



PEN Y BONT (CHIRK) LANDFILL SITE

SURFACE WATER MANAGEMENT

SPECIFICATION

VERSION 2.0, JUNE 2017

466-NW-2017-SW2

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1 GENERAL REQUIREMENTS

1.1 Introduction

1.1 Introduction

FCC Environment (FCC) are seeking to install an approved Surface Water Management system for the Pen y Bont Landfill site.

Pen y Bont Landfill Site (the site) is centred on National Grid Reference SJ 293 416, and is located between the villages of Newbridge and Pentre within the Vale of Llangollan, approximately 9.5 km south of Wrexham.

The site address is:

Pen y Bont Landfill Site

Pen-y-Bont

Chirk, Wrexham

LL14 5AR

Pen y Bont Landfill was an operational landfill site, permitted to accept a range of non-hazardous and inert wastes as specified within the extant permit. The 'Installation' within the PPC boundary has a total area of approximately 21 ha, of which approximately 9 ha is used for waste deposition, i.e. the landfill. The site is now fully capped and restored as required in the permit. The 9ha waste area is capped with welded geomembrane and restored with restoration soils, seeding (primarily the north-western, northern and north-eastern flanks) and in some areas tree planting (north-western and northern flanks).

FCC has prepared this CQA Plan which includes the Engineering Specification for the construction works to be undertaken. The plan has been prepared in accordance with the Environmental Permit for the site.

This document details both the requirements for the construction works undertaken by the Contractor and the quality control procedures to demonstrate that the works have been undertaken in accordance with the Specification.

1.2 Project Team

The project team will comprise:

Client – FCC Environment

Employer – FCC Environment

Designer – FCC Environment

Principle Designer – FCC Environment

Principle Contractor – Jones Brothers

Constriction Quality Assurance – Sirius

1.3 Definitions

For the sake of clarification the following definitions are given:

Construction Quality Assurance (CQA) – A planned and systematic pattern of all means and actions designed to provide confidence that items or services meet contractual and regulatory requirements, and will perform satisfactorily in service.

Construction Quality Assurance refers to means and actions employed by the CQA Inspector, to assure conformity of the lining system preparation, production, and installation to this CQA Plan and Specifications. FCC shall appoint a CQA Consultant prior to commencing each phase of construction.

Construction Quality Control (CQC) – Those actions which provide a means to measure and regulate the characteristics of an item or service to contractual requirements.

Construction Quality Control refers to those actions taken by Manufacturers, Contractors, or the Employer to ensure that the materials and the workmanship meet the requirements of the CQA Plan and Specifications.

Employer – means the person or persons, firm or company or other body who own and have responsibility for the facility. For the works undertaken at the Site, the Employer is FCC. The FCC has entered/will enter into a contract with a Contractor for the execution of the works detailed in the CQA Plan and Specification. FCC may be represented on site by personal representatives or other parties, e.g. the CQA Inspector.

Clients - are organisations or individuals for whom a construction project is carried out.

- Make suitable arrangements for managing a project. This includes making sure: other duty holders are appointed;
- Sufficient time and resources are allocated.
- Make sure: relevant information is prepared and provided to other duty holders;
- the principal designer and principal contractor carry out their duties;
- welfare facilities are provided

Designers - are those, who as part of a business, prepare or modify designs for a building, product or system relating to construction work.

- When preparing or modifying designs, to eliminate, reduce or control foreseeable risks that may arise during: construction;
- and the maintenance and use of a building once it is built.
- Provide information to other members of the project team to help them fulfil their duties.

Principal designers - are designers appointed by the client in projects involving more than one contractor. They can be an organisation or an individual with sufficient knowledge, experience and ability to carry out the role.

-
- Plan, manage, monitor and coordinate health and safety in the pre-construction phase of a project. This includes: identifying, eliminating or controlling foreseeable risks;
 - Ensuring designers carry out their duties.
 - Prepare and provide relevant information to other duty holders.
 - Provide relevant information to the principal contractor to help them plan, manage, monitor and coordinate health and safety in the construction phase.

Principal contractors - are contractors appointed by the client to coordinate the construction phase of a project where it involves more than one contractor.

- Plan, manage, monitor and coordinate health and safety in the construction phase of a project. This includes: liaising with the client and principal designer;
- preparing the construction phase plan;
- Organising cooperation between contractors and coordinating their work.
- Ensure: suitable site inductions are provided;
- reasonable steps are taken to prevent unauthorised access;
- workers are consulted and engaged in securing their health and safety; and
- welfare facilities are provided.

Contractors - are those who do the actual construction work and can be either an individual or a company.

- Plan, manage and monitor construction work under their control so that it is carried out without risks to health and safety.
- For projects involving more than one contractor, coordinate their activities with others in the project team – in particular, comply with directions given to them by the principal designer or principal contractor.
- For single-contractor projects, prepare a construction phase plan.

Workers - are the people who work for or under the control of contractors on a construction site.

They must:

- be consulted about matters which affect their health, safety and welfare;
- take care of their own health and safety and others who may be affected by their actions;
- report anything they see which is likely to endanger either their own or others' health and safety;
- cooperate with their employer, fellow workers, contractors and other duty holders.

Specification – means that part of the Contract entered into between FCC and the Contractor which sets out FCC's detailed requirements as to how the works should be constructed, tested, measured and quality assured. The Specification forms part of this CQA Plan.

1.4 Facilities

1.4.1 Contractor's Compound

The location and layout of the Contractor's compound shall be agreed with FCC prior to commencement of any works on site. The Contractor shall submit his proposals to FCC for mess

facilities, plant standing, and maintenance areas. The Contractor shall site his plant standing, maintenance and refuelling areas in an enclosed area so that no pollution will escape. 110% secondary containment bunding shall be used for fuel/oil storage tanks where appropriate, with appropriate Health, safety and environmental protection to cover issues related to delivery and disposal of fuel/oil. The Contractor shall also take into account the storage and mess requirements of his sub-contractors, if appropriate.

No lodgings or caravans will be allowed on site.

The Contractor shall ensure that adequate provision is made within the compound area for parking of all the plant, equipment and any private vehicles owned by operatives/subcontractors and visitors. Parking will not be permitted in any other areas of the landfill site.

The Contractor shall be responsible for the security of the works, all the Contractor's offices, plant, materials, services and machinery.

1.4.2 Contractor's Offices and Welfare Facilities

The Contractor shall be responsible for the provision and maintenance of welfare facilities for himself and any sub-contractors. These facilities shall be as prescribed in the Working Rule agreement published by the Civil Engineering Construction Conciliation Board for Great Britain. The sanitary accommodation and disposal arrangements shall comply with the requirements of the local Environmental Health Authority. The Contractor's personnel shall not be permitted access to FCC's mess, shower and toilet facilities.

1.4.3 Fuel and Oil Installations

The Contractor's fuel and oil installations within the site shall only be provided at locations approved by FCC, such approval not to be unreasonably withheld or delayed.

All fuel and oil installations provided by the Contractor within his compound shall be contained within an impermeable bund capable of containing 110% of the tank capacity in the event of a spillage; 'self-bunded' items will be permitted, subject to the Contractor being able to substantiate their efficacy. All fuel/oil/chemical storage will also be accompanied with appropriate Health, safety and environmental protection to cover issues related to the delivery and disposal of fuel/oil and not just its onsite use.

The Contractor shall designate an area within his compound for carrying out plant maintenance and repairs. The Contractor shall ensure that all routine maintenance and repairs take place within this area. Any fuel or oil spillages will be remediated in a safe and controlled manner by the Contractor and at his expense.

1.4.4 Facilities for CQA Inspector

The Contractor shall provide, service and maintain one high-security steel ISO container, or as otherwise provided for, for the sole use of the CQA Inspector within the agreed location of his compound, subject to the approval of the CQA Inspector, which shall not be unreasonably delayed or withheld. The Contractor shall ensure that the container is provided with power supply, sufficient

electricity power sockets, electric lighting and space heating, such that it will be ready for use by the CQA Inspector on the first day that CQA work is required. The Contractor shall be responsible for the maintenance of these facilities throughout the duration of the works.

All keys for the CQA Inspector's facilities shall be handed to the CQA Inspector.

1.5 Landfill Gas and Leachate Management Systems

FCC has installed landfill gas and leachate management systems across the site, including areas within and adjacent to the works. FCC shall inform the Contractor which systems are to remain undisturbed during the period of the works, and which can be, or have been, decommissioned.

The gas extraction system at the site is operated by Infinis, who will advise (through FCC) on matters relating to the gas extraction system. However, FCC shall remain the Contractors point of contact for the works. Infinis are to be given a minimum of two days' notice where movements in the gas system are required, and it will be the Contractors responsibility to liaise with FCC in sufficient time to allow such movements to be carried out.

Should the Contractor subsequently damage or disturb any operational system, he shall immediately inform FCC. Only if required by FCC, the Contractor shall carry out such reasonable remedial measures as are deemed necessary by FCC to reinstate any damaged or disturbed system to the same condition as immediately prior to commencement of the works, otherwise FCC shall provide for the remediation to be completed within a timescale to be agreed with the Contractor.

1.6 Environmental Permit

The area of the works is encompassed by the extant Environmental Permit, Number GP3830BG. For the current landfill. The Contractor shall not directly or indirectly compromise FCC's ability to carry out its operations in accordance with the Permit, a copy of which shall be provided by FCC on request.

1.7 Existing Services

As an active landfill site there are a number of services across the site, drawing 466S226A-Plan 5 in the appendix is the current services plan for the site. The contractor however is responsible for surveying all working areas to reduce the risk of service strikes with unknown services.

Any services identified that are not shown on the plan provided need to be brought to the attention of the FCC site manager and the FCC Design team.

2 CONSTRUCTION REQUIREMENTS

2.1 Regulations and Site Safety

The works come under the Construction (Design and Management) Regulations of 2015 and the Main Contractor will also be appointed as the Principal Contractor.

The Contractor shall comply with the safety requirements set out in the following documents:

- FCC - Health and Safety Policy,
- FCC - Site User Safety Instructions.

A copy of these documents is available for inspection at the landfill site office.

The Contractor shall adhere to the site Health and Safety Rules and the DSEAR Regulations dated 2002. The Contractor's performance with respect to these rules will be reviewed at each progress meeting.

2.2 CDM Area

The extent and location of the CDM area shall be agreed with FCC prior to any works commencing on-site, and 'works' shall include the delivery of any plant, equipment, materials and/or accommodation.

The agreed area shall be demarcated on site and once demarcated; the Principal Contractor shall ensure that the requirements of the CDM Regulations 2015 are adhered to at all times within it.

2.3 Method Statements and Risk Assessments

The Contractor shall submit to FCC for the approval, prior to commencement of the works, method statements and risk assessments detailing the proposals for all the works to be undertaken.

2.4 Substances Hazardous to Health

A substance hazardous to health shall only be used or generated in or about the works where specified in the Contract or with the consent of FCC

Where any substance hazardous to health is so used or generated during the works the Contractor shall provide FCC with:

- A copy of the assessment of the risks created by the use of that substance; and
- Details of the measures to be taken to prevent or adequately control the exposure of the persons working with or those who may be affected by the substance.

The information required in the above shall be provided to FCC at least 14 days prior to the use of or incorporation into the works of substances hazardous to health or where appropriate at the commencement of the works where this is less than 14 days.

The Contractor shall advise FCC of the information, instruction, training and supervision to be provided for the Contractor's personnel and any other person likely to enter the area in which the hazard exists. The Contractor is to ensure that provision is made for monitoring health.

Where the measures referred to necessitate the use of protective clothing or other safety apparatus the Contractor shall:

- Provide FCC and his staff with sufficient and suitable items of protective clothing and safety apparatus if not previously supplied;
- Arrange for the proper storage, maintenance and regular testing and replacement of the items provided to the Employer and his staff; and
- Arrange for appropriate training or instruction for FCC and his staff in the use of such items.

2.5 Noise

The Contractor shall comply with any site specific noise limits and the following specific requirements:-

- No work other than the operation of plant and equipment for the control of the groundwater shall take place outside the permitted hours except in case of emergency. FCC shall be informed of any such emergency immediately.
- All mobile plant, equipment and vehicles under the control of the Contractor, his sub-Contractors and suppliers, and in use or calling at the site, shall be fitted with appropriate silencing equipment and shall be maintained to manufacturers' standards.

2.6 Naked Flames and Smoking

Naked flames are prohibited within the working area on site at all times. Smoking will only be permitted in areas approved by FCC.

The Use of E-cigarettes will be permitted in the following circumstances:-

- During normal breaks
- If staff have their own office and are alone
- Outside away from any designated smoking areas but away from main entrances to buildings

This is to recognise that it is unfair to subject non-smokers/vapers to vapour cloud therefore vaping will not be allowed in any open plan or multi use offices or during meetings

The Contractor shall obtain a permit to work from FCC for any 'hot works'. The works are to be carried out away from the landfill area and at a location agreed with FCC.

2.7 Mobile Plant

All Contractors vehicles (plant and operatives vehicles) shall be fitted with flashing amber beacons for vehicle awareness. Green flashing beacons to indicate that seat belts are in operation shall also be fitted to all construction plant. These beacons shall be located in a visually prominent position and shall be used whenever vehicles are on site. No Contractors vehicles will be allowed on site without the use of a flashing amber beacon.

All mobile plant shall be assessed for restricted rear view vision and action agreed, dependent upon the outcome of this assessment, which may result in suitable equipment being fitted in order to minimise the potential risk to within acceptable limits.

2.8 Dust Nuisance

The Contractor shall take all necessary steps to eliminate the generation of dust nuisance during the works.

Existing highways, site and access roads used by the vehicles and plant of the Contractor or of his sub-Contractors or suppliers of materials, shall be kept clean and clear of all dust and mud dropped by the vehicles in any form. All dust and mud from the works spreading onto highways, site and access roads shall be immediately cleared by the Contractor by use of mechanical plant to the approval of FCC.

