Hawke's Bay Regional Investment Company Limited Ruataniwha Water Storage Scheme

Smedley Exchange Block Ecological Survey

KesselsEcology
SURVEY, ASSESSMENT AND RESTORATION

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Executive Summary

The Department of Conservation (DOC) and Hawke's Bay Regional Investment Company Limited (HBRIC) are investigating the option of a land exchange under the Conservation Act 1987 (the Act) for 22.2 ha of DOC administered Conservation Park which would be inundated by water as part of its proposed Ruataniwha Water Storage Scheme (the Scheme). The area of land that may be available for exchange with the Department of Conservation is the "Smedley Exchange Block" (SEB). Pending conclusion of negotiations with the landowner and an evaluation of the ecological values, this area will also form part of a wider biodiversity offset package.

It is understood that in order to enable a potential exchange of land, the test of 'conservation enhancement' under section 16A of the Act must be applied, such that there is a net enhancement of conservation values of land managed by DOC following the exchange with other land. It is also understood from discussion with DOC officers that a 'current value' approach to conservation values must be applied in determining whether this test is met. The purpose of this report is to assist a determination by DOC that this test is met relative to a proposed basis of exchange of part of the SEB land, as assessed and described in this report.

The ecological survey of the SEB found that there is a greater extent of indigenous vegetation cover within the block than within the DOC impact footprint. Of the indigenous vegetation mapped 131.91 ha were deemed to be ecologically significant under the Central Hawke's Bay District Plan and Hawke's Bay Regional Council Regional Policy Statement criteria. The area of indigenous vegetation recommended for a land exchange with DOC is 122.22 ha, which equates to an exchange factor of 5.5 for DOC land lost due to the Scheme, in order to meet the 'current value' requirement.

In addition, the proposed exchange land has a number of features not readily apparent. For example, it would form a buffer and corridor along the newly formed lake and create linkages of a range of representative vegetation types with the Gwavas Conservation Area to the east of the exchange land. If stock are excluded and pests controlled within the SEB land, it would provide higher quality habitat than currently exists for virtually all of the At Risk and Threatened indigenous fauna species within this locality, as well as for a range of more widespread species, such as bellbird, tui and whitehead.

In addition, to ensure that the area of exchange land remains at least as ecologically diverse and functionally intact as that which is to be lost a number of key management actions over the SEB land are required (assuming that the Department will place some form of permanent legal protection over the land) including:

- Fencing to exclude all stock;
- Long term animal pest control (focussing on possums, but also including other species such as ungulates, mustelids, rats and cats); and
- Long term plant pest control, notably on-going monitoring and control of wildling pines.

How this land is fenced and surveyed from the existing farm operations will require further negotiations with the landowner, the Gwavas Crown Forest Licensor and Licensee and DOC.

1 Introduction

The Department of Conservation (DOC) and Hawke's Bay Regional Investment Company Limited (HBRIC) are investigating the option of a land exchange under the Conservation Act 1987 (the Act) for 22.2 ha of DOC administered Conservation Park which would be inundated by water as part of its proposed Ruataniwha Water Storage Scheme (the Scheme) .

The existing DOC land which would be flooded by the proposed Ruataniwha Dam reservoir has previously been extensively surveyed and assessed for its terrestrial ecological values by Kessels Ecology since 2011. The results of these surveys are detailed in the project's Terrestrial Ecology Report (TER). Subsequent to this a summary and assessment of these findings as they specifically relate to the 22.2 ha of affected Conservation Park was prepared in June this year (Department of Conservation Managed Land – Description of Ecological Effects, Kessels Ecology).

The area of land which may be available for exchange with the Department is the "Smedley Exchange Block" (SEB). Pending conclusion of negotiations with the landowner and an evaluation of the ecological values, this area will also form part of a wider biodiversity offset package. Specifically, the land, if acquired, would also form an integral part of any translocation and habitat enhancement package in terms of enhancing and creating higher quality, pest free habitat for a range of nationally threatened and at risk flora and fauna species which would be inundated. Species and fauna groups, which would either be actively relocated or passively relocate on their own accord before the reservoir is created, include NZ fernbird, long-tailed bats, red mistletoe, and variety of lizard and invertebrate species.

This report describes the ecological values found within the SEB during field survey work and provides analysis to determine what areas and natural features would be most suitable for any exchange for the 22.2 ha of DOC administered land inundated by the Scheme.

It is understood that in order to enable a potential exchange of land, the test of 'conservation enhancement' under section 16A of the Act must be applied, such that there is a net enhancement of conservation values of land managed by DOC following the exchange with other land. It is also understood from discussion with DOC officers that a 'current value' approach to conservation values must be applied in determining whether this test is met. The purpose of this report is to assist a determination by DOC that this test is met relative to a proposed basis of exchange of part of the SEB land, as assessed and described in this report.

2 Methodology

A field survey was conducted over the 15th and 16th of August 2013. In order to assess the ecological values of the SEB and its potential for a land exchange the following survey methodologies were applied.

2.1 Vegetation Field Surveys

A general walkthrough survey was conducted to gain information on vegetation and habitat types present within the SEB, during which vegetation and habitat types were visually assessed from high vantage points or from transects. This assessment noted the main canopy and understory composition, as well as marked the extent of the vegetation/habitat encountered on recent aerial photographs supplied by Hawke's Bay Regional Council (HBRC). This information was then used for mapping the vegetation cover in GIS. Vegetation type descriptors as used in the TER report were adopted. The classifications generally followed Atkinson (1985) and were described as structural vegetation classes based on the dominant canopy species.

Beech forest was the main indigenous forest vegetation type encountered. Here, more detailed surveys of this vegetation type were conducted, as it was found to be comparable to indigenous forest found in the affected (inundated) 22.2 ha of DOC land. Two 20 x 20 m vegetation survey plots were established, plot 1 in an area where stock had been excluded and the forest's undergrowth had started to recover from grazing, and plot 2 in unfenced beech forest that showed evidence of stock access and grazing. These two vegetation survey plots were measured and recorded in general accordance with protocols as described by Hurst & Allen (2007a and b). For all species encountered within the two 20 x 20 m plots the height tiers and cover classes for live vegetation were recorded. Seedling counts were conducted within a 1 x 1m subplot extending from each of the four vegetation survey plot corners. A fifth 1 x 1m subplot was put in the centre of the vegetation survey plot. The diameter breast height (DBH) was recorded for all plants of a woody species taller than 135 cm and wider than 2 cm (plants whose stems were below 2 cm were counted as saplings) within the vegetation survey plot. Based on the walkthrough survey and the vegetation survey plots a vascular plant species list was also compiled.

2.2 Indigenous Fauna Field Surveys

2.2.1 Birds

For the TER surveys five-minute bird counts, line transects and placement of automated bio-acoustic recorders were considered the most appropriate methods to detect species composition due to the fragmented and varied nature of habitat in the survey area. However, given the results of the extensive avi-fauna surveys conducted to date as part of the TER assessment (aspects of which can be applied to the SEB land), and given that any results of this survey, conducted in August, would not be usefully comparable to those conducted in spring and summer periods for the TER, no further formal bird surveys were conducted. Specific eliciting calls for fernbird within potentially suitable habitat were nevertheless performed. In addition, the locations for notable bird species observed during this survey were noted.

2.2.2 Bats, Lizards and Terrestrial Invertebrates

The TER provides details of the extensive bat surveys conducted, some of which are also within the SEB. The TER and pre-feasibility report document a number of lizard and invertebrate surveys conducted in the locality, and in some cases also within the SEB itself. This information was summarised and interpreted in terms of the habitat found within the SEB and included in this survey report.

2.2.3 Freshwater Biota Habitats

In addition, a review of existing literature and databases was conducted to assess the value and habitat for freshwater fish in any streams and wetland found within the SEB.

2.3 Ecological Significance Evaluation and Threatened Environments

The evaluation of the ecological significance of the area was undertaken using the Central Hawke's Bay District Plan and Hawke's Bay Regional Council Regional Policy Statement criteria for identifying indigenous vegetation and habitats of indigenous fauna. All ecological significant vegetation types were mapped in GIS, as well as quantified and compared to the DOC land within the inundation area. The vegetation types were also assessed against the nationally threatened environments classification as defined by Walker et al. (2007). The area of indigenous vegetation and other habitat types within each threatened environment category were mapped and quantified in terms of the proportion of these areas in relation to the availability of the same habitats in the Ruahine Ecological District, as well as within the greater Waipawa catchment.

3 Results

3.1 Terrestrial Vegetation and Habitat

3.1.1 Mosaic of Vegetation and Habitat types

Based on the field survey and subsequent GIS mapping all indigenous vegetation on the SEB was assigned one of eleven different vegetation / habitat types (Figure 1), which are described below. Smaller scale maps of the vegetation / habitat types on the SEB can be found in Appendix 6.2 of this report.

3.1.2 Type 1 – Beech forest

This was the most widespread forest type within the SEB. These areas were usually dominated by mature black beech (i.e. >50% canopy cover). However, there were areas where large matai (>25 m in height) and the occasional kahikatea emerged above the black beech canopy and where red beech formed a small canopy component as well. The average canopy height within these areas reached 20 m. The lower tiers of this vegetation type (i.e. between 0.3 and 12 m height) still predominantly consisted of black beech (up to 50% coverage), but also contained a number of broadleaf species (up to 25%), such as black matipo, lacebark, mapou, mahoe, lancewood, white maire, hangehange, rangiora, as well as small-leaved shrubs, such as *Coprosma* species and mingimingi. Putaputaweta were often noted in areas closer to the river, and the occasional wheki-ponga was found within this vegetation type. Podocarps such as matai, kahikatea, rimu, totara and miro were also frequently regenerating in the lower tiers of this forest type. Common lianes in this forest type were clematis species, as well as bush lawyer. The groundcover usually comprised various groundferns (e.g. *Asplenium*, *Blechnum* and *Polystichum* species), a number of indigenous sedges and grasses (e.g. *Uncinia* and *Luzula* species, and bush rice grass), as well as common herbs and seedlings of the tree and shrub species.

Two vegetation survey plots were placed within beech forest habitat, results of which are described further below. Of note was also a section of beech forest at the northern tip of the SEB (4.4 ha), from which stock have been excluded and in which the understory has been regenerating over the past years

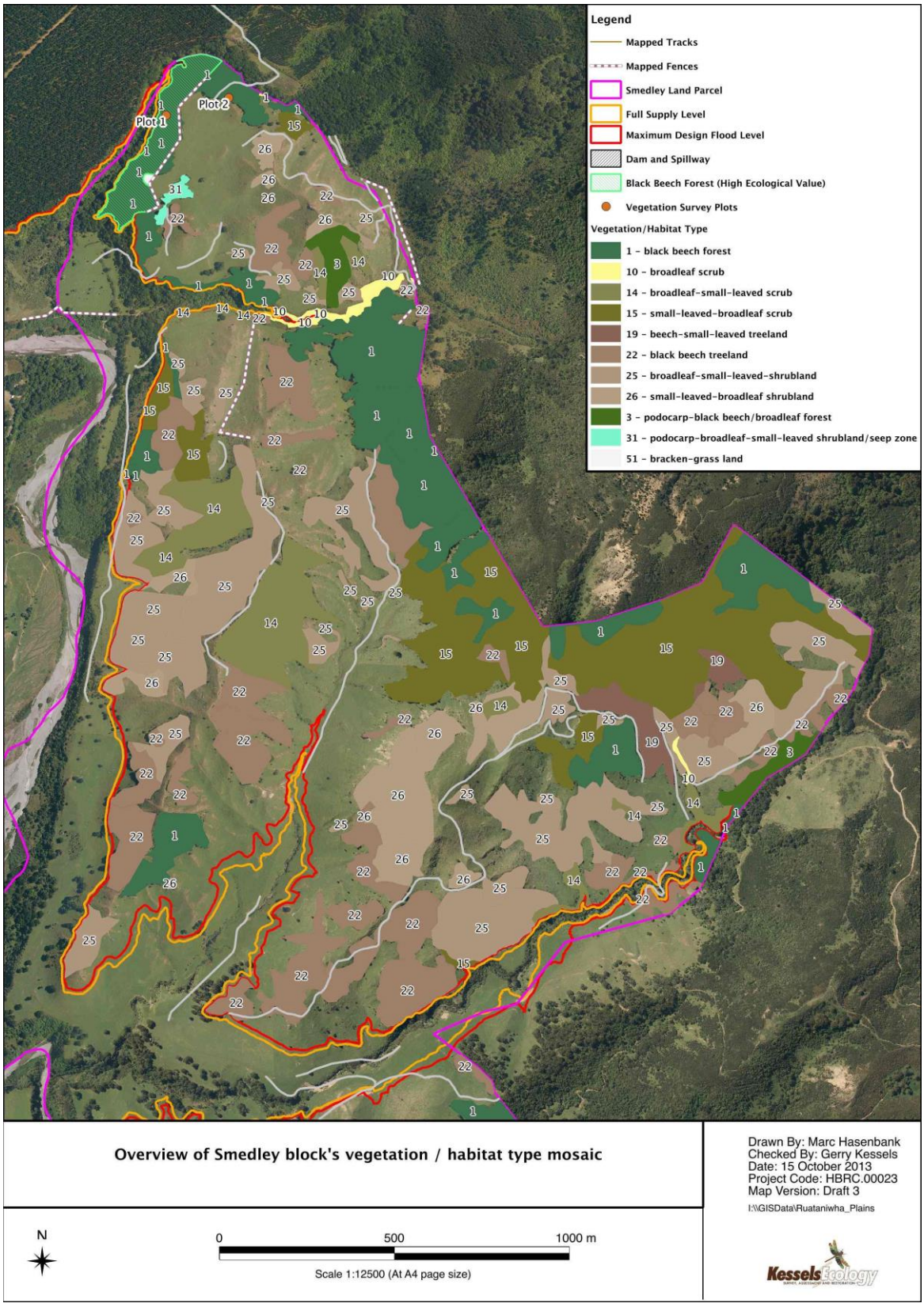

Figure 1: Overview map showing different vegetation and habitat types within the Smedley Exchange Block.

