ScapeSpec®

RG240

NORTH ISLAND

A rain garden mix engineered to absorb stormwater run-off during heavy rainfall

Prepared April 2021
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RG240

NORTH ISLAND

A rain garden mix engineered to absorb stormwater run-off during heavy rainfall

RG240 has been engineered alongside industry experts to create a superior bio-retention media that absorbs stormwater run-off from roads and paved areas during heavy rainfall. It is a specified blend of quality sands, premium Waikato topsoil and rich compost. RG240 has been installed extensively on key urban developments, new subdivisions, roads, highways, and carparks.

Our Performance

RG240 has been engineered for performance. Stringent laboratory testing proves our mix to absorb and filter contaminants of stormwater, surpassing the desired level required under Auckland Regional Council Storm Water Management Guidelines. Landcare Research Soil Physics Laboratory tests and in-situ test results are available on request.

All our engineered soils are prepared using quality control policies that drive consistency and accuracy.

Mulching

For best establishment a layer of pebbles or a mulch of woodchip and compost are recommended. This will reduce weed growth and help preserve soil moisture allowing for good plant development. ScapeSpec have a range of suitable products for rain garden mulching.

How to Use

For optimum installation please refer to specification details provided by the Landscape Architect or Engineer. Alternatively visit Auckland Council – Rain Gardens Construction Guide.
Important: To avoid saturation please cover onsite stock piles in wet weather prior to installation. Do not use fertilisers, herbicides or pesticides as they may pollute water quality.

Product Specification

Water Retention	**20% - 40%**
Saturated Hydraulic Conductivity	**50 - 300mm/hr**
Air Filled Porosity	**15% - 20%**
Particle <10mm	**90% - 100%**
pH range	**5.5 - 7.0**

Rain gardens are simple to implement and environmentally sound solution to urban stormwater run-off. The benefits of rain gardens are numerous including pollution control, flooding protection and water conservation. They also create new habitats for birds & insects, reducing garden maintenance and increasing street appeal.

Installation Guidelines

Specific RG240 installation guidelines are based on laboratory and field testing for optimum media performance in line with Storm Water Management Guidelines and GD01. These guidelines demonstrate proven best practice.

- Bio retention layer should be a minimum of 500mm once compacted.
- 25% compaction to achieve the required Hydraulic Conductivity rate of 75mm – 300mm.
- Install in 200-300mm layers and wet to aid compaction.
- Volume compaction ratio 4:3 (i.e. 400mm loose compacts to 300mm)
- To avoid product saturation and contamination, onsite stockpiles should be limited and covered in wet weather prior to installation.
- Do not use fertilisers, herbicides, or pesticides as they may pollute water quality.
- Following installation sediment controls should be installed to avoid media contamination whilst still in construction.
- Ensure media layers are compatible and in line with architectural or council guidelines.

RG240
(Bio Retention Media)

Please feel free to contact us around site specific installation, or with any further queries.

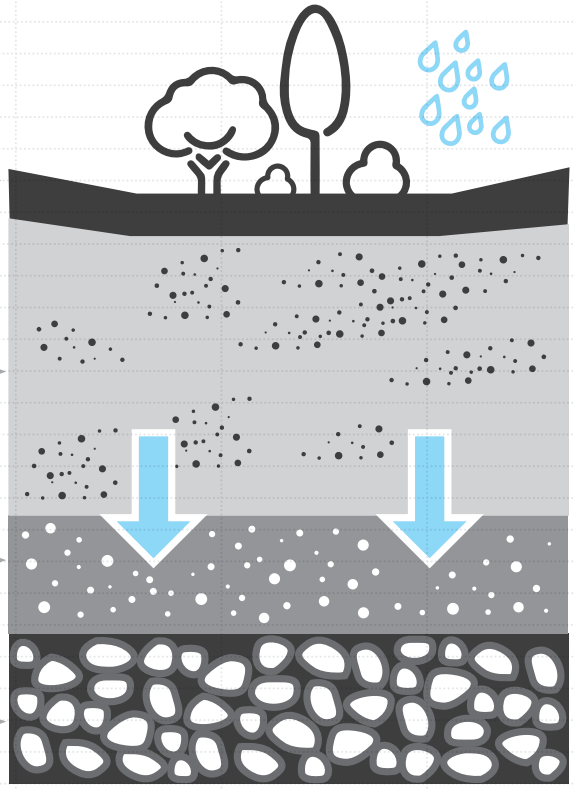
Media Layers:

Mulch
A larger particle size that ensures rapid permeability of water and air into the underlying soil. It protects the media surface from clogging during plant establishment and prevents weeds.

RG240 (Bio Retention Media)
Engineered soil media with specific particle size distribution to manage the effects of stormwater run-off. Promoting plant growth as well as absorbing and filtering contaminants.

Transition Filter Media
Additional heavy filter material, prevents media migrating into drainage aggregate.

Underdrainage
Aggregate layer connecting to the stormwater network or waterways. (Free draining soils may not require underdrain, as runoff will drain to groundwater)



DECLARATION OF CONFORMITY

Declaration Number: RG240- 064238

Specifications Supplier: ScapeSpec Limited

124 Halsey St, Wynyard Quarter

Declare that the product RG240 Rain Garden Media

This product has been designed for use as a bioretention media for the use in stormwater bioretention devices. The media when produced using the ScapeSpec System will absorb stormwater run-off from roads and impervious surfaces to filter contaminants. The product must be installed to the manufacturer's guidelines to ensure conformity to the below standards.

FEATURES

- Water Retention 20 - 40%
- Hydraulic Conductivity 50 – 300mm/hr
- Air Filled Porosity 15 - 25%
- Particle <10mm 90 – 100%
- PH Range 5.5 - 7.0

Is conformal to the following directives and standards:

GUIDELINE DOCUMENT 2017/001 STORMWATER MANAGEMENT

ASTM F1815 - 11 STANDARD TEST METHODS FOR SATURATED HYDRAULIC CONDUCTIVITY, WATER RETENTION, POROSITY, AND BULK DENSITY OF ATHLETIC FIELD ROOTZONES

Issued on: 16 - 04 - 2021

Dean Rissetto
ScapeSpec Limited

Product Related Projects

Project: Westhaven Marina Upgrade

Location: Auckland

Solution: TP120, RG240

Project Overview

Fittingly dubbed the 'City of Sails', Westhaven Marina is one of Auckland's most well-known locations. The largest yacht marina in the Southern Hemisphere, the marina's central location makes it a notable example of urban boating. As part of the marina's impressive upgrade, a 400m boardwalk along the water's edge, with major carpark upgrades and sea wall enhancement were included.

