STAFF REPORT

TO: Environment & Planning Committee

FROM: Andrew Burton, Resource Scientist - Land

REFERENCE: L213

SUBJECT: **UPDATE OF REGIONAL SOIL MAPPING AND INFORMATION PROGRAMME - REPORT REP10-08-06 -** Report prepared for meeting of 12 August 2010

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1. PURPOSE

The purpose of this report is to provide an update on the ongoing soil mapping and information gathering programme in the Tasman District.

2. INTRODUCTION

Our soils are fundamental to the Tasman District Council's requirements to achieve sustainable land use in the region through plan development and environmental monitoring. They are also fundamental to the landowner who desires to carry out agricultural activities.

Information on the soils is vital for both purposes. The Council's information requirements cover a varying range of scales and degree of detail. Much of the published soils information for the district is not at a scale to provide adequate detail and accuracy for its required purpose and the aim of the programme is to rectify this deficiency. Soil mapping and data collection for the Takaka Valley is nearing completion and the assessment of existing field maps as to accuracy and usefulness has also been completed.

3. THE NEED FOR BETTER SOIL INFORMATION

Published Soil surveys for the district were carried out approximately 50 years ago. Their scale and detail is not adequate for today's needs.

Two main soil surveys exist for the Tasman district. They are:

- The "General Soil Survey of the South Island." (1968) this was carried out to give an overall picture of soil pattern and to provide basic information for predicting future land use and broad fertility needs. It was carried out at a scale of 4 miles to 1 inch. (1:250,000).

- "Soils and Agriculture of the Waimea County" (1966). This report is a culmination of a number of surveys and maps carried out and compiled over the years dating back to the 1920s. It included surveys of the flood plains and lower terraces to classify soils for tobacco culture and also included reconnaissance surveys for the General Soil Survey of the South Island. The Soils and Agriculture of the Waimea County was published at a scale of 1:126720.

The Waimea County area did not include all of the Tasman District but in those areas it does cover, the Waimea and Motueka catchments in general, field maps exist for the plains and valleys at a scale of 1:15840. Their detail is excellent but is limited to the soils textural characteristics only. For many of the maps the legends have been lost.

In 1977 the New Zealand Land Resource Inventory (NZLRI) was published. This classification used soil information from the two surveys described above as the base information. The developers of the NZLRI refined some of the soils data by simply interpreting landscape patterns. Little, if any on-site assessment was carried out to ground truth these refinements. However the result is a slightly more detailed soil map.

4. LIMITATIONS OF THE EXISTING INFORMATION

The General Soil Survey of the South Island has limited use at a regional level simply because of the scale it was mapped at. Even with the refinements carried out under the NZLRI exercise, the soils information for the Upper Buller and Golden Bay area is not of adequate detail to provide adequate information for land use or planning exercises.

The Soils and Agriculture of the Waimea County does provide good information on the soil types and includes general information on land use and limitations of the soils to use. Soil chemical analysis of most soils is also provided. Although this information is reasonably accurate the scale of mapping has lead to a lot of generalization of soil attributes and mapping units. It is questionable whether the detail of the Waimea County maps is suitable for planning purposes today and in the future.

Other databases such as the "Classification System for the Productive Land in the Tasman District (1994), the NZLRI, and the Environmental Domains classification uses the published soil maps as an underlying and guiding dataset hence any existing inaccuracies are repeated in these related datasets.

The soils information for Council's planning purposes and consent processing is being requested more often and at greater detail.

5. TODAY'S SOIL INFORMATION REQUIREMENTS

The Council's information requirements cover a varying range of scales and degree of detail. Looking at other recent soil mapping work carried out, primarily for planning purposes, for other Regional Council's in New Zealand the scale of these mapping exercises is generally in the 1:20,000 to 1:50,000 range. The Topoclimate project carried out in Southland was also carried out at a scale of 1:20,000. This project

aimed at providing information for landowners as part of a Regional Councils/District Councils assisted initiative to stimulate rural production and growth. The recent "Crops for Rural Dunedin" soil surveys were also carried out at 1:20,000.

A scale of 1:20,000 was assessed to be appropriate for the ongoing soil mapping work here in Tasman.

