FOCUS
ENVIRONMENTAL SERVICES LTD

24 November 2016

Auckland Council

Level 2, 35 Graham Street

Auckland

Direct Dial: +64 9 579 4155

Email: mail@focusenvironmental.co.nz

PO Box 11455

Ellerslie

Auckland 1542

Attention: Nigel Donovan

Re: Soil Sampling for Auckland Council at the Three Kings Managed Fill site.

Job Reference: FES0092.033

Dear Nigel,

Attached are the results of the soil sampling and analysis carried out on 11th of November 2016 following the random soil material sampling of the fill deposited at the Winstone Aggregates Three Kings solid waste disposal site.

The biannual sampling was undertaken to satisfy Condition 25 of the Consent Number 36221/36222/37770/R/LUC/2009/743.

Work Programme

Winstone Aggregates Limited personnel directed Focus Environmental Services Limited personnel to the active fill deposit area of the site. Two composite samples (COMP01 & COMP02) were taken from across the active fill area of the site on the 11th of November 2016 from the materials requiring characterisation as shown in Figure 1 attached.

Sampling and Analysis Plan and Sampling Method

Environmental Sampling was carried out in accordance with the Contaminated Land Management Guidelines No.5 (MfE, 2011).

Two composite samples (COMP01 & COMP02) were collected by Focus Environmental Services Limited personnel using a stainless steel hand trowel and a freshly gloved hand across the active fill area of the site.

The two soil samples were sent under full chain of custody documentation to an IANZ accredited laboratory and analysed for:

- Total Recoverable Arsenic, Boron, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc.
- Total Recoverable Cyanide.
- Organo-Chlorine Pesticides.
- Poly-Aromatic Hydrocarbons.
- Total Petroleum Hydrocarbons.
- BTEX.

The sample location plan is presented as Figure 1.

Field Sampling Quality Assurance

All sampling implements were triple washed between samples using clean tap water, followed by a solution of laboratory grade phosphate free detergent (Decon 90), and a final rinse with de-ionised water.

Clean, latex gloves were worn when handling each sample. Samples were stored in laboratory cleaned glass jars and immediately placed in an iced cooler. The samples were transported under chain of custody documentation to an IANZ accredited laboratory for analysis.

Laboratory Quality Assurance

Routine laboratory quality assurance procedures include analysis of laboratory blanks and spiked samples. Soil sample analyses were carried out using industry standard methods as follows:

- Total Recoverable Metals - nitric acid digestion- ICP-MS analysis (USEPA 200.2).
- Total Cyanide Distillation – Distillation of sample as received APHA 4500-CN^- C & E 21st ed 2005.
- Organo-chlorine pesticides - Sonication extraction, SPE cleanup dual column GC-ECD analysis (modified US EPA 8082).
- TPH Oil Industry Profile + Poly-Aromatic Hydrocarbons - Sonication DCM extraction, SPE cleanup (if required), GC-FID & GS-MS analysis. US EPA 8015B/MfE Petroleum Industry Guidelines.
- BTEX – Solvent extraction, Headspace GC-MS analysis US EPA 8260B.

Fill Acceptance Criteria

In accordance with Consent Number 36221/36222/37770/R/LUC/2009/743 the results of the sample analysis will be compared to those values presented in Table 1 below.

Table 1: Fill Acceptance Criteria for Waste Disposal (mg/kg).

Parameter	Fill >2m depth from finished level
Arsenic	100
Boron	260
Cadmium	7.5
Chromium	400
Copper	325
Lead	250
Mercury	0.75
Nickel	320
Zinc	1160
Cyanide	25
BaP eq.[1]	2.15
DDT(total)	12
Aldrin	12
Dieldrin	6
Benzene	1[2]
TEX(total)[3]	20
TPH (C_7 – C_9)	300
TPH (C_{10} – C_{14})	300
TPH (C_{15} – C_{36})	5600

Note: 1. = Includes group of 7 compounds with equivalence factors that contribute to BaP (eq). 2. = To meet MfE Guidelines (1999) for residential land use all pathways. 3. = Sum of Toluene, Ethyl Benzene and Xylenes.

Results

Tabulated soil sampling results are presented in Table 2 below and the laboratory transcripts have been attached to this letter report.

