

SOILS AT 278 CLEVEDON – KAWAKAWA ROAD, CLEVEDON

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Supplied to Tim Grace (Lands & Survey Ltd) and Stuart Ford (Agribusiness Group)

At request of Mr Doug Scherning (Stratford Properties Limited)

Purpose and scope

Stratford Properties Limited has requested an independent assessment of soils on part of a farm at 272 - 278 Clevedon - Kawakawa Bay Road near Clevedon. The owner wishes to develop rural housing on the property at 278 Clevedon – Kawakawa Road (Lot 1 DP 146882, 52.0 hectares) by subdividing 11 countryside living lots plus a common lot (cumulatively 7.68 hectares) close to the road frontage, amalgamating 1.13 hectares with the adjoining property at 272 Clevedon – Kawakawa Road, while retaining the balance of the land (43.19 hectares) as part of the working farm.

The land is presently zoned Rural – Rural Coastal by the Auckland Unitary Plan - Operative in Part (AUPOiP). The statutory approval process that is being adopted for this project involves a private plan change request to rezone the land at 274 Clevedon – Kawakawa Road and parts of the land at 272 and 278 Clevedon – Kawakawa Road from Rural – Rural Coastal Zone to Rural – Countryside Living Zone and extend the Clevedon Sub Precinct C over this land and a subsequent resource consent application for the subdivision of 278 Clevedon-Kawakawa Road to create the 11 countryside living lots, balance farm lot and balance lot to be amalgamated with 272 Clevedon - Kawakawa Road. The resource consent application is being prepared on the basis that the land at 272, 274 and 278 Clevedon- Kawakawa Road will be zoned Rural Countryside Living and the Clevedon Sub Precinct C will apply to this land.

Specific matters on which Stratford Properties Limited seek independent advice about soil are:

- What soils are present on the property at 278 Clevedon – Kawakawa Road.
- What are the land use capability classes of the soils, using the latest definitions of land use capability class.
- Whether soils would be classified as elite, prime and other under the definitions used in the Auckland Unitary Plan - Operative in Part.

The assessment has been prepared by Dr. Douglas Hicks, a semi-retired soil scientist who has some 42 years' career experience, which includes 25 years mapping soils and land use capability (1994 – 2018).

Method

On 16 November 2018 I entered all paddocks on the property. Soil identifications were made at 64 dug holes, augered holes or other inspection points e.g. cuttings and drain banks, close to landform boundaries where changes were likely, and also at intermediate positions. Soil properties (topsoil depth; topsoil and subsoil colour; texture, structure, consistence and moisture retention in topsoil and upper subsoil) were visually observed and recorded at each hole i.e. standard procedure as described in the Soil Description Handbook (Milne et al 1995). To assist land use capability classification of the soils, landform boundaries were mapped. Underlying geology, surface soil, and other relevant physical features - slope, site wetness, and erosion or deposition (if any) - were noted for each landform i.e. standard procedure as described in the Land Use Capability Handbook (Lynn et al 2009). Figure 1 is the resulting 1:5,000 map. Table 1 summarises the match between soil, other physical features, and land use capability.

What soils are present at the property (Figure 1)

Definition of soil names

Soil names for the Clevedon area appear on the 1:20,000 Manukau S-map, a digital version of DSIR Soil Bureau's maps. This was prepared in 2012 by Landcare Research re-labelling the Manukau City Soil Map before entering it into digital storage on LRIS (its public-access geographic information portal). New labels on the digital version are soil family names and sibling numbers (from other parts of the country in some instances) which were assigned by a semi-automated computer matching process. The confidences attached to revised S-map labels are statistical confidences derived from field-checking soil at randomly selected points throughout the former Manukau City area (much of which remains rural). While in many instances they indicate that reliability is high to medium, my field investigations on several properties suggest S-map's reliability remains low on a proportion of the map polygons.

