Photovoltaic Array, Grid Connection, Access Improvement Works, and Ancillary Development

Bicker Fen, Boston

Construction Management Plan

Prepared for

AGR Solar 2 Limited

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1.0 INTRODUCTION

1.1 Preamble

1.1.1 Axis has been appointed by AGR Solar 2 Limited to prepare this Construction Management Plan (CMP) in relation to the approved development of a photovoltaic array, grid connection, access improvement works and ancillary development (hereafter referred to a as 'the development') on land at Bicker Fen, Boston and South Holland (hereafter referred to as 'the site').

1.1.2 The site is cross boundary, with part being within Boston Borough Council (BBC), and part being within South Holland District Council (SHDC). As such, separate applications were submitted to the two respective Local Planning Authorities (LPAs) (BBC and SHDC). The Local Highway Authority (LHA) is Lincolnshire County Council (LCC).

1.1.3 The separate planning applications pertaining to the development were approved by SHDC under reference H04-0849-22 and by BBC under reference B/22/0356.

1.1.4 The description of the development is as follows:

Proposed development of a photovoltaic solar array, grid connection, access improvement works & ancillary development on land at Bicker Fen, Boston, and South Holland.

1.1.5 A copy of the approved general arrangement plan is included at **Appendix A**.

1.1.6 The scheme includes for a grid connection cable to National Grid's Bicker Fen Substation located to the north and west of the site. The grid connection cabling would be located within the road corridor and would follow Cowbridge Road in a northerly direction from the site entrance. The cable route would then follow Bicker Drove and Vicarage Drove to the substation, where it would connect to National Grid infrastructure (as identified at **Image 2.1** in the following Chapter of this CMP).

1.1.7 A Principal Contractor is yet to be appointed in respect to the construction of the development.

1.1.8 Condition 10 (SHDC) and Condition 13 (BBC) of the approved applications state the following:

The development hereby permitted shall be undertaken in accordance with a Construction Management Plan and Method Statement that shall first be submitted to and approved in writing by the Local Planning Authority. The Construction Management Plan and Method Statement shall indicate measures to mitigate against the adverse impacts of vehicle movements and vehicle parking and shall include:

i) the phasing of the development to include access construction;
ii) the parking of vehicles of site operatives and visitors;
iii) the loading and unloading of plant and materials;
iv) the storage of plant and materials used in constructing the development;
v) wheel washing facilities;
vi) a strategy stating how surface water run off on and from the development will be managed during construction; and
vii) a complaints, engagement, and communication procedure.

Reason: In the interests of the safety and free passage of those using the adjacent public highway and to ensure that the permitted development is adequately drained without creating or increasing flood risk to land or property adjacent to, or downstream of, the permitted development during construction.

This Condition is imposed in accordance with Policies 2, 3 and 4 of the Southeast Lincolnshire Local Plan, 2019.

1.2 Construction Hours

1.2.1 Following repair to the haul road, the construction schedule of the development itself is expected to last for between 24 and 36 weeks, with an assumed commencement date of Summer / Autumn 2024.

1.2.2 Construction activities would take place 7 days per week, during the following hours:

i) Monday to Friday 07:30 – 18:00; and
ii) Saturday - Sunday 08:30 – 18:00.

1.2.3 Deliveries and noise generating activities would only take place from Monday – Saturday (inclusive) within the following hours:

i) Monday to Friday 07:30 – 18:00;
ii) Saturday 07:30 – 13:00; and

iii) No deliveries on Sundays with the exception of one-off abnormal loads or large vehicles such as cranes.

1.2.4 Whilst no local highway capacity concerns are anticipated, to minimise disruption construction traffic will be sought to occur outside of standard peak hours of 08:00-09:00 and 17:00-18:00 Monday to Friday. No deliveries are anticipated to take place on Sundays unless such work is associated with an emergency or with prior written consent of the LPA / LHA.

1.3 Purpose of this CMP

1.3.1 The principal purpose of this document is to discharge these conditions and set out how construction traffic, including site personnel movements, will be safely managed, and controlled at the site and surrounding roads.

1.3.2 The CMP ensures that the impacts of construction traffic and deliveries on the surrounding highway network are kept to a minimum by setting out a management plan of their routing, delivery phasing, delivery times and parking arrangements.

1.3.3 The points raised within the condition are dealt with in turn within the subsequent chapters.

2.0 PHASING OF DEVELOPMENT AND ACCESS CONSTRUCTION

2.1 Introduction

2.1.1 The construction period will allow for key construction-related works to be undertaken and will also include for the setting up and decommissioning of site compound areas. A copy of the construction management plan drawing for the site is contained within Appendix B at the end of this report. The matters illustrated on the plan include:

i) Areas of the Site where construction works will take place;
ii) 'No-Dig' construction areas to protect potential archaeology;
iii) Fencing and 'No Construction' Zones for protect existing trees and hedgerows;
iv) Temporary Welfare and Materials Laydown areas; and
v) On-site Construction Traffic Routes

2.1.2 The Development process splits into a 'Pre-Construction' phase, seven 'construction' phases and then Operation and ultimately Decommissioning.

2.2 Phasing

National Grid Haul Road Repairs

2.2.1 Prior to construction works commencing at the site itself, the National Grid Haul Road will be subject to repairs.

2.2.2 This will be carried out in Summer 2024 and will take approximately 2-3 weeks to complete. It is envisaged that this will require a total of 20 one-way (i.e. 40 two-way) HGV movements along with a small number of contractor movements. All vehicles will access and egress via the A52 from the southern end of the haul road.

Phase One: Pre-Construction Surveys and Site Preparation Works

2.2.3 This phase includes topographical, archaeological, geotechnical and detailed surface water and ecological surveys to inform the detailed design work and submission of all regulatory information.

2.2.4 The fields are currently laying fallow. Prior to the contractor mobilising to Site it is intended to carry out the necessary ground preparation works in terms of the creation of Grassland, that are the subject of a separate Landscape and Ecology Management Plan (LEMP).

Phase Two: Site Mobilisation and Enabling Works (75 days)

2.2.5 Contractor mobilising to site, erecting temporary Construction Traffic signage, forming the new site accesses and constructing the passing bay works. During this phase the site will be fenced, CCTV installed and the temporary welfare compounds and materials, plant and equipment laydown and storage areas formed.

2.2.6 During this phase and prior to any construction works taking place Pre-Construction Ecological Surveys will be undertaken and all the temporary fencing / protection measures for sensitive ecological, arboricultural and archaeological features will be put into place. Whilst archaeological investigations are yet to conclude, it is intended that a precautionary approach is taken to ensure that any archaeologically sensitive areas are protected from disturbance. The archaeologically sensitive areas (ASAs) are currently indicative, with the full extents to be determined by the Local Authority Planning archaeologist(s). The indicative ASAs are shown as 'no-dig' zones on the construction management plan drawing included at **Appendix B** at the end of this report. The protection of archaeologically sensitive areas, and any other areas which may lie outside of the currently indicative ASAs, will be in line with a Written Scheme of Investigation for Archaeological Mitigation (WSI), which will contain an appended Archaeological Mitigation and Management Plan (AMP).

2.2.7 The timing of this phase is dependent upon the completion and approval of the detailed design (and all other Pre-Construction planning matters as set out in the planning consent issued).

Phase Three: Construction (150 days)

2.2.8 All materials plant and equipment delivered to site, and the internal access roads, and Solar PV configurations will be set out and constructed.

2.2.9 In terms of the Solar PV, the construction process will be:

i) Cabling trenching and laying.
ii) The installation of the PV Module Mounting Structure (MMS) piling.
iii) Assembly of PV MMS.
iv) Inverter Station foundations.
v) Inverter Station installation.
vi) SCADA and Control System installation.

Phase Three b: Off-site Grid Connection Cabling works

2.2.10 These works, as mentioned earlier are carried out by an ICP contractor and regulated by the local highway authority under Street Works legislation. They will be carried out concurrent with 'on-site' construction works.

Phase Four: Commissioning and Testing (105 days)

2.2.11 This phase incudes both the 'cold' commissioning, 'G99' Testing and Site Energisation and Performance testing. This phase may overlap with the construction phase. The conclusion of this phase ends the construction works on BESS and Solar PV on site.

2.2.12 It is anticipated that export of electricity will take place in late Summer /Autumn 2025.

Phase Five: EPC Contractor Demobilise from Site (45 days)

2.2.13 During this phase, the EPC contractor closes down the construction site, removes and reinstates the temporary welfare and materials laydown areas.

Phase Six: Landscape and Ecological Works (duration to be agreed)

2.2.14 This phase is the delivery of the landscaping and ecological works as set out in the Landscape and Ecological Management Plan (LEMP). The LEMP is subject to separate consultation with the local planning authority. Implementation of the LEMP is governed by planting and other works taking place in the appropriate planting season.

Phase Seven: Operational Phase (40 years)

2.2.15 The development will be operational for 40 years from the date of the first export of electricity generated.

Phase Eight: Decommissioning and Restoration

2.2.16 The planning consent granted includes provisions for the decommissioning and restoration of the Site to its pre-construction condition. These works are the subject of separate local planning authority approvals. This phase will take place after the development ceases operation, which includes a trigger earlier than the 40-year period in the case that the export of electricity to the grid ceases for a continuous period of 12 months at any point after the date of first export (other than for operational reasons outside of the operator's control).

3.0 PARKING OF SITE OPERATIVE AND VISITOR VEHICLES

3.1 Staff Welfare and Parking Areas

3.1.1 There will be three compounds in Fields '1', BESS and '10' as per the Construction Management Plan Drawing contained within **Appendix B** at the end of this document, that will serve as areas for temporary welfare and contractor / visitor parking only. These areas will be stripped of topsoil and deposited in spoil for re-use following the completion of the works. A temporary surface of hard-core (over geo-textile) will be constructed for the parking area. Upon completion of the works this will be removed, and the area restored accordingly.

3.1.2 No construction traffic will be parked outside of these compounds, or indeed outside of the site. Parking will be managed and carefully monitored by the site manager to ensure that parking is provided in an efficient and safe manner, with sufficient separable distance from any plant, materials, or construction activity.

3.1.3 Special precautions will be taken when catering for any disabled staff / visitors to ensure that all access/egress to parking and other facilities are safe, practical, and reasonable.

3.1.4 The site boundary will be kept secure by means of temporary fencing to minimise the risk of unauthorised persons from gaining access to the site during the works.

3.1.5 The only vehicles that will be parked within the confines of the main construction areas are construction vehicles. Construction staff are expected to park within the temporary car parking areas.

3.1.6 All construction vehicles and plant are to be parked in a safe and tidy manner when not in use.

3.1.7 CDM Regulations 2015 require suitable and sufficient welfare facilities, with arrangements for maintaining them in a functional, clean, and tidy condition. The specific provisions are detailed below.

i) Office Areas;
ii) Messing Facilities;

iii) Drinking Water: within the mess facility;
iv) Means of heating food: within the mess facility;
v) Hot & cold water within the mess facility;
vi) Fridge within the mess facility;
vii) Kettle or means of boiling water in the mess facility;
viii) Washing Facilities;
ix) Welfare arrangements shall contain adequate washing facilities; and
x) Toilet Facilities

3.1.8 The above provisions will be implemented at the site. These areas will be kept clean at all times. Site facilities may vary over the duration of the project.

3.2 Site Access and Circulation

3.2.1 Access to the site is via Cowbridge Road or North Ing Drove (depending on route taken).

3.2.2 The entrance(s) to the site will be marked by a 'Site Entrance' sign as per the below image, or similar.

Image 3.1 – Site Entrance Sign



3.2.3 All vehicles will observe a 10mph site speed limit at all times. Emergency procedures and location of assembly areas will be made known to all contractors during induction. All contractors and visitors will sign in upon arrival and upon leaving the site.

3.2.4 Any reversing manoeuvres by construction traffic, either from the local highway or within each site will be controlled by a qualified banksman. All Banksmen / Traffic Marshalls working on the highway will be NRSWA qualified, so that they are qualified to control traffic entering and exiting the site.