Compliance with this clause shall not relieve the Contractor of any responsibility for complying with the requirements of any Highway Authority in respect of keeping roads clean.

2.9 Communication Systems

The Contractor shall obtain the approval of FCC prior to the commissioning of any communication equipment and, following approval, shall ensure that it does not interfere with any existing systems on the site.

2.10 Access

The general arrangement of the site is shown on the respective site layout drawings. The only entrances to the works for the use of the Contractor are via the main site entrance, no other site entrances are to be used unless stated in the Specification. Areas for site offices, welfare facilities and plant standing areas will be arranged with FCC.

The main access road is to be kept clear at all times, as it will be used primarily by FCC's operations traffic. The Contractor will need to make provision for providing suitable access within the site, in particular between borrow areas, stockpile areas and the Contractors compound.

The Contractor must not use the access roads used by FCC for access into active cells unless given prior permission of FCC. Alternative access roads must be used or constructed, the locations of which shall be agreed with FCC prior to work commencing.

The Contractor shall carry out jointly with FCC a condition survey of the access roads made available under the Contract prior to the commencement of any works. The Contractor shall repair and make good any damage to FCC's landfill access roads which occur as a result of the Contractor's activities.

The Contractor's vehicles must give way to landfill traffic and not impede the movement of the traffic involved in landfill operations.

The specified speed limits within the landfill site shall be observed at all times. Noncompliance may result in the exclusion of any offender from the site.

Appropriate signage must be displayed to warn traffic of slow moving plant, particularly if the haul road access crosses the main access road. All vehicles leaving the site must be free from mud and debris. The Contractor will be responsible and will pay for the removal of debris and any damages arising from mud and debris that leaves the site as a consequence of the works.

2.11 Control of Surface Water

The Contractor shall carry out all necessary operations for the control of standing water, or surface water run-off, within the CDM area to enable the construction of the works, and by doing so shall prevent damage to the works, the site, or adjoining properties. Where these actions include measures to prevent the in-flow of water from the site, these works shall be approved by FCC before commencement.

Any water shall only be discharged outside the CDM area and/or off-site following the receipt of approval by FCC.

2.12 Control of Leachate

The Contractor shall carry out all necessary operations for the control of leachate, within the CDM area to enable the construction of the works, and by doing so shall prevent damage to the works, the site, or adjoining properties. Where these actions include measures to prevent the in-flow of leachate from the site, these works shall be approved by FCC before commencement.

Any leachate collected shall only be discharged outside the CDM area and/or off-site following the receipt of approval by FCC.

2.13 Disposal of Exhumed Waste

In the event that it is necessary to excavate waste in order to achieve any element or elements of this specification, the excavated waste will be disposed of in the operational area of landfill, or as otherwise directed by FCC.

2.14 Protection of Boreholes

The Contractor shall locate and adequately protect existing deep ground water and landfill gas monitoring boreholes within the works area from damage during the works. The locations of the boreholes are to be confirmed with FCC.

2.15 Inclement Weather

No materials shall be placed or compacted during inclement weather conditions, if in the opinion of FCC, trafficking over compacted or uncompacted material would prove detrimental to the construction. Any such trafficking damage caused by the Contractor shall be repaired in accordance with the Contract at the Contractor's expense. Inclement weather conditions may include, rain, snow, freezing conditions or excessive heat as indicated by FCC.

Following wet weather conditions, any standing water on the surface of the construction must be removed at the Contractor's expense. If instructed by FCC, the Contractor shall remove any material rendered unsuitable by wetting at the Contractor's expense. Earthworks placement operations following inclement weather conditions shall not proceed without the prior approval of FCC.

Any frozen material shall be allowed to thaw before use. Previously compacted material that has become frozen shall be removed from the works and stockpiled until suitable for reuse.

2.16 Tolerance limits

Tolerance limits for the work shall be as follows:

- i) Positions in plan shall be within 50 mm of the true positions shown on or calculated from the drawings.
- ii) Levels shall be + 50mm of the required elevation shown on or calculated from the drawings.
- iii) For other survey tolerances and Survey Guidance please refer to the Good Practise Guide V6.0

2.17 Confidentiality

The whole of the Tender Documents and all information provided by FCC for the purpose of or in connection with the Contract shall be dealt with by the Contractor as confidential to him and not be disclosed by him other than to his employees, sub-contractors or agents as appropriate for the sole purpose of the Contract.

The Contractor shall not, except with the prior consent in writing of FCC:

- i) Publish or advertise or permit to be published or advertised any photograph, drawing or written matter concerning the Contract or the works.
- ii) Use or permit the use of the name of FCC in any publication or advertisement.
- iii) Place any advertisement on any part of the works.

The Contractor shall refer all press representatives to FCC. Photographs for publication shall not be made of any part of the works without the prior written authorisation of FCC. Such authorisation if granted shall be in the form of itemised approvals for each exposure concerned.

3 CQA SUPERVISION

3.1 General

The CQA Project Team will comprise the following:

The CQA Manager - Will be office based and responsible for the following:

- Administration of the CQA program;
- Attendance at selected progress or liaison meetings and is the key contact with regulatory officers;
- Production of the CQA Validation Report.

The CQA Inspector – The representative of the CQA Manager located full time at the site during works requiring CQA supervision and responsible for the following:

- The on-site representative of the CQA Manager;
- To be fully familiar with all CQA requirements for the project;
- Attendance at all CQA related meetings (e.g. Pre-construction and Progress);
- Preparation, or overseeing the on-going preparation of the as-built drawings;
- Assigning locations for testing and sampling;
- Keeping daily reports and records;
- Reporting to the CQA Manager any relevant observations;
- Reviewing the results of laboratory testing and making appropriate recommendations;
- Reporting any unresolved deviations from this CQA Plan to the CQA Manager;
- Provision of all records and relevant data to the CQA Manager for the preparation of the final validation report, which will be submitted to Natural Resources Wales for approval upon completion of the works; and
- Noting and bringing to the attention of the Contractor any on-site activities that could result in damage to the lining system.

Staff undertaking the roles of the CQA Manager and the CQA Inspector should have relevant experience in landfill construction and earthworks control or be supervised by experienced staff until relevant experience is obtained. The CV's of the CQA Project Team shall be supplied to Natural Resources Wales prior to commencement of the works. Should changes to CQA personnel be required, Natural Resources Wales shall be immediately notified and the respective CV shall be issued.

3.2 Daily Meetings

Meetings will be held daily between the CQA Inspector and the Contractor's representative. The purpose of which is to:

- Review the work activities and locations for that day;
- Note the Contractor's installation personnel and plant for the day/shift;
- Review the previous days progress;
- Review the work schedule;
- Discuss any interfacing with other contractors and/or site operations; and
- Discuss/highlight any problems and identify solutions.

3.3 Site Visits

It is anticipated that from time to time Natural Resources Wales will visit the site to review the works. During these visits the CQA Inspector shall make available all test results and daily records up to that date for inspection by Natural Resources Wales.

Any issues encountered during the construction should be discussed with the NRW upon arrival to site prior to any subsequent site walkover and that the CQA Inspector / FCC shall discuss the problems encountered and discuss any proposed remediation methods

3.4 CQA Requirements

The CQA requirements associated with each component of the works are detailed in the individual sections below.

3.5 Design Changes

Any design changes required to ensure the suitability of the construction works shall be referred to FCC prior to discussions with Natural Resources Wales for approval.

4 SCOPE OF THE CONSTRUCTION WORKS

4.1 General Description

The design concepts for the surface water management construction were developed to accord with the Permit for the site.

The position of the proposed development in relation to the landfill area is shown on Drawing 466-NW-2017-SW–Plan 1.

Construction of the Surface water drainage works to be performed by the Contractor comprise those works listed below:

- Setting-out as necessary for the works;
- Site clearance (including temporary movement and replacement or re-positioning of all gas, leachate, and compressed air pipework, in conjunction with the Project Manager and Employer's staff) and all temporary access requirements necessary for undertaking the works;
- Construction (and re-profiling, where necessary) of existing surface water collection ditches, including management/diversion of surface-water during entire works, including repair/construction of a piped culvert;
- Construction of 500mm high Cap deflection bunding
- Installation of New bund to the Attenuation ponds and removal of existing culverts
- Construction of Ditch 1 - 1.0m x 0.5m ditch
- Construction of Culvert 1 - 1.0mx0.5m box culvert with slab protection above with sandbag headwalls at both ends
- Construction of Ditch 2 - 1.0m x 0.5m ditch
- Construction of Ditch 3 – 0.5m x 0.5m ditch
- Construction of Culvert 2 - 0.5m diameter culvert with slab protection above with sandbag headwalls at both ends
- Construction of new 800m³ Attenuation basin with gravel low flow channel
- Construction of Culvert 3 - 0.15m diameter culvert with Althon H3c headwall with sandbag headwalls at Outlet
- Construction of Ditch 4 – 0.5m x 0.5m ditch
- Construction of Culvert 4 – Triple 0.525m diameter culvert with slab protection above with sandbag headwalls at both ends
- Construction of Ditch 5 – 1.0m x 1.0m ditch
- Construction of Culvert 5 – Triple 0.525m diameter culvert with slab protection above with sandbag headwalls at both ends
- Construction of Ditch 6 – 0.5m x 0.5m ditch
- Construction of Ditch 7 – 1.0m x 1.0m ditch
- Installation of new 200mm Isolation valve with the existing automated monitoring system
- Construction of 200mm overflow with Sandbag outlet headwall
- Clearing vegetation and debris from existing Filtration/infiltration beds

4.2 Principal Quantities

The principal quantities for the works are given in Appendix 1.

4.3 Survey Information

The Contractor shall undertake an initial survey on a 10m grid spacing and at breaks of slopes, of the site area, this shall be compared to existing surveys, and once approved by FCC, the Contractor's survey will form the 'original ground level survey' (OGL) from which the measurement of the works will be undertaken. Further surveys will be required as follows;

1. Position (and invert levels) of all surface water ditches, ponds, basins and pipework, on a 5m grid spacing and at breaks of slopes.
2. Detailed levels for the orifice and headwalls and outlets

4.4 Daily Journal

The Contractor will be required to keep a detailed daily journal recording the information detailed below. The Contractor will give FCC reasonable access to the daily journal which will, if necessary, be made available to FCC, NRW or any other Authority during and after completion of the Works if required. The Contractor will forward copies of the daily journals on a weekly basis to the FCC.

This information shall be recorded in an acceptable form of daily journal which shall include the following:

- date of shift;
- names of personnel in attendance during the shift;
- weather conditions, including ambient temperature;
- type of plant used; plant breakdowns and hours;
- approximate totals of earthworks carried out including identification of source and destination;
- removal of foreign matter and oversize material;
- summary of field and laboratory testing carried out;
- sample type and material taken for particular testing;
- delays;
- additional works, reasons and reference;
- deliveries;
- details of meetings and other correspondence;
- details of remedial works; and
- any other relevant information.

5 EARTHWORKS REQUIREMENTS

5.1 General

The compaction of engineered fill materials shall be carried out in accordance with the Highways Agency “Manual of Contract Documents for Highway Works (MCDHW) – Volume 1 Specification for Highway Works” 2009 Series 600 Earthworks, published by HMSO except as amended hereunder. The Contractor shall employ only that plant and those working methods that are suited to the materials to be handled and traversed. He shall be responsible for maintaining the nature of the suitable material so that when it is placed and compacted it remains in accordance with the Contract. Suitability shall be determined in accordance with the definitions below.

The Contractor shall submit his proposals to FCC regarding the extent and management of the excavations, stockpiling and filling of materials before starting works. Excavations shall not proceed without the prior approval of FCC.

The Contractor shall not remove any materials from the site unless approved by FCC.

After completion of the works, the Contractor is required to re-grade any stockpiles and surrounding areas where deemed necessary. This shall be carried out to the satisfaction of the CQA Inspector.

5.2 Definitions

The following definitions shall apply to the specifications wherever reference is made to the defined engineered fill material.

- “Suitable fill material” shall comprise all that is acceptable in accordance with the Contract for use in the works and deemed by FCC to be suitable;
- “Unsuitable material” shall mean material other than suitable materials and shall include:
 - Peat, material from swamps marshes and bogs;
 - Logs stumps and perishable material;
 - Material in a frozen condition; and
 - Material susceptible to spontaneous combustion.
- “rock” shall be deemed to mean hard material which, in the opinion of the Project Manager, necessitates for its loosening or removal the use of special machinery designed for rock cutting, but shall exclude any material that can be removed by normal excavating machinery and which, in any case, has a volume not exceeding 1 cubic metre or 0.25 cubic metres where the net width of the excavation is less than 2 metres.

5.3 CQA Requirements

The CQA Inspector shall:

- The CQA Inspector shall do a walkover survey prior to the Surface water asset construction to advise on the remediation of any soft spots or unsuitable material that may have a detrimental effect on the design.
- Assess the method statement submitted by the Contractor for the installation of SW Assets
- Ensure that all material within the working area deemed unsuitable in accordance with the specification is removed to an area agreed with FCC's Site Manager;
- Monitor the placement and compaction of the materials , ensuring that the works are carried out in accordance with the Specification and the required depth is attained
- Monitor that ditches are constructed to the minimum requirements set out in the Specification and that minimum falls are achieved
- Ensure that any deviations from the specification are documented with dates and people involved recorded, along with changes to designs
- Ensure that all areas of non-compliance are remediated in accordance with the specifications;
- Take photographs during the construction; and
- Ensure that surveys are undertaken in accordance with the specifications to confirm that the requisite levels have been achieved.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

6 ATTENUATION

6.1 Updating of Lagoons 1, 2, 3

The proposed lagoon area is currently a series of 3 unlined settlement lagoons with limited attenuation capability

6.1.1 New Bund

Surrounding the existing lagoons a new 0.5m high bund will be installed to provide a minimum top perimeter level of 54.5m AoD.

