Area 2,
Docksway Waste Disposal Site

Construction Quality Assurance Plan for Cell 3 Base Stabilisation

On behalf of **Newport City Council**

Project Ref: 14739/156 | Rev: 01 | Date: January 2015

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Document Control Sheet

Project Name: **Area 2, Docksway Disposal Site**

Project Ref: **14739/156**

Report Title: **CQA Plan for Cell 3 Base Stabilisation**

Doc Ref: **Rev01**

Date: **4th February 2015**

	Name	Position	Signature	Date
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For and on behalf of Peter Brett Associates LLP				

Revision	Date	Description	Prepared	Reviewed	Approved
Rev01	4th Feb 15	Issue	VKR	RHT	RHT

Contents

1 General

1.1 Introduction

This Construction Quality Assurance (CQA) Plan has been prepared by Peter Brett Associates LLP (PBA). It applies to the base stabilisation works that are required to be carried out in Area 2 of Docksway Disposal Site, as preparation for the construction of new engineered waste containment cells. The stabilisation works are required to provide a suitable platform on top of which the basal liner of the new landfill cells can be constructed. Without the stabilisation, the natural alluvium present at the site is unable, in some places, to support the necessary construction plant and machinery for the cell construction.

The general principles of the stabilisation works have previously been discussed and agreed with Natural Resources Wales (formerly the Environment Agency) and have previously been applied to Cells 1 and 2 of Area 2 at the site.

The objective of this CQA Plan is to define the roles and responsibilities of the various parties involved in the contract for the base stabilisation works. It also details the quality procedures to be adopted during the construction works. This is to ensure effective management of the contract and verification that the construction works have been undertaken to meet the requirements of the design.

1.2 Definitions and Duties

1.2.1 Definitions

In the context of this document, the following definitions shall apply;

Construction Quality Assurance (CQA) - A systematic and planned pattern of all actions employed by the CQA Consultant designed to provide confidence that items or services meet contractual or regulatory requirements and will perform satisfactorily in service. To this end the CQA Consultant will check conformity of the lining system, preparation, production, and installation to this CQA plan, the Contract drawings and Specification. The CQA Consultant shall be a party independent of installation and usage.

Construction Quality Control (CQC) – Those actions, which provide a means to measure and regulate the characteristics of an item or service to Contractual requirements. Such actions may be taken by manufacturers, installers, contractors or the employer to ensure that the materials and workmanship meet the requirements of the CQA plan and Specification.

1.2.2 Parties

The following parties shall be defined as follows, with associated duties:

Employer - means the person or persons, firm, company or other body who own and have responsibility for the facility. The Employer has entered into a contract with the Contractor for the execution of the Works specified in the Specification and Contract Drawings. The Employer may be represented on site by personal representatives or other parties, e.g. the CQA Consultant.

Contractor including specialist Sub-Contractor - means the person or persons, firm, company or other body to whom the Contract has been awarded by the Employer, and includes the Contractors personal representatives or other parties, e.g. Sub-Contractors. The Contractor is the party responsible for the preparation and construction of the works to the Specifications as detailed, within the CQA Plan and Contract Documents under the technical supervision of the CQA Engineer and CQA Consultant.

CQA Engineer – means the person appointed by the Employer to act as CQA Engineer for the purposes of the Contract. For the purpose of this project the Employer will also act as the CQA Engineer.

CQA Consultant – means the person or persons, firm, company or other body appointed by the Employer to provide independent oversight and verification that the works are constructed and recorded in accordance with the design Specification and the CQA Plan. The CQA Consultant shall be responsible for preparation of the CQA Validation Report.

The Employer – The Employer is Newport City Council, and;

- prepares the drawings, contract and specifications,
- reviews other site specific documentation including proposed layouts and Contractor's qualifications,
- reviews all changes to the design, drawings and specifications,
- oversees budgetary and contractual matters
- provide day to day management of the works,
- provide surveying services,
- setting out to specifications,
- provide technical support where required,
- attend pre-construction, progress, site and CQA related meetings,
- liaise with all parties.

Contractor/Sub-Contractor - The Contractor is Jim Davis Ltd and the Sub-Contractor is Deep Soil Mixing Ltd, and they are responsible for the design of the stabilisation works to meet the requirements of the Employer and CQA Consultant. They will also be responsible for undertaking the whole of the works in accordance with the Contract and providing a level of site attendance as defined in the Contract. The Contractor will also ensure that all daily records and testing reports are made available to the Employers CQA Engineer and the CQA Consultant.