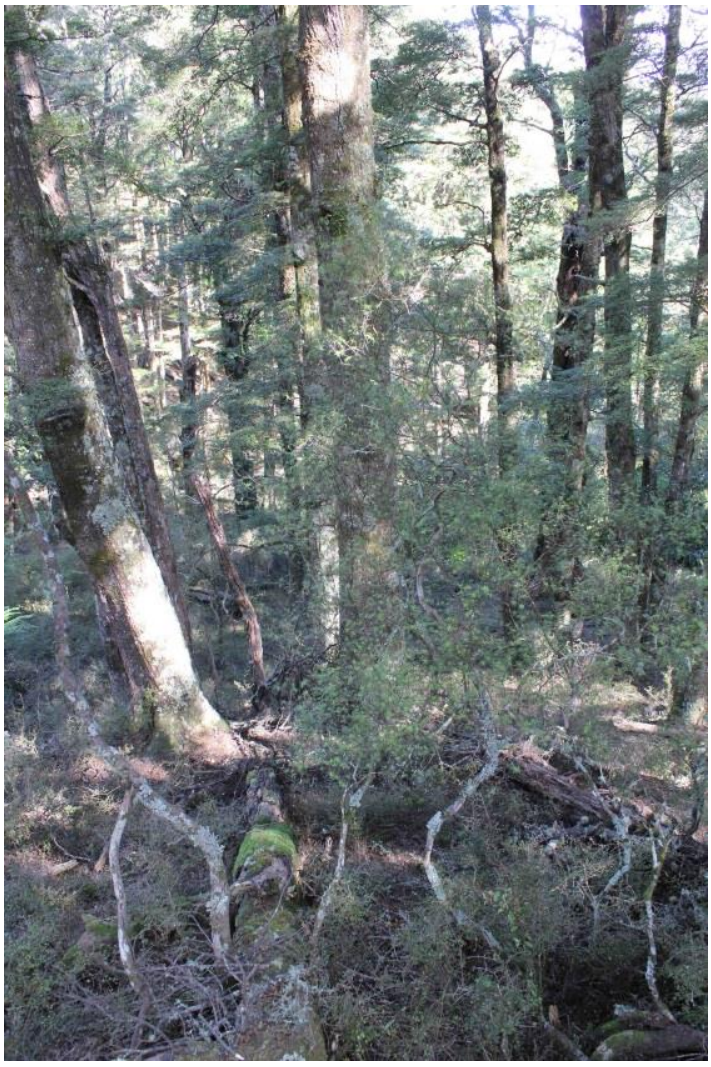

Figure 2: Beech forest

3.1.3 Type 3 – podocarp-black beech / broadleaf forest

This vegetation type comprised a mixture of podocarp species such as kahikatea, rimu and matai emergent over a broadleaf sub-/canopy. The average canopy height was estimated at 8-10 m. In parts, black beech trees also formed part of the canopy or were emergent. Broadleaf species commonly found amongst the canopy of this vegetation type were putaputaweta, five-finger, lancewood, white maire, lacebark, black matipo, pate and kaikomako. Cabbage trees and tree ferns (i.e. wheki-ponga and wheki) were also frequently present, and common lianes and climbers in this forest type were clematis and bush lawyer. The understorey of this vegetation type was typically comprised of karamu, kanono, hangehange, young mahoe and koromiko. Of note were also three rimu and one kahikatea found in the north-eastern section of the SEB. These old-growth trees were emergent and reached heights of around 30 metres.

3.1.4 Type 10 – broadleaf scrub

Figure 3: View onto broadleaf scrub along escarpment and stream with bracken fern and pasture grasses in foreground.

These areas were primarily secondary scrub with canopy heights of usually less than 6 m and comprising mainly broadleaf species on steep slopes and bluffs above two tributaries of the Makaroro River. Species common in this vegetation type included mahoe, hangehange, five-finger, koromiko, wheki tree ferns, cabbage trees and lancewood. A combination of bracken fern and pasture grasses, together with different small- and broad-leaf species (e.g. kanuka, mapou, *C. rhamnoides*) grew along the upper banks near the upstream parts of the escarpment. Fern species such as *Blechnum novae-zelandiae* were also found in different parts along the steeper slopes of the escarpment. The majority of this vegetation type was found in the northern part of the SEB, and here the southern cliff top of the escarpment was lined with beech forest edge vegetation.

3.1.5 Type 14 – broadleaf-small-leaved scrub

These areas were secondary scrub characterised by over 80% shrub/tree cover over small amounts of pasture. Shrubs were usually less than 6m tall, and comprised broadleaf species such as putaputaweta, kaikomako, small leaved Coprosma, as well as small-leaved species such as kanuka and manuka. The occasional emergent black beech or rimu were also found within areas of this habitat type, but primarily along ridge tops, or near the edge of these areas.

3.1.6 Type 15 – small-leaved-broadleaf scrub

Figure 4: Small-leaved-broadleaf scrub

This vegetation type was characterised by over 80% shrub/tree cover over small amounts of pasture. Another form of secondary scrub, here shrubs were usually less than 6m tall, but comprised mainly small-leaved species such as kanuka and manuka, and to a lesser extend broadleaf species such as putaputaweta, and small leaved Coprosma. The majority of this vegetation type was found along the eastern part of the SEB where it occasionally merged into/with beech forest edge vegetation.

3.1.7 Type 19 – beech-small-leaved treeland

This vegetation type comprised remnant trees of the original black beech forest canopy mainly situated within grazed pasture with no or only little understorey remaining. Species present were usually mature black beeches interspersed with only the occasional matai, kahikatea or rimu. Some areas were only occasionally grazed and still contained a thin indigenous shrub layer underneath a narrow line of black beech trees. Additionally, a higher amount of small-leaved scrub species such as kanuka also grew in between beech trees, and therefore this type represented a slight modification to type 22 below.

3.1.8 Type 22 – black beech treeland

This vegetation type comprised remnant trees of the original black beech forest canopy mainly situated within grazed pasture with no or only little understorey remaining. Species present were usually mature black beeches interspersed with only the occasional matai, kahikatea or rimu. Some areas were only occasionally grazed and still contained a thin indigenous shrub layer underneath a narrow line of black beech trees. Extensive areas of black beech treeland were found in the southern part of the SEB.

3.1.9 Type 25 – broadleaf-small-leaved-shrubland

Figure 5: Broadleaf-small-leaved-shrubland

This vegetation type was characterised by less than 80% shrub/tree cover over significant amounts of pasture. Shrubs were usually less than 6m tall, and comprised broadleaf species such as putaputaweta, small leaved Coprosma (primarily *C. rhamnoides*), and small-leaved species such as kanuka and manuka.

3.1.10 Type 26 – small-leaved-broadleaf-shrubland

Figure 6: Small-leaved-broadleaf-shrubland

This vegetation type was characterised by less than 80% shrub/tree cover over significant amounts of pasture. Shrubs were usually less than 6m tall, and comprised mainly small-leaved species such as kanuka and manuka, and to a lesser extend broadleaf species such as putaputaweta and small leaved Coprosma (primarily *C. rhamnoides*).

3.1.11 Type 31 – podocarp-broadleaf-small-leaved shrubland/seep zone

Figure 7: Podocarp-broadleaf-small-leaved shrubland/seep zone

This area was grazed and consisted of a mixed indigenous shrubland containing some large kahikatea, young podocarps (e.g. kahikatea and rimu), as well as various broadleaf and small-leaved species such as lacebark, manuka and cabbage tree, over a seep zone with remnant indigenous sedges and fern species. Blackberry, pasture grasses and common pasture herbs dominate the margins and became less frequent towards the centre of these areas.

3.1.12 Type 51 – bracken-grass land

Figure 8: Bracken-grass land

This area was surrounded by beech forest along its north- and south-western edges, while a fence separated it from an area of pasture to the east. The beech forest surrounding this area was part of the 4.4 ha of higher value beech forest found within SEB. The canopy within this area was a combination of bracken fern and pasture grasses.

3.2 Comparative Areas for Each Habitat Type

Table 1 provides a summary of the areas for the different vegetation / habitat types found within the SEB, as well as a comparison to areas of vegetation / habitat types found within

the Scheme footprint assessed in the TER, including the 22.2 ha of DOC administered land inundated by the reservoir (referred to as DOC Impact Footprint in the table). About 101 ha of shrubland/treeland (i.e. less than 80% vegetative cover over pasture) made up the largest portion of the indigenous vegetation. About 40 ha of indigenous forest were mapped on the SEB. This area was made up mainly by beech forest, with only a small portion of podocarp-black beech/broadleaf forest. The mapping classed about 49 ha as secondary indigenous scrub (i.e. greater than 80% vegetative cover), as well as about 0.5 ha as a small seep zone area. Pasture and rank grasses made up about 115 ha of vegetation cover within the SEB.

Table 1: Areas in hectares for different vegetation / habitat types within Scheme impact footprint, DOC land as part of the Scheme footprint, as well as for the Smedley Exchange Block.

Vegetation / habitat type	RWSS Impact footprint	DOC Impact Footprint	Smedley Block
Farm track or road	**2.91**		**2.13**
Stream channel	**0.83**		
Gravel river bed	**73.97**	**0.42**	
Indigenous Forest	**80.71**	**12.47**	**40.44**
beech forest	52.03	10.53	37.32
podocarp-broadleaf forest	10.61		
podocarp-black beech/broadleaf forest			3.12
broadleaf forest	17.4	1.94	
small-leaved forest	0.67		
Indigenous Scrub	**22.7**		**49.3**
broadleaf scrub			1.43
broadleaf-small-leaved scrub			14.89
(kowhai)/broadleaf scrub	1.19		
(podocarp)/broadleaf-small-leaved scrub	10.52		
small-leaved-broadleaf scrub	10.99		32.98
Indigenous Shrubland/Treeland	**59.05**	**8.18**	**100.53**
small-leaved-broadleaf shrubland			14.71
broadleaf-small-leaved shrubland			44.06
(podocarp)/broadleaf-small-leaved treeland/shrubland	18.8		
podocarp/broadleaf treeland		0.34	
broadleaf treeland		1.54	
black beech treeland (incl. beech-small-leaved treeland)	9.32	0.58	41.68
broadleaf-small-leaved-monocot scrub/treeland		5.57	
broadleaf-small-leaved tussock-shrubland	29.92		
manuka and/or kanuka shrubland		0.15	
small-leaved treeland and/or shrubland	1.01		
bracken-grass land			0.08
Wetland Vegetation	**5.11**	**0.29**	**0.49**
podocarp-broadleaf-small-leaved shrubland/seep zone	0.46		0.49
seep zone	4.36		
wetland	0.29	0.29	
Exotic Vegetation	**204.9**	**0.86**	**115.3**
exotic forest and/or treeland	16	0.57	
pasture or rank grass	174.24	0.29	115.3
willow/lupine forest and/or scrub	14.66	0	
Grand Total	**450.18**	**22.22**	**308.19**

3.2.1 Vegetation Survey Plots

As mentioned above two 20 x 20 m vegetation survey plots were established in beech forest habitat whereby plot 1 was set in an area from which stock had been excluded from while plot 2 was placed within an area where stock had unrestricted access to (Figure 1). In both cases black beech (*Nothofagus solandri*) was the dominant canopy species, with an average height of 20 m (c.f. Figure 11 & Figure 12). Besides that, the canopy in plot 1 also contained small amounts of totara (*Podocarpus totara*) and rimu (*Dacrydium cupressinum*), while rimu was only recorded in the sub-canopy of plot 2. The most obvious difference between the two plots was the reduced understory in plot 2. Notably, plot 1 exhibited a richer diversity of small to medium sized shrubs such as different *Coprosma* species, mingimingi (*Leptecophylla juniperina* and *Leucopogon fasciculatus*), and mapou (*Myrsine australis*) for example. The average DBH of black beech in plot 1 was 21.9 cm versus 45.9 cm in plot 2, and 5.9 cm and 8.6 cm for rimu respectively. Sapling counts conducted within each plot found a total of 38 saplings in plot 1 and none in plot 2. The majority of these saplings (~ 58%) were mingimingi, mapou and kanuka (*Kunzera ericoides*) to equal amounts. In contrast, seedling counts for both plots showed a larger number of seedlings in the more open plot 2, the majority of which were *Coprosma rhamnoides* (Table 2). A list of vascular plant species recorded during the survey can be found in Appendix 6.1.

