MWH

BUILDING A BETTER WORLD

Z0096704

12 February 2016

T&T Landfills Ltd
Happy Valley Road
WELLINGTON

**Attention:** **Sophie Gray**
Landfill Manager

Dear Sophie

**Quarterly Stream Monitoring Results – January 2016**
Stream surface water and groundwater quality monitoring at T&T Landfill is required by conditions 7 and 8 of discharge permit WGN070260 [26124] to be undertaken every three months. The sampling sites are:

TTW - western gully stream (true right branch) at the northern end of the landfill
TTE - eastern gully stream (true left branch) at the northern end of the landfill
TTD - lower stream, 100 m downstream from the toe of the landfill
TTG - groundwater bore 100 m downstream from the toe of the landfill
OSU - Owhiro Stream upstream of the landfill tributary
OSD - Owhiro Stream downstream of the landfill tributary

This report relates to routine quarterly monitoring undertaken in January 2016 (Laboratory report attached).

**Surface water monitoring results**
Stream conditions were inspected at each of the stream sampling sites and the following observations made:

- Stream flow was moderate at TTD (downstream) site and was moderately turbid. The streambed was heavily overgrown with watercress and other macrophytes which had to be cleared to access stream water. An orange precipitate was present on the streambed.
- At the TTW site, west branch of the stream, water was clear and the stream bed was clean. The channel was heavily overgrown with macrophytes which had to be cleared to access the stream. No periphyton was visible on the bed.
- At the TTE site, east branch of the stream, water was clear and the stream bed was clean. The channel was partially covered by macrophytes. No periphyton was visible on the bed.
- At the OSU site, water in the Owhiro Stream was clear and the streambed was clean. Very little periphyton was visible on the bed.
- At the OSD site, water in the Owhiro Stream was slightly turbid. Periphyton partially covered stream bed.

Condition 8 of the resource consent requires that the contaminant contribution from the landfill (the difference between the contaminant concentrations upstream and downstream of the landfill) be compared against specified tolerance limits. The contaminant contribution for T&T Landfill is calculated by subtracting the mean of TTW and TTE from TTD. Should any tolerance limit be exceeded, *and* where that result also exceeds ANZECC (2000) Guidelines for Ecosystem Protection 90% trigger value, further sampling is required to be undertaken.



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During the January 2016 sampling round the upper tolerance limits for **ammonia, iron** and **manganese** were exceeded (see Table 1), however none of the relevant ANZECC (2000) trigger values were exceeded (see Table 2). As no result exceeded both tolerance limits *and* ANZECC (2000) trigger levels for any parameter at TTD, no additional sampling is required pursuant to condition 8 of the consent.

**Table 1: Contaminant Contribution and Upper Control Limits**

| Parameter | Results | | | | Lower Tolerance Limit (LTL) | Upper Tolerance Limit (UCL) |
|---|---|---|---|---|---|---|
| | 29/01/2016 | 26/11/2015 | 12/06/2015 | 2/04/2015 | | |
| pH | -0.4 | -0.4 | -0.4 | -0.2 | -0.4 | 0.4 |
| Electrical Conductivity | 42.85 | 40.05 | 49.25 | 34.65 | | 72.4 |
| Alkalinity | 215.5 | 197 | 215 | 193 | | 226 |
| Total suspended solids | 38 | 9.5 | 12.5 | -0.25 | | 31.7 |
| COD | 11 | 0 | 15 | -2.5 | | 21 |
| Total Hardness | 198 | 192 | 243 | 176.5 | | 465 |
| Ammoniacal Nitrogen | **0.545** | **0.605** | **1.195** | **0.515** | | 0.346 |
| Iron | **17764** | **4083** | **4871** | **5875** | | 2748 |
| Manganese | **1835** | **1546** | **1696** | **1532** | | 1461 |
| Lead | 0.450 | 0.160 | 0.580 | -0.025 | | 5.9 |
| Copper | -0.165 | -0.175 | -0.145 | -0.630 | | 4.0 |
| Zinc | 5.38 | 2.53 | 6.57 | 2.1 | | 130 |
| Arsenic | 4.80 | 1.7 | 2.4 | 2.4 | | 13 |
| Chromium | 0.61 | 0.34 | 0.71 | 0.28 | | 1 |