The bund is to be constructed using impermeable engineered clays and compacted to produce a bund suitable for retaining water. Once completed the bunds are all to be hydro-Seeded

All material extracted needs to be removed and only materials suitable for engineering the retention bund are to remain. Any material to be removed is to be deposited in a suitable area approved by FCC and the CQA engineer.

6.1.2 Replace Culverts

The 3 lagoons are joined by existing culverts. These culverts are to be replaced with a 1m wide channel with 1:1.5 side slopes. Inverts of the new channel are to match the existing inverts of the culverts being removed. Once completed the channels left are all to be hydro-Seeded.

Any material to be removed is to be deposited in a suitable area approved by FCC and the CQA engineer, but if suitable could be used as part of the bund material

6.2 Maintenance for Filtration/Infiltration area

6.2.1 New Outlet Isolation Valve

The outlet system for the site discharges to 3 filtration/infiltration basins. This is fed from overland 200mm pipework and requires a new 200mm inline isolation gate valve to prevent discharge from entering these basins in the event of an emergency. The isolation valve needs fitting before the triple distribution system.

In the event of the filtration beds being taken offline a second isolation valve is needed on the outlet leg to the river, as shown on drawing 466-NW-2017-SW-Plan 1 this should remain closed unless the filtration beds are not operational.

6.2.2 Filtration/Infiltration area

The existing Filtration/Infiltration area is to be cleared of any vegetation larger than grass and all bunds are to be maintained to ensure a minimum 0.5m high bund level or a level of 52.35m AOD whichever is greater

New bund connection channels are to be installed in to the bunds to hydraulic link them and allow the overflow system to work, these channels need to be 1m wide with 1:1 side slopes to allow water to pass freely between the basins.

6.2.3 New overflow

The final basin will have a 200mm overflow to provide a method of controlled discharge to the river in the event of an extreme event exceeding the capacity of the basins. The overflow will be a 200mm pipe with a concrete filled sandbag headwall built on the bund edge of the basin as shown on drawing 466-NW-2017-SW-Plan 1.

6.3 CONSTRUCTION OF PROPOSED BASIN

The basin area is to be constructed in line with the drawings 466-NW-2017-SW-Plan 1.

The basin side slopes shall be set at 1:4 going to a depth of 1m. The Basin is designed to be a dry attenuation basin with the potential to store 800m³. The outlet for the lagoon outlet is set at 73.800m AoD with the top of lagoon set at 75.000m AoD.

The lagoon base and sidewalls are to be constructed in the local clay soils it is situated in. As the natural soil beneath is an impermeable clay it is not proposed that a liner will be needed.

6.3.1 Basin Formation

The CQA Inspector should be satisfied that the resulting foundation layer is firm and unyielding. Where recycled material is used the CQA Inspector should be satisfied of the homogeneity of the material, to avoid differential compression.

In order to ascertain the suitability of the formation and bunds as a suitable material. The CQA Inspector may request the contractor to produce a compaction trial, which may be subject to destructive examination at the CQA Inspector's request, Should the nature of the soils or recycled material significantly change throughout the works, the CQA inspector may request further trials to be carried out.

The surface of the formation shall be smooth and free from debris, roots, angular or sharp rocks and any other deleterious materials. Any such deleterious material shall be removed from the surface and any resulting depression repaired to the CQA Inspectors satisfaction. The surface shall be rolled and compacted such that in any event it provides a firm unyielding surface and shall have no sudden sharp or abrupt changes in grade, and shall be free from areas excessively softened by high water content.

As the natural soil beneath is an impermeable clay it is not proposed that a liner will be needed.

The lagoon side bund will be constructed of suitable engineering material and compacted to be impermeable. Compaction on this bund is to be tested by the CQA engineer for suitability. Material in this area is to be keyed into the base soils to ensure no slip plane exists.

6.3.2 Low Flow Channel

The low flow channel in the basin is to allow small volumes of water to pass through the basin. The Channel is to be 1m wide and 200mm deep and lined with a separation geotextile and filled with clean Angular stone. Refer to drawing 466-NW-2017-SW-Plan 3 for more details

6.3.3 Outlet

The basin area is to be constructed in line with the drawings 466-NW-2017-SW-Plan 1.

The outlet for the lagoon outlet is set at 73.800m AoD with the top of lagoon set at 75.000m AoD. The outlet will be a precast concrete headwall with a 150mm outlet pipe to restrict flow in line with the surface water management plan for the site.

6.3.4 Basin Planting

It is not proposed to plant or import any wildlife or vegetation into the proposed lagoon. The Basin will be hydro-seeded to provide a grass bowl and the low flow path will be left to naturally seed and encourage life from the surrounding environment.

7 CARRIER DRAIN CONSTRUCTION

7.1 New Pipework Construction

7.1.1 Culvert 1

The proposal for the 1.0m wide 0.5m deep concrete box culvert laid at a fall to connect Ditch 1 under the access road. This culvert will originate at a concrete sandbag headwall and will discharge via a concrete sandbag headwall. The culvert is to be jointed using proprietary collars and rubber seals, and laid in accordance with the levels shown on Drawing 466-NW-2017-SW-Plan 1 and the details included on drawings 466-NW-2017-SW-Plan 3. The culvert shall be installed within a trench with a concrete slab protection. The culvert shall be installed in accordance with the details provided on the drawings and the best practice set out in Sewers for Adoption 7th Edition, CESWI and BS EN 752

Parameter	Requirement
Pipe Internal Diameter	1.0m x 0.5m box culvert
Pipe Type	Reinforced Concrete
Joint Type	Collars or Rubber Seal
Pipe System Fall	To suit identified falls
Pipe Bedding	Concrete slab protected

7.1.2 Culvert 2

The proposal for the 150mm culvert laid at a fall to connect the basin to ditch 4. This culvert will originate at an Althon H3C Precast concrete headwall and will discharge via a concrete sandbag headwall. The culvert is to be jointed using proprietary collars and rubber seals, and laid in accordance with the levels shown on Drawing 466-NW-2017-SW-Plan 1 and the details included on drawings 466-NW-2017-SW-Plan 3. The pipe shall be installed within a trench with a concrete bed and surround. The culvert shall be installed within a trench with a concrete slab protection. The culvert shall be installed in accordance with the details provided on the drawings and the best practice set out in Sewers for Adoption 7th Edition, CESWI and BS EN 752

Parameter	Requirement
Pipe Internal Diameter	150 mm
Pipe Type	Twinwall PE / Concrete
Joint Type	Collars or Rubber Seal
Pipe System Fall	To suit identified falls and remain buried a minimum of 500mm to crown
Pipe Bedding	Type B bedding

7.1.3 Culvert 3 and 4

The proposal for the triple 525mm culvert laid at a fall to connect the final ditches. These culverts will originate at a concrete sandbag headwall and will discharge via a concrete sandbag headwall. The culvert is to be jointed using proprietary collars and rubber seals, and laid in accordance with the levels shown on Drawing 466-NW-2017-SW-Plan 1 and the details included on drawings 466-NW-2017-SW-Plan 3. The pipe shall be installed within a trench with a concrete bed and surround. The culvert shall be installed within a trench with a concrete slab protection. The culvert shall be installed in accordance with the details provided on the drawings and the best practice set out in Sewers for Adoption 7th Edition, CESWI and BS EN 752

Parameter	Requirement
Pipe Internal Diameter	525 mm
Pipe Type	Twinwall PE / Concrete
Joint Type	Collars or Rubber Seal
Pipe System Fall	To suit identified falls
Pipe Bedding	Concrete slab protected

7.1.4 200mm Lagoon outfall pipework

The final outfall is a 200mm over ground pipe culvert laid to discharge from lagoon 3 and into the 3 filtration/infiltration beds. The pipework is mainly intact but sections towards the river outfall needs to be modified along with a new overflow to the beds. All pipework is to be jointed using proprietary welded collars, and laid in accordance with the levels shown on Drawing '466-NW-2017-SW-Plan 1 and the details included on drawings 466-NW-2017-SW-Plan 3'. The pipe where buried shall be installed within a trench and with a gravel bed and surround. The culvert shall be installed in accordance with the details provided on the drawings and the best practice set out in Sewers for Adoption 7th Edition, CESWI and BS EN 752

Parameter	Requirement
Pipe Internal Diameter	200 mm
Pipe Type	HDPE
Joint Type	Welded
Pipe System Fall	To suit identified falls
Pipe Bedding	Gravel bed and surround where needed

The Overflow outfall is to be a concrete sandbag headwall with a welded connection to the river outfall pipework

7.2 200mm Isolation Valve

The existing outfall has an isolation gate valve to restrict flow from the offsite discharge to the Filtration/infiltration beds, however this valve is not working fully and needs to be replaced. As we also have a river outfall we do not want to use under normal conditions the river outfall diversion pipework will also need a new isolation gate valve which will be shut to keep flow entering the filtration/infiltration beds unless they need to be taken off line.

Valves will need to be to Sewers for Adoption 7th edition standard for clean water isolation and will need to be fitted with permanent shut off wheels

8 DITCH CONSTRUCTION

8.1 Existing Ditches

The site currently has an active drainage ditch system mainly around the north western side and in some of the southern areas of the capped site. The Existing Ditch 2 system to the south to be retained has recently been cleared and is checked and maintained by site and will not require work in this plan.

Existing ditches (1 and 3) indicated on drawing 466-NW-2017-SW-Plan 1 requiring work will need to be re-profiled to suit the minimum dimensions indicated on the drawing. Any vegetation larger than grass is to be removed from the base and side walls. Once completed the ditch repairs are to be hydro-Seeded Leaving a grass lined profile with a minimum ditch profile indicated.

8.2 New Onsite Cap Bund

The proposed surface-water collection bund shall be constructed in accordance with the Dimensions shown on Drawing 466-NW-2017-SW-Plan 1 and the detail drawing 466-NW-2017-SW-Plan 3. The bund will be constructed using cohesive material and lined with a UV resistant LLDPE welded liner. Lining to be in line with the welding chapter identified in this specification

8.3 New Onsite Ditches

The proposed surface-water collection ditches shall be constructed in accordance with the Dimensions shown on Drawing 466-NW-2017-SW-Plan 1 and the detail drawing 466-NW-2017-SW-Plan 3. All ditches shall be constructed with a minimum fall of 1:250 unless stated otherwise, but in most cases will follow the steeper natural fall of the landform. Excavated material is to be placed against the cap to provide a more even profile. Once the ditches are constructed they are to be Hydro seeded to produce a final grass lined system.

8.4 Setting Out

The exact alignment of ditches is to be confirmed with the project designer and the CQA Engineer on site, to reflect the latest topography (due to the latent effects of waste consolidation on surface levels), but is to be closely in accordance with the positions shown on Drawing 466-NW-2017-SW-Plan 1.

9 GEOMEMBRANE LINING

9.1 General

The approved surface of the regulating layer shall be covered with a welded, double textured, 1 mm thick LLDPE / HDPE geomembrane. The geomembrane shall be supplied in accordance with the following specification and installed in accordance with Drawing 466-NW-2017-SW-Plan 1.

The Contractor shall be required to undertake the following:

- Supply and install a welded, textured, 1 mm thick, LLDPE / HDPE geomembrane on the approved surface of the restoration layer;
- Tie the geomembrane into existing capping or basal lining previously installed at the site; and
- Provide all material quality control certificates and other information described below.

9.2 Contractor's Experience

The liner installation Contractor or Sub-Contractor shall have considerable experience of installing geomembrane of the type specified for the works. The Contractor shall submit a summary of the experience of the proposed liner installation Contractor with the specified materials including an estimate of the total area installed by him in the United Kingdom over the past 3 years.

9.3 Geomembrane Material

The geomembrane will consist of double textured 1.0 mm thick LLDPE / HDPE produced from new resins and containing no fillers, plasticisers or additives of any kind with the exception of carbon black. The surface shall be un-laminated and free from blemishes, abrasions or other surface imperfections.

The geomembrane will conform to the parameters established as given in Table 2 below.

Table 2: Geomembrane Specification

	Parameter	Test Method	Requirement	
			LLDPE	HDPE
1	Thickness	ASTM D5994	1.0 mm (nom -5%) 1.0 mm (-10%, 8 out of 10) 1.0 mm (-15% lowest value)	1.0 mm (nom -5%) 1.0 mm (-10%, 8 out of 10) 1.0 mm (-15% lowest value)
2	Density	ASTM D1505A	< 0.939 g/ml	>0.940 g/ml
3	Carbon Black Content*	ASTM D1603	2% to 3%	2% to 3%
4	Carbon Black Dispersion	ASTM D5596	9 of 10 in cat 1 or 2 1 of 10 in cat 3	9 of 10 in cat 1 or 2 1 of 10 in cat 3
5	Texture Asperity Height	GRI GM12	>0.40 mm (min. ave.)	>0.40 mm (min. ave.)
6	Tensile Properties: Yield Strength Elongation at Yield Break Strength Elongation at Break	ASTM D6693 Type IV	- - > 11 N/mm > 250%	>15 N/mm > 12% > 10 N/mm > 100%
7	Puncture Resistance	ASTM D4833	200 N (min. ave.)	267 N (min. ave.)
8	Tear Resistance	ASTM D1004	100 N (min. ave.)	125 N (min. ave.)
9	Oxidation Induction Time (OIT) Standard OIT or High Pressure OIT	ASTM D3895 ASTM D5885	100 minutes (min. ave.) 400 minutes (min. ave.)	100 minutes (min. ave.) 400 minutes (min. ave.)
10	Stress Crack Resistance (NCTL, single point test @ 30% of room temp yield stress)*	ASTM D5397	N/A	> 500 hours (min.)

9.4 Delivery, Handling and Storage

The geomembrane will be delivered to site in rolls equipped with canvas slings and loaded in such a way as to facilitate the unloading and handling of each roll without damaging it.