Figure 9: Beech forest at vegetation survey plot 1.

Figure 10: Beech forest at vegetation survey plot 2.

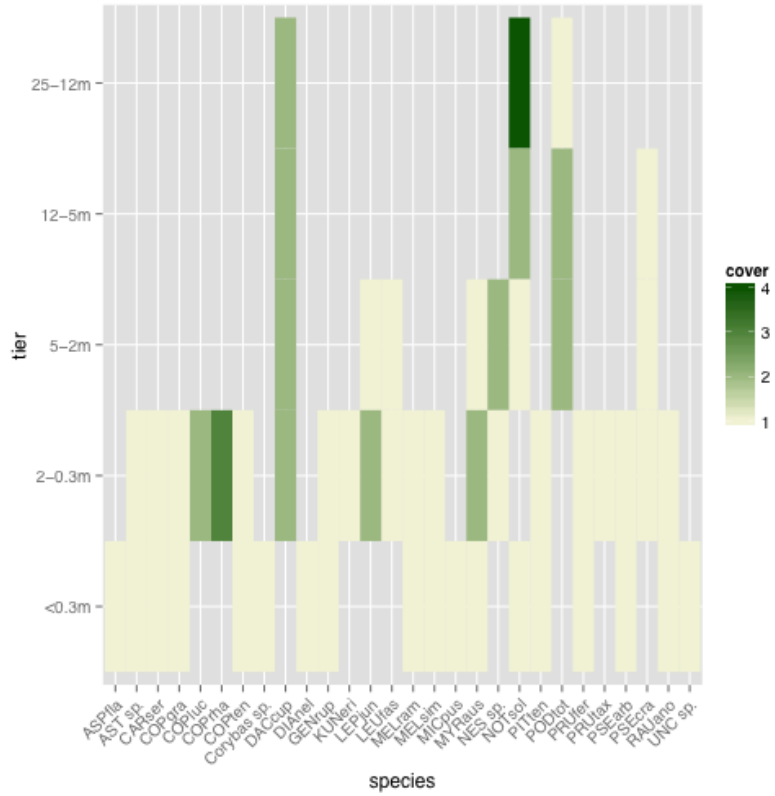

Figure 11: Cover scores for live vegetation at the different height tiers for vegetation survey plot 1 (stock excluded); cover classes: 1 = <1%; 2 = 1-5%; 3 = 6-25%, 4 = 26-50%, 5 = 51-75%. For an explanation of species abbreviations please refer to plant species list in appendix.

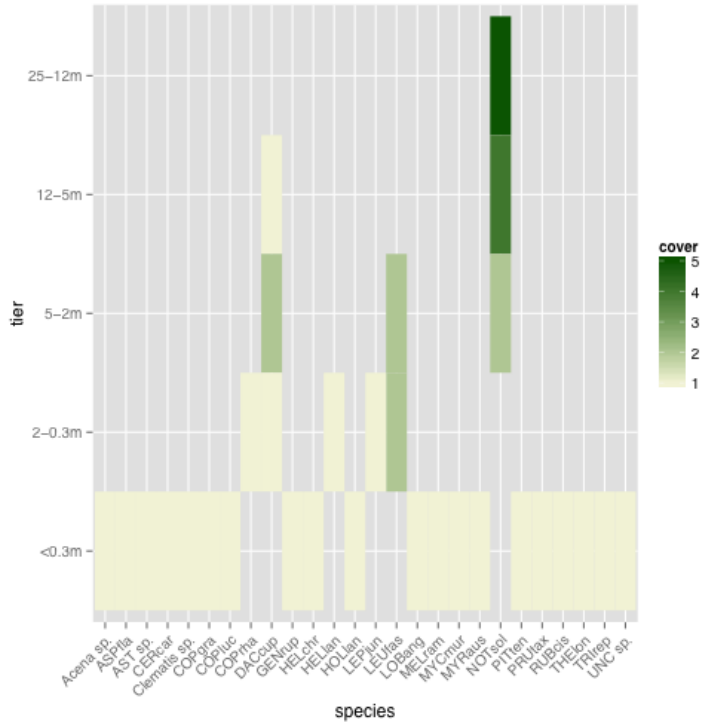

Figure 12: Cover scores for live vegetation at the different height tiers for vegetation survey plot 2 (unfenced); cover classes: 1 = <1%; 2 = 1-5%; 3 = 6-25%, 4 = 26-50%, 5 = 51-75%. For an explanation of species abbreviations please refer to plant species list in appendix.

Table 2: Number of seedlings for each species at specific height tiers for vegetation survey plots 1 & 2.

Sum of seedling count		tier				
plot	species	<15 cm	16-45 cm	46-75 cm	76-105 cm	Grand Total
1	AST sp.		1			1
	COPgra	4	1			5
	COPluc	5	4	2		11
	COPrha	36	14	4		54
	LEPjun	2				2
	LEUfas	21	2			23
	MICpus	1	1			2
	MYRaus	2	2			4
	NOTsol	11	3			14
	PITten		2			2
	PRUfer	1				1
	PRUtax	2				2
	PSEcra		1			1
	UNC sp.	11	9			20
1 Total		96	40	6		142
2	ARIser	1				1
	COPluc	2				2
	COPrha	154	44			198
	DACcup	1				1
	HELlan	1	4		1	6
	LEPjun	1				1
	LEUfas	1				1
	MYRaus	1				1
	NOTsol	14				14
	PRUtax	1				1
2 Total		177	48		1	226
Grand Total		273	88	6	1	368

3.3 Fauna

3.3.1 Avifauna

While no explicit bird surveys were conducted as part of this report, bird species noted during vegetation surveys included: kereru (*Hemiphaga novaeseelandiae*), tui (*Prosthemadera novaeseelandiae*), Eastern rosella (*Platycercus eximius*), grey warbler (*Gerygone igata*), blackbird (*Turdus merula*), NZ kingfisher (*Halcyon sancta*), Australian magpie (*Cracticus tibicen*), whitehead (*Mohoua albicilla*), silvereye (*Zosterops lateralis*), and Paradise Shelduck (*Tadorna variegata*).

Another bird species that has been observed during TER survey work and that is likely to frequent the area is the NZ bush falcon (*Falco novaeseelandiae*).

North Island fernbird (*Bowdleria punctata vealeae*), was not found to be present in the SEB, although some areas of scrub and shrubland do provide suitable habitat and it is found in close proximity, at the confluence of Dutch Creek with the Makaroro River (TER).

3.3.2 Bats, Lizards and Terrestrial Invertebrates

As part of the TER an extensive survey of the long-tailed bat population (*Chalinolobus tuberculatus*) inhabiting the Scheme footprint and wider landscape was conducted. Some of the bioacoustic recorders were set up along clearings of the beech forest found adjacent to the SEB within the Scheme footprint. At all those recorders bat activity during the hours

after sunset was detected on surveys conducted between 2011 and 2013. Forest edge habitat is a preferred feeding habitat for long-tailed bats and it has been found that the population detected within the Scheme footprint extends into beech forest found on the SEB.

During herpetological fauna searches as part of the TER a southern North Island forest gecko (*Mokopirirakau* 'southern North Island') was discovered among a rock pile amidst grassland. This discovery was made in close proximity to the SEB, and it matches a desktop study by Forbes et al. (2011) that identified small leaved scrub / shrubland, podocarp-broadleaf forest and some parts of the pasture land on the SEB as potential habitat for several lizard and skink species: *Nautilnus punctatus*, *Woodworthia maculates*, *Mokopirirakau* 'southern North Island', *Dactylocnemis pacificus*, *Oligosoma polychroma*, *O. microlepis*, *O. ornata*, and *O. aeneum*. A subsequent field survey of kanuka and native broadleaf forest bordering pasture on the SEB by Forbes et al. (2011) also discovered five common geckos (*W. maculates*), and 11 common skinks (*O. polychroma*).

Terrestrial invertebrate surveys as part of the TER noted a rich diversity of invertebrate species within the surveyed habitats. Of particular note was also the Hawke's Bay tree weta (*Hemideina trewicki*) that was discovered during one of the weta box checks. It is expected that this species would also be found within the SEB.

3.3.3 Freshwater Biota Habitats

Four larger streams run through the SEB, although none are as large as Dutch Creek. The lower sections of these streams would become inundated by the filling of the reservoir, while some of the upstream habitat would remain untouched. While no aquatic field surveys were conducted as part of this report, the ecological effects of the Scheme on the aquatic ecology of the Makaroro and Tukituki catchments have previously been assessed by Young et al. (2013). In their report Young et al. (2013) describe that 12 freshwater fish species were detected within the Makaroro catchment (Table 3), of which five were classed as "Declining". The majority of fish and macro-invertebrate species recorded by Young et al. (2013) were migratory species, which would be adversely affected by the dam unless a trap & release regime or fish passage would be provided. As most of the larger streams flowing from the SEB enter the Makaroro River above the proposed dam, populations of fish and macro-invertebrates inhabiting these streams would be affected by the formation of the lake downstream. On a 'current values' basis however, it is the present situation that applies (without the dam) in assessing relative conservation values lost and gained through any exchange of land, and so the degree of this impact and the effectiveness of proposed mitigation (trap and transfer) as part of the Scheme need not be assessed in this context.

Table 3: Extract from Young et al. (2013) showing freshwater fish and macro-invertebrate species recorded from Makaroro catchment, as well as their threat classification and migratory status.

Scientific Name	Migratory	Makaroro Catchment Records
Anguilla australis	Yes	3
Anguilla dieffenbachii	Yes	19
Cheimarrichthys fosteri	Yes	22
Galaxias divergens	No	24
Gobiomorphus basalis	No	4
Gobiomorphus cotidianus	Yes	2
Gobiomorphus hubbsi	Yes	3
Gobiomorphus huttoni	Yes	2
Onchorhynchus mykiss	Yes	25
Paranephrops planifrons	No	4
Retropinna retropinna	Yes	5
Salmo trutta	Yes	1

3.4 Threatened and At Risk Species

While no species classed as Threatened or At Risk were observed during the field survey, subsequent desktop analysis indicated the potential presence of two Threatened, and four At Risk terrestrial fauna species (Table 4 and Table 5) within the SEB. A further five freshwater fish species may also potentially live near or in streams within the SEB (Table 6). The following references were used to determine the Threat Classification for the different fauna species that are shown in the tables below: for mammals: O'Donnell et al. (2009); for reptiles: Hitchmough et al. (2013); for fish: Allibone et al. (2010); and for invertebrates: Trewick et al. (2012).

Table 4: Threatened terrestrial animal species potentially occurring within the Smedley Exchange Block.

Group	Scientific Name	Threat Classification
Bird	*Falco novaeseelandiae*	Nationally Vulnerable
Mammal	*Chalinolobus tuberculatus*	Nationally Vulnerable

Table 5: At Risk terrestrial animal species potentially occurring within the Smedley Exchange Block.

