A review of high class soils in the Waikato District

Prepared by:

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Prepared for:

Waikato District Council

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Date: August 2020
Status: Final

CITATION:
Hill, R.B. (2020). A review of high class soils in the Waikato District. Report for Waikato District Council. Waikato District Council. Ngaruawahia.

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Contents

Executive Summary

Brief
Landsystems have been contracted to provide technical soils expertise to support The Waikato District Plan (Stage 1) review. A specific task is the provision of this report to support the Planner's S42A report) to Council recommending a preferred approach for the proposed District Plan provisions.

This report draws on existing national and regional literature on high class soils and land fragmentation as well as Waikato district data (primarily for the Rural Zone) provided through GIS analysis provided by Waikato District Council.

Defining high class soils
The notified version of Stage 1 of the Proposed Waikato District Plan defines high class soils as:
...those soils in Land Use Capability Classes I and II (excluding peat soils) and soils in Land Use Capability Class IIIe1 and IIIe5, classified as Allophanic Soils, using the New Zealand Soil Classification.

This definition aligns with the high class soils definition in the Waikato Regional Policy Statement[1]. The Waikato Regional Policy Statement definition includes soils on LUC class 1, 2 and 3, with some exclusions that are seen as relevant to the Waikato region.

Irrespective of the definitions used to identify high class soils the New Zealand Land Use Capability (LUC) Classification system plays a fundamental role in identifying high class soils throughout New Zealand and provides nationally accepted methods for assessing the presence of high class soils.

Proposed rules related to high class soils and land fragmentation

The following rules in the notified version of Stage 1 of the Proposed Waikato District Plan refer specifically to high class soils:

22.4.1.1 Prohibited subdivision

PR2 (a) Subdivision of a Record of Title issued prior to 6 December 1997, which results in more than one additional lot being located on high class soil.

PR3 (a) Subdivision of a Record of Title issued after 6 December 1997, which results in any additional lot being located on high class soil.

22.4.1.2 General subdivision

RD1 (v) Land containing high class soil (as determined by a Land Use Capability Assessment prepared by a suitably qualified person) must be contained within the boundaries of only two lots as follows:

A. one lot must contain a minimum of 80% of the high class soil; and

B. the other lot may contain up to 20% of high class soil.

Issues and trends

Throughout New Zealand there is increasing recognition of the loss of high-class land for rural use to urban uses[2,3,4].

In the Waikato district high class soils are estimated to occupy 62,383 ha in the Rural Zone (around 16.4%). This high class soil area also equates to around 20.8% of the high class soil in the Waikato region, and nationally, the high class soils in the Waikato district Rural Zone make up an estimated 4.5% of the national total.

For the Waikato region, the greatest amount of subdivision is occurring on the land with the higher productive capabilities (LUC classes 1, 2, 3 and 4).

The greatest amount of subdivision over the 2006-2013 census period has taken place in Waikato District (76% of the total subdivision).

Preliminary national land fragmentation indicator analyses estimated that the land area for

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[1] Waikato Regional Council (2018) Waikato Regional Policy Statement: Te Tauākī Kaupapahere Te-Rohe O Waikato. Waikato Regional Council, Hamilton.

[2] Fiona Curran-Cournane F, Golubiewski N, Buckthought L. (2018) The odds appear stacked against versatile land: can we change them? New Zealand Journal of Agricultural Research, 2018.

[3] Mackay AD, Stokes S, Penrose M, Clothier BE, Goldson SL, Rowarth JS. (2011) Land: competition for future use. New Zealand Science Review 68(2): 68–72.

[4] Rutledge DT, Price R, Ross C, Hewitt A, Webb T, Briggs C. (2010) Thought for food: impacts of urbanisation trends on soil resource availability in New Zealand. Proceedings of the New Zealand Grasslands Association 72: 241–246.

production in the Waikato region decreased by 11,998 ha between 2001 and 2017.

Although much of the residential expansion is in close proximity to existing urban areas, much of rural residential expansion is scattered throughout the rural area, having the potential to reduce the viability of the remaining productive land for land uses requiring larger areas (e.g. pastoral farming) and therefore is likely to impact on land versatility (i.e. reduce the range of potential future land uses).

Summary points

An analysis of titles in the Rural Zone with regard to rules related to high class soils in the notified version of Stage 1 of the Proposed Waikato District Plan indicated the following:

Number of titles:

Reducing the eligible titles for subdivision through increasing the minimum parent title size is likely to have a positive impact on the loss of high class soils (less direct loss through the creation of associated child lots) and potentially retaining larger land areas enabling a greater range of land use options (land versatility).

- Irrespective of a date restriction, increasing the minimum parent title size from 20 ha to 40 ha would reduce the number of eligible titles for subdivision by 1403 titles (-39%).

Removing the current date restriction (6th December 1997) increases the number of titles that are eligible for subdivision, potentially increasing the likelihood of land fragmentation in the rural zone with greater potential to impact on high class soils.

- For a minimum parent title size of 20 ha this increase would equate to an additional 1628 titles (+81%).
- Retaining the proposed date restriction of 6th December 1997 and increasing the minimum parent title size from 20 ha to 40 ha would reduce the number of eligible titles for subdivision by 821 titles (-41%).
- In comparison, removing the date restriction but increasing the minimum parent title size from 20 ha to 40 ha would reduce the number of eligible titles for subdivision by 1621 titles (-39%).
- Removing the date restriction would potentially increase the loss of land from production through the creation of child lots (irrespective of whether they are high class soils or not) from 944 - 3202 ha to 1782 - 5806 ha depending on the eventual child lot size and the minimum parent title size.

Loss of high class soil:

- Retaining the proposed date restriction of 6th December 1997 with a minimum parent title size of 20 ha, the loss of high class soil for a child lot is estimated at between 669 - 1338 ha. Increasing the minimum parent title size from 20 ha to 40 ha is likely to reduce high class soil loss by 303 – 605 ha.

- Removing the proposed date restriction of 6th December 1997 and high class soil restriction estimates that for a minimum parent title size of 20 ha, the loss of high class soil for a child lot is 1333 - 2666 ha. Under this scenario increasing the minimum parent title size from 20 ha to 40 ha is likely to reduce high class soil loss by 438 – 1076 ha.

- However, removing the date restriction and allowing subdivision irrespective of high class soil is likely to increase the loss of high class soil for all minimum parent title sizes, and the loss will be 235 – 471 ha greater for the 20 ha minimum parent title size (664 - 1328 ha) compared with the 40 ha minimum parent title size (429 - 857 ha).

An analysis of high class soil loss related to the use of a high class soil area % threshold applied to a child lot indicated that the smallest direct loss of high class soils from the creation of a child lot is likely to be achieved using a smaller lot size in combination with a lower high class soils area threshold.

Reducing the eligible titles for subdivision through increasing the minimum parent title size is likely to have a positive impact on the loss of high class soils (less direct loss through the creation of associated child lots) and potentially retaining larger land areas enabling a greater range of land use options (land versatility).

Based on the available data, the mechanisms for retaining productive land are best focussed on:

1. Retaining the date restriction (6th December 1997) on the number of eligible titles,
2. Increasing the minimum size of eligible titles for subdivision (the parent lot) from 20 ha to reduce subdivision density and reduce the direct loss of high class soils through child lots.

Based on the available data, the mechanisms for retaining high class soils are best focussed on:

1. Reducing the number of child lots,
2. minimising the size of child lots, and
3. directing the placement of child lots away from high class soils

The use of a high class soil area % threshold for child lots is considered practical from a mapping perspective if a property scale assessment is undertaken.

Accurate identification of high class soils at property scale (by a suitably qualified person) using the LUC Classification is required to accurately identify high class soils.

Recommendations

1. Retain the date restriction (6th December 1997) on the number of eligible titles to ensure that the density of subdivision is not increased such that it will reduce the viability of induvial land uses or the range of potential land uses, especially for land with high class soils.
2. Increase the minimum size of eligible titles for subdivision (the parent title) from 20 ha to 40ha:
    a. reduce the potential for the density of subdivision to reduce the viability of induvial land uses or the range of potential land uses, especially for land with high class soils, and
    b. reduce the area of high class soils lost to child lots through subdivision.
3. Minimising the size of child lots (to at least less than 2.0 ha) to minimise the loss of high class soils, either directly or indirectly through subdivision.
4. Direct the placement of child lots away from high class soils to avoid the direct loss of high class soils from production.

5. Use of a high class soil area % threshold for a child lot is deemed acceptable and would minimise the direct loss of high class soils through the creation of a child lot. Identification using property scale assessment should be used to determine the location and area of high class soils, and whether the percentage threshold requirement is met.
6. An acceptable high class soil area % threshold for a child lot is considered 15%, as this minimises the direct loss of high class soils through the creation of the child lot, allows some area for productive use or a safe building platform, and minimises the need for earthworks on the site that may increase the potential for erosion and ongoing sediment loss.
7. The existing NZLRI (1:50,000) scale LUC map information should not be used for property scale identification of high class soils but may be acceptable for the coarse identification of areas of high class soils, and district GIS analyses.
8. A property scale assessment using the LUC Classification is recommended for accurate identification of high class soils for individual properties and for determining the % area of high class soils present if a high class soil area % threshold approach is use.

1 Background

1.1 Introduction and Qualifications

My full name is Reece Blackburn Hill. I am a Director and Soil Consultant at BeatsonHill Limited trading as Landsystems.

I hold a Bachelor of Science with a double major in Biological Sciences and Earth Sciences from University of Waikato, a Master of Applied Science in Soil Science from Lincoln University, and a Doctor of Philosophy in Soil Science from Lincoln University. I have also completed a Correspondence Certificate in Wine from Eastern Institute of Technology.

I am a past President of the New Zealand Society of Soil Science (2014-2016).

I have three years' experience mapping forest soils in Tasmania, 19 years' experience as a Soil Scientist at Waikato Regional Council and six years' experience as a Soil Consultant at Landsystems, of which I have been full time in this role for the past 1.5 years.

I specialise in soil characterisation, soil mapping, land use capability assessment, regional soil policy, and catchment and land management. I have applied these skills in numerous projects within Waikato Regional Council and Landsystems, working with individual land owners including farmers and growers, regional and district council staff, Crown Research Organisations, Universities, and Ministry staff (MPI and MfE).

I have advised central government and district and regional councils throughout New Zealand in relation to soil management, land use capability, high class soils and the use of soil map information. This included regional council representation on the Land Use Capability Classification System (LUCCS) Governance Group.

I have undertaken property scale soil and Land Use Capability (LUC) assessments, and regional scale soil mapping in Waikato, Auckland, Bay of Plenty and Otago regions.

As part of my role at Waikato Regional Council, I was Lead Technical Writer for the Soils chapter (Chapter 14) of the Waikato Regional Policy Statement which became operative in 2016. Chapter 14 included a policy on High Class Soils (Policy 14.2).

As part of my Soil Scientist role at Waikato Regional Council, I have provided expert soil and land fragmentation advice to the Ministry for Primary Industries for the proposed National Policy Statement on Highly Productive Land (NPS-HPL).

I have complied with the Code of Conduct for Expert Witnesses contained in the Environment Court Consolidated Practice Note 2014. This evidence is within my area of expertise, except where I state that I am relying on another person, and I have not omitted to consider any material facts known to me that might alter or detract from the opinions I express.

1.2 Brief

Landsystems have been contracted to provide technical soils expertise to support The Waikato District Plan (Stage 1) review. A specific task is the provision of this report to support the Planner's S42A report) to Council recommending a preferred approach for the proposed District Plan provisions.

This report draws on existing national and regional literature on high class soils and land fragmentation as well as Waikato district data (primarily for the Rural Zone) provided through GIS analysis provided by Waikato District Council.

1.3 Note on the data used for analysis

The data used in the analyses in this report includes rural titles in district with exclusions. A summary of exclusions id provided below:

- Excludes the following :
  - Where Title estate description is Minerals, Coal or Clay.
  - Where Title type is Records Embodied in the Register, Supplementary Record Sheet, Gazette Notice, Life Estate or Unit.
  - Where Title type is cross lease and estate description does not contain a flat or house.
  - DOC land (Reserve_DOC).
  - Maaori land (Parcel_Maori_prog).
  - Where Title owners are Her Majesty the Queen, Council, or Land Information.
  - Where Title type is leasehold and owners are BT Mining Limited, Genesis Energy Limited, Housing New Zealand limited, Spark New Zealand Trading Limited, Telecom Mobile Limited, Transpower New Zealand Limited or Vodaphone New Zealand Limited.
- This is a snapshot of titles of August 2019.
- High Class Soils have been defined as those in: LUC 1 (excluding Organic Orders) + LUC 2 (excluding Organic Orders) + only Allophanic Orders from both LUC3e1 & LUC3e5.

Where the analysis has used date (pre 6th December 1997 and post 6th December 1997, titles with no date have been excluded.

2 Defining high class soils

2.1 Terminology

The term *high class soils* is used in the Waikato District Plan, consistent with the Waikato Regional Policy Statement. The notified version of Stage 1 of the Proposed Waikato District Plan defines high class soils as:

...those soils in Land Use Capability Classes I and II (excluding peat soils) and soils in Land Use Capability Class IIIe1 and IIIe5, classified as Allophanic Soils, using the New Zealand Soil Classification.

Other terms used to refer to high class soils include versatile soils and land, elite soils and land, and prime soils and land and highly productive land. Although there are subtle differences in the

meanings of each term, the underlying concept is the same. That is, reference to the most versatile soils or land.

Irrespective of the term used, the New Zealand Land Use Classification system (LUC) is most commonly used to identify and classify the most versatile soil and land throughout New Zealand.

The use of soil as opposed to land provides a more direct link to the RMA; Sections 5, 7, 30, 31 and 35, which refer to soil more than land;

- *safeguarding the life-supporting capacity of air, water, soil, and ecosystems, and avoid, remedy or mitigate any adverse effects of activities on the environment (Section 5).*

Land and soil are often used interchangeably[5]. In essence soil is a component of land, land including other factors other than just soil for example, climate, slope, susceptibility to erosion.

Dr Fiona Curran-Cournane's Statement of Evidence on behalf of Auckland Council[6] noted that it was important to distinguish between (elite and prime) 'land' and (elite and prime) 'soil' because there is a clear distinction. Elite and prime 'soil' refer specifically to the underlying soil type e.g. Patumahoe clay loam, elite whereas prime 'land' considers the soil, rock type, slope angle, erosion type and severity and vegetation cover.

In contrast the term 'productive' means the ability to produce and producing abundantly. Soil or land can be productive irrespective of its versatility, although the term "highly productive land has been used for high class soil and versatile land.

Both soil and land can then be described as "versatile" and/or "productive". In New Zealand, our best soils have been defined using a number of terms; "high-class", "high value", "high quality", "elite" or "fertile". All soil terms used encompass two important concepts that are based on the inherent properties of the soil; (i) the soils have few if any limitations for use and (ii) the soils can be used for a wide range of uses (they are versatile). Of these the terms "high-class", "high value", "elite" or "fertile", and productive have most commonly been used for our best land.

2.1.1 Versatile Soils

The best soils in New Zealand are referred to as "versatile" or "high-class" soils. Hewitt (2017)[7] states that, versatile soils are critical for the supply of nutrients required for optimum plant and food growth. A versatile soil is one that is:

"capable of many uses needs to be deep, fine-textured, moist, free-draining, loamy, and have organic-rich topsoil. These properties best enable plant roots to take up nutrients, water and oxygen, and get enough support for rapid growth. Fertility is highest in soils young enough not to have been leached and old enough to have built up organic matter. They are also derived from parent rocks that are well supplied with essential nutrients."

[5] Bloomer, D. (2011) Versatile Soils – Productive Land: Report for the Hawkes Bay Regional Council. Unpublished text.
[6] Statement of Evidence of Dr Fiona Curran-Cournane on behalf of Auckland Council (01 December 2014).
[7] Hewitt, A. 'Soils - What makes a good soil?', Te Ara - the Encyclopedia of New Zealand, http://www.TeAra.govt.nz/en/soils/page-9 (accessed August 2020).

2.1.2 Versatile Land

Versatile land is not limited to land that has versatile soils but instead it includes a number of different physical and social factors. Versatile land is "land which supports the production and management of a wide range of crops. It is characterised by certain soil and physical characteristics, which have few to no limitations (such as poor drainage, low soil nutrient status or slope instability).

In an agricultural context, versatile land is characterised by other factors as well such as its proximity to services and transport[8]. Environment Court Judge Treadwell[9] has provided an alternative definition of versatile land encompassing a broader range of factors including soil, climate, and water characteristics; transport and industrial services, labour; and other resources as well as absence of conflicts. These are all factors that need to be considered when identifying versatile land.

2.1.3 Highly productive land

The reference to "highly productive land" recognises there are other factors in addition to soil quality that determine the productive capacity of land for primary production. While most councils define highly productive soils based on the LUC (typically Classes 1–3 or 1–2), there are lower classes of LUC land (4–6) that can be highly productive.

The proposed National Policy Statement for Highly Productive Land (NPS-HPL) includes requirements for councils to identify highly productive land based on a set of defined criteria (soil capability, climate, and the size and cohesiveness of the area) with LUC Classes 1–3 being the default criteria that determines what is highly productive land for the purposes of the proposed NPS until this process has been undertaken[10]. The NPS-HPL describes productive in relation to highly productive land, as the physical qualities of the land to support primary production and generate the most economic output. This includes consideration of physical constraints on use of land for primary production (e.g. lot size, presence of structures and buildings) but does not include consideration of wider soil quality issues[11].

2.1.4 Productive capacity

Based on the Land Use Capability Survey Handbook 3rd Edition[12], productive capacity is determined by the physical qualities of the land, soil, and the environment. Limitations imposed by the physical qualities of the soil, and the environment affect productivity, the number and

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[8] Chapman, RK. (2010) Soil Assessment for the Kingseat Village Structure Plan site - May - 2010) Evidence submitted to Franklin District Council.

[9] Refer Canterbury Regional Council v Selwyn District Council, (1996) 2 ELRNZ 395.

[10] Ministry for Primary Industries (2019) Valuing highly productive land. A discussion document on a proposed national policy statement for highly productive land. MPI Discussion Paper 2019/05. Ministry for Primary Industries, Wellington.

[11] Ministry for Primary Industries (2019) Valuing highly productive land. A discussion document on a proposed national policy statement for highly productive land. MPI Discussion Paper 2019/05. Ministry for Primary Industries, Wellington.