Each roll will be clearly labelled with the manufacturers' name, the product name and type, the batch and roll number, and the roll length, width, weight, and date of manufacture.

A crane or other suitable lifting equipment will be used to off-load the rolls to the storage area. Rolls will only be lifted by the supplied the canvas sling or core bars.

The storage area for the geomembrane will be agreed with FCC and prepared to the satisfaction of the contractor prior to delivery of the material to site. The storage area will be large enough to accommodate the rolls of geomembrane flat to the ground. It will be flat, clean, dry, and free from rocks or other obstacles and it will be located out of the way of the way of moving plant. The rolls of geomembrane will not be stacked more than 3 high with nothing stacked above the geomembrane.

The Contractor shall provide adequate and acceptable measures for protecting the material at all stages of the work, from all sources of potential damage such as sharp objects, boulders, cobbles etc, including weather conditions, until completion of the contract.

Any damaged or defective rolls are to be marked and segregated by the contractor for further investigation.

9.5 Manufacturer's Quality Control

The Contractor will supply a quality control certificate for each roll of material delivered to site and each batch of resin used in production of the geomembrane. The certificates will be supplied prior to delivery of the material to site and will contain quality control data in accordance with the test methods and requirements given in Table 2 above. CE Declaration certificates are also to be included when the material is delivered.

The certificates will include;

- i) The manufacturers name;
- ii) Product name and type;
- iii) Date of manufacture;
- iv) Batch number and roll number and;
- v) Values for those parameters listed in Table 2 (excluding UV resistance).

9.6 Conformance Testing

As soon as practicable after the delivery of the geomembrane rolls to site, the Contractor shall select, cut and label samples 1 m long across the entire width of the selected rolls for retention and/or conformance testing as directed by the CQA Inspector. Prior to taking the conformance sample the Contractor shall remove and discard the first 1m (outside) of the roll. One set of samples per 5,000 m², or part thereof, one per resin batch or one per 5 rolls delivered to site, whichever is greater.

The Contractor shall submit the samples for conformance testing to an independent laboratory having UKAS accreditation for each test being carried out. A copy of the results of the testing are to be forwarded to the CQA Inspector.

If testing shows that the geomembrane does not meet any one of the minimum requirements of Table 3 then this may be cause for rejection of the material from that roll.

Interface testing to be carried out in accordance with Appendix 7 of this specification.

Table 3: Geomembrane Conformance Testing

Parameter	Test Method	Test Frequency	Requirement	
			LLDPE	HDPE
Conformance Sampling and Testing				
Thickness (min.ave)	ASTM D5994	5,000 m ²	1.0 mm -5%	1.0 mm -5%
Thickness (8 out of 10)			1.0 mm -10%	1.0 mm -10%
Thickness (lowest value)			1.0 mm -15%	1.0 mm -15%
Density	ASTM D1505A	5,000 m ²	0.939 g/ml (max)	0.940g/ml (min)
Carbon Black Content (min)	ASTM D1603	5,000 m ²	2-3%	2-3%
Carbon Black Dispersion	ASTM D5596	5,000 m ²	9 of 10 in cat 1 or 2 1 of 10 in cat 3	9 of 10 in cat 1 or 2 1 of 10 in cat 3
Tensile Strength At Yield (min.ave) At Break (min.ave) Elongation at Yield (min.ave) Elongation at Break (min.ave)	ASTM D6693 Type IV	5,000 m ²	- 11 N/mm - 250 %	15 N/mm 10 N/mm 12 % 100 %
Puncture Resistance (min ave)	ASTM D4833	5,000 m ²	200 N	267 N
Texture Asperity Height (min. ave)	GRI GM12	5,000 m ²	> 0.40 mm	> 0.40 mm
Tear Resistance	ASTM D1004	5,000 m ²	100 N (min. ave.)	125 N (min. ave.)
Stress Crack Resistance	ASTM D5397	10,000 m ²	-	500 Hrs
Oxidative Induction Time (OIT) (min. ave)*	ASTM D3895/D5885	10, 000 m ²	100/400	100/400

The CQA Inspector may at his discretion accept material from elsewhere on that roll if the Contractor can demonstrate through further laboratory testing (at his expense) at a geosynthetic testing laboratory approved by the Engineer that this material does meet the acceptance criteria contained in Table 3.

9.7 Surface Preparation Prior to Geomembrane Deployment

The geomembrane will be deployed directly onto the prepared surface of the regulating layer. The surface will be clean, smooth rolled, and free from loose material, ponded water, desiccation cracks, soft spots or any other surface defects. There are to be no sharp angles in the subgrade which exceed ± 10 mm when checked with appropriate equipment.

The maximum particle size for the upper surface of the regulating layer in direct contact with the overlying geomembrane shall be 10mm except for isolated particles with a maximum size of 20mm in any dimension based upon a visual assessment at the point of placement in the Works and provided the isolated particles are dispersed within a finer matrix.

The CQA Inspector will inspect and approve the surface prior to deployment of the geomembrane. Geomembrane will not be installed at any location without the approval of the surface at that location.

Should any area fail to meet the required standard for geomembrane deployment the Contractor will remediate the area to the CQA Inspector's satisfaction. The methodology for the remediation of the failed surface will be discussed and agreed with the CQA Inspector prior to remedial works taking place.

Approval of the surface may be withdrawn if the surface should deteriorate prior to deployment of the geomembrane. Approval will then be withheld until the surface has been remediated to the CQA Inspector's satisfaction.

9.8 Deployment of Geomembrane

Prior to the commencement of installation, the Contractor will submit an accurate sketch or drawing to the satisfaction of the CQA Inspector, showing the proposed rolls, panel layout, and overlaps for the geomembrane. The sketch or drawing should show the Contractor's proposed start point and proposed direction of working. Any alterations from this proposed layout will not proceed without prior consent from the CQA Inspector.

The CQA Inspector will measure the thickness of the geomembrane at five locations along each edge per 100 m deployed at approximately 10-20 m intervals using a micrometer. The thickness results will be presented in the CQA Validation Report.

The Contractor will record each panel deployed and maintain a record of the date and location of installation. Each panel will be observed for defects and a record will be kept to assure that all defects are properly repaired. All geomembrane panels will be arranged so that seams are aligned in the direction of maximum slope, wherever practicable, in accordance with accepted good practice.

The Contractor will ensure that;

- No damage is caused to the geomembrane by the tools, plant or equipment during deployment;
- The geomembrane will remain clean and free from any contamination;
- Personnel working on the geomembrane will not smoke, wear shoes likely to cause damage, or engage in any other activity that could damage the geomembrane;
- The method of deployment will be such as to minimise stresses or strain on the geomembrane and will not cause damage to the underlying regulating layer;
- The geomembrane will be in intimate contact with the underlying surface without bridging over hollows or humps;
- The method of deployment will minimise wrinkles and creases in the geomembrane.
- No vehicles will track directly over the geomembrane;
- Surface water will be prevented from infiltrating beneath the deployed geomembrane; and
- No geomembrane will be deployed during periods of rain, snow, or wind likely to cause damage to the geomembrane.

The geomembrane shall be secured in anchor trenches and welded to existing geomembrane where required.

9.9 Seaming Procedures

Only suitably qualified and experienced personnel will carry out the deployment and welding of the geomembrane liner. The welding operators and installation staff should hold a current third party certificate for installation and welding of flexible lining systems to a recognised standard (e.g. the British Geomembrane Association (BGA) or Thermal Welding Institute (TWI/CSWIP) third party accreditation schemes).

The Contractor will only construct field seams on each working day after trial seams have been carried out on that day to the satisfaction of the CQA Inspector. The general seaming procedure will be such that:

- The welding equipment does not damage the geomembrane;
- All surfaces of the geomembrane to be seamed are clean, dry and free from dust, dirt, debris and foreign material of any kind prior to seaming;
- Where seam overlap grinding is necessary it shall not remove more than 10% of the nominal geomembrane thickness and does not extend more than 12mm on either side of any proposed extrusion seam. Grinding will not take place more than one hour prior to seaming;

- Temporary heat bonding of adjacent panels, or any pre-heating during seaming, will not cause any damage or overheating to the geomembrane. The use of adhesives shall not be permitted;
- Where a seam runs into an anchor trench the weld will extend to the back edge of the trench. Any seam defects falling within the anchor trench will be repaired in accordance with the specification;
- Seams will be aligned so as to minimise the number of wrinkles and "fishmouths". Any wrinkles/fishmouths that cannot be eliminated by pulling the sheet will be cut along their ridge, overlapped and extrusion welded. Where the overlap does not meet the requirements of the specification it will be patched in accordance with the specification. Seaming will not take place:
 - During any period of rain or snow unless the CQA Inspector is satisfied that measures have been implemented to allow the seam to be made on dry geomembrane materials;
 - At ambient temperatures lower than 5°C or higher than 35°C, unless approved by the CQA Inspector, during periods of high relative humidity or wind speed;
 - Over frozen or saturated ground;
 - Over ponded water;
 - During periods of darkness unless approved by the CQA Inspector and subject to the Contractor providing adequate lighting.

If the Contractor wishes carry out welding at ambient temperatures below 5°C or above 35°C, he shall demonstrate by trial seaming that the seam is equivalent to those produced under approved conditions and that the overall quality of the geomembrane is not adversely affected.

The Contractor will clearly mark the minimum overlap on the edge of the underlying geomembrane panel prior to welding the seam.

9.9.1 Trial Seams

The Contractor will perform trial seams with each seaming machine and operator at least at the start of each shift and following any period of machine shutdown greater than 1 hour or change of operator in the presence of the CQA Inspector and in accordance with the requirements of Table 4. In addition, trial seams should also be carried out where weather conditions have changed such that there will be an effect on the welding efficiency of the machinery, and if there is any doubt about the effectiveness of the welding equipment.

The trial seams will be at least 3 m long for both extrusion seams and fusion seams. On completion of the trial seam, the Contractor shall cut a total of six 25 mm wide field tabs normal to the seam at 150 mm centres and subject the tabs to field destructive testing. Three specimens shall be tested in peel mode and three in shear mode.

If a trial seam fails field destructive testing as specified above then the entire operation will be repeated. The seaming machine and the operator will not be allowed to perform field seaming until

the deficiencies are corrected and both machine and operator have achieved passing trial seams. The parameters for the seam testing are shown in Table 4.

If any of the additional specimens fail, the welding equipment shall be inspected and a report made of any defects and the corrective action taken. Welding may continue after two further consecutive full trial seams are achieved without failure.

Should three test welds fail in any 24 hour period, two samples will be sent to an independent laboratory for testing. If the test results indicate failure the machine shall be returned for repair. If the test results indicate a pass the equipment may be used subsequent to two further consecutive full trial seams being achieved without failure. The equipment should not be used until the test results are known. If the equipment fails five times in any 48 hour period it shall be returned for repair with a record kept of the service.

The CQA Inspector will verify that trial seaming is performed at the appropriate intervals and that passing results are achieved prior to any production seaming by the apparatus/seamer. The CQA Inspector will observe the field testing of each trial seam and will maintain a log of all trial seam data.

Table 4: Geomembrane Installation Testing

Parameter	Test Method	Test Frequency	Requirement
			Textured
Start Up Test Weld			
Welding Equipment and Operative	Visual and peel and shear using appropriate equipment	Daily at the start of works and after 1 hr stoppages and after any significant changes in welding conditions	Test fails outside welded area
Non-Destructive Weld Testing			
Dual Track Welds (Fusion welds)	Air Pressure Test	Continuous – every weld	Inflate to 2 bar and maintain pressure over 5 minutes
Extrusion Welds	Vacuum Box	Continuous – every weld	No bubbles witnessed
Destructive Weld Testing LLDPE			
On-site	Peel and shear using appropriate equipment	Every weld or a minimum of every 4 hours	Failure to be outside weld

Parameter	Test Method	Test Frequency	Requirement
			Textured
Off-site - Seam peel strength and seam strength Shear Elongation and Peel Separation	ASTM D6392 GRI GM19	1 per 200m of seam or 1 per day whichever is the higher frequency for each weld type	9.2.2.1 Fusion Weld: Shear Test>10.5N/mm Peel Test>8.8 N/mm 9.2.2.2 Extrusion Weld: Shear Test >10.5 N/mm Peel Test >7.6 N/mm 9.2.2.1 Fusion Weld: Shear Elongation >50% Peel Separation <25% 9.2.2.2 Extrusion Weld: Shear Elongation >50% Peel Separation <25%
Destructive Weld Testing HDPE			
On-site	Peel and shear using appropriate equipment	Every weld or a minimum of every 4 hours	Failure to be outside weld
Off-site - Seam peel strength and seam strength Shear Elongation and Peel Separation	ASTM D6392 GRI GM19	1 per 200m of seam or 1 per day whichever is the higher frequency for each weld type	9.9.2.1 Fusion Weld: Shear Test>14.0N/mm Peel Test>10.52 N/mm 9.9.2.2 Extrusion Weld: Shear Test >14.0 N/mm Peel Test >9.0 N/mm 9.2.2.1 Fusion Weld: Shear Elongation >50% Peel Separation <25% 9.9.2.2 Extrusion Weld: Shear Elongation >50% Peel Separation <25%
QA Inspection			
Visual Inspection of Geomembrane	For tears, holes, scratches, cuts etc.	Every roll	No defects
Thickness (along edge)	Micrometer	5 per 100m of deployed liner separated by 10-20m	mm (min.ave)

9.9.2 Seaming Methodology

The panels will be deployed in accordance with a method statement and proposed panel layout drawing issued by the Contractor prior to commencement of the works; the method statement and proposed layout will be submitted for approval to the CQA Inspector.

9.9.2.1 Fusion Welding

Wherever possible the seams in the geomembrane will be fusion welded with a double seam.

Fusion welded seams will be formed by working in one direction only.