6. RECENT WORK

6.1 Soils and Agriculture of the Waimea County, field map assessment

As described earlier a series of field maps were developed for the valley and plains at a scale of 1:15840 that are very detailed with regard to the soils textural characteristics but little other information exists and for many of the maps their legends had been lost.

There was a need to assess how useful the information on the maps was and develop a key for them. The Tasman District Council was successful in their application of a medium advice grant through Envirolink to carry out this study.

An electromagnetic induction (EM) survey was carried out by Landcare Research and Spatial Solutions Ltd on 2 sites covering in total 131 hectares in the Motupiko Valley. These areas were covered by an unpublished field map completed in 1940.

Electromagnetic surveys simply work by delineating soil units on a basis of varying soil electrical conductivity which is primarily influenced by texture and soil moisture.

Figure 1 displays the electrical conductivity (EC) patterns produced from the survey. The fine black lines and numbers are the position of the soil boundaries from the old field maps.

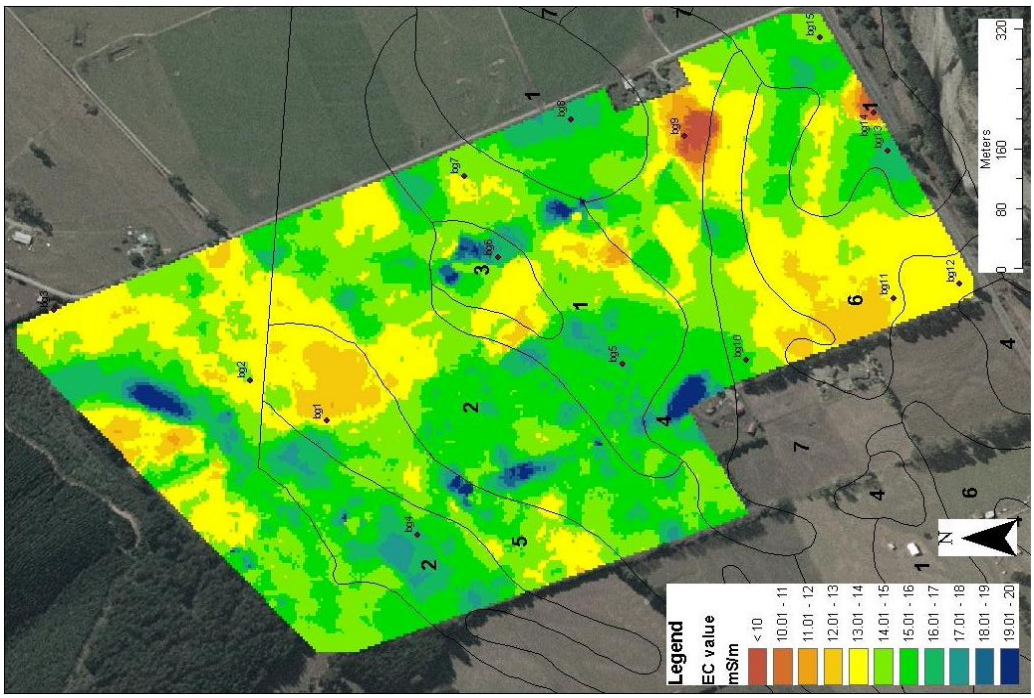


Figure 1: EM Survey Map of Baigent Property

Ground truthing of the EM survey by field work indicated that the EM survey was very accurately recording the textural variations. But as can be seen from Figure 1 the old field map boundaries were not a precise fit. Although there were, over both sample areas, some commonality between the two surveys to be of use.

The conclusions drawn from the study was that the EM survey, together with the existing soil and geological information, were useful in interpreting the unlabelled soil units on the unpublished field maps. Also there were a number of inaccuracies discovered in the field maps which could be partly explained by poor registration of the original maps. Consequently the old field maps have to be used with some caution. They can provide a starting point for information required today but further studies are required to verify their accuracy in other areas.

It was also concluded that the variation in textural character of the soils in the study area is great enough to have a significant impact on land productivity and versatility. Climatically the Motupiko valley is suitable for a wide range of crops. Where the deeper silt loams occur there are therefore opportunities for changes in land use from pasture to cropping and horticulture. The variability in the nature of soil where some high-quality, deep gravel-free loamy soils exist adjacent to very stony soils may be one of the major limitations to change of land use.

