Application for Permit Variation

Permit N° 53997 (New Tip)

Document NTPV 02 (C4)

Closure Plan

Author: D J Woodrow

Contaminated Land
Air Quality
Environmental Audit

SMITH GRANT Environmental Consultancy LLP

Partnership No: OC 300776

urbanspringside

SPRINGSIDE MILLS, BELMONT, LANCASHIRE; LICENSED LANDFILLS

Environmental Permit Nos. 53658 and 53997

Closure Plan

For: Urbanspringside Ltd.

November 2017

R1635-R08-v6

Smith Grant LLP, Station House, Station Road, Ruabon, Wrexham, LL14 6DL
tel: 01978 822367 fax: 01978 824718 e-mail: consult@smithgrant.co.uk web: www.smithgrant.co.uk
Members: A F Smith (Chairman), K E Hawkins, B J Thomas

DOCUMENT CONTROL SHEET

Report Title:	Springside Mills, Belmont, Lancashire: Licensed Landfills Environmental Permit Nos. 53658 and 53997 Closure Plan April 2016
Client:	Urbanspringside Limited
Report Reference Number:	R1635-R08
Issue	Final
Version:	V56
Report Date:	November 2017

SILC SPECIALIST IN LAND CONDITION
Anthony Smith
Reg. No. 139s

Signed For Smith Grant LLP

	Name	Position	Signature	Date
Author	**A F Smith BSc PhD MCIWM SiLC**	**Member**	[signature]	**13/11/2017**
Reviewer	**B J Thomas BSc MSc CEnv MCIWEM**	**Member**	[signature]	**13/11/2017**

Document Revision Record:

Version	Report Status	Date	Details of Revision
v1	draft	19/06/2014	draft for client review
v2	final	26/06/2014	minor edits
v3	final	11/07/2014	response to EA comments re sample locations / test suite and frequency
v4		06/05/2016	additional detail to reflect proposed waste recovery and use in restoration, and Old Tip gas barrier design and specification
v5	final	06/06/2016	minor edits and section drawing
v6	final	13/11/2017	minor edits

CONTENTS

DRAWINGS

APPENDICES

1. Introduction

1.1. Urbanspringside Ltd. has acquired the former Springside Mill industrial site from Kruger Paper for the purposes of remediating the site for residential development, amenity and conservation purposes. The site was previously owned and operated by William Turner & Sons Ltd. before transfer to Kruger. The site contains two closed industrial waste landfills referred to as the "Old Landfill" and "New Landfill" that were operated by Kruger primarily to receive effluent sludges from their paper recycling and paper-making processes.

1.2. The landfills are regulated by the Environment Agency (EA) via Environmental Permits originally issued to Kruger Paper, now transferred to Urbanspringside. Prior to transfer of the Permits, the EA requested that the Permit transfer application be accompanied by a Closure Plan for both landfills. The Closure Plan required contents were set out in a document "Summary of requirements for progressing the sites to closure" provided by the Environment Agency. These requirements came under the following headings:

- Risk-based monitoring plan for both sites;
- Gas management plan for the Old Tip, with 'in-principle' outline of the designed and managed system;
- Amenity Plan outlining environmental management of odour, dust and emissions to surface water and groundwater;
- Restoration Plan with proposed restoration contours and aftercare management of both sites.

1.3. The Closure Plan report was previously produced by Smith Grant LLP (SGP report reference R1635-R08-v3), based on anticipated methods of dealing with New Tip wastes and restoration of the Old Tip at the time. In order to now facilitate the remediation and redevelopment of the wider Springside Mill in accordance with Planning Consent 10/14/0440 granted by Blackburn with Darwen Borough Council, Urbanspringside is seeking the restoration and surrender of the New Tip Environmental Permit, whilst seeking EA agreement to the detailed plans for restoring the Old Tip to a state whereby the Permit for that site can be surrendered at some date in the future.

1.4. Part 1 of Schedule 5 of the Environmental Permitting (England and Wales) Regulations 2010 concerns the surrender of an Environmental Permit. Section 14(1) states that:
"The regulator must accept an application for the surrender of an environmental permit in whole or in part under regulation 25(2) if it is satisfied that the necessary measures have been taken—
(a) to avoid a pollution risk resulting from the operation of the regulated facility; and
(b) to return the site of the regulated facility to a satisfactory state, having regard to the state of the site before the facility was put into operation."

1.5. A monitoring strategy covering groundwater, surface water and ground gas has been in place at the site since 2006, and was agreed between Edge Consultants Ltd. on behalf of Kruger and the Environment Agency. The monitoring strategy has been implemented from 2007 onwards.

1.6. Further to submission of version 3 of this report to the EA, and discussions and feedback received, further work has been carried out regarding the design and specification of a gas barrier and restoration cover to the Old Tip, and treatability testing / impact assessment for wastes recovered from the New Tip. In addition, the EA has requested information to be submitted in accordance with the Technical Requirements for a Landfill Closure Report, as set out in Environmental Permitting Regulations guidance (EPR 5.02); this information is summarised in Appendix A. Version 5 of the Landfill Closure Plan includes the further information requested.

1.7. The agreement of this Closure Plan will enable restoration works to commence, culminating in the preparation of a Closure Report for the New Tip when this has been emptied of the deposited wastes and validation successfully completed. A Closure Report for the Old Tip may only be prepared when the site is fully restored and there is sufficient monitoring data available regarding gas and leachate monitoring to demonstrate that migration is being managed and achieves environmental assessment limits (EALS).

2. Background Information

2.1. Technical Reports

2.1.1. The following technical reports describing conceptual models for both sites together with reviews of all available monitoring data are listed below:

Table 2.1: Smith Grant LLP Reports

Title	Content and purpose	Reference and date
Springside Mills, Belmont, Lancashire; Licensed Landfills Environmental Permit Nos. 53658 and 53997 Hydrogeological Risk Assessment Report	For Environment Agency Permitting Purposes - review of previously reported data, risk assessment and review of tip leachate management options	R1635-R01-v3, March 2014
Springside Mills, Belmont, Lancashire; Licensed Landfills Environmental Permit Nos. 53658 and 53997 Landfill Gas Risk Assessment Report	For Environment Agency Permitting Purposes - review of previously reported data, description of preliminary flux box testing on Old Tip, and review of landfill gas management options	R1635-R02-v2, December 2013
Springside Mills, Belmont, Lancashire; Licensed Landfills Environmental Permit Nos. 53658 and 53997 Stability Risk Assessment Report	For Environment Agency Permitting Purposes - review of slope stability around and within landfills, and settlement data on Old Tip, with review of Old Tip restoration options.	R1635-R03-v1, March 2014
Restoration of the New Tip at the former Springside Mills Site, Belmont; Environmental Review and Mitigation Proposals	Review of site environmental setting and waste contents, with risk assessment and remedial options review	R1635-R04-v3, November 2012
Former Springside Mills, Belmont, Lancashire, Contamination Desk Study and Preliminary Risk Assessment	Desk Study review to support planning application for main works site reclamation	R1635-R05-v2, September 2013
Former Springside Mill, Belmont, Remediation and Restoration of New Tip; Planning Consent 10/12/1110; Condition 2, Contamination Desk Study, Site Investigations and Remedial Strategy	Contamination desk study, summarising all intrusive investigation results for Local planning Authority in pursuit of Planning Condition Discharge	R1635-R07-v1, March 2014

2.1.2. The Environment Agency is satisfied that the above reports adequately describe the sites and potential environmental risks. Specific comments concern the fitness for purpose of certain landfill gas monitoring installations, and these are reviewed in section 3 below, the integrity of the Supply Lodge dam (which has been the subject of a recent engineering inspection, details of which are provided in Appendix F), and the suggested absence of evidence for reduction in pollutant concentrations within the Old Tip (further comment provided in Section 3 below).

2.1.3. In conclusion, the Environment Agency agrees that water draining from west-facing surface slope of the Old Tip is likely to enter Three Nooked Shaws Brook (TNSB) via the Supply Lodge, and that the underlying bedrock aquifer is not at risk from leachate pollution. TNSB is diverted via a culvert away from its original course and now flows into Eagley Brook upstream of the site. The primary risk is agreed to be shallow migration of leachate via the TNSB valley below both landfills, apparently converging upon the "Ochre Culvert" discharging to Eagley Brook. Eagley Brook is the primary receptor for any waterborne pollutant emissions from both landfills, as well as any leaching from the main works and ash tips.

2.1.4. Urbanspringside has prepared a separate method statement covering the proposed excavation and relocation of deposited effluent treatment sludge wastes from the New Tip to the Old Tip for re-use. The method statement also sets out the arrangements for removing the landfill liner, monitoring and validation to allow the New Tip Closure Report to be prepared. The treatment and re-use proposals for cement-stabilised New Tip effluent treatment sludge has now been refined as a result of additional development and testing work, and additional information is provided in Appendix B; the proposed treatment and recovery of New Tip sludge is the subject of a separate deployment application by the licenced specialist contractor Urban Soil Solutions Ltd.

3. Risk-based Monitoring Plan

3.1. Controlled Waters Background

3.1.1. The sites lie at the lower (east) end of the west to east valley of Three Nooked Shaw Brook (TNSB) adjacent to its junction with the larger northwest to southeast Longworth Clough (occupied by Eagley Brook, also known as Belmont Brook). The Old and New Landfills have been constructed within the base of the TNSB valley to the east of a concrete dam impounding the Supply Lodge. The valley is eroded into a deep deposit of glacial till. The Old Landfill is uncontained. The New Landfill occupies a single lined cell.

3.1.2. The sites are underlain at depth by an aquifer within the Carboniferous gritstone bedrock however this is not at risk from pollutants from the landfills due to the thick layer of glacial till which confines the aquifer. There is no monitoring of the aquifer.

3.1.3. No exceedances of Priority Substances Values, as set down in The River Basin Districts Typology, Standards and Groundwater Threshold Values (Water Framework Directive) (England and Wales) Directions 2010, have been detected during the monitoring of leachate, groundwater and surfaces waters linked to the two landfills, with the following exceptions:

- cadmium has been detected in BH110/06, BH114/06 and BH5/95(d) in excess of the EQS, reflecting slightly elevated natural background levels in the glacial drift, and at a maximum of 0.29 µg l^{-1} in the Ochre Culvert (monitoring point SWR5);
- mercury was detected in all monitoring locations on one occasion (June 2012) probably signifying a systematic laboratory error, and as exceptional slight exceedances of the standard for the upstream TNSB (SWR1 - 0.06 µg l^{-1}), New Tip leachate (0.06 µg l^{-1}), BH110/06 (0.053 µg l^{-1}), and BH4/95(d) (0.055 µg l^{-1}); also, a relatively high concentration was recorded on one occasion (December 2009) in SWR5 at 12 mg l^{-1} - that result cannot be checked but has not been repeated since, and may be erroneous; the average results are not of significance.

3.1.4. Iron and manganese are naturally elevated in the receiving watercourses, TNSB and Eagley Brook, but with average results that meet the EQS. Results in the key surface water monitoring locations up and down-stream of the sites show an improvement in water quality downstream, with no evidence of impact from landfill leachate:

Table 3.1. Iron and Manganese Monitoring in TNSB and Eagley Brook, 2006-2013

	Iron (mg l^{-1})		Manganese (mg l^{-1})	
	average	maximum	average	maximum
SWR1 (TNSB - Supply Lodge)	0.97	1.9	0.21	0.70
SWR4 (Eagley Brook upstream)	0.59	1.4	0.05	0.25
SWR6 (Eagley Brook downstream)	0.55	2.1	0.06	0.38

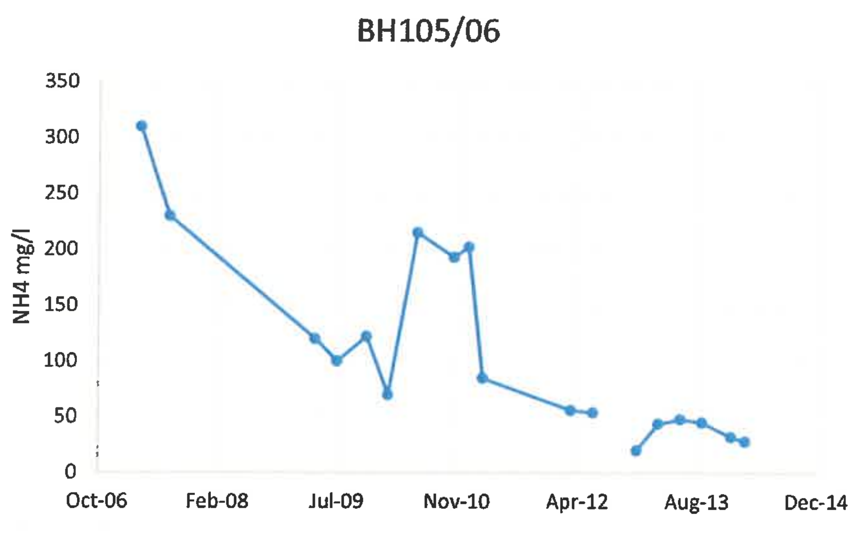
3.1.5. Ammonia concentrations in the receiving watercourses, TNSB and Eagley Brook meet the EQS. Results in the key surface water monitoring locations up and down-stream of the site show an improvement in water quality downstream, with no evidence of impact from landfill leachate:

Table 3.2. Ammonia Monitoring in TNSB and Eagley Brook, 2006-2013

	Ammonia (mg N l^{-1})	
	average	maximum
SWR1 (TNSB - Supply Lodge)	0.15	0.27
SWR4 (Eagley Brook upstream)	0.12	0.29
SWR6 (Eagley Brook downstream)	0.08	0.15

3.2. Leachate Sources

3.2.1. The Old Landfill permitted waste contents include non-polluting sludge from paper manufacture - paper effluent treatment sludges (essentially limestone and clay fillers and cellulose fibre) and demolition wastes. Some hydrocarbons, in particular toluene, have been identified, together with low concentrations of other organic compounds however these have not been shown to be present in significant concentrations in leachate leaving the site. Ammonia within leachate in the central part of the tip has been identified as the pollutant of primary concern with respect to surface waters. The longest run of monitoring data for leachate within the Old Tip is from BH105/06, and shows a declining trend in ammonia concentration within the landfill (see graph below). Leachate concentrations at the down-gradient pump location / adjacent to the Supply Lodge are substantially below the discharge consent limit and similar to the local background.



3.2.2. The New Landfill contents are solely paper effluent treatment sludges of similar composition to those within the Old Tip. The leachate monitoring to date at the pumping well has been found to comply with the discharge consent except for occasional exceedances of the total suspended solids, probably due to the formation of iron (III) oxyhydroxide flocs on exposure to the atmosphere.

3.2.3. A discharge consent (ref: NPSWQD006635) allows for the pumping of 20m³/d and 10m³/d of leachate from the Old and New Landfills respectively into the 42" culvert. The following quality limits are specified:

- biochemical oxygen demand - 20 mg/l
- ammoniacal nitrogen - 5 mg/l
- pH 5.0 - 9.0
- suspended solids - 20 mg/l
- free from visible oil/grease
- List 1 substances as per Annex 1 to the permit – monitoring is currently carried out for cadmium (consent limit 10.0 µg/l) and mercury (consent limit 2.0 µg/l)
- Annex 2 of the Permit lists other dangerous substances whose discharge should not cause an exceedance of the environmental quality standard (EQS) in the receiving watercourse downstream (this is assumed to be the culverted TNSB).

3.3. <u>New Tip Waste Recovery</u>

3.3.1. In order to assess the potential impact from leachate draining from the New Tip paper wastes during and following their proposed treatment by cement stabilisation and re-use in the restoration of the Old Tip, trials have been carried out (see Appendix B for full details). The initial study involved the bulk sampling of the New Tip waste which was placed in 2 lined metal builders skips of ~4.6m³ maximum capacity. These were equipped with a standpipe to enable sampling of any collected leachate. The sampling locations were from the lower part of the tip near to the leachate chamber ("skip 1") and up-gradient area towards the western end of the landfill ("skip 2"). The wastes were soft and tended to slump but contained no visible water, although water could be squeezed by hand from the material represented by skip 2. The skip 2 material was noticeably softer and weaker than the skip 1 material which appeared to be more consolidated.

3.3.2. The analyses of the solid waste sampled showed high water contents of 53% and 64% (114% and 175% of dry weight), with organic matter contents of 11.2% and 15.5% dry weight. The nitrogen content was low, with carbon:nitrogen ratios of <1:50 suggesting that microbial decomposition of the organic content will be constrained. Volatile organic compounds in the waste included a range of aromatic compounds including toluene and naphthalene in low concentrations.

3.3.3. After filling of the skips, the wastes were sheeted to prevent infiltration and were allowed to settle for a week, after which leachate sampling was carried out. The leachate, which may be assumed to be representative of the drainage from freshly disturbed and lightly re-compacted material, was analysed, and estimates of the volume of free liquid made in order to carry out an assessment of potential pollutant loads. The leachate was moderately odorous, of milky colour, and contained high levels of chemical oxygen demand (COD), raised phenol and cresol, raised ammonia (in skip 1 only), and slightly elevated concentrations of some metals and aromatic volatile organic compounds (VOCs).

3.3.4. It was previously speculated that degreasing solvents might have entered the effluent stream giving rise to the noted presence of toluene, however the detailed analysis of leachate has also found a range of related aromatic compounds, monohydric phenols and alcohols. The substances found are suggestive of intermediate breakdown products from the natural anaerobic hydrolysis of lignin fibre in the effluent sludge; lignin is a propyl phenol polymer. Although these substances have not been previously identified in pumped leachate or groundwater down-gradient of the landfills, the disturbance of the materials during the proposed restoration of the tips could temporarily give rise to "higher strength" leachate, and the management plan and monitoring therefore takes account of this.

3.3.5. EA-approved method tank tests of cement stabilised New Tip sludge samples are reported in Appendix B, and demonstrate leachability results that comply with surface water EQS values. The treated material also meets physical requirements for handleability and stability in use to form a lower cover layer to the present low-lying, soft and unstable sections of the Old Tip where ground levels need to be raised to create an unsaturated zone. The specialist contractor, Urban Soils Solutions Ltd, holds a "mobile plant licence" for stabilisation and has obtained a deployment notice for treatment of the New Tip sludges to render the treated material physically suitable for use in Old Tip restoration and non-polluting in such use.