Group	Scientific Name	Threat Classification
Bird	*Bowdleria punctata vealeae*	Declining
Bird	*Anthus novaeseelandiae novaeseelandiae*	Declining
Reptile	*Mokopirirakau "southern North Island"*	Declining
Invertebrate	*Hemideina trewicki*	Relict

Table 6: At Risk freshwater species potentially occurring near or in streams for the Smedley Exchange Block.

Group	Scientific Name	Threat Classification
Fish	*Anguilla dieffenbachii*	Declining
Fish	*Cheimarrichthys fosteri*	Declining
Fish	*Galaxias divergens*	Declining
Fish	*Gobiomorphus hubbsi*	Declining
Fish	*Gobiomorphus huttoni*	Declining

3.5 Threatened Environments Classification

The distribution of the different LENZ Threatened Environment Classifications (TEC) within indigenous vegetation cover throughout the SEB is shown in Figure 13. The map has been prepared at LENZ Level 4 (i.e. 500 land environments) and shows land environments with 30% or less remaining indigenous vegetation cover from a New Zealand wide perspective. The mapping was done against indigenous and exotic vegetation cover, and excluded residential areas, tracks etc. A breakdown of the TEC for indigenous and exotic vegetation cover in the SEB is provided in Table 7. For extant indigenous vegetation remaining within the SEB, 29.95 ha fell within the 'Chronically Threatened' category, assigned to land environments of which only 10 – 20% remain within New Zealand. The majority of the indigenous vegetation cover in the SEB, about 161 ha, fell within the 'Less reduced and better protected' TEC category of which more than 30% remain within New Zealand.

The SEB falls within the Waipawa catchment, which itself is part of the Ruahine Ecological District. A breakdown of TEC areas is provided in Table 8 and Table 9 for areas within the Waipawa catchment and Ruahine Ecological District respectively. The area of 'Chronically threatened' land found in SEB made up about 2.3% and 1.5% of similarly classed land remaining within the Waipawa catchment and Ruahine Ecological District respectively.

A summary of Threatened Environment areas within the inundated DOC land is provided in Table 10. Here, over 80% of the land fell within the 'Chronically Threatened' category (10 – 20% remaining nationally).

Table 7: LENZ Threatened Environment Classification areas within exotic and indigenous vegetation cover in the Smedley Exchange Block.

LENZ Threatened Environment Classification	Area (ha) in Exotic Vegetation Cover	Percent of Total	Area (ha) in Indigenous Vegetation Cover	Percent of Total	Total (ha)
Acutely Threatened (<10% indigenous cover left)	0.00	0.00%	0.00	0.00%	0.00
Chronically Threatened (10-20% left)	43.88	14.24%	29.95	9.72%	73.83
Less reduced and better protected (>30% left and >20% protected)	73.55	23.87%	160.70	52.16%	234.25
Grand Total (ha)					308.08

Table 8: LENZ Threatened Environment Classification areas in Waipawa catchment and the Smedley Exchange Block.

LENZ Threatened Environment Classification	Area (ha) in Waipawa Catchment	Area (ha) in SEB	Percent of Area in Waipawa Catchment
Acutely Threatened (<10% indigenous cover left)	1064.36	0.00	0.00%
Chronically Threatened (10-20% left)	3170.83	73.83	2.33%
Less reduced and better protected (>30% left and >20% protected)	13803.72	234.25	1.70%

Table 9: LENZ Threatened Environment Classification areas in Ruahine ED and Smedley Exchange Block.

LENZ Threatened Environment Classification	Area (ha) in Ruahine ED	Area (ha) in SEB	Percent of Area in Ruahine ED
Acutely Threatened (<10% indigenous cover left)	1716.34	0.00	0.00%
Chronically Threatened (10-20% left)	5082.97	73.83	1.45%
Less reduced and better protected (>30% left and >20% protected)	91780.80	234.25	0.26%

Table 10: LENZ Threatened Environment Classification areas in inundated DOC land.

LENZ Threatened Environment Classification	Area (ha) in inundated DOC land	Percent of Total
Acutely Threatened (<10% indigenous cover left)	3.7	16.6%
Chronically Threatened (10-20% left)	18.3	82.5%
Underprotected (>30% left and 10-20% protected)	0.1	0.4%
Less reduced and better protected (>30% left and >20% protected)	0.1	0.5%
Total	22.2	

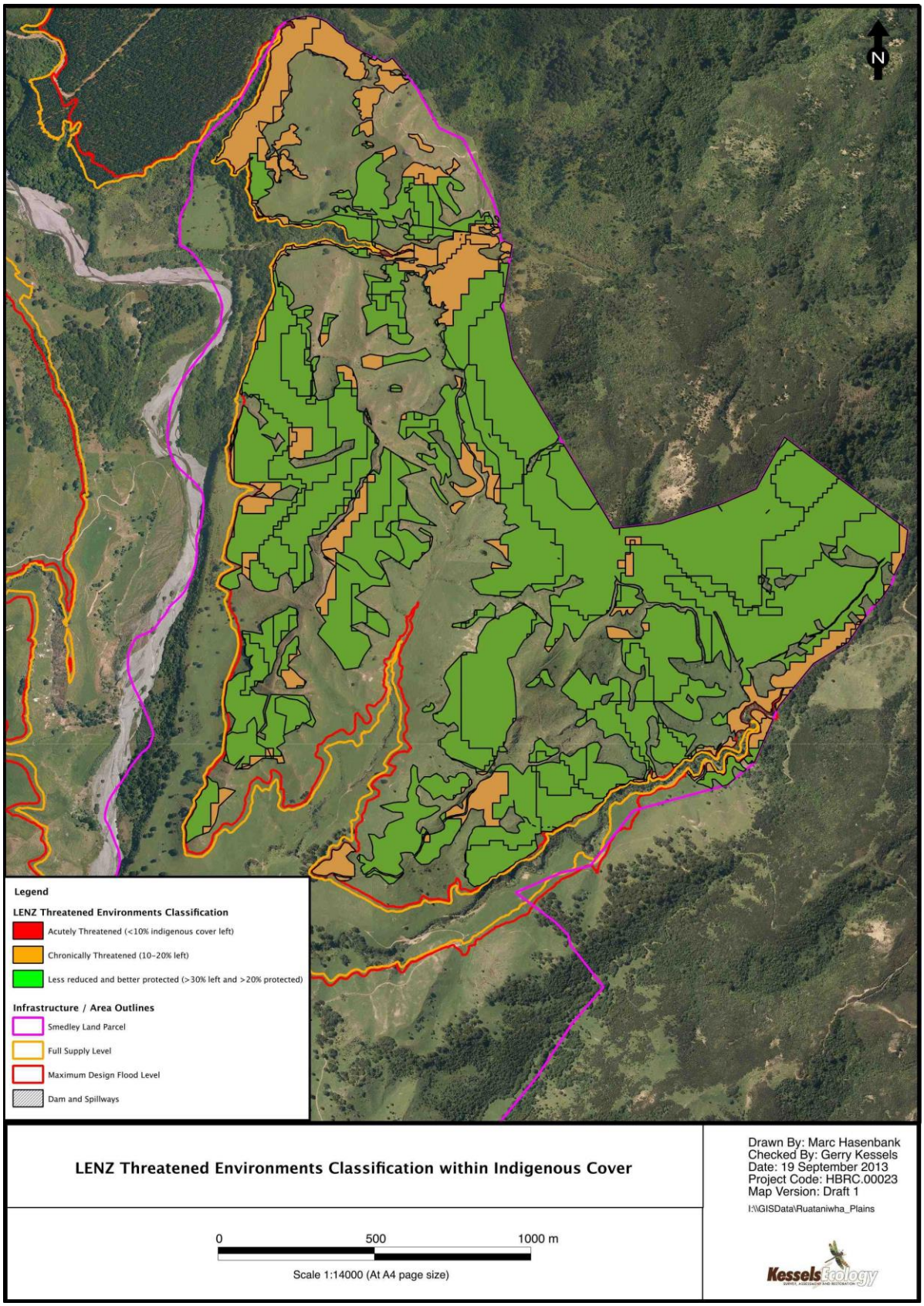

Figure 13: LENZ Threatened Environments Classification within indigenous vegetation cover.

3.6 Ecological Significance Evaluation

The indigenous vegetation cover in the SEB was assessed in terms of the policies stated in both the Hawke's Bay Regional Policy Statement (RPS; Chapter 3.4) and the Central Hawke's Bay District Plan (CHBDP - Section 2.2 and Section 4.9.13). The relevant sections of both documents are provided in Appendices XII and XIII of the TER. The criteria for determining 'significant indigenous vegetation' and 'Areas of Significant Nature Conservation Value' are very similar in both documents (in TER refer to Appendix XII for Section 3.4.7(a) of the RPS and Appendix XIII for Part 4, Section 4.9.13 of the District Plan). Remaining indigenous vegetation and habitat types present within the SEB, which were ecologically functional, and were shown to provide habitat for Threatened and At Risk species, were considered to be ecologically significant under the relevant criteria of the District Plan and RPS.

The indigenous vegetation cover within the SEB that was considered to be ecologically significant under both assessment criteria (meeting one or more of the indigenous vegetation extend, maturity or rarity criteria) was:

- beech forest, podocarp-black beech/broadleaf forest (40.44 ha);
- broadleaf scrub, broadleaf-small-leaved scrub, small-leaved-broadleaf scrub (49.30 ha);
- beech-small-leaved treeland, black beech treeland (41.68 ha); and
- podocarp-broadleaf-small-leaved shrubland/seep zone (0.49 ha).

The total area of ecologically significant vegetation within the SEB was found to be 131.91 ha (Figure 14). Beyond this core area of ecologically significant vegetation, other indigenous shrubland types may also provide habitat for native fauna, including Threatened and At Risk species that may frequent the area.

Aside from some 4.4 ha of beech in the north-west corner of the SEB (refer to the description of plot 1 in section 3.2.1) and some tributary escarpments (Type 10 in particular), most of these indigenous vegetation remnants are grazed by stock so that regeneration is hindered. It is noted that wildling pines are present on the adjacent Gwavas Conservation Area. Wildling pines could become a threat to some of the more open and seral habitats within the SEB once stock are excluded. Also, animal pests are widespread, although controlled to some extent by the regional council and the landowner. While these threats lower the quality and sustainability of the affected habitats, they do not change the ecological significance evaluation for the affected habitats. Rather, by legal protection and fencing from stock, in combination with a number of habitat enhancement, translocation, animal and plant pest control measures associated with the Scheme (refer to section 13 of the TER), this proposal presents opportunities to legally protect and enhance these significant ecological values.

No specific surveys for At Risk or Threatened species have been conducted on the proposed SEB exchange land. It may be that as well as long-tailed bats, several other At Risk or Threatened species may be currently utilising suitable habitats within the SEB, such as falcon, fernbird or red mistletoe as well as species such as Hawke' Bay tree weta and southern North Island forest gecko, which have all been previously found in this locality (refer to section 4 in the TER). Evidence of regular utilisation by any of these species may extend and/or elevate the significance of habitats identified within the SEB.