6.2 Takaka Soil Mapping

Mapping is near completion in the Takaka Valley. The survey work was carried out by local pedologist and soil scientist Dr Iain Campbell. The survey area was split into five distinct areas. The first area was started 2006 and maps and reports were developed for each mapping area as they were completed. The maps and reports complete are:

- Soils of the Lower Takaka Valley (3000ha) 2006
- Soils of the Puramahoi District (3000ha) 2007
- Soils of the East Takaka District (1500ha) 2008
- Soils of the Kotinga District (2400ha) 2009

The last area to be surveyed has had the field work completed and the map development and report writing is near completion. That area is:

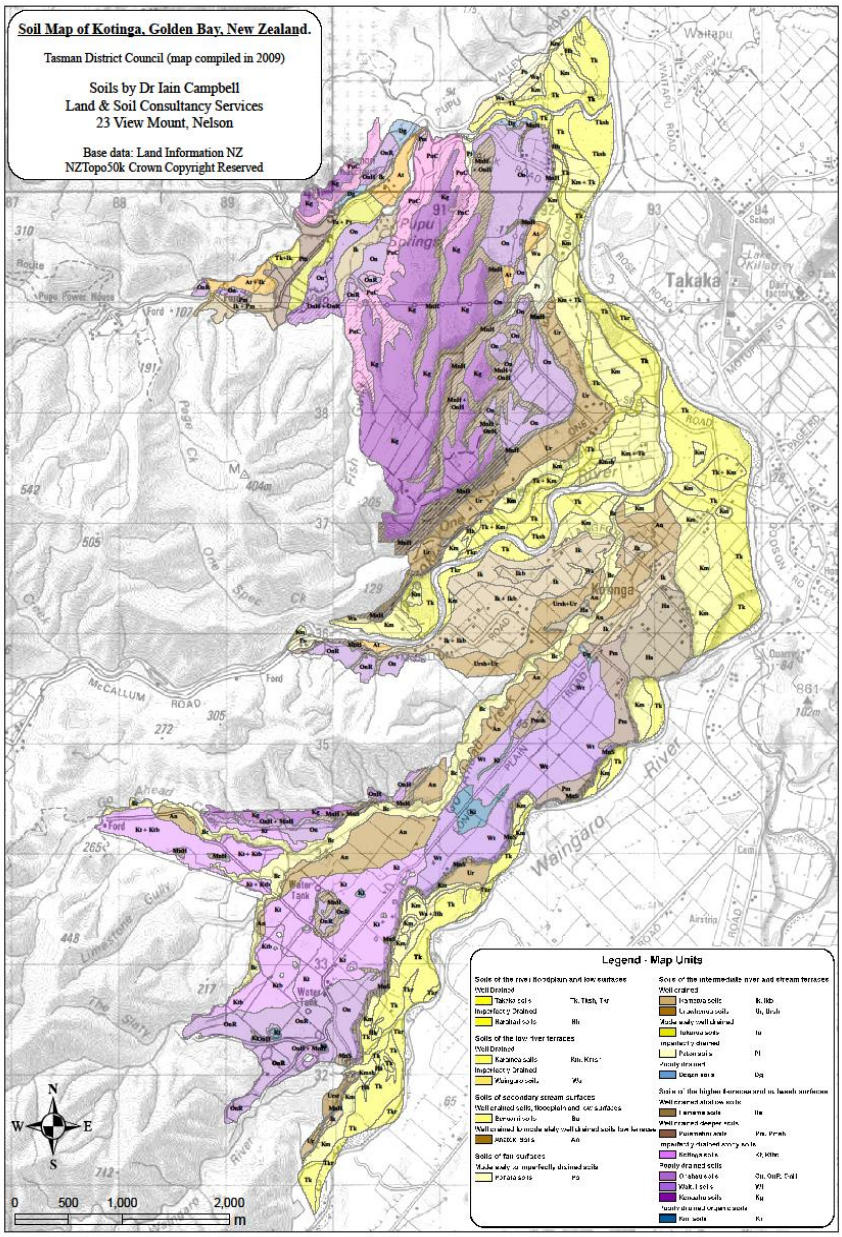
- Soils of the Hamama District (2900ha) 2010

A total of 12800 hectares have been surveyed.

