CHADWICH LANE QUARRY
GEOLOGICAL BARRIER

Construction Quality Assurance Proposals for the Installation of the Engineered Geological Barrier

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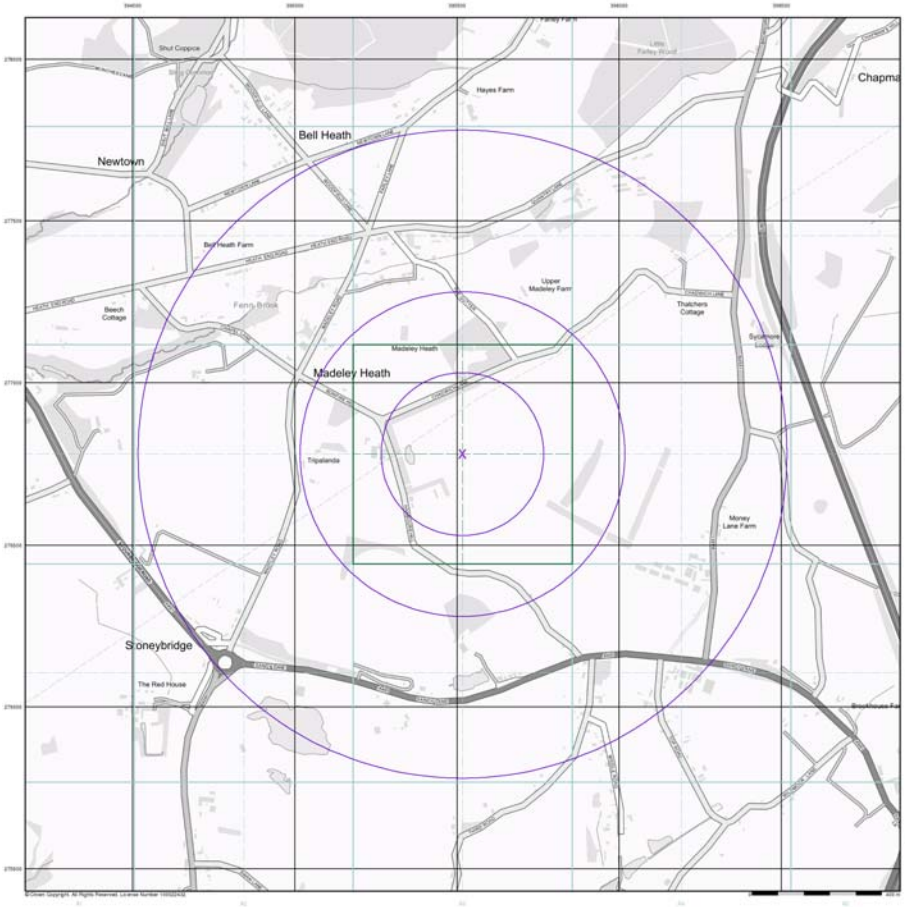
1. INTRODUCTION

1.1 Chadwich Lane Quarry is situated off the Chadwich Lane and the site entrance is off Money Lane. The site is south western fringe of Birmingham at National Grid reference SO 395448 276819 is the centre of the site and the site entrance is SO 396373 276818 see Figure 1 and Drawing ESID 1.

Figure 1: Site Location



1.1.1 The Chadwich Lane Quarry landfill site Geological Barrier is to be constructed using suitable inert fill materials obtained from the Wildmoor Sandstone Formation.

1.2 Definitions

(a) "Contractor" means Chadwich Lane Quarry Ltd appointed operator/tenant in accordance with the signed lease for the site and includes the Contractor's personal representatives, and covers all works the Contractor carries out under the lease in accordance with current and future Planning Permissions, Permits and Exemptions;

(b) Engineer means Third Party Consulting Engineers and includes the Engineer's personal representatives;

(c) Geological Barrier means a 1 metre thick geological seal constructed using clay that will achieve a permeability of 1 x 10^{-7}m/s and have a minimum 7% clay content and a fines content of 15%;

(d) Suitable Fill will be in accordance with Clause conditions Department of Transport Specification for Highways Works: Part 2: 601.

(e) Placement and Compaction shall be in accordance with Clause 612 Compaction of Fills conditions Department of Transport Specification for Highways Works: Clause 612 and Tables 6/1 and 6/4.

(f) Environmental Permit means a Permit issued for inert landfilling at the site issued under the Environmental Permitting Regulations 2010 and any subsequent amendments.

(g) Town and Country Planning Act 1990 means any planning permission issued for the site in relation to infilling for either restoration or commercial development at the site.