[12] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.

complexity of corrective practices needed, and the intensity and manner of land use. Limitations include susceptibility to erosion, steepness of slope, susceptibility to flooding, liability to wetness or drought, salinity, depth of soil, soil texture, structure and nutrient supply and climate[13].

2.2 Land fragmentation

In a broad context, land fragmentation has four key fundamental characteristics that can change individually. These include:

1. **Cover** – physical changes (e.g. infrastructure) which affect the range of possible uses of the land resource.
2. **Title** – changes to the spatial distribution of rights to the land resource (e.g. by subdivision)
3. **Rights** – changes to the range of activities in connection with the land resource.
4. **Ownership** – changes in the person or people who have rights to the land resource.

In terms of high class soils, the characteristics of Cover and Title are most relevant; Cover will determine whether high class soils can be used for primary production, and Title can determine whether a land use option is viable.

There is no single common term or definition of land fragmentation is used across regional councils and unitary authorities[14]. A definition is provided by Hart et al. (2013)[15]:

Land fragmentation is the "division of a land resource that changes the current or future range of possible activities and thereby alters the actual or potential uses of that land resource across a number of scales"

In the Statement of Evidence of Dr Fiona Curran-Cournane on Behalf of Auckland Council[16], Dr Curran-Cournane referred to rural or land fragmentation as the on-going subdivision of rural land that leads to increasingly smaller land parcels and defined it as 'any division of a land resource that changes the current or future range of possible land uses'.

3 The importance of high class soils and versatile land

3.1 High class soils

By nature, high class soils are the best soils, suitable for a wide range of primary production uses (especially horticulture), with minimal need for management to overcome inherent soil limitations. Their minimal need for management to overcome inherent soil limitations is what

[13] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[14] Hart, G., Rutledge, D., Price, R. (2013) Guidelines for monitoring land fragmentation: review of knowledge, issues, policies and monitoring. Landcare Research, New Zealand.
[15] Hart, G., Rutledge, D., Price, R. (2013) Guidelines for monitoring land fragmentation: review of knowledge, issues, policies and monitoring. Landcare Research, New Zealand.
[16] Statement of Evidence of Dr Fiona Curran-Cournane on behalf of Auckland Council (01 December 2014).

separates them from other lesser soils. For example, the best of the high class soils (often referred to as elite soils) are the only soils that are capable of supporting intensive horticulture such as kiwifruit.
Throughout New Zealand there is increasing recognition of the loss of high-class land for rural use to urban uses[17,18,19]. High-class land has been defined by some practitioners as Land Use Capability (LUC) Classes 1-2 and other practitioners as LUC Classes 1-3. Class 1 (or elite land) is the most versatile, multiple use land on flat to undulating land. Classes 2 and 3 (or prime land) is also very good prime agricultural and horticultural land with slight (Class 2) or moderate (Class 3) physical limitations to arable use[20]. LUC Class 1-2 land represents 5% of total New Zealand land areas and Class 1-3 land represents 14%[21].

New Zealand horticulture has an industry value of $5.6 billion (excluding wine), with exports of $3.4 billion in value to 124 countries. Exports have increased in recent times (by 40 percent from June 2014 to 2016). The industry consists of 5,500 commercial fruit and vegetable growers employing an estimated 60,000 people nationally[22].

These operations are only suitable on multiple use, highly versatile land areas (high class soils). Rutledge et al. (2010) report that urbanisation disproportionately affects New Zealand's most high-class and productive soils which could have a negative impact on New Zealand's primary production capacity in the future[23].
In the Waikato region high class soils occupy an estimated 300,000 ha[24] (~23%) of land. In the Waikato district high class soils are estimated to occupy 62,383 ha in the Rural Zone (around 16.4%). This high class soil area also equates to around 20.8% of the high class soil in the Waikato region, and nationally, the high class soils in the Waikato district Rural Zone make up an estimated 4.5% of the national total. This are o high class soils is greater than for some regions in New Zealand (Gisborne, Tasman, Marlborough, Nelson and West Coast)[25].

3.2 Versatile land

The concept of versatile land is that the land remains viable for a range of land uses into the future. This includes land with high class soils, which compared to lesser soils can support a greater range of production types (land uses). It is important to note that removal of any land

[17] Fiona Curran-Cournane F, Golubiewski N, Buckthought L. (2018) The odds appear stacked against versatile land: can we change them? New Zealand Journal of Agricultural Research, 2018.
[18] Mackay AD, Stokes S, Penrose M, Clothier BE, Goldson SL, Rowarth JS. (2011) Land: competition for future use. New Zealand Science Review 68(2): 68–72.
[19] Rutledge DT, Price R, Ross C, Hewitt A, Webb T, Briggs C. (2010) Thought for food: impacts of urbanisation trends on soil resource availability in New Zealand. Proceedings of the New Zealand Grasslands Association 72: 241–246.
[20] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[21] Rutledge DT, Price R, Ross C, Hewitt A, Webb T, Briggs C. (2010) Thought for food: impacts of urbanisation trends on soil resource availability in New Zealand. Proceedings of the New Zealand Grasslands Association 72: 241–246.
[22] HorticultureNZ (2017) New Zealand domestic vegetable production: the growing story. HorticultureNZ, Wellington.
[23] Auckland Council Technical Report 2013/050
[24] https://www.waikatoregion.govt.nz/environment/environmental-information/environmental-indicators/land-and-soil/rural-subdivision-report-card/p5a-data/
[25] Rutledge DT, Price R, Ross C, Hewitt A, Webb T, Briggs C. (2010) Thought for food: impacts of urbanisation trends on soil resource availability in New Zealand. Proceedings of the New Zealand Grasslands Association 72: 241–246.

from production will result in a need for production on other land, or intensification of production on other land if total production is to be maintained. Loss of land with high class soils will also have a greater production loss "footprint" as either production will have to be intensified on land with high class soils or require a greater land area and management inputs on land with lesser class soils.

Therefore, it is essential that land with high class soils is assigned greater importance for production and retained in production. This will ensure sustainable production can be achieved, and that the soils available can support a range of production (land uses) nationally, regionally, and locally.

4 LUC Classification system for identifying high class soils

Irrespective of the definitions used to identify high class soils the New Zealand Land Use Capability (LUC) Classification system plays a fundamental role in identifying high class soils throughout New Zealand. For example, the Waikato regional Policy Statement defines high class soils using the LUC Classification and the New Zealand Soil Classification, as does the Waipā District Plan. Auckland Council's plan uses LUC Class in conjunction with specifically name soil types for identifying Elite and Prime land[26] and the proposed NPS-HPL uses LUC Class 1, 2 and 3 for identifying highly productive land.

4.1 Land use capability

Land use capability is defined in the Land Use Capability Handbook 3rd Edition[27] as *the land's properties that determine its capacity for long term sustained production*. The productive capacity of the land is determined by the physical qualities of the land, soil and environment and its limitations. Limitations include susceptibility to erosion, steepness of slope, susceptibility to flooding, liability to wetness or drought, salinity, depth of soil, soil texture, structure and nutrient supply and climate[28]. Increasing limitations reduce the land's versatility for use. These concepts are encapsulated in New Zealand's Land Use Capability Classification system.

Irrespective of how high class soils are defined, their identification and the mapping of high class soils is most commonly done using the LUC Classification system. The likely reasons for its use are that it is the only nationally complete land use classification layer, it is freely available and incorporates both soil map information and other land resource characteristics that define versatile land.

4.2 The New Zealand Land Use Capability Classification system

The New Zealand Land Use Capability (LUC) Classification is defined as,

[26] Auckland Plan 2050 (2018) Auckland Council, Auckland.
[27] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[28] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.

"a systematic arrangement of different kinds of land according to those properties that determine its capacity for long term sustained production. Capability is used in the sense of suitability for productive use after taking into account the physical limitations of the land."

The New Zealand Land Use Capability Classification system has two main components:

1. The **New Zealand Land Resource Inventory (NZLRI**) is a single layer, national, geospatial database containing an inventory of five key physical factors (rock, soil, slope, erosion, and vegetation) that define the suitability of land for sustainable use. Mapping units consist of land with similar physical characteristics. An inventory code records the physical factors for each mapping unit.
2. The **Land Use Capability (LUC) classification is an assessment of** the capacity of the land for long-term sustainable agricultural production.

The LUC Classification is a three level hierarchical classification system, comprising LUC Class, LUC Subclass, and LUC Unit.

LUC Class is the highest level. It classifies the land into eight main classes, based on increasing physical limitations and decreasing versatility for long-term agricultural uses (**Figure 1**).
Other information e.g. flood risk, climate, is used to support the LUC classification of the land.

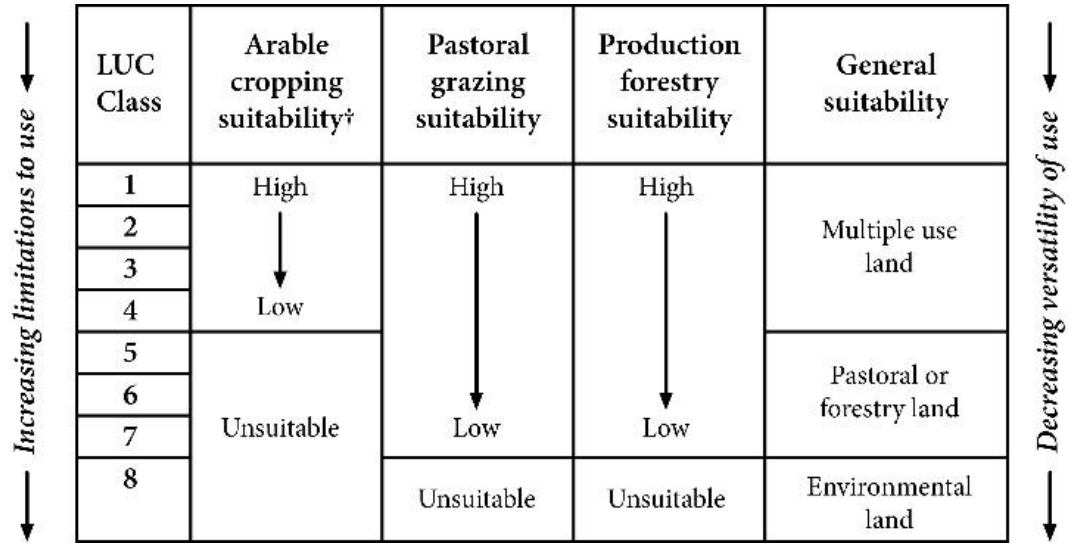

Figure 1. Increasing limitations to use and decreasing versatility of use from LUC Class 1 to LUC Class 8 (cited in Lynn et al., 2009).

Four **LUC Subclasses** – erosion (e), wetness (w), soil physical or chemical limitations (s), and climate (c) – are used to identify the dominant factor limiting sustainable agricultural production in each class.

LUC Unit is the 'management' level of the LUC classification. It is the most detailed mapping unit of the classification and comprises land with similar physical characteristics which would require the same kind of management and have similar production yields.

The revised **Land Use Capability Survey Handbook** (3rd Edition) sets out the methods and standards for undertaking LUC surveys at any scale[29].

4.3 Use of LUC for defining high class soils

The LUC Classification provides a nationally consistent way of defining high class soils. The main alternative approaches would be to (i) specify every soil, or (ii) use a mix of land and climate quality datasets that are overlaid in a geographic information system (GIS) to define high class soils[30]. Using specifically named soils does rely on a consistent soil naming protocol (soil classification) and complete district map coverage. Nationally and in the Waikato district, these are presently undergoing change. Soil Series are being replaced and remapped using S-Map[31] which uses a hierarchical classification based on the New Zealand Soil Classification[32]. The use of the LUC Classification at least as a basis for identifying high class soils, makes use of a nationally consistent, well tested classification. At present this is considered the best approach.

Until recently the later has not been possible due to the availability of regional data and the ability to overlay data in a GIS.

5 Definition of high class soils for Waikato district

The notified version of Stage 1 of the Proposed Waikato District Plan defines high class soils as:

...those soils in Land Use Capability Classes I and II (excluding peat soils) and soils in Land Use Capability Class IIIe1 and IIIe5, classified as Allophanic Soils, using the New Zealand Soil Classification.

This definition aligns with the high class soils definition in the Waikato Regional Policy Statement[33]. The Waikato Regional Policy Statement definition includes soils on LUC class 1, 2 and 3, with some exclusions that are seen as relevant to the Waikato region.

5.1 Exclusion of Organic (peat) Soils

The exclusion of Organic soils (often referred to as “peat soils”) is based on the premise that in the long term these soils are not sustainable under any productive land use. The LUC definition in the handbook states that any soil that can be permanently improved by management (such as drains to reduce the water table can be classified according to the improved soil and that LUC class assigned. An example of this are the Te Kowhai soils, which are often mapped as a complex with well drained Horotiu soils. Permanent drainage can improve the Te Kowhai soil’s drainage and

[29] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[30] Used by Tasman District Council (PLC).
[31] https://smap.landcareresearch.co.nz/
[32] Hewitt AE. (2010) New Zealand Soil Classification. 3rd ed. Landcare Research Science Series No. 1. Lincoln, Manaaki Whenua Press.
[33] Waikato Regional Council (2018) Waikato Regional Policy Statement: Te Tauākī Kaupapahere Te-Rohe O Waikato. Waikato Regional Council, Hamilton.

they are classed as LUC Unit 2w3 (i.e. they are high class soils). Without drains present these soils have a greater wetness limitation are classified as LUC class 3w or 4w (i.e. they are not high class soils).

In terms of Organic Soils, drainage schemes are considered viable over the medium term, but are not always considered permanent over the long term. This understanding is based on relatively new research and monitoring. We know that under any productive land use peat soils subside by about 1.85 cm per year[34]. Eventually this subsidence means that drainage schemes can no longer ensure the viability of the soils (and the classification as high class soils).

5.2 Exclusion of some LUC Class 3 soils

The intent is to specifically identify and protect Allophanic Soils (ash soils) on 8-15 degree slopes as these soils have the same qualities as ash soils on lesser slopes due to their texture, structure, and drainage, with only "slight" increase in erosion risk. These soils can still be used for intensive cropping (i.e. there is no real loss of versatility caused by increased slope). Compared with non Allophanic Soils (such as clay loams) which are not considered as versatile as they are not as well drained and can only be intensively cropped seasonally. LUC Class 3 Allophanic Soils are within LUC Units 3e1 and 3e5 but do not include all soils within these LUC units.

5.3 Other definitions

5.3.1 Auckland Council

Auckland Council have not used the term "high class soils", opting instead to use the terms Land containing elite soil, and Land containing prime soil.

The definitions are as follows:

Land containing elite soil
Land classified as Land Use Capability Class 1 (LUC1). This land is the most highly versatile and productive land in Auckland. It is:
• well drained,
friable, and has well structured soils;
• flat or gently undulating; and
• capable of continuous cultivation.

Includes:
• LUC1 land as mapped by the New Zealand Land Resource Inventory (NZLRI);
• other lands identified as LUC1 by more detailed site mapping;
• land with other unique location or climatic features, such as the frost free slopes of Bombay Hill;
• Bombay clay loam;
• Patumahoe clay loam;
• Patumahoe sandy clay loam; and

[34] Pronger J, Schipper LA, Hill RB, Campbell DI, and McLeod M. (2014) Subsidence Rates of Drained Agricultural Peatlands in New Zealand and the Relationship with Time since Drainage. Journal of Environmental Quality 43(4):1442-9.

• Whatitiri soils.

Land containing prime soil
Land identified as land use capability classes two and three (LUC2, LUC3) with slight to moderate physical limitations for arable use.

Factors contributing to this classification are:
• readily available water;
• favourable climate;
• favourable topography;
• good drainage; and
• versatile soils easily adapted to a wide range of agricultural uses.

Both definitions use the LUC classification and identify specific soil types in their definitions.

The level of protection for elite land and prime land in Auckland region is different. In summary the Hearings Panel recommended the protection of land containing elite soils from inappropriate subdivision, use and development.
The panel recommended that land containing prime soils should not be treated in the same way, due to the broad definition of prime soils in the proposed Auckland Unitary Plan and their wide geographic distribution across the region. In accepting the versatility of prime soils, recommended that it be protected where it is practicable to do so[35].

Relating this to the Waikato district, the definition of high class soils spans the Auckland region's definitions for elite and prime soils; there is no separate recognition of elite (LUC Class 1) and prime soils (LUC Classes 2 and 3).

5.3.2 Waipa District Council

The Waipa District Plan uses the term "high class soils". Their definition is as follows:
…means those soils of LAND USE capability classes I and II (excluding PEAT SOILS), and soils of LAND USE capability class IIIe1 and IIIe5 classified as Allophanic Soils using the New Zealand soil classification.
This definition is the same as that used for the Waikato region and proposed for the Waikato District.

5.3.3 NPS-HPL

The definition of highly productive land in the proposed NPS_HPL is based on the LUC classification system, but it provides flexibility for councils to identify highly productive land based on a range of considerations. When the proposed NPS comes into effect, the proposed default definition of highly productive land is land with LUC classification Class of 1, 2 or 3[36].
It is then proposed that regional councils will be required to identify highly productive land based on a range of considerations, to exclude some of this land or to identify other highly productive

[35] Report to Auckland Council Hearing topic 11 Rural environment July 2016.
[36] Ministry for Primary Industries (2019) Valuing Highly Productive Land - A discussion document on a proposed national policy statement for highly productive land. MPI. Wellington.

land. Regional councils will need to undertake this process, in consultation with their communities, within three years of the proposed NPS coming into effect[37].

6 Policy guidance

6.1 National Guidance

Under the Resource Management Act (RMA), local authorities (regional councils, unitary authorities, city/district councils) share responsibility for the sustainable management of natural and physical resources, which also encompasses the issue of land fragmentation (Hart et al., 2013).

Local authority responsibilities include:

- Providing for the people and communities' social, economic, and cultural wellbeing while sustaining the potential of natural and physical resources to meet the reasonably foreseeable needs of future generations (Section 5),
- safeguarding the life-supporting capacity of air, water, soil, and ecosystems, and avoid, remedy, or mitigate any adverse effects of activities on the environment (Section 5),
- giving particular regard to any finite characteristics of natural and physical resources (e.g. finite stocks of land or soil) (Section 7),
- establishing, implementing, and reviewing objectives, policies, and methods to achieve integrated management of natural and physical resources (Sections 30 and 31), and
- monitoring and assessing the impacts on the land resource to help ensure that resource management interventions (policy) are appropriate and effective in maintaining land and soil resources (Section 35).