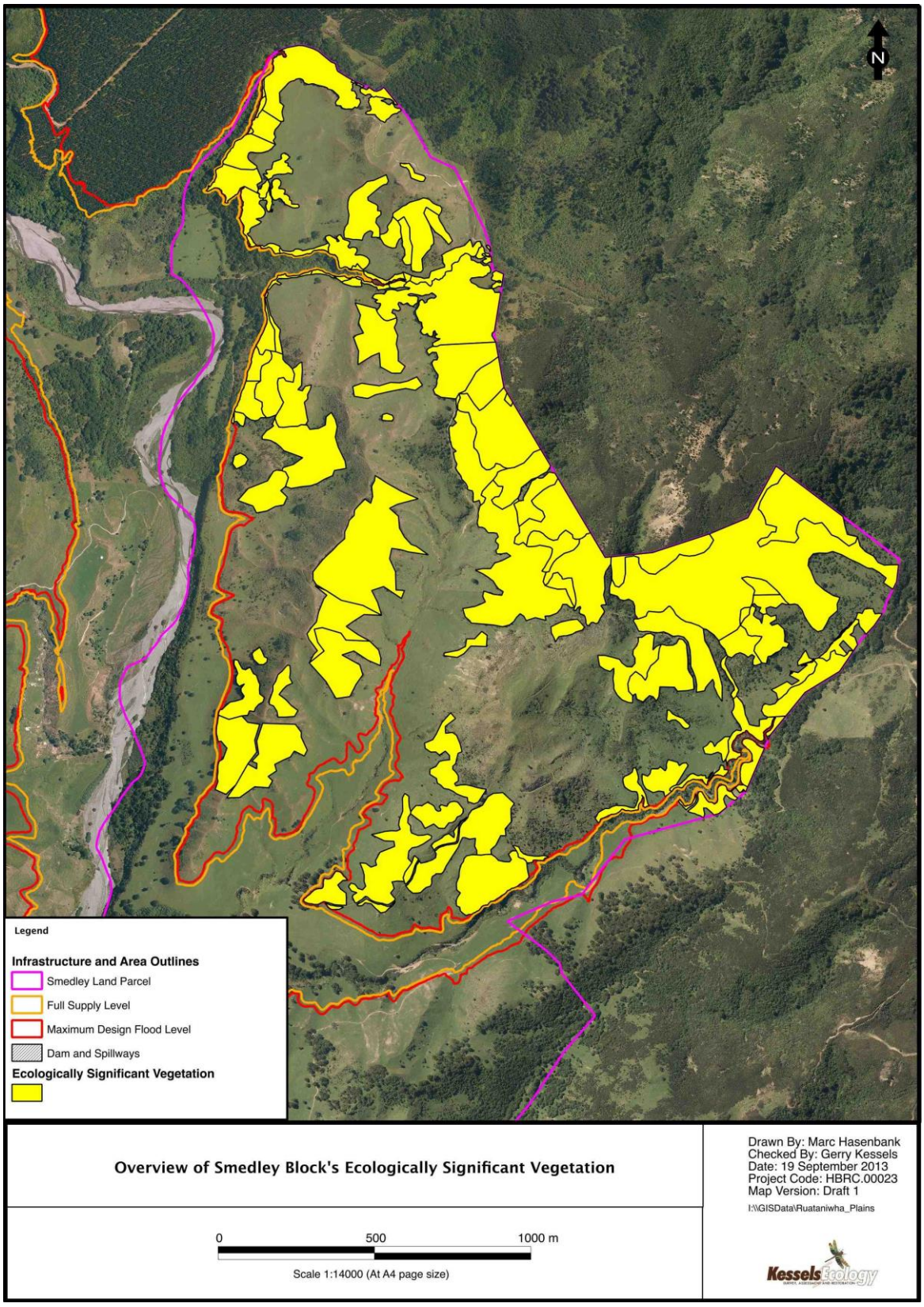

Figure 14: Smedley Exchange Block vegetation cover identified as being ecologically significant following District Plan and RPS criteria.

4 Summary & Recommendations

The ecological survey of the SEB found that there is a greater extent of indigenous vegetation cover within the block than within the DOC impact footprint. While some vegetation types could not be matched against the same vegetation type within the vegetation found within Dutch Creek, other similar vegetation types were found that could provide an equivalent habitat type or structure, e.g. broadleaf forest in the DOC land (1.94 ha) vs. podocarp-black beech/broadleaf forest in the SEB land (3.12 ha). The current use of the SEB as farm for pastoral farming purposes (cattle and sheep grazing) has led to modification of the indigenous vegetation within the block, which would require management to improve ecological sustainability in the future. That said, an ecologically highly valuable area of beech forest (some 4.4 ha excluding the portion flooded by the Scheme) was found at the northern extent of the SEB, which is considered to be at least as diverse as similar forest types found within Dutch Creek. This suggests that when fenced from stock grazing the indigenous areas presently grazed within the SEB will regenerate well (refer to plot 1 data). The black beech forest/podocarp-black beech/broadleaf forest (40.44 ha) and beech-small-leaved treeland/beech treeland (41.68 ha) would improve relatively rapidly once seedling and sapling recruitment advances in absence of grazing (we estimate that with stock exclusion and animal pest control seedling densities would be similar to that found within plot 1). Besides stock exclusion pest plant and animal control would be required in order to improve and maintain indigenous habitat values for the long term.

Red mistletoe (*Peraxilla tetrapetala*), which is a nationally At Risk species, was found within the DOC impacted land. Growing new plants from seed collected from the impacted specimen may be the only option to address the loss of the observed red mistletoe within Dutch Creek. However, growing mistletoe from seed is difficult and generally has only a low success rate. Nevertheless, suitable beech forest habitat is present within the SEB block for this to occur.

From a fauna perspective, previous surveys have found that twelve nationally Threatened and At Risk species frequent the area close to or within the SEB, including NZ bush falcon, long tailed bats and fernbird for example. In particular, previous surveys showed that long-tailed bats were found to utilize the margins of old growth beech forest within the SEB and it is considered likely that bats are roosting in the 82.12 ha of beech forest and beech treeland. Once suitable wetland vegetation along the lake margin has been restored, North Island fernbird, a nationally At Risk – Declining species, could also utilize parts of the SEB as habitat. The 49.30 ha broadleaf scrub, broadleaf-small-leaved scrub, small-leaved-broadleaf scrub will provide suitable habitat for many indigenous species, including fernbird, lizards as well as common insectivorous and fruitivorous bird species.

In total 131.91 ha of indigenous vegetation were found to be ecological significant within the SEB. Adding to the potential for ecological restoration is the classification of 29.95 ha of indigenous vegetation as 'Chronically threatened' within the SEB.

Potential Exchange Areas

Based on the results of this survey potential areas of indigenous vegetation/habitat equating to some 124 ha have been identified as being a suitable exchange for the habitat affected with the DOC estate. The green marked areas in Figure 15 indicate potential areas for the land exchange. Following the design of an indicative fenceline, an area of 146.87 ha containing 122.22 ha of a number of indigenous vegetation types has been proposed for the land exchange (Figure 16). A breakdown of this area by vegetation/habitat type is provided in Table 11 below.

Given that the areas of vegetation on the DOC estate are largely within Acutely or Chronically Threatened environments (16.6% and 82.5% respectively) and for the most part, in a less modified ecological state than those habitats within the SEB land, and applying a 'current values' approach to conservation values, it is considered appropriate that the exchange land offered should be a larger area than that lost to achieve the enhancement test. In this case the area of

land proposed for the exchange is indicatively 5.5 times larger than the area which would be flooded (subject to survey and fencing arrangements).

However the exchange land has a number of features not readily apparent. For example, it would form a buffer and corridor along the newly formed lake and create linkages of a range of representative vegetation types with the Gwavas Conservation Area to the east (refer to Figure 16). If stock are excluded and pests controlled within the SEB land, it would provide higher quality habitat than currently exists for virtually all of the At Risk and Threatened indigenous fauna species within this locality, as well as for a range of more widespread species, such as bellbird, tui and whitehead.

In addition, to ensure that the area of exchange land remains at least as ecologically diverse and functionally intact as that which is to be lost a number of key management actions over the SEB land are required (assuming that the Department will place some form of permanent legal protection over the land) including:

- Fencing to exclude all stock;
- Long term animal pest control (focussing on possums, but also including other species such as ungulates, mustelids, rats and cats); and
- Long term plant pest control, notably on-going monitoring and control of wildling pines.

How this land is fenced and surveyed from the existing farm operations will require further negotiations with the landowner, the Gwavas Crown Forest Licensor and Licensee and DOC. For example, part of the northern portion of the land which is currently in pasture (c. 24.7 ha refer to Figure 16), will be used as an exchange with Gwavas Crown Forest Licence, so access to this area through the beech forest separating the existing plantation forest and the exchange area would be required. The proposed corridor crosses a small stream gully and covers an area of c. 0.41 ha, and would require the clearing of 0.39 ha of SEB black beech forest, of which 0.13 ha would be beech forest found to be of high ecological value. The clearing of this beech forest area, especially clearing of the ecologically highly valuable component, is however not a preferred option due to the associated ecological impact on the valuable indigenous vegetation in this area, but would be required under the current Gwavas Forest Exchange Land negotiations. In order for the access corridor to connect up to existing forestry roads additional clearing of indigenous forest vegetation outside the SEB property boundary would also be necessary.

Fence lines will have to follow most practical routes, meaning that some areas of pasture would be included in any exchange, and some areas of indigenous vegetation may be left out. The fence line will also be extended to the south along the newly formed lake to include the nominal 20 m buffer area as part of the Scheme's offset package, and this may also be suitable for inclusion in the exchange. Figure 16 also shows the indicative fence line route. Thought should also be given to creating public access to the block, particularly from the newly formed lake, as there are a number of opportunities for public access, with many flat areas and glades found in the beech treeland habitats adjacent to streams in the northern portion, as well as viewpoints along the western ridge.

Table 11: Areas (ha) of different vegetation / habitat types for potential DOC land exchange (based on the indicative fenceline layout as shown in Figure 16.

Vegetation / Habitat Type	Area (ha) SEB vegetation type suitable for DOC exchange
1 - black beech forest	33.31
10 - broadleaf scrub	1.42
14 - broadleaf-small-leaved scrub	13.74
15 - small-leaved-broadleaf scrub	32.16
19 - beech-small-leaved treeland	2.95
22 - black beech treeland	9.95
25 - broadleaf-small-leaved-shrubland	19.36
26 - small-leaved-broadleaf shrubland	5.68
3 - podocarp-black beech/broadleaf forest	3.12
31 - podocarp-broadleaf-small-leaved shrubland/seep zone	0.45
51 - bracken-grass land	0.08
Grand Total	122.22

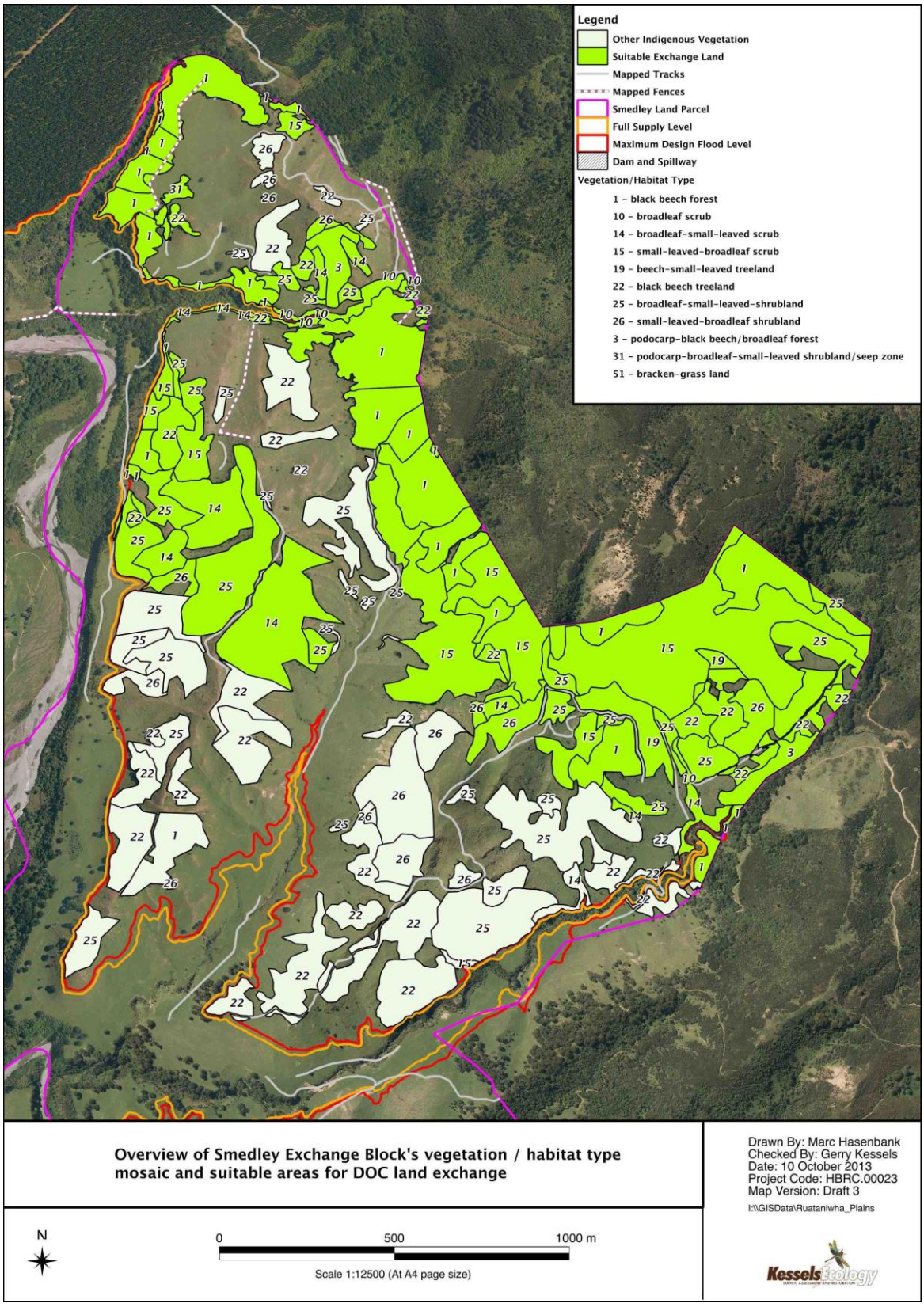

Figure 15: Potential DOC exchange land within the Smedley Exchange Block.