The Manukau City Soil Map is a 1:20,000 map compiled by DSIR Soil Bureau (Purdie et al 1981). Sheet B7 covers the area east of Clevedon. It is based on earlier field investigations of soil by DSIR Soil Bureau staff through the 1960s - 1970s. During these investigations, existing soil names from old small-scale DSIR maps were adapted, and several new soil names were defined. The names remain in ongoing use amongst local soil scientists when identifying, sampling, or mapping soils on Auckland's rural outskirts. Additional descriptions e.g. sandy loam, silt loam (shallow), clay loam (mottled), may be appended to a soil name, to describe any variations observable on-site. Planners and consultants generally use the same names, when supplying published (and unpublished) information about soil properties to local landowners. Accordingly I retain the DSIR's nomenclature for my map of 278 Clevedon – Kawakawa Road.

Assignment of soil names

Figure 1 shows that the soils on the property are:

Ka = Karaka loam

Ka' = Karaka loam (shallow topsoil)

Kam = Karaka loam (mottled)

Wps = Whatapaka sandy loam

Wpg = Whatapaka sandy loam (gleyed) with clay subsoil

Cl = Clevedon silt loam with clay subsoil (incl. weathered gravel)

Cl' = Clevedon silt loam (shallow topsoil)

Clm = Clevedon silty clay loam (mottled)

Ha = Hauraki clay loam

Ham = Hauraki clay loam (mottled)

Hag = Hauraki clay (gleyed)

Hay = Hauraki peaty clay (raw)

Wm = Whangamaire silt loam

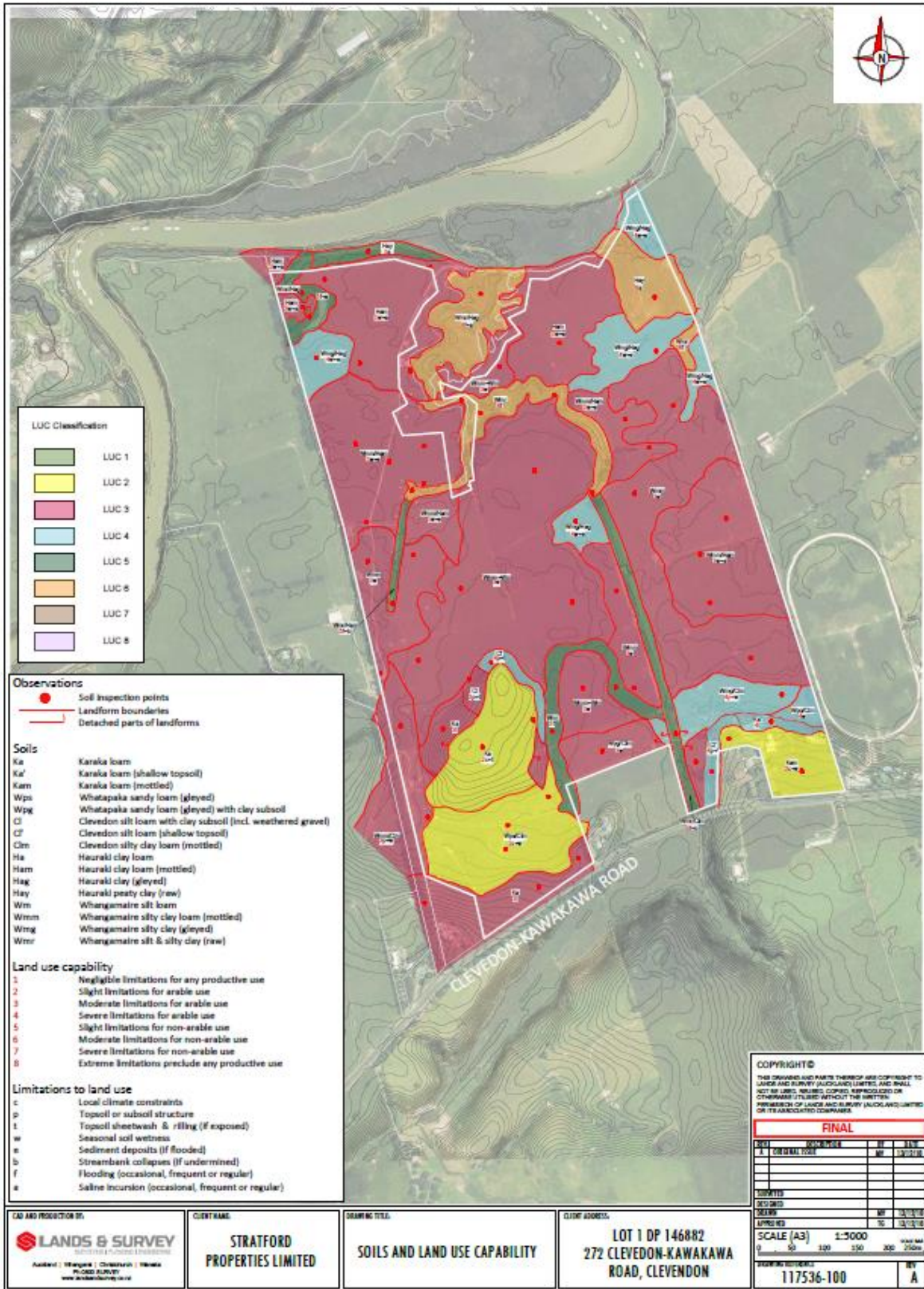
Wmm = Whangamaire silty clay loam (mottled)