This juxtaposition of coast with urban surrounds makes the marina a truly unique and challenging environment. Due to the harsh conditions, careful consideration was given to soils and plants selected. The sea wall was softened by retained Pohutukawa trees stabilised in TP120 to support native coastal root establishment, our bio-retention media was used to mitigate large impermeable surfaces created by carpark upgrades close to the waters edge, rain gardens were installed. Using our RG240, these rain gardens allow filtration of contaminants and reduced speed of stormwater run-off from nearby roads and paved areas.

Great product availability and communication from the team - Supply was hassle-free, consistent and met project specifications.
JARROD THOMPSON, HEB

Through boardwalks, this project has integrated sea and land to create a thriving green pathway for cyclists and walkers.

Project: Silo Park - Wynyard Quarter

Location: Auckland

Solution: Organic-Lock, TP120

Project Overview

Silo Park has undergone recent revitalisation from old industrial land into an energetic public space in the heart of Auckland's waterfront. Incorporating old and new together, Silo Park maintains traces of it's cement depot history while integrating sitewide stormwater treatment and permeable natural zones throughout.

One of the key factors to the transformation of the area was the introduction of natural ground and splashes of native green. Organic-Lock blended Hoggin was installed in multiple areas throughout Silo Park. Creating a natural aesthetic, Organic-Lock provides pleasant contrast to the concrete whilst still being a firm and low maintenance solution that is going to last. Native trees throughout this project not only inject life into silo park but also aid in conservation efforts. TP120 is MetroGreen's preferred soil for their strata cell, this soil and system combination will support the large mature trees against exposure to the elements from standing alone in an urban environment.

The team was invested in the overall success for the project – they were able to provide us with practical product solutions, along with supporting documentation promptly.
RYAN GOOD, ASSET CONSTRUCTION

The inclusion of Organic-Lock and Tree-pits create new permeable spaces, with stormwater treatment throughout the project.

Project: Quay Street

Location: Auckland

Solution: RG240, TP120

Project Overview

Quay Street, in prime position on the edge of the Waitematā Harbour, has capitalised on its location creating an iconic spot that will define Auckland as much as the skyscrapers. A revitalised waterfront space, with wider footpaths, easier navigation, new street furniture, more trees, and greater opportunity for business and events. This transformation had people in mind, invigorating a city set to enjoy more parks, small green spaces, and outdoor areas in the coming years.

We needed to ensure we had selected not only the right product, but also the right team. The ScapeSpec team was critical in assisting us to deliver, no matter how demanding the timeframe.
RYAN MUIR , JFC

In 6 afternoons, we craned 260 one tonne bags of TP120 to fill podiums over Auckland's Waterfront. This engineered tree pit media was selected to support transplantation of large mature trees, a focal point of the project.

The media selection for the Quay St project was critical for the success of 50 new gardens and over 200 new native trees providing shade and shelter, reducing the urban head island effect. In addition, 19 rain gardens were installed in the project, using ScapeSpec RG240 media. The rain gardens will naturally drain and filter pollutants from surface water during heavy rainfall, reducing pressure on storm drains and improving water quality.

Project: Daldy Street

Location: Auckland

Solution: TP120, RG240

Project Overview

Daldy Street is a vibrant greenspace in the middle of urban infrastructure. The rolling lawns, mature trees and numerous rain gardens offer great recreational and aesthetic amenities. Both pleasant and practical, these rain gardens improve air quality and mitigate storm water runoff from surrounding buildings and roads.

This high-profile project was a cornerstone for ScapeSpec product development using TP120 and RG240. The site variables demanded a calculated soil blend that balanced water retention and hydraulic conductivity to sustain healthy plant life all year round.

Having a product that met stringent specifications was essential to ensure a successful project. Collaborating with Dean and his team over a period of months resulted in a product that exceeded expectations and after a year in service continues to perform as well as when first installed.
DARYL GREGG, CONTRAX GREENSCAPES

ScapeSpec is proud to be associated with this injection of green infrastructure in a largely commercial area.

Water Sensitive Urban Design

Water-sensitive urban design (WSUD) is an approach which integrates the water cycle into urban design to minimise environmental degradation. Promoting a more resourceful use of water to address both water quantity and water quality issues.

The Need for WSUD

In natural & undeveloped environments, rainwater mostly evaporates, gets absorbed by plants or soaks into the ground. Urban development dramatically changes these processes, clearing land of vegetation and covering it with 'hard' or impervious surfaces that cannot let water through. As a result, rainwater runs off these surfaces, through stormwater drains and straight into our waterways as polluted stormwater in a very short time.

Investing in the development of bio-retention-media that contributes to better environmental and ecosystem outcomes for New Zealand.

Integrating water management in our cities, will increase our resilience to climate change and protect the existence of our natural resources.