**Table 2: January 2016 Quarterly Monitoring Results and ANZECC (2000) trigger values**

| Determinand | Unit | ANZECC guidelines* | TTD | TTE | TTW | OSU | OSD |
|---|---|---|---|---|---|---|---|
| pH | pH | NA (6-9) | 7.3 | 7.5 | 7.8 | 7.6 | 8 |
| Conductivity | µS/m | NA | 75 | 32.1 | 32.2 | 34.4 | 63.3 |
| Alkalinity | $g/m^3CaCO_3$ | NA | 270 | 54 | 55 | 58 | 210 |
| Total suspended solids | $g/m^3$ | NA | 42 | 4 | 4 | < 3 | < 3 |
| COD | $g/m^3$ | NA | 14 | < 6 | < 6 | < 6 | 11 |
| Total Hardness | $g/m^3CaCO_3$ | NA | 260 | 61 | 63 | 65 | 210 |
| Ammoniacal Nitrogen | $g/m^3$ | 1.430 (2.34) | 0.55 | < 0.010 | < 0.010 | < 0.010 | < 0.010 |
| Total Iron | $g/m^3$ | NA | 17.8 | 0.035 | 0.037 | 0.056 | 0.31 |
| Total Manganese | $g/m^3$ | 2.500 | 1.84 | 0.0078 | 0.0028 | 0.0053 | 0.2 |
| Total Lead | $g/m^3$ | 0.0056 (0.011) | 0.0005 | < 0.00011 | < 0.00011 | 0.00028 | < 0.00011 |
| Total Copper | $g/m^3$ | 0.0018 (0.0028) | < 0.00053 | 0.00059 | < 0.00053 | 0.0031 | 0.00092 |
| Total Zinc | $g/m^3$ | 0.015 (0.027) | 0.0074 | 0.0035 | < 0.0011 | 0.0131 | 0.0035 |
| Total Arsenic | $g/m^3$ | 0.042 | 0.0053 | < 0.0011 | < 0.0011 | < 0.0011 | < 0.0011 |
| Total Chromium | $g/m^3$ | 0.006 | 0.00087 | < 0.00053 | < 0.00053 | < 0.00053 | < 0.00053 |

* ANZECC (2000) Guidelines for Ecosystem Protection 90% default trigger value (Table 3.4.1); values in brackets are guidelines adjusted to site specific factors (ie. pH = 7.6 and hardness = 50 $g/m^3$ $CaCO_3$.

**Groundwater monitoring results**

The groundwater monitoring bore showed significantly elevated levels of iron but concentrations of iron and other metals have been trending down over the last four quarters (Table 3).

**Table 3: Groundwater monitoring results**

| Determinand | Unit | TTG | | | |
|---|---|---|---|---|---|
| | | 29/01/2016 | 26/11/2015 | 12/06/2015 | 2/04/2015 |
| pH | pH | 6.5 | 6.6 | 6.8 | 6.6 |
| Chloride | $g/m^3$ | 82 | 83 | 89 | 83 |
| Conductivity | µS/m | 46.6 | 46.1 | 47.8 | 47.1 |
| Nitrate Nitrogen | $g/m^3$ | 2.0 | 1.185 | 2.2 | 2.3 |
| Ammoniacal Nitrogen | $g/m^3$ | 0.005 | 0.021 | 0.044 | 0.01 |
| Total Lead | $g/m^3$ | 0.025 | 0.049 | 0.123 | 0.20 |
| Total Zinc | $g/m^3$ | 0.079 | 0.143 | 0.30 | 0.51 |
| Total Iron | $g/m^3$ | 15.1 | 28 | 57 | 99 |
| Total Manganese | $g/m^3$ | 1.05 | 1.99 | 8.9 | 11.7 |
| Total Copper | $g/m^3$ | 0.014 | 0.024 | 0.045 | 0.082 |

**Conclusion**

The water quality monitoring results for January 2016 indicate that contaminant levels in the tributary below the landfill were within an acceptable range and that no additional sampling is required.