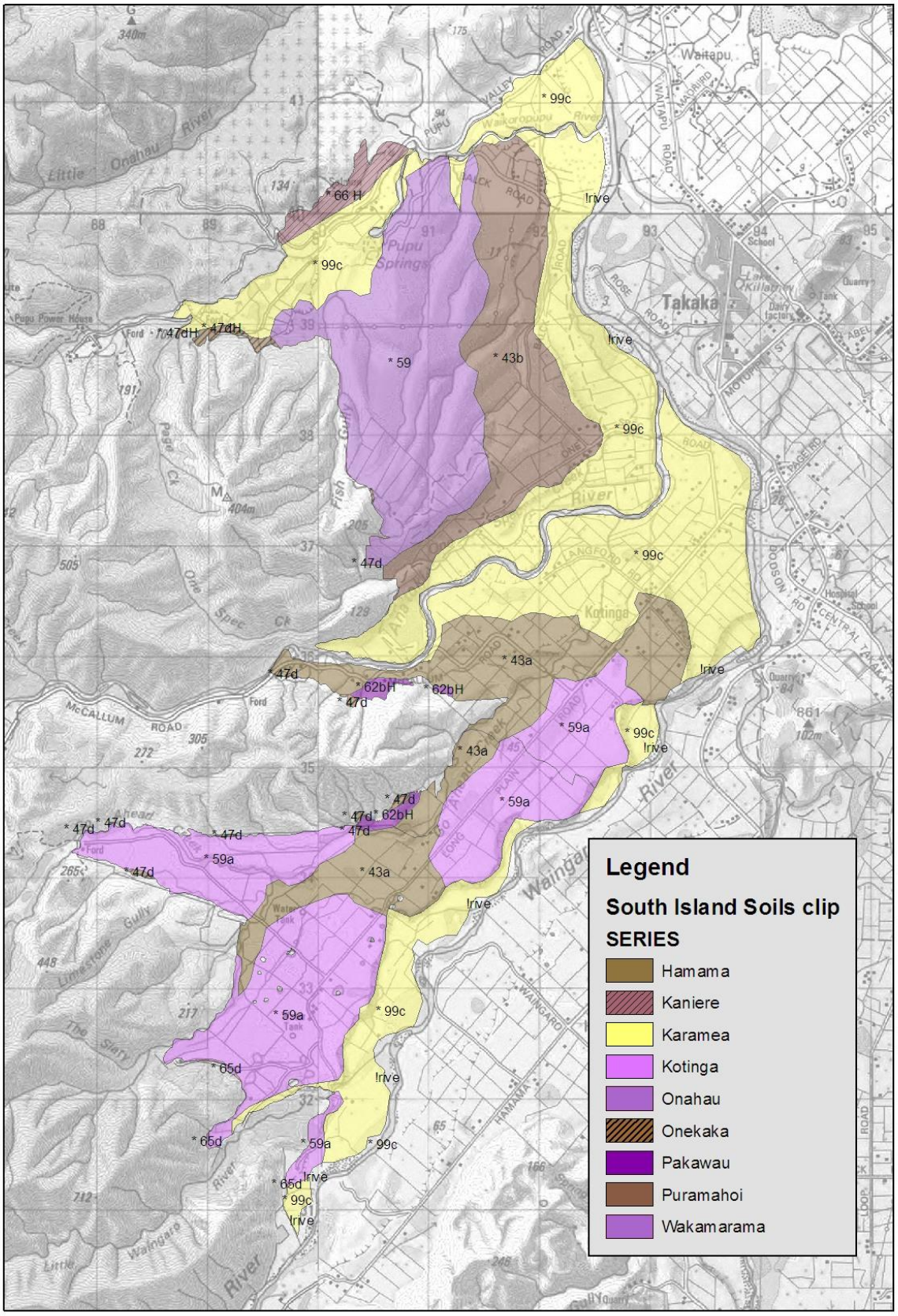
As an example of the information detail and type obtained for each district, the Soils of the Kotinga District survey was produced from field examinations during which 881 observations were recorded. This included 803 observations from auger holes and 78 observations from excavation pits, giving an observation frequency of one per 2.7 hectares. Map 1: Soils Map of Kotinga, Golden Bay, New Zealand highlights the detail of the survey. Individual areas were mapped down to 0.25 hectares. There were 19 different soil types mapped. In all 41 different soil variations or combinations were mapped for this survey compared to the nine on the latest published map for the same area. See Map 2 “Soils of Kotinga from the NZLRI dataset 1975” to note the comparison.