Wmg = Whangamaire silty clay (gleyed)

Wmr = Whangamaire silt & silty clay (raw)

Areas in yards or along farm tracks, stock races and drains where soil has been re-contoured, are included with surrounding soil because they retain enough of their soil properties for a name to apply.

Figure 1: Soil map of Stratford Properties' proposed rural subdivision



What are the land use capability classes of the soils (Table 1 and Figure 1)

Definition of land use capability class

Current definitions are given in the Land Use Capability Handbook (Lynn et al 2009):

Class 1 : the most versatile multiple-use land with minimal physical limitations for arable use.

Class 2 : very good land with slight physical limitations to arable use, readily overcome by management and soil conservation practices.

Class 3 : land (which) has moderate physical limitations to arable use. These limitations restrict the choice of crops and the intensity of cultivation, and/or make special soil conservation practices necessary.

Class 4 : land (which) has severe physical limitations to arable use. These limitations substantially reduce the range of crops which can be grown, and/or make intensive soil conservation (and management) necessary.

Class 5 : high producing land with physical limitations that make it unsuitable for arable cropping, but only negligible to slight limitations or hazards to pastoral, vineyard, tree crop or production forestry use (except where flood-prone).

Class 6 : land (which) is not suitable for arable use, and has slight to moderate limitations and hazards under a perennial vegetation cover ... erosion is commonly the dominant limitation, but it is readily controlled by appropriate soil conservation ...

Deciding land use capability sub-classes

Table 1 summarises the decision-making process for land use capability classification of each area on the map (Figure 1). Two land use capability classifications are given : LUC classes, sub-classes and units as defined for South Auckland (Walsh 1977, Jessen et al 1984). These appear on the 1:50,000 New Zealand Land Resource Inventory (NZLRI) maps which are used for indicative regional-scale planning. Each NZLRI polygon (map area) indicates LUC class for the majority of land within its boundary. To support planning applications for individual properties, NZLRI LUC usually needs to be re-mapped in greater detail and at larger scale, to ascertain where better (or worse) LUC classes are present on parts of the polygons. As an independent check, Table 1 also contains FARM LUC. These are equivalent land use capability classes and sub-classes, introduced for farm-scale (1:5,000 - 1:10,000) soil maps of Auckland in recent years (Hicks and Vujcich 2017). FARM LUC sub-classes assigned to the property are:

c Denotes that natural limitations for horticulture and cropping are minimal except for any climate constraints to crop growth.

p Denotes that topsoil or subsoil structure limits cultivation.

t Where there is a slight risk of topsoil erosion (undulating land), a t sub-class is added to c or p. On a few areas where there is moderate risk of topsoil erosion (rolling land) or the risk is severe (strongly rolling), just a t sub-class is retained, denoting that topsoil erosion risk becomes a primary limitation if land is cultivated or if pasture is depleted by over-grazing.