3.2.5 On entering the site, construction traffic will be directed to follow the established traffic management system which will include temporary turning areas along the construction roads within the site. The plan at **Appendix B** provides additional detail on construction routeing at the immediate site approaches as well as within the site itself.

3.2.6 It is not envisaged that there will any need for large materials laydown areas. Materials delivered to site will be taken into the site, along the construction roads and then materials temporarily stored in the areas where they are to be used.

4.0 PLANT AND MATERIALS (LOADING & UNLOADING AND STORAGE)

4.1 Loading and Unloading

4.1.1 Loading and unloading of materials will be undertaken within the three on-site compounds as mentioned previously in section 3.1 earlier within this report.

Deliveries

4.1.2 All delivery vehicles will be unloaded or loaded within the Site clear from the Public Highway in designated materials, plant and equipment 'laydown' areas. The laydown areas will be located within the fields directly adjacent to the Site Accesses and will be fenced off with Heras fencing, gated and secured during non-operational hours. The size of the compounds has yet to be finalised but will be in the order of 20,000sqm in total spilt evenly between the three areas. All delivery vehicles and HGVs will enter and leave the site in forward gear so as to protect the safety of the users of the Public Highway.

4.1.3 The laydown areas and internal access tracks, including those constructed for permanent use during the operational phase of the development will be constructed from granular aggregate, be unsurfaced (i.e. not asphalted) and be free draining so as to minimise surface water flooding risks.

4.1.4 During the construction phase of the development the Laydown compounds and internal access tracks close to the site accesses will be inspected on a daily basis to ensure they are free of mud or other debris at risk of being tracked out onto the public highway.

Construction Traffic Routing

4.1.5 Wherever possible, access to the site will be taken via a combination of two routes so as to provide a separate arrival and departure route for construction vehicles.

4.1.6 These routes comprise:

i) **Route 1**: Via the Viking Link 'haul / access road' route from Bridge End Causeway (A52), towards North Ing Drove, and Middle Fen Drove; and,
ii) **Route 2**: Via the existing National Grid 'haul road' from the Bicker Road (A52), towards Ing Drove and Cowbridge Road.

4.1.7 The entry points to Route 1 and Route 2 from the A52 are shown at **Image 4.1** and **Image 4.2**, respectively.

Image 4.1 – A52 / Viking Link Road Junction



Image 4.2 – A52 / National Grid Haul Road Junction



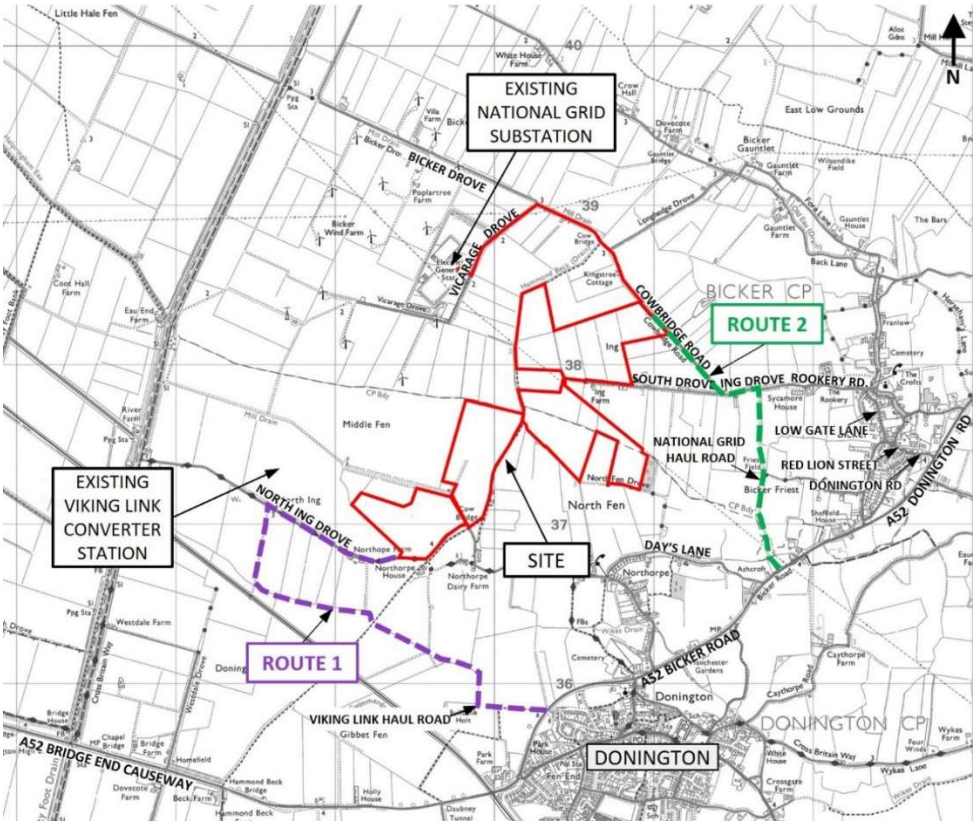
4.1.8 Wherever possible, the routes will be allocated for separate arrival and departures, with the exact access and egress routes being depending on the respective construction stage and given area of work being undertaken on the site at that time. This will minimise incidences of vehicles meeting.

4.1.9 Whilst the above routing arrangement will be utilised wherever possible, there will likely be periods during the course of the works, particularly prior to the implementation of the bridge across Hammond Beck which traverses the site, where sole access and egress to this site will only be feasible from the east – i.e. via Route 2 (Cowbridge Road and the National Grid haul road).

4.1.10 Once the development is operational, only occasional maintenance access will be necessary and this will be provided from Cowbridge Road.

4.1.11 The construction routing arrangements for the site is shown at **Image 4.3**.

Image 4.3 – Construction Traffic Routeing to and from Site



Abnormal Loads

4.1.12 The construction of the development will not involve a significant number of abnormal load deliveries.

4.1.13 The following total abnormal loads are anticipated across the entire construction programme:

i) One abnormal load delivery of an Earthing Transformer for the cable connection works. To be undertaken by a specialist heavy load contractor from the manufacturer Hyosung. Likely to be undertaken on a weekend.

ii) One abnormal load delivery to transport the new bridge required across Hammond Beck, depending on whether the bridge is prefabricated off-site.

4.1.14 All abnormal load vehicles will travel to and from the site infrequently (a maximum of two deliveries are anticipated across the entire programme) and under escort following standard procedures, which will be carefully planned and agreed in advance with the LHA and National Highways (if involving use of the SRN) as necessary.

4.1.15 These movements will also be planned in advance to ensure that the route between the A52 and the site is kept entirely clear of other construction vehicles whilst the abnormal loads are routing to and from the site.

4.2 Storage

4.2.1 Temporary Laydown compounds for plant, equipment and construction materials will be provided on throughout the site. These compounds will be accessed direct from both site accesses.

4.2.2 During the winter months when the hours of daylight are reduced, and the construction site is open temporary lighting will be provided within the laydown compounds. This lighting is required to ensure the safety of operatives and delivery drivers. There is a risk that the lighting could cause ‘light pollution’ or be a distraction to users of public roads, or neighbouring residential properties. To mitigate this risk only temporary lighting that can be angled and baffled will be used. The site manager will conduct an audit of all temporary lightning immediately after its first installation to ensure it is fit for purpose and avoids the creation of light pollution.

4.2.3 All materials on Site will be stored in accordance with the Control of Substances Hazardous to Health (COSHH) regulations and supporting COSHH assessments and data sheets.

4.2.4 The temporary hardstanding, comprising of unbound free draining aggregate material will be removed as the construction works are completed. Spoil will be used to backfill the areas to start of the topsoil layer and then the areas re topsoiled and reinstated to their pre-construction condition in accordance with the LEMP in advance of final landscaping works.

5.0 WHEEL WASHING FACILITIES

5.1 Wheel Wash

5.1.1 In order to mitigate against dust and dirt arising from construction activities, wet cutting and vacuum extraction will be applied where possible.

5.1.2 If considered necessary during any periods of wet weather, all site traffic would exit the site via a wheel washing facility which would be installed at the site to help reduce any potential impact on the local highway network during construction.

5.1.3 Examples of wheel washing facilities that could be utilised are provided within **Appendix C** at the end of this report.

5.1.4 All HGV's will be required to drive through the wheel washing facility prior to exiting the site.

5.1.5 SHDC have approved these details in relation to Condition 11, '*Details of methods to prevent the deposit of mud on public highways*'.

5.2 Environmental Control Measures

5.2.1 It is anticipated that the following measures will also be implemented throughout the works:

i) Use of an approved mechanical road sweeper to clean the highways of mud or debris that is deposited by site vehicles within the vicinity of the site. The sweeper will be available whenever required and will be properly used and maintained;
ii) Provision of adequate sheeting of vehicles carrying waste materials; and
iii) Measures to ensure mud and debris is not swept into gullies by the road sweeper.

5.3 Waste Management

5.3.1 The removal of any waste products from the site would be minimised by recycling excess materials wherever possible.

6.0 SURFACE WATER RUN-OFF STRATEGY

6.1 Flood Forecasting and Warning

6.1.1 The Environment Agency operates a flood forecasting and warning service in areas at risk of flooding from rivers or the sea. The warning service has three types of warnings - Flood Alert, Flood Warning and Severe Flood Warning and operates 24 hours a day, 365 days a year.

6.1.2 The contractor will 'sign-up' up to the Environment Agency's Flood Warning Service.

6.1.3 When a Severe Flood warning is given, it should be acknowledged that flooding is imminent and urgent action is required. If such a warning is given the Site Manager will safely stop all construction works and evacuate the Site.

6.1.4 It is the Site Manager's, or their designated deputy's, responsibility for disseminating a warning to everyone working on-site, including visitors, conducting the evacuation procedures and arranging any necessary exercises to test the system, liaising with the Emergency Services prior to and during an evacuation event.

6.1.5 No Construction Work shall recommence until the Environment Agency has issued an 'All Clear'.

6.2 Foul and Surface Water Drainage Scheme

6.2.1 Interim and temporary drainage measures form the subject of a separate submission to the local planning authority in respect of the discharge of Condition 12 (BBC) and 15 (SHDC). Details of the Foul and Surface Water Drainage Scheme's proposed are included within **Appendix D** at the end of this report.

7.0 COMPLAINTS, ENGAGEMENT, COMMUNICATION AND ENFORCEMENT

7.1 Complaints

7.1.1 It is important that members of the public and / or other interested parties are able to make valid complaints about the construction works and associated construction traffic. Measures set out within this CMP seek to avoid potential impacts on sensitive receptors as much as possible.

7.1.2 Valid complaints can provide a valuable feedback mechanism, which could help reduce identified potential impacts on sensitive features or sensitive areas and also allow the construction traffic routing and site procedures to be assessed, refined, and improved.

7.2 Public Engagement

7.2.1 This development has been the subject of significant Public Engagement and debate throughout the determination of the planning application.

7.2.2 A site manager will be appointed and act as the single point of contact for site related matters throughout the construction testing and commissioning phases of the development, and they are responsible for ensuring any reports received from local people are acted upon promptly and feedback provided.

7.2.3 Prior to any construction works starting on site. The site manager will carry out a letter drop of all local residents and businesses, using the scope of the neighbour consultees defined by the local planning authority during the planning process. The letter drop will include:

i) Site Contact details (telephone and email).
ii) General Information about the development.
iii) Overall phasing of the construction works.
iv) Details of the Construction Traffic Routes.
v) FAQs (to help answer the initial questions we know people are likely to have)

7.2.4 AGR Solar 2 recognises, as was considered during the determination of the planning application, that constructing the development will give rise to a temporary inconvenience to local residents and business.

7.2.5 The management of the construction process will however ensure that the safety of existing road users is protected, and that any potential noise or dust issues are managed so as not to cause nuisance to those that neighbour the Site.

7.2.6 The Site Manager will be proactive in ensuring the Construction Site is a good neighbour, and that local people are kept informed and if concerns are raised, they are acted upon promptly and feedback given.

7.3 Communication

7.3.1 AGR Solar 2 Limited is the client. Tim Edmunds, Business Development Manager at AGR Renewables Limited is the Client lead for the delivery of this Project and acts as the Responsible Person for AGR Solar 2 Limited in relation to this project.