3.4. Leachate Pathways

3.4.1. Pathways for leachate egress and estimates of their relative significance in terms of flows are as follows:

Table 3.3. Summary of Leachate Pathways

Old Landfill		**Significance**
1	runoff and seepage from waste body to west directly into standing water adjacent to and connected with Water Supply Lodge and TNSB upstream culvert	may account for ~60% of Old Tip drainage based on surface area and slopes (6,883m^2); assuming annual effective rainfall of 1,000 mm, the average discharge would be 11.3 m^3 d^{-1} however this does not include natural seepage that enters the landfill from springlines in adjacent rising ground to south and north; given the absence of significant pollution in leachate monitored at the west end of the site compared to boreholes within the waste body it appears that most incident rainfall is likely to flow over the surface of the low permeability paper effluent treatment wastes

2	seepage to east into base of ash embankment, thence down valley across the boulder clay surface, below the basal liner of the New Tip, to discharge via the drain outfall to Eagley Brook	may account for ~40% of Old Tip drainage based on surface area and slopes (6,883m^2); assuming annual effective rainfall of 1,000mm, the average discharge would be 7.5 m^3 d^{-1}
3	managed pumping to TNSB culvert	intermittent pumping - maximum consented discharge rate 20 m^3 d^{-1} - assumed to include a mix of leachate and Supply Lodge surface water seeping through dam
New Landfill		
4	over-topping of basal liner to merge with general valley flow and discharge via drain outfall to Eagley Brook	episodic, during wet weather when pumping ineffective; previously a significant volume >80 m^3 d^{-1} due to entry of TNSB culvert leakage into lined cell
5	seepage through any imperfections in the basal liner into underlying ash drainage layer and alluvium, to merge with pathways 2 & 4	unknown contribution to augment pathway 2 flow from Old Tip plus general area drainage, in particular leakage from TNSB culvert; the Ochre Culvert groundwater discharge is estimated at an average ~100 m^3 d^{-1}
6	managed pumping to TNSB culvert	intermittent pumping - maximum consented discharge rate 10 m^3 d^{-1}

3.4.2. With respect to the Old Landfill, the central leachate monitoring wells, in particular BH3/11 contain leachate with the potential to cause pollution outside the site, in particular with respect to ammonia and toluene. However, the external monitoring wells have recorded no occurrence of toluene above detection limits, and ammonia has only been recorded in slightly elevated concentrations immediately adjacent to the down-gradient (east) end of the landfill within the base of the ash embankment. Given the common presence of ammonia in excess of the surface water EQS concentration in groundwater due to a variety of sources in the catchment (including natural deposition, agriculture, forestry, domestic sanitation, and industry), the concentrations recorded adjacent to the landfills over recent years, in the order of 2-3 mg l^{-1} are not considered to indicate significant risk.

3.4.3. Ammonia concentrations are reduced downstream and monitoring of the Ochre culvert discharge (SW5), which is considered to represent a significant pathway to Eagley Brook, has shown generally low levels of potential pollutants with the exception of iron. The Old Landfill is uncapped and unlined, with waste deposition ceasing over 15 years ago, and is considered to be in a state of equilibrium whereby future increased releases of water-borne pollutants appears to be very unlikely.

3.4.4. The New Tip leachate monitoring and discharges have not been shown to be significantly polluting, except where temporarily disturbed. This is due to the mobilisation of fine cellulose fibre that can generate a high suspended solids / high BOD leachate. Whilst unlikely to cause any impact on groundwater due to natural filtration, the leachate could impact surface waters if directly discharged. It will therefore be important to maintain the containment, and treatment as necessary, of leachate arising during proposed stabilisation treatment works on the New Tip sludge waste; once treated, the waste is no longer polluting. As it is proposed to treat and remove all of the deposited sludge wastes as part of the landfill closure, any post-closure risks will be nullified. The potential for residual leachate within the landfill basal drainage (ash layer) or natural strata appears to be negligible given the absence of any detectable pollutants in down-gradient monitoring wells, however the liner and any leakage residues of sludge will be removed following treatment and removal of the landfill contents.

3.4.5. The only significant exceedances of environmental standards (WFD Priority Substance EQSs for inland surface waters in leachate leaving the landfills in monitoring since 2009 have been for ammonia, iron and manganese. In addition, there have been recent exceedances of the TNSB Culvert Discharge Consent limit for suspended solids, probably as a result of the formation of iron oxyhydroxide (ochre) flocs. As TNSB already carries peaty water with elevated background iron concentrations the consequences of the discharge exceedances are considered to be negligible.

3.4.6. In conclusion, the leachate leaving the landfills at present is not significantly polluted. There are no groundwater resources at risk from pollutants within leachate from the site. The bedrock aquifer is protected by a substantial thickness of glacial till aquitard or aquiclude and has a hydraulic gradient liable to provide baseflow to Eagley Brook where the drift cover thins. Surface watercourses are linked to the site and leachate migration pathways, either via unmanaged drainage via the base of the former TNSB valley, or via managed discharge to the TNSB culvert. No significant impact of pollutants from the landfills has been recorded within the surface watercourses over the last 7 years of monitoring, and for the ubiquitous non-hazardous substances ammonia, iron and manganese, there is an improvement in water quality downstream of the landfills.

3.5. Controlled Waters Monitoring Proposals

3.5.1. Based upon the above assessment and the historical leachate monitoring programme, the current and future predicted leachate quality is as follows:

Table 3.4. Leachate pollution potential

	Old Landfill		**New Landfill**	
	current	future predicted	current	future predicted
priority substances	not detected above EQS	no deterioration likely	not detected above EQS	Potential short-term increases in metals during waste disturbance / initial drainage, but less than discharge consent values; mitigated by settlement and aeration in temporary lagoon prior to discharge;

				Long-term – no pollution risk following removal of waste
other pollutants	elevated ammonia and toluene present within landfill body - not found in leachate leaving the site	no deterioration likely	elevated ammonia and toluene present within landfill body - not found in leachate leaving the site	Potential short-term increase in BOD/COD, suspended solids and ammonia in excess of Discharge Consent standards. Some risk of phenol exceedance of EQS in TNSB but not in Eagley Brook; Long-term – no pollution risk following removal of waste

3.5.2. The risk based monitoring plan for surface water and groundwater is set out in Appendix C, and involves an increased frequency of leachate monitoring during the proposed New Tip waste drainage and re-location proposals, reverting to the existing plan following the works, with the exclusion of New Tip up-and down-gradient monitoring wells, and TNSB downstream monitoring point (SWR3), not needed after removal of New Tip.

3.5.3. Groundwater compliance limits have been provided for the key identified potential water pollutants at locations down-gradient of the Old Tip (BH4/95 and BH103/06 deep), and Ochre Culvert (SWR5), down gradient of the both Old and New Tips, as follows:

Table 3.5. Proposed Environmental Assessment Levels

Receptor	Compliance Point	Substance	Baseline Concentration Data	Proposed Limit	Rationale
Ground-water, down-gradient of Old Tip	BH 4/95	cadmium	mean 0.248 max 0.900 s.d. 0.259 (limit of detection 0.02*)	0.756	~95%ile of background; (EQS 0.20 LT)
		mercury	mean <0.087 max 0.280 s.d. 0.072 (limit of detection 0.05*)	0.232	~95%ile of background; (EQS 0.05 LT 0.07 ST)
		ammonia	mean 1.36 max 15.0 s.d. 3.79 (limit of detection 0.05*)	8.95	~95%ile of background; (EQS (type 4) 0.3 LT)
		monohydric phenols	no data	7.7	No data for statistical approach; EQS (LT) adopted

Receptor	Compliance Point	Substance	Baseline Concentration Data	Proposed Limit	Rationale
		toluene	no data	50.0	No data for statistical approach; minimum reporting value (MRV) taken from EA H1 guidance Annex J Appendix A2 (v2.1) (EQS 50 LT 380 ST)
		chemical oxygen demand (COD)	mean 54.6 max 150.0 s.d. 52.1 (limit of detection 1*)	159	~95%ile of background; No EQS
	BH 103/06 (deep)	cadmium	mean 0.077 max 0.500 s.d. 0.149 (limit of detection 0.02*)	0.375	~95%ile of background; (EQS 0.20 LT)
		mercury	mean <0.088 max 0.280 s.d. 0.077 (limit of detection 0.05*)	0.242	~95%ile of background; (EQS 0.05 LT 0.07 ST)
		ammonia	mean 2.64 max 3.70 s.d. 0.73 (limit of detection 0.05*)	4.10	~95%ile of background; (EQS (type 4) 0.3 LT)
		monohydric phenols	no data	7.7	No data for statistical approach; EQS (LT) adopted
		toluene	no data	50.0	No data for statistical approach; minimum reporting value (MRV) taken from EA H1 guidance Annex J Appendix A2 (v2.1) (EQS 50 LT 380 ST)
		chemical oxygen demand (COD)	mean 21.4 max 35.2 s.d. 8.2 (limit of detection 1*)	37.7	~95%ile of background; No EQS

Receptor	Compliance Point	Substance	Baseline Concentration Data	Proposed Limit	Rationale
Eagley Brook feeder	Ochre Culvert discharge (SWR5) (ground-water down-gradient of Old and New Tips)	cadmium	mean <0.064 max 0.290 s.d. 0.084 (limit of detection 0.02*)	0.231	~95%ile of background; (EQS 0.20 LT)
		mercury	mean <0.133 max 0.640 (excluding July 2009 anomalous result) s.d. 0.193 (limit of detection 0.05*)	0.520	~95%ile of background; (EQS 0.05 LT 0.07 ST)
		ammonia	mean 0.404 max 0.730 s.d. 0.162 (limit of detection 0.05*)	0.728	~95%ile of background; (EQS (type 4) 0.3 LT)
		monohydric phenols	no data	7.7	No data for statistical approach; EQS (LT) adopted
		toluene	no data for SWR5 (leachate surface discharge consistently below limit of detection 1.0)	50.0	No data for statistical approach; minimum reporting value (MRV) adopted from H1 Annex J Appendix A2 (v2.1) guidance (EQS 50 LT 380 ST)
		chemical oxygen demand (COD)	mean 13.9 max 39.0 s.d. 8.5 (limit of detection 1*)	31	~95%ile of background; No EQS

Concentrations in µg l^{-1}; * - for statistical analysis, results below limit of detection are assumed to be at limit of detection; equivalent 95%ile concentrations calculated as mean + 2 std. deviations of the data set; ST – short term - 95%ile, LT – long term – annual average; EQS values from Environment Agency H1 guidance, Annex D.

3.5.4. No standards are proposed for iron and manganese due to the elevated natural background concentrations of these substances, and their absence as significant sources within the paper wastes. No standard is proposed for suspended solids due to the occasional natural elevation of these in the receptors due to storm runoff and iron flocs from natural ferruginous seeps within Longworth Clough, however all discharges will be required to be free from discoloration and odour, and free from visible oil films in accordance with the current discharge consent.

3.5.5. Exceedance of groundwater compliance limits will trigger investigation into the causes, including repeat sampling and analysis, risk assessment and proposals for remedial action as necessary. Remedial actions might involve the interception of groundwater and treatment, and/or leachate volume reduction by reducing water inflows.

3.6. Landfill Gas

3.6.1. Details of the Environment Agency specified gas monitoring locations and other monitored installations are provided below:

Table 3.6. Gas Monitoring Wells

Location	Borehole well	EA specified (2007)	Response zone (m bgl)	Response stratum over typical water table (m)	monitored to January 2012 by Edge Consultants / Coffey Geotechnics	monitored since January 2012 by Smith Grant
within Old Landfill body	BH101/06	x	1.0 - 8.0	waste onto clay till, saturated to near ground level	up to Nov 2007	lost
	BH105/06	x	4.0 - 6.0	sand and gravel over clay till, saturated to near ground level	x	x
	BH1/11		1.0 - 14.0	waste, water table at ~4.5	x	x
	BH2/11		1.0 - 12.0	waste, water table at ~5.0	x	flooded, lost December 2012
	BH3/11		1.0 - 9.0	waste, water table at ~3.0	x	x
north of Old Landfill	BH106/06	x	1.0 - 4.0	sand and gravel, water table in 1.0 - 1.5m range	x	x
	BH117/07		0.8 - 4.0	clayey sand on water table at ~2.2m	x	
	BH118/07		2.0 - 5.0	sand, gravel and silt on water table at ~3.0	x	
	BH119/07		2.0 - 6.0	sand on water table at 5.0	x	
	BH120/07		1.5 - 5.5	sand and gravel on water table at ~2.5	x	
south of Old Landfill	BH1/95		17.7 - 24.7	clay till below water table	x	not found
	BH102/06	x	18.0 - 20.0	clay till below water table	x	x
	BH109/06	x	0.5 - 6.0	clay till, water table in surface - 0.5 range	damaged	not found
	BH110/06	x	1.0 - 3.5	clay till, water table in surface - 0.3 range	x	x
in ash bank between Old and	BH4/95	x	14.5 - 25.0	clay till, saturated	x	x
	BH6/95		1.3 - 13.0	granular fill, water table at ~12.0	x	
	BH103/06 (s)	x	2.0 - 16.0	granular fill over clay till at base, water table at ~12.0	x	x

Location	Borehole well	EA specified (2007)	Response zone (m bgl)	Response stratum over typical water table (m)	monitored to January 2012 by Edge Consultants / Coffey Geotechnics	monitored since January 2012 by Smith Grant
New Landfills	BH107/06	x	1.0 - 4.8	granular fill to 1.4 over predominantly clay till with clayey sandy gravel layers, water table ~2.5	x	x
	BH108/06	x	1.0 - 6.0	predominantly granular fill with water table in 3.0 - 3.5 range	x	x
	BH114/06		2.0 - 16.0	predominantly granular fill with some more cohesive bands, water table in 10.0 - 11.5 range	x	x
	WS8/05	x	0.9 - 4.0	granular made ground, unsaturated	x	x
north of New Landfill	BH112/06		1.0 - 4.3	predominantly cohesive fill to 1.6 over clay till, water table in 1.0 - 1.6 range	x	x
	BH113/06		1.0 - 5.0	cohesive fill to 1.8 over 0.7 peat band and clay till, water table in 2.5-2.7 range	x	x
south of New Landfill	BH115/06(s)		2.0 - 6.0	granular fill onto clay till at base, water table in 4.0-5.0 range	x	x
	BH115/06(d)		10 - 20	clay till, water table in 10.0 - 12.0 range	x	
	BH116/06(s)		2.0 - 14.0	granular fill, water table in 12.0 >14.0 range	x	x
	BH116/06(d)		16.0 - 20.0	clay till, saturated	x	x
east of New Landfill	BH5/95(s)		5.8 - 7.0	base of granular fill onto alluvial clay, saturated	x	x
	BH104/06 (s)		2.0 - 10.0	granular fill with clay till at base, water table in 5.0 - 5.5 range	x	x

3.6.2. Results from boreholes in cells shaded orange in Table 4.1 are considered unrepresentative of soil gas due to the saturation zone lying above the well response zone. They can however provide information on headspace equilibrium above the water table where dissolved methane may be present. Boreholes within saturated degradable waste may accumulate gas from bubbles rising directly into the borehole headspace (BH101/06 and 105/06).

3.6.3. The Environment Agency has questioned the performance of some monitoring wells where atmospheric conditions have been recorded, suggesting leakage into the well from surface. In permeable ground, as represented by the ash embankment, leakage of air into a well via the soil surrounds is inevitable and natural, and does not invalidate the monitoring. Leakage of this type is to be expected and is the cause of methane oxidation taking place in the shallow soils within the ash embankment, as demonstrated by the relative preponderance of carbon dioxide over methane with the presence of oxygen, in marked contrast to monitoring data from wells within the paper waste. All wells have been inspected by SGP and examined for potential leakage past the well head, depth of the response zone, water table and flow failures. Two wells have been identified as having potential problems due to settlement of the well surrounds; these are BH102/06 and WS4/03. All other wells have been found to be in good order.

3.6.4. The proposed forwards gas monitoring plan is set out in Appendix C and will continue the current format, but with increased frequency of monitoring to monthly for the period of movement and storage of New Tip waste on the Old Landfill and restoration works when lateral gas migration could potentially increase.

3.6.5. The monitoring arrangements will be reviewed following restoration of the Old Tip, but are expected to include twice yearly walkover FID surveys of the landfill cover to check for localised emissions. Further monitoring wells are likely to be needed following completion of the New Tip restoration and installation of gas venting one the development side of the Old Tip.

3.6.6. Environmental Assessment Levels for landfill gas will be 1% above background for methane and 3% above background for carbon dioxide at such time as new sensitive receptors arise at the site (i.e. during and following possible residential or other built development).

4. Landfill Gas Management Plan

4.1. Site Overview

4.1.1. Both landfills contain effluent treatment sludges that include minor proportions of degradable organic matter in the form of cellulose, hemi-cellulose and lignin within a matrix of fine particulate inert minerals. The sludges are largely water-saturated and in some respects, resemble natural organic-rich wetland soils. Anaerobic decomposition is occurring at slow rates that appear to be mediated by nutrient availability, with the primary degradation products being methane, carbon dioxide and water, although toluene, phenols and other VOC intermediate degradation products have been detected in freshly disturbed New Tip waste leachate. No VOCs have been detected in landfill gas monitoring.

4.1.2. The volume of potentially gas-generating sludge fill is estimated to be 19,500 m^3 in the Old Tip and around 3,000 m^3 in the New Tip. As previously noted, the Old Tip is unlined and is contained by a variety of largely impermeable natural soils and permeable man-made fills (boiler ash and demolition rubble / hardcore). The New Tip has a basal liner that appears to have good integrity and retains leachate.

4.1.3. The New Tip effluent sludge wastes are proposed to be treated by stabilisation methods and removed in their entirety from the lined cell, and the liner removed. Any degradable waste, as defined by having an organic content >6% or visible paper waste, will similarly be removed from the New Tip site. No significant sources of landfill gas will remain within the New Tip, and landfill gas management will not be required for this site. The remainder of this section therefore addresses landfill gas risks and management for the Old Tip only.

4.1.4. The organic matter content of waste samples from the Old Tip had an average content of 9.7%, with a maximum of 48.6%. The above-average organic matter levels were associated with the paper wastes. Using the GasSim decay equation, a preliminary estimate of the potential current gas generation from the landfill has been made:

- mass of waste – 19,500 t (assuming bulk density of 1 t m^{-3})
- carbon content - 200 kg t^{-1} waste
- medium decay rate constant 0.1
- 13 years since deposition (conservative assumption - actual median age of waste >33 y)
- gas generation rate = 11.7 m^3 hr^{-1} (1.1 l m^{-2} hr^{-1} assuming 60% methane content)

4.1.5. Surface flux box testing by SGP has indicated a best estimate of about 2.5 m^3 hr^{-1} emission rate for landfill gas from the Old Tip.

4.1.6. The glacial till which forms the dominant natural strata surrounding both landfills are cohesive and generally has low permeability to gas and water. Minor discontinuous lenses of sands and gravels have been encountered in some boreholes below the water table, however these are considered unlikely to provide potential gas migration pathways due to their saturated condition and discontinuous nature.