1.3 The geological barrier is to provide a 1 metre seal that is placed in four distinct layers and subjected to compaction in accordance with the method specification set out in Tables 6/1 and 6/4.

1.4 It is the responsibility of the NRS on issue of any new Planning Permission or Environmental Permit to comply with all of the requirements and to also comply with this specification, but the highest standard. Therefore if there is a more onerous requirement in the Permit than the CQA Plan and Method Statement contained herein the Permit standard shall be achieved. If the specification contained below is higher then this shall be the minimum standard.

2. DESCRIPTION OF THE WORKS

2.1 General

2.1.1 The Works to be performed by Chadwich Lane Quarry Ltd will comprise:

2.1.1.1 All cleaning and setting out necessary for carrying out the Works.

2.1.1.2 The Construction of associated temporary access roads and temporary drainage and the diversion and modification of any existing drainage ditches.

2.1.1.3 Construction of the 1 metre geological barrier on the sides and base on released Phases.

2.1.1.4 The phasing for infilling is set out on Drawing No. ESID 6 the following process is to be adopted for the terms of the contract and conditions pertained herein.

2.1.1.5 Satisfactory will be defined that all of the relevant Construction Quality Assurance Validation Reports have been completed by third party consulting engineers appointed on behalf of NRS and confirm compliance with this specification.

2.1.2 The Works to be performed by the appointed Engineer will comprise:

2.1.2.1 The Construction Quality Control (CQC) by way of independent testing both chemical and physical.

2.1.2.2 Construction Quality Assurance (CQA) by way of independent verification that the Works have been carried out in accordance with the Construction Quality Assurance Plan (CQAP) on a part time basis.

2.1.2.3 The production of the Construction Quality Assurance Validation Reports (CQAVR).

3. EARTHWORKS

3.1 General

3.1.1 The geological barrier shall be placed on the base and sides of all landfill areas. Compacted fill shall be placed in individual layers of uncompacted thickness of approximately 300mm and compacted to achieve a 250mm compacted layer in accordance with Table 6/1 and 6/4, and any approved modifications prior to commencement of the Earthworks.

3.2 Fill Materials for the Geological Barrier

3.2.1 Acceptable materials will fall into one of the following general classifications;

(i) Acceptable material; material excavated within the site or imported to the site, which meets the requirements of Table 6/1 and Appendix 6/1 for acceptable use in the Permanent Works.

(ii) Unacceptable material Class U1 or U2 as defined in sub clauses 3.2.2 and 3.2.3: material, which shall not be used in the Permanent Works.

3.2.2 Unacceptable material Class U1 shall be;

(i) Material which does not comply with the permitted constituents and material properties of Table 6/1 for acceptable material

(ii) The following materials and constituents

- Material from swamps, marshes and bogs;
- Peat, logs, stumps and perishable materials;
- Material susceptible to spontaneous combustion;
- Material in a frozen condition;
- Suitable fill having a liquid limit exceeding 90 or a plasticity index exceeding 65.

3.2.3 Unacceptable material Class U2 shall be;

(i) Material having a hazardous chemical or physical properties requiring special measures for its excavation, handling, storage transportation deposition and disposal.

3.3 Compaction

3.3.1 Compaction shall be carried out in uniform layers as soon as practicable after deposition. Plant and methods will only be used that have been proved satisfactory by site compaction trials and approved in writing by the Engineer.

3.3.2 The methodology for compaction will be as per Highways Specification standards attached in Tables 6/1 and 6/4. The earthworks shall therefore be carried out in the following sequence.

3.3.2.1 Deposition of suitable fill with no material greater than 150mm in diameter.

3.3.3.2 Blading out of material to a uniform uncompacted thickness (**D**), as defined by the compaction trials, to achieve a compacted lift thickness (**T**).

3.3.3.3 Compaction by **N** passes of the compactors as defined by the compaction trials.

3.3.3.4 Finish with smooth drum roller to provide uniform surface for testing and sampling.

3.3.3.5 Prior to placement of further layers, the surface will be traversed by the tamping roller to enable the next layer to be keyed in, with a minimum penetration of the previous layer by 30mm or scarified to ensure that sufficient bonding of the individual lifts occur.

4. QUALITY CONTROL

4.1 British Standards

4.1.1 All materials and workmanship shall comply with the appropriate British Standard Specification as described in the British Standard Yearbook, or such other standards as approved in writing by the Engineer. The abbreviation BS is used when referring to a British Standard and CP when referring to a Code of Practice.