Apart from the direction provided by the RMA, there is currently no national policy for the management of high class soils in New Zealand.

The Ministry for the Environment and the Ministry for Primary Industries have drafted a proposed National Policy Statement for Highly Productive Land (NPS-HPL). Submissions closed on 10 October 2019 and a final draft of the NPS-HPL is currently being prepared.

The proposed NPS-HPL will go to Ministers and Cabinet for approval, now most likely in early 2021. If approved, it would likely come into force in the first half of 2021. The proposed NPS-HPL follows a report known as 'Our land' 2018[38], which identified the pressures facing highly productive land; on the edge of towns and cities as the expansion of urban areas on the edges of towns and cities, and the, and the change of land-use on the fringes of urban areas, in particular the increase in lifestyle blocks.

[37] Ministry for Primary Industries (2019) Valuing Highly Productive Land - A discussion document on a proposed national policy statement for highly productive land. MPI. Wellington.
[38] https://www.mfe.govt.nz/sites/default/files/media/RMA/Our-land-201-final.pdf

The absence of considered decision making at regional and district government level was seen as contributing to urban expansion over highly productive land, as was a lack of clarity in the RMA on how to manage highly productive land.

The stated purpose of the NPS-HPL is to improve the way that highly productive land is managed under the RMA and to protect it from inappropriate use, development, or subdivision.
Local authorities will be required to identify highly productive land based on defined criteria, such as soil capacity, climate, water availability, and size. Land classified as Class 1-3 under the Land-Use Capability ("LUC") system will be highly productive land by default for a period of three years until regional authorities redefine and map highly productive land for their region. Regional councils must identify and map areas of highly productive land using the criteria set out in Appendix A of the NPS-HPL and amend their regional policy statements to identify areas of highly productive land within the region. Territorial authorities must amend their district plans to identify highly productive land identified by the relevant regional council.

6.1.1 Proposed definition of highly productive land

The definition of highly productive land in the proposed NPS is based on the LUC classification system, but it will provide flexibility for councils to identify highly productive land based on a range of considerations.
When the proposed NPS comes into effect, the proposed default definition of highly productive land is land with a LUC classification of Class 1, 2 or 3.
It is then proposed that regional councils will be required to identify highly productive land based on a range of considerations, including those set out in 2.3.3 above, to exclude some of this land, or to identify other highly productive land.
Regional councils will need to undertake this process, in consultation with their communities, within three years of the proposed NPS coming into effect. The main points relevant to high class soils are summarised in **Table 1**.

Table 1. A summary of the main points of the proposed NPS-HPL policy relevant to high class soils.

Summary point		Policy
Identification of HPL	Alignment with regional policy. Use the LUC classification as a basis for identifying HPL, also considering other factors such as climate and size and cohesiveness of the land. Identify HPL at property scale based on LUC classification.	Policy 1 and Policy 7.
Loss of HPL	Mainly around protecting against the loss of HPL from primary production. Protect against inappropriate subdivision into non primary productive uses.	Policy 2 and Policy 3.
Land fragmentation	Mainly based around retaining productive capacity and versatility of land use and avoiding reverse sensitivity.	Policy 4, Policy 5, and Policy 6.

6.1 Regional Guidance

6.1.1 Waikato RPS Objectives

The Waikato Regional Policy Statement[39] provides the regional guidance for managing high class soils. The Waikato Regional Policy Statement (WRPS) Objective 3.26 High class soils states:

The value of high class soils for primary production is recognised and high class soils are protected from inappropriate subdivision, use or development.

Objective 3.26 High class soils is achieved through Policy 14.2 High class soils. Policy 14.2 of the WRPS states:

Avoid a decline in the availability of high class soils for primary production due to inappropriate subdivision, use or development.

Two other RPS objectives and policies have some relevance for high class soils;

Objective 3.25 Values of soil
The soil resource is managed to safeguard its life supporting capacity, for the existing and foreseeable range of uses.

Policy 14.1 Maintain or enhance the life supporting capacity of the soil resource
Manage the soil resource to:
a) minimise sedimentation and erosion;
b) maintain or enhance biological, chemical and physical soil properties; and
c) retain soil versatility to protect the existing and foreseeable range of uses of the soil resource.

The relevance to high class soils is that the loss of high class soils (and other soils) could cause intensification on remaining soils which in turn could impact on the biological, chemical and physical soil properties of the soil (reducing soil quality) and reducing the existing and foreseeable range of uses of the soil resource.

Policy 14.5 Peat soils
Manage the adverse effects of activities resulting from use and development of peat soils, including by slowing the rate of subsidence and the loss of carbon by oxidation from peat soils.

The relevance of this policy to high class soils is that the subsidence of peat soils (even if the rate of subsidence is minimised) means that over the long term, they are not a sustainable soil resource. This is the basis for their exclusion in the definition of high class soils.

6.1.2 Waikato RPS definition of high class soil

High class soils – those soils in Land Use Capability Classes I and II (excluding peat soils) and soils in Land Use Capability Class IIIe1 and IIIe5, classified as Allophanic Soils, using the New Zealand Soil Classification.

[39] Waikato Regional Council (2018) Waikato Regional Policy Statement: Te Tauākī Kaupapahere Te-Rohe O Waikato. Waikato Regional Council, Hamilton.

6.1.3 Future Proof: Growth Strategy and Implementation

Future Proof is a growth strategy specific to the Hamilton, Waipā, and Waikato sub-region[40]. It aims to
manage growth in a collaborative way for the benefit of the Future Proof sub-region both from a community and a physical perspective. It provides a framework for ongoing co-operation and implementation to ensure the costs and resources required to fund and manage infrastructure such as
transport, wastewater, stormwater, recreation, and cultural facilities are provided for.

Future Proof discusses what the region might look like in 50 years' time, outlining the key influences and
drivers to ensure the region's long-term sustainability. It covers four key areas of development – residential development/settlement patterns, rural land, business and industrial, and retail and commercial
development - what might happen in those areas, and some of the timing involved.
Futureproof provides some basis for consistent policy for high class soils and land fragmentation across the districts that are part of Futureproof.

In the Waipā district (which is part of Future{ Proof and borders the Waikato district), the Waipa District Plan includes an Objective that identifies the importance of **reducing the fragmentation of rural land and retain rural land for production Rural fragmentation (Section 15[41]). They note that** this is particularly important to ensure that large lots are retained for a wide range of rural productive uses (15.2.8) and prevent an inefficient use of rural land (15.2.8).

7 Waikato District - Rural Zone policy

The notified version of Stage 1 of the Proposed Waikato District Plan was publicly notified on 18 July 2018. The Proposed Waikato District Plan provides issues, objectives, policies, and rules relating to the management of high class soils. Chapter 22: Rural Zone in the Proposed Waikato District Plan Stage 1 (Notified version) provides guidance for the management of high class soils in the Rural Zone. Issues relating to high class soils

1.4.3.2 Protecting the rural environment

1. The continued use of rural areas for productive rural activities and other land and soil resource-dependent rural-based activities, as well as access to and the extraction of mineral resources, are important to the economic health and well-being of the district and wider subregion. It is therefore necessary to ensure that the continued, effective operations of farming activities or productive rural activities are not adversely affected by lifestyle activities. A key focus is to ensure that the resource does not become so fragmented that its attraction for activities that require a rural setting is diminished.
2. Activities affecting landscape, historic and amenity values including rural character, recreational activities, high quality soils, significant mineral resources and ecological values need to be managed to avoid adverse effects on the environment, including cumulative effects. This should occur

[40] Section 32 Report Proposed Waipa District Plan - 31 May 2012.
[41] Waipa District Plan - Section 15 - Infrastructure, Hazards, Development and Subdivision.

through limiting the extent to which non-rural activities are able to establish in the Rural Zone. There is a need to uphold the increased level of control the Council has placed over subdivision activities in the Rural and Country Living Zones, particularly within the north Waikato and around the Hamilton City boundary. Any additional areas for rural residential development should be considered within identified growth areas of towns or villages. Non-rural activities must occur in towns, villages and defined growth areas, and the expansion of such areas should be managed so that adverse effects on rural areas are minimised.

3. In line with the Regional Policy Statement, the district plan must ensure that rural-residential built development is directed away from natural hazard areas, regionally significant industry, high class soils primary production activities on high class soils, electricity transmission, and locations identified as likely renewable energy generation sites and from identified significant mineral resources and their identified access routes.

7.1.1 Objectives relating to high class soils

5.1.1 Objective – The rural environment

Objective 5.1.1 is the strategic objective for the rural environment and has primacy over all other objectives in Chapter 5.

(a)Subdivision, use and development within the rural environment where:

(i) high class soils are protected for productive rural activities;

(ii)productive rural activities are supported, while maintaining or enhancing the rural environment;

(iii)urban subdivision, use and development in the rural environment is avoided.

5.2.1 Objective - Rural resources

(a)Maintain or enhance the:

(i)Inherent life-supporting capacity and versatility of soils, in particular high class soils;

(ii)The health and wellbeing of rural land and natural ecosystems;

(iii)The quality of surface fresh water and ground water, including their catchments and connections;

(iv)Life-supporting and intrinsic natural characteristics of water bodies and coastal waters and the catchments between them.

7.1.2 Policies relating to high class soils

5.2.2 Policy – High class soils

1. Soils, in particular High class soils, are retained for their primary productive value.
2. Ensure the adverse effects of activities do not compromise the physical, chemical and biological properties of High class soils.

5.2.3 Policy - Effects of subdivision and development on soils

1. Subdivision, use and development minimises the fragmentation of productive rural land, particularly where high class soils are located.
2. Subdivision which provides a range of lifestyle options is directed away from high class soils and/ or where indigenous biodiversity is being protected.

7.1.1 Rules relating to high class soils

The following rules in the notified version of Stage 1 of the Proposed Waikato District Plan relate to high class soils:

22.4.1.1 Prohibited subdivision

PR1	Any subdivision within the Urban Expansion Area involving the creation of any additional lot.
PR2	(a) Subdivision of a Record of Title issued prior to 6 December 1997, which results in more than one additional lot being located on high class soil. (b) Exceptions to PR2(a) are where an additional lot is created by any of the following rules: (i) The conservation lot subdivision (Rule 22.4.1.6); (ii) Reserve lot subdivision (Rule 22.4.1.7); (iii) Access allotment or utility allotment using Rule 14.12 (Transportation); (iv) Subdivision of Maaori Freehold Land (Rule 22.4.1.3).
PR3	(a) Subdivision of a Record of Title issued after 6 December 1997, which results in any additional lot being located on high class soil. (b) Exceptions to PR3(a) are where an additional lot is created by any of the following: (I)Conservation lot subdivision (Rule 22.4.1.6); (ii) Reserve lot subdivision (Rule 22.4.1.7); (iii)Access allotment or utility allotment using Rule 14.12 (Transportation); (iv) Subdivision of Maaori Freehold Land (Rule 22.4.1.3); (c) Rule PR3(a) does not apply to the following: (i) a boundary relocation or adjustment between Records of Title that existed prior to 6 December 1997; (refer to Rule 22.4.1.4); or (ii) a process other than subdivision under the Resource Management Act 1991.
PR4	(a) Any subdivision where a lot has been created for the purpose of a transferable rural lot subdivision under the provisions of the previous Operative Waikato District Plan – Franklin Section by either: (i) Amalgamation; or (ii) Re-survey.

22.4.1.2 General subdivision

RD1	(a) Subdivision must comply with all of the following conditions: (i) The Record of Title to be subdivided must have issued prior to 6 December 1997; (ii) The Record of Title to be subdivided must be at least 20 hectares in area; (iii) The proposed subdivision must create no more than one additional lot, excluding an access allotment. (iv)The additional lot must have a proposed area of between 8,000m^2 and 1.6 ha; (v) Land containing high class soil (as determined by a Land Use Capability Assessment prepared by a suitably qualified person) must be contained within the boundaries of only two lots as follows: A. one lot must contain a minimum of 80% of the high class soil; and B. the other lot may contain up to 20% of high class soil. (b) Council's discretion is restricted to the following matters: (i) subdivision layout and design including dimensions, shape, and orientation of the proposed lot; (ii) effects on rural character and amenity values; (iii) effects on landscape values; (iv) potential for reverse sensitivity effects; (v) extent of earthworks including earthworks for the location of building platforms and accessways.
NC1	General subdivision that does not comply with Rule 22.4.1.2. RD1.

8 Mapping high class soils

8.1 Use of LUC to map high class soils

Identifying areas of high class soils (or productive land) using maps has been adopted by territorial authorities and is proposed as part of the NPS-HPL. The most common approach to mapping high class soils is using LUC map information provided by the NZLRI (1:50,000 scale)[42]. The application of these maps for identifying high class soils has limitations, inherent in the maps (of GIS layers) available.

The regional LUC mapping was completed using the best available cartographic techniques at the time. Data from the 1st edition and early 2nd edition field sheets and aerial photographs was transferred onto transparent overlays of topographic maps, manually digitised and stored on the Ministry of Works and Development computer system[43]. Developments in technology since then facilitate the use of data such as LiDAR, and digital mapping techniques which greatly improve the spatial accuracy of map units[44].

The smallest mappable unit on the 1:50,000 scale LUC maps is 10 ha[45]. For sub-property management decisions this is not *fit for purpose*[46], and property scale (finer scale) mapping of high class soils is required to accurately identify the presence and location of the high class soils.

8.2 Effect of map information scale and quality

A soil map shows the spatial distribution of soils for an area. Maps are usually based on field soil observations and the assessment of other related environmental data such as topography, geology, geomorphology, vegetation, land cover, and climate[47].

Map scale is the ratio of the size of a feature on a map compared with the size of the feature on the ground. For example, at 1:20,000, 1 cm on the map represents 200 m on the ground. A detailed scale map (e.g. 1:500 to 1:15,000) enables identification of short-range spatial changes in soils, whereas a broad-scale map shows less detail (i.e. > 1:25,000 scale) can used for catchment and regional planning but cannot be used for site specific (property scale) management. This is

[42] https://lris.scinfo.org.nz/layer/48076-nzlri-land-use-capability/
[43] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[44] MPI 2018. Use of modern technology including LiDAR to update the New Zealand Land Resource Inventory. Final Report. MPI technical paper no. 2018/51. Prepared by Manaaki Whenua-Landcare Research for Ministry for Primary Industries.
[45] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[46] Molloy, L., Forde, B. (1980) Land Alone Endures: land use and the role of research. Department of Scientific and Industrial Research discussion paper.
[47] Grealish G. (2017) New Zealand soil mapping protocols and guidelines. Envirolink Grant: C09X1606. Landcare Research, Palmerston North.

primarily because the density of observations is not sufficient to delineate the soil map unit areas[48].

Maps are usually drawn at specific scale depending on the smallest area of interest for a particular use and the density of field observations. For example, a 1:5,000 scale map requires on average four observation/ha while a 1:50,000 scale map requires 0.04 observation/ha (four observations per 100 ha)[49]. With GIS tools and geospatial databases, it has become easy to manipulate maps, creating the temptation to rescale or manipulate all or part of a map beyond its original scale of collection[50].

Enlarging maps from their original scale will not provide the same accuracy or contain more detail then a coarse scale map. Inaccuracies, such as the location of boundary lines, will be magnified. The increase in scale will not capture the effect of different parameters or factors that control the distribution of soil types [51] . Most importantly, the information expressed in the map needs to match the level of detail of information needed for its application.

In practical terms, on the ground map units often comprise more than one soil. These are referred to as soil associations or soil complexes. Soil associations and complexes delineated areas that consist of two or more dissimilar components that occur in a consistent, repeating pattern. The soils in a complex cannot be separated at the mapping scale (soil types are mixed in a way where it is difficult/impractical to show them separately). The soils in an association can be separated. These soil types are adjacent to one another but the number of observations at the given scale does not delineate them. In the Waikato district one common example is the Horotiu-Te Kowhai Complex. Separately the Horotiu soils are classified as LUC Unit 1s1 and the Te Kowhai soils are classified as LUC Unit 2w3. In complex the LUC classification is LUC Unit 2s1. All are high class soil under the Waikato district high class soil definition but would be elite soils and prime soils in the Auckland region.

The LUC classification can be applied at any scale. Property scale mapping is typically mapped at a scale between 1:5,000 and 1:15,000, while catchment and regional maps are mapped at 1:15,000 to 1:50,000 scale. The Land Use Capability Handbook sets out recommended mapping scales for inventory surveys and LUC mapping (**Table 2**).

[48] Grealish G. (2017) New Zealand soil mapping protocols and guidelines. Envirolink Grant: C09X1606. Landcare Research, Palmerston North.
[49] Grealish G. 2(017) New Zealand soil mapping protocols and guidelines. Envirolink Grant: C09X1606. Manaaki Whenua – Landcare Research.
[50] Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF. (2009) Land Use Capability survey handbook – a New Zealand handbook for the classification of land. AgResearch Hamilton; Manaaki Whenua Lincoln; GNS Science Lower Hutt, New Zealand.
[51] Hewitt A, Lilburne L. (2003) The effect of scale on the information content of soil maps. Soil News Vol. 51 No. 4. NZSSS.

Table 2. Recommended mapping scales for inventory surveys and LUC mapping (adapted from Lynn et al., 2009).

Scale level	National	Regional	District and catchment	Farm
Scale	1:250,000 to 1:100,000	1:100,000 to 1:50,000	1:50,000 to 1:15,000	<1:15,000
Smallest area	250-40 ha	40-10 ha	10-1 ha	≤ 1 ha
Common application examples	Broad planning, prioritising for detailed investigations.	Land use planning, reference for more detailed survey.	Catchment projects, farm planning for large properties.	Farm planning and development projects, precision agriculture.

Table 4 indicates that for farm scale planning mapping at a scale of <1:15,000 would be considered most appropriate for property scale assessment of high class soils. An actual example of the effect of scale is shown in **Figure 2**.

