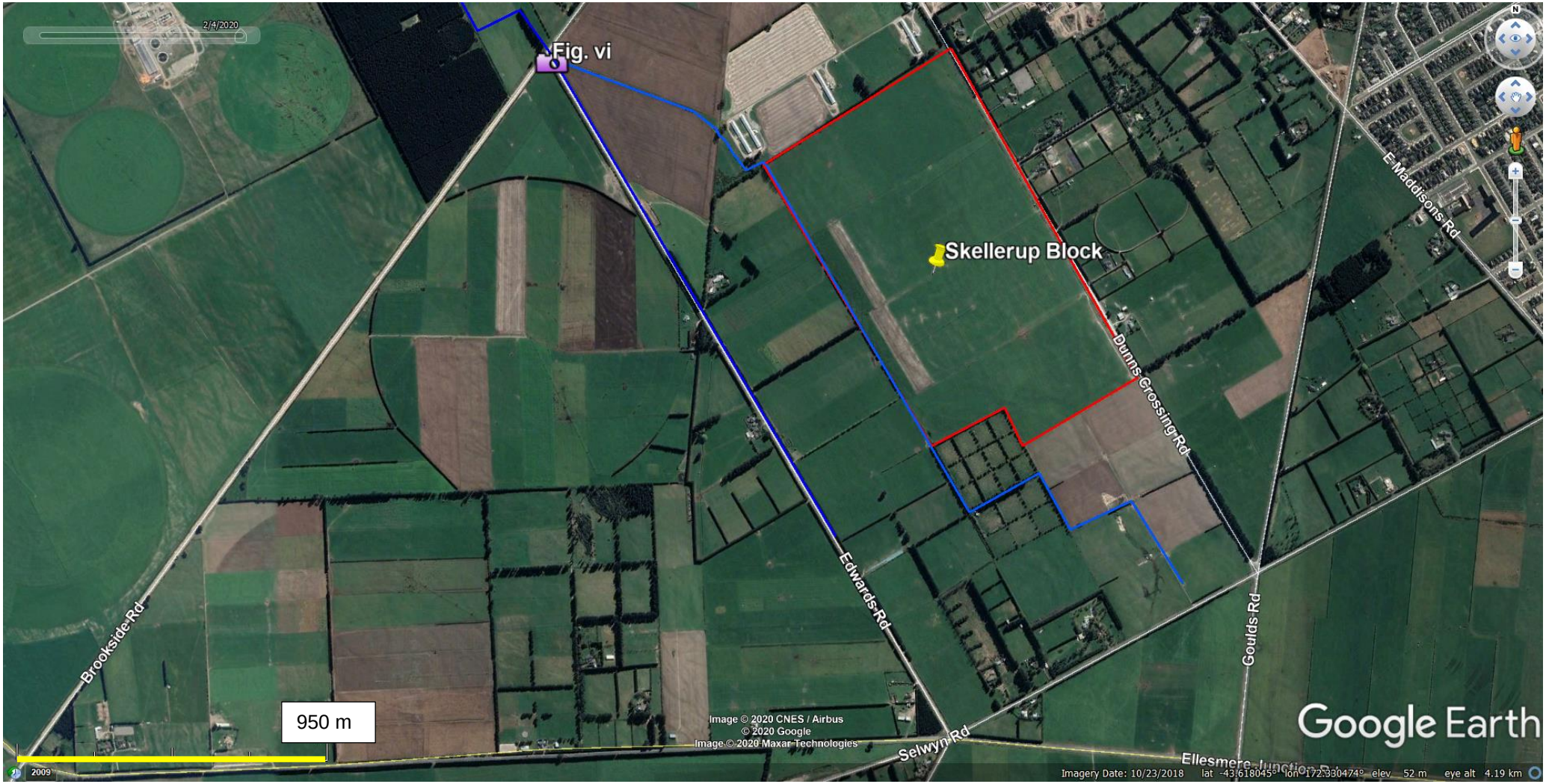
App. I. Figure i. Paparua Race Irrigation scheme in relation to waterways in the Holmes and Skellerup Blocks.



App. I. Figure ii. Paparua Race Irrigation scheme in relation to waterways in the Holmes and Skellerup Blocks. An approximate fish census is conducted on the channel reach in the yellow ring.

App. I. Figure iii. Looking south and downstream from SH1 at the irrigation raceway entering the north boundary of the Holmes Block, March 2020.

App. I. Figure iv. Water race at Burnham School Road, (September 2019), looking upstream (north) into the Selwyn District Council land, at the SW corner of the Holmes Block.



App. I. Figure v. The raceway network path (blue line) along the west boundary of the Skellerup Block (red line).

App. I. Figure vi. Looking east at the weedy raceway channel which further down borders the Skellerup Block (September 2019). While the broom and/or gorse appears sprayed, introduced emergent macrophytes provide a significant amount of instream cover for koura and fish, especially shortfin eels and trout.

Appendix II. Recent field photographs from the Holmes Block (Bruce Van Duyn, Carter Group).

Figure i. The raceway through the west corner of the Holmes Block.

Figure ii. Shallow gravel reaches of the raceway through the west corner of the Holmes Block.