4.1.7. The valley sides to both landfills have been modified to varying extents by the deposition of coal ash from the paper mill boilers prior to the deposition of paper effluent sludge wastes. These deposits are most extensive in the area of an embankment separating the Old and New Tips, and in the ground to the south of the New Tip where they extend to up to 14.5 m in depth (BH 116/06). The ash is loose-tipped, granular and free-draining, and is consequently permeable to migrating landfill gas. The Old Tip wastes are retained by the western slope of the ash embankment crossing the TNSB valley. To the south of the Old Tip, made ground is also present and comprises a mix of dense ash and brick demolition materials beneath the existing hard-standings.

4.2. Landform Requirements

4.2.1. The fundamental requirements for the capping with respect to future gas management on the Old Tip are that:

- it must remain above the local water table, as defined by standing water adjacent to the Supply Lodge dam at about 193 m aod;
- it must have adequate slopes to promote moderate surface runoff and to counter future settlements that might produce closed hollows and ponding.

4.2.2. Currently the Old Tip has an unsatisfactory profile with no capping, saturated / flooded areas and over-steep slopes of up to 1 in 5 that do not facilitate satisfactory restoration or gas management. It is therefore proposed to re-grade the Old Tip surface to the final (cover surface) contours as shown on the Appendix E drawing. This will involve a minor cut into the upper part of the landfill which comprises soil and inert waste, and filling of the lower areas, in particular towards the dam. The net requirement is for 6,000m^3 of cover/capping materials, incorporating the landfill cover system and a woven geotextile; this averages out to 1m cover thickness over the waste area, although on-going consolidation of the softer wastes in the west of the tip is expected, and will be increased as a result of the capping surcharge, needing additional cover thickness in these areas to achieve the objectives in 4.2.1. Further details regarding the proposed re-grading and restoration are provided in section 6 below.

4.3. Landfill Gas Management

4.3.1. The SGP Landfill Gas Risk Assessment report (R1635-R02, December 2013) set out the options for landfill gas management taking into account the slow rate of gas production at the site. It has been concluded that the objectives of gas management are to:

- control sub-surface lateral gas migration to the east and southeast, particularly with regard to the proposed future residential development of the land adjacent;
- reduce methane emissions from the site by means of bio-oxidation within the landfill cover soil; and
- prevent landfill gas accumulation in the cover soils to levels that could cause vegetation damage or death.

4.3.2. Typical rates of methane oxidation in landfill caps are assumed by default to be around 10%, however an extensive literature review (Chanton et al, Journal of Environmental Quality, 2009) has documented higher rates in various soils, at up to 53% in sandy soils. At low methane generation rates, oxidation rates of up to 96-100% have been found. The DEFRA report, "Methane emissions from landfill sites in the UK", January 2003, found that oxidising potential of landfill cover in laboratory and field trials is capable of treating ~80 - 140 m^3 ha^{-1} hr^{-1} of methane with a conversion efficiency of 75%; this level of flow is substantially greater than that estimated for the Old Landfill, and a reasonable target for methane oxidation for the site could be set at 75% conversion efficiency. On the basis of the average measured flux box rate of 0.04 mg m^2 s^{-1}, a 75% reduction would be 0.01 mg m^2 s^{-1}, which is 10% of the Environment Agency standard for methane flux from temporary or interim capped landfills.

4.3.3. The requirements for bio-oxidation are a suitable depth of unsaturated gas-permeable soil (i.e. open-textured soils), with small potential for the development of preferential pathways via fissures to surface. The suitable minimum depth of soil cover is considered to be 1m comprising a very permeable unsaturated base layer that allows lateral dispersion and diffusion of gas to spread concentrations and flows, and a relatively moist upper soil layer to provide a plant root zone and oxidation zone. Methane bio-oxidation occurs via the action of microbes in aerobic soil; the physical conditions are best achieved within moist, organic-rich soils that are not subject to excessive shrink-swell behaviour (i.e. low content of expansive clays). Compost-enriched sandy loams are likely to be best-suited to enhance bio-oxidation.

4.3.4. The proposed cover specification to be constructed on the re-graded tip surface will utilise locally-sourced materials as far as possible and will be as follows:

Table 4.1. Old Tip Capping Outline Specification

depth	material	function
0-150mm	topsoil	Grass / shrub support / bio-oxidation
150 – 700mm	sandy subsoil / compost	Bio-oxidation layer / plant root support
-	woven geotextile	Filter/separation layer to prevent fines migration down into drainage layer / root barrier
700 – 1,000mm	coarse-textured drainage layer (300mm minimum thick layer, fine/medium gravel size, low fines content)	Layer to provide high porosity for lateral dispersion of gases, and water drainage

depth	material	function
0 – 2,500mm variable	free-draining cement-stabilised effluent treatment sludge recovered from New Tip, typical 500 – 1,500mm thick layer placed over soft uncapped sludges, with allowance for settlement	provides mechanical strength over areas of soft, deformable wastes; thickness will need to be increased over softest / low-lying areas of waste to create necessary unsaturated zone and support to upper cover soils, to meet approved finished levels and allow for future settlement of underlying waste

4.3.5. Previous research on bio-oxidation covers has demonstrated the efficacy of such systems, however there will be an inspection and maintenance requirement to counter the development of local settlement and development of preferential flow pathways via weak points. No enclosed structures or impermeable paved areas will be permissible on the landfill surface until such time as gas production has reached negligible levels.

4.3.6. Proposals for preventing lateral gas migration out of the Old Tip utilise a proprietary venting system along the southeast and east margins of the Old Tip, outside the extent of any paper wastes, but at a minimum 25m distance from future proposed houses. Gas migration outside the tip has been driven by atmospheric pressure variations and diffusion, with no significant pressures or flows detected in wells outside the tip. The proposed barrier alignment is shown on Drawing R08-05. Use of a full depth impermeable cut-off wall keyed into the underlying boulder clay is not feasible given the valley topography and need to avoid groundwater damming within the infilled valley. There is also evidence from existing split-level boreholes in the ash embankment that most gas migration has occurred at depths of less than 5m below ground level, which is probably related to the relatively shallow water levels within the landfill itself.

4.3.7. It is therefore proposed to use a proprietary vent system "Virtual Curtain Gas Migration Barrier", designed and installed by the specialist contractor SEL Environmental Ltd. This features a series of geosynthetic vents installed by vibro-flotation methods, producing a high intrinsic permeability 'k' in excess of 1.75×10^{-5} m^2 (approximately 150X greater than 20mm single sized gravel). Each vent node creates a low-pressure zone and pressure gradient or preferential pathway for gas. The extent of the zone of influence around each node will be dependent on the local ground conditions, but is expected to be well-suited to the deep boiler ash deposits generally present along the alignment. The vertical vent nodes connect to an upper horizontal gas collection and dilution duct which then connects to proprietary vent bollards above ground level.

4.3.8. The gas barrier specification will be subject to detailed design with supporting gas flow modelling to provide assurance regarding performance characteristics. This will have the objective of limiting gas concentrations outside the barrier to below 1% methane / 5% carbon dioxide. The barrier initial design and specification is as follows, with an extended section shown on drawing R08-05:

- length 150m (terminating where cohesive glacial till rises to <1m below surface)
- average 8.5m depth (to maximum 10m depending upon depth to glacial till / long-term water table in base of valley, and ease of installation)
- vent node spacing 3-5m, subject to flow modelling
- surface venting via bollards at 15m centres

4.3.9. Over a distance of approximately 30m within the central section of the former TSNB valley the ash embankment is >10m deep, however the unsaturated depth of ash below the barrier down to the water table will be an average of around 2.3m (maximum 3.0m). It is considered that the radius of influence of the nodes will prevent any significant migration below the base of the barrier in this area, whilst not interfering with normal groundwater movement.

4.3.10. As noted above, the monitored off-site migration appears to be essentially by diffusion, with some evidence of atmospheric pressure variations causing convective flows, but significant gas pressures or flows have never been recorded in the off-site boreholes. At present there is clear evidence of bio-oxidation of methane having occurred within the ash embankment, and it is expected that this process will continue on the landfill side of the barrier. Therefore, methane emissions via the venting system are expected to be minimal. However, in the event that significant flows are detected during monitoring of the barrier performance, then additional measures could be incorporated to pass the collected emissions through an additional bio-filter to reduce methane concentrations through bio-oxidation. Flows and concentrations will be insufficient for any form of thermal treatment.

5. Amenity Management

5.1. Leachate

5.1.1. Short-term management of leachate during the removal and temporary storage of New Tip wastes will be required to ensure that pollution of Eagley Brook does not occur. The discharge permit currently allows for the pumping of up to 5 m^3d^{-1} of leachate within specified concentration limits into the TNSB culvert. The skip trials (see Appendix A) indicate that the maximum potential leachate volume arising from pore-water drainage off the disturbed wastes could be a maximum of around 2.32 m^3d^{-1}, and the dilution factor for this volume entering TNSB and estimated worst case low flow conditions of 2 ls^{-1} would be 1:74.4. The dilution factor to Eagley Brook would be considerably greater given the much larger size of this watercourse.

5.1.2. Leachate arising from freshly disturbed waste will be treated prior to discharge; this will involve settlement and aeration processes to achieve the discharge consent limits. In the event that discharge consent limits are not met then leachate will be recirculated within the lined system to allow for further filtration and settlement of organic fibres and enhanced biodegradation.

5.1.3. The proposals for treatment and reuse of New Tip wastes will require controlled dewatering within the New Tip; further details are provided in the Urbanspringside Method Statement.

5.1.4. In the long-term, no new measures are proposed or likely to be required for leachate at the Old Tip, although monitoring will be continued in accordance with proposals in section 4. The removal of all permit waste and associated residues from the New Tip means that there will be no future leachate source at this site, and no requirement for long-term management.

5.2. Surface Water Drainage

5.2.1. The New Tip is a contained system and at present surface water mixes with leachate and is either pumped to the discharge point on the TNSB culvert, or, given the absence of significant pollution, is allowed to overtop the liner and flow via the Ochre culvert to Eagley Brook.

5.2.2. During the proposed works to remove treated, recovered waste from the New Tip, no surface water drainage will be allowed to leave the lined New Tip except via a pumped or gravity drain to a settlement tank to enable monitoring prior to discharge. All discharges will take place via the consented discharge point on the TNSB culvert unless otherwise agreed. Any exceedance of agreed limits will result in either additional treatment or removal of the drainage by tanker for disposal to a treatment works.

5.2.3. Surface drainage not entering the licensed waste deposits or impacted by leachate will continue to drain to Eagley Brook, although inspections of all discharges will be carried out routinely to ensure that silt pollution is not present. In the event that silty runoff is observed then drainage will be temporarily impounded to allow settlement before any discharge of the clarified water.

5.2.4. The removal of the sludges and lined cell is proposed, with re-engineering of the adjacent ash slopes and infilling of the lower TNSB valley with inert soil and rock to create a stable landform to support planned development. The geotechnical engineering design of this has been carried out, with key considerations being the reduction of slope angles to increase the factor of safety, and the provision of groundwater drainage in the base of the valley to avoid any disturbance to the existing hydrogeological regime.

5.3. Dust

5.3.1. The sites occupy sheltered locations within a valley and with tree surrounds. There are no sensitive receptors with respect to windblown fugitive dust within 100m of potential sources.

5.3.2. The paper wastes are damp and do not give rise to dust emissions when handled. Haul roads are largely hard-surfaced and track-out and dust raising by haulage is considered unlikely. In the event that mud, or dust accumulates on haul road surfaces than these will be cleaned and damped down by bowser as necessary.

5.4. Odour

5.4.1. Disturbance of the paper waste can release airborne odour, however during recent movement of the New Tip contents to promote drainage within the lined cell, odours were not noticeable at distances of >50m from the source. Odours tend to be released from the recently exposed waste surfaces but rapidly diminish within several minutes as volatile substances are dispersed.

5.4.2. The nearest potentially sensitive receptors to odour outside the site are users on the footpath close to the New Tip, where any exposure to odour would be transient at worst, and residences at over 150m to the northwest and southwest, up-wind in the prevailing wind directions.

5.4.3. It is considered that odour nuisance outside the site is highly unlikely to occur. However, Urbanspringside will establish monitoring procedures and working rules to minimise odours in the event that these might cause nuisance or complaint outside the site. Mitigation measures may include:

- stopping works and covering over odour sources until conditions abate / wind directions change;
- limiting waste movements to reduce source areas;
- deployment of odour suppressing mist sprays / chemicals

5.4.4. Further details are provided in the Urbanspringside method statement.

5.5. Litter / Vermin

5.5.1. The wastes do not contain litter or foodstuffs. There are no requirements for litter or pest control.

5.6. Accidents / Fire

5.6.1. The closure operations will be covered by an Urbanspringside Health and Safety Plan and Risk Assessment.

5.6.2. Key risks are considered to be physical hazards arising from the use of earth-moving machinery on soft unstable surfaces and slopes. Due regard will be paid to ground stability and safe working practices.

5.6.3. Wastes and other soil-forming materials to be handled during the works are likely to be in a damp condition and not form a fire risk. Vegetable matter generated as a result of clearance works, or used to form part of the Old Tip cover will be temporarily placed in small heaps that are not subject to excessive heating and fire risk. No burning will be permitted on site.

5.6.4. The polymer landfill liner from the New Tip will be removed and stored in a location that is remote from possible ignition sources or other flammable materials pending, shredding and or disposal off-site.

6. Restoration Plan

6.1. New Tip

6.1.1. Proposed restoration contours for the New Tip are shown in the drawing in Appendix E associated with the site redevelopment planning consent. These require the infilling of the lower TNSB valley, including the New Tip footprint with a combination of re-graded suitable fill materials from the adjacent slopes and imported inert wastes.

6.1.2. The restoration of the east-facing slope is subject to detailed landscaping proposals prepared by Appleton Associates and ERAP as part of the planning consent for restoration of the New Tip. The slope angles are designed to merge with the natural valley sides of Longworth Clough, and surface runoff / gullying will be mitigated by use of horizontal terraces across the slopes, with land drains directed to the southern side via a catchpit before discharge to the existing millrace.

6.1.3. The upper surface of the infilled valley will have a shallow slope to promote drainage and restoration to amenity grassland, although the long-term proposal is for residential development.

6.1.4. Given the proposed after-uses of the restored site, it is unlikely that topsoil will be used due to the preference for use of lower fertility subsoils in keeping with the setting. The upper surface of the fills will therefore use selected materials to include stony clay subsoils free from extraneous materials such as brick and concrete. The finished slope will be progressively restored to vegetation with an initial stabilising grass cover using hydroseeding techniques.

6.2. Old Tip

6.2.1. The Old Tip is currently uncapped, with partial natural vegetation colonisation, and areas of bare waste, standing water and dead trees. Initial works have partly cleared the existing scrub vegetation to allow for reshaping and later placement of a landfill cover across the site. Stripping and re-grading works will be carried out by suitable equipment possibly needing "Bogmaster" type excavators to form stable working areas across the softer deposits.

6.2.2. An impermeable cap would not maintain or improve the quality of water surrounding the site, which is demonstrably in satisfactory condition and unlikely to deteriorate in the future. An impermeable cap would be undesirable with respect to landfill gas control as this would increase risks of lateral migration, and would probably have a limited life due to anticipated future settlements of the soft paper waste fills. An impermeable cap would necessitate the construction of a gas drainage blanket, and would concentrate flows of landfill gas to a number of vents which would nevertheless have insufficient flow to sustain flaring or power generation, but would make treatment of the gas by methane oxidation more difficult.

6.2.3. The restoration design therefore centres upon the construction of a permeable cover system that enhances natural methane oxidation within an aerobic soil layer.

6.2.4. Proposed restoration contours for the Old Landfill are shown in the drawing in Appendix E. These involve some limited cutting of materials on the highest part of the site, and re-grading and lifting of levels to a minimum of 194m aod, considered necessary to maintain the cover system above the local water table near to the Lodge dam.

6.2.5. The landform to be created forms a saddle with slopes of around 1 in 12 to the east and west. Following placement of the landfill cover / bio-oxidation system, as described in section 4, the site will be restored to a combination of amenity grassland and native tree / shrub planting.

6.2.6. The earthworks model produced by Daineswell Ltd and MCK Associates Ltd. on behalf of Urbanspringside of the cut and fill operation to achieve the design will require a minimum net fill of approximately 6,000m^3 of various cover materials; the tip area enclosing paper wastes and needing restoration is about 6,255m^2. The approximate volumes of cover materials required are estimated to be:

- 940 m^3 topsoil or suitable soil-forming material;
- 3,440 m^3 organic-rich permeable soil as bio-oxidation layer;
- 1,880 m^3 coarse granular gas drainage layer (screened low fines hardcore / clinker of median 5mm particle size – fine/medium gravel)
- ~ 3,000 m^3 cement-stabilised effluent treatment sludge to provide working surface / raise levels above water table.

6.2.7. Long-term settlement of the restored Old Tip is to be expected, principally within the area of softer paper wastes in the west of the site; short term stability during the works will be improved by a woven, fully permeable geotextile matting over the formation. Over-filling of cover materials will therefore be desirable to avoid potential future water-logging of the lower area in the west, and consequent reduction in air entry to the cover and reduced methane oxidation potential. Sludges below the central part of the Old Tip are denser and have been subject to consolidation and surcharge by the placing of inert construction and demolition wastes; this part of the site was latterly used for parking and storage, and settlement monitoring has demonstrated minimal ground movement over the last few years.

6.3. <u>Treatment of New Tip Wastes</u>

6.3.1. New Tip wastes have over the last 12 months been subject to works to enhance self-drainage within their lined cell, by relocating the sludges in the lowest, eastern part of the cell to the higher part of the cell in the west. This has facilitated gravity drainage of leachate, and has resulted in a reduction in water content and consequential shrinkage of the waste volume and mass.

However, the sludge remains in a soft condition that constrains handling and reuse without additional treatment.

6.3.2. It is therefore proposed to treat the New Tip sludge wastes by means of cement stabilisation techniques by a specialist contractor, Urban Soils Solutions Ltd., to reduce water contents, improve physical stability, and reduce the leachate potential. This operation will be carried out in situ within the New Tip lined cell area, and will involve batch mixing waste with the reactive agents, and curing before the treated material can be removed and transported to the Old Tip for use in restoration. The stabilised treated waste is non-polluting, more permeable and has a higher bearing capacity than the untreated sludge, making it well suited to the purpose of providing a base layer to the cover system for the Old Tip.