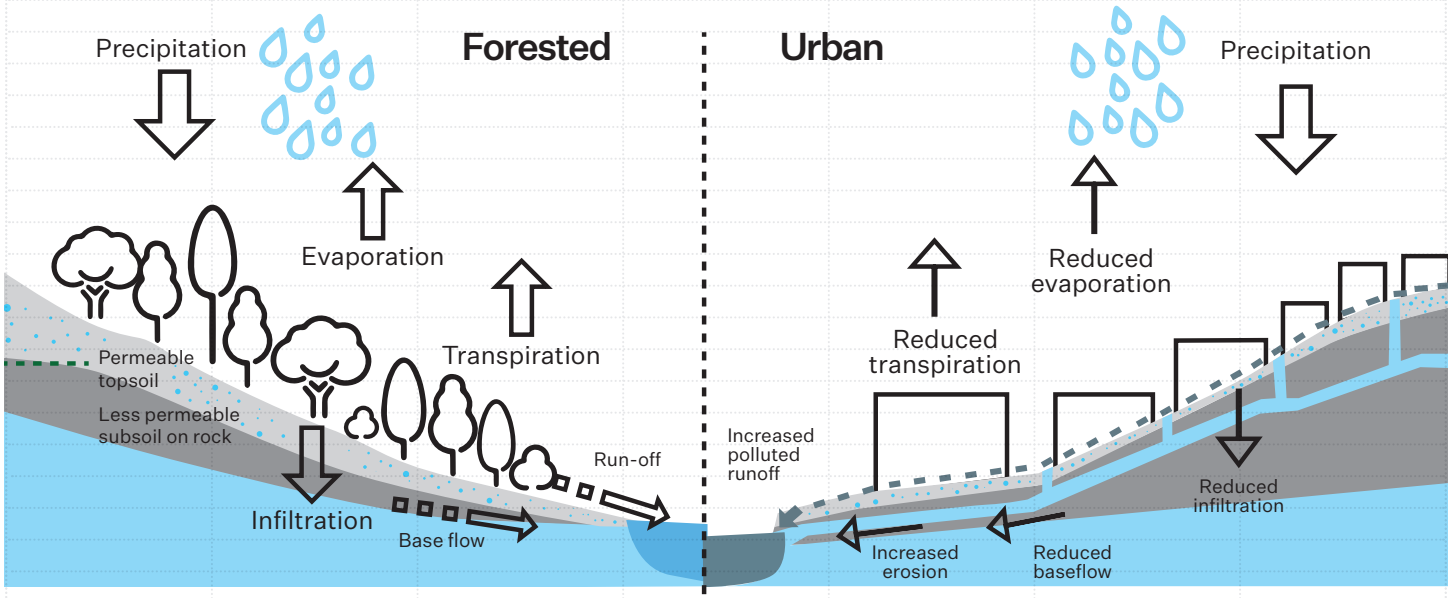
Importance of Bio-retention Media

Bio-retention Media helps remove pollutants and slow down stormwater flows to recharge freshwater bodies. The surface runoff from impervious structures flow into specialised gardens or tree pits, filter through the surface vegetation and then through a speciality bio-retention media where fine particles are removed, soluble nutrients are taken up by roots of the plants and soil microbes. The cleansed water is now at a manageable infiltration rate to enter the surrounding ground, pipes, drains and streams and eventually the sea.

Our commitment to WSUD

As WSUD becomes increasingly important in today's urban environment we have a commitment to ensure consistent quality and fit for purpose products. We are continually investing in product development with industry experts, government departments, iwi, and council to refine our processes and to assure our bio-filtration media is contributing to positive water cycles and improving water quality for healthy resilient communities.

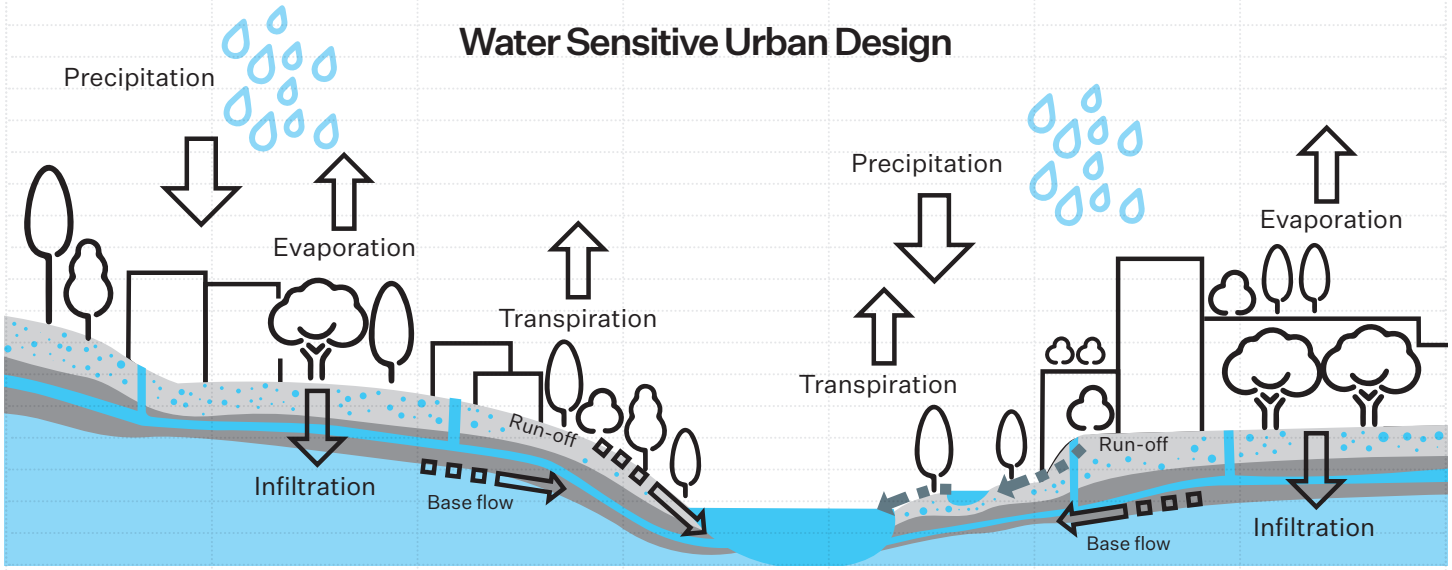
Integrated Water Management – how it works



Natural cycles cause rainwater to evaporate, absorbed by plants or soaks into the ground.

Waterflows cannot infiltrate the ground or evaporate bypassing natural systems and processes.

Water Sensitive Urban Design



Protects natural systems, allowing for evaporation and directing runoff to designated areas that helps remove pollutants and slow down water flow for greater infiltration.

We are developing relationships with key stake holders through our shared alignment of WSUD and Kaitiakitanga commitment:

"If you do not sustain the waterways, the mahinga kai sourced from them, and sites of significance in the wider environment, then you cannot sustain yourself, honour your ancestors, or provide for the children of your children into the future." Tipa & Teirney, 2003

Health & Safety

Health Information

Ordinary garden soil and products like Compost and Potting Mixes may contain a variety of living micro-organisms. On rare occasions some of these micro-organisms can cause illness in humans. Serious infection is rare. However, for older people or those with reduced immunity, infection can be life threatening.