9.9.2.2 Extrusion Welding

Extrusion seaming will only be used with the approval of the CQA Inspector where;

- Double seam welding is not practicable;
- Defects in the geomembrane need to be repaired; and/or
- Patches have to be welded over the location of field seam test samples.

The width of extrusion seams will not be less than 30 mm. Prior to forming an extrusion seam adjacent panels will be temporarily secured by heat bonding and the seam surfaces roughened by grinding to provide a key and to remove surface oxidation.

The extrudate material used for extrusion welding shall be identical in composition to that of the geomembrane and supplied by the Geomembrane supplier.

The extruder will be purged prior to the commencement of any extrusion seaming or after any stoppage in seaming until all heat degraded extrudate has been removed from the barrel.

The CQA Inspector will utilise a seam numbering system that is a combination of the panel numbers being joined. For example, the seam joining panels No 1 and 2 would be seam No 1/2. The CQA Inspector will maintain a log of seaming data for each seam including the source roll for each panel, date and time, identification of the seamer and machine, ambient and machine temperatures. All seams will be observed for visual integrity and any defects will be logged to verify that they are properly repaired and tested.

9.10 Sampling and Testing

Sampling and testing shall be carried out in accordance with the requirements of Table 4.

9.10.1 Qualitative Destructive Testing

The Contractor will take a tab sample from the start and end of each completed seam. The tabs will be 25 mm wide and at least 105 mm long with all tabs being tested for peel and shear failure. The seam will be deemed to have passed qualitative destructive testing if the failure occurs solely in the geomembrane and does not enter the seam. The seam will be deemed to have failed qualitative destructive testing if any of the failure enters the seam.

If the tab sample fails field qualitative destructive testing the Contractor will carry out all of the following actions:

- The welding equipment will be taken out of service until it has passed a trial seam.
- Additional tabs will be taken at 3 m intervals each side of the failed tab for qualitative destructive testing.
- Further tabs will be taken until the failed part of the seam can be identified between two successful tabs.
- The failed seam will then be reconstructed in accordance with the specification.

9.10.2 Quantitative Destructive Testing

The Contractor will recover samples for quantitative destructive testing from completed field seams as the seaming work progresses at a frequency of one sample from a minimum of every 200m of welding or one sample per day per machine, whichever is the greater, at locations as directed by the CQA Inspector. The Contractor shall submit the samples for conformance testing and will send a copy of the results of the testing to the CQA Inspector. This shall not relieve the Contractor from any of his obligations under the Contract.

Each sample will be at least 0.3 metres wide by 1.2 metres long with the seam centred lengthways. One 25mm wide tab will be cut from each end of the sample. The remaining sample will be cut into three parts with one additional 25mm wide tab being cut from each end of the central portion. The tabs will be tested in the field for failure in peel and shear in accordance with the specifications.

The three sample parts shall be distributed as follows:

- i) one part measuring 300mm x 300mm, to the Contractor;
- ii) one part measuring 300mm x 500mm, to the CQA Inspector, and;
- iii) one part measuring 300mm x 300mm, to FCC.

The Contractor shall forward the sample to the testing laboratory for quantitative destructive testing in accordance with ASTM D6392. In total 10 tabs will be tested from the sample, 5 in peel mode and 5 in shear mode, taken alternately throughout the sample. Copies of the results of the testing will be forwarded to the Contractor but this shall not relieve him of any of his obligations under the Contract.

The seam strength will be deemed to have passed quantitative destructive testing if in at least four out of the five tabs:

-
- i) Failure occurs solely on the parent material and does not enter the seam;
 - ii) The peel and shear strength exceeds these requirements specified in Table 4 for four of the five samples, where the fifth tab fails to meet the requirements above then its peel and shear strength must exceed 80% of the requirements specified in Table 4.
 - iii) For Peel Separation and Shear Elongation all 5 samples must meet the minimum requirements specified in Table 4.

If there is a failure the Contractor shall extract an additional test sample from a seam produced on the same day by the same item of seaming equipment and/or operator, at a location to be agreed with the CQA Inspector, to confirm that the failure was an isolated occurrence. If this sample fails destructive testing, all seams produced by the particular item of equipment will not be approved.

In the event of a failed destructive test the Contractor may either of the following:

- i) Replace or cap the entire seam length i.e. remove the seam and re-seam, or extrusion weld over the seam;
- ii) Extract further samples for destructive testing a minimum of 3m in both directions (if applicable) from the location of the failed test. If these samples pass destructive testing, the seam shall be reconstructed between these locations by capping in accordance with the Specification.

9.10.3 Non-Destructive Seam Testing

All seams shall be non-destructively tested by the Contractor in the presence of the CQA Inspector.

The CQA Inspector will verify that the procedures outlined for non-destructive testing are adhered to by the Contractor. The CQA Inspector will record the date and time, identification of the person performing the test, pressure values and the pass/fail conditions for all seams. The CQA Inspector will verify that all failed conditions are properly remediated and retested, and verify that all data is complete.

9.10.4 Air Pressure Testing

All fusion seams shall be air pressure tested. The air channel formed between the twin welds shall be sealed at both ends and an inlet valve and pressure gauge fitted to one end. The channel shall then be pressurised to a maximum pressure of 2.0 bar and a minimum pressure of 1.8 bar. Following removal of the pressure source, the pressure shall be allowed to equalise for two minutes to allow for the stabilisation of the temperature effects. The change in pressure shall then be recorded over the next five minute period. If the pressure decreases by more than 0.2 bar over the 5 minute period then the fusion seam will be deemed to have failed the test.

Upon completion of the air pressure test, the channel shall be deflated from the opposite end to which the pressure source was applied to confirm that the full length of seam had been pressurised.

If a seam fails the air pressure, or indicates a blockage in the channel, the test length shall be incrementally reduced until the failure area has been clearly identified. In the case of identifiable points of failure, the seam shall be repaired using an extrusion weld and the test repeated. If specific points of failure cannot be identified to the satisfaction of the CQA Inspector then the whole seam shall be repaired in accordance with the requirements of the specification.

9.10.5 Vacuum Box Testing

Extrusion seams shall be tested over their entire length using the purpose made equipment which produces a vacuum over the tested area. A detergent/water solution shall be applied to the full test area prior to the application of the test equipment. Upon application of the vacuum, bubbling of the solution should indicate the location of a leak in the seam. The vacuum shall be applied for a period of not less than 10 seconds. The location of any leaks shall be marked in an indelible manner and then the seam repaired in accordance with the specification.

9.11 Defect Repair

All discontinuities in the geomembrane (whether caused by damage, or failure of geomembrane or seams, to conform with the specifications, or of sampling or testing or other factors), will be repaired by the Contractor in the following manner:

- Point defects;
 - a) The area will be prepared by grinding and an extra layer of extrudate applied.
- Large faults;
 - a) The faulted area will be cut back to remove all imperfections and will be overlain with a single piece of compatible geomembrane to give a minimum overlap of 100 mm in all directions. The area will then be prepared and seamed in accordance with this CQA Plan.
- Seam faults;
 - a) Faulted extrusion seams will be overlain with a single piece of compatible geomembrane with a minimum overlap of 100 mm in all directions to form a cap strip. The repair may then be completed as for large faults;
 - b) Faulted fusion seams will be cut back to remove the upper flap, prepared by grinding and extruded in accordance with this CQA Plan;
 - c) Junctions of three panels shall be either covered by a patch with a minimum overlap of 200 mm in all directions or an extrusion weld extending at least 200 mm from the junction point in all directions; and
 - d) Multiple joints i.e. four or more corner meeting points will be overlain with a single piece of compatible geomembrane with a minimum overlap of 300 mm in all directions.

The CQA Inspector will log each defect requiring repair with a unique code and then, using the same code, verify that each defect is properly repaired and tested. Non-destructive testing of all repairs will be observed by the CQA Inspector.

9.11.1 Testing Review

The CQA Inspector will review all destructive and non-destructive testing data, including a walkover prior to the placement of the covering layer and record that all testing has been completed to his satisfaction.

9.12 Temporary Surcharge

The Contractor shall be responsible for providing adequate temporary loading and/or anchoring measures (e.g. in the form of durable sandbags or similar weights without sharp edges and not likely to damage the geomembrane) on the geomembrane immediately after deployment to protect the geomembrane from damage by the wind or to prevent slippage during the works. These measures shall remain in place until the overlying layers are placed over the geomembrane, unless otherwise directed by the CQA Inspector. On steep embankments, suspension of sandbags or other weights by ropes may be required.

9.13 Anchor Trenches

If applicable the geomembrane shall be secured in an anchor trench as shown on the drawings. The trench shall be excavated and prepared to accept the geomembrane. After the geomembrane has been placed, the trench shall be backfilled using suitable material and plant to the satisfaction of the CQA Inspector.

9.14 Tie-in to Existing Capping Geomembrane

The geomembrane shall be tied-in to the existing geomembrane liner of completed capping systems. The tie-ins will be, where possible fusion welded and will be observed and recorded by the CQA Inspector to confirm that a satisfactory seal is achieved. Where fusion welding is not reasonably practicable, extrusion welding may be used, and will be observed and recorded by the CQA Inspector to confirm that a satisfactory seal is achieved.

9.15 Protuberances

Where concrete ring leachate extraction/monitoring wells or HDPE pipework are required to pass through the cap, the area around the penetration will be sealed below the waste regulation layer with a 150 mm wide, 500 mm deep ring of hydrated bentonite powder/granules.

To comply with the DSEAR requirements the Contractor shall form and install a geomembrane boot detail with a minimum diameter of 2.2 m. Details are shown on Drawing 213D-NE-2017-02-01.

9.16 CQA Requirements

The CQA Inspector shall:

- Ensure that the materials are delivered, handled and stored in accordance with the manufacturers recommendations;
- Ensure all welders hold and can produce current third party certification for welding and installation to the standard indicated in the specification, prior to any welding taking place
- Make a visual inspection of each roll as it is unloaded to identify any damage and record the relevant information for each roll;
- Assess all manufacturers' quality control certificates to confirm that the material meets the requirements of the specifications prior to installation;
- Witness all trial seaming ensuring compliance with the specification
- Assess and approve, with respect to the requirements set out in the specifications, the proposed panel layout for the geomembrane to be submitted by the Contractor, The drawing should show the Contractor's proposed start point, direction of working and the panels should be arranged so that seams are aligned parallel to the line of maximum slope (i.e. normal to contours), wherever practicable, in accordance with accepted good practice. The panel layout should seek to minimise the number of required overlapped seams;
- Assess the methods statement submitted by the Contractor detailing his proposed deployment and seaming techniques;
- Identify rolls from which conformance samples of the geomembrane are to be taken for laboratory conformance testing in accordance with the specifications;
- Assess the results of conformance tests to ensure compliance with the specifications. Should any materials fail to meet the specifications, the CQA Inspector shall reject the failed roll and schedule further testing in accordance with the specifications;
- Ensure that weld speeds and temperatures used in successful trial welds are the same used in field seaming
- Ensure qualitative destructive testing is carried out in accordance with the requirement of the specification.
- Instruct the Contractor as to the location of destructive test samples to be taken at the frequency detailed in the specification.
- Ensure samples are sent to a laboratory accredited for all tests required within the specification and that sub-samples are retained on site
- Review the results of destructive testing to ensure that the testing has been undertaken in accordance with, and met, the specification required values.
- Measure the geomembrane thickness at regular intervals. The CQA Engineer shall measure the lead, trail, left and right edges of each panel a minimum of three times. The thickness shall comply with the Specification;
- Provide written certification to the Contractor that the surface on which the geomembrane is to be installed is acceptable prior to installation. *Note the CQA Inspector may withdraw the certificate should the surface deteriorate for any cause prior to installation and only reissue upon remediation works being compliant with the specifications;*
- Witness all panel deployment ensuring compliance with the specifications;

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- Witness all seam constructions to ensure compliance with the specifications verifying that all surfaces are completely clean, dry and free from imperfections and the correct overlap has been achieved;
 - Ensure non-destructive testing is carried out in accordance with the specification;
 - Ensure that all defects / repairs and patch works are identified on the geomembrane and witness that they are repaired in accordance with the specifications;
 - Ensure that a defect free tie-in with the existing geomembrane is constructed;
 - Ensure that all protuberances are sealed around in accordance with the specification;
 - Ensure that geomembrane and seam construction continues to the back of the anchor trenches;
 - Ensure that on completion of the geomembrane installation the Contractor produces a fully referenced as-built panel layout plan including all the detail listed within the specifications.

All laboratory testing will be undertaken by UKAS Accredited Laboratories, with accreditation for all the required tests.

The CQA Inspector shall fully document each item above and the documentation shall be presented in the CQA Validation Report.

10 ANCILLARY CONSTRUCTION DETAILS

10.1 Lifebuoy

The Contractor shall provide a 600mm diameter orange or yellow polyethylene lifebuoys with reflective panels next to the existing attenuation lagoons adjacent to the existing outfall. Lifebuoy will be mounted to a single pole in an encapsulated housing and provided with a 30m minimum encapsulated line with graphical user instructions. Lifebuoy stations to be clearly visible around the Pond at a maximum height of 1.7m above the ground.

10.2 Deep water and No Swimming Signage

The Contractor shall provide 450mm x 350mm plastic warning signs marked with approved graphical representations and the words 'Danger – Deep Water' and 'No Swimming'. These shall be fixed adjacent to the personal access gate, the lifebuoy station, around the existing lagoon using plastic zip ties.

11 SEEDING

Hydraulic mulch seeding using Groweb cotton fibres and tackifier shall be applied to all disturbed areas at the site, comprising the new ditches and the amended ditches, the footprint of the drainage basin and any remediated areas that require seeding following construction.