4.1.2 The primary control documents are BS1377:1990 Methods for Testing Soils for Civil Engineering Purposes and BS 5930:1999+ A2 2010 Code of Practice for Site Investigation and Environment Agency Guidance on Inert Landfill.

4.2 Test Definitions

4.2.1 Throughout this CQAP unless otherwise stated, the following test definitions shall apply:

4.2.2 **Classification Tests** shall be that defined in *Methods 4.3, 5.3 and 5.4,8 in BS 1377, Part 2: 1990.*

4.2.3 **Particle Size Distribution** shall be that defined in *Method 9 of BS 1377, Part 2: 1990.*

4.2.4 **Permeability Test** will be as per Environment Agency Guidance for Inert Landfills including Triaxial Cell Tests.

4.3 Testing Schedule

4.3.1 During the various phases of the Works, the Engineer will undertake testing and will take samples for laboratory testing to ensure the integrity of the base and perimeter seals. These tests will include:

- Particle Size Distribution 1No.test per 2,500m^3
- Particle Density Test 1No test per 2,500m^3
- Atterberg Limited 1No test per 2,500m^3
- Permeability Tests 2 per phase and one per lift of each phase.
- WAC Test 1No.Test per 5,000m^3

4.3.2 In addition to the above, thickness surveys are to be carried out by the Engineer to demonstrate that the correct thickness of compacted suitable fill has been constructed. The Engineer shall carry out visual and physical observations and shall verify observations using a measuring staff and photographs.

4.4 Material Sampling Procedures

4.4.1 All material samples shall be taken in accordance with BS 5930:1999+A2 2010, and any subsequent revisions. All samples shall be given a unique reference and placed in sealed containers before removal to a secure site store for transfer to the approved soils laboratory. Both a despatch advice note and two copies of the Laboratory Testing Schedule, all signed by the Engineer on site, shall accompany the samples during their transfer.

4.5 Material Testing Procedures

4.5.1 All materials sampled will be taken to a UKAS accredited laboratory. Upon receipt at the laboratory the samples will be logged into the sample store (and into the computer system) where they will be kept until required for testing. All laboratory testing will be in accordance with *BS 1377; 1990,* or other approved method. After testing, any material remaining will be disposed of in accordance with the *Duty of Care.*

4.6 Material for Compaction

4.6.1 Source materials shall be taken by the Engineer for independent laboratory testing in accordance with Clause 4.4.1 for the geological barrier. Source testing shall consist of:

4.6.1.2 **Classification Tests** PL, LL, NMC, SG, BS 1377: 1990; Part 2: Clause 4.3 and 5.0

4.6.1.3 **Particle Size Distribution** BS EN ISO 17892-4*:* 2016: Clause 5.2 and 5.4.

4.6.1.4 **Permeability Test** BS1377:Part 6 Clause 6: 1990

4.6.1.4 **Particle Density Test** BS1377: Part 2 Clause 8.3:1990

4.6.2 The testing shall be carried out in advance of the works as a form of source evaluation and the results Approved by the Engineer prior to commencement of placement of the geological barrier and a record of assessment and approval kept which shall form part of the Construction Quality Assurance Validation Report.

4.7 Site Clearance

4.7.1 The surface to be occupied by the geological barrier shall be graded. Any debris, angular or sharp rocks larger than 150mm in diameter shall be removed as well as any other deleterious materials. The sub-grade should be compacted if appropriate such that no significant rutting is caused by installation equipment or vehicles.

4.7.2 Materials removed in the clearing operations shall be stockpiled for removal or re-use on site.

4.7.3 The Contractor shall take all reasonable precautions against the site being flooded or water-logged. The Contractor shall conduct his cleaning operations in such a way as to minimise the disturbance to the ground surface. In the event of surface deterioration by any cause, the Engineer may direct the Contractor to trim, scarify and roll the formation as appropriate. The Engineer must certify that surfaces are suitable for compacting on or against.

4.7.4 Material originally deposited under Waste Recovery to produce bunds for water removal will be excavated at the edges and a side wall seal constructed, that is keyed into the clay base as detailed on Drawing ESID 4.

4.8 Emplaced Material

4.8.1 Classification tests (PL, LL, NMC, PI, SG/PD) shall be carried out on emplaced material every 2,500m^3 on a regular grid pattern.

4.8.3 Particle size distribution gradings shall be carried out on emplaced geological barrier material every 2,500m^3 on a regular grid pattern.

4.8.4 Placed material will be regularly checked using a Cone Penetrometer and Shear Vanes on compacted lifts of the development platform with random Core Cutter samples collected.