Safety

We recommend the following precautions:

- Bags: Avoid opening bags in enclosed areas and dampen the product before use
- Bulk: Avoid inhaling the mix
- Always wear gloves and wash hands after us
- See your doctor if you develop a high fever, chill breathlessness or cough

Product Analysis

Hill Laboratories
TRIED, TESTED AND TRUSTED

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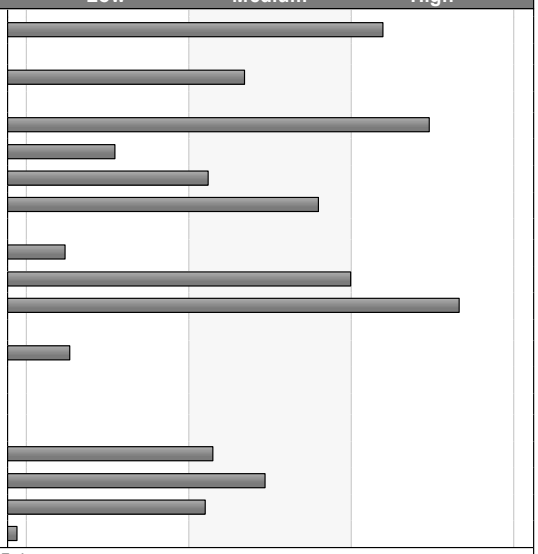
Certificate of Analysis

Client:	Central Landscapes Supplies Silverdale 2009 Limitec	**Lab No:**	2168166 shpv2
Address:	90 Foundry Road Silverdale 0932	**Date Received:**	01-May-2019
		Date Reported:	13-May-2019 **(Amended)**
		Quote No:	
		Order No:	RG240
		Client Reference:	
Phone:	09 421 0024	**Submitted By:**	Dean Rissetto

Sample Name: Rain Garden Mix RG240 **Lab Number:** 2168166.1
Sample Type: SOIL General, Outdoor (S10)

Analysis		Level Found	Medium Range
pH	pH Units	6.5	5.8 - 6.3
Olsen Phosphorus	mg/L	23	20 - 30
Potassium	me/100g	1.09	0.50 - 0.80
Calcium	me/100g	4.2	6.0 - 12.0
Magnesium	me/100g	1.24	1.00 - 3.00
Sodium	me/100g	0.44	0.20 - 0.50
CEC	me/100g	8	12 - 25
Total Base Saturation	%	85	50 - 85
Volume Weight	g/mL	1.17	0.60 - 1.00
Organic Matter*	%	1.9	7.0 - 17.0
Total Carbon	%	1.1	
Iron	mg/kg	472	
Manganese	mg/kg	101	50 - 400
Zinc	mg/kg	5.8	2.0 - 10.0
Copper	mg/kg	1.4	1.0 - 5.0
Cobalt	mg/kg	0.4	2.0 - 4.0
Base Saturation %		K 13.3 Ca 51	Mg 15.1 Na 5.4
MAF Units		K 26 Ca 6	Mg 32 Na 24



The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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		Date Reported:	13-May-2019	**(Amended)**
		Quote No:		
		Order No:	RG240	
		Client Reference:		
Phone:	09 421 0024	**Submitted By:**	Dean Rissetto	

Sample Name: Rain Garden Mix RG240 **Lab Number:** 2168166.2
Sample Type: COMPOST, General (C10)

Analysis		Level Found	Medium Range	Low	Medium	High
Loss on Ignition*	%	4.3				

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information.
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Certificate of Analysis

Client:	Central Landscapes Supplies Silverdale 2009 Limited	**Lab No:**	2168166	shpv2
Address:	90 Foundry Road Silverdale 0932	**Date Received:**	01-May-2019	
		Date Reported:	13-May-2019	**(Amended)**
		Quote No:		
		Order No:	RG240	
		Client Reference:		
Phone:	09 421 0024	**Submitted By:**	Dean Rissetto	

Analyst's Comments

Sample 1 Comment:
The medium or optimum range guidelines shown in the histogram report relate to sampling protocols as per Hill Laboratories' crop guides and are based on reference values where these are published. Results for samples collected to different depths than those described in the crop guide should be interpreted with caution.
For pastoral soils, the medium ranges are specific for a 75mm sample depth, but if a 150mm sampling depth is used the nutrient levels measured may appear low against these ranges, as nutrients are typically more concentrated in the top of the soil profile. These soil profile differences are altered upon cultivation or contouring.

Sample 1 Comment:
The low CEC level found in this soil indicates that it can only retain cation nutrients (potassium, calcium, magnesium and sodium) at low levels. The normal ranges and the derived histograms are based on a typical soil with a CEC level between 12 and 25 me/100g.

Sample 2 Comment:
Note 1: Reporting Units.
% = g/100g = g analyte/100g compost (dry weight basis)
mg/kg = ppm = mg analyte/kg compost (dry weight basis)
Electrical Conductivity units mS/cm = dS/m

Note 2: % x 10 = kg/T

Note 3: To calculate results to a fresh weight basis:
Result (dry matter basis) x (Dry Matter % / 100) = Result (fresh weight basis)

Sample 2 Comment:
The Loss on Ignition result reported will usually be a closer approximation of Organic Matter (OM) than the OM result calculated from Total Carbon. The different types of organic matter present means that the commonly used equations for the calculation from Total Carbon may not always be appropriate.

Amended Report: This certificate of analysis replaces an earlier report issued on 07 May 2019 at 3:25 pm
Reason for amendment: Additional test(s) included.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Sample Registration*	Samples were registered according to instructions received.	-	1-2
Soil Prep (Dry & Grind)*	Air dried at 35 - 40°C overnight (residual moisture typically 4%) and crushed to pass through a 2mm screen.	-	1
pH	1:2 (v/v) soil:water slurry followed by potentiometric determination of pH.	0.1 pH Units	1
Olsen Phosphorus	Olsen extraction followed by Molybdenum Blue colorimetry.	1 mg/L	1
Organic Matter*	Organic Matter is 1.72 x Total Carbon.	0.2 %	1
Total Carbon	Dumas combustion.	0.1 %	1
Iron	0.05M EDTA extraction followed by ICP-OES.	3 mg/kg	1
Manganese	0.05M EDTA extraction followed by ICP-OES.	2 mg/kg	1
Zinc	0.05M EDTA extraction followed by ICP-OES.	0.4 mg/kg	1
Copper	0.05M EDTA extraction followed by ICP-OES.	0.2 mg/kg	1

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Certificate of Analysis

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Address:	90 Foundry Road Silverdale 0932	**Date Received:**	01-May-2019	
		Date Reported:	13-May-2019	**(Amended)**
		Quote No:		
		Order No:	RG240	
		Client Reference:		
Phone:	09 421 0024	**Submitted By:**	Dean Rissetto	