The map detail is very important as there is generally large variation in soil characteristics even within the same soil type. For example the Takaka soils (Tk) mapped in the Soils of the Kotinga survey have several major variants. Included with the Takaka soils (Tk) are Takaka bouldery soils (Tkb) where the surface cover is predominantly bouldery, Takaka shallow soils (Tksh) (30%) where stones or boulders are common within 45 cm of the surface, Takaka moderately deep soils (30%) where the depth to gravel is between 45-90 cm and Takaka deep soils (30%) where the depth to gravel is 90 cm or greater. Also Takaka raw soils (Tkr) are separated on river berms where there is very frequent flooding and negligible soil development in the sandy alluvium. The significance of this variation is highlighted when comparing the productivity rating of the variants as shown below.

Soil variant	Land productivity Rank
Tk	B (semi intensive horticulture)
Tksh	F (Extensive pastoral)
Tkb and Tkr	H (non productive)



Map 1



Map 2: Soils of Kotinga from the NZLRI dataset 1975

For each soil, a full description is produced. This covers the physical characteristics such as texture, structure, drainage, rooting depth, wetness as well as land versatility. An example of the information provided in these descriptions follows:

Karamea Soils

Soil name and map symbol: Karamea (Km, Kmsh)

Concept and overview

Karamea soils (249 ha) are mapped on the low terraces of the floodplain surfaces and occur most extensively on the broader portion of the Takaka Valley floor where the Anatoki, Waingaro and Takaka Rivers join. These soils are on surfaces that lie just above the main floodplain surface and are essentially flood free except in rare and extreme flood events. The presence of a more distinct and deeper topsoil and a weakly developed B horizon is indicative of an absence of recent flood and sedimentation history.

Relationship to previously named soils

Karamea soils were not delineated in the unpublished soil survey of Takaka County but were instead mapped principally as Takaka sands. In the 1:250,000 General Survey of the soils of South Island (Soil Bureau Staff 1968), they were included with all of the soils on the lower terraces as Karamea set (99c). Karamea soils have been mapped in the recent Lower Takaka, Puramahoi and East Takaka surveys.

Landform origin and history

The low terraces of the Anatoki, Waingaro and Takaka Rivers are composite surfaces with terracetts that mark minor stages of river adjustments to base level changes. Soil profile development increases with height above river level but the overall degree of soil development, which is predominantly weak indicates that the low terrace surfaces are of a very recent age. Where the rivers are incised, Karamea soils are on small terrace remnants away from the river but in the lower reaches, recent flood overflows have resulted in a patchwork of Takaka soils in overflow zones and Karamea soils in slightly more elevated areas.

Key soil features

Karamea soils are predominantly moderately deep (46% 45-90 cm over gravel) with around 25% shallow (< 45 over gravel) or stony with gravel at the surface. The topsoil is brown to dark brown or brown silt loam and averages around 20 cm in thickness The B horizon is weakly developed, about 18 cm thick and is varied in colour but is mainly olive brown to light olive brown silt loam. Colour differences are largely attributable to differing sediments in the differing river systems. C horizons are mainly sandy to loamy textured.

Identified variants

Karamea deep soils (40%) occur along with Karamea moderately deep soils and Karamea shallow soils (Kmsh), which are shown separately in several places. Moderately well drained soils with some reddish brown, brownish yellow and occasionally grey mottles are sometimes found in sites where surface drainage is restricted.

Associated and similar soils

Karamea soils are associated with Takaka soils on some of the lower surfaces where flood overflows are complicated by the merging of three river systems over a short distance. Waingaro soils occur on the same land surface in sites that have poor surface drainage. Anatoki soils are somewhat similar to Karamea soils and are confined to the Go Ahead Creek catchment but are characterised by a dominance of olive colours in the subsoil.

Key physical properties

Karamea soils are moderately deep and well drained with silt loam texture passing into sandy loam then gravel in the lower horizons. They have moderately deep rooting depth but weak soil subsoil strength and weakly developed subsoil structures.