4.8.5 Permeaility testing will be carried out using BS1377 Part 6 and in site tests using U100 tubes.

4.8.6 Soil contamination testing will be carried out as part of the infill quality assurance protocol to ensure that the material is inert, to comply with an Environmental Permit Waste Acceptance Criteria and will be acceptable as suitable material for inert landfill acceptance.

4.9 Adverse Conditions

4.9.1 The Contractor shall not carry out any placing or compaction of geological barrier materials when conditions are such that, in the opinion of the Engineer, the quality of the work or adjacent completed works would be adversely affected. After any operation has been stopped due to adverse conditions, it shall not be re-started without the verbal approval of the Engineer, and recorded on the daily logs.

4.10 Instability

4.10.1 The Contractor shall take all necessary precautions to prevent instability in any part of the Works. The Contractor shall make good both any damage or defect and remove reject material caused by instability and provide backfill or other reinstatement to the written approval of the Engineer.

4.11 Placement Methodology

4.11.1 The Contractor shall place un-compacted lifts of thickness D, and traverse with N passes, to achieve a minimum compacted thickness T as per Table 6/1 and Table 6/4 for the Geological Barrier and the Development Platform.

4.11.2 Placement of the suitable fill will be in un-compacted lifts of thickness D, and traversed with N passes, in uniform strips, to allow for visual examination as per Table 6/1 and Table 6/4.

4.11.3 The side wall will be built up in layers as per the base but in 2 metre lifts in a Christmas tree type construction. The typical construction process is presented in the SRA and Working Plan for Chadwich Lane Quarry.

4.11.4 Typical values for silt and clay have been modelled to assess the short and medium term stability as the walls will be retained with inert fill within a short period of time. The values have been obtained from the Government Publication Handbook on the Design of Tips and Related Structures, HMSO.

5. DRAINAGE

5.1 General

5.1.1 The Contractor shall construct all necessary drainage works as required or as approved by the Engineer.

5.1.2 The areas to be occupied by the suitable fill shall be drained and maintained dry by the use of appropriate pumping equipment as necessary.

5.1.3 No surface water will be allowed to freely leave the site and should at all times be intercepted by the surface water cut-off ditches.

5.1.4 All water will be discharged a so as to comply with the Discharge Consent.

6. WORKS SUPERVISION

6.1 Quality Control Procedures for Supervision of the Works shall be in accordance with those specified within this document.

6.2 When compaction works are being carried out, the Engineer or approved site personnel shall be on site at sufficient frequency to be able to sign off each section of the works to the standard set out herein, and it shall be demonstrated that the material is suitable by collecting samples pre start for WAC testing, permeability tests, particle size distribution, particle density and a section rolled to demonstrate compaction capability.

6.3 The Engineer shall be a Civil Engineer, Geotechnical Engineer, Engineering Geologist as required or other persons with relevant experience and suitable training. In addition site staff will be trained to undertake physical measurements of clay liner thickness, to undertake permeability testing to photograph the cores and keep a site diary when the engineer is not present on site.

7. PROJECT MANAGEMENT STRUCTURE

7.1 Staff and there responsibilities are to be forwarded to Environment Agency prior to commencement of any lining works.

7.2 Liaison meetings will be held to discuss progress and any matters arising. These meetings will be attended by the Contractor and the Engineer.

8. CONSTRUCTION QUALITY ASSURANCE VALIDATION REPORTS

8.1 Upon completion of each of the phase of compaction both of the Geological Barrier and phases of the Development Platform, the Engineer will present a Construction Quality Assurance Report describing the construction work undertaken in each phase, together with the quality control monitoring, sampling and testing of the Works and the results of all testing and test locations, both in the field and in the laboratory. These will be known as the Construction Quality Assurance Validation Reports (CQAVR's) and shall be submitted in writing to Environment Agency on completion of each phase of compaction.

REFERENCES

BRITISH STANDARDS AND CODES OF PRACTICE

BS 1377: 1990: Methods of Testing for Soils for Civil Engineering Purposes. British Standards Institution.

BS 5930: 1999+A2 2010: Code of Practice for Site Investigations. British Standards Institution.

ORDNANCE SURVEY MAPS

OS Sheet 1:50,000 topographical map. Landranger Series. Birmingham and surrounding area

PUBLICATIONS AND REPORTS

Department of the Transport: Specification for Highways Works Part 1 and 2.Series 600 Earthworks

Department of Environment: Handbook on the Design of Tips and Related Structures.

Environment Agency; Guidance on Inert Landfills