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Cobalt	0.05M EDTA extraction followed by ICP-OES.	0.2 mg/kg	1
Potassium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.01 me/100g	1
Calcium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.5 me/100g	1
Magnesium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.04 me/100g	1
Sodium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.05 me/100g	1
CEC	Summation of extractable cations (K, Ca, Mg, Na) and extractable acidity. May be overestimated if soil contains high levels of soluble salts or carbonates.	2 me/100g	1
Total Base Saturation	Calculated from Extractable Cations and Cation Exchange Capacity.	5 %	1
Volume Weight	The weight/volume ratio of dried, ground soil.	0.01 g/mL	1

Sample Type: COMPOST, General

Test	Method Description	Default Detection Limit	Sample No
Media & Compost Prep (Dry & Grind)*	Oven dried at 105°C for 24 hours and ground to pass through a 2.0mm screen.	-	2
Loss on Ignition*	Oven dried at 105°C for 24 hours and ground to pass through a 2.0mm screen. Weight loss after ashing at 550°C for two hours.	1.0 %	2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Andrew Whitmore BSc (Tech)
Client Services Manager - Agriculture

Soil Physics Laboratory
Analytical Report

Landcare Research
Manaaki Whenua

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Palmerston North 4442

phone: +64 6 353 4911
fax: +64 6 353 4801

Job Number: PJ18026C

Date Received: 21/03/2019

Customer: Central Landscapes, Dean Rissetto

Date Reported: 30/04/2019

Sample name	ID number	Remarks	Particle density (g/cm^3)	Dry bulk density (g/cm^3)	Porosity (%)	Water retention (%)	Capillary porosity (%)	Air–filled porosity (%)	AWC (%)	Saturated hydraulic conductivity (mm/hr)
RG240	PP18-1112		2.37	1.12 (0.01)	52.6 (0.5)	30.8 (0.4)	34.5 (0.4)	18.1 (0.8)	27.0 (0.3)	290 (42)

John Dando
Laboratory manager

References:

Monash University 2009. Guidelines for filter media in biofiltration systems (vers. 3.01). Monash University, Melbourne, Australia, Facility for Advancing Water Biofiltration (FAWB).

ASTM F1815 – 11 Standard Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones. 10.

Notes:
Samples sieved to 4.75 mm.
Media water contents were reduced to 19% gravimetric before testing.
Results are means of four replicate samples (standard deviations).
Samples tested to ASTM F1815 standards as required for Monash University 2009 standard.

The following explain ASTM terminology.
Water retention = gravimetric water content at -3 kPa pressure potential.
Capillary porosity = volumetric water content at -3 kPa pressure potential.
Air–filled porosity = % air space at -3 kPa pressure potential.
AWC = (non- ASTM) % available water to plants. Measured between -3 and -1500 kPa pressure potentials.

Raw Product Analysis

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Certificate of Analysis

Client:	Envirowaste - Hampton Downs Landfill	**Lab No:**	2208243	CPv1
Contact:	Envirowaste - Hampton Downs Landfill Private Bag 92810 Penrose Auckland 1642	**Date Received:**	13-Jul-2019	
		Date Reported:	19-Jul-2019	
		Quote No:	72700	
		Order No:	345379	
		Client Reference:	Compost Analysis	
		Submitted By:	Kathy Grant	

Sample Type: COMPOST, General

Sample Name:		Batch 74	Batch 75	Guideline NZS 4454:2005*	BioGro Std 2009 Appendix A**
Lab Number:		2208243.1	2208243.2		
Water Extractable Results					
pH	pH Units	6.0	6.3	5.0 - 8.5	-
Electrical Conductivity (EC)	mS/cm	5.1	4.9	-	-
Nitrate-N	mg/L	8	< 1	-	-
Ammonium-N	mg/L	47	19	-	-
Phosphorus	mg/L	79	79	-	-
Potassium	mg/L	1,166	1,240	-	-
Sulphur	mg/L	102	145	-	-
Calcium	mg/L	127	81	-	-
Magnesium	mg/L	93	67	-	-
Sodium	mg/L	181	187	-	-
Total Analysis Results - Dry Weight Basis					
Organic Matter*	%	56.5	64.3	Greater than 25	-
Total Carbon*	%	32.8	37.3	-	-
Total Nitrogen*	%	2.08	2.42	Greater than 0.6 (if a contribution to plant nutrition is claimed)	-
C/N Ratio*		15.7	15.4	-	-
Dry Matter*	%	58.5	55.5	-	-
'Total' Phosphorus*	mg/kg	5,530	4,870	-	-
'Total' Phosphorus*	%	0.55	0.49	Greater than 0.1 (if a contribution to plant nutrition is claimed)	-
'Total' Sulphur*	mg/kg	2,770	2,890	-	-
'Total' Sulphur*	%	0.28	0.29	-	-
'Total' Potassium*	mg/kg	13,860	15,460	-	-
'Total' Potassium*	%	1.39	1.55	-	-
'Total' Calcium*	mg/kg	24,100	24,000	-	-
'Total' Calcium*	%	2.41	2.40	-	-
'Total' Magnesium*	mg/kg	5,000	4,070	-	-
'Total' Magnesium*	%	0.50	0.41	-	-
'Total' Sodium*	mg/kg	2,030	1,962	-	-
'Total' Sodium*	%	0.20	0.20	-	-
'Total' Iron*	mg/kg	13,400	6,400	-	-
'Total' Manganese*	mg/kg	410	310	-	-
'Total' Zinc*	mg/kg	164	155	Less than 600	Less than 300
'Total' Copper*	mg/kg	37	32	Less than 300	Less than 60

Sample Type: COMPOST, General					
	Sample Name:	Batch 74	Batch 75	**Guideline NZS 4454:2005***	**BioGro Std 2009 Appendix A****
	Lab Number:	2208243.1	2208243.2		
'Total' Boron*	mg/kg	29	30	Less than 200	-
'Total' Chromium*	mg/kg	17.8	14.2	Less than 600	Less than 150
'Total' Arsenic*	mg/kg	10.5	9.1	Less than 20	Less than 20
'Total' Lead*	mg/kg	25	20	Less than 250	Less than 250
'Total' Nickel*	mg/kg	10.9	7.6	Less than 60	Less than 60
'Total' Mercury*	mg/kg	< 0.12	< 0.11	Less than 2	Less than 1
'Total' Cadmium*	mg/kg	0.31	0.25	Less than 3	Less than 1

* New Zealand Standard Composts, Soil Conditioners and Mulches: NZS 4454:2005, Table 3.1. Test results apply to the sample(s) submitted for analysis and do not necessarily imply that the product meets all the requirements of the standard. Note that the laboratory methods used for these test results may differ slightly to those referred to in the standard.