11.1 Cotton Fibres

The cotton fibres shall promote nutrient binding/impoverishment & dependent on chip type can impart localised acidification to the detriment of establishment. The cotton based fibre material that gives a near neutral pH, is biodegradable and non-toxic. Application rate slope dependant but typically in the region of 80-120g/m². A suitable (harmless) temporary green dye, approved by the Project Manager, shall be added to aid application and improve the initial appearance. The fibres shall be completely natural and contain no growth inhibiting factors. They shall form a blanket over the soil surface to provide an ideal microclimate for rapid germination. After germination, the fibres shall bio-degrade adding organic nourishment to the soil. Slow release fertilisers, to avoid leaching of nitrates into the ground, shall also be included in the mix.

11.2 Seed Mix Type

The grass seed shall be a low maintenance seed, providing dense vegetative mat characteristics to aid erosion control.

11.3 Application Equipment

Application of the mix shall be with hydro-seeders equipped with mixing and delivery systems approved by the CQA Engineer, capable of variable speed agitation to ensure thorough mixing before discharge.

11.4 Seed Spread Variations with Slope

Seed Spread Rate = 10-15g/m² on slopes 10 degrees or more
Rate = 6g/m² on slopes 10 degrees or less

11.5 Seed Mix (to be confirmed by the Project Manager)

Seed mix to be selected and approved from the following seed types:

- For soil with a High Clay Bias - Bent grass/fescue based Germinal A3 (Embankments & Drought - CORAIL Strong Creeping Red Fescue 60%, JOANNA Chewings Fescue 20%, BLACKWATCH Tall Fescue 15%, HIGHLAND Bentgrass 2.5%, ABER®ROYAL Browntop Bentgrass 2.5%)
- For soils with a lower Clay Bias - A18 (roadways & embankments - CORAIL Creeping Red Fescue 30%, CADIX Perennial Ryegrass 25%, JOANNA Chewings Fescue 20%, EVORA Smooth–Stalked Meadow Grass 12.5%, HIGHLAND Browntop Bentgrass 7.5%, ABER®ACE Miniature White Clover 2.5%, ABER®ROYAL Browntop Bent 2.5%)

11.6 Slow Release Fertiliser

Fertiliser to be 15:30:15 spread at a rate of 15-25ml/m²

11.7 Trace Elements

Trace Elements Rate = 12 litres/ha of Seaweed Extract

11.8 Tackifier

Tackifier to be a Groweb product with a slope dependant application rate of between 2.5-3g/m². Its nontoxic, biodegradable comprising 99% organic colloids and 1% inhibitor. To be approved by the Project Manager

12 CQA VALIDATION REPORT

Upon completion of the works the CQA Inspector will prepare a Certification Report summarising the works undertaken and including all CQA documentation prepared. As a minimum this shall include:

- Description of the works
- Completed summary sheets detailing the installation of each element of the works;
- Contractor's documentation
- manufacturer's documentation
- Test (laboratory & field) reports
- As-built drawings which should include;
 - Title of Project, contract, element of works;
 - Drawing version number, with details of revision history;
 - Falls and gradients of constructed ditches
 - Scale (Scale at size to be printed, e.g. 1:500 at A1);
 - Details of the Survey Grid (e.g. OSGB36, or local grid);
 - Locations of control stations/levels, benchmarks, etc. (permanent and temporary);
 - North arrow;
 - Grid intersections;
 - Distinguish between surveys done on different times and dates;
- Photographic record of the construction
- Daily diaries
- Description of design changes, non-conformances and the subsequent remediation

The above report shall confirm that the works have been carried out in accordance with the specifications as incorporated in this Construction Quality Assurance Plan. The report will be certified by the CQA Manager.

APPENDIX 1

PRINCIPAL QUANTITIES

FCC Environment

PROJECT ACTIVITY SCHEDULE

ACTIVITY	LANDFILL
SUB-ACTIVITY	Surface water Management
CONTRACTOR	Jones Brothers
SITE NAME	Chirk
SITE REF	466
PROJECT REF.	
PROJECT NAME	Surface Water Management
PROJECT STATUS	Preliminary
ENGINEERING MANAGER	Tim Darby
SITE START DATE	
SITE WORKS DURATION	
PROJECT DRIVER	Site Closure

NOTES:

Please note that this is the draft issue of quantities from the designer and the Contractor should verify these quantities before completing the Contractor Return Activity Schedule for agreement

Description of Works
<u>General:-</u>
Construction of a completed surface water management system
<u>Scope of Works:-</u>
New Cap Bund with LLDPE liner and Anchor Trenches. Spoil removed to be placed on upper slope and blended in to a smooth surface
Clear Existing Perimeter Drain
Rework Existing lagoon Area bunds
New Cap and Perimeter Ditches
New Culverts
New Drainage Basin
<u>Extra-ordinary Works</u>

<u>Assumptions</u>
It is assumed that the NRW will approve the route and connection

Preliminary
1.Design
2.General Items
3. New Cap Bund
4. Clear Existing Perimeter Drain
5. Existing lagoon Area
6. New Cap and perimeter Drains
7. New Culverts
8. New Drainage Basin
Project Total
£ -

FCC Environment
LANDFILL
Surface water Management

Status: Preliminary

Site: Chirk

	L3	L4	L5	L6	Quants 1	Meas Unit 1	Quants 2	Meas Unit 2	Unit Rate	Total Cost £
1	Design									
		1	Concept			Sum		Hrs		-
		2	Detailed			Sum		Hrs		-
			Post Construction Support			Sum				-
		3	CDM			Sum		Hrs		-
			1 Pre-Construction Health & Safety Plan			Sum		Hrs		-
			2 Planning Supervisor Duties			Sum		Hrs		-
			3 Health & Safety File & As-built records			Sum		Hrs		-
									Total	-
2	General Items									
		1	Site Supervision			Sum				-
		2	Site Establishment & Temporary works			Sum				-
		3	General Attendant Plant and Equipment			Sum				-
		4	Other works.			Sum				-
		5	Risk			Sum				-
									Total	-
3	Cap Bund with LLDPE liner and Anchor Trenchs. Spoil removed to be placed on upper slope and blended in to a smooth surface									
		1	0.5m high soil bund with 0.5m wide pletau and and 1:1 sides		118	m				-
			1 cohesive soil		59	m3				-
		2	UV resilient LLDPE Liner 2m wide		236	m2				-
									Total	-
4	Clear Existing Perimeter Drain									
		1	Existing Ditch 1							
			1 Remove silt and vegetation and make good Existing 0.5m wide 1m deep ditch		336	m				-
		2	Clear large vegetation From Rip Rap Channel and make good		44	m				-
		3	Existing Ditch 2							-
			1 Remove silt and vegetation and make good Existing 0.5m wide 0.5m deep ditch		123	m				-
		4	Existing Ditch 3							-
			1 Remove silt and vegetation and make good Existing 0.5m wide 0.5m deep ditch		89	m				-
		5	Hydroseed ditches where required		1	no.				-
									Total	-
5	Existing lagoon Area									
			Remove existing culverts between lagoons 1, 2 and 3 and replace with a 1m wide ditch with 1:1.5							
		1	side slopes		22	m				-
		2	ensure all lagoon perimeters are at 54.5m AoD							-
			1 construct 0.5m high cohesive soil bund with 0.5m wide pletau and and 1:1 sides		285					-
			2 cohesive soil		142.5	m3				-
		3	New Life bouy and housing with 30m encapsulated rope		1	no.				-
		4	Replace existing outlet valve system to be able to divert flow to river or filter beds							-
			1 200mm isolation valves		2	no.				-
			2 200mm HDPE pipeworks		30	m				-
			3 overflow outlet		1	no.				-
		5	New 1m wide Overflow channels between Filtration/infiltration beds		2	no.				-
			Ensure existing external Filtration/infiltration bed bunds are higher than 52.35m AOD or 0.5m high							-
		6	(which ever is greater) and add material as required, Hydroseed as required		300	m	75	m3		-
		7	Clear Filtration/infiltration beds of any large vegetation		1	no.				-
									Total	-
6	New Cap and Perimeter Ditches - All to be hydroseeded once complete									
		1	Ditch 1							
			1 0.5m deep x 1.0m wide 1:1 side slopes		290	m				-
		2	Ditch 2							-
			1 0.5m deep x 1.0m wide 1:1 side slopes		156	m				-
		3	Ditch 3							-
			1 0.5m deep x 0.5m wide 1:1 side slopes		285	m				-
		4	Ditch 4							-
			1 0.5m deep x 0.5m wide 1:1 side slopes		175	m				-
		5	Ditch 5							-
			1 1.0m deep x 1.0m wide 1:1.5 side slopes		40	m				-
		6	Ditch 6							-
			1 0.5m deep x 0.5m wide 1:1 side slopes		195	m				-
		7	Ditch 7							-
			1 1.0m deep x 1.0m wide 1:1.5 side slopes		56	m				-
									Total	-
7	New Culverts									
		1	Culvert 1, 1.0m wide x 0.5m deep box culvert with concrete slab protection		8	m				-
			1 Concrete sandbag headwall		2	no.				-
		2	Culvert 2, 150mm diameter pipe culvert		27	m				-
			1 Concrete sandbag headwall		1	no.				-
		3	Culvert 3, Tripple 525mm Pipe culvert with concrete slab protection		10	m				-
			1 Concrete sandbag headwall		2	no.				-
		4	Culvert 4, Tripple 525mm Pipe culvert with concrete slab protection		17	m				-
			1 Concrete sandbag headwall		2	no.				-
									Total	-
8	New Drainage Basin									
		1	Excavate a new 800m3 lagoon in existing land area.		800	m3				-
		2	Hydroseed the Basin		1100	m2				-
		3	Low flow channel 1m wide 200mm deep v channel		75	m				-
			1 Filter Gravel fill 0.5mx0.2mxlength		7.5	m3				-
			2 Separation Geotextile		75	m2				-
		4	Althon H3C Precast headwall with grill		1	no.				-
										-
			Grand Totals							-

LANDFILL

Surface water Management

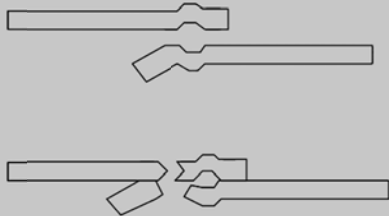
Site: Chirk

General Items Build Up Sheet.	Quants 1	Meas Unit 1	Quants 2	Meas Unit 2	Quants 3	Meas Unit 3	Unit Rate	Total Cost £
1 Site Supervision								
1 Office Manager		wks		%				-
2 Sub Agent		wks		%				-
3 Section Foreman		wks		%				-
4 Site Engineer		wks		%				-
5 Site Agent		wks		%				-
6 Other Staff (incl. H&S)		wks		%				-
7 Surveyor		wks		%				-
						Total		-
2 Site Establishment								
1 Offices / Welfare and Equipment		wks						-
2 Communications (Phones / Radios etc)		wks						-
3 PPE		wks						-
4 Bunded Fuel tank		wks						-
5 Site equipment (Levels, CAT detectors etc.)		sum						-
6 Site Security		wks						-
7 Site Consumables		wks						-
8 Punctures		wks						-
9 Repairs		wks						-
10 4x4 van		wks						-
11 Van		wks						-
12						Total		-
3 General Attendant Plant and Equipment.								
1 Mob & Demob		sum						-
2 Diesel fuel for genny etc.		sum						-
3 Setting out mats		sum						-
4 Sundries inc first aid		sum						-
5 Road / Site Signs		wks						-
6 Office maintenance and Cleaning		wks						-
7 Petty Cash, stationary etc		wks						-
8 Pumping to excavations		wks						-
9 Road Sweeper		hrs						-
						Total		-
4 Other works Outside the scope of Major Cost Centres								
1								-
2								-
3								-
4								-
5								-
6								-
						Total		-
5 Risk								
1								-
2								-
3								-
4								-
5								-
6								-
7								-
8								-
9								-
						Total		-
General Items Build Up Total.								£ -

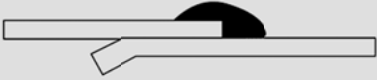
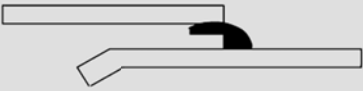
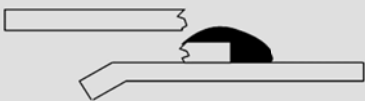
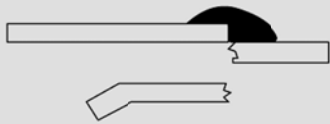
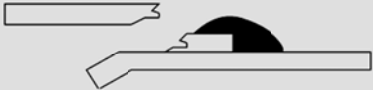
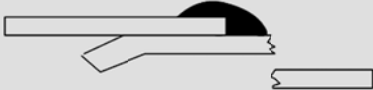
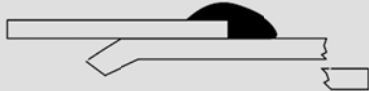
APPENDIX 2

Weld failure codes

FUSION WELD FAILURE CODES

UNTESTED SPECIMEN DUAL HOT WEDGE FUSION WELD		
<u>TYPES OF FAILURE</u>	PASS/FAIL CODE	DESCRIPTION
	FAIL 1	ADHESION FAILURE
	FAIL 2	FTB BREAK AT SEAM EDGE
	FAIL 3	FTB BREAK AT SECOND SEAM EDGE
	FAIL 4	FTB BREAK AT SECOND SEAM EDGE
	PASS 1	FTB BREAK IN SHEETING
	PASS 2	FTB BREAK AT SEAM EDGE

EXTRUSION WELD FAILURE CODES

UNTESTED SPECIMEN EXTRUSION WELD		
TYPES OF FAILURE	PASS/FAIL CODE	DESCRIPTION
		
	FAIL 1 (F1)	ADHESION FAILURE
	FAIL 2 (F2)	ADHESION FAILURE
	FAIL 3 (F3)	ADHESION FAILURE
	PASS 1 (P1)	FTB WELDED SEAM EDGE
	PASS 2 (P2)	FTB WELDED SEAM EDGE
	PASS 3 (P3)	FTB HEAT SEAM EDGE
	PASS 4 (P4)	FTB HEAT SEAM EDGE
	PASS 5 (P5)	FTB WELDED SEAM EDGE
	PASS 6 (P6)	FTB IN SHEETING