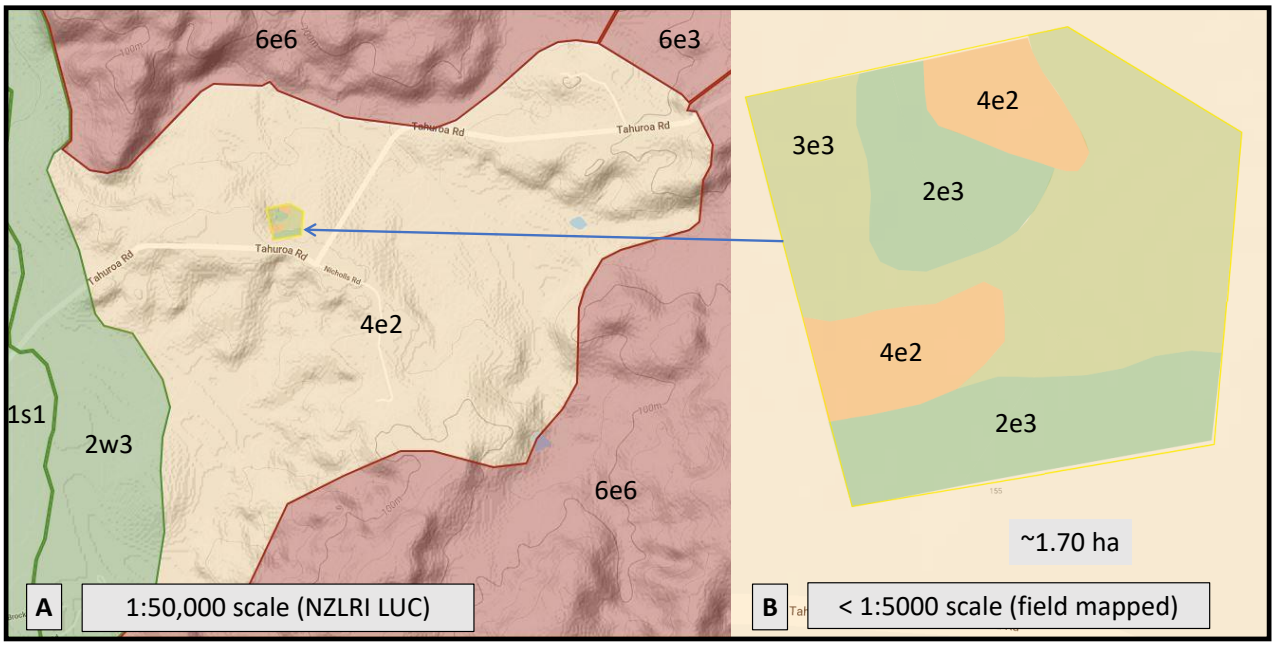

Figure 2. An example of the effect of the scale of map information; (A) 1:50,000 scale NZLRI LUC and (B) <1:5000 field map information.

Figure 2 highlights several points associated with map scale. Firstly, using the NZLRI (1:50,000 scale) LUC map information (shown in A), the LUC Units are broad and include a range of topography which would be outside the slopes defining the LUC unit. In many situations map unit boundaries do not follow the topography (slope) by which the are classified. This is most evident for the 4e2-6e6 boundary which should clearly delineate steeper topography changing from 4e2 (defined by 16-20° slopes) to 6e6 (defined by 21-35° slopes). The example shows the limitations of relying on broad scale map information to identify high class soils. In this example, the field mapped window area of ~1.70 ha would be defined as not containing high class soils.

Based on the field mapping, high class soils (LUC Unit 2e3) are identified and occupy about 33% of the area and about 25% of the area is LUC Unit 4e2 as identified by the NZLRI map information.

8.2.1 Soil map information in the New Zealand Land Resource Inventory

The only available soil map information that covers the Waikato District is provided by the NZLRI inventory. The soil symbols and names for each map unit (polygon) are from classifications that were available at the time the inventory was compiled and are from numerous publicly available soil surveys produced by the New Zealand Soil Bureau, DSIR. The scale of the soil survey map information used is shown in **Figure 3**.

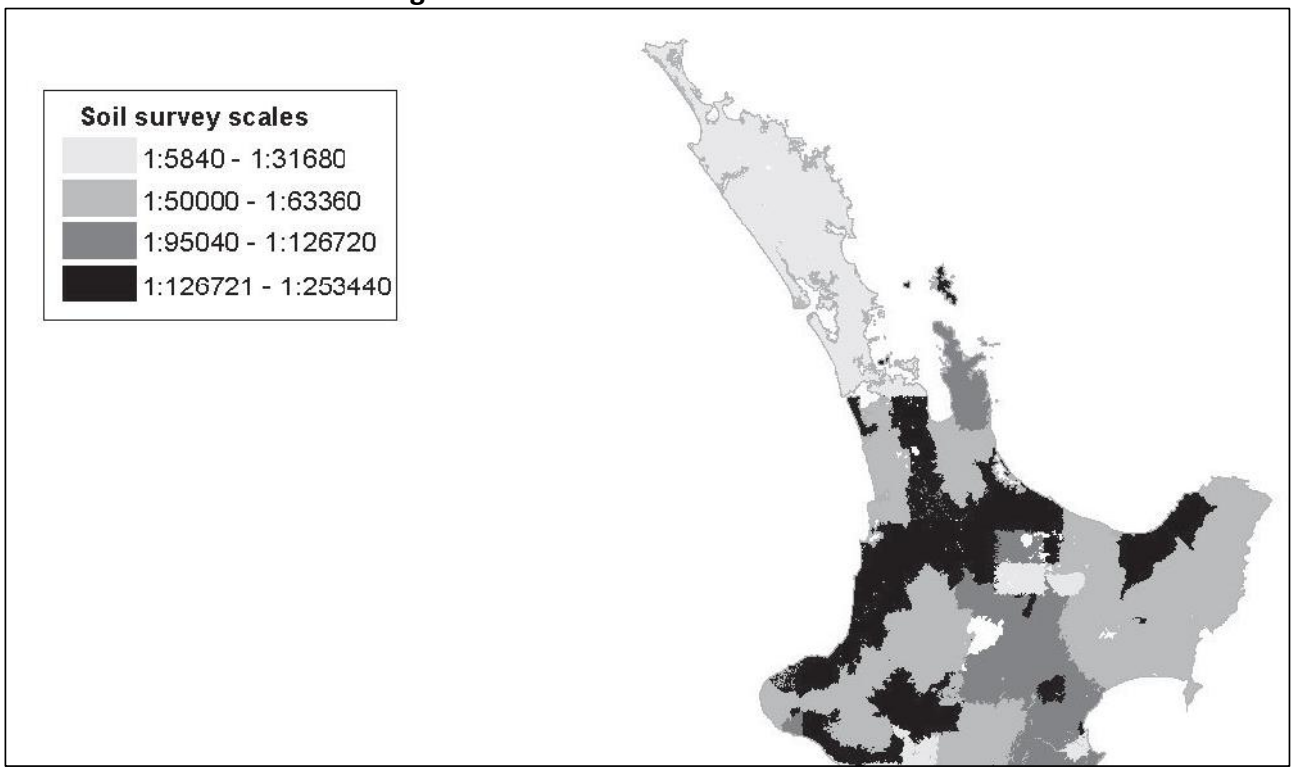

Figure 3. Mapping scales of the soil surveys used in the compiling the NZLRI (Leathwick et al., 2002)[52].

Two scale ranges of soil survey contribute to the NZLRI soil map information (1:50,000 - 1:63360 and 1:126,721 – 1:253440). All scales of survey are considered regional scale at best.

The NZLRI covers all of New Zealand and is based on a compilation of many soil surveys. For example, the North Island includes the compilation of the Gisborne Plains (1:15 840), Manawatu County (1:63,360), and the Coromandel−Thames (1:126,720) soil surveys.

For the Waikato district, the majority of soil map information available is at scale of 1:50,000 to 1:63,360 and 1:126,721 to 1:253,440. These soil map information data provide the base soil information portrayed in the NZLRI (1:50,000 scale) for the Waikato district.

8.2.2 Mapping technology and limitations

The increased avaibality of new technologies for mapping provides the potential for more accurate and finer scale mapping of soils and LUC. These technologies include the use of LiDAR to produce finer resolution Digital Elevation Models (DEMs) that fit map units more accurately to the landscape. Currently in the Waikato district Smap soil mapping using these techniques (through a

[52] Leathwick, J. Morgan, F., Wilson, G., Rutledge D., McLeod, M. Johnston, K. (2002) Land Environments of New Zealand: a technical guide. Ministry for the Environment.

mapping technique known as digital soil mapping (DSM) is being finalised. The final Smap soil map will more accurately depict soils than currently available soil map information provided by FSL soil map information. However, Smap soil map information will still only be considered appropriate for use at the district and catchment scale level and would not be suitable for delineating high class soils for individual properties. This is partially a function of the map scale but also because Smap does not currently include other land characteristics such as slope which are included in LUC assessment.

9 Overview of the Rural zone

9.1 Land and titles in the rural zone

The size class distribution of titles in the rural zone and the area for each size class is shown in **Figure 4**.

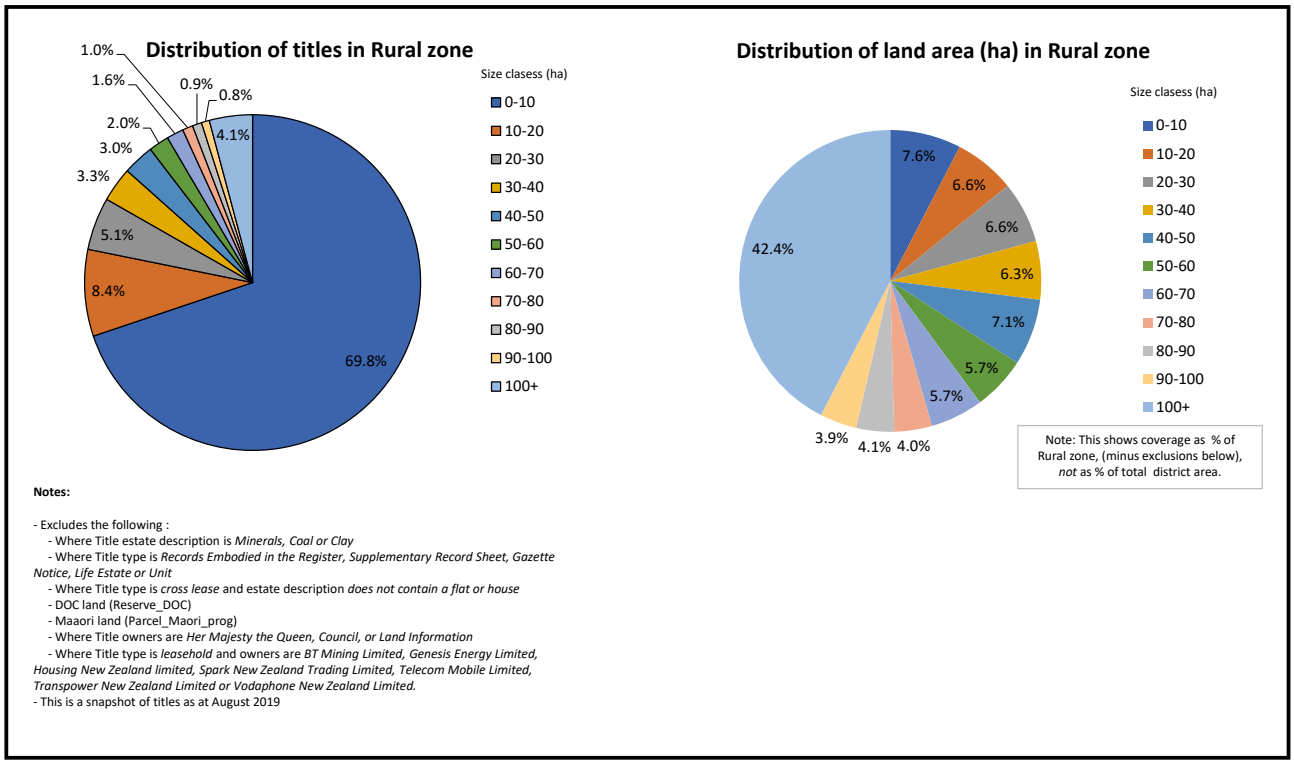

Figure 4. The size class distribution of titles in the rural zone and the area for each size class.

The majority of titles (68%) are in the size class 0-10 ha. The total area occupied by these titles is only 6.8% of the rural zone. Titles greater than 20 ha.

9.2 Waikato District rural zone titles by date

The number of Waikato District rural zone titles greater and less than 20 ha and before and after 6th December 1997 is shown in **Figure 5**.

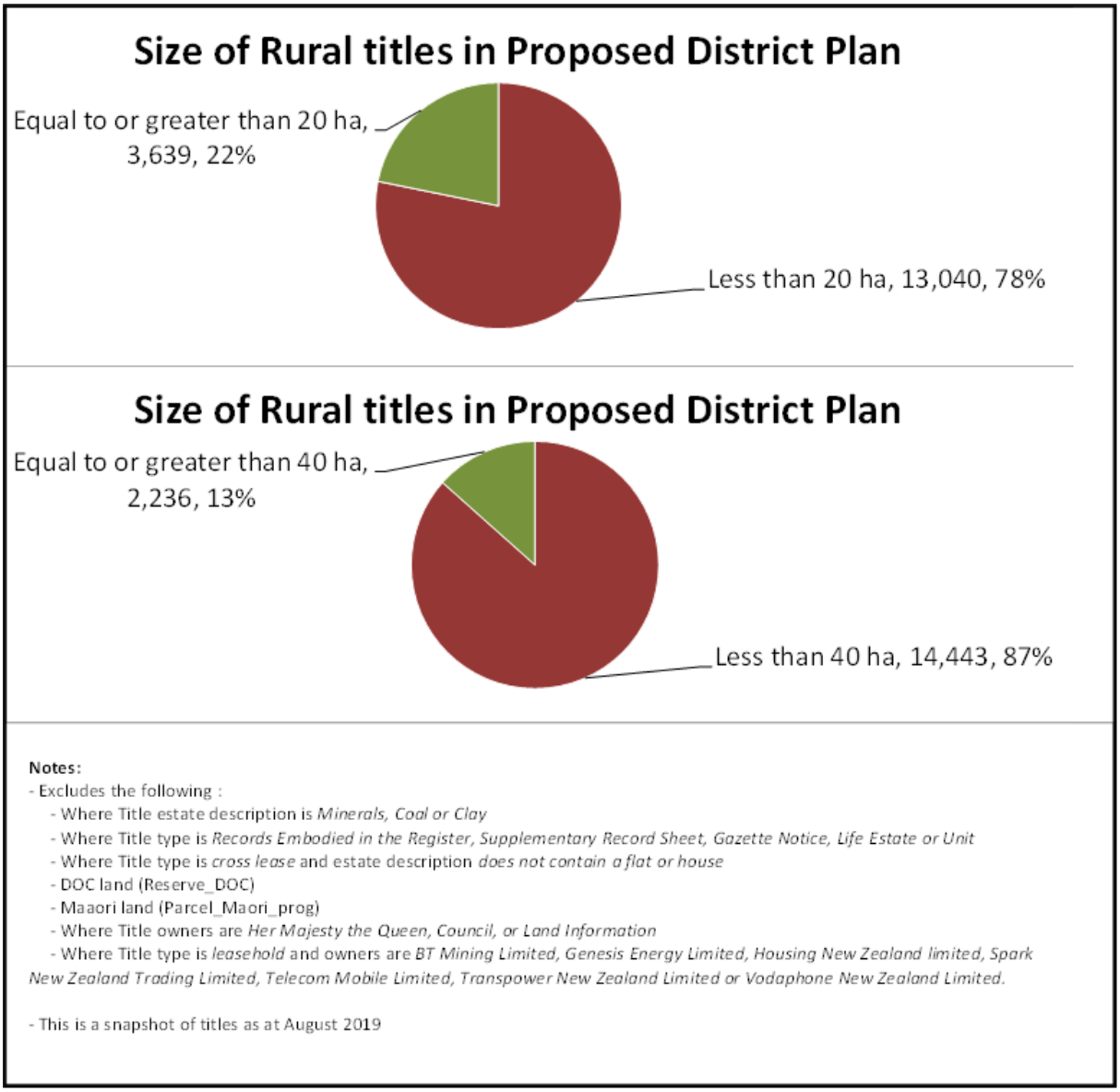

Figure5. The number of Waikato District rural zone titles before and after 6th December 1997.

9.1 Waikato District rural zone titles by minimum size

The number of Waikato District rural zone titles greater than 20 ha and before and greater than 40 ha is shown in **Figure 6**.

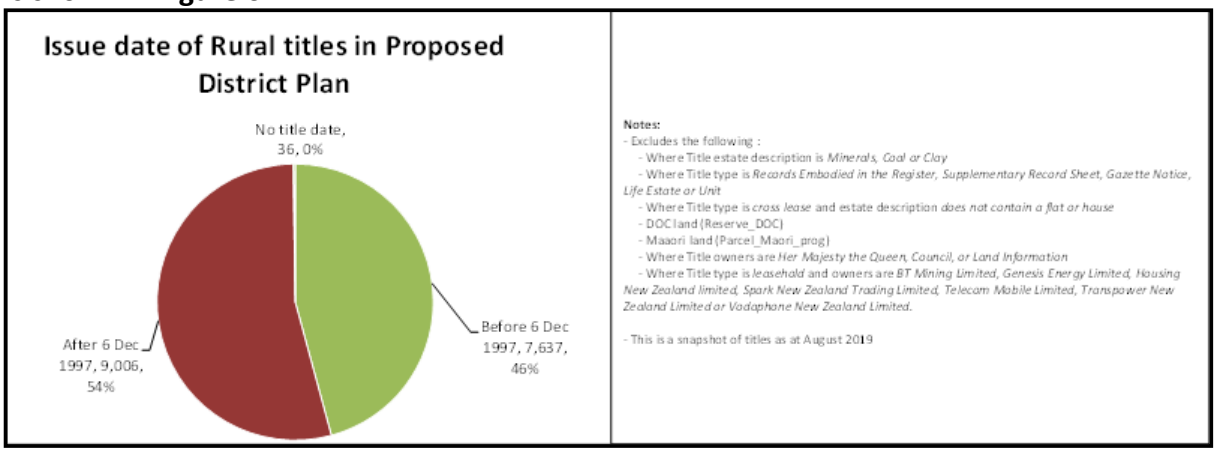

Figure 6. The number of Waikato District rural zone titles before and after 6th December 1997.

9.2 High class soils

The distribution of high class soils in the Waikato district are identified using the NZLRI (1:50,000 scale) soil attribute map information (**Figure 7**).