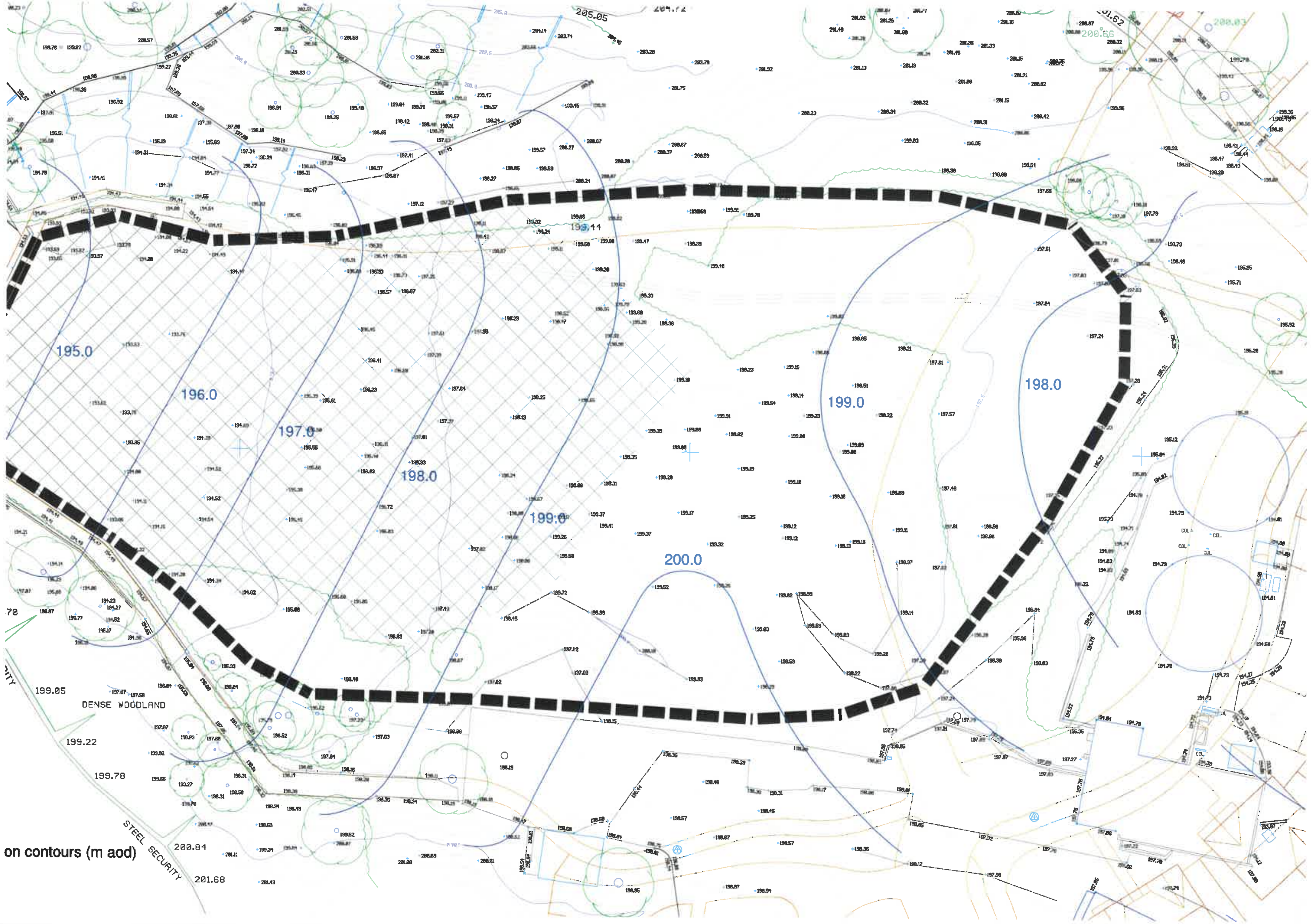
6.3.3. Within the Old Tip, the placing of recovered stabilised New Tip sludge as the lower part of the restoration cover is considered unlikely to cause any significant change in the underlying 5-10m thickness of existing waste, however the monitoring plan is designed to record any change so that mitigation measures can be taken if necessary. The treated stabilised sludge will be relatively permeable to gases compared to the underlying material, and therefore no increase in lateral gas migration as a result of the cover placement is considered likely.

6.4. Supply Lodge Wall

6.4.1. The Supply Lodge wall has received an Engineers inspection by Reid Jones Partnership on behalf of Urbanspringside; their report is included as Appendix F. The upper brick section of the wall (above standing water levels) is reported to be permeable to water and will be removed in its entirety leaving the top of the structure some 200mm higher than normal dry weather levels in the supply lodge.

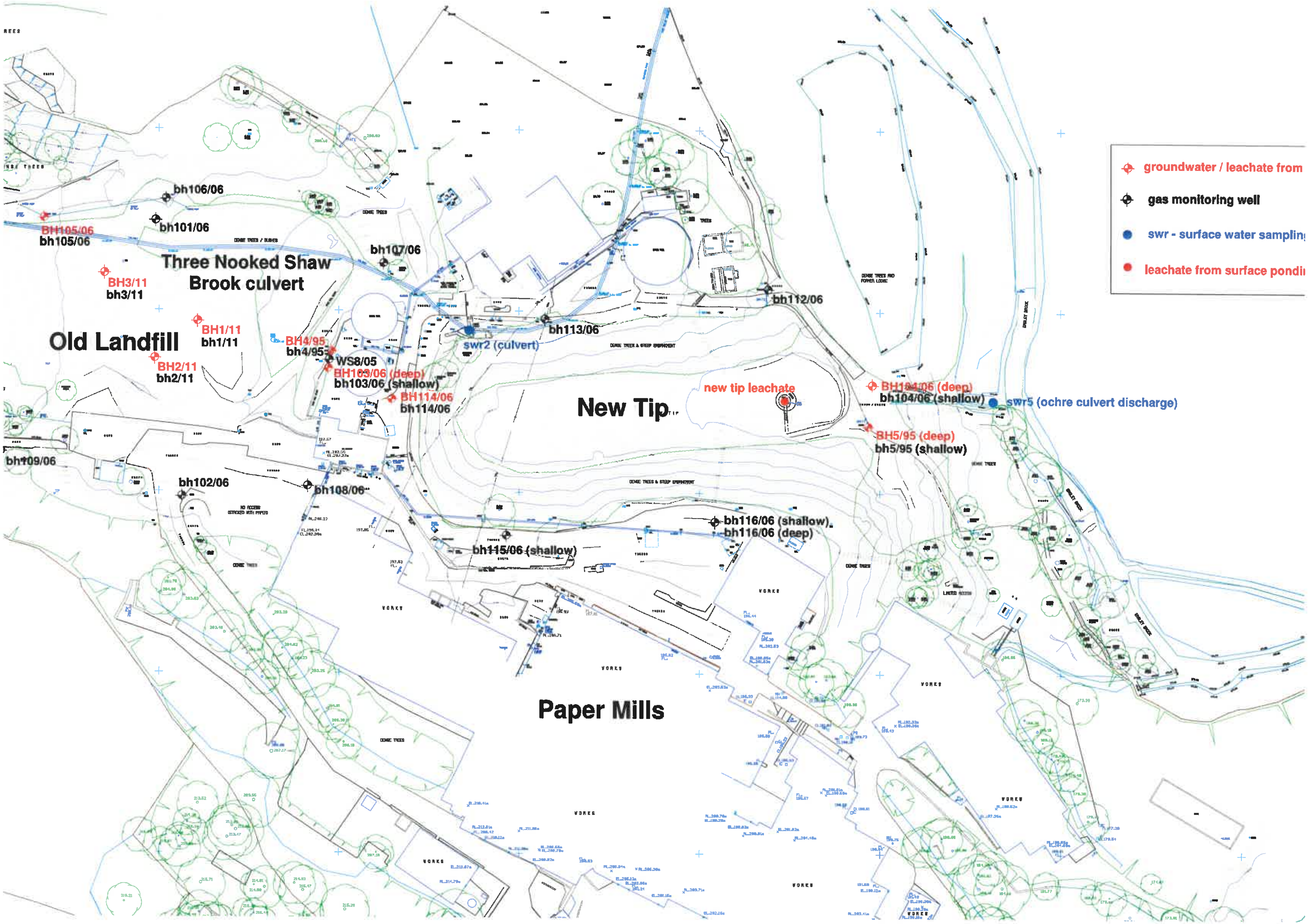
6.4.2. The restoration of the Old Tip will lend support to the Supply Lodge wall. It is proposed to buttress the east face of the dam by the placing of granular fill in this area, to displace the saturated and very weak paper waste currently lying against the wall. The ground level to be formed adjacent to the wall will be about 700mm higher than the existing ground level and will be flat for a distance of 2m before rising east as the general landfill cover. On the Lodge side of the dam, it is proposed to create a 1v:2h slope down by means of placing coarse rock fill; this will provide additional protection, improve public safety and amenity value.

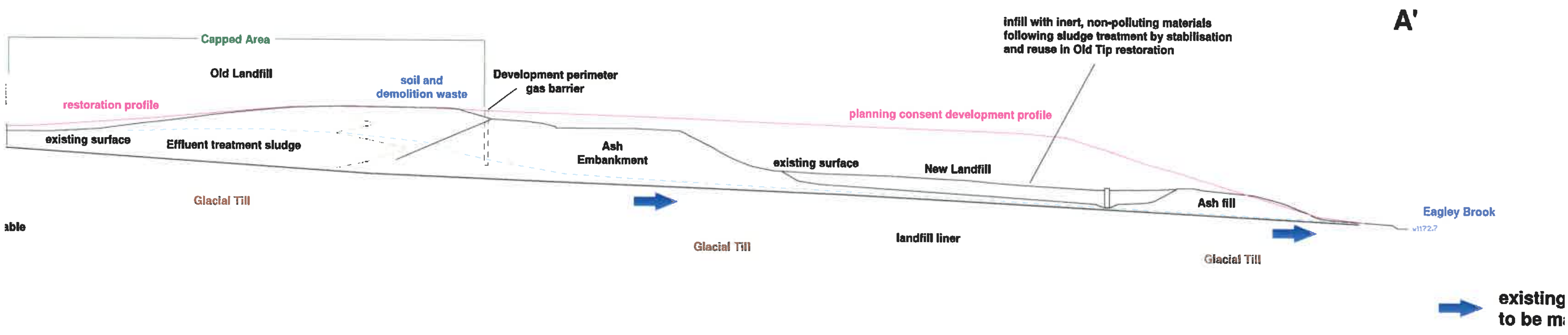
DRAWINGS



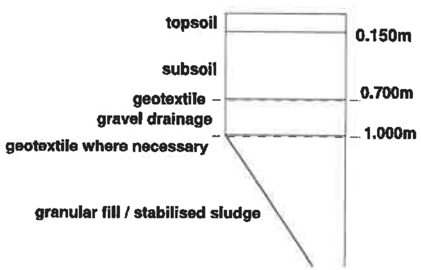
195.0
196.0
197.0
198.0
199.0
200.0
198.0
199.0
205.05
199.05
DENSE WOODLAND
199.22
199.78
200.84
201.68
STEEL SECURITY
on contours (m aod)

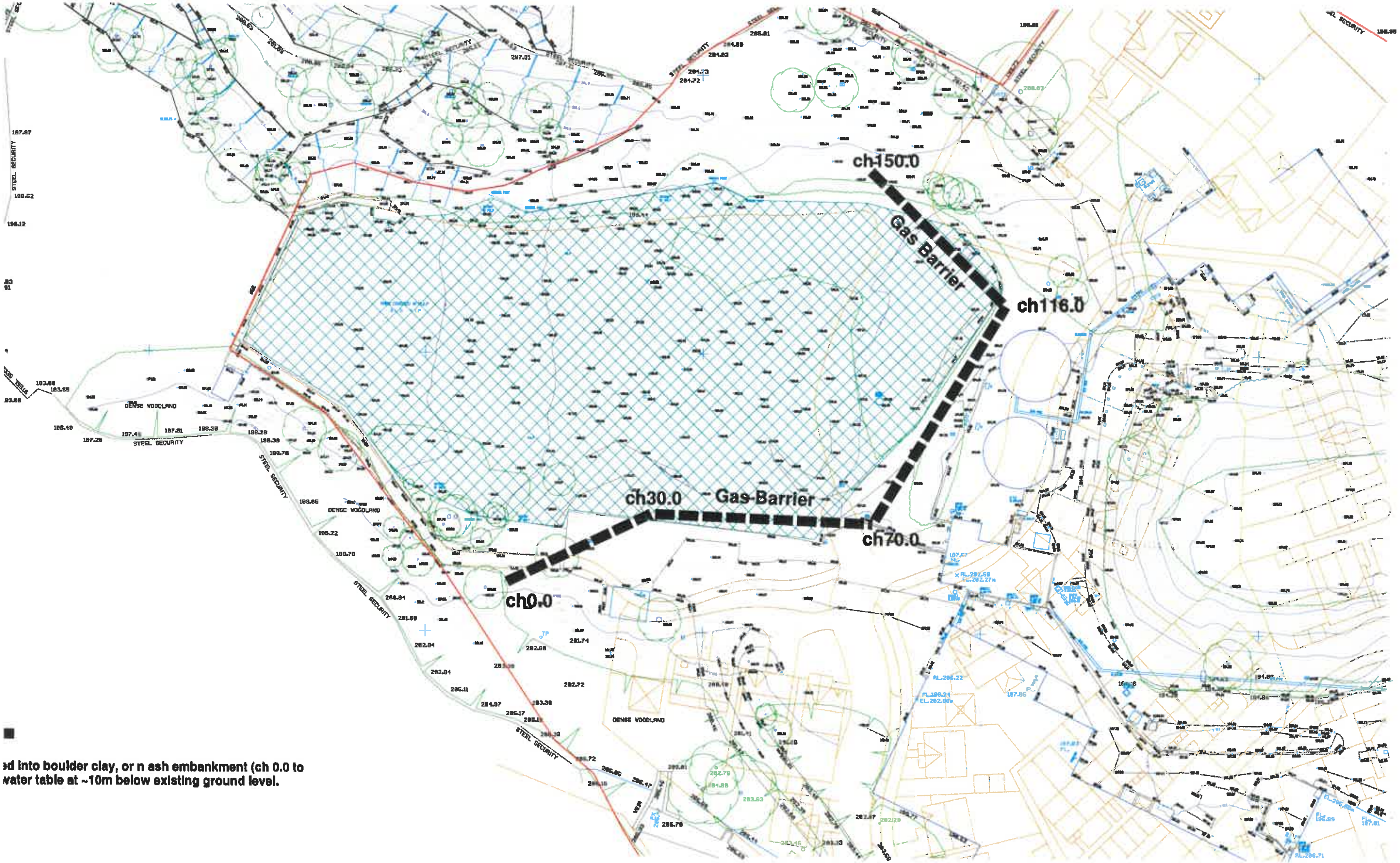
ERSLEY BROOK
DENSE TREES AND FORMER LODGE
DENSE TREES
LIMITED ACCESS
193.0
194.0
195.0
196.0
197.0
NEW TIP
DENSE TREES & STEEP EMBANKMENT
TREES
WORKS


groundwater / leachate from
gas monitoring well
swr - surface water samplin
leachate from surface pondi
Old Landfill
Three Nooked Shaw
Brook culvert
New Tip
Paper Mills
new tip leachate
BH105/06
bh105/06
bh106/06
bh101/06
BH3/11
bh3/11
BH1/11
bh1/11
BH2/11
bh2/11
BH4/95
bh4/95
WS8/05
BH103/06 (deep)
bh103/06 (shallow)
BH114/06
bh114/06
bh107/06
swr2 (culvert)
bh113/06
bh112/06
BH104/06 (deep)
bh104/06 (shallow)
swr5 (ochre culvert discharge)
BH5/95 (deep)
bh5/95 (shallow)
bh109/06
bh102/06
bh108/06
bh115/06 (shallow)
bh116/06 (shallow)
bh116/06 (deep)



Old Tip Capping Detail

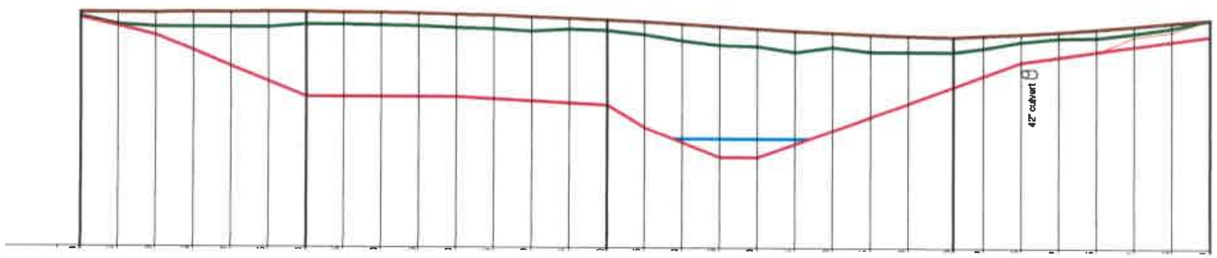




■

ed into boulder clay, or n ash embankment (ch 0.0 to
water table at ~10m below existing ground level.