The next round of routine quarterly testing is due by the end of March 2016.

Yours sincerely,

David Cameron
**Senior Environmental Scientist**
**MWH New Zealand Limited**

Encl.: Lab Report

Copy to: Ian Leary (Spencer Holmes)

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# ANALYSIS REPORT



| | | | | |
|---|---|---|---|---|
| **Client:** | MWH New Zealand Limited | **Lab No:** | 1531500 | SPv1 |
| **Contact:** | Kristin Stokes | **Date Registered:** | 30-Jan-2016 | |
| | C/- MWH New Zealand Limited | **Date Reported:** | 09-Feb-2016 | |
| | PO Box 9624 | **Quote No:** | 37978 | |
| | WELLINGTON 6141 | **Order No:** | | |
| | | **Client Reference:** | | |
| | | **Submitted By:** | Kristin Stokes | |

**Sample Type: Aqueous**

| Sample Name: | | TTG 29-Jan-2016 1:20 pm | TTE 29-Jan-2016 2:00 pm | TTW 29-Jan-2016 2:15 pm | TTD 29-Jan-2016 1:40 pm | OSU 29-Jan-2016 2:40 pm |
|---|---|---|---|---|---|---|
| **Lab Number:** | | 1531500.1 | 1531500.2 | 1531500.3 | 1531500.4 | 1531500.5 |
| pH | pH Units | 6.5 | 7.5 | 7.8 | 7.3 | 7.6 |
| Total Alkalinity | g/m³ as $CaCO_3$ | - | 54 | 55 | 270 | 58 |
| Total Hardness | g/m³ as $CaCO_3$ | - | 61 | 63 | 260 | 65 |
| Electrical Conductivity (EC) | mS/m | 46.6 | 32.1 | 32.2 | 75.0 | 34.4 |
| Total Suspended Solids | g/m³ | - | 4 | 4 | 42 | < 3 |
| Total Arsenic | g/m³ | 0.0039 | < 0.0011 | < 0.0011 | 0.0053 | < 0.0011 |
| Dissolved Calcium | g/m³ | - | 13.9 | 14.8 | 81 | 15.1 |
| Total Chromium | g/m³ | 0.0136 | < 0.00053 | < 0.00053 | 0.00087 | < 0.00053 |
| Total Copper | g/m³ | 0.0141 | 0.00059 | < 0.00053 | < 0.00053 | 0.0031 |
| Total Iron | g/m³ | 15.1 | 0.035 | 0.037 | 17.8 | 0.056 |
| Total Lead | g/m³ | 0.025 | < 0.00011 | < 0.00011 | 0.00050 | 0.00028 |
| Dissolved Magnesium | g/m³ | - | 6.3 | 6.3 | 15.0 | 6.6 |
| Total Manganese | g/m³ | 1.02 | 0.0078 | 0.0028 | 1.84 | 0.0053 |
| Total Zinc | g/m³ | 0.079 | 0.0035 | < 0.0011 | 0.0074 | 0.0131 |
| Chloride | g/m³ | 82 | - | - | - | - |
| Total Ammoniacal-N | g/m³ | < 0.010 | < 0.010 | < 0.010 | 0.55 | < 0.010 |
| Nitrite-N | g/m³ | < 0.002 | - | - | - | - |
| Nitrate-N | g/m³ | 2.0 | - | - | - | - |
| Nitrate-N + Nitrite-N | g/m³ | 2.0 | - | - | - | - |
| Chemical Oxygen Demand (COD) | g $O_2$/m³ | - | < 6 | < 6 | 14 | < 6 |