w Where wetness limitation is slight (slow to imperfectly-draining subsoil) a w sub-class is added to c or p. On areas where wetness limitation becomes moderate (imperfectly draining subsoil) or severe (impeded drainage), just a w sub-class is retained denoting that subsoil wetness becomes a primary limitation to cultivation and crop growth; and seasonally to pasture growth.

e Where sediment is deposited by infrequent (less than annual) floods, an e sub-class is added to w, denoting that sediment deposits are an additional limitation.

f Where proximity to low-gradient streams or drains creates flood risk (occasional, frequent or regular), a f sub-class is substituted for w+e, to denote that floods preclude horticulture and cropping, and (from time to time) will limit grazing.

b Denotes risk of stream bank scour or collapse (also applies to steep drain banks).

a Denotes saline incursion risk, either through subsoil or across the surface of land close to tidewater.

Table 1: Land use capability classification of soils at Stratford Properties Limited proposed rural subdivision

Karaka soil on undulating high terraces and terrace edges (airfall ash over weathered stream sediment)

Soil texture	Drainage class	Slope	Erosion/depositi on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC at
loam	free to slow	flat to undulating	negligible	2s4	1 c
with clay subsoil (mottled)	slow to imperfect	flat to undulating	negligible	2s4	2 c+w
loam	free to slow	undulating	slight sheetwash	2e4	2 c+t
with shallow topsoil	free to slow	rolling	moderate sheetwash	3e5	3 t
with shallow topsoil	free to slow	strongly rolling	severe sheetwash	-	4 t

Whatapaka soil in basins (water-sorted ash over weathered stream sediment)

Soil texture	Drainage class	Slope	Erosion/depositi on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC at
sandy loam with pale subsoil	free to slow	undulating to flat	slight sheetwash	incl in 2s4 or 2e4	2 c+w
with clay subsoil (mottled)	imperfect	undulating to flat	slight sheetwash	incl in 2s4 or 2e4	3 w
with clay subsoil (gleyed)	impeded	undulating to flat	slight sheetwash	incl in 2s4 or 2e4	4 w

Clevedon soil on terrace edges and footslopes (weathered stream sediment)

Soil texture	Drainage class	Slope	Erosion/deposition on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC
silt loam	slow to imperfect	rolling	moderate sheetwash	3e7	3 p+t
with shallow topsoil	slow to imperfect	strongly rolling	severe sheetwash	-	4 p+t
silt loam	slow	flat to undulating	negligible	2s5	2 p+w
silty clay loam (mottled)	imperfect	flat to undulating	negligible	3s5	3 p+w
silty clay (gleyed)	impeded	flat to undulating	negligible	-	4 p+w

Hauraki soil on low flats (from estuary sediment)

Soil texture	Drainage class	Slope	Erosion/deposition on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC
clay loam	slow	flat	slight deposition	2w3	2 w+a
clay loam (mottled)	imperfect	flat	slight deposition	3w2	3 w+a
clay (gleyed)	impeded	flat	slight deposition	-	4 w+a
gleyed or peaty clay (raw)	saline incursion, drained	undulating	moderate deposition	5w1	5 a, 5 f+a
gleyed or peaty clay (raw)	saline incursion, semi-drained	undulating	severe deposition	6w1	6 a, 6 f+a

Whangamaire soil on low flats (from stream sediment)

Soil texture	Drainage class	Slope	Erosion/deposition on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC
silt loam	slow	flat	slight deposition	2w4	2 w
silty clay loam (mottled)	imperfect	flat	slight deposition	3w3	3 w
silty clay (gleyed)	impeded	flat	slight deposition	4w3	4 w
mottled, Clevedon or Hauraki soil	imperfect	flat	moderate deposition	incl in 3w3	3 p+w, 3 w+e
gleyed, Clevedon or Hauraki soil	impeded	flat	moderate deposition	incl in 4w3	4 p+w, 4 w+e