Gas Barrier - Extended Section



APPENDIX A

Summary of Closure Plan Technical Requirements

Springside Mill, Belmont (former Kruger Paper)
Landfill Closure Report - Technical Requirements (EPR 5.02)

Landfill closure report template		Old Tip (53658)	New Tip (53997)
	Submission	Details of evidence submitted	Details of evidence submitted
Area of site progressing to definite closure - site plans	a) proposed closure area	closure area is entire permit site; **Site Plan, drawing ref: R08-01,** 1:500 scale, 19/01/2016; uncompleted landfill: no site plan is attached to Permit; boundary of paper sludge waste determined by investigation	closure area is entire permit site; **Site Plan, drawing ref: R08-02,** 1:1000 scale, 19/01/2016; uncompleted landfill; no site plan attached to Permit; boundary of paper sludge waste defined by limit of cell liner
	b) gas control system	refer to landfill gas risk assessment **report R1635-R02** and **drawing ref: R08-04, 19/01/2016**; showing alignment of proposed perimeter gas vent, and sections of vent system and landfill cover / methane oxidation layer; note no gas extraction system installed to date or required under current permit; future gas management will be via passive venting and biological oxidation	**Not Applicable** no gas extraction system installed or required under current permit; no future requirement for gas control due to total removal of degradable waste
	c) leachate extraction system	no permanent leachate collection system or leachate wells in operation - leachate was intermittently pumped from surface water pond, as shown on **dwg R08-01**, to surface water discharge point (consent ref: NPSWQD006635)	leachate pumped from central collection chamber via pipeline to surface water discharge point (consent ref: NPSWQD006635) - **see drawing R08-02.** Leachate extraction system to be removed in association with removal of all leachate sources
	d) surface water management system	refer to hydrogeological risk assessment **report R1634-R01;** no system currently in place - rainfall either infiltrates or runs off to west (Mill Lodge) or east (ash embankment); groundwater discharges on north and south sides of landfill flow across landfill west to Mill Lodge; in future, surface runoff from restored tip and peripheral spring discharges to be directed to tip perimeter drains, as per **drawing R08-01**.	refer to hydrogeological risk assessment **report R1634-R01;** rainfall on tip surface passes to leachate collection; future drainage arrangements during restoration of New Tip described in URL report and **drawing R08-02**.
	e) location of extraction and monitoring wells	extraction well locations - see b) and c) responses; monitoring wells - existing and proposed shown on **drawing R08-03**	extraction well locations - see b) and c) responses - existing and proposed shown on **drawing R08-03**
Waste Stability		final (existing) level survey drawing; refer to stability assessment **report R1635-R04**; settlement rate data indicates low settlement; cover placement may induce short-term increased settlement under loading	final (existing) level survey drawing; refer to stability assessment **report R1635-R04**; existing wastes to be physically treated (cement solidification/ stabilisation) prior to removal; inert backfills to be placed under geotechnical specification for purpose of supporting development

Landfill closure report template		Old Tip (53658)	New Tip (53997)
Site infrastructure	leachate infrastructure	portable pump and pipework to be removed during restoration works	sump and pump to be retained and operated during waste treatment and removal; following removal of all waste contents and liner, the site will be infilled, commencing at the eastern side, to form a central low area to collect surface runoff; a pump will be temporarily operated as filling proceeds and when necessary to remove accumulated rainfall; drainage water will be pumped to a settlement tank to south prior to discharge to the existing mill race; all infrastructure will be removed on completion of the site restoration
	leachate infrastructure maintenance	not required following restoration	not required following restoration
	landfill gas infrastructure	surface (passive) venting of gas barrier via bollards; bio-oxidation in landfill cover	not required following restoration
	landfill gas infrastructure maintenance	restored Old Tip cover and gas venting to be subject to routine inspection and maintenance by landscape management company	not applicable
	groundwater infrastructure	none present – not applicable	existing under-cell drainage / Ochre culvert to remain unchanged
	groundwater infrastructure maintenance	see under New Tip for down-gradient drainage	Ochre culvert discharge for groundwater to be maintained by landscape maintenance company
	surface water infrastructure	perimeter drains and Lodge Dam – see drg R08-01	none present; development drainage will subject to separate engineering by developer, with adopted sewers
	surface water infrastructure maintenance	subject to routine inspection and maintenance by landscape management company	surface runoff drains subject to routine inspection and maintenance by landscape management company;
	cap maintenance	aftercare maintenance procedures, including repairs to cap soils and vegetation, and treatment of localised subsidence / instabilities	not applicable – waste to be removed and no residual permit waste to cap
Monitoring	leachate monitoring	refer to section 3.0 RBMP	refer to section 3.0 RBMP
	landfill gas monitoring	refer to section 3.0 RBMP	refer to section 3.0 RBMP
	groundwater monitoring	refer to section 3.0 RBMP	refer to section 3.0 RBMP
	surface water monitoring	refer to section 3.0 RBMP	refer to section 3.0 RBMP
	restored surface monitoring	refer to section 3.0 RBMP	not applicable following closure survey and report
Reporting	significant environmental effects	procedure for assessing and reporting significant groundwater, surface water, gas or stability impacts	not applicable following closure survey and report

Landfill closure report template		Old Tip (53658)	New Tip (53997)
Habitats	Habitats Directive site review	ecological monitoring to ensure no impact on Habitats Directive sites (Longworth Clough SSSI) in accordance with planning condition; impacts unlikely assuming that no discernible pollution to Eagley Brook, and no pathway for pollutants to Longworth Clough	not applicable following closure survey and report

APPENDIX B

New Tip Treatability Testing

Springside Mills, Belmont; New Tip Paper Waste

Skip Trial Notes

June 2014

Introduction

Proposals to drain and re-locate the paper mill effluent treatment sludges ("paper waste") from the New Tip raise questions over the possible quality, quantity and management requirements for any water emissions from the waste. There has been in situ leachate monitoring within the body of the New Tip landfill given its shallow depth (typically around 3m), and all leachate monitoring has been from a central collection sump where dilution by surface runoff and oxidation through atmospheric exposure has occurred. All monitoring to date has shown that the leachate has met consent limits for discharge to Three Nooked Shaws Brook, with the occasional exception of suspended solids, apparently arising from the formation of iron oxyhydroxide (ochre) flocs.

The paper waste is wet and unsuitable for re-location or recovery unless the moisture is reduced. This is partly due to the low permeability of the material and its containment which inhibits drainage under gravity. The paper waste has a spongy and cohesive consistency, and drainage of excess porewater is expected to be at a slow rate.

A trial was therefore devised to assess the potential worst case quality and quantity of leachate that might be drained from the waste in the initial stages of its' proposed re-location.

Methodology

Two bulk samples were collected on 19th May 2014 from locations within the central axis of the New Tip at locations near to standing water in the lower part of the site, near to the leachate sump ("skip 1") and about 30m to the west in the upper part of the site. Both locations were covered by vegetation mats which were stripped away using a long-boom 360° excavator located outside the lined cell. Paper sludge was collected from depths of between 1 and 2.5m using a smooth bucket, taking care not to intercept the basal liner. The waste samples were placed in a dumper for immediate transport and unloading to steel builders skips located on car parking near to the Old Tip.

Sub-samples of the skip 1 and skip 2 wastes were collected for laboratory analysis, and were placed in appropriate containers, and transported to the laboratory (Jones Environmental) in a chilled cool-box within 6 hours. Analysis was carried out for pH, ammonia, sulphate, sulphide, organic matter and volatile organic compounds (VOCs).

The skips were lined with PE membrane to be water tight, and were of nominal 6 cubic yard size. Washed rounded gravel was placed in the base of the skips to provide a drainage layer, and was sloped to a collection point in one corner, equipped with a 50mm HDPE slotted standpipe to permit leachate sampling. Skip 1 was filled with approximately 3.7m^3 of waste and skip 2 with approximately 3.3m^3 of waste; both skips contained 900mm depth of settled paper waste. The waste was lightly compacted by excavator bucket to eliminate air pockets, and the plastic sheet was extended over the top of the skips to prevent evaporation and rainfall entry.

Leachate samples were collected by peristaltic pump from the standpipes of each skip on 28th May 2014, 9 days after filling. Field measurements of pH, temperature, dissolved oxygen, electrical conductivity and oxidation-reduction potential were made, and samples were placed in containers supplied by the laboratory. The samples were stored in a chilled cool-box and delivered to the laboratory (SAL) within 3 hours of collection.

Laboratory analysis was carried out for pH, a range of metals, ammonia and oxidised nitrogen, chemical oxygen demand (COD), chloride, sulphide, sulphate, VOCs and semi-volatile organic compounds (SVOCs).

The skips were covered over again after sampling. A second round of pumped removal of leachate was carried out on 12th June 2014, 17 days after filling of the skips, on this occasion the volume of leachate removed from each skip to drain down the standpipe contents and any water sitting on the waste surface was recorded.

The skip trial will continue until the extractable leachate volume alters significantly, at which point the waste contents will be removed back to the landfill.

Skip 2 leachate sampling, 28/05/14

Skip 1 leachate, 28/05/14

Skip 1 leachate, 12/06/14

Skip 2 leachate, 12/06/14

Observations

The waste was notably softer and wetter in the skip 2 sampling position than at skip 1 position; this may be due to the down-hill waste being older and more consolidated, despite the water table being effectively at surface. Skip 1 material when squeezed by hand would leave a damp surface, whereas some drops of leachate could be squeezed from the skip 2 material. Neither test pit showed water/ leachate entry, although skip 2 pit quickly slumped. A moderate organic odour was noted, although the wastes remained a uniform light grey colour, and the odour was undetectable more than 10m from the excavations. The sides of the skip1 pit were relatively stable, with minor slumping at about 2m depth over a period of half an hour.

During leachate sampling on 28th May, a small volume of water/leachate was noted in the corner of the skip on the waste surface. This was identical to the leachate removed from the standpipe and was a light milky grey colour and with a moderate organic odour. The field measurements were as follows:

	Skip 1	Skip 2
temperature °C	13.1	13.0
pH	6.59	6.32
dissolved oxygen mg l^{-1}	5.16	7.52
redox ORP mV	-21.3	-10.1
electrical conductivity µs cm^{-1}	10010	10400

The volumes of leachate present and removed were as follows:

day	date	Skip 1	Skip 2
0	19th May 2014	0	0
9	28th May 2014	15 removed during sampling	15 removed during sampling
24	12th June 2014	28 removed over 15 mins to "dry"	42 removed over 15 mins to "dry"

Volumes in litres

The volume of free liquid leachate generated within the skips averages 0.78 l/m^3 waste/day (based on leachate removed between 28th May and 12th June). Scaled up to the full landfill contents, this would be 2.34 m^3/d, although drainage would not occur simultaneously from all of the waste, and the rate of drainage will quickly reduce as excess pore water is released. However using the above figure, which is 23% of the discharge consent limit, the calculated dilution rate during low dry weather flow within TNSB, estimated at 2 l/s, is 1:74. This calculation does not include storm runoff, which would add to volumes but would reduce concentrations, both within the leachate, and within the receiving water due to increased baseflow.

Test Results

Solid waste

Solid waste analyses are presented on Jones Environmental certificate reference 14/5930. Moisture content was recorded as 114% and 175% for skips 1 and 2 respectively, relative to dry weight, i.e. 53% and 64% respectively of fresh weight. For comparison, the typical water content for similar paper wastes being spread to farmland is around 40% fresh weight.

pH was slightly alkaline in both samples, reflecting the lime content. Organic matter was 11.2% and 15.5% of the dry weight, forming a relatively small fraction of the waste, the remainder being mineral matter. Sulphide concentrations were below the limit of detection. Ammoniacal nitrogen concentrations were 0.04 and 0.09% for skips 1 and 2 respectively, indicating a probable carbon:nitrogen ratio in the waste of >>50, although total nitrogen was not analysed; the low ammoniacal nitrogen content would suggest a significant constraint on bio-degradation of the organic content of the waste.

VOC analysis revealed a range of non-chlorinated mainly aromatic hydrocarbons together with some alkanes. These are likely to be natural constituents or breakdown intermediates from wood pulping residues including lignin and resins. Substances detected in excess of 1 mg/kg are summarised below:

substance	skip 1	skip 2	substance	skip 1	skip 2
toluene	<1.0	18.8	2,6-dimethyloctane*	1.1	1.7
ethylbenzene	<1.0	1.0	decane*	<1.0	12.5
p/m-xylene	2.9	6.1	1-ethyl-2-dimethylbenzene*	<1.0	5.0
o-xylene	1.3	2.7	1,2,3-trimethylbenzene*	1.4	<1.0
isopropylbenzene	<1.0	1.1	1-methyl-3-propylbenzene*	<1.0	1.7
propylbenzene	2.3	2.5	undecane*	<1.0	5.5
1,3,5-trimethylbenzene	1.8	6.3	o-cymene*	1.4	<1.0
sec-butylbenzene	1.2	1.3	4-ethyl-1,2-dimethylbenzene*	<1.0	2.0
4-isopropyltoluene	<1.0	1.7	1-ethyl-2,3-dimethylbenzene*	1.1	<1.0
n-butylbenzene	3.9	4.5	1,3-diethyl-5-methylbenzene*	1.9	1.4
naphthalene	9.7	17.2	dodecane*	3.6	7.2
ethyl-cyclohexane*	1.7	2.5	2,6-dimethylundecane*	1.5	3.1

* tentatively identified compound

The results indicate generally higher concentrations in the skip 2 compared to skip 1 wastes, probably related to the relative age of the deposits.

In total, the identified aromatic compounds amount to 40 mg/kg in skip 1, and 93 mg/kg in skip 2. Identified aliphatic compounds amount to 7 and 31 mg/kg respectively. The concentrations found are not acutely hazardous to human health, and would not exceed the long-term generic assessment criteria (LQM/CIEH edition 2, 2009; 6% soil organic matter) for the protection of human health if permanently present at shallow depth within residential land (aliphatic hydrocarbons C6 – C16 fractions, and aromatic hydrocarbons C7 – C16 fractions) with the exception of naphthalene. Naphthalene concentrations in both samples exceed the residential GAC (8.7 mg/kg at 6% organic matter) but are considerably below the commercial / industrial generic assessment criteria.

The above compounds are generally likely to be semi-volatile and strongly absorbed to clays and organic matter within the waste. All are expected to be non-persistent and readily bio-degradable by a range of bacteria and fungi. The principle modes of attenuation are likely to be via volatilisation and microbial assimilation which will be determined largely by drainage and aeration and the availability of macro-nutrients.

Leachate

Sample test results are presented on SAL certificate reference 398245-1. The test results are considered to be representative of pore water released during settlement of the freshly disturbed waste, and may therefore represent "worst case" concentrations of substances likely to be released during and immediately following re-location of the New Tip contents. The results are based on total analysis rather than only dissolved substances and metal concentrations will be unrepresentative of the potential concentrations in a settled discharge.

The chemical oxygen demand (COD) was high, at 19,000 and 24,000 mg/l for skips 1 and 2 respectively, compared to a typical guideline of 30 mg/kg in discharge consents; the high COD probably reflects the presence of fine organic matter (cellulose fibre) suspended in the pore water, as the concentrations of other chemical substances and the mineral content are unlikely to contribute significantly.

Ammoniacal nitrogen concentrations were above the existing leachate discharge consent limit of 5 mg/l in skip 1, at 16 mg/l, but was low in skip 2 at 0.9 mg/l; the difference between the results is not readily explained, however the overall results are considered to be low compared to a typical non-hazardous waste landfill, and there is little doubt that the consent standard would be achieved following aeration and settlement of the leachate.

Metals concentrations were elevated with respect to EQS values, however the discharge consent standards for cadmium (10 µg/l) and mercury (2 µg/l) were achieved, and, where dilution in the receiving waters (TNSB or Eagley Brook) is accounted for (worst case 1:115), then no EQS is likely to be exceeded with the exception of phenol. The short term (95%ile) EQS for phenol of 46 µg/l would not be exceeded in TNSB, although the long term (annual average) of 7.7 µg/l could be theoretically exceeded, although of course the elevated concentrations are expected to be of short duration, and treatment of the leachate would reduce phenol concentrations alongside the more significant issue relating to suspended solids / COD.

The range of VOCs / SVOCs detected largely reflects the solid analysis, being dominated by methylphenol (cresol) and phenol, toluene, xylenes and trimethylbenzene. No naphthalene was detected, confirming the strong absorption of this substance. One chlorinated compound, chlorotoluene, was detected at a low level of 5 µg/l in both samples.

The key test results together with comparisons against water quality standards are summarised below:

TNSB dw flow	2	l/s	172.8	m3/d	dilution factor TNSB DW flow / max leachate flow	73.85

substance	skip 1	skip 2	Discharge Consent	EQS	other	max predicted conc in TNSB
cadmium	2	2.3	10			0.031
mercury	0.29	0.55	2			0.007
phenol	110	1300		7.7LT 46ST		17.604
methylphenol (cresol)	9400	16000			330 ST (10% of salmon LC50)	216.667
1,2,4 trimethylbenzene	39	43				0.582
1,3,5 trimethylbenzene	12	13				0.176
2-chlorotoluene	5	5			15 (chloro-benzene)	0.068
ethylbenzene	9	5		10LT (benzene)		0.122
isopropylbenzene	4	3				0.054
n-propylbenzene	14	7				0.190
m/p-xylene	30	18		30LT		0.406
o-xylene	22	15		30LT		0.298

substance	skip 1	skip 2	Discharge Consent	EQS	other	max predicted conc in TNSB
p-isopropylbenzene	2	2				0.027
s-butylbenzene	3	3				0.041
toluene	61	190		50LT 380ST		2.573

Concentrations in µg/l; predicted concentrations in TNSB assume negligible background concentrations.

Conclusions

Leachate from the New Tip has consistently met the discharge consent requirements apart from an occasional exceedance of suspended solids levels, attributed to the formation of iron flocs, although leachate is visibly clear during discharge. However there is concern that the satisfactory leachate quality could be changed as a result of disturbance of the wastes during the clearing of the New Tip contents.

The skip trial has provided useful information concerning the potential volume and quality of leachate (pore water) that could be released during, and in the short term following, disturbance and re-location of New Tip wastes. The leachate flows, in the absence of inputs from rainfall, draining under gravity or as a result of increased pore pressure from compaction, are likely to be small and readily contained without risk of uncontrolled release to the nearby surface watercourses.

The principal concerns relate to the high chemical oxygen demand and suspended solids content of the undiluted leachate, together with initial concentrations of phenol and cresol in particular. The testing is believed to represent a worst case scenario, and the quality of actual leachate escaping from the waste is unlikely to sustain the same high levels of COD over time. Nevertheless, the test results confirm a requirement for collection and treatment of fresh leachate before discharge. This process should continue until flows and concentrations are sufficiently diminished and the waste is physically stable enough to allow removal from the liner.

The Contractors method statement provides for internal drainage of leachate towards the eastern lower end of the New Tip within the lined cell, pending pumping to the reinstated filter bed. This will facilitate aeration of the leachate and settlement to reduce suspended solids and consequent oxygen demand to acceptable limits. Whilst COD is not specified within the current discharge consent, the limit for biological oxygen demand (BOD) of 20 mg/l should be readily achievable by these means (typically, a COD value of 30-40 will correlate with a BOD of 20).

In the medium term, temporary storage of the drained waste on the Old Tip would not generate significant additional loadings of pollution into the Old Tip waste body that could cause a reduction in existing Old Tip leachate quality given the relative sizes of the waste masses. However, the prevention of surface runoff to the Supply Lodge would be important until the waste is stabilised.

A further round of leachate analysis and volume measurement is being carried out before ending the trial, at which time the skip contents will be returned to landfill and the equipment cleaned and decommissioned.

Jones Environmental Laboratory

Unit 3 Deeside Point
Zone 3
Deeside Industrial Park
Deeside
CH5 2UA

Tel: +44 (0) 1244 833780
Fax: +44 (0) 1244 833781

Smith Grant LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

4225

Attention :	Tony Smith
Date :	30th May, 2014
Your reference :	R1635
Our reference :	Test Report 14/5930 Batch 1
Location :	
Date samples received :	19th May, 2014
Status :	Final report
Issue :	1

Two samples were received for analysis on 19th May, 2014. Please find attached our Test Report which should be read with notes at the end of the report and should include all sections if reproduced. Interpretations and opinions are outside the scope of any accreditation, and all results relate only to samples supplied.
All analysis is carried out on as received samples and reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected.