APPENDIX 3

CQA FIELD AND SUMMARY PROFORMA SHEETS

Daily Site Record Sheet

Date:		Site:	
Weather:		CQA Plan Ref:	

Visitors to Site:	
-------------------	--

Work Inspected and Progress on Site:

List of Plant	Hours of Operation	Comments

Prepared by:		Signed:	
--------------	--	---------	--



Materials Received

Site:

Sheet No:

CQA Engineer:

CQA Plan Ref:

[illegible]

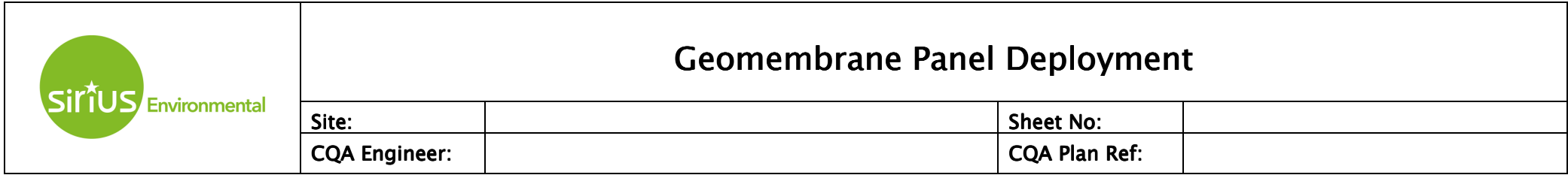


Material Conformance Sampling

Site:			Sheet No:	
CQA Engineer:		Anticipated/Actual Area:	/	m ²
		Anticipated/Actual No. of Tests:	/	

[illegible]

[illegible]



	Geomembrane Panel Deployment			
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	CQA Engineer:		CQA Plan Ref:	

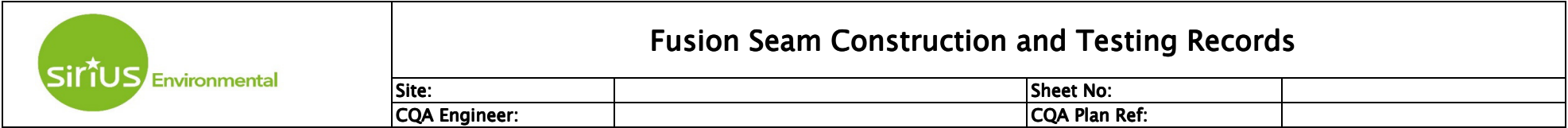
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	Site:		Sheet No:	
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	Geomembrane Panel Deployment			
	Site:		Sheet No:	
	CQA Engineer:		CQA Plan Ref:	

	Geomembrane Panel Deployment			
	Site:		Sheet No:	
	CQA Engineer:		CQA Plan Ref:	

[illegible]



	Fusion Seam Construction and Testing Records			
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	CQA Engineer:		CQA Plan Ref:	

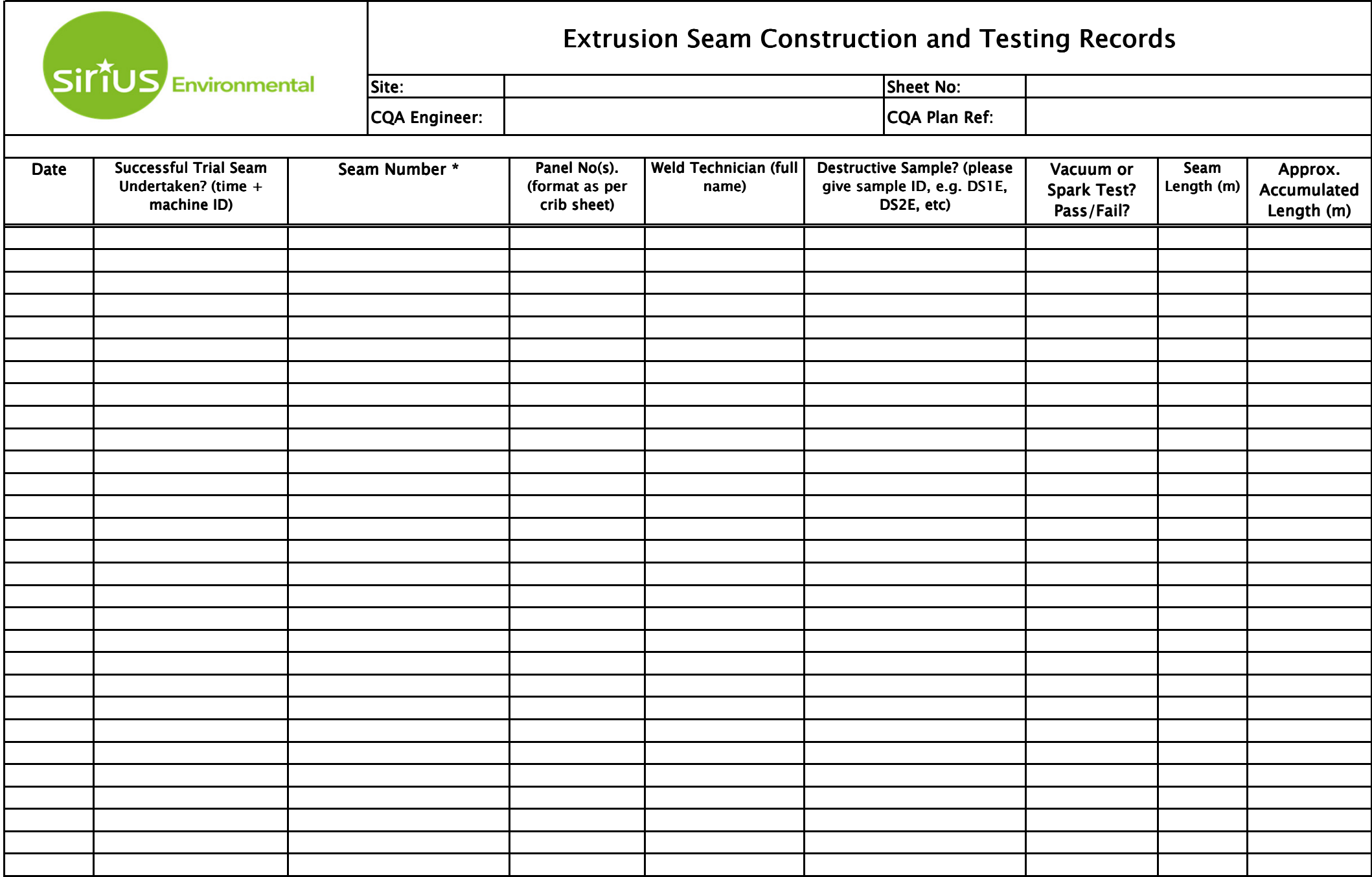
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	Fusion Seam Construction and Testing Records			
	Site:		Sheet No:	
	CQA Engineer:		CQA Plan Ref:	

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APPENDIX 4

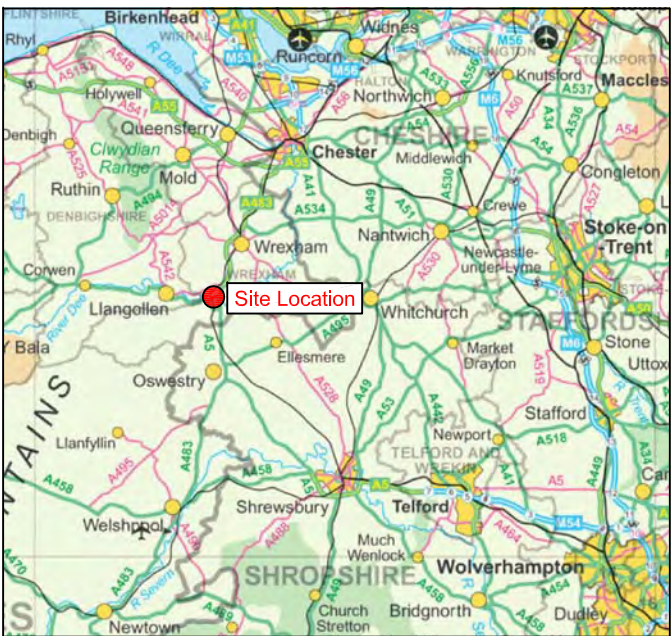
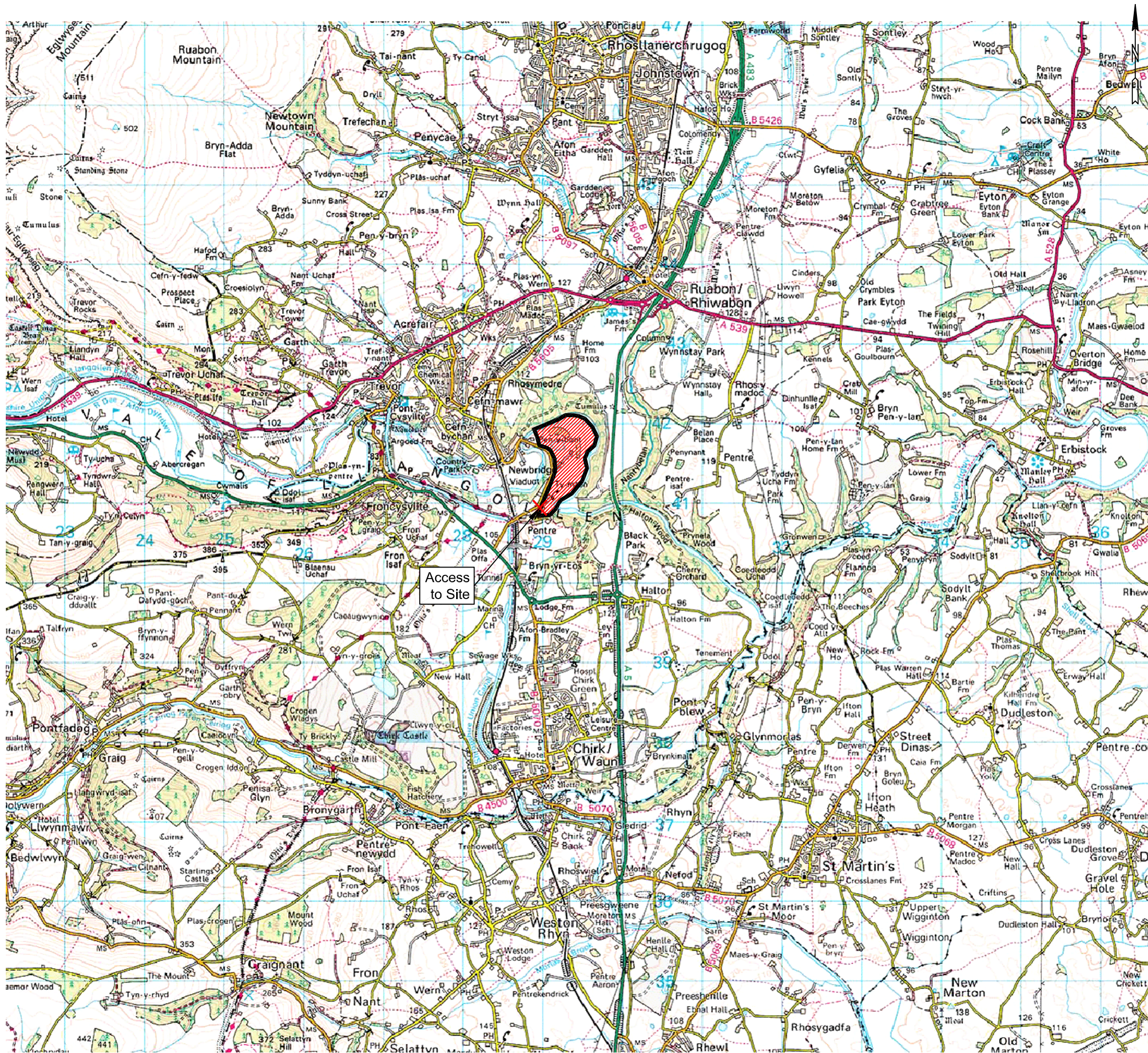
DESIGNERS' RISK ASSESSMENT