| Sample Name: | | OSD 29-Jan-2016 2:30 pm | | | | |
|---|---|---|---|---|---|---|
| **Lab Number:** | | 1531500.6 | | | | |
| pH | pH Units | 8.0 | - | - | - | - |
| Total Alkalinity | g/m³ as $CaCO_3$ | 210 | - | - | - | - |
| Total Hardness | g/m³ as $CaCO_3$ | 210 | - | - | - | - |
| Electrical Conductivity (EC) | mS/m | 63.3 | - | - | - | - |
| Total Suspended Solids | g/m³ | < 3 | - | - | - | - |
| Total Arsenic | g/m³ | < 0.0011 | - | - | - | - |
| Dissolved Calcium | g/m³ | 63 | - | - | - | - |
| Total Chromium | g/m³ | < 0.00053 | - | - | - | - |
| Total Copper | g/m³ | 0.00092 | - | - | - | - |
| Total Iron | g/m³ | 0.31 | - | - | - | - |
| Total Lead | g/m³ | < 0.00011 | - | - | - | - |
| Dissolved Magnesium | g/m³ | 12.1 | - | - | - | - |
| Total Manganese | g/m³ | 0.20 | - | - | - | - |
| Total Zinc | g/m³ | 0.0035 | - | - | - | - |
| Total Ammoniacal-N | g/m³ | < 0.010 | - | - | - | - |
| Chemical Oxygen Demand (COD) | g $O_2$/m³ | 11 | - | - | - | - |

| Sample Type: Aqueous | | | | | |
|---|---|---|---|---|---|
| **Sample Name:** | OSD 29-Jan-2016 2:30 pm | | | | |
| **Lab Number:** | 1531500.6 | | | | |

# 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: Aqueous**

| Test | Method Description | Default Detection Limit | Sample No |
|---|---|---|---|
| Filtration, Unpreserved | Sample filtration through 0.45µm membrane filter. | - | 1-6 |
| Total Digestion | Boiling nitric acid digestion. APHA 3030 E 22nd ed. 2012 (modified). | - | 1-6 |
| pH | pH meter. APHA 4500-$H^+$ B 22nd ed. 2012. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. | 0.1 pH Units | 1-6 |
| Total Alkalinity | Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (Modified for alk <20) 22nd ed. 2012. | 1.0 g/m³ as $CaCO_3$ | 2-6 |
| Total Hardness | Calculation from Calcium and Magnesium. APHA 2340 B 22nd ed. 2012. | 1.0 g/m³ as $CaCO_3$ | 2-6 |
| Electrical Conductivity (EC) | Conductivity meter, 25°C. APHA 2510 B 22nd ed. 2012. | 0.1 mS/m | 1-6 |
| Total Suspended Solids | Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D 22nd ed. 2012. | 3 g/m³ | 2-6 |
| Filtration for dissolved metals analysis | Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 22nd ed. 2012. | - | 2-6 |
| Total Arsenic | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.0011 g/m³ | 1-6 |
| Dissolved Calcium | Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012. | 0.05 g/m³ | 2-6 |
| Total Chromium | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.00053 g/m³ | 1-6 |
| Total Copper | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.00053 g/m³ | 1-6 |
| Total Iron | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012. | 0.021 g/m³ | 1-6 |
| Total Lead | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.00011 g/m³ | 1-6 |
| Dissolved Magnesium | Filtered sample, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012. | 0.02 g/m³ | 2-6 |
| Total Manganese | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.00053 g/m³ | 1-6 |
| Total Zinc | Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012 / US EPA 200.8. | 0.0011 g/m³ | 1-6 |
| Chloride | Filtered sample. Ferric thiocyanate colorimetry. Discrete Analyser. APHA 4500 $Cl^-$ E (modified from continuous flow analysis) 22nd ed. 2012. | 0.5 g/m³ | 1 |
| Total Ammoniacal-N | Filtered sample. Phenol/hypochlorite colorimetry. Discrete Analyser. ($NH_4$-N = $NH_4$+-N + $NH_3$-N). APHA 4500-$NH_3$ F (modified from manual analysis) 22nd ed. 2012. | 0.010 g/m³ | 1-6 |
| Nitrite-N | Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-$NO_3^-$ I 22nd ed. 2012 (modified). | 0.002 g/m³ | 1 |
| Nitrate-N | Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House. | 0.0010 g/m³ | 1 |
| Nitrate-N + Nitrite-N | Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-$NO_3^-$ I 22nd ed. 2012 (modified). | 0.002 g/m³ | 1 |
| Chemical Oxygen Demand (COD), trace level | Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 22nd ed. 2012. | 6 g $O_2$/m³ | 2-6 |

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.

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Ara Heron BSc (Tech)
Client Services Manager - Environmental Division