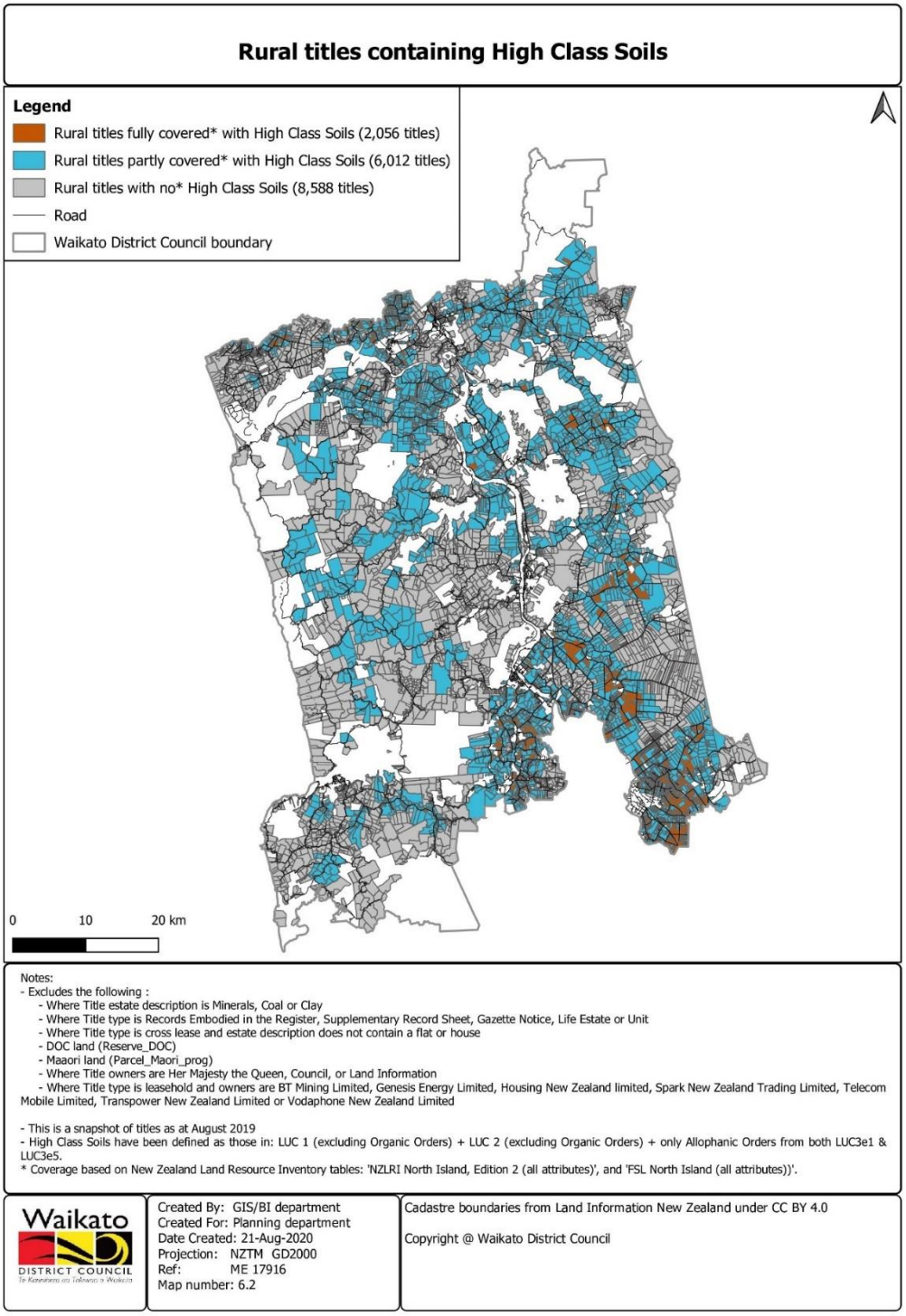

Figure 7. The distribution of high class soils in the Rural Zone of the Waikato district.

The estimated number of titles with high class soils present (fully or partially high class soils) is shown in **Table 3**.

Table 3. The estimated number of titles with high class soils present in the Waikato district*.

	Number of titles	% of titles
Rural titles FULLY covered with High Class Soils	2,056	12%
Rural titles PARTLY covered by High Class Soils	6,012	36%
Rural titles with no High Class Soils	8,588	51%
Rural titles with Gross Area of 0 ha	23	0%
TOTAL	16,679	100%

*** Notes:**

- Excludes the following :
  - Where Title estate description is *Minerals, Coal or Clay*
  - Where Title type is *Records Embodied in the Register, Supplementary Record Sheet, Gazette Notice, Life Estate or Unit*
  - Where Title type is *cross lease* and estate description *does not contain a flat or house*
  - DOC land (Reserve_DOC)
  - Maaori land (Parcel_Maori_prog)
  - Where Title owners are *Her Majesty the Queen, Council, or Land Information*
  - Where Title type is *leasehold* and owners are *BT Mining Limited, Genesis Energy Limited, Housing New Zealand limited, Spark New Zealand Trading Limited, Telecom Mobile Limited, Transpower New Zealand Limited or Vodaphone New Zealand Limited*
- This is a snapshot of titles as at August 2019
- High Class Soils have been defined as those in: LUC 1 (excluding Organic Orders) + LUC 2 (excluding Organic Orders) + only Allophanic Orders from both LUC3e1 & LUC3e5.

The area of high class soils in the Waikato district Rural Zone is estimated at 62,383 ha (16% of soils in the Rural Zone). After excluding titles that are not eligible for subdivision (e.g. DOC estate) the area of high class soils is estimated at 58,199 ha (19% of soils on eligible titles in the Rural Zone[53]).

Because these estimates are based on 1;50,000 scale map information, it is likely at property scale the number of titles with and without high class soils will vary from these estimates. To provide an exact estimate would require property scale field mapping at a finer scale (<1:15,000 scale). However, for a district scale assessment the use of 1;50,000 scale map information is considered adequate for providing estimates[54].

9.1 Historic subdivision of HCS

There is minimal information on the historical subdivision of rural land in the Waikato district. Additionally, data specific to the definitions of high class soils used in the Waikato Regional Policy

[53] Base on the same data as used in Table 3 (see notes).
[54] Table 1 of Lynn et al. (2009).

Statement[55] is absent; the current regional assessments either use LUC Classes 1-4 or LUC Classes 1-3.

A source of information for the Waikato region (which includes the Waikato district) is the Waikato Progress Indicator (WPI) for Residential Expansion onto Versatile Land[56]. However, the trends are only at regional scale (no specific data is available for Waikato district).

This indicator is based on the area (ha, hectares) of versatile land (Land Use Capability classes 1-4) in urban and rural residential use in the Waikato region at four time steps (2001, 2008, 2012, and 2017). Urban residential area is defined to be land parcels of 0.00-0.50 ha in size with a dwelling whereas rural residential area is defined to be land parcels 0.51-2.00 ha in size with a dwelling[57].

Of the indicators used for the WPI, urban expansion is one of only few indicators that are trending negatively (**Figure 8**).

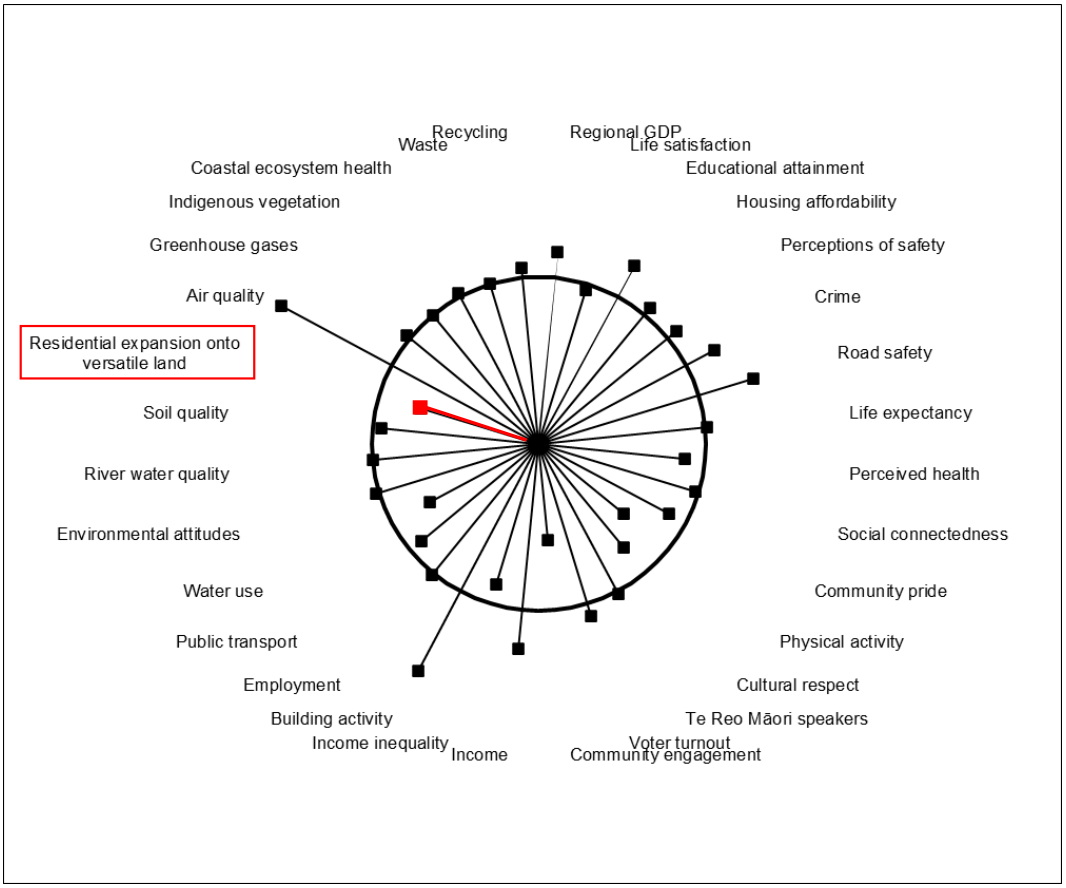

Figure 8. Relative trends for Waikato Progress Indicators (2001-2017).

The Waikato Regional Council's Rural Subdivision indicator provides an estimate of the loss of high class soils in the Waikato district from 2001 to 2013[58].

55

56 www.waikatoregion.govt.nz/community/waikato-progress-indicators-tupuranga-waikato/residential-expansion/

57 www.waikatoregion.govt.nz/community/waikato-progress-indicators-tupuranga-waikato/residential-expansion/

58 www.waikatoregion.govt.nz/Environment/Environmental-information/Environmental-indicators/Land-and-soil/rural-subdivision-report-card/

For the Waikato region, the greatest amount of subdivision is occurring on the land with the higher productive capabilities (LUC classes 1, 2, 3 and 4).

The greatest amount of subdivision over the 2006-2013 census period has taken place in Waikato District (76% of the total subdivision).

Rural land subdivided in the Waikato district (2001-2006 and 2006-2013) on LUC Classes 1, 2 and 3 is shown in **Figure 9**.

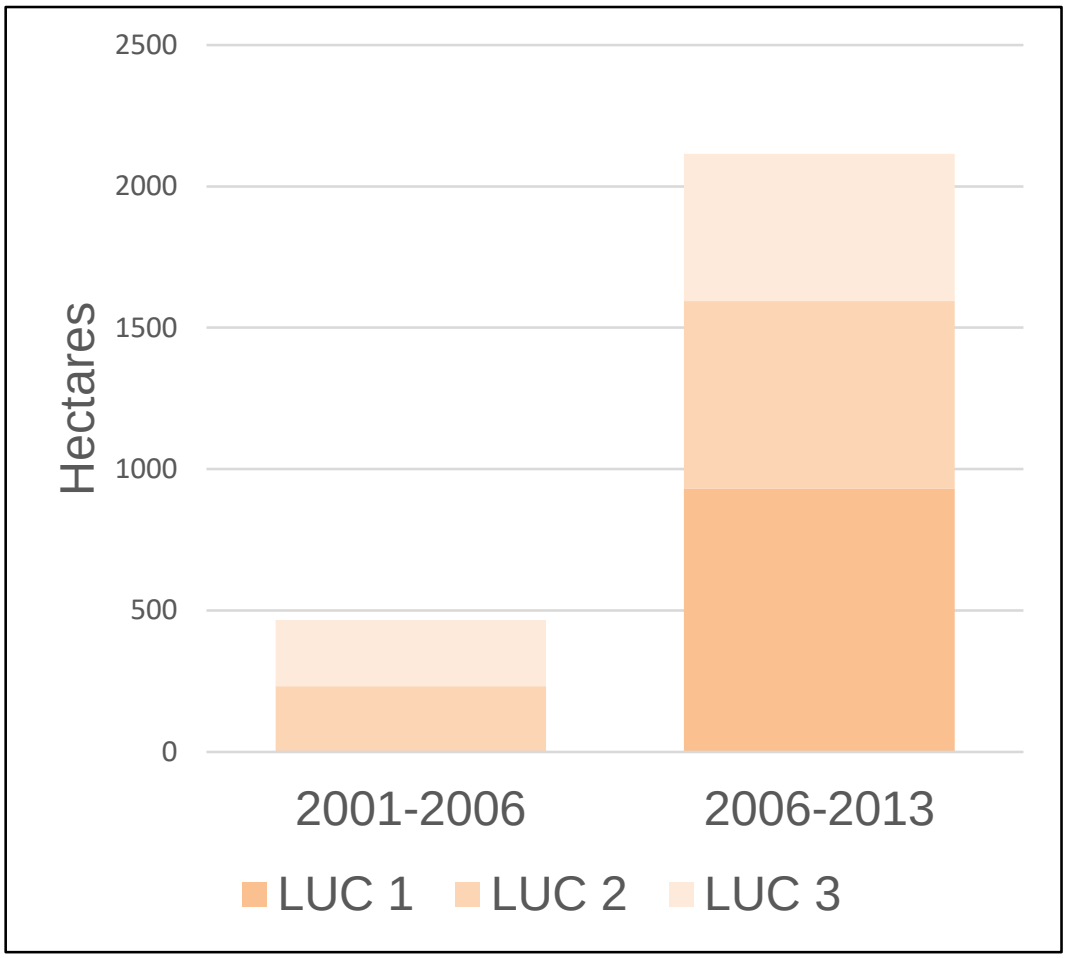

Figure 9. Rural land subdivided in the Waikato district (2001-2006 and 2006-2013) on LUC Classes 1, 2 and 3.

What is clear from the data available is that:

- subdivision continues to occur on rural land in the Waikato region,
- the greatest amount of subdivision in the Waikato region has occurred in the Waikato district, and
- subdivision has been proportionally greater on LUC Classes 1, 2 and 3 compared with other LUC Classes.
- Although on an individual basis the loss of land (and high class soils) from productive use is small, the cumulative effect over years is likely to impact on the greater long term soil resource and land use versatility of the Waikato district, Waikato region and nationally.

9.2 Land fragmentation issues and trends

Land fragmentation issues have been identified by councils (Hart et al., 2013)[59]. Loss of land, especially versatile or "high quality" soils, and decreasing options for productive land use (i.e. due to smaller title size and/or increasing property values in traditionally productive/rural land areas) were two of the most common issues identified by councils.

For the Waikato district, development pressure in a number of key areas included residential development along the Waikato River, in coastal areas, and lifestyle block development in Pokeno and Tuakau.

Preliminary land fragmentation indicator analysis for the Waikato region[60,61] separated the effects of land fragmentation caused by rural residential and urban residential expansion on the loss of land available for production. The indicator used change in land parcel size from 2001 to 2017 to assess the loss of land (including versatile land) to residential expansion. This approach was based on a revised method of that used by Rutledge et al. (2015)[62].

This distinction between land fragmentation caused by rural residential and urban residential subdivision is an important point to note for several reasons.

Firstly, land fragmentation by urban residential expansion can result in less total loss of land due to the creation of small sized new lots. Also, because it borders existing urban residential areas, its impact is limited to the land it directly occupies. The effect of course is greater if this includes high class soils in primary production.

In comparison, land fragmentation resulting from rural residential subdivision generally has a bigger footprint, potentially resulting in the loss of larger areas from primary production, and if containing high class soils a greater loss of these soils.

The analysis defined rural residential and urban residential as shown in **Table 4**.

[59] Hart, G., Rutledge, D., Price, R. (2013) Guidelines for monitoring land fragmentation: review of knowledge, issues, policies and monitoring. Landcare Research, New Zealand.
[60] Jones H, Hill R, Curran-Cournane F, Borman D. (2018) Loss of versatile land available for production. Paper presented at the NZSSS Biennial Conference, Napier Conference Centre, Napier, December 2018.
[61] Hill R, Jones H, Borman D. (2018) Local scale land fragmentation on high class soils in the Waikato region. Paper presented at the NZSSS Biennial Conference, Napier Conference Centre, Napier, December 2018.
[62] Rutledge D, Price R, Hart G. (2015) National Guidelines for Monitoring and Reporting Effects of Land Fragmentation. Envirolink Tool Grant: C09X1202/28950. Landcare Research, Lincoln.

Table 4. Definitions of urban and rural residential used in the preliminary land fragmentation indicator analysis for the Waikato region (after Jones et al., 2018[63]).