Project - Chirk Surface water Network			Designer's Risk Assessment												
Date of Assessment		16/05/2017		Construction and Demolition											
Completed By		Scott McLean													
Project Ref No.		466-NW-2017-SW													
Severity	5	Fatality	Likelihood	5	Very Likely	Risk Rating	11-25 Red. NOT ACCEPTABLE	Severity	5	5	10	15	20	25	
	4	Major Injury or Disease (RIDDOR Reportable)		4	Likely				4	4	8	12	16	20	
	3	Moderate Injury (RIDDOR reportable)		3	Possible		SEEK TO REDUCE RISKS WHERE POSSIBLE		3	3	6	9	12	15	
	2	Minor Injury (non-RIDDOR reportable)		2	Unlikely				2	2	4	6	8	10	
	1	Insignificant		1	Very Unlikely		< 5 Green ACCEPTABLE		1	1	2	3	4	5	
										1	2	3	4	5	
										Likelihood					
Stage 1						Stage 2				Stage 3					
		Uncontrolled Risk or Impact				Risk Elimination/Reduction							Significant risk (Y/N)		
No.	Hazards Identified	Who might be harmed?	Severity	Likelihood	Risk Rating	Measures to Eliminate or Reduce Risk				Severity	Likelihood	Risk Rating			
1	Services identified are from record drawings, other services may exist	Site Staff	5	3	15	Contractor to confirm all buried services by on-site detection and hand excavation of trial pits, O/H services to be marked with safety barriers				5	1	5			
2	Landfill Gas Pipework - risk of explosion and exposure to Gas	Site Staff	5	3	15	Employ safe systems of work including using hand, rather than power tools or machine implements, provide scanning of the area to detect if any buried services exist, effectively mark the location of pipework and ensure the work is properly supervised.				5	1	5			
3	Leachate pipework - risk of contamination loss of leachate control	Site Staff	3	3	9	Employ safe systems of work including using hand, rather than power tools or machine implements, provide scanning of the area to detect if any buried services exist, effectively mark the location of pipework and ensure the work is properly supervised. ensure communication with LFS staff so the system can be shut down quickly if needed				3	1	3			
4	Potential contaminated ground, risk of contact or ingestion of toxic materials	Site Staff	3	4	12	Make all staff aware of the risks of landfill waste and provide suitable welfare and first aid to suit.				3	1	3			
5	Vehicles working around Ditches	Site Staff	5	3	15	Ensure all edges and excavations are properly illuminated, signed and edge protection provided				5	1	5			
6	Vehicle movements, risk to operatives	Site Staff and public	5	3	15	Control of movement of vehicles around the work areas and provide signage and demarcation around work areas. Use of high visibility clothing, all vehicles to have flashing beacons when working				5	1	5			
7	Slips, trips and falls into ditches	Site staff and Public	4	3	12	Ensure all ditches deeper than 1m are protected from accidental access by providing fences and suitable signage during construction works and provide permanent fencing after construction to protect the public around the Old Wallingford Way				4	1	4			
8	Leptospirosis	Site Staff	5	2	10	Make all staff aware of the risks of Leptospirosis and provide suitable welfare facilities				5	1	5			
9	Manual handling	Site Staff	3	4	12	Safe working practices to be employed, all staff to be suitably trained for the tasks they will be undertaking.				3	2	6			
10	Landfill Gas migration into the working area	Site Staff	5	2	10	Regular monitoring of the excavation and working areas to ensure safe levels of gas are present, operatives to carry gas monitors when exposing cap areas or working near wells				5	1	5			
11	Working Around Water	Site Staff	5	2	10	potential for water to be held in the ditche/lagoon if blocked, staff to not work alone if, clearing ditches/outfalls, care to be taken when working in cold conditions to avoid issues with exposure causing injury, Suitable water proof PPE to be utilised				5	1	5			
12	Working on Slopes	Site Staff	5	3	15	Suitable RAMS for working with plant on slopes are to be used with suitably trained and competent staff working and managing staff on the slopes				5	2	10			

Project - Chirk Surface water Network			Designer's Risk Assessment											
Date of Assessment	16/05/2017		Operation and Maintenance											
Completed By	Scott McLean													
Project Ref No.	466-NW-2017-SW													
Severity	5	Fatality	Likelihood	5	Very Likely	Risk Rating	11-25 Red. NOT ACCEPTABLE	Severity	5	5	10	15	20	25
	4	Major Injury or Disease (RIDDOR Reportable)		4	Likely				4	4	8	12	16	20
	3	Moderate Injury (RIDDOR reportable)		3	Possible		SEEK TO REDUCE RISKS WHERE POSSIBLE		3	3	6	9	12	15
	2	Minor Injury (non-RIDDOR reportable)		2	Unlikely				2	2	4	6	8	10
	1	Insignificant		1	Very Unlikely		< 5 Green ACCEPTABLE		1	1	2	3	4	5
										1	2	3	4	5
										Likelihood				
Stage 1						Stage 2				Stage 3				
		Uncontrolled Risk or Impact				Risk Elimination/Reduction							Significant risk (Y/N)	
No.	Hazards Identified	Who might be harmed?	Severity	Likelihood	Risk Rating	Measures to Eliminate or Reduce Risk			Severity	Likelihood	Risk Rating			
1	overhead High Voltage Cables, buried Low Voltage Cables risk of explosion, electrocution and fire	Site Staff	5	3	15	Carry out surveys in accordance with HSG 47 (Avoiding danger from underground services), employ safe systems of work including limiting height of veicles working due to O/H cables, using hand, rather than power tools or machine implements, provide scanning of the area to detect buried services using a cable detector, effectively mark the location of cables and ensure the work is properly supervised.			5	1	5			
2	Landfill Gas Pipework - risk of explosion and exposure to Gas	Site Staff	5	3	15	Employ safe systems of work including using hand, rather than power tools or machine implements, provide scanning of the area to detect if any buried services exist, effectively mark the location of pipework and ensure the work is properly supervised.			5	1	5			
3	Leachate pipework - risk of contamination loss of leachate control	Site Staff	3	3	9	Employ safe systems of work including using hand, rather than power tools or machine implements, provide scanning of the area to detect if any buried services exist, effectively mark the location of pipework and ensure the work is properly supervised. ensure communication with LFS staff so the system can be shut down quickly if needed			3	1	3			
4	Potential contaminated ground, risk of contact or ingestion of toxic materials	Site Staff	3	4	12	Make all staff aware of the risks of landfill waste and provide suitable welfare and first aid to suit.			3	1	3			
5	Vehicles working around Ditches and slopes	Site Staff	5	3	15	Ensure all edges and excavations are properly illuminated, signed and edge protection provided			5	1	5			
6	Vehicle movements, risk to operatives	Site Staff and public	5	3	15	Control of movement of vehicles around the work areas and provide signage and demarcation around work areas. Use of high visibility clothing, all vehicles to have flashing beacons when working			5	1	5			
7	Slips, trips and falls into ditches	Site staff and Public	4	3	12	Ensure all ditches deeper than 1m are protected from accidental access by providing fences and suitable signage during construction works and provide permanent fencing after construction where staff access and vehicle collision is likely			4	1	4			
8	Leptospirosis	Site Staff	5	2	10	Make all staff aware of the risks of Leptospirosis and provide suitable welfare facilities			5	1	5			
9	Manual handling	Site Staff	3	4	12	Safe working practices to be employed, all staff to be suitably trained for the tasks they will be undertaking.			3	2	6			
10	Landfill Gas migration into the working area	Site Staff	5	2	10	Regular monitoring of the excavation and working areas to ensure safe levels of gas are present, operatives to carry gas monitors when exposing cap areas or working near wells			5	1	5			
11	Working Around Water	Site Staff	5	2	10	potential for water to be held in the ditches and lagoon if blocked, staff to not work alone if, clearing ditches/headwalls, care to be taken when working in cold conditions to avoid issues with exposure causing injury, Suitable water proof PPE to be utilised			5	1	5			
12	Working on Slopes	Site Staff	5	3	15	Suitable RAMS for working with plant on slopes are to be used with suitably trained and competent staff working and managing staff on the slopes			5	2	10			

DRAWINGS

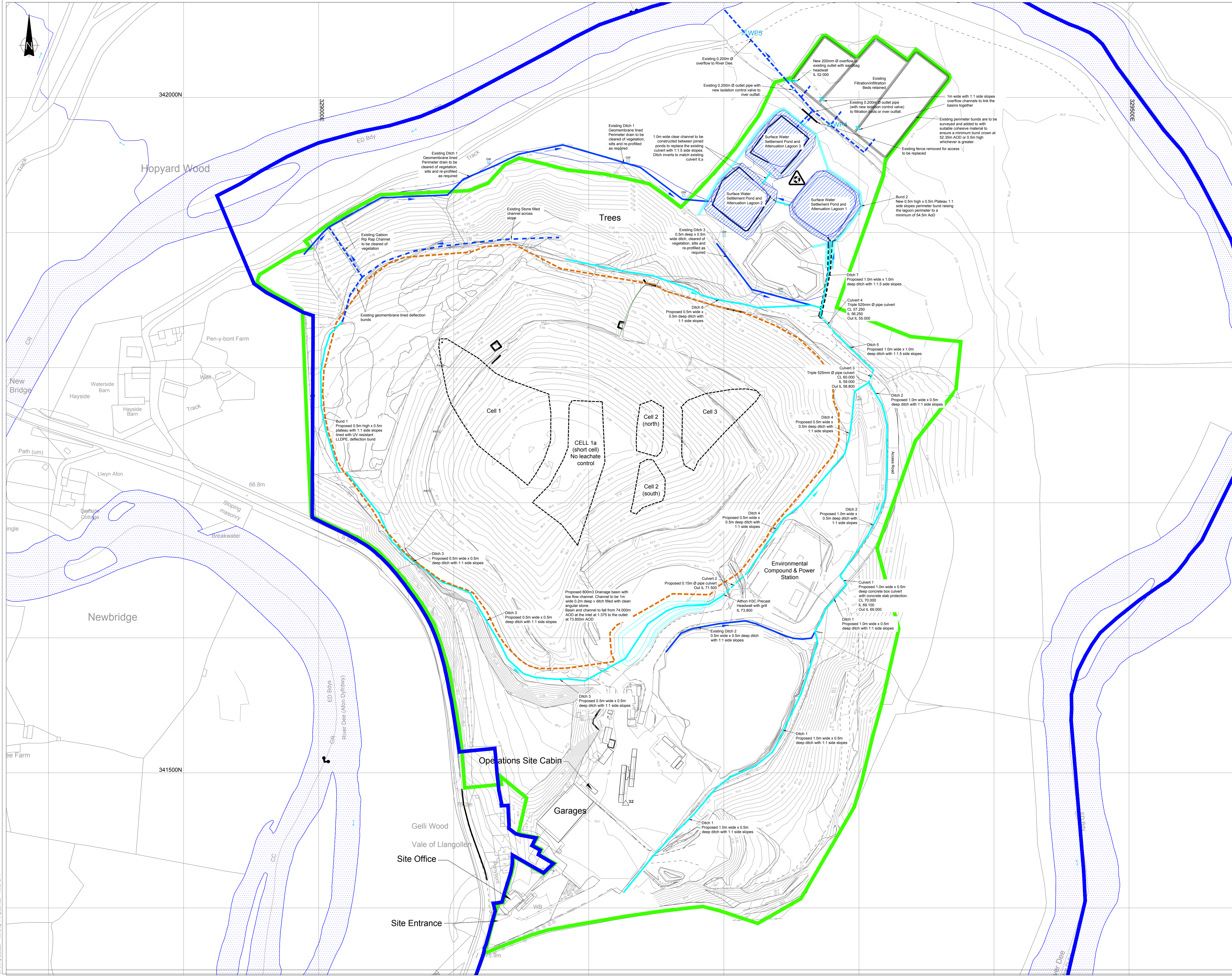
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Drawing 676S259A Plan 5	Site Services Plan
Drawing NE-676-SWM – Plan 1	General Arrangement Drawing
Drawing NE-676-SWM – Plan 2	Cross Sections
Drawing NE-676-SWM – Plan 3	General Details



Chirk Landfill Site
Pen-Y-Bont
Chirk
Wrexham
LL14 5AR
Tel: 01978 810660

9.5km south of Wrexham.
Site centred N.G.R. SJ293416

REVISIONS				
No	Description	By	Chk'd	Date
Project:				
CHIRK LANDFILL SITE				
Title:				
Site Location Plan				
Drawn By	CMD	Date	17.01.05	F:\acadd\2004\WRG LOGO 2004\wrg82003yg.PNG
Chk'd By	DCW	Date	17.01.05	
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Waste Recycling Group 3 Sidings Court White Rose Way Doncaster DN4 5NU				Drawing No 466T010
				Plan 1



- NOTES:
1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM.
 2. DO NOT SCALE FROM THIS DRAWING.
 3. ANY ANOMALIES IDENTIFIED WITH THE DETAILS SHOWN ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF FCC ENVIRONMENT (UK) LIMITED PRIOR TO CONSTRUCTION WORKS COMMENCING.
- LEGEND:
- Ownership Boundary
 - PPC Boundary
 - Latest Available Ground Contours
 - Landfill Extent
 - Existing Drainage Network
 - Proposed drainage network
 - Culverted drains
 - River Dee
 - Lif buoy with 30m encapsulated line
- NOTES:
1. All Ditches are to be Hydroseeded once completed
 2. all culverts are to have concrete sandbag headwalls on inlets and outlets, unless stated otherwise

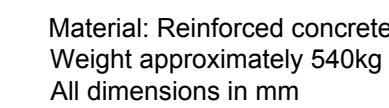
Revision	Date	Description	By	Chk
C	2018.17	Revised with C&A Plans	SMC	AK
B	15.06.17	Drainage network	SMC	AK
A	19.05.17	Preliminary Issue	SMC	AK

Reference files:
Information taken from plans:
Site Survey: 46891425

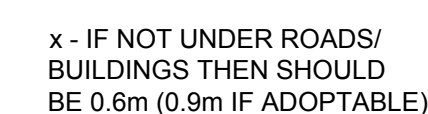
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6 Siddings Court, White Rose Way, Doncaster DN4 9NU Licence No 0100031673



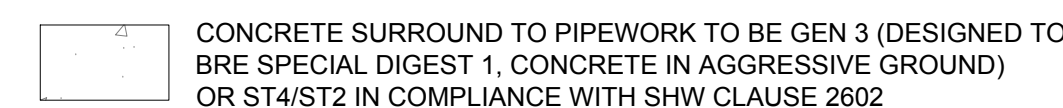
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CHIRK LANDFILL SITE				
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SMC	AK	16.05.17	1:1250	A1
Status:	Revision:	Drawing No:	Plan Number:	
Final	C	466-NW-2017-SW	PLAN 1	



3. ANY ANOMALIES IDENTIFIED WITH THE DETAILS SHOWN ON THIS DRAWING ARE TO BE BROUGHT TO THE ATTENTION OF FCC ENVIRONMENT (UK) LIMITED PRIOR TO CONSTRUCTION WORKS COMMENCING.



ROCK & SOILS CONTAINING HARDSPOTS
a=Bc/4 OR 200mm WHICHEVER IS GREATER.



Drawing Title: Proposed Surface Water Management Plan Details				
Drawn By: SMC	Checked By: AK	Date: 19.06.17	Scale: Varied	Paper Size: A1
Status: Final	Revision: A	Drawing No: 466-NW-2017-SW		Plan Number: PLAN 3