7.3.2 Sunnerg are the Principal Designer and Principal Contractor for the Solar PV parts of this project. Their Project Manager is Tommaso Crespi. He has overall responsibility for the detailed design and construction of the development. Sunnerg will appoint a Site Manager, who will be based on-site. The Site Manager will be the Single Point of Contact for site related matters throughout the construction testing and commissioning phases of the development.

7.3.3 A Site Notice Board will be based at both Site Accesses, providing the name and contact details (telephone and email) of the Site Manager and Emergency Contact information so that members of the Public can report any concerns or issues. The Site Manager will be responsible for ensuring any reports received are acted upon promptly and feedback provided.

7.3.4 The Site Manager will be responsible for monitoring and reporting various health safety environmental and quality (SHEQ) matters to AGR Solar 2's Responsible Person on a weekly basis. AGR Solar 2 will also conduct its own SHEQ audits to ensure the Contractor and their Supply Chain of sub-contractors adhere to all contractual and regulatory requirements.

7.3.5 In addition to the works on the development site, there are works 'off-site' to connect the development to the electricity grid at National Grid's Bicker Fen Sub-station. These 'off-site' grid connection works will be carried out and managed on behalf of AGR Solar 2 by an Independent Connections Contractor (ICP).

7.3.6 The ICP contractor will liaise with the local highway authority in respect of laying of the grid connection cable in the public highway. These works are regulated under the provisions of the New Roads and Street Works Act 1991 and include provisions for consultation and advanced publicity of any Temporary Traffic Orders required.

7.4 Management

Management of Construction Traffic

7.4.1 A number of mitigation measures relating to construction traffic routeing have been identified. These measures are set out below and primarily relate to periods at the early stage of the project when only the eastern route (Route 2) is available for construction traffic.

Security Gate Houses

7.4.2 Security gate houses would be located along the construction routes, as follows:

i) **Southern End of National Grid Haul Road**. This gate house would be located within the Haul Road with sufficient clearance provided to the A52 carriageway to accommodate at least two stacked 16.5m articulated vehicles.
ii) **Entry to Site**. This gate house would be located within the site entry point (off the public highway) and would be managed by the contractor responsible for the site. It would be located either at the Cowbridge Road entry point or the Viking Link / North Ing Drove entry point to the site (depending on the respective stage of works and associated entry point in use at that time).

7.4.3 All gate houses would be provided with two-way radio communication facilities between the other gate houses.

7.4.4 The gate house at the southern end of the National Grid Haul Road would be the 'principal' gate house and would have overall control over construction traffic on a day-to-day basis. This gate house would include additional features (live stream CCTV monitoring of the site and the associated construction routes).

Booking and Arrival Procedure

7.4.5 All deliveries and collections of materials and equipment to site must be arranged and agreed in advance. 24 hr Notice is required. A specific time slot will be given and the driver will report to the security gate house at the southern end of the National

Grid Haul Road (unless using the Viking Link route to reach the site), where their details will be recorded and checked against the booking log.

7.4.6 Assuming the vehicle has arrived within their allocated time slot and the CCTV monitoring shows that the route is clear, they will be instructed to proceed to the site, or will be directed to wait within one of the holding areas along the haul road in the event that an existing vehicle from the site is already proceeding along the route. The vehicle will then report to the site-specific security gate house upon entry to the site accordingly.

7.4.7 During delivery and collection, the contractor responsible for the delivery or collection will escort the vehicle to the loading area (banksman). The driver will be under supervision of the responsible contractor, who will manage these deliveries and activities accordingly.

Vehicle Holding Areas

7.4.8 The site is sufficiently large such that more than one lorry can easily be stored within the site at any given time. As far as reasonably possible therefore, arriving and departing lorry movements will be coordinated to seek to ensure there is only a single lorry on the main eastern route (Route 2) between the A52 and the site at any given time, although following completion of the bridge over Hammond Beck separate access and egress routes can be utilised (i.e. Route 1 and Route 2) such that vehicle holding areas procedures are not necessary.

7.4.9 Arriving lorry drivers will be in communication with site staff. In the unlikely event that a lorry is arriving at the same time as a lorry is seeking to depart, site staff will hold the departing lorry within the site until the arriving lorry has entered the site.

7.4.10 There may be times when it is not feasible to have only one lorry on the eastern route (Route 2) at any given time, due to unforeseeable factors that may impact delivery schedules and unavoidable clashes in delivery schedules, alongside potential issues caused by ‘bunching’ of multiple vehicles within the site.

7.4.11 Therefore, a number of holding areas have been identified along this eastern route where vehicles can wait without blocking the network. These areas comprise widened areas along the National Grid Haul Road that would be used during more

intensive periods of operation during the early stages of the project (i.e. prior to the construction of the bridge over Hammond Beck).

7.4.12 In the unlikely event that the holding areas along the National Grid Haul Road are also fully in-use, formal parking areas along the A52 or other suitable locations would be used to temporarily hold vehicles prior to their arrival on-site.

7.4.13 It will be communicated to the contractor and supply chain that they are not permitted to wait on the public highway outside of designated areas. The contractor and supply chain will be advised in advance of the times when deliveries can be received and will be required to meet those delivery windows.

Communication with Suppliers

7.4.14 An information pack will be distributed to all suppliers involved in the transport of materials and plant to and from the site. The pack will be a convenient size so it can be stored in a truck cab.

7.4.15 The pack will include key information on delivery routes and will clearly set out the abovementioned procedures, as well as those for dealing with emergencies and disciplinary measures for non-compliance.

7.4.16 The site manager will ensure that the installation team and other contractors and operatives that work on / travel to the development site are informed of the measures and procedures set out in the CMP.

Site Rules

7.4.17 A copy of the Site Rules is attached as **Appendix E** at the end of this report.

7.5 Enforcement

Site Rules

7.5.1 Any drivers found to be disobeying the traffic management procedures – for example through CCTV observations or via the complaints procedure – will be issued with a written warning, with reminder letters regarding the proper procedures also sent to all contractors should this be deemed necessary. Any individual that repeatedly breaches procedures will be subject to a ‘three strikes and out’ policy.

7.5.2 The Site Manager will be responsible for upholding the requirements of the CMP and ensuring complete compliance with the CMP from all site contactors and operatives.

7.6 Security

7.6.1 The site boundary will be kept secure by means of fencing to minimise the risk of unauthorised persons from gaining access to the site during the works.

7.7 Highways Remediation

7.7.1 The Developer is aware that construction of an adjacent solar energy project is likely to coincide with construction of the permitted development. The Developer commits to proportionately contributing towards remedial highway works identified as having directly arisen from construction works on any shared sections of highway access route. The Developer will work with the adjacent development to agree a mechanism for proportioning shared costs should this need arise.

Appendix A – Proposed Site Layout Plan

Q:\2901-2950\2920-01 Bicker Fen Solar Farm\Dwgs\CAD\Planning Drawings\2920-01-03 General Arrangement (RevE).dwg



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•	Revision History	• Date
D	Battery storage layout updated	28-07-22
E	Access tracks and red line updated	04-08-22

- Application Boundary
- Photovoltaic Panels
- Deer / Stock Fence 2.1m
- Acoustic Fence 5m
- Solar Inverter / Transformer Station
- Solar Storage Building
- Solar Control Building
- Solar Switchgears Building
- Battery Storage Container
- Inverter / Transformer Station
- Control Building
- Switchgears Building
- Access Track
- Low Maintenance Pasture
- Species Rich Grassland
- Hedgerow
- Woodland Shelterbelt
- Existing ditch retained and enhanced
- Existing public right of way
- Existing pylon
- Proposed ditch crossing

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Well House Barns
Bretton
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CH4 0DH

South Manchester Office:
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76 Water Lane
Wilmslow
SK9 5BB

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client: AGR

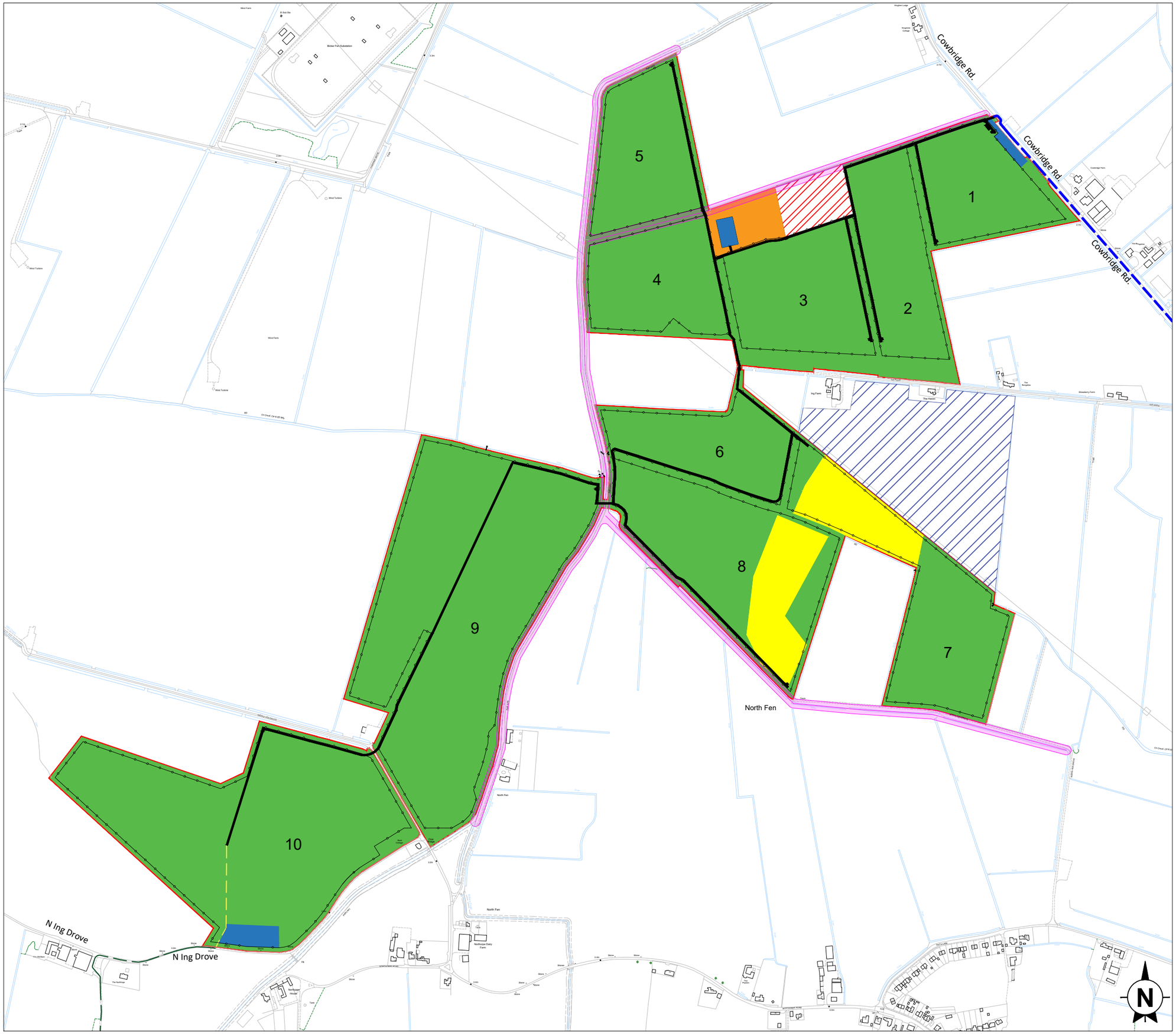
project: BICKER FEN SOLAR FARM

drawing title: GENERAL ARRANGEMENT FULL LAYOUT

date:	drawn by:	checked:
FEBRUARY 2022	TR	PR
drawing number: 2920-01-03	status: --	
scale(s): 1:5,000@A2	rev: E	

planning environment design

Appendix B – Construction Management Plan Drawing



Bicker Fen 1 Construction Management Plan

- Redline Boundary
- Solar CDM Zone
- BESS CDM Zone
- Welfare Compound & Material Laydown
- Construction Track
- Skylark Mitigation Land
- No Dig Zone
- No Construction Zone
- Site Fencing
- Construction Traffic (North-East)
- Construction Traffic (South-West)
- Temporary Construction Track
- IDB Drain
- 9m IDB Drain Buffer