Whangamaire soil in floodways (from stream sediment), as complex with Clevedon or Hauraki soil on stream & drain banks

Soil texture	Drainage class	Slope	Erosion/deposition on risk	NZLRI (re-mapped at 1:5000)	LUC FARM LUC
silt or silty clay (raw)	occasional flooding	undulating	severe deposition	5w1	5 f
other soil on banks		rolling to strongly rolling	slight bank-collapse		5 b
silt or silty clay (raw)	regular to frequent flooding	undulating	severe deposition	6w1	6 f
other soil on banks		steep	moderate bank-collapse		6 b

Assessment of matters relevant to determining whether soils would be classified as elite, prime and other

Land containing elite soil

If the soil and land use capability map (Figure 1) is considered in terms of the matters referred to in the AUPOiP's definition of land containing elite soil, there is no soil labelled in Figure 1 as LUC class 1 sub-class c:

- well-drained, friable and well-structured soil (if “well-drained” is intended to denote naturally free-draining soils, and “well-structured” is intended to denote soils with crumb or granular structure suited to cultivation);
- flat or gently undulating; and
- capable of continuous cultivation.

The areas of elite soil total 0 hectares, 0 % of the land on the property.

Land containing prime soil

If the soil and land use capability map (Figure 1) is considered in terms of the matters referred to in the AUPOiP's definition of land containing prime soil, the sites where Karaka and Whatapaka soils are labelled in Figure 1 as LUC class 2 subclass c+w, or as LUC class 2 subclass c+t, are:

- versatile soils adapted to a wide range of agricultural uses;
- have good drainage (if “good drainage” is intended to denote naturally slow-draining soils);
- have readily available water (in the technical sense that given rain or irrigation, soils retain enough water for plant root uptake and crop growth);
- have favourable topography (if “favourable topography” is intended to mean easily cultivable slope); and
- have favourable climate (if “favourable climate” is intended to mean local climate enables a wide range of horticultural crops to be grown).

The areas of prime soil total 6.03 hectares, 11.6 % of the land on the property.

Land containing other soil (i)

Sites where Karaka soil has more slope (labelled in Figure 1 as LUC class 3 subclass t); where Clevedon, Hauraki, Whatapaka or Whangamaire soils have poorer drainage (labelled as LUC class 3 subclasses w, w+e, w+a, p+w); and where Clevedon soil has rolling slope (LUC class 3 subclass p+t) meet some but not all the criteria in AUPOiP's definition of land containing prime soil. Here the soils require greater care when cultivating to avoid sheetwash (when Karaka soil is exposed on rolling slopes), compaction or pugging (when Clevedon, Hauraki, Whatapaka or Whangamaire soil is exposed on footslopes or basins or elevated flats), and both (when Clevedon soil is seasonally wet on rolling slopes).

The soils at such sites:

- are less versatile than prime soil (horticultural crops would struggle, but grain or forage crops could be grown if rotated with pasture);
- have either a slope angle which is difficult to cultivate;
- or imperfect drainage which restricts cultivation windows;
- or protracted waterlogging which reduces crop growth;
- despite having the same local climate (favourable for horticulture) as adjacent soils.

On other sites where the same soils meet all criteria in AUPOiP's definition, they can be - and are - designated prime. Here they cannot, because they just meet some but not all the prime soil criteria, so must be designated other. These areas of other soil (i) total 35.10 hectares, 67.5 % of the land on the property.

Land containing other soil (ii)

Small areas of Karaka soil with strongly rolling slope (labelled in Figure 1 as LUC class 4 subclass t); Whatapaka or Whangamaire soil with impeded drainage (labelled as LUC class 4 subclass w+e); and Clevedon soil with strongly rolling slope (LUC class 4 subclass p+t) do not meet the AUPOiP definitions of elite or prime soil. Nor is Whangamaire soil in watercourse bottoms together with associated Clevedon or Hauraki soils exposed in watercourse or drain banks (labelled as LUC classes 5 or 6, sub-classes f, f+b, f+a). The soils at these sites:

- are not versatile (horticultural crops would not grow on the Whatapaka or Whangamaire soils at wet sites);
- have natural soil drainage which is impeded (restricts cultivation window);
- have seepages or standing water in surface depressions (reduces crop growth);
- or have bottoms which are too flood-prone and banks which are too steep to cultivate;
- despite having the same local climate (favourable for horticulture) as adjacent soils.