** Bio-Gro NZ Organic Standards 2009, Appendix A, Table A3: Limits for Heavy Metals in Soils and Composts: BioGro Standard for compost - ingredients other than household waste. Other limits apply for compost with ingredients including household waste.

Analyst's Comments

Samples 1-2 Comment:
Note 1: Reporting Units.
% = g/100g = g analyte/100g compost (dry weight basis)
mg/kg = ppm = mg analyte/kg compost (dry weight basis)
Electrical Conductivity units mS/cm = dS/m

Note 2: % x 10 = kg/T

Note 3: To calculate results to a fresh weight basis:
Result (dry matter basis) x (Dry Matter % / 100) = Result (fresh weight basis)

Samples 1-2 Comment:
Organic Matter Note: The relationship between carbon and organic matter varies according to organic matter type and soil type if soil is present in the product. Commonly used conversion factors range from 1.65 to 2.2 (Ref: NZS 445:2005). A Loss on Ignition (LOI) test may be requested if a more accurate organic matter value is required.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: COMPOST, General			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
'Total' Sulphur*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	45 mg/kg	1-2
'Total' Sulphur*	Calculated from 'Total' Sulphur result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
pH	1:1.5 (v/v) Water extraction followed by potentiometric pH determination.	0.1 pH Units	1-2
Electrical Conductivity	1:1.5 (v/v) Water extraction followed by potentiometric conductivity determination (25°C).	0.1 mS/cm	1-2
Nitrate-N	1:1.5 (v/v) Water extraction followed by Salicylate colorimetry.	1 mg/L	1-2
Ammonium-N	1:1.5 (v/v) Water extraction followed by Berthelot colorimetry.	1 mg/L	1-2
Phosphorus	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Sulphur	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Potassium	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Calcium	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Magnesium	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Sodium	1:1.5 (v/v) Water extraction followed by ICP-OES.	1 mg/L	1-2
Total Carbon*	Sample dried and ground and analysed by Dumas combustion. Results expressed on a dry weight basis.	0.2 %	1-2
Total Nitrogen*	Sample dried and ground and analysed by Dumas combustion. Results expressed on a dry weight basis.	0.04 %	1-2

Sample Type: COMPOST, General			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Organic Matter*	Dumas combustion. Organic Matter is 1.72 x Total Carbon.	0.2 %	1-2
Dry Matter*	Weight loss on drying at 105°C for 24 hours.	0.5 %	1-2
'Total' Phosphorus*	Calculated from 'Total' Phosphorus result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
'Total' Phosphorus*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	65 mg/kg	1-2
'Total' Potassium*	Calculated from 'Total' Potassium result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
'Total' Potassium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	70 mg/kg	1-2
'Total' Calcium*	Calculated from 'Total' Calcium result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
'Total' Calcium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	100 mg/kg	1-2
'Total' Magnesium*	Calculated from 'Total' Magnesium result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
'Total' Magnesium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	40 mg/kg	1-2
'Total' Sodium*	Calculated from 'Total' Sodium result for mg/kg (reported on a dry weight basis).	0.01 %	1-2
'Total' Sodium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	20 mg/kg	1-2
'Total' Iron*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	40 mg/kg	1-2
'Total' Manganese*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	3 mg/kg	1-2
'Total' Zinc*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	4 mg/kg	1-2
'Total' Copper*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	4 mg/kg	1-2
'Total' Boron*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-OES. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	6 mg/kg	1-2

Sample Type: COMPOST, General			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
'Total' Chromium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.2 mg/kg	1-2
'Total' Arsenic*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.2 mg/kg	1-2
'Total' Lead*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.10 mg/kg	1-2
'Total' Nickel*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.2 mg/kg	1-2
'Total' Mercury*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.10 mg/kg	1-2
'Total' Cadmium*	Nitric/hydrochloric digestion (based on US EPA 200.2) followed by ICP-MS. (Total recoverable nutrients reported on a dry weight basis) The levels from this method are referred to as 'Totals' in quotation marks, as they will be a slight under-estimation of the true Totals for some elements.	0.02 mg/kg	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

W.M.Homewood.

Wendy Homewood
Operations Support - Agriculture

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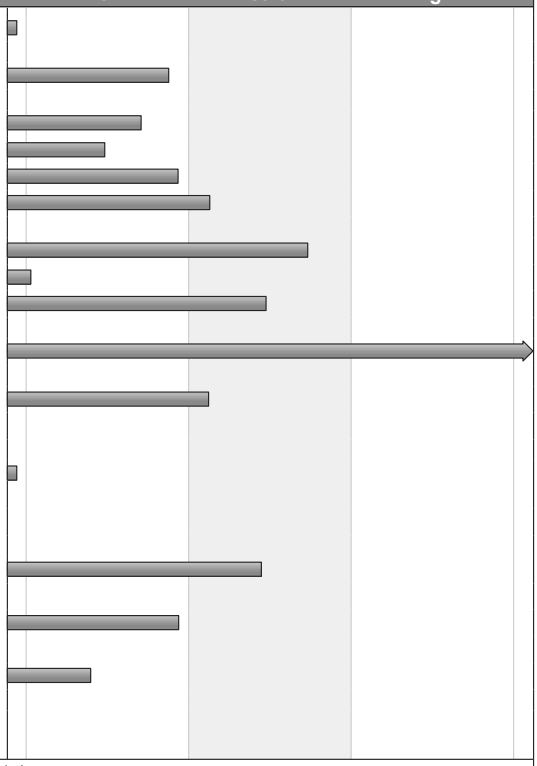
Certificate of Analysis

Client:	Mr Soil Limited	**Lab No:**	2158723	shpv1
Address:	PO Box 268 Greymouth 7840	**Date Received:**	10-Apr-2019	
		Date Reported:	08-May-2019	
		Quote No:	83649	
		Order No:		
		Client Reference:	Jackson Ngare	
		Submitted By:	Mr Soil Limited	

Sample Name: Bulk Soil 1 **Lab Number:** 2158723.1
Sample Type: SOIL General, Outdoor (S10)