REV	DESCRIPTION	DATE
A	Amendments to Laydown Areas	04/06/24
B	Addition of No Dig Zones	18/06/24

COMPANY
AGR Solar 2

DRAWING TITLE
Bicker Fen 1
Construction Management Plan

DATE	SCALE
18.06.24	NTS @ A3
DRAWN: EJ	CHECKED: TE

DRAWING TITLE
BF-BF1CMP-001

Mayfair Office:
19 Heddon Street, Fourth Floor
London, W1B 4BG

AGR

0207 042 1100 - www.agr-group.co.uk/

Positive Energy

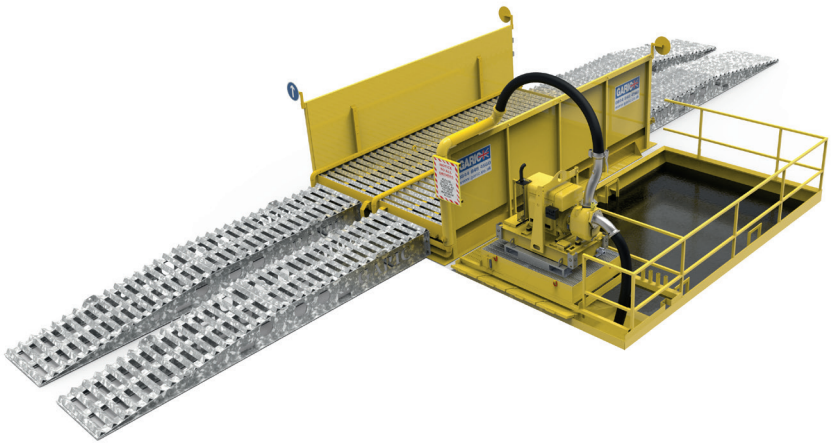
Appendix C – Wheel Washing

GARIC

ON-DEMAND, ON-SITE, ON-TIME.

ENVIRO WHEEL WASH

A HISTORY OF INNOVATION



MIN 1 WEEK HIRE

STANDARD SPECIFICATIONS:

Product Code	300002
Unit Name	Enviro Wheel Wash
Dimensions with ramps	62 x 24ft / 20 x 7.3m
Dimensions without ramps	22 x 24ft / 6.7 x 7.3m
Weight	8500Kg
Weight (with pump)	17000Kg
Power type	6" Electric water pump
Steel fabricated wash area	✔
Internal removable rumble road sections	✔
25mm water inlet (c/w ball cock fitted)	✔
Heavy duty lifting/lashing points	✔
Automated magic eye system	✔
Dig Measurements	6.3m length x 1.02m depth x 3.5m width

Our enviro wheel wash is the ideal solution for demolition, quarrying and ground works sites where trucks, dumpers and lorries are regularly passing through heavy duty mud, dirt and debris.

Our fully automated and totally self-sufficient enviro wheel wash is perfect for sites where sticky clay and mud can be a big problem. As vehicles pass through the wheel wash, exceptionally powerful jets spray water onto the wheels, chassis and undersides, cleaning the vehicles without them even needing to stop. The wheel wash is environmentally friendly and utilises the latest water filtration technology combined with a 100 percent water recirculation system.

It doesn't require an operative and is easy to maintain due to an innovative easy-clean water catchment area. Furthermore, it requires no electricity power source because it runs off a simple yet reliable 6" diesel pump.

The enviro wheel wash can be elevated and placed directly onto a surfaced area with ramps or excavated into the ground making it suitable for a large variety of sites.

KEY FEATURES:

- Powered heavy duty wheel wash
- Steel fabricated wash area
- Heavy duty lifting and lashing points
- Cleaning area with vertical spray jets
- Automatic sensors

OPTIONAL EXTRAS AVAILABLE

- Electric pumps
- Water fills
- Water Tank / Bowser
- Header Tank / Bowser

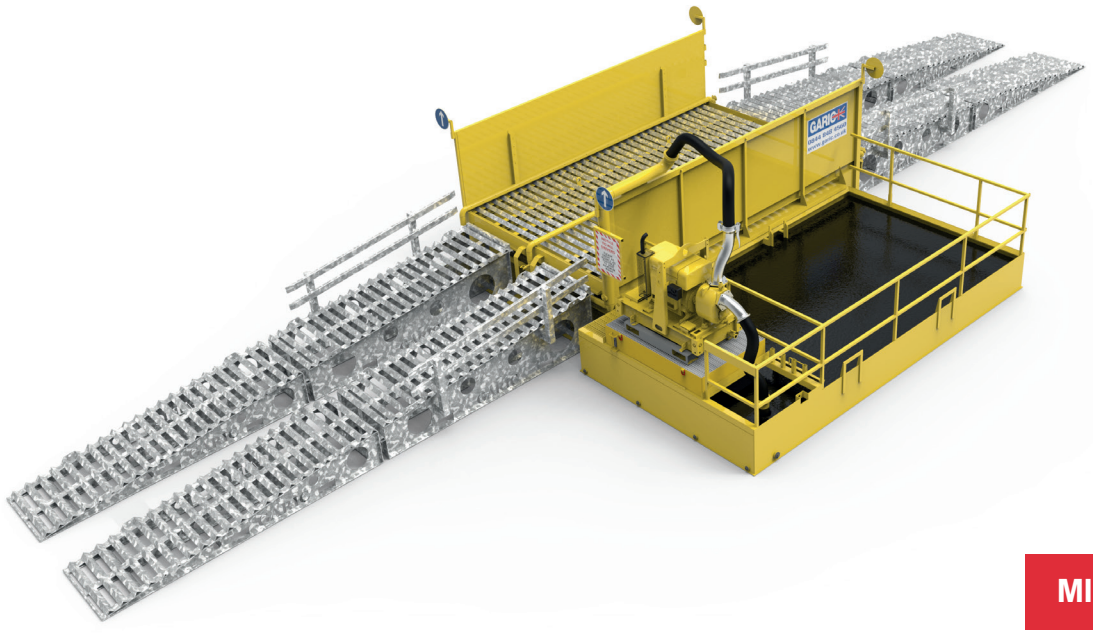
**All data is based on Garic product specifications. If unavailable at the time of hire, an alternative specification model may be supplied.*

GARIC

ON-DEMAND, ON-SITE, ON-TIME.

ELEVATED ENVIRO WHEEL WASH

A HISTORY OF INNOVATION



MIN 1 WEEK HIRE

The Enviro wheel wash can also be elevated and placed directly onto a surfaced area with ramps; perfect for quick set-up and removal on short-term contracts or sites that require heavy duty wheel washing. The Enviro wash recycles and re-circulates water separating the muck and debris in the lagoon area for easy removal and cleaning.

STANDARD SPECIFICATIONS:

Product Code	300001
Unit Name	Elevated Enviro Wheel Wash
Dimensions (with ramps)	66 x 24ft / 20 x 7.3m
Dimensions (without ramps)	22 x 24ft / 6.7 x 7.3m
Weight (without ramps)	9300Kg
Weight (with ramps)	11300Kg
Power type	6" Diesel water pump
Steel fabricated wash area	✔
Internal removable rumble road sections	✔
25mm water inlet (c/w ball cock fitted)	✔
Heavy duty lifting/lashing points	✔
Automated magic eye system	✔

KEY FEATURES:

- Powered heavy duty wheel wash
- Steel fabricated wash area
- Heavy duty lifting and lashing points
- Cleanin area with vertical spray jets
- Automatic sensors

OPTIONAL EXTRAS AVAILABLE

- Electric pumps
- Water Fills
- Header Tank / Bowser

0330 094 8064 | www.garic.co.uk | info@garic.co.uk

**All data is based on Garic product specifications. If unavailable at the time of hire, an alternative specification model may be supplied.*

GARIC

ON-DEMAND, ON-SITE, ON-TIME.

DRIVE THROUGH BATH

A HISTORY OF INNOVATION



MIN 1 WEEK HIRE

STANDARD SPECIFICATIONS:

Product Code	303500
Unit Name	Drive Through Bath
Dimensions with ramps	77 x 12ft / 23.4 x 3.6m
Dimensions without ramps	35 x 12ft / 10.6 x 3.6m
Weight (bath only)	6300Kg
Weight (with ramps)	15900Kg
Power type	Unpowered
Steel fabricated wash area	✔
Internal removable rumble road sections	✔
25mm water inlet (c/w ball cock fitted)	✔
Heavy duty lifting/lashing points	✔

Garic's unpowered drive through bath is an inexpensive yet very efficient vehicle wash system. It is ideal for sites that have moderate mud and dirt and is quick and easy to install, doesn't require an operative and is very easy to maintain.

Trucks, dumpers and lorries are cleaned as they drive over a series of rumble strips which shake off the heaviest earth. They are then washed as the wheels, chassis and undersides pass through a water lagoon to provide a quick, safe and effective cleaning system. If required, extra road rumble strips are available.

Like our enviro wheel washer, the drive through bath can be elevated and placed directly onto a surfaced area with ramps or excavated into the ground making it suitable for a whole host of site needs.

KEY FEATURES:

- Steel fabricated wash area
- Removable rumble road sections
- Heavy duty lifting and lashing points

OPTIONAL EXTRAS AVAILABLE

- Ramps
- Water Fills
- Water Tank / Bowser
- Header Tank / Bowser

**All data is based on Garic product specifications. If unavailable at the time of hire, an alternative specification model may be supplied.*

Appendix D – Foul and Surface Water Drainage Scheme

Weetwood Services Ltd
info@weetwood.net

Weetwood
Development • Planning • Environment

Land to the East of Bicker Fen, Lincolnshire, PE20 3BN

Foul and Surface Water Drainage Scheme

Technical Note

Project ref:	5086
Prepared by:	Warren Chan BEng (Hons) *Project Engineer*
Checked and Approved by:	Tim Brook BSc (Hons) *Technical Director*
Date:	18 January 2024
Version:	Final v2.1

Introduction

1. A full planning application for the "*Proposed development of a photovoltaic solar array, grid connection, access improvement works and ancillary development on land at Bicker Fen, Boston and South Holland at land to the west of Cowbridge Road, Bicker, Boston*" was submitted to Boston Borough Council and South Holland District Council on 25 August 2022 (application ref: B/22/0356 and H04-0849-22).

2. The proposed site layout plan is presented in **Annex 1**.

3. The planning application was accompanied by a Flood Risk Assessment report (ref: 5086/FRA/Final/v1.1/2022-11-04) and a Hydrological Analysis Technical Note (ref: 5086/TN/Final/v1.0/2022-05-13) prepared by Weetwood.

4. Planning permission was subsequently granted by Boston Borough and South Holland District Council by way of a decision letter notice dated 21 July 2023, subject to the following planning condition relating to surface water drainage:

   Condition 12 (Boston Borough Council) / Condition 15 (South Holland District Council)

   Prior to commencement of the development hereby approved, full details of the means of surface water disposal and foul water drainage shall be submitted to and approved in writing by the Local Planning Authority. The details so approved shall be implemented in full before the development hereby permitted is first brought into use.

   Reason: To ensure that the site is adequately drained, to avoid pollution, and to prevent increased risk of flooding in accordance with Policies 2, 3 and 30 of the South East Lincolnshire Local Plan, 2019 and national guidance contained within the National Planning Policy Framework 2021.

5. This document presents a surface water drainage scheme commensurate with the level of detail required to discharge planning condition 12/15.

Site Details

6. The site is approximately 97.3 hectare (ha) in extent and is located to the west of Bicker, near Boston, Lincolnshire. The centre of the site is at Ordnance Survey National Grid Reference TF 200 376, as shown in **Figure 1**. The site currently comprises of agricultural land.

7. LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in **Figure 2**. This indicates that ground levels across the site are generally in the range 1.5 to 2. 5 m AOD. Ground levels along Cowbridge Road are between 2.2 to 3.2 m AOD.