Compiled By:

Phil Sommerton BSc
Project Manager

Bob Millward BSc FRSC
Principal Chemist

Jones Environmental Laboratory

Client Name: Smith Grant LLP
Reference: R1635
Location:
Contact: Tony Smith
JE Job No.: 14/5930

Report : Solid

Solids: V=60g VOC jar, J=250g glass jar, T=plastic tub

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4									LOD/LOR	Units	Method No.
Sample ID	NTW1	NTW2											
Depth													
COC No / misc													
Containers	T V	T V											
Sample Date	19/05/2014	19/05/2014											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	19/05/2014	19/05/2014											
Total Sulphate #M	678	601									<50	mg/kg	TM50/PM15
VOC TICs	See Attached	See Attached										None	TM15/PM10
Natural Moisture Content	113.8	174.7									<0.1	%	PM4/PM0
Ammoniacal Nitrogen as N	372.2	864.5									<0.6	mg/kg	TM38/PM20
Organic Matter	11.2	15.5									<0.2	%	TM21/PM24
Sulphide	<10	<10									<10	mg/kg	TM106/PM45
pH #M	7.95	7.55									<0.01	pH units	TM73/PM11

Client Name: Smith Grant LLP
Reference: R1635
Location:
Contact: Tony Smith
JE Job No.: 14/5930

VOC Report : **Solid**

Please see attached notes for all abbreviations and acronyms

J E Sample No.	1-2	3-4									LOD/LOR	Units	Method No.
Sample ID	NTW1	NTW2											
Depth													
COC No / misc													
Containers	T V	T V											
Sample Date	19/05/2014	19/05/2014											
Sample Type	Soil	Soil											
Batch Number	1	1											
Date of Receipt	19/05/2014	19/05/2014											
VOC MS													
Dichlorodifluoromethane	<2	<2									<2	ug/kg	TM15/PM10
Methyl Tertiary Butyl Ether#	<2	<2									<2	ug/kg	TM15/PM10
Chloromethane#	<3	<3									<3	ug/kg	TM15/PM10
Vinyl Chloride	<2	<2									<2	ug/kg	TM15/PM10
Bromomethane	<1	<1									<1	ug/kg	TM15/PM10
Chloroethane#	<2	<2									<2	ug/kg	TM15/PM10
Trichlorofluoromethane#	<2	<2									<2	ug/kg	TM15/PM10
1,1-Dichloroethene (1,1 DCE)#	<6	<6									<6	ug/kg	TM15/PM10
Dichloromethane (DCM)#	<7	<7									<7	ug/kg	TM15/PM10
trans-1-2-Dichloroethene#	<3	<3									<3	ug/kg	TM15/PM10
1,1-Dichloroethane#	<3	<3									<3	ug/kg	TM15/PM10
cis-1-2-Dichloroethene#	<3	<3									<3	ug/kg	TM15/PM10
2,2-Dichloropropane	<4	<4									<4	ug/kg	TM15/PM10
Bromochloromethane#	<3	<3									<3	ug/kg	TM15/PM10
Chloroform#	<3	<3									<3	ug/kg	TM15/PM10
1,1,1-Trichloroethane#	<3	<3									<3	ug/kg	TM15/PM10
1,1-Dichloropropene#	<3	<3									<3	ug/kg	TM15/PM10
Carbon tetrachloride#	<4	<4									<4	ug/kg	TM15/PM10
1,2-Dichloroethane#	<4	<4									<4	ug/kg	TM15/PM10
Benzene#	<3	<3									<3	ug/kg	TM15/PM10
Trichloroethene (TCE)#	<3	<3									<3	ug/kg	TM15/PM10
1,2-Dichloropropane#	<6	<6									<6	ug/kg	TM15/PM10
Dibromomethane#	<3	<3									<3	ug/kg	TM15/PM10
Bromodichloromethane#	<3	<3									<3	ug/kg	TM15/PM10
cis-1-3-Dichloropropene	<4	<4									<4	ug/kg	TM15/PM10
Toluene#	626	18776++									<3	ug/kg	TM15/PM10
trans-1-3-Dichloropropene	<3	<3									<3	ug/kg	TM15/PM10
1,1,2-Trichloroethane#	<3	<3									<3	ug/kg	TM15/PM10
Tetrachloroethene (PCE)#	<3	<3									<3	ug/kg	TM15/PM10
1,3-Dichloropropane#	<3	<3									<3	ug/kg	TM15/PM10
Dibromochloromethane#	<3	<3									<3	ug/kg	TM15/PM10
1,2-Dibromoethane#	<3	<3									<3	ug/kg	TM15/PM10
Chlorobenzene#	<3	<3									<3	ug/kg	TM15/PM10
1,1,1,2-Tetrachloroethane	<3	<3									<3	ug/kg	TM15/PM10
Ethylbenzene#	635	1036									<3	ug/kg	TM15/PM10
p/m-Xylene#	2893	6118++									<6	ug/kg	TM15/PM10
o-Xylene#	1321	2733++									<3	ug/kg	TM15/PM10
Styrene	<3	<3									<3	ug/kg	TM15/PM10
Bromoform	<3	<3									<3	ug/kg	TM15/PM10
Isopropylbenzene#	827	1099									<3	ug/kg	TM15/PM10
1,1,2,2-Tetrachloroethane#	<3	<3									<3	ug/kg	TM15/PM10
Bromobenzene	<2	<2									<2	ug/kg	TM15/PM10
1,2,3-Trichloropropane#	<4	<4									<4	ug/kg	TM15/PM10
Propylbenzene#	2277++	2541++									<4	ug/kg	TM15/PM10
2-Chlorotoluene	<3	<3									<3	ug/kg	TM15/PM10
1,3,5-Trimethylbenzene#	1832	6335++									<3	ug/kg	TM15/PM10
4-Chlorotoluene	<3	<3									<3	ug/kg	TM15/PM10
tert-Butylbenzene#	<5	<5									<5	ug/kg	TM15/PM10
1,2,4-Trimethylbenzene#	4336++	15196++									<6	ug/kg	TM15/PM10
sec-Butylbenzene#	1195	1319									<4	ug/kg	TM15/PM10
4-Isopropyltoluene#	883	1736									<4	ug/kg	TM15/PM10
1,3-Dichlorobenzene#	<4	<4									<4	ug/kg	TM15/PM10
1,4-Dichlorobenzene#	<4	<4									<4	ug/kg	TM15/PM10
n-Butylbenzene#	3895++	4456++									<4	ug/kg	TM15/PM10
1,2-Dichlorobenzene#	<4	<4									<4	ug/kg	TM15/PM10
1,2-Dibromo-3-chloropropane#	<4	<4									<4	ug/kg	TM15/PM10
1,2,4-Trichlorobenzene#	<7	<7									<7	ug/kg	TM15/PM10
Hexachlorobutadiene	<4	<4									<4	ug/kg	TM15/PM10
Naphthalene	9730++	17193++									<27	ug/kg	TM15/PM10
1,2,3-Trichlorobenzene#	<7	<7									<7	ug/kg	TM15/PM10
Surrogate Recovery Toluene D8	75	78									<0	%	TM15/PM10
Surrogate Recovery 4-Bromofluorobenzene	82	87									<0	%	TM15/PM10

Job number:	14/5930	**Method:**	**VOC**
Sample number:	2	**Matrix:**	**Solid**
Sample identity:	NTW1		
Sample depth:			
Sample Type:	Soil		
Units:	ug/kg		

Note: Only samples with TICs (if requested) are reported. If TICs were requested but no compounds found they are not reported.

CAS No.	Tentative Compound Identification	Retention Time (minutes)	% Match	Concentration
1072-05-5	Heptane, 2,6-dimethyl-	5.004	90	284
1678-91-7	Cyclohexane, ethyl-	5.136	95	1657
2216-30-0	Heptane, 2,5-dimethyl-	5.316	81	874
1000309-22-4	Sulfurous acid, cyclohexylmethyl hexadecyl ester	5.664	80	502
2051-30-1	Octane, 2,6-dimethyl-	5.735	95	1060
611-14-3	Benzene, 1-ethyl-2-methyl-	6.251	92	821
526-73-8	Benzene, 1,2,3-trimethyl-	6.550	94	1420
1074-43-7	Benzene, 1-methyl-3-propyl-	6.648	93	983
527-84-4	o-Cymene	6.835	90	1417
933-98-2	Benzene, 1-ethyl-2,3-dimethyl-	6.870	94	1118
2050-24-0	Benzene, 1,3-diethyl-5-methyl-	6.941 - 7.512	83,83	1884
112-40-3	Dodecane	7.277	96	3609
17301-23-4	Undecane, 2,6-dimethyl-	7.352	91	1533

Please include all sections of this report if it is reproduced
All solid results are expressed on a dry weight basis unless stated otherwise.

Jones Environmental Laboratory

Job number: 14/5930 **Method:** VOC
Sample number: 4 **Matrix:** Solid
Sample identity: NTW2
Sample depth:
Sample Type: Soil
Units: ug/kg

Note: Only samples with TICs (if requested) are reported. If TICs were requested but no compounds found they are not reported.

CAS No.	Tentative Compound Identification	Retention Time (minutes)	% Match	Concentration
108-87-2	Cyclohexane, methyl-	4.302	94	332
6876-23-9	Cyclohexane, 1,2-dimethyl-, trans-	4.884	91	346
1678-91-7	Cyclohexane, ethyl-	5.136	95	2538
2216-30-0	Heptane, 2,5-dimethyl-	5.316	81	1253
2051-30-1	Octane, 2,6-dimethyl-	5.735	93	1728
124-18-5	Decane	6.131	93	12532
611-14-3	Benzene, 1-ethyl-2-methyl-	6.251	93	5013
526-73-8	Benzene, 1,2,3-trimethyl-	6.550	94	931
1074-43-7	Benzene, 1-methyl-3-propyl-	6.648	90	1676
1120-21-4	Undecane	6.728	95	5456
934-80-5	Benzene, 4-ethyl-1,2-dimethyl-	6.870	96	2044
2050-24-0	Benzene, 1,3-diethyl-5-methyl-	6.941	86	1428
112-40-3	Dodecane	7.277	96	7222
17301-23-4	Undecane, 2,6-dimethyl-	7.352	94	3085

Notification of Deviating Samples

Client Name: Smith Grant LLP
Reference: R1635
Location:
Contact: Tony Smith

J E Job No.	Batch	Sample ID	Depth	J E Sample No.	Analysis	Reason
					No deviating sample report results for job 14/5930	

Please note that only samples that are deviating are mentioned in this report. If no samples are listed it is because none were deviating.
Only analyses which are accredited are recorded as deviating if set criteria are not met.

NOTES TO ACCOMPANY ALL SCHEDULES AND REPORTS

JE Job No.: 14/5930

SOILS

Please note we are only MCERTS accredited for sand, loam and clay and any other matrix is outside our scope of accreditation.

Where an MCERTS report has been requested, you will be notified within 48 hours of any samples that have been identified as being outside our MCERTS scope. As validation has been performed on clay, sand and loam, only samples that are predominantly these matrices, or combinations of them will be within our MCERTS scope. If samples are not one of a combination of the above matrices they will not be marked as MCERTS accredited.

It is assumed that you have taken representative samples on site and require analysis on a representative subsample. Stones will generally be included unless we are requested to remove them.

All samples will be discarded one month after the date of reporting, unless we are instructed to the contrary. If we are instructed to keep samples, a **storage charge of £1 (1.5 Euros) per sample per month will be applied until we are asked to dispose of them.**

If you have not already done so, please send us a purchase order if this is required by your company.

Where appropriate please make sure that our detection limits are suitable for your needs, if they are not, please notify us immediately.

All analysis is reported on a dry weight basis unless stated otherwise. Results are not surrogate corrected. Samples are dried at **35°C ±5°C** unless **otherwise stated. Moisture content for CEN Leachate tests are dried at 105°C ±5°C.**

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

Where a CEN 10:1 ZERO Headspace VOC test has been carried out, a 10:1 ratio of water to wet (as received) soil has been used.

% Asbestos in Asbestos Containing Materials (ACMs) is determined by reference to HSG 264 The Survey Guide - Appendix 2 : ACMs in buildings listed in order of ease of fibre release.

WATERS

Please note we are not a Drinking Water Inspectorate (DWI) Approved Laboratory . It is important that detection limits are carefully considered when requesting water analysis.

UKAS accreditation applies to surface water and groundwater and one other matrix which is analysis specific, any other liquids are outside our scope of accreditation

As surface waters require different sample preparation to groundwaters the laboratory must be informed of the water type when submitting samples.

Where Mineral Oil or Fats, Oils and Grease is quoted, this refers to Total Aliphatics C10-C40.

DEVIATING SAMPLES

Samples must be received in a condition appropriate to the requested analyses. All samples should be submitted to the laboratory in suitable containers with sufficient ice packs to sustain an appropriate temperature for the requested analysis. If this is not the case you will be informed and any test results that may be compromised highlighted on your deviating samples report.

SURROGATES

Surrogate compounds are added during the preparation process to monitor recovery of analytes. However low recovery in soils is often due to peat, clay or other organic rich matrices. For waters this can be due to oxidants, surfactants, organic rich sediments or remediation fluids. Acceptable limits for most organic methods are 70 - 130% and for VOCs are 50 - 150%. When surrogate recoveries are outside the performance criteria but the associated AQC passes this is assumed to be due to matrix effect. Results are not surrogate corrected.

NOTE

Data is only reported if the laboratory is confident that the data is a true reflection of the samples analysed. Data is only reported as accredited when all the requirements of our Quality System have been met. In certain circumstances where all the requirements of the Quality System have not been met, for instance if the associated AQC has failed, the reason is fully investigated and documented. The sample data is then evaluated alongside the other quality control checks performed during analysis to determine its suitability. Following this evaluation, provided the sample results have not been effected, the data is reported but accreditation is removed. It is a UKAS requirement for data not reported as accredited to be considered indicative only, but this does not mean the data is not valid.
Where possible, and if requested, samples will be re-extracted and a revised report issued with accredited results. Please do not hesitate to contact the laboratory if further details are required of the circumstances which have led to the removal of accreditation.

ABBREVIATIONS and ACRONYMS USED

#	UKAS accredited.
B	Indicates analyte found in associated method blank.
DR	Dilution required.
M	MCERTS accredited.
NA	Not applicable
NAD	No Asbestos Detected.
ND	None Detected (usually refers to VOC and/SVOC TICs).
NDP	No Determination Possible
SS	Calibrated against a single substance
SV	Surrogate recovery outside performance criteria. This may be due to a matrix effect.
W	Results expressed on as received basis.
+	AQC failure, accreditation has been removed from this result, if appropriate, see 'Note' on previous page.
++	Result outside calibration range, results should be considered as indicative only and are not accredited.
*	Analysis subcontracted to a Jones Environmental approved laboratory.
CO	Suspected carry over
LOD/LOR	Limit of Detection (Limit of Reporting) in line with ISO 17025 and MCERTS
ME	Matrix Effect
NFD	No Fibres Detected
OC	Outside Calibration Range

JE Job No: 14/5930

Test Method No.	Description	Prep Method No. (if appropriate)	Description	UKAS	MCERTS (soils only)	Analysis done on As Received (AR) or Air Dried (AD)	Reported on dry weight basis
PM4	Gravimetric measurement of Natural Moisture Content and % Moisture Content at either 35°C or 105°C. Calculation based on ISO 11465 and BS1377.	PM0	No preparation is required.				
TM15	In-House method based on USEPA 8260. Determination of Volatile Organic compounds (VOCs) by Headspace GC-MS. Accredited to ISO 17025 for soils and waters and MCERTS for Soils. All accreditation is matrix specific. Quantification by Internal Standard method.	PM10	In-house method based on USEPA 5021. Preparation of solid and liquid samples for headspace analysis. Samples are spiked with surrogates to facilitate quantification. ISO 17025 accredited extraction method. All accreditation is matrix specific			AR	Yes
TM15	In-House method based on USEPA 8260. Determination of Volatile Organic compounds (VOCs) by Headspace GC-MS. Accredited to ISO 17025 for soils and waters and MCERTS for Soils. All accreditation is matrix specific. Quantification by Internal Standard method.	PM10	In-house method based on USEPA 5021. Preparation of solid and liquid samples for headspace analysis. Samples are spiked with surrogates to facilitate quantification. ISO 17025 accredited extraction method. All accreditation is matrix specific	Yes		AR	Yes
TM21	TOC and TC by Combustion	PM24	Eltra preparation			AD	Yes
TM38	Ionic analysis using the Thermo Aquakem Photometric Automatic Analyser. Accredited to ISO17025 and MCERTS for most analytes. All accreditation is matrix specific.	PM20	in-house method based on USEPA 1311 (TCLP). Solid samples are extracted with two parts de-ionised water to one part solid material for analysis of the extract for various parameters.			AR	Yes
TM50	Total Sulphate by ICP-OES	PM15	In-house method based on USEPA 3010A. Acid digestion of dried and crushed solid samples using Aqua Regia reflux.	Yes	Yes	AD	Yes
TM73	pH in by Metrohm	PM11	1:2.5 soil/water extraction	Yes	Yes	AR	No
TM106	Sulphide by CFA	PM45	Cyanide & Thiocyanate prep for soils			AR	Yes

Scientific Analysis Laboratories is a limited company registered in England and Wales (No 2514788) whose address is at Hadfield House, Hadfield Street, Manchester M16 9FE

Scientific Analysis Laboratories Ltd

Certificate of Analysis

Hadfield House
Hadfield Street
Cornbrook
Manchester
M16 9FE
Tel : 0161 874 2400
Fax : 0161 874 2468

Report Number: 398245-1

Date of Report: 03-Jun-2014

Customer: Smith Grant LLP
Station House
Station Road
Ruabon
Wrexham
LL14 6DL

Customer Contact: Mr Tony Smith

Customer Job Reference: R1635
Date Job Received at SAL: 28-May-2014
Date Analysis Started: 29-May-2014
Date Analysis Completed: 03-Jun-2014

The results reported relate to samples received in the laboratory
Opinions and interpretations expressed herein are outside the scope of UKAS accreditation
This report should not be reproduced except in full without the written approval of the laboratory
Tests covered by this certificate were conducted in accordance with SAL SOPs
All results have been reviewed in accordance with QP22

UKAS TESTING 1549

Report checked and authorised by : Mr Ross Walker Customer Services Manager (Land)

Issued by : Mr Ross Walker Customer Services Manager (Land)