Broad parcel-size classes	Detailed parcel-size classes
Urban residential	X1. 0.00-0.25 ha (with a house)
	X2. 0.26-0.50 ha (with a house)
Rural residential	X3. 0.51-1.00 ha (with a house)
	X4. 1.10-2.00 ha (with a house)

Preliminary results estimated that the land area for production in the Waikato region decreased by 11,998 ha between 2001 and 2017. The total residential area had increased by 11,063 ha for the same period indicating that residential expansion is the key contributor to the loss of land potentially available for production. Additionally, increasing rural residential expansion showed that the loss of land was equally attributable to rural residential and urban residential expansion **(Figure 10).**

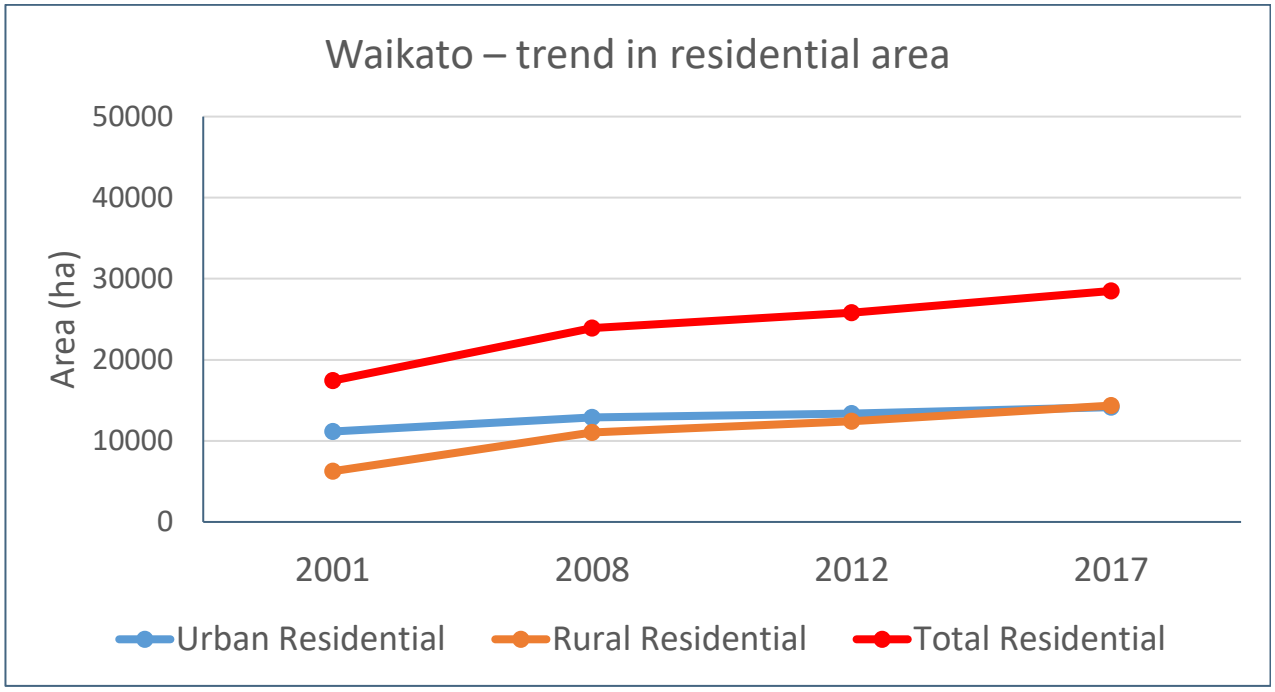

Figure 10. The loss of productive land in the Waikato region to rural residential and urban residential expansion in the Waikato region (2001-2017).

[63] Jones H, Hill R, Curran-Cournane F, Borman D. (2018) Loss of versatile land available for production. Paper presented at the NZSSS Biennial Conference, Napier Conference Centre, Napier, December 2018.

Data were also presented for residential expansion with respect to versatile land. Versatile land classes were defined using LUC classes as follows:

- High versatility – LUC 1 & 2
- Moderate versatility – LUC 3 & 4
- Limited versatility – LUC 5 & 6
- Low versatility – LUC 7 & 8

The estimated changes in residential area by versatility class from 2001 to 2017 indicated that residential had occurred on the more versatile land (**Figure 11**) and that residential expansion had continued to increase from 2001 to 2017, with a greater proportion of the change being attributable to rural residential expansion (**Figure 12**).

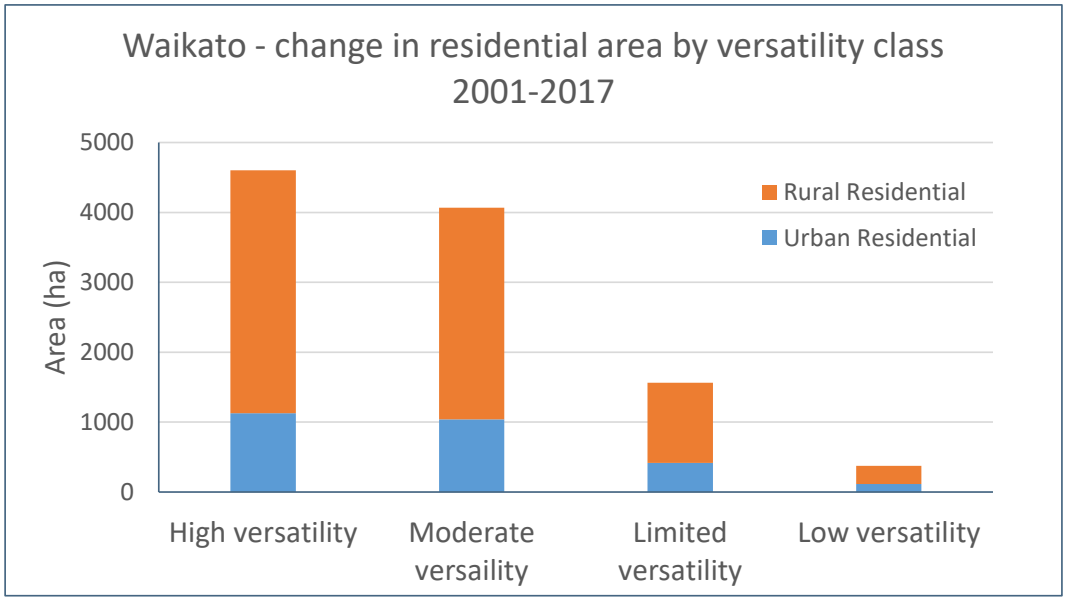

Figure 11. Change in residential area by versatility class for the Waikato region (2001-2017).

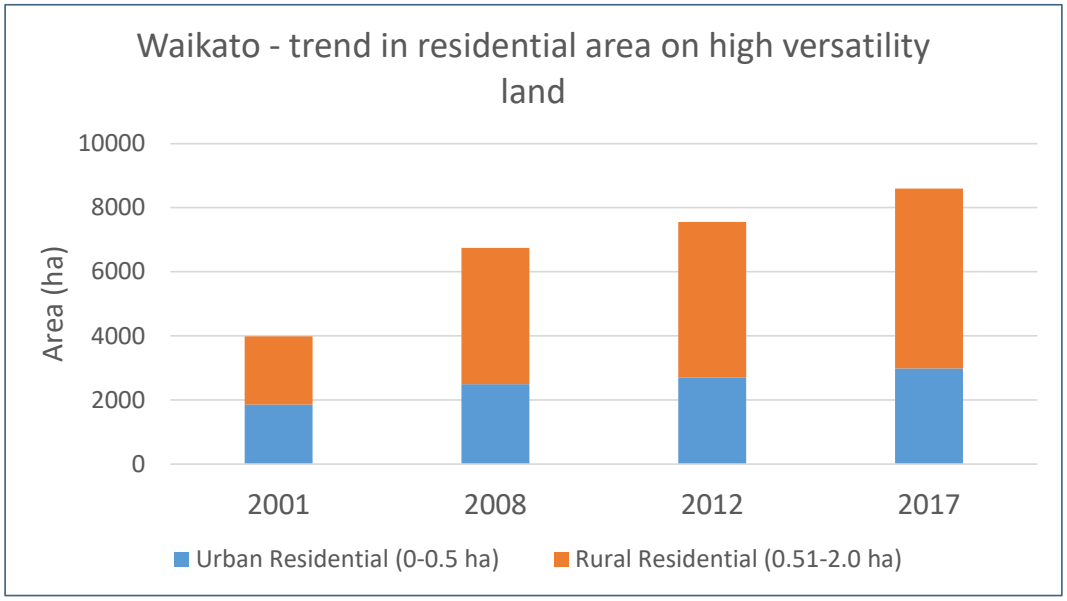

Figure 12. Trend in residential area on highly versatile land for the Waikato region (2001-2017)

The distribution of residential expansion in the Waikato region in the proximity of Hamilton is shown in **Figure 13**.

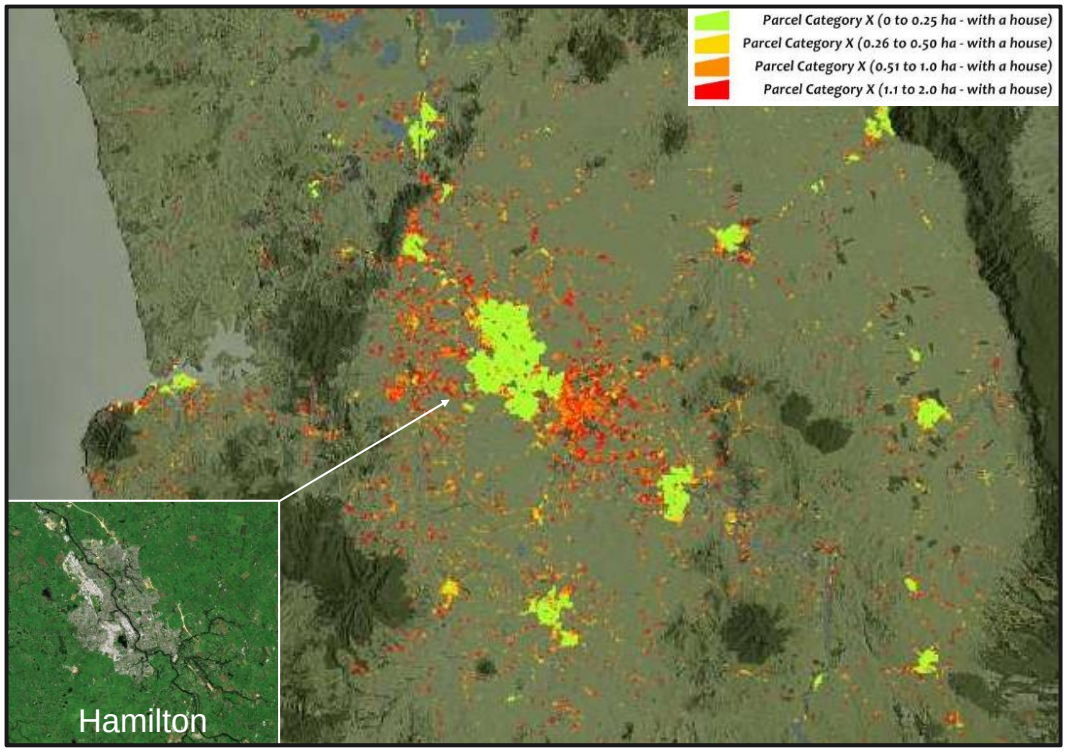

Figure 13. The distribution of residential expansion in the Waikato region in the proximity of Hamilton

Although much of the residential expansion is in close proximity to existing urban areas, much of the parcel categories in the size ranges of 0.51-1.0 ha (orange) and 1.1-2.0 ha (red) are scattered throughout the rural area, which has potential to reduce the viability of the remaining productive land for land uses requiring larger areas (e.g. pastoral farming) and therefore is likely to impact on land versatility (i.e. reduce the range of potential future land uses).

In the Statement of Evidence of Dr Fiona Curran-Cournane on Behalf of Auckland Council[64], Dr Curran-Cournane stated that rural subdivision would through increased settlement density exclude land uses such as pastoral and horticultural farming that for practical or economic reasons require large land parcels. Furthermore, the adverse accumulative effects of subdivision would compromise the future use and availability of this resource for productive activities that directly rely on it.[65]

There are opposing international viewpoints which consider land fragmentation as a positive situation. Fragmented land (and ownership) allows farmers to minimise production risk, optimise the schedule for cropping activities, and remain productive[66]. Such an example is the commercial

[64] Statement of Evidence of Dr Fiona Curran-Cournane on Behalf of Auckland Council (01 December 2014).
[65] Statement of Evidence of Dr Fiona Curran-Cournane on Behalf of Auckland Council (01 December 2014).
[66] Kadigi RMJ, Kashaigili JJ, Sirima A, Kamau F, Sikira A, Mbungu W. (2017) Land fragmentation, agricultural productivity and implications for agricultural investments in the Southern Agricultural Growth Corridor of Tanzania (SAGCOT) region, Tanzania. Journal of Development and Agricultural Economics Vol. 9(2), pp. 26-36.

vegetable production land around Pukekohe which may be on leased land blocks of a few hectares. However, the important point to remember and consider with regard to maintaining unfragmented land for primary production is the concept of versatility - fragmented land reduces the future range of possible land uses.

Stakeholder workshops as part of the NPS-HPL consultation[67] identified that continued fragmentation of land, especially near the rural urban boundary (RUB), such as around Pukekohe, also increased land prices. The workshop noted that the price of this land had increased to an extent that it is not changing hands to growers and is now likely to only be sold for urban development. The price of land means it is not economically viable to buy this land for new horticultural production. In response growers in Pukekohe hub were moving production into areas south (e.g. the Waikato, Ohakune and Hawke's Bay) and remained viable[68]. The consequences are that high class soils not currently used for crop production need to be retained to ensure this flexibility of land use change.
Land fragmentation trends have been reported at national, regional, and local levels across New Zealand[69].

The report Competition for Productive Land: Rural-Urban Pressures in New Zealand[70] summarised knowledge on issues of urban-rural land dynamics at that time. The report identified approximately 10% of New Zealand land as having high actual or potential value for food production, which was consistent with provisions of the Town and Country Planning Act in force at the time.

Hunter et al. (1998)[71] evaluated impacts of rural subdivision by assessing the environmental effects of subdividing large farms into rural lots ranging in size from 1 to 10 hectares. They found a range of positive and negative effects, including a loss in the stock of versatile soils, which they defined as "soils that are highly valued for primary production". The 2007 State of the Environment Report the Ministry for the Environment[72] identified increased pressure on highly versatile soils (soils on LUC Class 1 or 2, and sometimes LUC Class 3).

Trends in land fragmentation have been provided in research by Northland Regional Council who reported that 10% of its LUC Class 1–3 land had been subdivided into lifestyle blocks between 2001 and 2007[73]. This equated to a conversion rate of 1.67% per year. In Marlborough district

[67] Stakeholder Workshops on Potential National Policy Statement for Highly Productive Soils Summary of key themes MPI Technical Paper No: 2019/09.
[68] Stakeholder Workshops on Potential National Policy Statement for Highly Productive Soils Summary of key themes MPI Technical Paper No: 2019/09.
[69] Hart, G., Rutledge, D., Price, R. (2013) Guidelines for monitoring land fragmentation: review of knowledge, issues, policies and monitoring. Landcare Research, New Zealand.
[70] Healey WB ed. (1974) Competition for productive land: rural-urban pressures in New Zealand. Wellington, New Zealand Institute of Agricultural Science. 48 p.
[71] Hunter G, Jarvis P, Kilvington M, Partridge T, Webb T. (1998) Biophysical and ecological impacts of rural subdivision. Landcare Research Report LC9798/117 prepared for MAF Policy. 93 p.
[72] https://www.mfe.govt.nz/sites/default/files/environment-nz07-dec07.pdf
[73] Northland Regional Council (2010) Soil conservation and rural land productivity. Whangarei, Northland Regional Council. 13 p. Available at:
http://www.nrc.govt.nz/upload/7851/Land%20Management%20and%20Rural%20Land%20Productivity%20%20Background.pdf

average annual conversion rates for the period 1985 to 2001 were from 2.32% on LUC Class 1 land, 1.78% on LUC Class 2 land and 1.52% on LUC Class 3 land[74] (Rutledge et al. 2010).

Nationally, the highest conversion rates have occurred in LUC Classes 1 and 2 compared with other LUC Classes of land. Andrews and Dymond (2012)[75] found that one sixth of the 175 000 lifestyle blocks occurring nationally occupy 10% of the total area of high-class land (as defined by Webb and Wilson 1995)[76].

In the Auckland region (neighbouring Waikato district) it is estimated that a total of 10,399 ha (or 8.3%) of Auckland's elite and prime land had been converted to development. Of this, 10,080 ha (8.1%) of elite and prime land was converted between 1975-2012. Since 1996 the rate of urban extension onto elite and prime land has accelerated, with the majority of land allocated to urban extension on elite and prime land[77].

10 Concepts relating to Rural zone subdivision

10.1.1 The fragmentation of land

Rural and urban residential development is not seen as a negative process in its own right, but scattered, un-managed, and un-planned rural residential development can be expensive for councils as well as having potential financial and social impacts on local communities[78]. For example, in Auckland region, vegetables have been grown on high class soils close to major urban centres. With continued urban expansion there has been increasing pressure to create more housing on land currently used for commercial vegetable growing. The risk is that growers are forced onto land with lesser class soils that are not inherently capable of supporting that land use over the long term and require more management inputs to maintain yields.

Land fragmentation can result in the loss of high class soils and lesser class soils alike. However, the greatest impact on productive capacity is when high class soils are lost, as these soils are more versatile, supporting a greater range of land uses. The objective of policy should be to retain or if possible, improve primary productive potential of the rural land resource by minimising or reducing land fragmentation in the Rural Zone.

[74] Rutledge DT, Briggs C, Lynn I, Price R. (2010) Land use trends in Marlborough District: consequences for soil resources. Landcare Research report for Marlborough District Council. 50 p.
[75] Andrews R, Dymond J. (2012) Expansion of lifestyle blocks and urban areas into high-class land: an update for planning and policy. Journal of the Royal Society of New Zealand.
[76] Webb T, Wilson A. (1995) A manual of land characteristics for evaluation of rural land. Landcare Research Science Series No 10.
[77] Curran-Cournane, F., Vaughan, M., Memon, A. & Fredrickson, C. (2014) Trade-offs between high class land and development: recent and future pressures on Auckland's valuable soil resources. *Land Use Policy* 39**,** 146-154.
[78] Rutledge D, Price R, Hart G. (2015) National Guidelines for Monitoring and Reporting Effects of Land Fragmentation. Envirolink Tool Grant: C09X1202/28950. Landcare Research, Lincoln.

As well as loss of high class soil, the range of land uses can be diminished by land fragmentation. This results when there are changes that reduce the total land supply by dividing land resources below thresholds useful for different types of primary production[79].

The objective of policy should be to retain or if possible, improve primary productive potential of the rural land resource by retaining high class soils in primary production in combination with maintaining land area to maximise its usefulness for different types of primary production.

10.1.2 Location of subdivision

The location of subdivision can impact on both high class soils and the primary productive potential of the rural land resource. Placement of a lots on high class soils directly removes those soils from production. Additionally, the placement of a lot away from the parent title boundary can create the need for an accessway to the lot and potentially fragment off any surrounding land, excluding it from production.

Placement of the lot should be such that it minimises the direct loss of high class soils, and that the placement (of the lot) is such that there is no additional loss of high class soils and primary productive potential of the rural land resource as the result of land fragmentation.