Here soils must be designated other because they meet none of the prime soil criteria in AUPOiP's definition. Such areas of other soil (ii) total 10.87 hectares, 20.9 % of the land on the property.

Elite, prime and other soils within the proposed countryside living lots

The proposed subdivision plan for 278 Clevedon – Kawakawa Road shows eleven countryside living lots collectively 5.46 hectares, a twelfth 2.22 hectare lot to be held in common, a thirteenth 1.1 hectare lot to be amalgamated with adjoining rural property and a fourteenth 43.19 hectare balance lot to be retained for rural production. As the balance (Lots 13 and 14) will continue to be used for productive purposes the areas of soil on Lots 1 to 12 which would cease to be used for rural production are:

- elite 0.00 hectares;
- prime 4.80 hectares (Whatapaka sandy loam over Clevedon silty clay loam 2 c+w, Karaka loam 2 c+t);
- other (i) 2.37 hectares (Karaka loam 3t, Whangamaire silty clay loam plus patches Whangamaire silt loam 3w, Whangamaire silty clay loam over Clevedon silty clay loam 3 p+w, Clevedon silt loam 3 p+t); and
- other (ii) 0.52 hectares (Clevedon silt loam 4 p+t, Whangamaire silt and silty clay 5f).

Summary

Figure 1 is a map which extends across all land at 278 Clevedon – Kawakawa Road. It identifies the soils throughout, based on a wide distribution and great density of inspection holes. The map also indicates that each soil's land use capability varies from site to site across the property.

Table 1 assesses the soils' land use capability by reference to other site characteristics which enter into the classification process (landform, underlying geology, slope, site wetness, risk of erosion or deposition, flooding, saline incursion), as well as soil properties. It verifies NZLRI LUC classes by cross-checking them with FARM LUC classes which are now used for property-scale maps in the Auckland region.

Section 3 analyses each soil (given its land use capability on different sites) in terms of the definitions of land containing elite or prime soil in the Auckland Unitary Plan - Operative in Part. It demonstrates that:

- 0% of the land on Lot 1 DP 146882 has elite soil, in terms of the AUPOiP definition.
- 11.6% of the land has prime soil which meets all criteria in the AUPOiP definition. 2.4 % would remain available for farming after the subdivision and development enabled by the proposed plan change has taken place. The original percentage equates to 6.03 hectares and the residual percentage would equate to 1.23 hectares. A separate assessment by Mr Stuart Ford confirms that neither area suffices to support a viable horticultural enterprise.
- 67.5% of the land has other soil (i) which meets some but not all the criteria for prime soil in AUPOiP's definition. 62.9% of the other soil (i) would remain available for farming after the subdivision and development enabled by the proposed plan change has taken place. This other soil (i) has moderate to severe limitations for any type of

horticulture, though is capable of occasional grain or fodder cropping. It has slight to moderate limitations for growing pasture and grazing livestock. The original percentage equates to 35.10 hectares and the residual percentage would equate to 32.73 hectares.

- 20.9% of the land has other soil (ii) which does not meet the AUPOiP definitions. 19.9% of the other soil (ii) would remain available for farming after the subdivision and development enabled by the proposed plan change has taken place. The other soil (ii) has moderate to severe limitations for growing pasture and grazing livestock. Its original percentage equates to 10.87 hectares and the residual percentage would equate to 10.35 hectares.

If the subdivision and development enabled by the proposed plan change takes place - creating 5.46 hectares of Countryside Living lots plus a 2.22 hectare common lot - the net residual area of prime, other soil (i) and other soil (ii) available for farming will be 44.32 hectares.

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