SAL Reference: 398245
Customer Reference: R1635

Water Analysed as Water
Metals

					SAL Reference	398245 001	398245 002
					Customer Sample Reference	Skip 1	Skip 2
					Date Sampled	28-MAY-2014	28-MAY-2014
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Aluminium	T6	AR	20	µg/l		**910**	**1000**
As (Total)	T301	AR	0.2	µg/l		**85**	**120**
Cd (Total)	T301	AR	0.02	µg/l		**2.0**	**2.3**
Calcium	T6	AR	100	µg/l		**920000**	**1300000**
Cu (Total)	T301	AR	0.5	µg/l		**120**	**67**
Iron	T6	AR	10	µg/l		**12000**	**70000**
Pb (Total)	T301	AR	0.3	µg/l		**17**	**15**
Magnesium	T6	AR	100	µg/l		**75000**	**86000**
Mn (Total)	T301	AR	1	µg/l		**1**	**2**
Hg (Total)	T301	AR	0.05	µg/l		**0.29**	**0.55**
Ni (Total)	T301	AR	1	µg/l		**280**	**350**
Potassium	T6	AR	100	µg/l		**120000**	**160000**
Zn (Total)	T301	AR	2	µg/l		**390**	**860**
Sodium	T6	AR	100	µg/l		**38000**	**47000**

SAL Reference: 398245
Customer Reference: R1635

Water Analysed as Water
Miscellaneous

					SAL Reference	398245 001	398245 002
					Customer Sample Reference	Skip 1	Skip 2
					Date Sampled	28-MAY-2014	28-MAY-2014
Determinand	**Method**	**Test Sample**	**LOD**	**Units**			
Ammoniacal nitrogen	T686	AR	0.05	mg/l		**16**	**0.90**
Chemical Oxygen Demand	T4	AR	5	mg/l		**19000**	**24000**
Chloride	T686	AR	1	mg/l		**100**	**95**
Sulphate	T686	AR	0.5	mg/l		<0.5	**2.7**
Sulphide	T4	AR	0.05	mg/l		**0.37**	**0.16**
Total Oxidised Nitrogen	T686	AR	0.1	mg/l		<0.1	<0.1
pH	T7	AR				**6.5**	**6.7**

SAL Reference: 398245
Customer Reference: R1635

Water Analysed as Water
Semi-Volatile Organic Compounds (USEPA 625)

				SAL Reference	398245 001	398245 002
				Customer Sample Reference	Skip 1	Skip 2
				Date Sampled	28-MAY-2014	28-MAY-2014
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
1,2,4-Trichlorobenzene	T16	AR	10	µg/l	<10	<10
1,2-Dichlorobenzene	T16	AR	10	µg/l	<10	<10
1,3-Dichlorobenzene	T16	AR	10	µg/l	<10	<10
1,4-Dichlorobenzene	T16	AR	10	µg/l	<10	<10
2,4,5-Trichlorophenol	T16	AR	10	µg/l	<10	<10
2,4,6-Trichlorophenol	T16	AR	10	µg/l	<10	<10
2,4-Dichlorophenol	T16	AR	10	µg/l	<10	<10
2,4-Dimethylphenol	T16	AR	10	µg/l	<10	<10
2,4-Dinitrophenol	T16	AR	10	µg/l	(36) <50	(36) <50
2,4-Dinitrotoluene	T16	AR	10	µg/l	<10	<10
2,6-Dinitrotoluene	T16	AR	10	µg/l	<10	<10
2-Chloronaphthalene	T16	AR	10	µg/l	<10	<10
2-Chlorophenol	T16	AR	10	µg/l	<10	<10
2-methyl phenol	T16	AR	10	µg/l	<10	<10
2-Methylnaphthalene	T16	AR	10	µg/l	<10	<10
2-Nitroaniline	T16	AR	10	µg/l	<10	<10
2-Nitrophenol	T16	AR	10	µg/l	<10	<10
3-Nitroaniline	T16	AR	10	µg/l	<10	<10
3/4-Methylphenol	T16	AR	10	µg/l	**9400**	**16000**
4-Bromophenyl phenylether	T16	AR	10	µg/l	<10	<10
4-Chloro-3-methylphenol	T16	AR	10	µg/l	<10	<10
4-Chloroaniline	T16	AR	10	µg/l	<10	<10
4-Chlorophenyl phenylether	T16	AR	10	µg/l	<10	<10
4-Nitroaniline	T16	AR	10	µg/l	<10	<10
4-Nitrophenol	T16	AR	10	µg/l	(36) <50	(36) <50
Acenaphthene	T16	AR	10	µg/l	<10	<10
Acenaphthylene	T16	AR	10	µg/l	<10	<10
Anthracene	T16	AR	10	µg/l	<10	<10
Azobenzene	T16	AR	10	µg/l	<10	<10
Benzo(a)Anthracene	T16	AR	10	µg/l	<10	<10
Benzo(a)Pyrene	T16	AR	10	µg/l	<10	<10
Benzo(b/k)Fluoranthene	T16	AR	10	µg/l	<10	<10
Benzo(ghi)Perylene	T16	AR	10	µg/l	<10	<10
Bis (2-chloroethoxy) methane	T16	AR	10	µg/l	<10	<10
Bis (2-chloroethyl) ether	T16	AR	10	µg/l	<10	<10
Bis (2-chloroisopropyl) ether	T16	AR	10	µg/l	<10	<10
Bis (2-ethylhexyl)phthalate	T16	AR	10	µg/l	<10	<10
Butyl benzylphthalate	T16	AR	10	µg/l	<10	<10
Carbazole	T16	AR	10	µg/l	<10	<10
Chrysene	T16	AR	10	µg/l	<10	<10
Di-n-butylphthalate	T16	AR	10	µg/l	<10	<10
Di-n-octylphthalate	T16	AR	10	µg/l	<10	<10
Dibenzo(ah)Anthracene	T16	AR	10	µg/l	<10	<10
Dibenzofuran	T16	AR	10	µg/l	<10	<10
Diethyl phthalate	T16	AR	10	µg/l	<10	<10
Dimethyl phthalate	T16	AR	10	µg/l	<10	<10
Fluoranthene	T16	AR	10	µg/l	<10	<10
Fluorene	T16	AR	10	µg/l	<10	<10
Hexachlorobenzene	T16	AR	10	µg/l	<10	<10
Hexachlorobutadiene	T16	AR	10	µg/l	<10	<10
Hexachlorocyclopentadiene	T16	AR	10	µg/l	(36) <50	(36) <50
Hexachloroethane	T16	AR	10	µg/l	<10	<10
Indeno(123-cd)Pyrene	T16	AR	10	µg/l	<10	<10
Isophorone	T16	AR	10	µg/l	<10	<10
Naphthalene	T16	AR	10	µg/l	<10	<10
Nitrobenzene	T16	AR	10	µg/l	<10	<10
Pentachlorophenol	T16	AR	10	µg/l	(36) <50	(36) <50
Phenanthrene	T16	AR	10	µg/l	<10	<10
Phenol	T16	AR	10	µg/l	**110**	**1300**
Pyrene	T16	AR	10	µg/l	<10	<10
SVOC screen	T16	AR	10	µg/l	<10	<10

SAL Reference: 398245
Customer Reference: R1635

Water Analysed as Water
Volatile Organic Compounds (USEPA 624)

				SAL Reference	398245 001	398245 002
				Customer Sample Reference	Skip 1	Skip 2
				Date Sampled	28-MAY-2014	28-MAY-2014
Determinand	Method	Test Sample	LOD	Units		
1,1,1,2-Tetrachloroethane	T54	AR	1	µg/l	<1	<1
1,1,1-Trichloroethane	T54	AR	1	µg/l	<1	<1
1,1,2,2-Tetrachloroethane	T54	AR	1	µg/l	<1	<1
1,1,2-Trichloroethane	T54	AR	1	µg/l	<1	<1
1,1,2-Trichloroethylene	T54	AR	1	µg/l	<1	<1
1,1-Dichloroethane	T54	AR	1	µg/l	<1	<1
1,1-Dichloroethylene	T54	AR	1	µg/l	<1	<1
1,1-Dichloropropene	T54	AR	1	µg/l	<1	<1
1,2,3-Trichloropropane	T54	AR	1	µg/l	<1	<1
1,2,4-Trimethylbenzene	T54	AR	1	µg/l	**39**	**43**
1,2-dibromoethane	T54	AR	1	µg/l	<1	<1
1,2-Dichlorobenzene	T54	AR	1	µg/l	<1	<1
1,2-Dichloroethane	T54	AR	1	µg/l	<1	<1
1,2-Dichloropropane	T54	AR	1	µg/l	<1	<1
1,3,5-Trimethylbenzene	T54	AR	1	µg/l	**12**	**13**
1,3-Dichlorobenzene	T54	AR	1	µg/l	<1	<1
1,3-Dichloropropane	T54	AR	1	µg/l	<1	<1
1,4-Dichlorobenzene	T54	AR	1	µg/l	<1	<1
2,2-Dichloropropane	T54	AR	1	µg/l	<1	<1
2-Chlorotoluene	T54	AR	1	µg/l	**5**	**5**
4-Chlorotoluene	T54	AR	1	µg/l	<1	<1
Benzene	T54	AR	1	µg/l	(13) <1	(13) <1
Bromobenzene	T54	AR	1	µg/l	<1	<1
Bromochloromethane	T54	AR	1	µg/l	<1	<1
Bromodichloromethane	T54	AR	1	µg/l	<1	<1
Bromoform	T54	AR	1	µg/l	<1	<1
Bromomethane	T54	AR	1	µg/l	<1	<1
Carbon tetrachloride	T54	AR	1	µg/l	<1	<1
Chlorobenzene	T54	AR	1	µg/l	<1	<1
Chlorodibromomethane	T54	AR	1	µg/l	<1	<1
Chloroethane	T54	AR	1	µg/l	<1	<1
Chloroform	T54	AR	1	µg/l	<1	<1
Chloromethane	T54	AR	1	µg/l	<1	<1
Cis-1,2-Dichloroethylene	T54	AR	1	µg/l	<1	<1
Cis-1,3-Dichloropropene	T54	AR	1	µg/l	<1	<1
Dibromomethane	T54	AR	1	µg/l	<1	<1
Dichlorodifluoromethane	T54	AR	1	µg/l	<1	<1
Dichloromethane	T54	AR	50	µg/l	<50	<50
EthylBenzene	T54	AR	1	µg/l	**9**	**5**
Isopropyl benzene	T54	AR	1	µg/l	**4**	**3**
M/P Xylene	T54	AR	1	µg/l	**30**	**18**
n-Propylbenzene	T54	AR	1	µg/l	**14**	**7**
O Xylene	T54	AR	1	µg/l	**22**	**15**
p-Isopropyltoluene	T54	AR	1	µg/l	**2**	**2**
S-Butylbenzene	T54	AR	1	µg/l	**3**	**3**
Styrene	T54	AR	1	µg/l	<1	<1
T-Butylbenzene	T54	AR	1	µg/l	<1	<1
Tetrachloroethene	T54	AR	1	µg/l	<1	<1
Toluene	T54	AR	1	µg/l	**61**	**190**
Trans-1,2-Dichloroethene	T54	AR	1	µg/l	<1	<1
Trans-1,3-Dichloropropene	T54	AR	1	µg/l	<1	<1
Trichlorofluoromethane	T54	AR	1	µg/l	<1	<1
Vinyl chloride	T54	AR	1	µg/l	<1	<1

SAL Reference: 398245
Customer Reference: R1635

Water Analysed as Water
Volatile Organic Compounds (USEPA 624)

				SAL Reference	398245 001	398245 002
				Customer Sample Reference	Skip 1	Skip 2
				Date Sampled	28-MAY-2014	28-MAY-2014
Determinand	**Method**	**Test Sample**	**LOD**	**Units**		
VOC Screen (Extra Peaks)	T54	AR	10	µg/l	Trimethylsilanol **50**	Trimethylsilanol **63**
					2 Butanol **93**	2 Butanol **110**
					Dimethyl sulphide **99**	n-butanol **37**
					Unidentified Aliphatic Hydrocarbon containing O circa C6 **22**	Isopentyl Alcohol **77**
					2-Hexanol **13**	Pentanol **49**
					Methyl phenol **14**	Hexanol **58**
					No other compounds detected above **10**	1-Hexanol, 2-ethyl **21**
						Undecane **27**
						Methyl phenol **23**
						No other compounds detected above **10**

Index to symbols used in 398245-1

Value	Description
AR	As Received
36	LOD Raised due to low Matrix spike recovery
13	Results have been blank corrected.
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Method Index

Value	Description
T7	Probe
T6	ICP/OES
T54	GC/MS (Headspace)
T301	ICP/MS (Total)
T4	Colorimetry
T686	Discrete Analyser
T16	GC/MS

Accreditation Summary

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Aluminium	T6	AR	20	µg/l	U	001-002
As (Total)	T301	AR	0.2	µg/l	U	001-002
Cd (Total)	T301	AR	0.02	µg/l	U	001-002
Calcium	T6	AR	100	µg/l	N	001-002
Cu (Total)	T301	AR	0.5	µg/l	U	001-002
Iron	T6	AR	10	µg/l	N	001-002
Pb (Total)	T301	AR	0.3	µg/l	U	001-002
Magnesium	T6	AR	100	µg/l	N	001-002
Mn (Total)	T301	AR	1	µg/l	U	001-002
Hg (Total)	T301	AR	0.05	µg/l	U	001-002
Ni (Total)	T301	AR	1	µg/l	U	001-002
Potassium	T6	AR	100	µg/l	N	001-002
Zn (Total)	T301	AR	2	µg/l	U	001-002

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
Sodium	T6	AR	100	µg/l	N	001-002
Ammoniacal nitrogen	T686	AR	0.05	mg/l	U	001-002
Chemical Oxygen Demand	T4	AR	5	mg/l	N	001-002
Chloride	T686	AR	1	mg/l	N	001-002
Sulphate	T686	AR	0.5	mg/l	N	001-002
Sulphide	T4	AR	0.05	mg/l	N	001-002
Total Oxidised Nitrogen	T686	AR	0.1	mg/l	N	001-002
pH	T7	AR			U	001-002
1,2,4-Trichlorobenzene	T16	AR	10	µg/l	U	001-002
1,2-Dichlorobenzene	T16	AR	10	µg/l	U	001-002
1,3-Dichlorobenzene	T16	AR	10	µg/l	U	001-002
1,4-Dichlorobenzene	T16	AR	10	µg/l	U	001-002
2,4,5-Trichlorophenol	T16	AR	10	µg/l	U	001-002
2,4,6-Trichlorophenol	T16	AR	10	µg/l	U	001-002
2,4-Dichlorophenol	T16	AR	10	µg/l	U	001-002
2,4-Dimethylphenol	T16	AR	10	µg/l	U	001-002
2,4-Dinitrophenol	T16	AR	10	µg/l	U	001-002
2,4-Dinitrotoluene	T16	AR	10	µg/l	U	001-002
2,6-Dinitrotoluene	T16	AR	10	µg/l	U	001-002
2-Chloronaphthalene	T16	AR	10	µg/l	U	001-002
2-Chlorophenol	T16	AR	10	µg/l	U	001-002
2-methyl phenol	T16	AR	10	µg/l	U	001-002
2-Methylnaphthalene	T16	AR	10	µg/l	U	001-002
2-Nitroaniline	T16	AR	10	µg/l	U	001-002
2-Nitrophenol	T16	AR	10	µg/l	U	001-002
3-Nitroaniline	T16	AR	10	µg/l	U	001-002
3/4-Methylphenol	T16	AR	10	µg/l	U	001-002
4-Bromophenyl phenylether	T16	AR	10	µg/l	U	001-002
4-Chloro-3-methylphenol	T16	AR	10	µg/l	U	001-002
4-Chloroaniline	T16	AR	10	µg/l	U	001-002
4-Chlorophenyl phenylether	T16	AR	10	µg/l	U	001-002
4-Nitroaniline	T16	AR	10	µg/l	U	001-002
4-Nitrophenol	T16	AR	10	µg/l	U	001-002
Acenaphthene	T16	AR	10	µg/l	U	001-002
Acenaphthylene	T16	AR	10	µg/l	U	001-002
Anthracene	T16	AR	10	µg/l	U	001-002
Azobenzene	T16	AR	10	µg/l	U	001-002
Benzo(a)Anthracene	T16	AR	10	µg/l	U	001-002
Benzo(a)Pyrene	T16	AR	10	µg/l	U	001-002
Benzo(b/k)Fluoranthene	T16	AR	10	µg/l	U	001-002
Benzo(ghi)Perylene	T16	AR	10	µg/l	U	001-002
Bis (2-chloroethoxy) methane	T16	AR	10	µg/l	U	001-002
Bis (2-chloroethyl) ether	T16	AR	10	µg/l	U	001-002
Bis (2-chloroisopropyl) ether	T16	AR	10	µg/l	U	001-002
Bis (2-ethylhexyl)phthalate	T16	AR	10	µg/l	U	001-002
Butyl benzylphthalate	T16	AR	10	µg/l	U	001-002
Carbazole	T16	AR	10	µg/l	U	001-002
Chrysene	T16	AR	10	µg/l	U	001-002
Di-n-butylphthalate	T16	AR	10	µg/l	U	001-002
Di-n-octylphthalate	T16	AR	10	µg/l	U	001-002
Dibenzo(ah)Anthracene	T16	AR	10	µg/l	U	001-002
Dibenzofuran	T16	AR	10	µg/l	U	001-002
Diethyl phthalate	T16	AR	10	µg/l	U	001-002
Dimethyl phthalate	T16	AR	10	µg/l	U	001-002
Fluoranthene	T16	AR	10	µg/l	U	001-002
Fluorene	T16	AR	10	µg/l	U	001-002
Hexachlorobenzene	T16	AR	10	µg/l	U	001-002
Hexachlorobutadiene	T16	AR	10	µg/l	U	001-002
Hexachlorocyclopentadiene	T16	AR	10	µg/l	U	001-002
Hexachloroethane	T16	AR	10	µg/l	U	001-002
Indeno(123-cd)Pyrene	T16	AR	10	µg/l	U	001-002
Isophorone	T16	AR	10	µg/l	U	001-002
Naphthalene	T16	AR	10	µg/l	U	001-002
Nitrobenzene	T16	AR	10	µg/l	U	001-002
Pentachlorophenol	T16	AR	10	µg/l	U	001-002
Phenanthrene	T16	AR	10	µg/l	U	001-002
Phenol	T16	AR	10	µg/l	U	001-002
Pyrene	T16	AR	10	µg/l	U	001-002
SVOC screen	T16	AR	10	µg/l	N	001-002
1,1,1,2-Tetrachloroethane	T54	AR	1	µg/l	U	001-002