8. South Forty Foot Drain is located approximately 1.2 km west of the site.

   Hammond Beck bisects the eastern and western parts of the site. Hammond Beck is pumped into the South Forty Foot Drain at three pumping stations:

   - Donnington North Ing pumping station located approximately 2.5 km upstream of the site
   - Bicker Fen pumping station located 2.5 km downstream of the site
   - Swineshead pumping station located 6.1 km downstream of the site.

There is a network of on-site drainage ditches located within and in the vicinity of the site, which drain to the South Forth Foot Drain.

9. According to the Soilscapes soils dataset produced by the Cranfield Soil and AgriFood Institute[1], soil conditions at the site and within the surrounding area are loamy and clayey soils of coastal flats with naturally high groundwater.

10. British Geological Survey mapping of surface geology[2] indicates the underlying bedrock formation comprises of mudstone (Oxford Clay formation), overlain by clay and silt (Tidal Flat deposits) superficial deposit.

11. According to the MAGIC website[3] the Tidal Flat superficial deposits and Oxford Clay bedrock is classified as an Unproductive aquifer. An Unproductive aquifer are rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

12. Infiltration testing was carried out by RGS on 6 December 2023 (refer to **Annex 2**) in accordance with the requirements set out in BRE365[4]. This included the excavation of three trial pits, two of which had to be relocated due to groundwater ingress. Ground conditions generally consisted of topsoil 0.3 – 0.4 m below ground level (bgl), underlain by silty clay 0.4 – 2.4 m bgl, sandy silt 1.2 – 1.8 m bgl, clayey silt 1.2 – 2.1 m bgl, clayey sandy gravel to 2.45 m bgl and sandy silty clay to 3.0 m bgl.

13. Groundwater was struck within trial pits TP01A and TP02A at 1.1 m and 1.6 m bgl respectively.

14. All tests during the site investigation indicate that infiltration is not feasible due to very poor drainage characteristics of the ground material and naturally high groundwater.

Surface Water Drainage at the Existing Site

15. The site currently comprises agricultural farmland. It is possible that field drains are present, but no other formal drainage infrastructure is believed to be present. Given ground conditions and site topography, surface water runoff would be expected to slowly infiltrate where conditions allow and flow overland in a direction determined by topography.

The greenfield surface water runoff rates for the site, calculated using the Greenfield runoff estimation tool on the uksuds.com website, are presented in **Annex 3** and **Table 1** below:

Table 1: Greenfield Runoff Rate

AEP of Rainfall Event	Greenfield Runoff Rate (l/s/ha)
1 in 1	1.2
QBAR	1.4
1 in 30	3.4
1 in 100	5.0

Proposed Surface Water Drainage Scheme

16. According to published research into the impact of solar-farm panels on runoff rates and volumes[5], solar panels do not have a significant impact on the hydrologic response of a site when the ground comprises of well managed vegetation such as good grass cover. In such instances, the research cites that well managed vegetation beneath the solar panels would limit the potential increase in runoff volume to less than 0.35%.

17. Given that the site is virtually flat, and that the proposed development includes managed grassland beneath the solar panels, the impact on runoff rates and volumes from the panelled part of the development is assessed to be negligible. As such, no specific drainage for the panelled part of the site is proposed.

[1] www.landis.org.uk/soilscapes/
[2] https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
[3] https://magic.defra.gov.uk/MagicMap.aspx
[4] BRE Digest 365 Soakaway Design, Building Research Establishment, 2016
[5] 'Hydrologic Response of Solar Farms', Cook LM and McCuen RH, American Society of Civil Engineers, 2013

18. In accordance with PPG para. 056, surface water runoff should be disposed of according to the following hierarchy: Into the ground (infiltration); To a surface water body; To a surface water sewer, highway drain, or another drainage system; To a combined sewer.

19. As detailed in paragraphs 11-13, infiltration testing undertaken by RGS indicates that the disposal of surface water by infiltration is not feasible at the site. It is therefore proposed to direct surface water runoff from access tracks and other areas of hardstanding (inverter/transformer stations, battery storage area, etc.) to the on-site drainage ditches.

20. The total area of hardstanding surfaces within the proposed development has been calculated to be 1.96 ha based on **Annex 1**. For the purposes of this technical note, the site has been subdivided into six drainage areas based on the location of surface waterbodies, as illustrated on **Figure 3**. The contributing area within each drainage area is presented in in **Table 2** below.

21. Black Sluice Internal Drainage Board (IDB)[6] requires surface water runoff to be restricted to 1.4 l/s/ha. This runoff rate will be achieved so far as is practicable; however, it is recognised that a flow control with a diameter of less than 50 mm may pose a risk of blockage to the drainage system. The proposed peak discharge rate for each drainage area is presented in **Table 2** below.

22. Attenuation storage will be provided to store surface water runoff generated across access tracks and other areas of hardstanding.

23. The attenuation storage facilities have been modelled using the Source Control module of MicroDrainage and has been sized to store the 1 in 100 AEP rainfall event including a 40% increase in rainfall intensity to allow for climate change in accordance with Environment Agency guidance[7]. The total required storage volumes are presented in **Table 2** below. Details of the design criteria used for a range of storm durations and return periods are presented in **Annex 4**.

Table 2: Summary of Proposed Surface Water Drainage Scheme
(1 in 100 AEP Event plus 40% Climate Change)

Drainage Area	Contributing Area (ha)	Peak Discharge (l/s)		Attenuation Volume (m^3)
1	0.115	0.2	1.0*	61.4
2	0.455	0.6		339.4
3	0.447	0.6		342.8
4	0.499	0.7		378.7
5	0.316	0.4		217.5
6	0.125	0.2		68.1

*Based on a flow control (e.g. Hydro-Brake) diameter of 50 mm

24. The storage volumes could be accommodated within a Type 3 sub-base material utilised as access tracks serving the development at a depth of 0.3 – 0.5 m.

25. A preliminary surface water drainage layout is provided in **Annex 5**.

26. Table 26.2 of the CIRIA SuDS Manual (2015) identifies low traffic roads as having a low pollution hazard level and indicates that the pollution hazard indices associated with low traffic roads for total suspended solids, hydrocarbons and metals are 0.50, 0.40 and 0.40 respectively.

27. It is recommended that the access tracks are constructed with a Type 3 material to allow surface water runoff to be stored and treated within the pavement structure. Table 26.3 of the CIRIA SuDS Manual indicates that the SuDS mitigation indices for permeable pavements for total suspended solids, hydrocarbons and metals are 0.70, 0.60 and 0.70 respectively.

[6] Email correspondence, Black Sluice IDB (Andy Scott), November 2023

[7] Flood Risk Assessments: climate change allowances (https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances)

28. The CIRIA SuDS manual identifies commercial roofs (inverter/transformer stations and battery containers) as having a low pollution hazard level, as such minimal treatment measures would be required to treat the quality of the water.

29. SuDS elements within the curtilage of the solar farm would be the responsibility of the owner of the site. An indicative maintenance schedule is presented in **Table 3**.

Table 3: Maintenance Requirements

Schedule	Required action	Frequency
Type 3 Permeable Access Tracks		
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions and rutting considered detrimental to the structural performance or a hazard to users	
	Rehabilitation of surface and substructure	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth- if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate removal frequencies	Annually
Flow Control Unit		
Routine maintenance	Remove litter and debris and inspect for sediment accumulation	Six Monthly
	Remove sediment from sump	As necessary – Indicated by system inspections
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six Monthly
	Inspect flow control unit and establish appropriate replacement frequencies	Six Monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first year of operation, then every six months

Proposed Foul Water Drainage Scheme

30. It is understood that there is no requirement for foul water drainage at this site.

This document has been prepared solely as a Technical Note for AGR Solar 2 Limited and is confidential to AGR Solar 2 Limited. Weetwood Services Ltd accepts no responsibility or liability for any use that is made of this document other than by AGR Solar 2 Limited for the purposes for which it was originally commissioned and prepared.