Soil versatility and land use rating

Karamea soils have easy slopes with slight surface undulations and are relatively stone free. Trafficability is unlikely to be restricted for significant periods as waterlogging over winter months is not prolonged. A summer soil moisture deficit is relatively short and can be corrected by irrigation while flood risk where present, can be overcome by flood control measures. Karamea soils are included in class A of the Tasman District Council land classification scheme.

Horizon Depth Description

A 0-14 cm Brown (10YR 5/3) silt loam; moderately developed medium polyhedral structure; weak soil strength; friable; many fine and few coarse roots; indistinct boundary,

B 14-30 cmdark yellowish brown (10YR 4/4) silt loam; weakly developed coarse polyhedral and fine blocky structure; weak soil strength; friable; many fine roots; indistinct boundary,

C1 30-60 cmolive brown to dark yellowish brown (2.5Y 4/4- 10YR 4/4) silt loam; weakly developed fine polyhedral and medium blocky structure; weak soil strength; friable; few fine roots; distinct boundary,

C2 60-70 cm+ olive (5Y 4/3) sandy gravel; structure less; loose; 60% fine to coarse stones

6.3 S Map

The completed soil surveys and maps are to be integrated into a National programme called S-Map. This is a new digital soil spatial information system for New Zealand. It provides consistent and comprehensive national soil data layers to support applications at local, regional and national scales.

As part of that integration the soils information that Council has provided will be used to develop "work sheets". The aim of these sheets is focussed at getting the type of soils information out to landowners, farmers, horticulturalists and foresters that will be of benefit to them.

6.4 Chemical and Physical Information

In 2009 soil sampling was carried out on eight soil types in the Takaka Valley to quantify the physical and chemical characteristics of some of the main soil types mapped in the recent surveys. This sampling was also coupled in with the Council's ongoing Soil Health Monitoring Programme.

Sample sites were determined in the field to ensure that sites selected are representative of the major soils, topography and land use/management of the area. The sites and their description are listed in Table 1 below.

Site code	Soil type	Land use
TDC 09.16	Takaka	Pasture, dairying
TDC 09.17	Uruwhenua	Pasture, dairying
TDC 09.18	Anatoki	Pasture, dairying
TDC 09.19	Ikamatua	Pasture, dairying
TDC 09.20	Puramahoi	Pasture, dairying
TDC 09.21	Motupipi	Pasture, dairying
TDC 09.22	Pisgar	Pasture, beef
TDC 09.23	Hamama	Pasture, dairying

Table 1

At each sample site, a site description and soil profile was completed and sampling carried out to assess the following basic soil properties:

1. Total Carbon
2. Total Nitrogen
3. Mineralisable Nitrogen
4. Soil pH
5. Olsen P
6. Bulk density
7. Macroporosity
8. Aggregate stability

In addition to these properties the volumetric water content at 5, 10, 100, 1500kpa, was gathered. The volumetric water content data is required to assist with irrigation management and will be used specifically by Council for irrigation water allocation purposes. Data for the Takaka soil with regard to irrigation management was, up to now nonexistent. Irrigation in the Takaka catchment has increased dramatically over the past five year so the information fills an immediate demand.

The information from this sampling has been used to estimate values for soils that have not been sampled so that a complete dataset can be developed.

7. INFORMATION USE

The soil survey information has been used to update the Land Productivity Classification for the Takaka area. This has highlighted the large degree of inaccuracy in the existing classification map. As an example some survey districts have 32% less class A land than that indicted on the original classification map for the same area.

The soils information and particularly the new Land Productivity Classification for the area has been instrumental in the policy work for the Takaka East Golden Bay Growth Project. In particular for defining land of high productive potential for protection.

The new information has also been used for land use consent (irrigation and subdivision) application processes in Golden Bay.

Landowners, surveyors, consultants and law firms have requested information off the new surveys at both a property specific and district scale.

Several prospective landowners have also requested information on a property basis to assist finding land of a specific productive nature. Their very positive response to the information available demonstrates the high quality and usefulness of the survey information.

This all leads to a wiser use of our limited soil resource.

8. RECOMMENDATION

That Report REP10-08-06 be received.

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