Table 2: Laboratory Analysis Results (mg/kg).

Parameter	COMP01	COMP02
Arsenic	4	4
Boron	<20	<20
Cadmium	<0.10	<0.10
Chromium	17	16
Copper	21	22
Lead	7.7	8.7
Mercury	<0.10	<0.10
Nickel	20	20
Zinc	55	59
Cyanide	<0.10	<0.10
BaP eq.	<0.07	<0.07
DDT(total)	<0.06	<0.06
Aldrin	<0.010	<0.010
Dieldrin	<0.010	<0.010
Benzene	<0.05	<0.05
TEX(total)	<0.25	<0.25
TPH (C_7 – C_9)	<9	<9
TPH (C_{10} – C_{14})	<20	<20
TPH (C_{15} – C_{36})	<70	<70

Note: Results in **red** exceed the Managed Fill acceptance criteria for the Three Kings Managed Fill Disposal site.

Discussion & Conclusion

The concentrations of all parameters tested from the two composite samples taken on the 11th of November 2016 were all below the site acceptance criteria for fills being deposited on site. The next biannual sampling event will be scheduled for April 2017.

Thank you for the opportunity to work with you and we look forward to being of further assistance. Please contact David Dwyer on (09) 579 4155 or Cell (027) 666 2232.

Yours sincerely,

David Dwyer
Environmental Scientist
Focus Environmental Services Limited

Attachments:
Figure 1: Sample Location Plan
Laboratory Transcripts

Legend

⊕ Composite Location

FOCUS ENVIRONMENTAL SERVICES LTD	Focus Environmental Services Limited PO Box 11455 Ellerslie Auckland 1542 Ph: +64 9 622 0179 Fax: +64 9 622 0179 www.focusenvironmental.co.nz	**Auckland Council** Three Kings Managed Fill Site	**Figure 1: Sample Location Plan** Letter Report	Drawing Number: 0092.033.01 Drawn By: DD 0092.032 Checked By: DO'R Date: 23/11/16

Hill Laboratories
BETTER TESTING BETTER RESULTS

R J Hill Laboratories Limited
1 Clyde Street
Private Bag 3205
Hamilton 3240, New Zealand

Tel +64 7 858 2000
Fax +64 7 858 2001
Email mail@hill-labs.co.nz
Web www.hill-labs.co.nz

ANALYSIS REPORT

Client:	Focus Environmental Services Limited	**Lab No:**	1679318	SPv1
Contact:	David Dwyer	**Date Received:**	12-Nov-2016	
	C/- Focus Environmental Services Limited	**Date Reported:**	21-Nov-2016	
	PO Box 11455	**Quote No:**	80876	
	Ellerslie	**Order No:**	0092.033	
	Auckland 1542	**Client Reference:**	0092.033	
		Submitted By:	David Dwyer	