10.1.3 Title size and land versatility

For a land use to exists on an area of land it must be have greater than the minimum area required for the enterprise to be viable. Land fragmentation has the potential to reduce the area of land available and therefore may affect the range of viable land uses (reduce land versatility).

Rutledge et al. (2015)[80] provides national data on the range of land areas for different land uses (**Figure 14**). These can collectively be used to show the range of land uses (land versatility) for different land area classes.

[79] Rutledge D, Price R, Hart G. (2015) National Guidelines for Monitoring and Reporting Effects of Land Fragmentation. Envirolink Tool Grant: C09X1202/28950. Landcare Research, Lincoln.

[80] Rutledge D, Price R, Hart G. (2015) National Guidelines for Monitoring and Reporting Effects of Land Fragmentation. Envirolink Tool Grant: C09X1202/28950. Landcare Research, Lincoln.

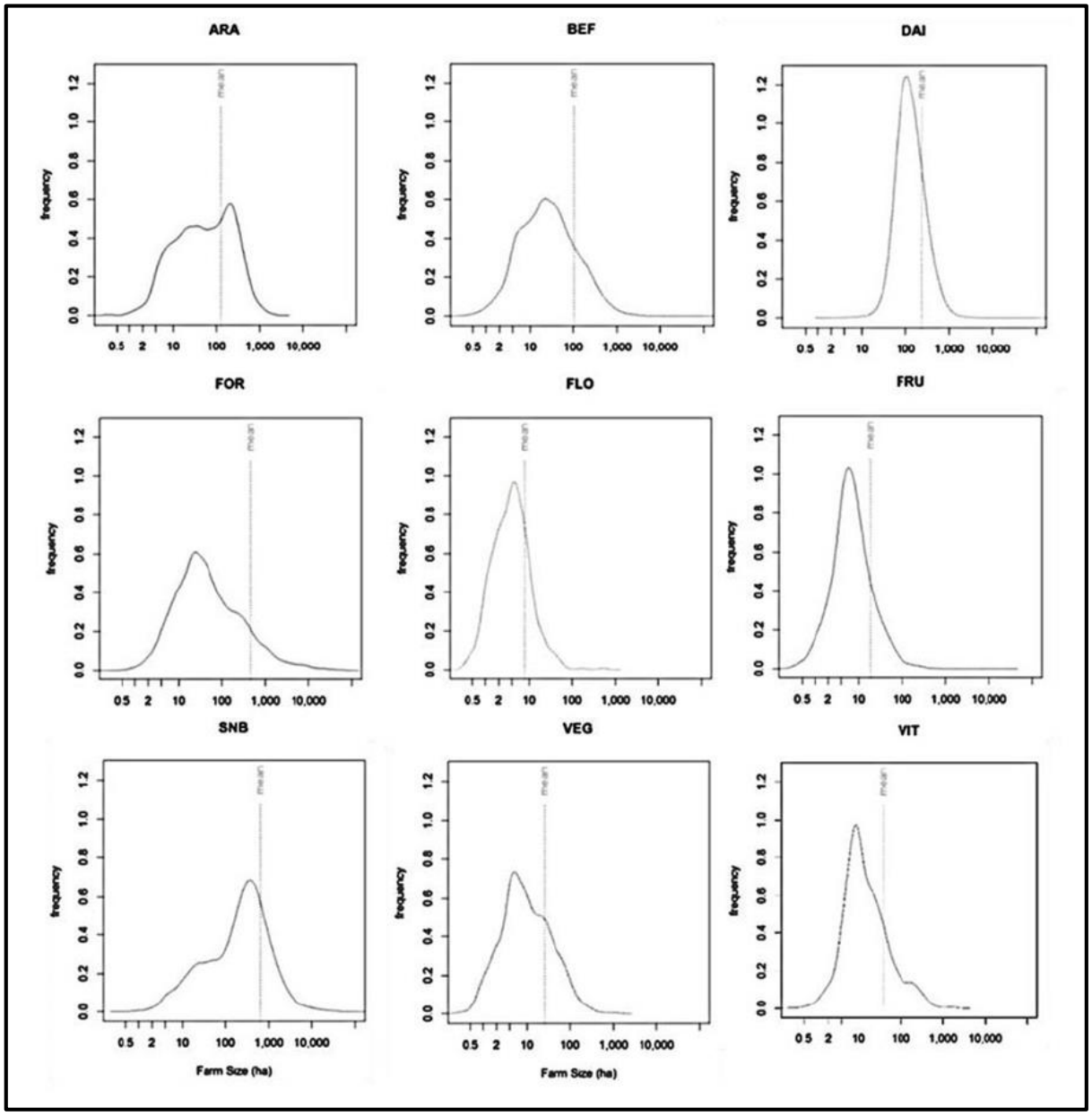

Figure 14. Distribution of farm sizes based on Agribase 2014 data. ARA = Arable, BEF = Beef, DAI = Dairy, FOR = Forestry, FLO = Flowers, FRU = Fruit, SNB = Sheep and Beef, VEG = Vegetables, VIT = Viticulture.

Figure 15 conceptually depicts land uses against the estimated minimum land area required for viable use of that area for the land use and assuming the land is capable of supporting the land use. It does not include "lifestyle" blocks that may have a stock for non-commercial production. Horticultural enterprises can exist on land areas as small as 2 ha. Cropping (such as maize require larger land areas but can exist on areas greater than 4 ha. Intensive grazing enterprises (including dairy goat cut and carry are viable land areas greater than 20 ha whereas dairy requires a greater land area. In the Waikato region, the average dairy farm is 125 ha[81]. However, dairy farms do exist

[81] www.dairynz.co.nz/media/5791537/quickstats-about-dairying-waikato-2018.pdf

in the Waikato on areas as small as 75 ha[82]. Low intensity grazing can provide some viable level of production on land generally greater than 20 ha. Production forestry (including woodlots) can be viable on land areas as small as 4 ha, however, the financial viability on land areas less than 20 ha area highly variable[83].

General land use (e.g.)	<2 ha	2-4 ha	4-20 ha	20-40 ha	40-75 ha	75- 200 ha	200+ ha
Very Intensive horticulture (flowers)							
Intensive horticulture (orchards)							
Cropping (commercial vegetatables)							
Cropping (maize)							
Intensive pasture "dairy"							
Intensive pasture "other"							
Low intensity pastoral							
Production forestry							

Figure 15. Estimated land area required for a range of land uses (green- indicates a viable land use).

The main points to note are that the range of land uses reduces below 20 ha and that the range of viable land uses for 20-40 and 40-75 ha are likely to be the same. The full range of viable land uses is most likely on land areas greater than 75 ha. The creation of a child lot (assuming the child lot remains small – e.g. <1.6 ha) on these larger land areas (> 20ha) is unlikely to impact on the range of viable land uses for these areas.

10.1.4 Density of subdivision

The main effect of the density of subdivision is likely to be on the primary productive potential of the rural land resource and the range of viable land uses. As subdivision density increases (and the associated the creation of additional lots increases) the area of the surrounding land may be

[82] Based on my personal observation.

[83] Indufor (2017) Waipa Afforestation Feasibility Study Economic Analysis and Optimisation of Afforestation Options. Indufor A15-10896 report for WRA and WRC. Auckland.

reduced to below size thresholds useful for different types of primary production. Additionally, the increased number of lots resulting from the denser subdivision has the potential to increase the direct loss of high class soils from production.

11 Impacts of subdivision

11.1 Impact of title size and date

The size distribution of rural titles for pre and post 6th December 1997 is shown in **Table 5**.

Table 5. The non-cumulative and cumulative size distribution of rural titles for pre and post 6th December 1997.

Rural titles by size class and date*			
	(not cumulative)		*(cumulative)*
Title size (ha)	**Number of titles**	**Title size (ha)**	**Number of titles**
Issue date BEFORE 6Dec1997			
0-10	5,011	0 ha & greater	7,637
10-20	625	10 ha & greater	2,626
20-30	500	20 ha & greater	2,001
30-40	321	30 ha & greater	1,501
40-50	276	40 ha & greater	1,180
50-60	158	50 ha & greater	904
60-70	143	60 ha & greater	746
70-80	77	70 ha & greater	603
80-90	84	80 ha & greater	526
90-100	66	90 ha & greater	442
100+	376	100 ha & greater	376
Issue date AFTER 6Dec1997			
0-10	6,611	0 ha & greater	9,006
10-20	767	10 ha & greater	2,395
20-30	346	20 ha & greater	1,628
30-40	235	30 ha & greater	1,282
40-50	225	40 ha & greater	1,047
50-60	166	50 ha & greater	822
60-70	129	60 ha & greater	656
70-80	90	70 ha & greater	527
80-90	65	80 ha & greater	437
90-100	61	90 ha & greater	372
100+	311	100 ha & greater	311

*data excludes 36 titles with no date

The total number of titles greater than the proposed 20 ha minimum lot size is 3629, of which 2001 titles (55%) are pre 6th December 1997, and 1628 titles (45%) are post 6th December 1997. In comparison for a minimum lot size of 40 ha, the total number of titles is 2227, of which 1180 titles (53%) are pre 6th December 1997, and 1047 titles (47%) are post 6th December 1997.

11.1.1 Parent title size (irrespective of high class soil)

Currently rule 22.4.1.2 (a) (ii) proposes a minimum parent title size of 20 ha. In addition to the direct loss of land (and high class soils) from production from the creation of child lots, the child lots created through subdivision increase the potential to fragment land which could result in decreased land use versatility and increased reverse sensitivity issues. Although the potential fragmentation of land will depend on the distribution of parent titles, a comparison of the number of eligible parent titles (and therefore the number of child lots created) provides a relative indication of the different subdivision densities and potential to fragment land. The analysis in **Table 6** estimates the number of eligible parent titles for 20 ha and 40 ha minimum parent title sizes.

Table 6. The estimated number of eligible parent titles for 20 ha and 40 ha minimum parent title sizes.

Minimum Parent title size	Estimated number of eligible parent titles for subdivision*
20 ha	3639
40 ha	2236
Difference	1403

*data includes titles with no date

Irrespective of a date restriction, increasing the minimum parent title size from 20 ha to 40 ha will reduce the number of eligible titles for subdivision by 1403 titles (-39%). Reducing the eligible titles for subdivision through increasing the minimum parent title size is likely to have a positive impact on the loss of high class soils (less direct loss through the creation of associated child lots) and potentially retaining larger land areas enabling a greater range of land use options (land versatility).

11.1.2 Impact of a removing the 6 December 1997 date requirement

Currently rule 22.4.1.1 (a) prohibits subdivision of a Record of Title issued after 6 December 1997, which results in any additional lot being located on high class soil. An assessment of the number of titles affected and the area potentially lost from production to a child lot for Pre and Post 6th December 1997 for 20 ha and 40 ha minimum title sizes are summarised in **Table 7** and **Table 8** respectively.

Table 7. The number of titles impacted for Pre and Post 6thDecember 1997 for 20 ha, 30 ha and 40 ha minimum title sizes.

Minimum Parent title size	Estimated number of eligible parent titles for subdivision*		
	Pre 6th December 1997	Post 6th December 1997	Combined
20 ha	2001	1628	3629
30 ha	1501	1282	2783
40 ha	1180	1047	2227

*data excludes titles with no date

Removing this date restriction would increase the number of titles that are eligible for subdivision, potentially increasing the likelihood of land fragmentation in the rural zone with greater potential to impact on high class soils.

For a minimum parent title size of 20 ha this increase would equate to an additional 1628 titles (+81%), and for a minimum parent title size of 40 ha this increase would equate to an additional 1047 titles (+89%).

Retaining the proposed date restriction of 6th December 1997 and increasing the minimum parent title size from 20 ha to 40 ha would reduce the number of eligible titles for subdivision from 2001 to 1180, a decrease of 821 titles (-41%).

The area affected by the creation of the child lots (irrespective of high class soils) for the different combinations of Parent title size and date are shown for child lot sizes of 0.8 ha and 1.6 ha (**Table 8**).

Table 8. Area of land lost to child lots (irrespective of high class soils) for different combinations of Parent title size and date.

		Area of land lost to child lots (ha)*		
Minimum Parent title size	Child lot size	Pre 6th December 1997	Post 6th December 1997	Combined
20 ha	0.8 ha	1601	1302	2903
	1.6 ha	3202	2605	5806
30 ha	0.8 ha	1201	1026	2226
	1.6 ha	2402	2051	4453
40 ha	0.8 ha	944	838	1782
	1.6 ha	1888	1675	3563

*data excludes titles with no date

Removing the date restriction would potentially increase the loss of land from production through the creation of child lots (irrespective of whether they are high class soils or not) from 944 - 3202 ha to 1782 - 5806 ha depending on the eventual child lot size and the minimum parent title size.

11.1.1 Title date, minimum parent title size and high class soil

The proposed rules for subdivision (22.4.1.1 PR2 (a), PR3 (a), and 22.4.1.2 (a) (i)) currently restrict subdivision on a lot post 6th December 1997 if there are high class soils present. The number of titles with and without high class soils and areas of high class soil pre and post 6th December 1997 are presented in **Table 9**.

Table 9. The number of titles with and without high class soils and areas of high class soil pre and post 6th December 1997.

Rural titles and high class soils*						
	Rural titles with issue date **before** 6-12-1997		Rural titles with issue date **after** 6-12-1997		All rural titles (combined dates)	
	Number of titles	Area of high class soil (ha)	Number of titles	Area of high class soil (ha)	Number of titles	Area of high class soil (ha)
Rural titles greater than **20 ha**						
Rural titles FULLY covered by high class soil	70	2612	73	3126	143	5738
Rural titles PARTLY covered by high class soil	766	16819	757	19918	1523	36737
Rural titles with no high class soil	1165	0	798	0	1963	0
TOTAL	2001	19431	1628	23044	3629	42475
Rural titles greater than **30 ha**						
Rural titles FULLY covered by high class soil	38	1853	50	2597	88	4450
Rural titles PARTLY covered by high class soil	570	14383	617	18057	1187	32440
Rural titles with no high class soil	893	0	615	0	1508	0
TOTAL	1501	16236	1282	20654	2783	36890
Rural titles greater than **40 ha**						
Rural titles FULLY covered by high class soil	23	1327	36	2113	59	3440
Rural titles PARTLY covered by high class soil	435	12028	500	15843	935	27871
Rural titles with no high class soil	722	0	511	0	1233	0
TOTAL	1180	13354	1047	17957	2227	31311

*excludes titles with no date.

Based on the current rules, the total number of titles eligible for subdivision are titles before 6th December 1997 (irrespective of high class soil) and titles after 6th December 1997 that have no high class soil. **Table 10** shows the impact on number of titles of removing the date restriction and the high class soil restriction and removing the date restriction and applying the high class soil restriction to all titles for minimum parent title sizes of 20 ha, 30 ha and 40 ha.

Table 10. The impact on number of titles of removing the date restriction and the high class soil restriction for minimum parent title sizes of 20 ha, 30 ha and 40 ha*.

Minimum parent title size (ha)	With the date and high class soil restriction (current rule)	Without the date and high class soil restriction	Without date restriction but with high class soil restriction for all titles
20 ha	2799	3629	1963
30 ha	2115	2783	1508
40 ha	1691	2227	1233

* excludes titles with no date.

For those rule options that allow subdivision on high class soil (the current rule and the rule without the date and high class soil restriction) the estimated loss of high class soil for child lot sizes of 0.8 ha and 1.6 ha, and minimum parent title sizes of 20 ha, 30 ha and 40 ha is shown in **Table 11**. The estimates assume that 100% of the child lot area will be high class soil.

Table 11. The estimated loss of high class soil (area) for child lot sizes of 0.8 ha and 1.6 ha, and minimum parent title sizes of 20 ha, 30 ha and 40 ha and child lot size or rule options that allow subdivision on high class soil*.

Loss of high class soil area on child lot (ha)

Minimum parent title size (ha)	With the date and high class soil restriction (current rule)			Without the date and high class soil restriction		
	Number of titles	0.8 ha child lot	1.6 ha child lot	Number of titles	0.8 ha child lot	1.6 ha child lot
20 ha	836	669	1338	1666	1333	2666
30 ha	608	486	973	1275	1020	2040
40 ha	458	366	733	994	795	1590

* excludes titles with no date.

The current rule estimates that for a minimum parent title size of 20 ha, the loss of high class soil for a child lot is 669 - 1338 ha. For a minimum parent title size of 40 ha, the loss of high class soil for a child lot is 366 - 733 ha. Under this rule increasing the minimum parent title size from 20 ha to 40 ha is likely to reduce high class soil loss by 303 – 605 ha.

Using a rule without the date and high class soil restriction estimates that for a minimum parent title size of 20 ha, the loss of high class soil for a child lot is 1333 - 2666 ha. For a minimum parent title size of 40 ha, the loss of high class soil for a child lot is 795 - 1590 ha. Under this rule increasing the minimum parent title size from 20 ha to 40 ha is likely to reduce high class soil loss by 438 – 1076 ha.

However, a change from the current rule to one that removes the date restriction and allows subdivision irrespective of high class soil is likely to increase the loss of high class soil for all minimum parent title sizes, and the loss will be 235 – 471 ha greater for the 20 ha minimum parent title size (664 - 1328 ha) compared with the 40 ha minimum parent title size (429 - 857 ha).

Additionally, the increased number of eligible parent titles (and associated child lots) on high class soils with increase the potential for land fragmentation on land containing high class soils; 830 more titles for a 20 ha minimum parent title size, and 536 more titles for a 40 ha minimum parent title size.

11.2 Child lot size and a high class soil area % threshold

Currently rule 22.4.1.2 RD1 (a) (iv) requires the child lot to have proposed area of between 0.8 ha and 1.6 ha well as a requirement that it can contain up to 20% high class soils (22.4.1.2 RD1 (a) (B)).

The direct effect of creating a child lot is that the child lot area (and any high class soils within its area) are lost from primary production. The effects change as the size of the child lot changes and the proportion of high class soils contained within the child lot changes. Three options were identified to reduce the loss of high class soils associated with the subdivision of a child lot.

Option one - place the child lot in an area where there is no high class soil.
This option results in no net direct loss of high class soils as the result of creating a child lot. This option does require the accurate identification and mapping of high class soils at property scale.

Option two - use a threshold value for the maximum proportion of high class soil in the child lot. This option results in some net direct loss of high class soils as the result of creating a child lot. The maximum loss is determined by the percentage threshold used. It does require the accurate identification and mapping of high class soils at property scale.