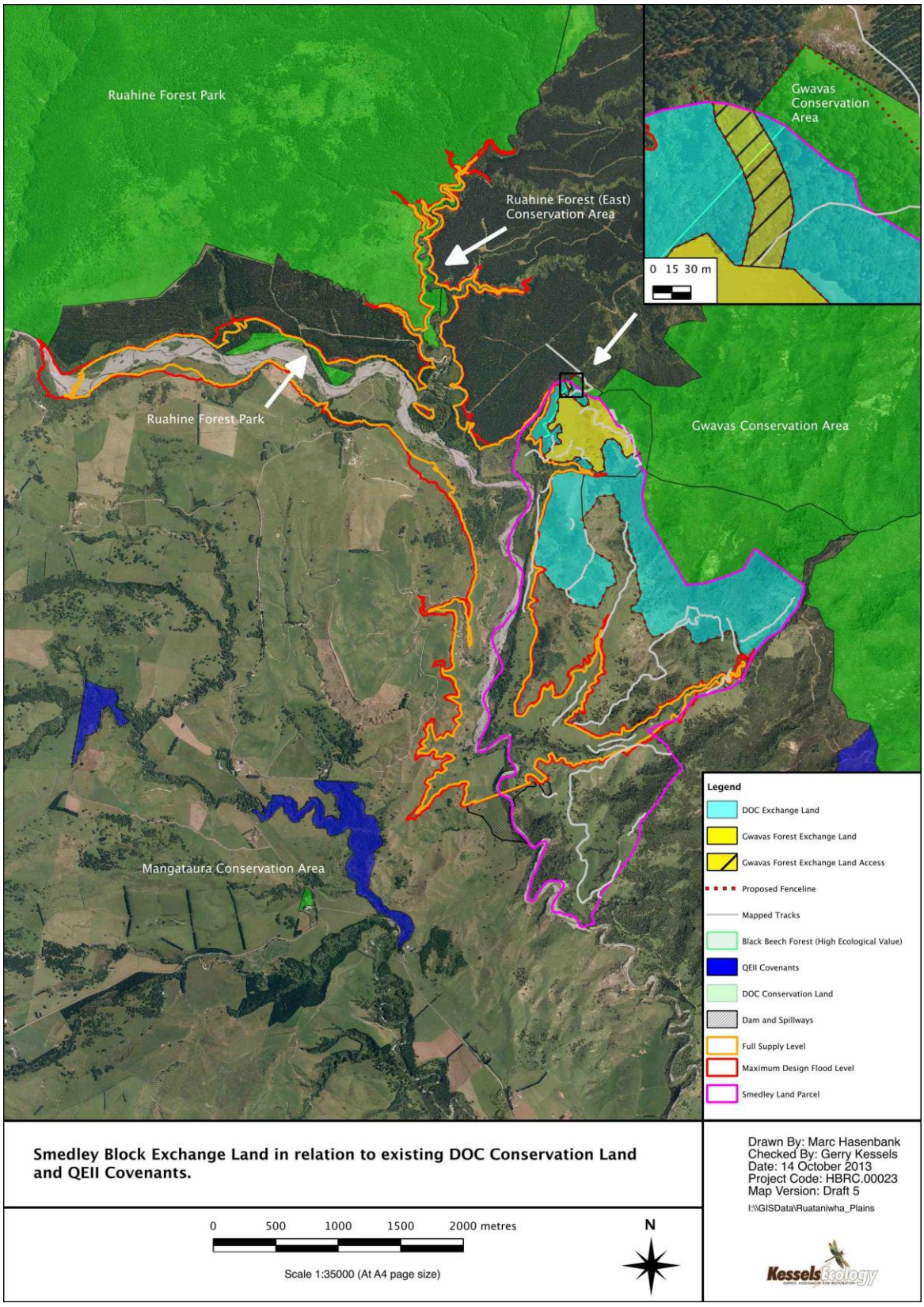

Figure 16: Indicative layout of the SEB Exchange Block in relation to existing DOC land, QEII covenants and the proposed lake.

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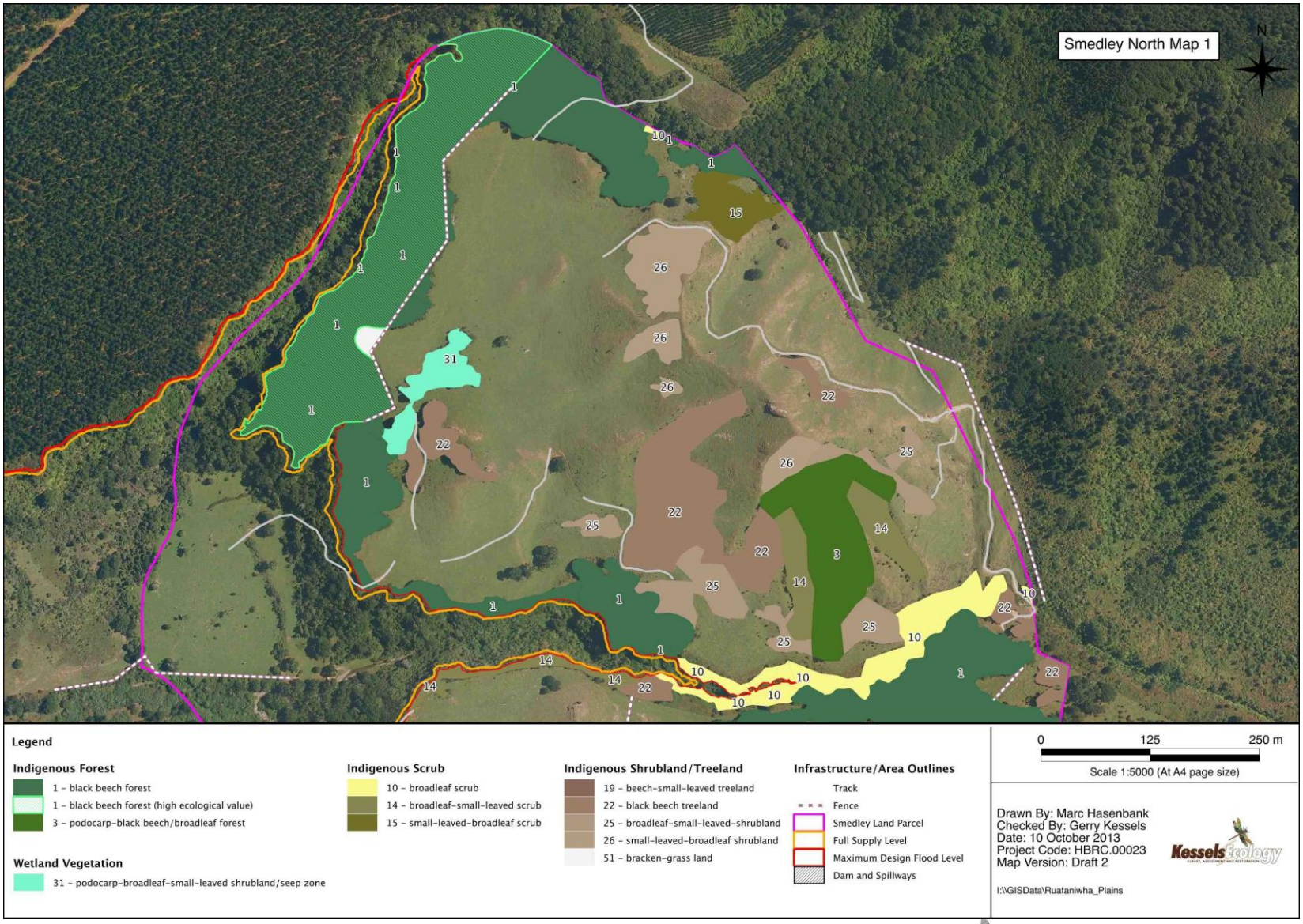
6 Appendix

6.1 Vascular Plant Species List

Species code	Scientific name	**Threat Classification** (deLange et al. 2009)
ACAmic	*Acaena microphylla*	Not threatened
ARIser	*Aristotelia serrata*	Not threatened
ASPbul	*Asplenium bulbiferum*	Not threatened
ASPfla	*Asplenium flaccidum*	Not threatened
ASPpol	*Asplenium polyodon*	Not threatened
AST sp.	*Astelia sp.*	Not threatened
BLEcha	*Blechnum chambersii*	Not threatened
BLEflu	*Blechnum fluviatile*	Not threatened
BLEnov	*Blechnum novae-zelandiae*	Not threatened
BLEpen	*Blechnum penna-marina*	Not threatened
BRArep	*Brachyglottis repanda*	Not threatened
BUDdav	*Buddleja davidii*	Not threatened
CARser	*Carpodetus serratus*	Not threatened
CLE sp.	*Clematis sp.*	Not threatened
COPgra	*Coprosma grandifolia*	Not threatened
COPluc	*Coprosma lucida*	Not threatened
COPpro	*Coprosma propinqua*	Not threatened
COPrha	*Coprosma rhamnoides*	Not threatened
COPrig	*Coprosma rigida*	Not threatened
COProb	*Coprosma robusta*	Not threatened
COProt	*Coprosma rotundifolia*	Not threatened
COPten	*Pittosporum tenuifolium*	Not threatened
CORaus	*Cordyline australis*	Not threatened
CORT sp.	*Cortaderia sp.*	Not threatened
CORY sp.	*Corybas sp.*	Not threatened
CYTsco	*Cytisus scoparius*	Not threatened
DACcup	*Dacrydium cupressinum*	Not threatened
DACdac	*Dacrycarpus dacrydioides*	Not threatened
DACglo	*Dactylis glomerata*	Not threatened
DIAnel	*Dianella sp.*	Not threatened
DICfib	*Dicksonia fibrosa*	Not threatened
DIGpur	*Digitalis purpurea*	Not threatened
ELAden	*Elaeocarpus dentatus*	Not threatened
FICnod	*Ficinia nodosa*	Not threatened
FUCexc	*Fuchsia excorticata*	Not threatened
GENlig	*Geniostoma ligustrifolium*	Not threatened
GENrup	*Geniostoma rupestre*	Not threatened
GRI sp.	*Griselina sp.*	Not threatened
HEBstr	*Hebe stricta*	Not threatened
HELlan	*Helichrysum lanceolatum*	Not threatened
HOHsex	*Hoheria sexstylosa*	Not threatened
HOLlan	*Holcus lanatus*	Not threatened
HYD sp.	*Hydrocotyle sp.*	Not threatened