Analysis		Level Found	Medium Range
pH	pH Units	4.8	5.8 - 6.3
Olsen Phosphorus	mg/L	18	20 - 30
Potassium	me/100g	0.40	0.50 - 0.80
Calcium	me/100g	3.9	6.0 - 12.0
Magnesium	me/100g	0.95	1.00 - 3.00
Sodium	me/100g	0.24	0.20 - 0.50
CEC	me/100g	22	12 - 25
Total Base Saturation	%	26	50 - 85
Volume Weight	g/mL	0.79	0.60 - 1.00
Sulphate Sulphur	mg/kg	163	7 - 15
Soluble Salts (Field)	%	0.08	0.05 - 0.30
EC (in 1:5 Extract)	mS/cm	0.23	
Potentially Available Nitrogen (15cm Depth)*	kg/ha	43	100 - 150
Anaerobically Mineralisable N*	µg/g	36	
Organic Matter*	%	11.5	7.0 - 17.0
Total Carbon	%	6.7	
Total Nitrogen	%	0.29	0.30 - 0.60
C/N Ratio*		23.2	
Anaerobically Mineralisable N/Total N Ratio*	%	1.2	3.0 - 5.0
Soil Texture analysis*		See attached report	



Base Saturation %	K 1.8	Ca 18	Mg 4.4	Na 1.1
MAF Units	K 6	Ca 4	Mg 17	Na 9

The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information.
IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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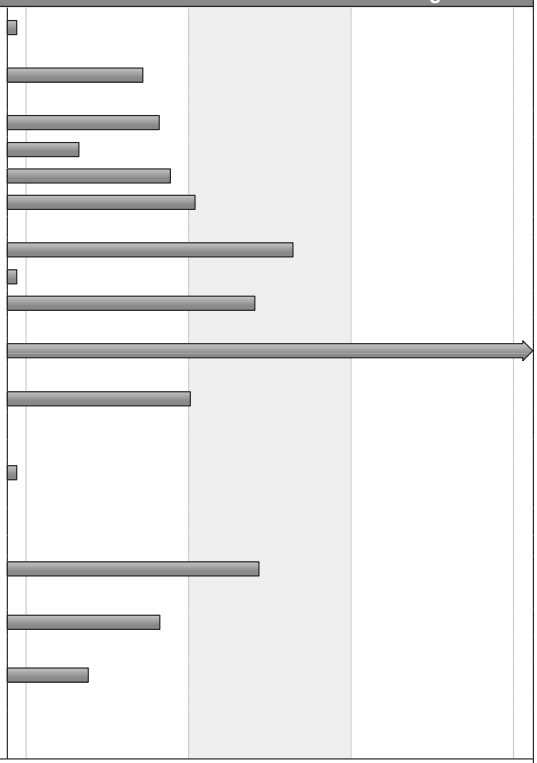
Certificate of Analysis

Client:	Mr Soil Limited	**Lab No:**	2158723	shpv1
Address:	PO Box 268 Greymouth 7840	**Date Received:**	10-Apr-2019	
		Date Reported:	08-May-2019	
		Quote No:	83649	
		Order No:		
		Client Reference:	Jackson Ngare	
		Submitted By:	Mr Soil Limited	

Sample Name: Bulk Soil 2 **Lab Number:** 2158723.2
Sample Type: SOIL General, Outdoor (S10)

Analysis		Level Found	Medium Range
pH	pH Units	4.9	5.8 - 6.3
Olsen Phosphorus	mg/L	16	20 - 30
Potassium	me/100g	0.44	0.50 - 0.80
Calcium	me/100g	3.3	6.0 - 12.0
Magnesium	me/100g	0.92	1.00 - 3.00
Sodium	me/100g	0.21	0.20 - 0.50
CEC	me/100g	20	12 - 25
Total Base Saturation	%	24	50 - 85
Volume Weight	g/mL	0.76	0.60 - 1.00
Sulphate Sulphur	mg/kg	172	7 - 15
Soluble Salts (Field)	%	0.05	0.05 - 0.30
EC (in 1:5 Extract)	mS/cm	0.15	
Potentially Available Nitrogen (15cm Depth)*	kg/ha	36	100 - 150
Anaerobically Mineralisable N*	µg/g	32	
Organic Matter*	%	11.3	7.0 - 17.0
Total Carbon	%	6.6	
Total Nitrogen	%	0.26	0.30 - 0.60
C/N Ratio*		24.9	
Anaerobically Mineralisable N/Total N Ratio*	%	1.2	3.0 - 5.0
Soil Texture analysis*		See attached report	
Base Saturation %		K 2.1 Ca 16	Mg 4.5 Na 1.0
MAF Units		K 7 Ca 3	Mg 16 Na 7



The above nutrient graph compares the levels found with reference interpretation levels. NOTE: It is important that the correct sample type be assigned, and that the recommended sampling procedure has been followed. R J Hill Laboratories Limited does not accept any responsibility for the resulting use of this information. IANZ Accreditation does not apply to comments and interpretations, i.e. the 'Range Levels' and subsequent graphs.

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Certificate of Analysis

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		Quote No:	83649	
		Order No:		
		Client Reference:	Jackson Ngare	
		Submitted By:	Mr Soil Limited	

Analyst's Comments

Samples 1-2 Comment:
The medium or optimum range guidelines shown in the histogram report relate to sampling protocols as per Hill Laboratories' crop guides and are based on reference values where these are published. Results for samples collected to different depths than those described in the crop guide should be interpreted with caution.
For pastoral soils, the medium ranges are specific for a 75mm sample depth, but if a 150mm sampling depth is used the nutrient levels measured may appear low against these ranges, as nutrients are typically more concentrated in the top of the soil profile. These soil profile differences are altered upon cultivation or contouring.

Samples 1-2 Comment:
The Potentially Available Nitrogen (kg/ha) test above assumes the sample is taken to a 15 cm depth. If the depth is 7.5 cm, then the result reported above should be divided by two.
To calculate Potentially Available Nitrogen (as kgN/ha) for other sample depths use the reported Anaerobic Mineralisable Nitrogen (AMN) result in the following equation:
AN (kg/ha) = AMN (µg/g) x VW (g/ml) x sample depth (cm) x 0.1
Note that the AN and AMN results reported include the readily available Mineral N (NH4-N and NO3-N) fraction, which is typically quite low.