Option three - direct the building platform away from any high class soil in the child lot.
This option allows any amount of high class soils in child lot or could be used in association with a high class soil area % threshold. This option results in some net direct loss of high class soils as the result of creating a child lot. However, directing the building platform away from the areas of high class soils means that the soil remains available for some level of productive use. It does require the accurate identification and mapping of high class soils at property scale.

To test the net loss of high class soils associated with child lot size and high class soil area thresholds, an analysis was undertaken by Waikato District Council GIS staff to ascertain the number of titles likely to be affected and the potential total loss of high class soils associated with child lot size and using a high class soil percentage threshold. The analysis used the available NZLRI 1:50,000 LUC map information to identify high class soils in association with Rural Zone title data. Titles were considered to contain high class soils if they had any high class soil area identified in the title area.

The following analysis looked at the impact of child lot size and the use of a maximum high class soil area threshold (% threshold) on the loss of high class soil. The approach allows the child lot to contain a certain percentage area of high class soil. The % threshold was applied to the child lot area to estimate the maximum high class soil area in each lot and multiplied by the number of titles to the estimate the total possible high class soil area impacted. The analysis assumed that all high class soil in the child lot was lost from production. Titles before 6/12/1997 with any high class soil were used. A minimum parent lot size of 40 ha was used. Four child lot sizes (0.5 ha, 0.8, 1.6 ha and 2.0 ha) were compared. High class soil area thresholds of 10%, 15%, 20% and 30% were used. **Table 12** summarises the high class soils associated with each of the lot size/% threshold combinations.

Table 12. The area high class soils associated with selected lot size/% threshold combinations.

Child lot size (ha)	High class soil area threshold (% of child lot area)			
	10%	15%	20%	30%
0.5	0.05	0.075	0.10	0.15
0.8	0.08	0.12	0.16	0.24
1.6	0.16	0.24	0.32	0.48
2.0	0.20	0.30	0.40	0.60

The greatest impact on the area of high class soil in a child lot is caused by changing child lot size. **Table 13** summarises the number of eligible titles associated with each of the lot size/% threshold combinations. Note that for a title to be eligible it must have a at least enough non high class soil for a child lot of the given size to meet the high class soil area % threshold. For example, for a child lot size of 0.5 ha and a 10% threshold the minimum area of non high class soil required is 0.45 ha (0.9 x 0.5 ha).

Table 13. The number of eligible titles with high class soils associated with each of the lot size/% threshold combinations.

Child lot size (ha)	High class soil area threshold (% of child lot area)			
	10%	15%	20%	30%
0.5	1141	1141	1141	1142
0.8	1139	1139	1139	1140
1.6	1137	1137	1137	1137
2.0	1137	1137	1137	1137

The greatest impact on the number of titles affected is caused by changing child lot size and changing the % threshold has a minimal effect on the number of eligible titles. Overall, there is minimal difference in the number of parent titles affected.

Assuming high class soils occupy the maximum % threshold value in a child lot, the relative area of high class soil lost to child lots can be estimated. **Table 14** shows the relative loss of high class soils associated with each of the lot size/% threshold combinations.

Table 14. The estimated loss of high class soils associated with each of the lot size/% threshold combinations.

Child lot size (ha)	High class soil area threshold (% of child lot area)			
	10%	15%	20%	30%
0.5	57	86	114	171
0.8	91	137	182	274
1.6	182	273	364	546
2.0	227	341	455	682

The smallest direct loss of high class soils from the creation of a child lot is likely to be achieved using a smaller lot size in combination with a lower high class soils area threshold.

11.2.1 Use of a high class soil area % threshold

The concept of applying a % threshold for the area of high class soil in a title or a lot is not commonly used. The proposed NPS-HPL applies a threshold of 50% or more coverage of LUC 1-3 to determine if a land parcel is highly productive land[84]. The analysis indicates that applying a high class soil area %threshold reduces the direct loss of high class soils resulting from the creation of a child lot. This reduction increases as the % threshold is reduced, and child lot size is reduced (refer **Table 14**).

Implementing a high class soil area % threshold would require the accurate identification and mapping of high class soils at property scale. The use of a % threshold value may be problematic (from an implementation sense) given the nature of field soil mapping, and the use of an exact value to determine the eligibility of a child lot. For example, field mapping could be manipulated (even at the finer scale) to produce a value of 19%, which would deem the child lot eligible. For a

[84] Proposed National Policy Statement – Highly Productive Land. Indicative Cost-Benefit Analysis MPI Technical Paper No: 2019/10.

child lot of 1.6 ha every 1% equates to 160 m^2. Using soil map scale guidelines[85], delineation of 160 m^2 area would suggest a mapping scale of less than 1:1000.

However, the main emphasis of the rationale for the approach should be that the % threshold does provide at least some certainty that the child lot is predominantly not high class soils.

For the Waikato region (including the Waikato district) the presence or absence of high class soils (as defined using the LUC Classification) generally depends on the values for LUC erodibility (e) wetness (w) limitations, in combination with the presence or absence of Organic Soils and Allophanic Soils as defined by the New Zealand Soil Classification. This means that in reality most soils that are not high class soils are on land that has a slope of >7 ° (or >15 ° if on Allophanic Soils), has moderate or greater erosion susceptibility or is poorly or very poorly drained.

These limitations mean that the land is generally not that amicable to providing a flat or well drained platform for building. Also, placement of a building platform (and accessways) on steeper topography potentially increases the potential for erosion and sediment loss from the site. Furthermore, in my experience mapping at property scale it is common to have small areas of high class soils. These generally occur in localised areas where slopes are ≤7 °.

Placement of a child lot to contain no high class soils is likely to be either impossible or require that its placement is either on sloping (> 7 ° slopes, or >15 ° if on Allophanic Soils) or on very poorly drained soils or soils prone to erosion. In my opinion allowing some high class soil within a child lot is justifiable to ensure some land is available for a building platform.

11.2.2 Setting a high class soil area % threshold

Figure 16 graphically presents the data from **Table 14** showing the estimated loss of high class soils associated with each of the lot size/% threshold combinations.

[85] Grealish G. (2017) New Zealand soil mapping protocols and guidelines. Envirolink Grant: C09X1606. Landcare Research, Palmerston North.

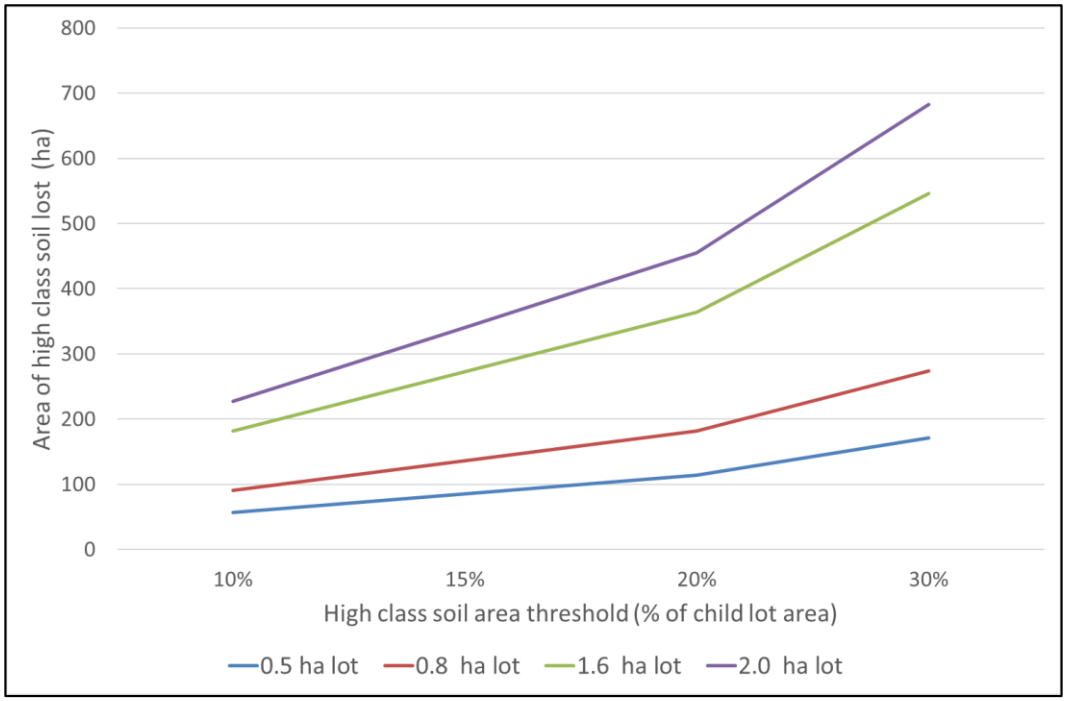

Figure 16. The relative loss of high class soils associated with each of the lot size/% threshold combinations, using a 40 ha minimum parent title size.

Based on **Figure 16**, the high class soil area % threshold should not exceed 20% for any child lot size. A % threshold of 10% will have the greatest impact on reducing the loss of high class soil but may be excessively restrictive in the number of eligible titles and not provide sufficient area for productive use or a safe building platform.

An acceptable % threshold is considered 15%, as this minimises the direct loss of high class soils through the creation of the child lot, allows some area for productive use or a safe building platform, and minimises the need for earthworks on the site that may increase the potential for erosion and ongoing sediment loss.

11.3 Collective impacts

The overall objectives with regard to high class soil and land fragmentation should be to retain high class soils for productive use in the Rural Zone and to retain the broadest range of viable land uses on these soils and all other soils. There are four main policy mechanisms used to retain high class soil and land area for productive use in the Rural Zone; title date, minimum parent title size, child lot size and a high class soil area % threshold. The impact on high class soil and land area for productive use in the Rural Zone has been assessed individually, however, their collective and relative impacts on land fragmentation and the loss of high class soil is important to consider.

11.4 Retaining productive land

The loss of high class soils and retaining large areas of land need to be considered together to maintain the range of potential land uses. Retaining larger areas of high class soils will ensure the range of potential land uses is not reduced because some land uses can only exist on high class soils. For example, if an area of high class soils is on a parcel size of >100 ha it remains viable for dairy production and potentially higher producing land uses such as commercial vegetable cropping and intensive horticulture land uses. Reducing the land area below 100 ha excludes dairy

from being a viable land use, whereas losing areas of high class soil will exclude commercial vegetable cropping and intensive horticulture from being viable land uses.
Based on the available data, the mechanisms for retaining productive land are best focussed on:

3. Retaining the date restriction (6th December 1997) on the number of eligible titles,
4. Increasing the minimum size of eligible titles for subdivision (the parent lot) from 20 ha to reduce subdivision density and reduce the direct loss of high class soils through child lots.

11.1 Retaining high class soils for productive capacity

Retaining high class soils for future primary production use essentially requires them to remain in primary production, irrespective of what the specific land use is (e.g. – some high class soils may be in land uses that are not optimising their long term productive capacity). Based on the data available, the loss of high class soils continues to occur throughout New Zealand, including the Waikato region and in the Waikato district. The primary cause of the loss is due to residential expansion. Based on the available data, the mechanisms for retaining high class soils are best focussed on:

4. Reducing the number of child lots,
5. minimising the size of child lots, and
6. directing the placement of child lots away from high class soils

The use of a high class soil area % threshold for child lots is considered practical from a mapping perspective if a property scale LUC Classification assessment is undertaken.

Implicit in the suggested mechanisms is the accurate identification of high class soils at property scale. For accurate identification and mapping of high class soils, the use of LUC assessment at property scale is recommended as opposed to relying on the available NZLRI (1:50,000 scale) LUC map information (or any other similar scale map information). This is best undertaken as required on a case by case basis. It should be noted that the NPS-HPL (once operative) will require Regional Councils to define and map highly productive land (high class soils) as stated in Policy 1, but also that resource consent applications must include a site-specific Land Use Capability Assessment prepared by a suitably qualified expert (Policy 7).

12 Recommendations

9. Retain the date restriction (6th December 1997) on the number of eligible titles to ensure that the density of subdivision is not increased such that it will reduce the viability of induvial land uses or the range of potential land uses, especially for land with high class soils.
10. Increase the minimum size of eligible titles for subdivision (the parent title) from 20 ha to 40ha:
    a. reduce the potential for the density of subdivision to reduce the viability of induvial land uses or the range of potential land uses, especially for land with high class soils, and
    b. reduce the area of high class soils lost to child lots through subdivision.
11. Minimising the size of child lots (to at least less than 2.0 ha) to minimise the loss of high class soils, either directly or indirectly through subdivision.

12. Direct the placement of child lots away from high class soils to avoid the direct loss of high class soils from production.
13. Use of a high class soil area % threshold for a child lot is deemed acceptable and would minimise the direct loss of high class soils through the creation of a child lot. Identification using property scale assessment should be used to determine the location and area of high class soils, and whether the percentage threshold requirement is met.
14. An acceptable high class soil area % threshold for a child lot is considered 15%, as this minimises the direct loss of high class soils through the creation of the child lot, allows some area for productive use or a safe building platform, and minimises the need for earthworks on the site that may increase the potential for erosion and ongoing sediment loss.
15. The existing NZLRI (1:50,000) scale LUC map information should not be used for property scale identification of high class soils but may be acceptable for the coarse identification of areas of high class soils, and district GIS analyses.
16. A property scale assessment using the LUC Classification is recommended for accurate identification of high class soils for individual properties and for determining the % area of high class soils present if a high class soil area % threshold approach is use.

13 Appendices

Appendix 1: Summary of Proposed NPS-HPL policy

Proposed Policy 1: Identification of highly productive land

1.1 Regional councils must identify areas of highly productive land using the criteria set out in Appendix A and:

- map each area of highly productive land; and
- amend their regional policy statements to identify areas of highly productive land within the region.

1.2 Territorial authorities must amend their district plans to identify highly productive land identified by the relevant regional council under policy 1.1.

Appendix A: Criteria to identify highly productive land

In accordance with Policy 1, regional councils must use the following criteria to assess and identify areas of highly productive land:

a. the capability and versatility of the land to support primary production based on the Land Use Capability classification system;
b. the suitability of the climate for primary production, particularly crop production; and
c. the size and cohesiveness of the area of land to support primary production.

When identifying areas of highly productive land, local authorities may also consider the following factors:

a. the current or potential availability of water;
b. access to transport routes;
c. access to appropriate labour markets;
d. supporting rural processing facilities and infrastructure;
e. the current land cover and use and the environmental, economic, social, and cultural benefits it provides; and
f. water quality issues or constraints that may limit the use of the land for primary production.

Highly productive land excludes:

a. urban areas; and
b. areas that have been identified as future urban zones in district plans.

Proposed Policy 2: Maintaining highly productive land for primary production

Local authorities must maintain the availability and productive capacity* of highly productive land for primary production by making changes to their regional policy statements and district plans to:

a. prioritise the use of highly productive land for primary production
b. consider giving greater protection to areas of highly productive land that make a greater contribution to the economy and community;
c. identify inappropriate subdivision, use and development of highly productive land; and

d. protect highly productive land from the identified inappropriate subdivision, use and development.

*Note the draft definition for productive capacity is: “means, in relation to highly productive land, the physical qualities of the land to support primary production and generate the most economic output. This includes consideration of physical constraints on use of land for primary production (e.g. lot size, presence of structures and buildings) but does not include consideration of wider soil quality issues”.

Proposed Policy 3: New urban development and growth on highly productive land

Urban expansion must not be located on highly productive land unless:

a. there is a shortage of development capacity to meet demand (in accordance with the NPS-UDC methodologies and definitions); and

b. it is demonstrated that this is the most appropriate option based on a consideration of:

- a cost-benefit analysis that explicitly considers the long-terms costs associated with the irreversible loss of highly productive land for primary production;
- whether the benefits (environmental, economic, social, and cultural) from allowing urban expansion on highly productive land outweigh the benefits of the continued use of that land for primary production; and
- the feasibility of alternative locations and options to provide for the required demand, including intensification of existing urban areas.

Proposed Policy 4: Rural subdivision and fragmentation

Territorial authorities must amend their district plans to manage rural subdivision to avoid fragmentation and maintain the productive capacity of highly productive land, including by:

a. setting minimum lot size standards for subdivision located on highly productive land to retain the productive capacity of that land;

b. incentives and restrictions on subdivisions to help retain and increase the productive capacity of highly productive land; and

c. directing new rural lifestyle development away from areas of highly productive land.

Proposed Policy 5: Reverse sensitivity

Territorial authorities must recognise the potential for sensitive and incompatible activities within and adjacent to areas of highly productive land to result in reverse sensitivity effects and amend their district plans to:

a. Identify the typical activities and effects associated with primary production activities on highly productive land that should be anticipated and tolerated in rural areas;

b. restrict new sensitive and potentially incompatible activities on highly productive land to ensure these do not compromise the efficient operation of primary production activities;

c. establish methods to avoid or mitigate reverse sensitivity effects including through setbacks and the design of developments; and

d. establish methods to avoid or mitigate reverse sensitivity effects at the interface between areas of highly productive land and adjacent residential and rural lifestyle zones.

Proposed Policy 6: Consideration of requests for plan changes

When considering a request for a private plan change for urban expansion on highly productive land, or to rezone an area of highly productive land to rural lifestyle use, local authorities must have regard to:

a. The alignment of the request with relevant local authority statutory and non-statutory plans and policies relating to urban growth and highly productive land;
b. The benefits (environmental, economic, social, and cultural) from the proposed use of land compared to benefits from the continued use of that land for primary production; and
c. Whether there are alternative options for the proposed use on land that has less value for primary production.

Proposed Policy 7: Consideration of resource consent applications for subdivision and urban expansion on highly productive land

When considering an application for subdivision or urban expansion on highly productive land, consent authorities must have regard to:

a. The alignment of the application with relevant local authority statutory and non-statutory plans and policies relating to urban growth and highly productive land;
b. The extent to which the subdivision or development will impact on the existing and future use of the land for primary production;
c. The practical and functional need for the subdivision or urban expansion to occur at that location;
d. The potential for reverse sensitivity effects and proposed methods to avoid or mitigate potential adverse effects on, and conflicts with, lawfully established activities; and
e. The benefits (environmental, economic, social, and cultural) from the proposed activity compared to the long-term benefits that would occur from the continued or potential use of the land for primary production. Resource consent applications must include a site-specific Land Use Capability Assessment prepared by a suitably qualified expert.