CQA Consultant - For the purpose of this document the CQA Consultant is Peter Brett Associates LLP (PBA). A personal representative will be appointed for the Works or part thereof. The CQA Consultant:

- Prepares the CQA Plan,
- administers the CQA program, i.e., assigns tasks and instructs the CQA Engineer, reviews field reports taken by the CQA Engineer, and provides a review of CQA related issues;
- provides quality control of the CQA Engineer;
- prepares the final CQA Validation Report Report.

CQA Engineer – who for the purpose of this project operates from the offices of the Employer, but is located at the site and is directed and monitored by the CQA Consultant. The CQA Engineer:

- acts as the on-site representative of the CQA Consultant;
- familiarises the Contractor with the site, and the CQA requirements for the project;
- manages the daily activities of the Contractor;
- attends all CQA-related meetings (e.g. Preconstruction and Progress);
- prepares, or oversees the ongoing preparation of the Record Drawings;
- monitors on site conformance testing;
- assigns locations for testing and sampling;
- prepares daily reports and logs;
- reports to the CQA Consultant, and logs in his daily report any relevant observations;
- oversees the collection and shipping of all samples for laboratory testing;
- reviews results of laboratory testing and makes appropriate recommendations;
- reports any unresolved deviations from this CQA Plan to the CQA Consultant;
- provides all logs and relevant data to the CQA Consultant for the preparation of the final report;
- reviews all Certifications and Documentation from the Contractor and makes appropriate recommendations;

The list of the CQA Engineers duties is not exhaustive and may include additional roles as required. Anyone standing in for the CQA Engineer in his absence will be required to perform all the above as necessary.

The CQA Engineer may have delegated duties of the CQA Consultant as necessary.

1.3 Relationship with Other Documents

In the event of ambiguity or conflict between this CQA Plan and other Contract Documents, then in general the Specification shall take precedence, followed by the Contract Documents, and then this CQA Plan. Should resolution on this basis not be possible, then the Employer in consultation with the CQA Consultant shall decide on which interpretation is applicable.

1.4 Key Personnel

The Client/Employer is: Newport City Council
Consultancy Services
Civic Centre
Newport
South Wales
NP20 4UR

The CQA Engineer is: Mr Ian Fisher
Newport City Council
Consultancy Services
Civic Centre
Newport
South Wales
NP20 4UR

The CQA Consultant is: Peter Brett Associates LLP
Caversham Bridge House
Waterman Place
Reading
Berkshire
RG1 8DN

The Contractor is: Jim Davis Civil Engineering Ltd
Ty-Gwyn
Banalog Terrace
Hollybush
Blackwood
South Wales
NP12 0SG

The Sub-Contractor is: Deep Soil Mixing Ltd
Birchwood
Westoning Rd
Greenfield
Bedfordshire
MK45 5BJ

2 Design Philosophy

2.1 Area 2 General Design

Area 2 is designed on a full containment principle, to minimise the creation of leachate by rainfall infiltration or groundwater seepage, in accordance with the 'Area 2 Engineering Design Philosophy[1]' and the 'Conceptual Model and Hydrogeological Risk Assessment for Area 2[2]'.

Leakage from the site and the associated transport of contaminants will be impeded by the presence of an engineered barrier and a natural geological barrier (the natural alluvial clays present beneath the site). The engineered barrier system (EBS) will comprise an upper clay barrier of 1.2m of imported clay, engineered to have a maximum permeability of 1×10^{-9} m/sec, and a lower barrier comprising 2m of stabilised in-situ alluvial clay, with a further 2m of in-situ alluvial clay beneath the stabilised material. The in-situ alluvial clays have a typical permeability of 1×10^{-9} m/sec, and the stabilisation works shall not increase the permeability of the alluvial clays.

2.2 Base Stabilisation Design

There are some areas within Cell 3 where the alluvial clays have insufficient strength to support construction plant and machinery, and these areas therefore require stabilisation prior to any landfill cell construction works. These areas have been approximately delineated and are shown on Figure 1. The areas will be subject to precise delineation during the field trials described in Section 2.3.

The design principle of the base stabilisation works is to achieve a stabilised formation on which the artificial clay liner can be constructed whilst retaining a permeability of the stabilised alluvial clays not exceeding 1×10^{-9} m/sec. The design has been developed by the specialist sub-contractor, Deep Soil Mixing Ltd (DSML), to meet the requirements of the Contract and Specification documents, presented in Appendix 1.

A 'General Site Proposals' document, produced by DSML, and describing the methodology to be adopted for the proposed stabilisation works is presented as Appendix 2 and summarised below.