HYMsan	*Hymenophyllum sanguinolentum*	Not threatened
JUN sp.	*Juncus sp.*	Not threatened
KUNeri	*Kunzea ericoides*	Not threatened
LEPhym	*Leptopteris hymenophylloides*	Not threatened
LEPjun	*Leptecophylla juniperina*	Not threatened
LEUfas	*Leucopogon fasciculatus*	Not threatened
LOBang	*Lobelia angulata*	Not threatened
MELram	*Melicytus ramiflorus*	Not threatened
MELsim	*Melicope simplex*	Not threatened
METcol	*Metrosideros colensoi*	Not threatened
MICpus	*Microsorum pustulatum*	Not threatened
MYCmur	*Mycelis muralis*	Not threatened
MYRaus	*Myrsine australis*	Not threatened
NES sp.	*Nestegis sp.*	Not threatened
NOThet	*Notogrammitis heterophylla*	Not threatened
NOTsol	*Nothofagus solandri*	Not threatened
OLEran	*Olearia rani*	Not threatened
Paspet	*Passiflora petandra*	Not threatened
PENcor	*Pennantia corymbosa*	Not threatened
PHOten	*Phormium tenax*	Not threatened
PITten	*Pittosporum tenuifolium*	Not threatened
PNEpen	*Pneumatopteris pennigera*	Not threatened
PODtot	*Podocarpus totara*	Not threatened
POLves	*Polystichum vestitum*	Not threatened
POLwaw	*Polystichum wawranum*	Not threatened
PRUfer	*Prumnopitys ferruginea*	Not threatened
PRUtax	*Prumnopitys taxifolia*	Not threatened
PRUvul	*Prunella vulgaris*	Not threatened
PSEarb	*Pseudopanax arboreus*	Not threatened
PSEaxi	*Pseudowintera axillaris*	Not threatened
PSEcra	*Pseudopanax crassifolius*	Not threatened
PSElan	*Pseudopanax lanceolatus*	Not threatened
PTE sp.	*Pteridium sp.*	Not threatened
PYRele	*Pyrrosia eleagnifolia*	Not threatened
RANrep	*Ranunculus repens*	Not threatened
RAUano	*Raukaua anomalus*	Not threatened
RUBcis	*Rubus cissoides*	Not threatened
RUBfru	*Rubus fruticosus*	Not threatened
RUBsch	*Rubus schmidelioides*	Not threatened
SALcin	*Salix cinerea*	Not threatened
SCHdig	*Schefflera digitata*	Not threatened
SOPmic	*Sophora microphylla*	Not threatened
THElon	*Thelymitra longifolia*	Not threatened
TRIrep	*Trifolium repens*	Not threatened
URTinc	*Urtica incisa*	Not threatened
UNC sp.	*Uncinia sp.*	Not threatened

6.2 Maps showing Vegetation / Habitat Types


Smedley North Map 1
N
Legend
Indigenous Forest
1 – black beech forest
1 – black beech forest (high ecological value)
3 – podocarp–black beech/broadleaf forest
Wetland Vegetation
31 – podocarp–broadleaf–small–leaved shrubland/seep zone
Indigenous Scrub
10 – broadleaf scrub
14 – broadleaf–small–leaved scrub
15 – small–leaved–broadleaf scrub
Indigenous Shrubland/Treeland
19 – beech–small–leaved treeland
22 – black beech treeland
25 – broadleaf–small–leaved–shrubland
26 – small–leaved–broadleaf shrubland
51 – bracken–grass land
Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
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125
250 m
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Checked By: Gerry Kessels
Date: 10 October 2013
Project Code: HBRC.00023
Map Version: Draft 2
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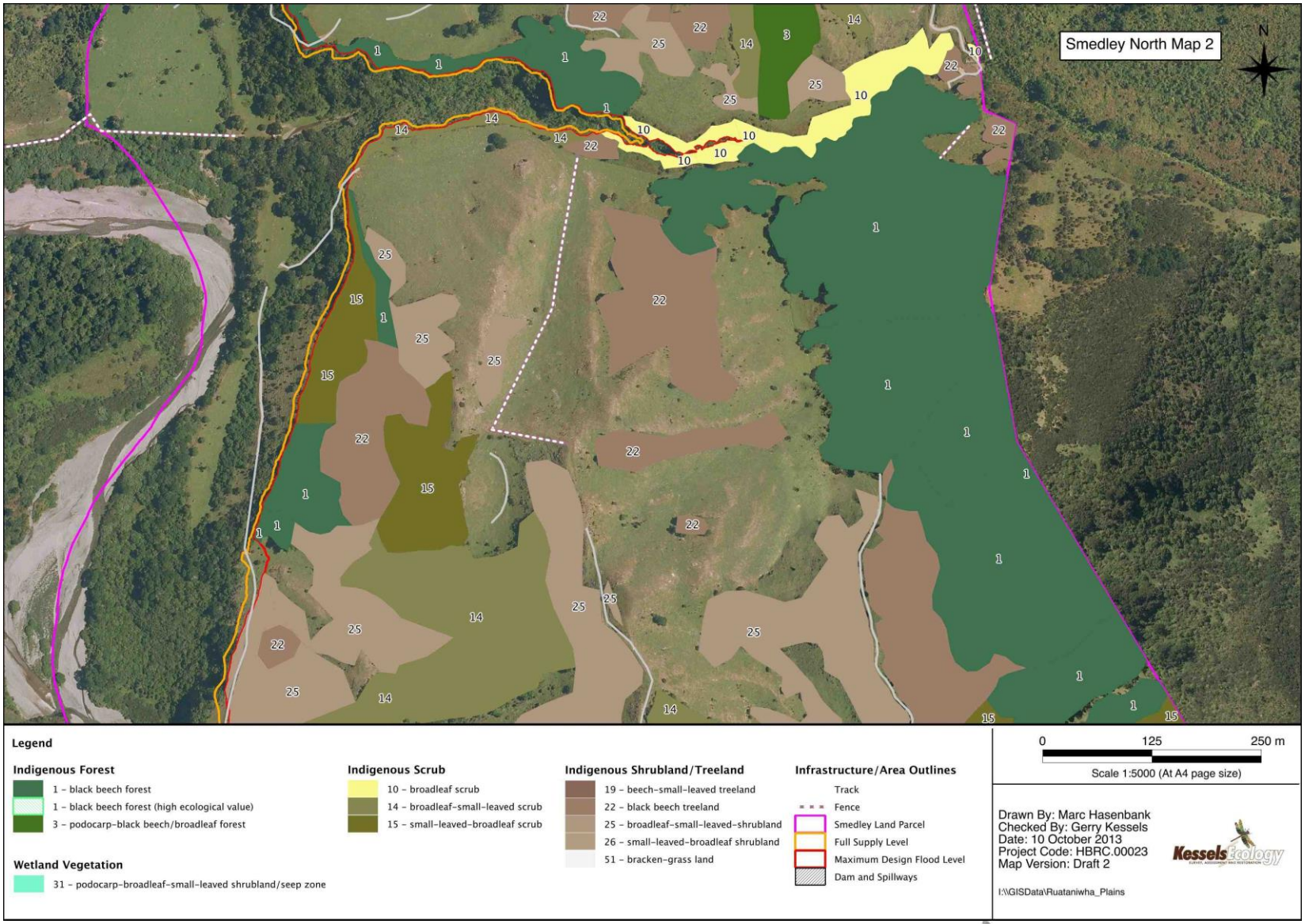
Smedley North Map 2
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Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
0 125 250 m
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Drawn By: Marc Hasenbank
Checked By: Gerry Kessels
Date: 10 October 2013
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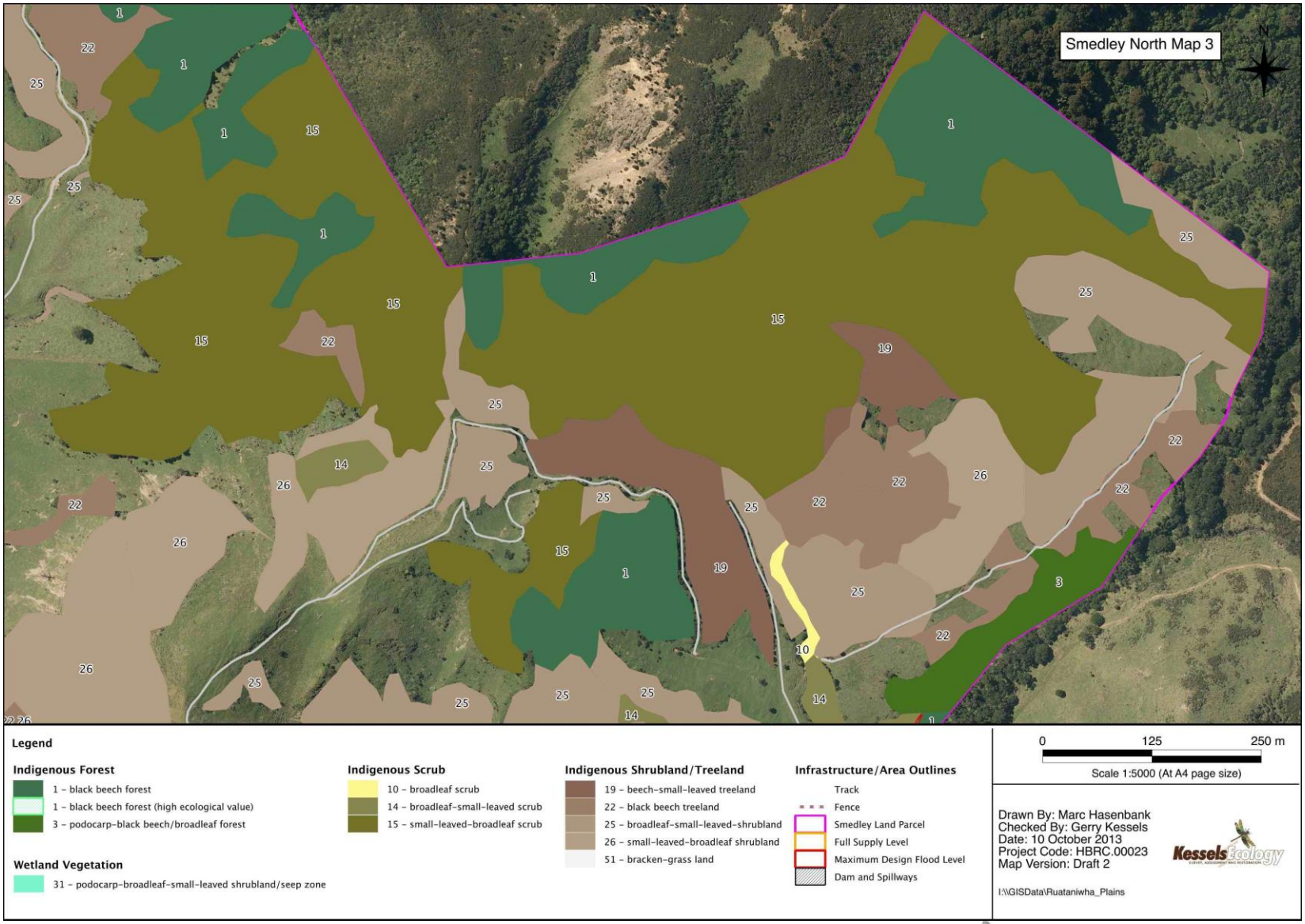
Kessels Ecology