FIGURES

Figure 1: Site Location

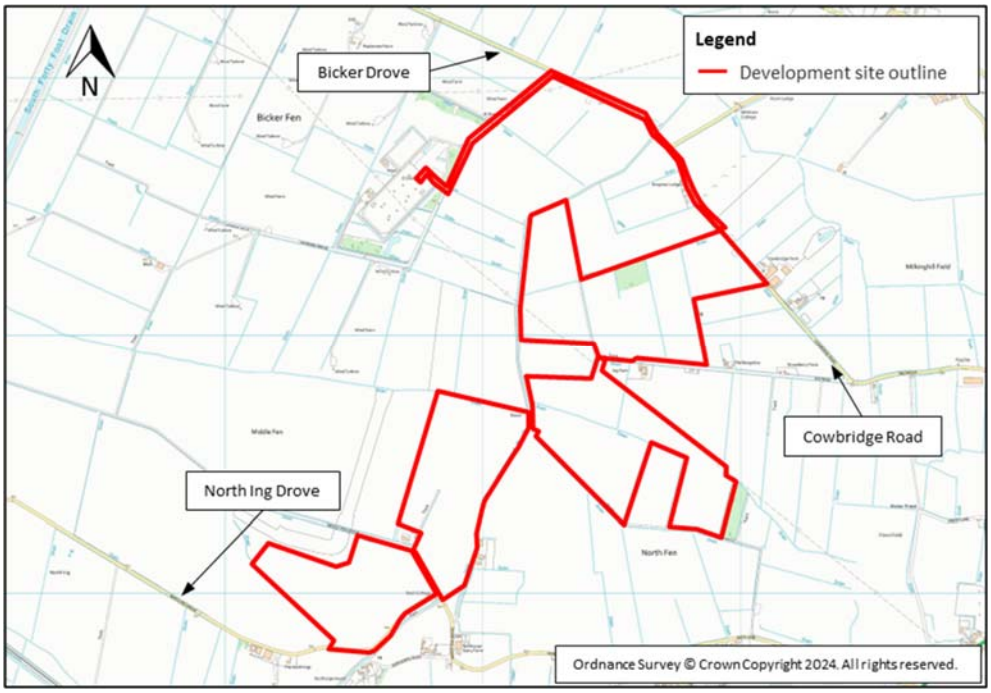


Figure 2: Digital Terrain Model from LiDAR Data

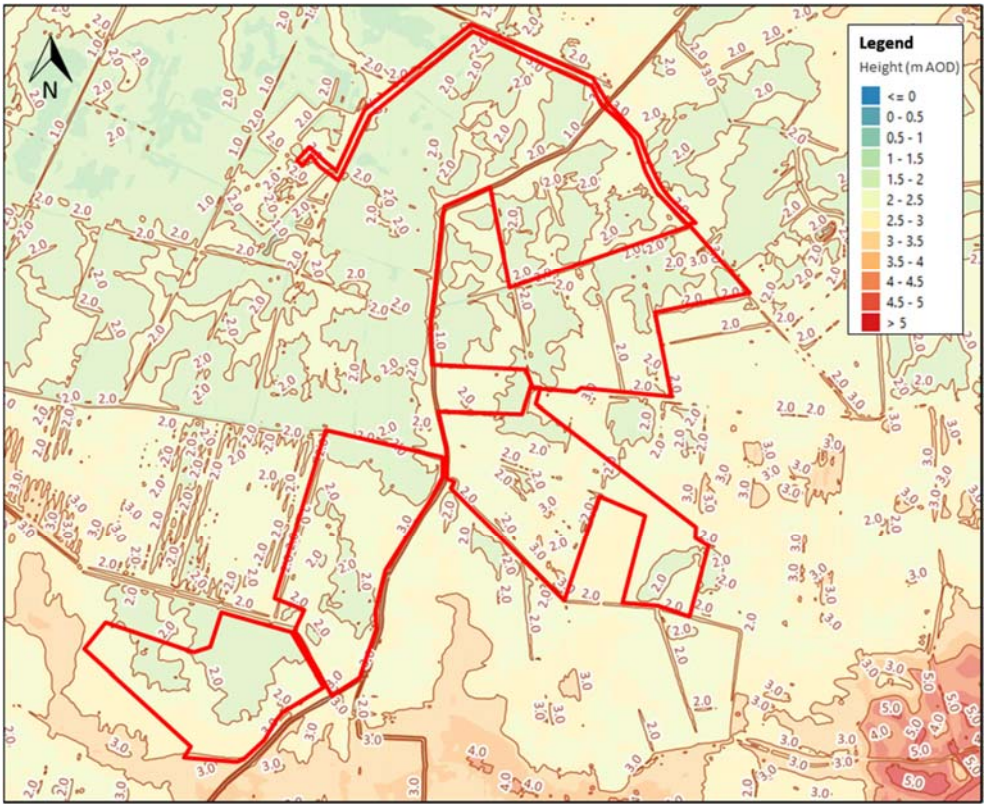
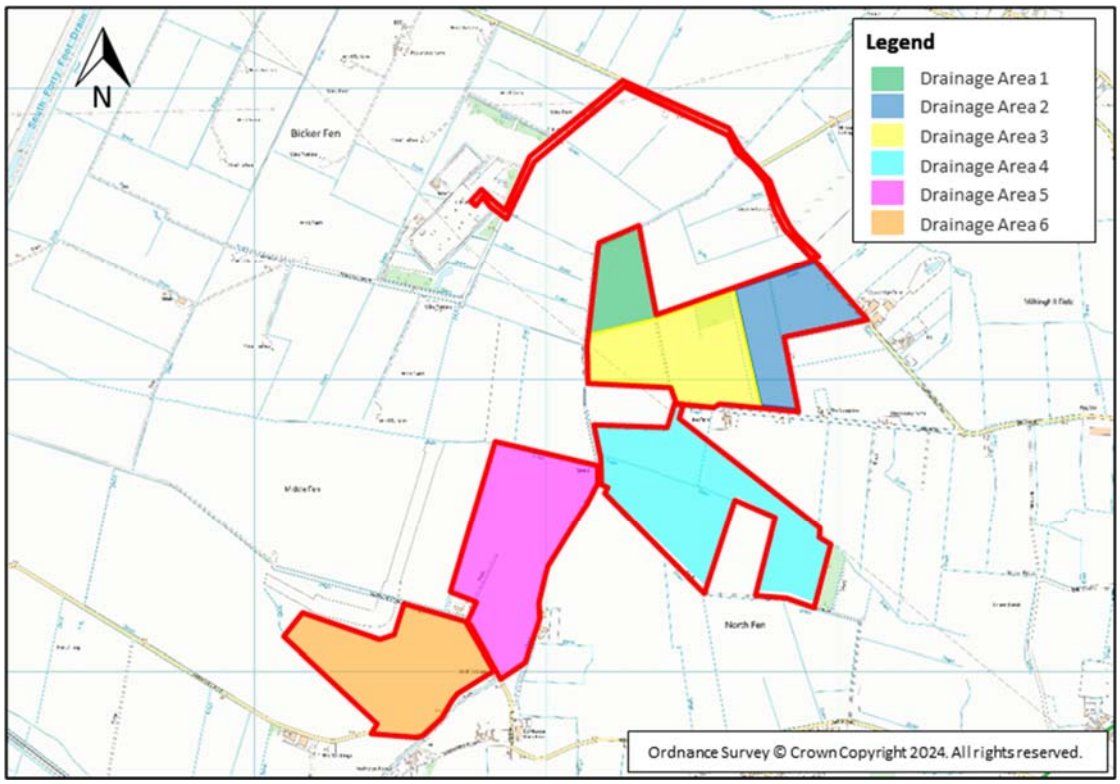


Figure 3: Indicative Drainage Areas



ANNEX 1

Proposed Site Plan

Q:\2901-2950\2920-01 Bicker Fen Solar Farm\Dwgs\CAD\Planning Drawings\2920-01-03 General Arrangement (RevE).dwg



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•	Revision History	• Date
D	Battery storage layout updated	28-07-22
E	Access tracks and red line updated	04-08-22

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Wilmslow
SK9 5BB

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axis

client: AGR

project: BICKER FEN SOLAR FARM

drawing title: GENERAL ARRANGEMENT FULL LAYOUT

date:	drawn by:	checked:
FEBRUARY 2022	TR	PR
drawing number: 2920-01-03	status: --	
scale(s): 1:5,000@A2	rev: E	

planning environment design

ANNEX 2

Infiltration Testing

Environmental
Geotechnical
Specialists

RGS

SOAKAWAY
LETTER
REPORT

job number	C3956/23/E/5995
date	14/12/23
site address	Bicker Fen Solar Farm Spalding Lincolnshire PE11 4XY
written by	J.Finch
checked by	R.Palmer
issued by	J.Finch

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Constructionline
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<ENVIRONMENTAL><GEOTECHNICAL>

Rogers Geotechnical Services Ltd
Offices 1 & 2 Barncliffe Business Park, Near Bank, Shelley, Huddersfield, HD8 8LU
01484 604354 Company No. 5130864

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	6.1	Soakaway Test	4
7.		Discussion	4
8.		References	4

Appendices

1.	Site Plan
2.	Trial Pit Records
3.	Trial Pit Photographs
4.	Soakaway Results

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before printing this report.

Report on Soakaway Testing

Location:	Bicker Fen Solar Farm Spalding, Lincolnshire, PE11 4XY		
For:	AGR Solar 2 Limited		
Report No.	C3956/23/E/5995	Report Date:	December 2023

For and on behalf of **Rogers Geotechnical Services Ltd**

James Finch BSc FGS Graduate Engineer	**Rob Palmer** MSc FGS ACIEH Senior Geo-environmental Engineer

Report Summary[1]

Item	Comments	Section
Geology	Tidal flat deposits over Oxford Clay Formation.	4.
Strata Conditions	Predominantly soft cohesive material, comprising silty CLAY and clayey SILT, with localised sands lenses. Granular material encountered in the base of TP02.	5.
Groundwater	Water strikes recorded within the cohesive material at depth ranging from surface to 1.6m.	5.
Suitability of Soakaways	Not recommended.	7.

[1] This summary should not be relied upon to provide a comprehensive review. All of the information contained in this document should be considered.

1. Introduction

We thank you for your request to undertake percolation testing at the above mentioned site and take pleasure in enclosing the results of this work. The investigation was undertaken on the 6th December 2023 in accordance with your instruction to proceed. This reports describes the work undertaken, presents the data obtained and discusses the results of the tests

2. Limitations

The recommendations made and opinions expressed in this report are based on the ground conditions revealed by the site works, together with an assessment of the site. Whilst opinions may be expressed relating to sub-soil conditions in parts of the site not investigated, for example between trial pit positions, these are for guidance only and no liability can be accepted for their accuracy.

This report has been prepared in accordance with our understanding of current best practice. However, new information or legislation, or changes to best practice may necessitate revision of the report after the date of issue.

3. Fieldworks

Three trial pits were initially planned to be excavated in order to undertake soakaway testing at the positions proposed in the Statutory Plan (Drawing Number: 2920-01-02). The initial trial pits at TP01 and TP03 encountered rapid ingress of water due to strike of a land drain that hadn't been indicated on service plans and therefore the additional trial pits TP01A and TP03A were undertaken. The location of TP02 was moved to be adjacent to the access roads due to poor conditions within the fields. Rapid surface water inflow was encountered within this initial trial pit, and therefore TP02A was undertaken in the adjacent field. The initial positions TP01, TP02 and TP03 and the final positions TP01a, TP02a and TP03a are presented on a site plan in Appendix 1.

The soakaway tests were undertaken at the base of the trial pits TP01A, TP02A and TP03A at depths rational to the construction of soakaways. The soils exposed in the trial pits were logged on site in general accordance with BS5930: 2015 +A1: 2020, and full descriptions are given on the trial pit records which are presented in Appendix 2. Photographs of the trial pits are included within Appendix 3.

Once excavations were completed, the trial pits were carefully re-instated with the arisings. Whilst every care was taken during the infilling process, including compacting of the infill at regular intervals with the back acting arm of the excavator, it should be appreciated that some mounding of the surface may have resulted. Moreover, the infilled soils may be subjected to settlement over time, such that a depression in the surface may also occur. Therefore, the locations of any pits undertaken in this investigation should be conveyed to the current site user, as the mounds or depressions associated with the pits may present a risk to current site operations. Furthermore, it must be realised that the infilled pits represent an area of disturbance within the site soils, thus the soils at the pit locations may vary characteristically compared to the undisturbed ground. As such, foundations placed in this disturbed material may not perform as anticipated.

4. Geology

The available published geological data for the site has been examined and the following table presents the anticipated geology.

Table 1: Geological Data for the Site

Strata Type	Strata Name[2]	Previous Name[3]	Description[3]
Superficial Geology	Tidal Flat Deposits, 1 - Clay and Silt	-	Tidal flat deposits, including mud flat and sand flat deposits, form extensive nearly horizontal marshy land in the intertidal zone that is alternately covered and uncovered by the rise and fall of the tide. They consist of unconsolidated sediment, mainly mud and/or sand. They may form the top surface of a deltaic deposit.
Solid Geology	Oxford Clay Formation - Mudstone	Forest Clay Clunch Clay and Shale Fen Clay	Silicate-mudstone, grey, generally smooth to slightly silty, with sporadic beds of argillaceous limestone nodules.

5. Strata Conditions

In accordance with the geology of the area, the succession has been shown to include the following:

Table 2: Generalised Strata Profile

Depth m below ground level to underside of layer	**Strata Type**	**Positions Layer Revealed**	**Groundwater Strikes** m below ground level
0.3 – 0.4	Topsoil (Cohesive)	ALL	TP02
+0.4 – 2.4	Silty CLAY	TP01A, TP02, TP02A	TP02A
+1.2 - +1.8	Sandy SILT	TP03, TP03A	TP103
+1.2 – 2.1	Clayey SILT	TP01, TP01A	TP01A, TP01
+2.45	Clayey sandy GRAVEL	TP02A	None
+ 3	Sandy silty CLAY	TP01A	None

'+' denotes that the strata extended below the termination depth of the investigated positions, thus the extent of the deposit is only proven to the depths indicated.

[2] Sources: British Geological Survey (NERC) Map Sheets 78; Wakefield; Solid and Drift Edition, and Geology of Britain Viewer [*online resource from www.bgs.ac.uk*]
[3] Sources: British Geological Survey (NERC) Lexicon of Named Rock Units [*online resource from www.bgs.ac.uk*]

6. Insitu Testing

6.1 Soakaway Test

On reaching the elected soakaway test depth, the pit was trimmed and squared as much as practicable. Water was then introduced into the pit at a controlled rate to prevent collapse of the sides and the level monitored at time intervals relative to a reference bar at ground level. The results obtained from the soakaway tests are presented at Appendix 4 and are summarised below:

Table 3: Soakaway Test Results

Location	Soakage Area Dimensions (average) (m)	Depths of soaked strata (m)	Soil Description (of soaked strata)	Infiltration Rate (m/sec)	*Drainage Characteristics
TP01A	3.22	1.92 – 1.41	Side – Very soft dark brown clayey SILT. Base – *Very soft dark grey slightly sandy silty CLAY.*	N/A	Very Poor
TP02A	1.79	1.8 – 1.63	Side – Firm becoming soft dark grey and orangish brown silty CLAY. Base – *Light brown slightly clayey slightly gravelly medium SAND.*	N/A	Very Poor
TP03A	1.36	1.32 – 1.26	Side – Soft dark grey and orange brown sandy laminated silt. Base – As above	N/A	Very Poor

*Based on the most onerous results for each test.

During the soakaway tests the water level did not fall. Indeed, either due to water ingress or collapse within the pits, the water levels rose during every test. On this basis, the tests could not be completed within the scope of the method provided in BRE Digest 365.