Whereas the previous stabilisation that has taken place in Cells 1 and 2 of Area 2 at the site has comprised the installation of 2m long columns (see Area 2 – Cell 1 Base Stabilisation, Construction Quality Validation Report[3]), the current stabilisation works within Cell 3 will comprise the mass stabilisation of the upper 2m of alluvial clays in the areas identified (see Figure 1). This is achieved by the addition of a binder (generally a mix of cement and bentonite) in the form of a premixed wet grout into the soil at depths down to 2m, and then subsequent mixing with specialist equipment (see Appendix 2). After an optimal period of time, the binder cures and forms a stiffened upper crust to the soft and very soft alluvial clays, whilst retaining the required low permeability.

The specific ratios of the binder mix and the curing time before testing will be defined following the trials described in Section 2.3

2.3 Laboratory and Field Trials

Prior to the award of the Contract, a laboratory trial on samples of alluvial clay taken from the site was carried out to determine whether the proposed method of wet mass mixing would be able to achieve the requirements of the stabilisation, and to determine the mix type, optimal binder and mixing ratios. The results of the laboratory trial undertaken by DSML indicated that a wet mix using a combination of cement and bentonite binder would achieve a sufficient strength increase of the alluvial clays to allow construction traffic to work, whilst retaining the low permeability requirements.

Subsequent to the award of the contract and prior to commencement of the overall works, a field trial shall be carried out to determine that the Specification requirements can be achieved in the field and to allow the contractor to determine the optimal range of mix ratios for the in-situ conditions. The Employer, CQA Engineer and CQA Consultant shall review the results of the field trial and be satisfied with the results prior to the works commencing.

3 Quality Procedures and Testing Requirements

3.1 Setting Out/Survey

The Employer shall provide the Contractor with a topographical survey of the site and shall agree with the Contractor the precise extent of the areas to be stabilised. The Contractor shall, in accordance with his general site proposals (Appendix 2), apply a grid to the survey drawing, indicating the maximum extent of the areas to be stabilised on a cellular block basis, to facilitate quality control of the works. The grid shall be set out on the ground using marker pegs, and the coordinates of the grid shall be surveyed by the Employer. Each cell will be assigned a unique ID and shall have a unique set of coordinates. The stabilisation will be undertaken on a cell by cell basis.

3.2 Mix Ratio and Depth Control

The specialist mixing equipment will be marked to indicate 2m depth so that the operator can clearly see the maximum depth to be stabilised.

Each cell will be stabilised using the wet mix material drawn from the batching plant, and each batch of mixed binder material shall have a unique ID. The details of precise batch mix ratios is electronically recorded and assigned to the unique batch ID for quality control purposes.

3.3 Sampling and Testing Procedures

Sampling and testing of the mixed stabilised material shall be undertaken in accordance with the Specification and as reproduced in Table 3.1 below.

The CQA Engineer will determine the cell locations for the proposed sampling, based on the frequency of testing required and his site observations, and shall inform the Contractor accordingly. Each sample will be assigned a unique ID that shall be able to be cross referenced back to the individual cell that it was taken from.

The samples will be obtained in accordance with the DSML general site proposals, and shall be submitted to the appropriately accredited testing laboratory identified therein. The Contractor shall arrange for these samples to be undertaken in the presence of the CQA Engineer or a representative from the CQA Engineer. Copies of all test data shall be provided by the Contractor to the CQA Engineer and the CQA Consultant. The CQA Engineer will provide summary reports of the work, detailing progress, problems, testing and proposed work programme, and these will be included in the CQA Validation Report.

For the purposes of the CQA Validation Report, only the test results relating to the permeability testing shall be presented, as the strength testing is an operational requirement and not a requirement related to the integrity of the EBS.

Table 3.1: Testing Requirements

Clause	Work, Goods or Material	Test	Frequency of Testing	Test Certificate	Comments
SHW SERIES 600 EARTHWORKS					
630, 633 & 640	Soil Mixing	Hand Shear Vane	1 per 200m^2 within the upper 0.5m of the treated soil	Required	Tests to be undertaken at 2 days and 5 days after mixing
		Undrained Shear Strength on Core	1 per 500m^2 with cores taken from various depths of the treated soil	Required	Quick undrained triaxial cores to be taken at 5 days after mixing
		Permeability	On cores recovered from treated soil at a frequency of 1 per 500m^2 with cores taken from various depths of the treated soil	Required	By triaxial method cores to be taken at 7days after mixing
		CBR	1 per 500m^2	Required	Plate Bearing Test across the finished treated area at a minimum of 5 days after completion of soil mixing
Note: UKAS accredited tests and test certification should be assumed to be required in all cases unless such accreditation is unavailable for a particular test, or agreement is otherwise reached with the Engineer that accreditation is not required.					

3.4 Acceptability Testing

Acceptability testing shall be in accordance with the Specification and as reproduced in Table 3.2 below.