Appendix No.1 - Soil Texture Report

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Soil Texture analysis*	Analysis of % sand, silt, clay. Subcontracted to; Eurofins NZ Laboratory Services Ltd - Penrose, Auckland.	-	1-2
Sample Registration*	Samples were registered according to instructions received.	-	1-2
Soil Prep (Dry & Grind)*	Air dried at 35 - 40°C overnight (residual moisture typically 4%) and crushed to pass through a 2mm screen.	-	1-2
pH	1:2 (v/v) soil:water slurry followed by potentiometric determination of pH.	0.1 pH Units	1-2
Olsen Phosphorus	Olsen extraction followed by Molybdenum Blue colorimetry.	1 mg/L	1-2
Sulphate Sulphur	0.02M Potassium phosphate extraction followed by Ion Chromatography.	1 mg/kg	1-2
Potentially Available Nitrogen*	Determined by NIR, calibration based on Available N by Anaerobic incubation followed by extraction using 2M KCl followed by Berthelot colorimetry. (Calculation based on 15cm depth sample). Note that any Mineral N present is included in the AN/AMN result reported.	1 mg/L	1-2
Anaerobically Mineralisable N*	As for Potentially Available Nitrogen but reported as µg/g.	5 µg/g	1-2
Organic Matter*	Organic Matter is 1.72 x Total Carbon.	0.2 %	1-2
Total Carbon	Dumas combustion.	0.1 %	1-2
Total Nitrogen	Dumas combustion.	0.04 %	1-2
Soluble Salts (Field)	1:5 soil:water extraction followed by potentiometric determination of conductivity. Calculated by EC (mS/cm) x 0.35.	0.05 %	1-2
Electrical Conductivity (EC)	Electrical Conductivity measured in 1:5 Soil:Water extract.	0.01 mS/cm	1-2
Potassium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.01 me/100g	1-2
Calcium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.5 me/100g	1-2

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Certificate of Analysis

Client:	Mr Soil Limited	**Lab No:**	2158723	shpv1
Address:	PO Box 268 Greymouth 7840	**Date Received:**	10-Apr-2019	
		Date Reported:	08-May-2019	
		Quote No:	83649	
		Order No:		
		Client Reference:	Jackson Ngare	
		Submitted By:	Mr Soil Limited	

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Magnesium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.04 me/100g	1-2
Sodium	1M Neutral ammonium acetate extraction followed by ICP-OES.	0.05 me/100g	1-2
CEC	Summation of extractable cations (K, Ca, Mg, Na) and extractable acidity. May be overestimated if soil contains high levels of soluble salts or carbonates.	2 me/100g	1-2
Total Base Saturation	Calculated from Extractable Cations and Cation Exchange Capacity.	5 %	1-2
Volume Weight	The weight/volume ratio of dried, ground soil.	0.01 g/mL	1-2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Andrew Whitmore BSc (Tech)
Client Services Manager - Agriculture

eurofins

AR-19-NU-036730-01 1 2

ANALYTICAL REPORT

REPORT CODE **AR-19-NU-036730-01**

REPORT DATE **08/05/2019**

For the attention of Hill Laboratories Ltd
Enviro Reports
28 Duke Street
Frankton
3204 Hamilton
NEW ZEALAND
Phone 6478582000
Email envjobenquiry@hill-labs.co.nz

Contact for your orders: Hanin Khan

Order code: EUNZAU-00171734
Purchase Order Number: 151684

SAMPLE CODE 816-2019-00100681

Client reference:
Sample described as: 2158723.1
Reception Date & Time: 15/04/2019 14:28
Analysis starting date: 15/04/2019
Analysis ending date: 02/05/2019

SOIL PHYSICAL MEASUREMENT	RESULTS		LOQ
◆ **NU092** Coarse Sand (0.6-2mm)			
Coarse Sand	7	%	1
◆ **NU199** Medium Sand (0.2-0.6mm)			
Medium Sand	10	%	1
◆ **NU134** Fine Sand (0.06-0.2mm)			
Fine Sand	30	%	1
◆ **NU318** Silt (0.002-0.06mm)			
Silt	34	%	1
◆ **NU091** Clay (<0.002mm)			
Clay	19	%	1

SAMPLE CODE 816-2019-00100682

Client reference:
Sample described as: 2158723.2
Reception Date & Time: 15/04/2019 14:28
Analysis starting date: 15/04/2019
Analysis ending date: 08/05/2019

SOIL PHYSICAL MEASUREMENT	RESULTS		LOQ
◆ **NU092** Coarse Sand (0.6-2mm)			
Coarse Sand	7	%	1
◆ **NU199** Medium Sand (0.2-0.6mm)			
Medium Sand	10	%	1
◆ **NU134** Fine Sand (0.06-0.2mm)			
Fine Sand	21	%	1
◆ **NU318** Silt (0.002-0.06mm)			
Silt	36	%	1
◆ **NU091** Clay (<0.002mm)			
Clay	26	%	1

REPORT INFORMATION

Texture results reported as % of inorganic fraction

LIST OF METHODS

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eurofins

AR-19-NU-036730-01 2 2

NU091	**Clay (<0.002mm):** Sedimentation procedure by hydrometer. < 0.002mm	NU092	**Coarse Sand (0.6-2mm):** Sieve analysis. 0.6-2.0mm
NU134	**Fine Sand (0.06-0.2mm):** Sieve analysis. 0.06-0.2mm	NU199	**Medium Sand (0.2-0.6mm):** Sieve analysis. 0.2-0.6mm
NU318	**Silt (0.002-0.06mm):** Sedimentation procedure by hydrometer. 0.002-0.06mm		

Signature

Brent Miller Team Leader Agri Testing

EXPLANATORY NOTE

◆ test is not accredited
○ test is subcontracted within Eurofins group and is accredited
● test is subcontracted within Eurofins group and is not accredited
□ test is subcontracted outside Eurofins group and is accredited
■ test is subcontracted outside Eurofins group and is not accredited

N/A means Not applicable
Not Detected means not detected at or above the Limit of Quantification (LOQ)

Accreditation does not apply to comments or graphical representations.
Eurofins General Terms and Conditions apply.

This document can only be reproduced in full; it only concerns the submitted sample. Results have been obtained and reported in accordance with our general sales conditions available on request.
The tests are identified by a five-digit code, their description is available on request.

Unless otherwise stated, all tests in this analytical report (except for subcontracted tests) are performed at 35 O'Rorke Road, Penrose, Auckland, NEW ZEALAND.

END OF REPORT

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