7. Discussion

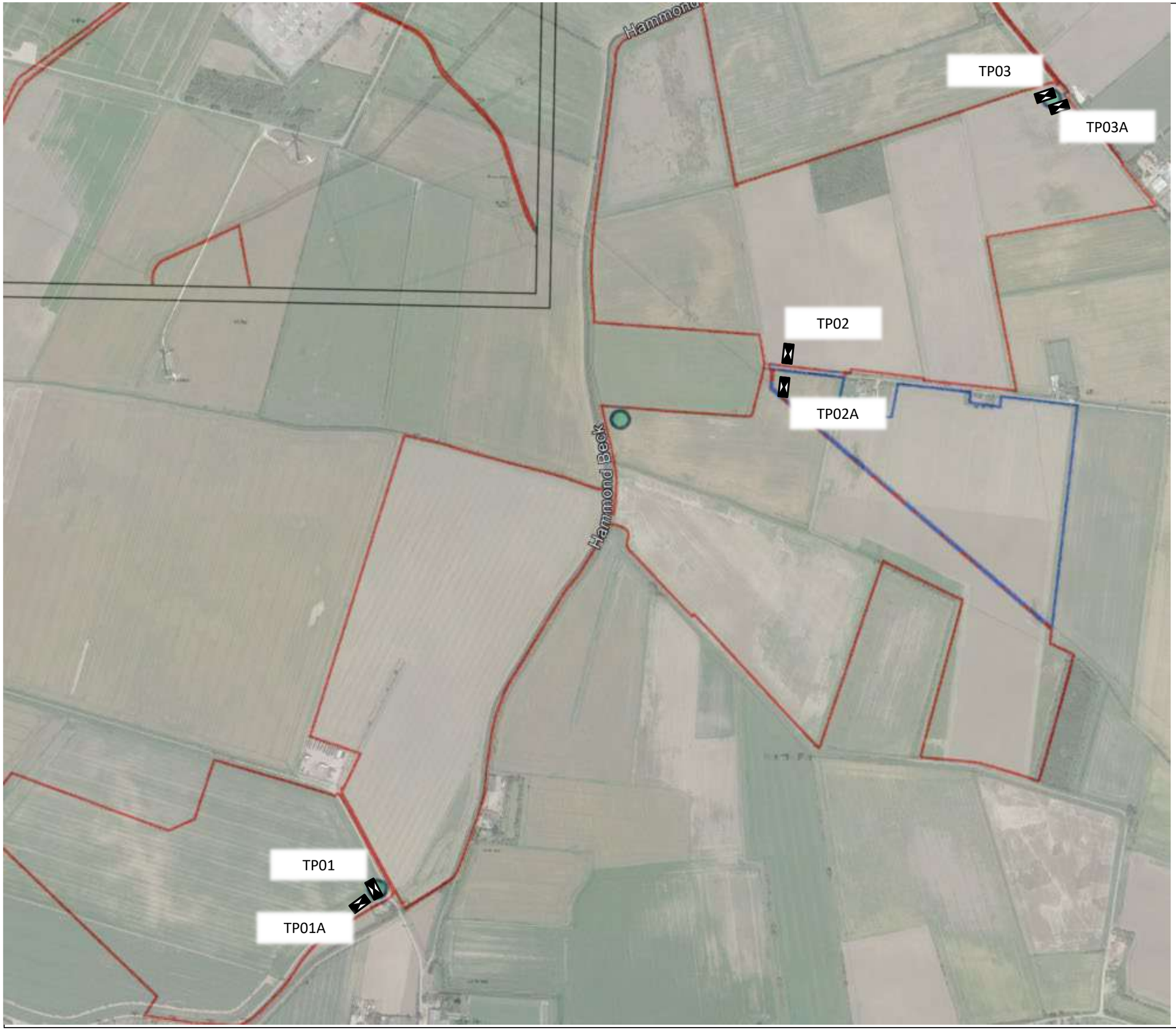
The soils encountered beneath the site were found to be typical of the Tidal Flat Deposits recorded on the published geological map. The strata conditions and subsequent drainage characteristics appear to be comparable across the site. In this instance, the infiltration testing has revealed that the soils have very poor drainage characteristics. Therefore, soakaways cannot be recommended at this site and an alternative form of drainage should be adopted.

8. References

- Building Research Establishment (BRE) Digest 365, *Soakaway Design*, September 1991.
- British Standards Institution (2015 +A1: 2020) BS 5930: *Code of practice for ground investigations*, B.S.I., London.
- Barnes, G. (2000). *Soil Mechanics Principle and Practice.* 2nd ed. London: Macmillan Press Ltd, p.47.

Appendix 1

Site Plan



Notes:

Investigation positions approximated from site operative's notes.

RGS Environmental Geotechnical Specialists

Rogers Geotechnical Services Ltd

Offices 1 & 2, Barncliffe
Business Park,
Near Bank,
Shelley,
Huddersfield,
HD8 8LU

Telephone: 0843 50 66 87
www.rogersgeotech.co.uk

Client:

AGR Solar 2 Limited

Job Number:

C3956/23/E/5995

Project Details:
Bicker Fen Solar Farm
Spalding,Lincolnshire
PE11 4XY

Scale:	Not to scale - reference only

ground investigation · drilling & excavation · insitu testing · laboratory testing & gas monitoring · engineering consultancy · surveying & flood risk assessments · training, CPD & expert witness
... delivered using our own drilling rigs / crews / soils lab / engineers

Appendix 2

Trial Pit Records

Trial Pit Log

Trialpit No **TP01A**

Sheet 1 of 1

Project Name: Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location: Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY		Dimensions (m): 2.1 × 0.3, Depth 3.00	Scale 1:25
Client: AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL (Brown clayey SILT).
				0.40			Very soft dark brown clayey SILT. TIDAL FLAT DEPOSITS
▼							
				2.10			Soft dark brown silty CLAY. TIDAL FLAT DEPOSITS
				2.40			Very soft dark grey slightly sandy silty CLAY. Sand is fine. TIDAL FLAT DEPOSITS
				3.00			End of pit at 3.00 m

1 2 3 4 5

Remarks: Water strike at 1.1m.

Stability: Major instability throughout pit. Major collapse during soakaway testing.

Trial Pit Log

Trialpit No **TP101** Sheet 1 of 1

Project Name:	Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location:	Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY	Dimensions (m): Depth 1.20	2 / 0.3	Scale 1:25
Client:	AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL (Brown clayey SILT).
				0.40			Very soft dark brown clayey SILT. TIDAL FLAT DEPOSITS
▼				1.20			End of pit at 1.20 m

Remarks: Land drain struck at 1.1m, rapid ingress of water. Trial pit concluded.

Stability: Minor instability throughout.

Trial Pit Log

Trialpit No **TP02A**

Sheet 1 of 1

Project Name:	Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location:	Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY	Dimensions (m): Depth 2.45	1.7 / 0.3	Scale 1:25
Client:	AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL (Dark grey clayey SILT).
				0.30			Firm becoming soft dark grey and orangish brown silty CLAY. TIDAL FLAT DEPOSITS
▼							
				2.20			Light brown slightly clayey slightly gravelly medium SAND. Gravel is medium rounded and sub rounded sandstone. TIDAL FLAT DEPOSITS
				2.45			End of pit at 2.45 m

Remarks: Water strike at 1.6m

Stability: Minor instability in topsoil.

Trial Pit Log

Trialpit No **TP102**

Sheet 1 of 1

Project Name:	Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location:	Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY	Dimensions (m): Depth 0.40	1.4 × 0.3	Scale 1:25
Client:	AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
▼				0.30			TOPSOIL (Dark grey clayey SILT).
				0.40			Soft dark grey silty CLAY. TIDAL FLAT DEPOSITS End of pit at 0.40 m

Remarks: Rapid inflow of surface water, pit concluded.

Stability: Stable.

Trial Pit Log

Trialpit No **TP03A** Sheet 1 of 1

Project Name:	Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location:	Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY	Dimensions (m): Depth 1.80	2.2 × 0.3	Scale 1:25
Client:	AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
				0.30			TOPSOIL (Dark brown silty CLAY).
				1.80			Soft dark grey and orange brown sandy laminated silt. Sand is very fine. TIDAL FLAT DEPOSITS End of pit at 1.80 m

Remarks: No groundwater encountered.

Stability: Instability within silt.

Trial Pit Log

Trialpit No **TP103**

Sheet 1 of 1

Project Name:	Bicker Fen Solar Farm	Project No. C3956/23/E/5995	Co-ords: - Level:	Date 06/12/2023
Location:	Bicker Fen Solar Farm, Spalding, Lincolnshire, PE11 4XY	Dimensions (m): Depth 1.20	2 / 0.3	Scale 1:25
Client:	AGR Solar 2 Limited			Logged JF

Water Strike	Samples and In Situ Testing: Depth	Type	Results	Depth (m)	Level (m)	Legend	Stratum Description
							TOPSOIL (Dark brown silty CLAY).
				0.30			Soft dark grey and orange brown sandy laminated SILT. Sand is very fine. TIDAL FLAT DEPOSITS
▼				1.20			End of pit at 1.20 m

Remarks: Land drain struck at 1.1m, rapid ingress of water. Trial pit concluded.

Stability: Minor instability.

Appendix 3

Trial Pit Photographs



Photo 1: TP01 showing the ingress of water from the land drain strike.



Photo 2: TP01A showing the collapses throughout the pit.



Photo 3: TP02A, showing water ingress.



Photo 4: TP03A

Appendix 4

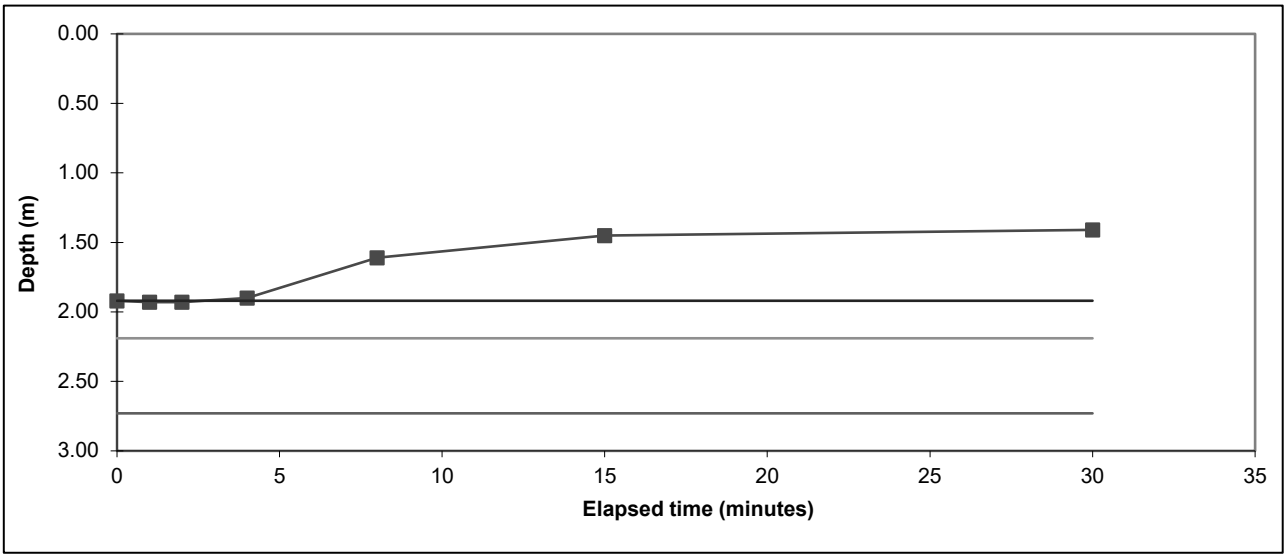
Soakaway Results

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP01	Test No:	1	Date:	06/12/2023
Length (m):	2.100		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	3.00		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.920		
1	1.930		
2	1.930		
4	1.900		
8	1.610		
15	1.450		
30	1.410		



Start water depth for analysis (mbgl):	1.92		
75% effective depth (mbgl):	2.19	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.46		
25% effective depth (mbgl):	2.73	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	3.00		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		3.22	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks	Results processed following BRE 365 (2007). Minor collapses from start of test, major collapse around 8 minute mark and complete collapse around 15 minute mark.