Table 3.2: Acceptability Testing Requirements

General Material Description	Material Properties Required for Acceptability				Comments
	Property (See exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits within		
			Lower	Upper	
Stabilised Clay	(i) Direct Shear Strength by Hand Shear Vane	BS 1377: Part 7	50kN/m^2	100kN/m^2	The Stabilised/ Treated Clay will remain

General Material Description	Material Properties Required for Acceptability				Comments
	Property (See exceptions in previous column)	Defined and Tested in Accordance with:	Acceptable Limits within		
			Lower	Upper	
	(ii) Quick Undrained Triaxial Shear Strength on Core Sample	BS 1377: Part 7	50kN/m^2	100kN/m^2	plastic after treatment and the testing shall demonstrate that failure during shear strength testing is a ductile plastic type failure (none brittle). The plate size for the plate bearing tests shall be a min 450mm diameter.
	(iii) Permeability in Triaxial Cell on Core Sample	BS 1377: Part 6	-	1 x 10^{-9}m/s	
	(iv) CBR	Plate Bearing Test	15%	-	
	(v) Thickness of underlying natural soils	Contractor to determine and agree with Employer	2m	-	

Where the test results or site conditions indicate that the design criteria are unlikely to be met the CQA Engineer and CQA Consultant shall be informed and a review undertaken of the conditions. Following the review and appraisal of the design the method of works shall be amended by agreement between the Contractor and the CQA Engineer/Consultant to ensure that the completed works satisfy the Specification requirements.

3.5 Contractors Records

The Contractor shall record the following information and provide the information to the CQA Engineer and CQA Consultant in weekly progress reports;

- No of Cells completed (that week and cumulative)
- Site photographs
- Binder ratio and total volume mixed into each cell
- In-situ acceptability test results for that week
- Laboratory acceptability test results for that week including testing certificates
- Minutes of site/progress meetings
- Description of any failures of acceptability tests and proposed remedial actions

3.6 Reinstating Sample Locations

Sample locations will be reinstated by backfilling with bentonite pellets that will be hydrated in situ.

4 Documentation

4.1 Document Collation

The CQA Engineer will document that the Specification has been satisfied during construction of the project. The CQA Engineer will maintain a site file of plans and specifications, checklists, test results, daily logs, record drawings, photographs and other pertinent documents. The CQA Engineer is to obtain from the Contractor the following documents:

- Sampling subcontractor Method Statement
- Laboratory details and accreditation certificates
- Weekly reports
- Construction drawings

The CQA Engineer shall promptly acknowledge receipt, review documentation and either acknowledge that the information is satisfactory or reject giving reasons.

Should the CQA Engineer not receive this information, or the information is unsatisfactory or not in compliance with this Specification, then the CQA Engineer shall reject the works related to the unsatisfactory/missing information, and the works shall not be allowed to proceed.

4.2 Daily Reports

The CQA Engineer shall obtain from the Contractor daily reports detailing:

- the number, location and unique ID of cells stabilised
- the mix ratios of all batches mixed
- the location and unique ID of any samples obtained
- the results of any laboratory or in situ testing, cross referenced to sample ID's
- location and results of repairs

In addition the CQA Engineer shall maintain a Daily Diary, which will contain:

- Prevailing weather conditions
- Contractor's plant and labour
- Work undertaken (cross referenced to grid/cell layout plan)
- Construction problems and solutions
- Record of site visitors
- Photographs of work progress

Upon completion of the works the CQA Engineer will prepare an 'as built' layout plan of the works that will be referenced to the site records, together with results of all testing carried out.

The CQA Engineer will prepare and forward a weekly report to the CQA Consultant.

All of the above will be forwarded as one complete package to the CQA Consultant on completion of the works, to be utilised for and included within the CQA Validation Report that will be prepared by the CQA Consultant.

4.3 CQA Validation Report

At the completion of the project, and once the CQA Consultant has received all the necessary and required data from the CQA Engineer, the CQA Consultant will provide to the Employer and to the Environment Agency, a signed Construction Quality Assurance Validation Report, which will outline the works undertaken in compliance with the Specification and CQA Plan. As a minimum it will include:

- Project description.
- Contractor's submissions.
- Daily logs/records as received from the CQA Engineer.
- As constructed drawings as received from the CQA Engineer.
- Testing Certificates.

5 REFERENCES

1) Docksway Landfill Site, Area 2 Engineering Design Philosophy. October 2004, Peter Brett Associates.

2) Docksway Disposal Site, Newport. Conceptual Model and Hydrogeological Risk Assessment for Area 2 – Landfill Extension. April 2005, Peter Brett Associates.

3) Docksway Landfill Site, Newport. Stage 2, Cell 1, Clay Lining Works. Construction Quality Assurance Validation Report. December 2006, Peter Brett Associates.

FIGURES

Appendix A

Appendix B