Determinand	Method	Test Sample	LOD	Units	Symbol	SAL References
1,1,1-Trichloroethane	T54	AR	1	µg/l	U	001-002
1,1,2,2-Tetrachloroethane	T54	AR	1	µg/l	U	001-002
1,1,2-Trichloroethane	T54	AR	1	µg/l	U	001-002
1,1,2-Trichloroethylene	T54	AR	1	µg/l	U	001-002
1,1-Dichloroethane	T54	AR	1	µg/l	U	001-002
1,1-Dichloroethylene	T54	AR	1	µg/l	U	001-002
1,1-Dichloropropene	T54	AR	1	µg/l	U	001-002
1,2,3-Trichloropropane	T54	AR	1	µg/l	U	001-002
1,2,4-Trimethylbenzene	T54	AR	1	µg/l	U	001-002
1,2-dibromoethane	T54	AR	1	µg/l	U	001-002
1,2-Dichlorobenzene	T54	AR	1	µg/l	U	001-002
1,2-Dichloroethane	T54	AR	1	µg/l	U	001-002
1,2-Dichloropropane	T54	AR	1	µg/l	U	001-002
1,3,5-Trimethylbenzene	T54	AR	1	µg/l	U	001-002
1,3-Dichlorobenzene	T54	AR	1	µg/l	U	001-002
1,3-Dichloropropane	T54	AR	1	µg/l	U	001-002
1,4-Dichlorobenzene	T54	AR	1	µg/l	U	001-002
2,2-Dichloropropane	T54	AR	1	µg/l	U	001-002
2-Chlorotoluene	T54	AR	1	µg/l	U	001-002
4-Chlorotoluene	T54	AR	1	µg/l	U	001-002
Benzene	T54	AR	1	µg/l	U	001-002
Bromobenzene	T54	AR	1	µg/l	U	001-002
Bromochloromethane	T54	AR	1	µg/l	U	001-002
Bromodichloromethane	T54	AR	1	µg/l	U	001-002
Bromoform	T54	AR	1	µg/l	U	001-002
Bromomethane	T54	AR	1	µg/l	U	001-002
Carbon tetrachloride	T54	AR	1	µg/l	U	001-002
Chlorobenzene	T54	AR	1	µg/l	U	001-002
Chlorodibromomethane	T54	AR	1	µg/l	U	001-002
Chloroethane	T54	AR	1	µg/l	U	001-002
Chloroform	T54	AR	1	µg/l	U	001-002
Chloromethane	T54	AR	1	µg/l	U	001-002
Cis-1,2-Dichloroethylene	T54	AR	1	µg/l	U	001-002
Cis-1,3-Dichloropropene	T54	AR	1	µg/l	U	001-002
Dibromomethane	T54	AR	1	µg/l	U	001-002
Dichlorodifluoromethane	T54	AR	1	µg/l	U	001-002
Dichloromethane	T54	AR	50	µg/l	N	001-002
EthylBenzene	T54	AR	1	µg/l	U	001-002
Isopropyl benzene	T54	AR	1	µg/l	U	001-002
M/P Xylene	T54	AR	1	µg/l	U	001-002
n-Propylbenzene	T54	AR	1	µg/l	U	001-002
O Xylene	T54	AR	1	µg/l	U	001-002
p-Isopropyltoluene	T54	AR	1	µg/l	U	001-002
S-Butylbenzene	T54	AR	1	µg/l	U	001-002
Styrene	T54	AR	1	µg/l	U	001-002
T-Butylbenzene	T54	AR	1	µg/l	U	001-002
Tetrachloroethene	T54	AR	1	µg/l	U	001-002
Toluene	T54	AR	1	µg/l	U	001-002
Trans-1,2-Dichloroethene	T54	AR	1	µg/l	U	001-002
Trans-1,3-Dichloropropene	T54	AR	1	µg/l	U	001-002
Trichlorofluoromethane	T54	AR	1	µg/l	U	001-002
Vinyl chloride	T54	AR	1	µg/l	U	001-002
VOC Screen (Extra Peaks)	T54	AR	10	µg/l	N	001-002

APPENDIX C

Risk-based Monitoring Plan

Controlled Waters

In summary, monitoring of pumped landfill leachate from both Tips has been in compliance with the discharge consent limits, specified as follows:

Table B1.

parameter	limit	parameter	limit
pH	5.0 – 9.0	cadmium	10.0 µg/l
BOD	20 mg/l	mercury	2.0 µg/l
suspended solids	20 mg/l	ammonia	5 mg/l
oils - no visible floating film		Other List 1 substances – not normally tested for	
other substances to not exceed EQS values in receiving watercourse (TNSB)			

The current monitoring regime uses upstream and downstream boreholes for both landfills, boreholes within the Old Tip, leachate surface discharges, and adjacent surface watercourses, as follows:

Table B2.

	Old Landfill	New Landfill
upstream wells	BH110/06	BH114/06
downstream wells	BH4/95 BH103/06(d)	BH104/06(d) BH5/95(d)
in waste wells	BH105/06 BH1/11 BH2/11 BH3/11	none
leachate	discharge point adjacent to Supply Lodge	leachate sump
surface waters	SWR1 (TNSB culvert entry at Supply Lodge) SWR2 (TNSB culvert at ash embankment) SWR3 (TNSB culvert above Eagley Brook confluence	SWR4 (Eagley Brook upstream of TNSB) SWR5 (Ochre Culvert) SWR6 (Eagley Brook downstream of Mill)

The agreed potential migration routes for leachate are:

- from the Old Landfill west towards the Supply Lodge, east into and below the ash embankment towards the Ochre Culvert and Eagley Brook;
- from the New Landfill, east into the Ochre Culvert and Eagley Brook

It is proposed to continue monitoring at the following locations:

Table B3.

	Old Landfill	**New Landfill**
upstream wells	BH110/06	BH114/06
downstream wells	BH4/95 BH103/06(d)	none
in waste wells	BH105/06 BH1/11 BH2/11 BH3/11	none
leachate	discharge point adjacent to Supply Lodge	leachate sump
surface waters	SWR1 (TNSB culvert entry at Supply Lodge) SWR2 (TNSB culvert at ash embankment) SWR5 (Ochre Culvert)	SWR4 (Eagely Brook upstream of TNSB) SWR5 (Ochre Culvert) SWR6 (Eagley Brook downstream of Mill)

Down-gradient wells for the New Tip have been removed as not lying within the leachate flow path and serving no useful purpose. Similarly, there is no potential entry for leachate between the SWR2 and SWR3 monitoring positions on the TNSB culvert, therefore the SWR3 monitoring point serves no useful purpose and is excluded.

The monitoring suite is as follows:

field recording:

Table B4.

borehole purge volume (l)	dissolved oxygen (mg/l)
groundwater depth (m)	electrical conductivity (uS/cm)
base of borehole depth (m)	pH (units)
temperature (°C)	oxygen reduction (redox) potential - ORP mV

laboratory measurement:

Table B5.

metals	**inorganics**	**organics**
arsenic	pH	chemical oxygen demand
cadmium	chloride	total oxidisable nitrogen
calcium	sulphate	ammoniacal nitrogen
copper	sulphide	benzene*
iron		toluene*
lead		ethylbenzene*
manganese		xylenes*
mercury		monohydric phenols*

metals	inorganics	organics
nickel		
potassium		
zinc		

*SWR5, boreholes and tip leachate only

Monitoring frequency will be:

Table B6.

period	location	frequency
during New Tip remediation & waste storage on Old Tip	Old Tip / New Tip leachate; BH4/95, BH103/06(d) SWR5 Ochre Culvert	monthly
	all other sites	quarterly
restoration of Old Tip	Old Tip leachate; BH4/95, BH103/06(d) SWR5 Ochre Culvert	monthly
post-restoration	Old Tip leachate, SWR5 Ochre Culvert	quarterly

Field records and laboratory monitoring data will be compiled into a factual report following each sampling round, and will be distributed to the stakeholders and Environment Agency.

Inspection, maintenance and replacement of monitoring wells will take place as necessary to maintain continuity of data collection until and unless otherwise agree with the Environment Agency. A written record of the condition of monitoring wells will be noted on each sampling round.

Landfill Gas

The Old Landfill remains a source of landfill gas, with evidence for migration of methane / carbon dioxide into the permeable made ground to the south and east of the tip. The New Tip is not a significant source of landfill gas, and the degradable waste contents are to be removed. Monitoring will be continued on the current quarterly frequency at the following wells:

Table B7.

WS8/05	BH108/06	BH115/06(S)	BH3/11
BH103/06(S)	BH110/06	BH116/06(S)	BH1/13
BH105/06	BH112/06	BH116/06(D)	BH2/13
BH106/06	BH113/06	BH1/11	BH3/13
BH107/06	BH114/06	BH2/11	

The following wells which have been monitored at some time in the past are no longer proposed for monitoring for the reasons stated:

BH4/95 - damaged condition and adjacent to wells WS8/05 and BH103/06

BH101/06 - lost for many years, and not in a sensitive area

BH102/06 - limited utility given deep response zone in boulder clay, effectively superseded by BH1/13 and BH2/13
BH109/06 - lost for several years and in non-sensitive area with negligible migration risk (boudler clay and shallow water table / in springline
BH104/06 - remote from Old Tip, with no evidence of gas presence in past

Monitoring comprises field measurement of borehole pressure and flow, concentration of methane, carbon dioxide, oxygen, hydrogen sulphide, and borehole water level.

Borehole inspection, maintenance and data reporting will be as set down for water monitoring arrangements.

The monitoring regime on and around the Old Tip will be revised in agreement with the Local Planning Authority and Contaminated Land Officers and Environment Agency when works to restore the landfill and install gas management measures are carried out.

APPENDIX D

Gas Monitoring Well Review

R1635 Kruger, Springside Mills

Gas Monitoring Well Condition Survey, March 2014

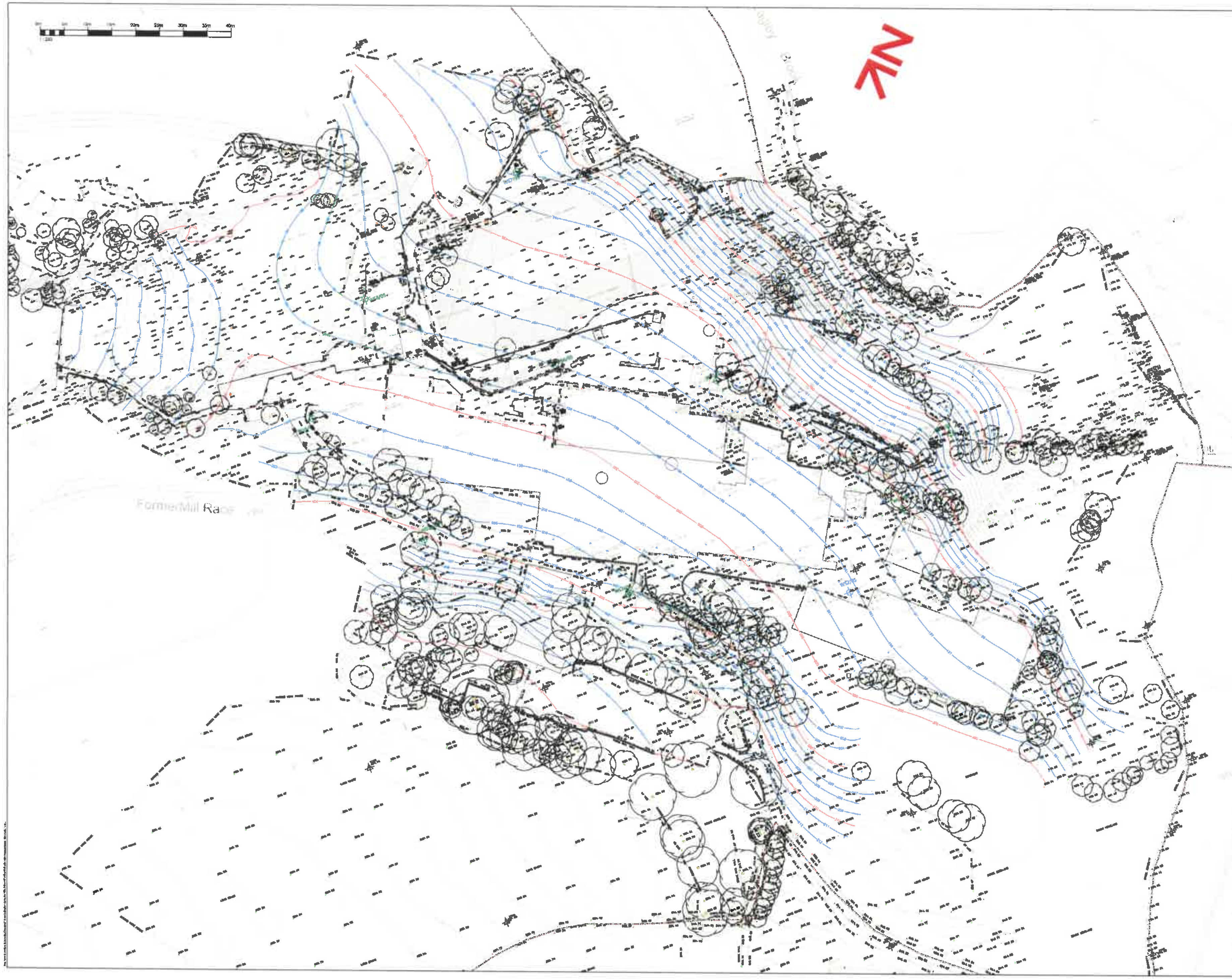
surveyors: AFS/DW/GC

borehole	date of installation	location	condition	notes
BH4/95	1995	ash embankment	poor	top of standpipe broken, and bung pushed down although airtight
BH5/95	1995	east of New Tip	buried	may be recoverable, previously in good condition
WS8/05	2005	ash embankment, adj to BH4/95	good	no issues
BH101/06	2006	north part of Old Tip	lost	destroyed
BH102/06	2006	south of Old Tip	poor	ground caved in around standpipe, although depth of respnse zone means that performance unlikely to be impaired
BH103/06 (S)	2006	ash embankment, adj to WS8/05	good	no issues
BH104/06	2006	east of New Tip	lost	possibly destroyed during fencing works
BH105/06	2006	north part of Old Tip	good	no issues
BH106/06	2006	north margin of Old Tip	good	dense vegetation needs clearing
BH107/06	2006	north side of ash embankment	good	no issues
BH108/06	2006	south side of ash embankment	good	no issues
BH109/06	2006	south of Old Tip	lost	no traces found
BH110/06	2006	south of Old Tip	good	no issues
BH112/06	2006	north of New Tip	good	no issues
BH113/06	2006	north of New Tip	good	no issues
BH114/06	2006	ash embankment	good	no issues
BH115/06 (S)	2006	south of New Tip	good	no issues
BH116/06 (S)	2006	south of New Tip	good	no issues
BH116/06 (D)	2006	south of New Tip	good	no issues
BH1/11	2011	within Old Tip	good	occasional flooding
BH2/11	2011	within Old Tip	good	occasional flooding
BH3/11	2011	within Old Tip	poor	bung cannot be removed, frequently flooded
BH1/13	2013	south of Old Tip	good	no issues
BH2/13	2013	south of Old Tip	good	no issues
BH3/13	2013	south of ash embankment	good	no issues

good condition: bung and gas tap airtight, evidence of bentonite seal, water level usually below top of response zone, not subject to flow failure or or oxygen rise during pumping signifying leakage from surface

APPENDIX E

Restoration Contour Plan



general notes
do not scale the drawing.

represent proposed
levels (i.e. top of garden soils, road construction, etc.)
plus/minus 600 mm

mck associates limited
architecture | building surveying | urban design

Former Kruger Works. Springside Mills. Belmont.
Proposed Site Regrade.

Proposed Contour Plan.

TGH		1:500	2013
12-127			

A0

PRELIMINARY

APPENDIX F

Lodge Dam Inspection Report

Reid Jones partnership

Consulting Civil & Structural Engineers

Ref. 4144/ej/I01
Date. 10 June 2014

Urban Regen Ltd
23 Springvale
Edgworth
Bolton
BL7 0FS

For the attention of Mr J Bamforth

Dear John,

VISUAL INSPECTION – POND DAM, FORMER KRUGER WORKS, BELMONT

You requested we visit the above site to inspect the dam construction and its current condition in order to assess its integrity and long-term stability.

We visited the site on Wednesday 7th May and again on Thursday 5th June 2014.

The dam appears to be constructed of concrete to a level approximately 300mm above current water level within the pond with brickwork above and a concrete capping forming the walkway across the dam. The dam is 850mm wide overall and 1450mm above current pond water level. The pond water level is controlled via an outlet at the northern end of the dam and therefore remains relatively constant.

Along the top and off the side of the dam there are several steel platforms and support frames used for water sampling and monitoring. The steel is rusty and cables trail along the handrail and across the walkway.

During our first visit the water level on the front of the dam was 400mm higher than the pond and on the second visit, after heavy rainfall, was 750mm above the pond. There is a degree of water seepage through the brickwork, which over time, and subject to rainfall, will allow the hydrostatic pressure to reduce or equalise.

There is some vegetation growth in various areas along the dam predominantly from the brickwork mortar joints.

The dam generally is in good overall condition and is plumb and level along its length and there are no indications of distress or signs of movement visible.

We would recommend the platforms and other steel support frames and vegetation be removed to prevent any deterioration of the structural integrity in the long term. The areas of masonry affected should be re-pointed following any removal works.

We consider the dam to be stable currently and have no reason to doubt its long-term structural stability or integrity, particularly if the above-mentioned maintenance/mitigation works are carried out.

Photos of the dam are attached for record purposes.

We trust this brief report is satisfactory, however please do not hesitate to call should you have any questions.

Reid Jones Partnership Ltd. 9 Orrell Road, Orrell, Wigan, Lancs WN5 8EY
Tel: 01942 216006 Fax: 01942 216007 Email: enq@reidjonespartnership.co.uk Web: www.reidjonespartnership.co.uk

Directors: S John Reid, BSc(Hons) CEng MICE MIStructE, Edwin Jones, BEng(Hons) CEng MIStructE AMICE
Registered in England No. 4022288 Registered Office - 105 Garstang Road, Preston PR1 1LD

Yours sincerely
For and on behalf of
Reid Jones Partnership Ltd

Edwin Jones
Director

Enc.

PHOTO 1 – VIEW OF DAM FROM SOUTH SIDE

PHOTO 2 – VIEW OF DAM FROM NORTH SIDE

PHOTO 3 – VIE OF SAMPLING PLATFORM AND VARIOUS FRAMES ALONG LENGTH OF DAM

PHOTO 4 – VIEW OF FRONT FACE OF DAM

PHOTO 5 – VIEW OF SURFACE WATER INLET TO POND