Smedley North Map 3
N
Legend
Indigenous Forest
1 – black beech forest
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3 – podocarp–black beech/broadleaf forest
Wetland Vegetation
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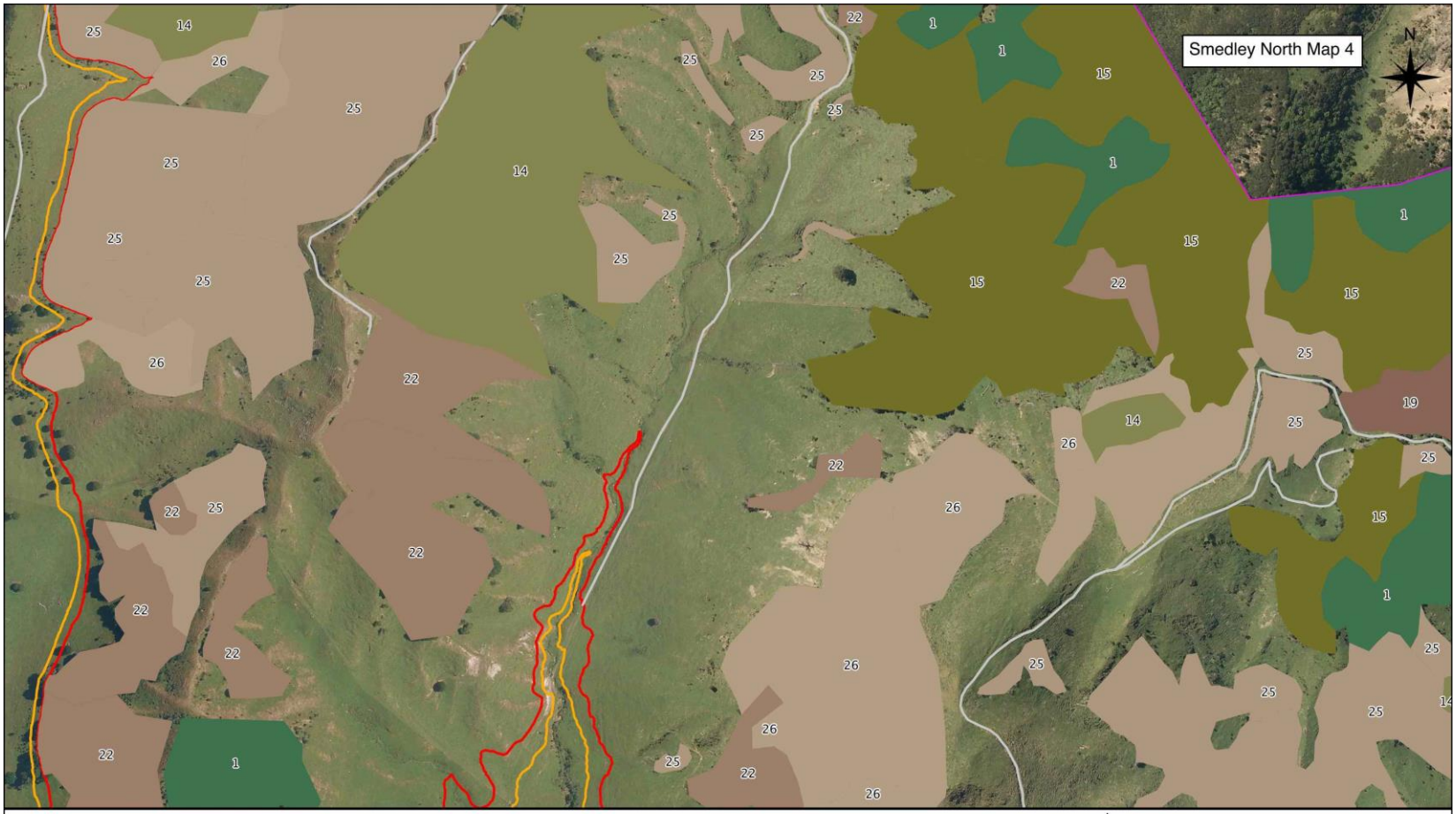
19 – beech–small–leaved treeland
22 – black beech treeland
25 – broadleaf–small–leaved–shrubland
26 – small–leaved–broadleaf shrubland
51 – bracken–grass land
Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
0
125
250 m
Scale 1:5000 (At A4 page size)
Drawn By: Marc Hasenbank
Checked By: Gerry Kessels
Date: 10 October 2013
Project Code: HBRC.00023
Map Version: Draft 2
I:\\GISData\Ruataniwha_Plains
Kessels Ecology


Smedley North Map 4
N
Legend
Indigenous Forest
1 – black beech forest
1 – black beech forest (high ecological value)
3 – podocarp–black beech/broadleaf forest
Wetland Vegetation
31 – podocarp–broadleaf–small–leaved shrubland/seep zone
Indigenous Scrub
10 – broadleaf scrub
14 – broadleaf–small–leaved scrub
15 – small–leaved–broadleaf scrub
Indigenous Shrubland/Treeland
19 – beech–small–leaved treeland
22 – black beech treeland
25 – broadleaf–small–leaved–shrubland
26 – small–leaved–broadleaf shrubland
51 – bracken–grass land
Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
0 125 250 m
Scale 1:5000 (At A4 page size)
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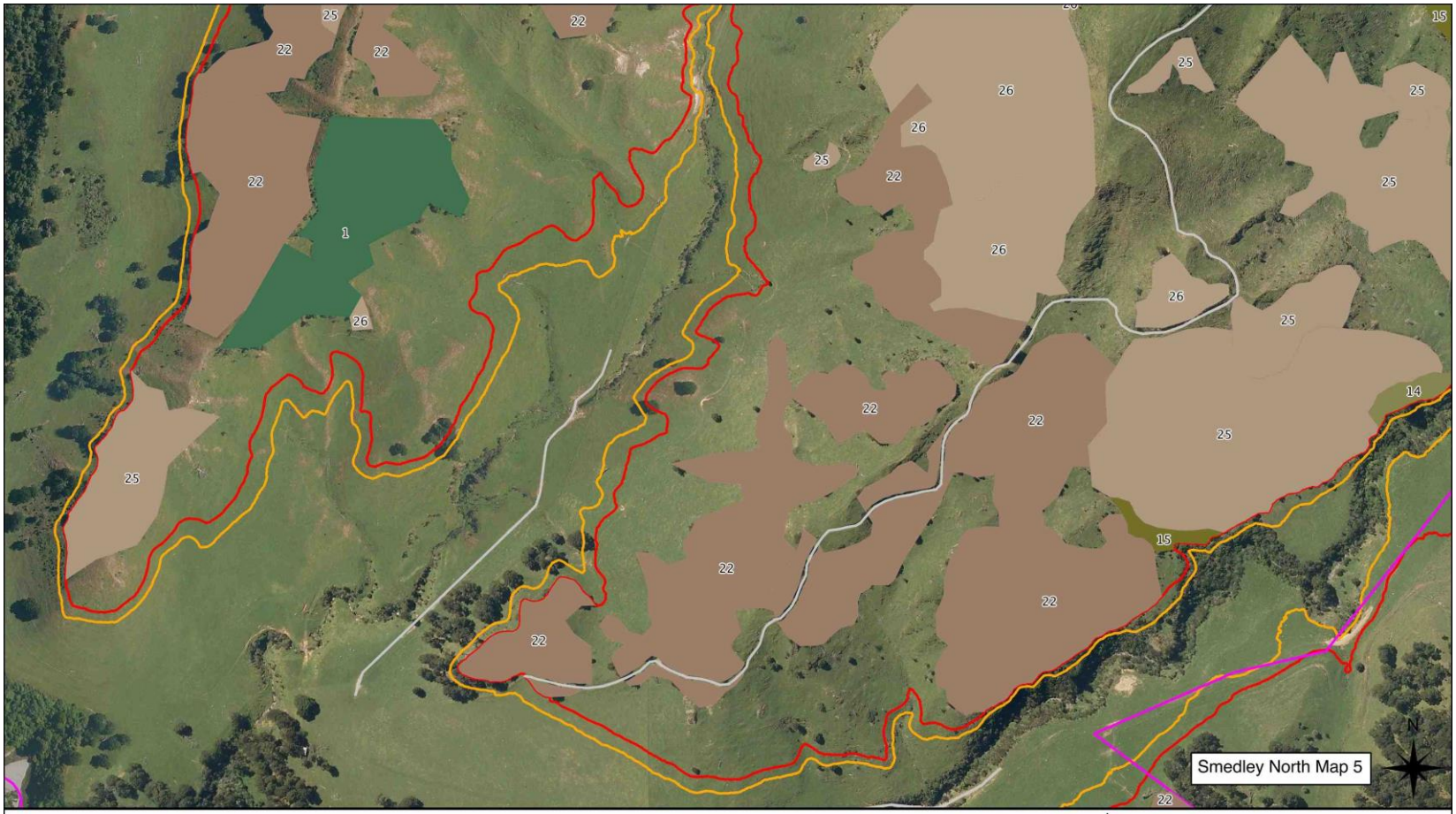
Smedley North Map 5
N
Legend
Indigenous Forest
1 – black beech forest
1 – black beech forest (high ecological value)
3 – podocarp–black beech/broadleaf forest
Wetland Vegetation
31 – podocarp–broadleaf–small–leaved shrubland/seep zone
Indigenous Scrub
10 – broadleaf scrub
14 – broadleaf–small–leaved scrub
15 – small–leaved–broadleaf scrub
Indigenous Shrubland/Treeland
19 – beech–small–leaved treeland
22 – black beech treeland
25 – broadleaf–small–leaved–shrubland
26 – small–leaved–broadleaf shrubland
51 – bracken–grass land
Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
0
125
250 m
Scale 1:5000 (At A4 page size)
Drawn By: Marc Hasenbank
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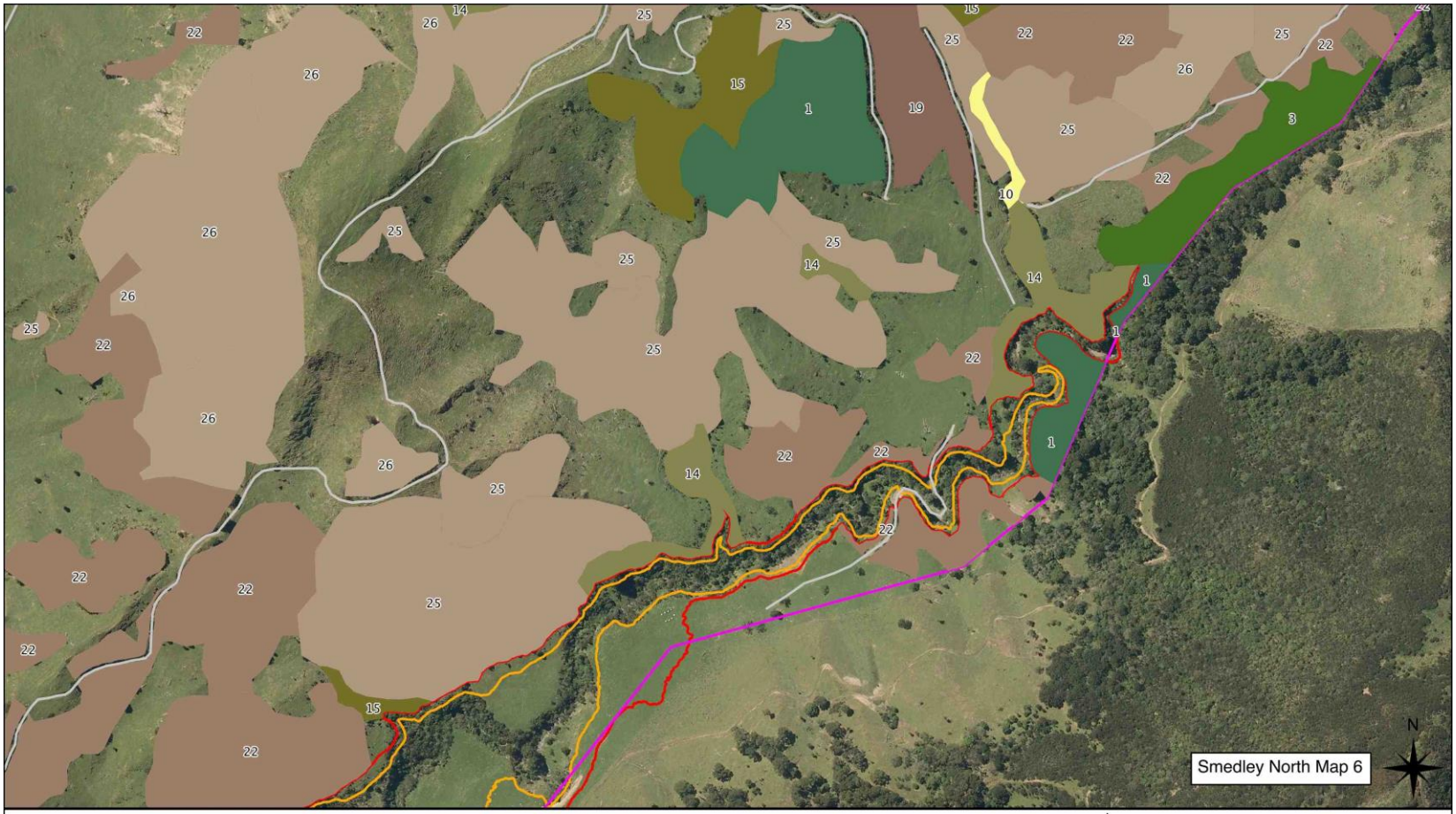
I:\\GISData\Ruataniwha_Plains
Kessels Ecology


Smedley North Map 6
N
Legend
Indigenous Forest
1 – black beech forest
1 – black beech forest (high ecological value)
3 – podocarp–black beech/broadleaf forest
Wetland Vegetation
31 – podocarp–broadleaf–small–leaved shrubland/seep zone
Indigenous Scrub
10 – broadleaf scrub
14 – broadleaf–small–leaved scrub
15 – small–leaved–broadleaf scrub
Indigenous Shrubland/Treeland
19 – beech–small–leaved treeland
22 – black beech treeland
25 – broadleaf–small–leaved–shrubland
26 – small–leaved–broadleaf shrubland
51 – bracken–grass land
Infrastructure/Area Outlines
Track
Fence
Smedley Land Parcel
Full Supply Level
Maximum Design Flood Level
Dam and Spillways
0 125 250 m
Scale 1:5000 (At A4 page size)
Drawn By: Marc Hasenbank
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Date: 10 October 2013
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Kessels Ecology