Sample Type: Soil

		Sample Name:	Comp01 11-Nov-2016	Comp02 11-Nov-2016			
		Lab Number:	1679318.1	1679318.2			
Individual Tests							
Dry Matter	g/100g as rcvd		81	81	-	-	-
Total Recoverable Boron	mg/kg dry wt		< 20	< 20	-	-	-
Total Recoverable Mercury	mg/kg dry wt		< 0.10	< 0.10	-	-	-
Total Cyanide*	mg/kg dry wt		< 0.10	< 0.10	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	mg/kg dry wt		< 0.07	< 0.07	-	-	-
Heavy Metals, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		4	4	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	< 0.10	-	-	-
Total Recoverable Chromium	mg/kg dry wt		17	16	-	-	-
Total Recoverable Copper	mg/kg dry wt		21	22	-	-	-
Total Recoverable Lead	mg/kg dry wt		7.7	8.7	-	-	-
Total Recoverable Nickel	mg/kg dry wt		20	20	-	-	-
Total Recoverable Zinc	mg/kg dry wt		55	59	-	-	-
BTEX in Soil by Headspace GC-MS							
Benzene	mg/kg dry wt		< 0.05	< 0.05	-	-	-
Toluene	mg/kg dry wt		< 0.05	< 0.05	-	-	-
Ethylbenzene	mg/kg dry wt		< 0.05	< 0.05	-	-	-
m&p-Xylene	mg/kg dry wt		< 0.10	< 0.10	-	-	-
o-Xylene	mg/kg dry wt		< 0.05	< 0.05	-	-	-
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		< 0.010	< 0.010	-	-	-
alpha-BHC	mg/kg dry wt		< 0.010	< 0.010	-	-	-
beta-BHC	mg/kg dry wt		< 0.010	< 0.010	-	-	-
delta-BHC	mg/kg dry wt		< 0.010	< 0.010	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt		< 0.010	< 0.010	-	-	-
cis-Chlordane	mg/kg dry wt		< 0.010	< 0.010	-	-	-
trans-Chlordane	mg/kg dry wt		< 0.010	< 0.010	-	-	-
Total Chlordane [(cis+trans)* 100/42]	mg/kg dry wt		< 0.04	< 0.04	-	-	-
2,4'-DDD	mg/kg dry wt		< 0.010	< 0.010	-	-	-
4,4'-DDD	mg/kg dry wt		< 0.010	< 0.010	-	-	-
2,4'-DDE	mg/kg dry wt		< 0.010	< 0.010	-	-	-
4,4'-DDE	mg/kg dry wt		< 0.010	< 0.010	-	-	-
2,4'-DDT	mg/kg dry wt		< 0.010	< 0.010	-	-	-
4,4'-DDT	mg/kg dry wt		< 0.010	< 0.010	-	-	-
Total DDT Isomers	mg/kg dry wt		< 0.06	< 0.06	-	-	-
Dieldrin	mg/kg dry wt		< 0.010	< 0.010	-	-	-

Sample Type: Soil						
Sample Name:		Comp01 11-Nov-2016	Comp02 11-Nov-2016			
Lab Number:		1679318.1	1679318.2			
Organochlorine Pesticides Screening in Soil						
Endosulfan I	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan II	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endosulfan sulphate	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin aldehyde	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Endrin ketone	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Heptachlor epoxide	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Hexachlorobenzene	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Methoxychlor	mg/kg dry wt	< 0.010	< 0.010	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Chrysene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Fluoranthene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Fluorene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Naphthalene	mg/kg dry wt	< 0.14	< 0.14	-	-	-
Phenanthrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Pyrene	mg/kg dry wt	< 0.03	< 0.03	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 9	< 9	-	-	-
C10 - C14	mg/kg dry wt	< 20	< 20	-	-	-
C15 - C36	mg/kg dry wt	< 40	< 40	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	< 70	-	-	-

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.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-2
BTEX in Soil by Headspace GC-MS	Solvent extraction, Headspace GC-MS analysis US EPA 8260B. Tested on as received sample [KBIs:5782,26687,3629]	0.05 - 0.10 mg/kg dry wt	1-2
Organochlorine Pesticides Screening in Soil	Sonication extraction, SPE cleanup, dual column GC-ECD analysis (modified US EPA 8082).. Tested on dried sample	0.010 - 0.06 mg/kg dry wt	1-2
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	1-2
Total Petroleum Hydrocarbons in Soil	Sonication extraction in DCM, Silica cleanup, GC-FID analysis US EPA 8015B/MfE Petroleum Industry Guidelines. Tested on as received sample [KBIs:5786,2805,10734]	8 - 60 mg/kg dry wt	1-2
TPH + PAH + BTEX profile	Sonication extraction, SPE cleanup, GC & GC-MS analysis	0.010 - 60 mg/kg dry wt	1-2

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-2
Total Cyanide Distillation*	Distillation of sample as received. APHA 4500-CN^- C 22nd ed. 2012.	-	1-2
Total Recoverable Boron	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	20 mg/kg dry wt	1-2
Total Recoverable Mercury	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.10 mg/kg dry wt	1-2
Total Cyanide*	Distillation, colorimetry. APHA 4500-CN^- C (modified) & E (modified) 22nd ed. 2012.	0.10 mg/kg dry wt	1-2
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES	BaP Potency Equivalence calculated from Benz(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1 + Chrysene x 0.01 + Dibenz(a,h)anthracene x 1 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	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.

Carole Rodgers-Carroll BA, NZCS
Client Services Manager - Environmental