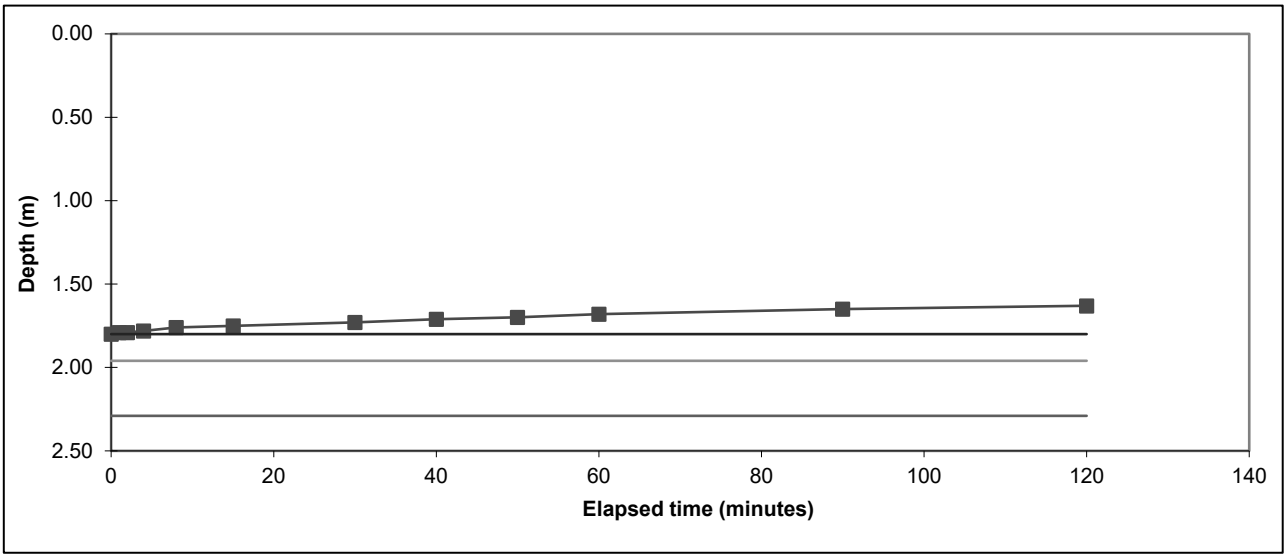
Client:	AGR Solar 2 Limited	**Job No:**
Site:	Bicker Fen Solar Farm	C3956/23/E/5995

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP02A	Test No:	1	Date:	06/12/2023
Length (m):	1.700		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	2.45		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.800		
1	1.790		
2	1.790		
4	1.780		
8	1.760		
15	1.750		
30	1.730		
40	1.710		
50	1.700		
60	1.680		
90	1.650		
120	1.630		



Start water depth for analysis (mbgl):	1.80		
75% effective depth (mbgl):	1.96	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	2.13		
25% effective depth (mbgl):	2.29	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	2.45		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):		1.79	
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks Results processed following BRE 365 (2007).

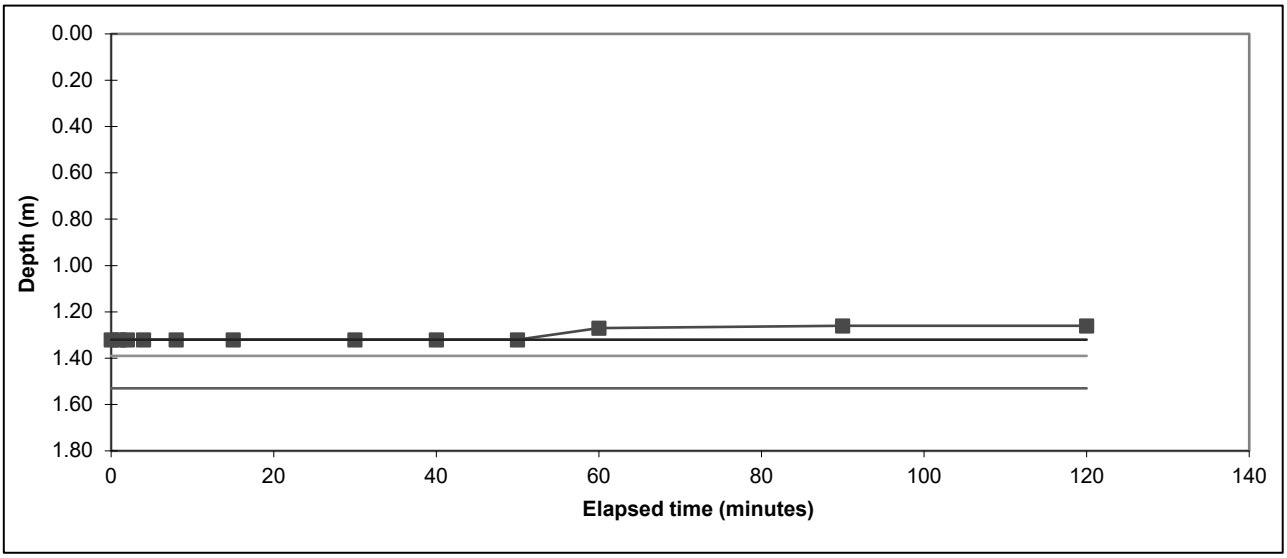
Client:	AGR Solar 2 Limited	**Job No:**
Site:	Bicker Fen Solar Farm	C3956/23/E/5995

Rogers Geotechnical Services L

Soakaway Test

Trial Pit No:	TP03A	Test No:	1	Date:	06/12/2023
Length (m):	2.200		Datum Height:	0.00	m agl
Width (m):	0.30		Granular infill:	None	
Depth (m):	1.60		Porosity of infill:	1	(assumed)

Elapsed time (minutes)	Water Depth (m below datum)	Elapsed time (minutes)	Water Depth (m below datum)
0	1.320		
1	1.320		
2	1.320		
4	1.320		
8	1.320		
15	1.320		
30	1.320		
40	1.320		
50	1.320		
60	1.270		
90	1.260		
120	1.260		



Start water depth for analysis (mbgl):	1.32		
75% effective depth (mbgl):	1.39	Elapsed time (mins):	#N/A
50% effective depth (mbgl):	1.46		
25% effective depth (mbgl):	1.53	Elapsed time (mins):	#N/A
Base of soakage zone (mbgl):	1.60		
Volume outflow between 75% and 25% effective depth (m^3):			
Mean surface area of outflow (m^2):			1.36
(side area at 50% effective depth + base area)			
Time for outflow between 75% and 25% effective depth (mins):			

Soil infiltration rate (m/s):	**Test incomplete as 25% effective depth not achieved. Unable to reliably determine soil infiltration rate.**

Remarks	Results processed following BRE 365 (2007). Collapse around 60 minute mark.

Client:	AGR Solar 2 Limited	**Job No:**
Site:	Bicker Fen Solar Farm	C3956/23/E/5995

ANNEX 3

Greenfield Runoff Rates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	warren chan
Site name:	5086 Bicker Fen
Site location:	Lincolnshire

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	52.94956° N
Longitude:	0.19392° W
Reference:	835613710
Date:	Jan 03 2024 10:01

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	558	558
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.4	1.4
1 in 1 year (l/s):	1.22	1.22
1 in 30 years (l/s):	3.42	3.42
1 in 100 year (l/s):	4.98	4.98
1 in 200 years (l/s):	5.88	5.88

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at www.uksuds.com. The use of this tool is subject to the UK SuDS terms and conditions and licence agreement , which can both be found at www.uksuds.com/terms-and-conditions.htm. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

ANNEX 4

Surface Water Attenuation - Storage Volume Calculation

Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

Date 16/01/2024 10:16 | Designed by ModellingMold
File 2023-01-03 5086 Storage Estimate ... | Checked by
Micro Drainage | Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 525 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.775	0.075	0.0	1.0	1.0	23.8	O K
30 min Summer	1.802	0.102	0.0	1.0	1.0	32.4	O K
60 min Summer	1.829	0.129	0.0	1.0	1.0	40.8	O K
120 min Summer	1.852	0.152	0.0	1.0	1.0	48.1	O K
180 min Summer	1.861	0.161	0.0	1.0	1.0	51.1	O K
240 min Summer	1.865	0.165	0.0	1.0	1.0	52.3	O K
360 min Summer	1.865	0.165	0.0	1.0	1.0	52.5	O K
480 min Summer	1.862	0.162	0.0	1.0	1.0	51.3	O K
600 min Summer	1.858	0.158	0.0	1.0	1.0	50.0	O K
720 min Summer	1.853	0.153	0.0	1.0	1.0	48.5	O K
960 min Summer	1.845	0.145	0.0	1.0	1.0	45.9	O K
1440 min Summer	1.830	0.130	0.0	1.0	1.0	41.1	O K
2160 min Summer	1.809	0.109	0.0	1.0	1.0	34.4	O K
2880 min Summer	1.789	0.089	0.0	1.0	1.0	28.3	O K
4320 min Summer	1.757	0.057	0.0	0.9	0.9	17.9	O K
5760 min Summer	1.732	0.032	0.0	0.9	0.9	10.1	O K
7200 min Summer	1.715	0.015	0.0	0.9	0.9	4.7	O K
8640 min Summer	1.705	0.005	0.0	0.9	0.9	1.4	O K
10080 min Summer	1.700	0.000	0.0	0.9	0.9	0.0	O K
15 min Winter	1.786	0.086	0.0	1.0	1.0	27.3	O K
30 min Winter	1.817	0.117	0.0	1.0	1.0	37.1	O K
60 min Winter	1.847	0.147	0.0	1.0	1.0	46.6	O K
120 min Winter	1.874	0.174	0.0	1.0	1.0	55.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	24.3	19
30 min Summer	90.705	0.0	33.6	33
60 min Summer	56.713	0.0	43.3	64
120 min Summer	34.246	0.0	53.4	122
180 min Summer	25.149	0.0	59.2	182
240 min Summer	20.078	0.0	63.3	242
360 min Summer	14.585	0.0	69.2	360
480 min Summer	11.622	0.0	73.7	430
600 min Summer	9.738	0.0	77.3	488
720 min Summer	8.424	0.0	80.1	550
960 min Summer	6.697	0.0	84.9	676
1440 min Summer	4.839	0.0	91.6	952
2160 min Summer	3.490	0.0	98.2	1360
2880 min Summer	2.766	0.0	102.8	1756
4320 min Summer	1.989	0.0	108.6	2504
5760 min Summer	1.573	0.0	112.2	3176
7200 min Summer	1.311	0.0	114.4	3824
8640 min Summer	1.129	0.0	115.7	4496
10080 min Summer	0.994	0.0	116.6	0
15 min Winter	138.153	0.0	27.9	19
30 min Winter	90.705	0.0	38.3	33
60 min Winter	56.713	0.0	49.2	62
120 min Winter	34.246	0.0	60.5	120

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

Date 16/01/2024 10:16 | Designed by ModellingMold
File 2023-01-03 5086 Storage Estimate ... | Checked by
Micro Drainage | Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.885	0.185	0.0	1.0	1.0	58.8	O K
240 min Winter	1.891	0.191	0.0	1.0	1.0	60.5	O K
360 min Winter	1.894	0.194	0.0	1.0	1.0	61.4	O K
480 min Winter	1.892	0.192	0.0	1.0	1.0	60.7	O K
600 min Winter	1.887	0.187	0.0	1.0	1.0	59.1	O K
720 min Winter	1.881	0.181	0.0	1.0	1.0	57.3	O K
960 min Winter	1.870	0.170	0.0	1.0	1.0	53.8	O K
1440 min Winter	1.848	0.148	0.0	1.0	1.0	47.0	O K
2160 min Winter	1.816	0.116	0.0	1.0	1.0	36.9	O K
2880 min Winter	1.787	0.087	0.0	1.0	1.0	27.7	O K
4320 min Winter	1.740	0.040	0.0	0.9	0.9	12.8	O K
5760 min Winter	1.709	0.009	0.0	0.9	0.9	2.9	O K
7200 min Winter	1.700	0.000	0.0	0.9	0.9	0.0	O K
8640 min Winter	1.700	0.000	0.0	0.7	0.7	0.0	O K
10080 min Winter	1.700	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	67.0	178
240 min Winter	20.078	0.0	71.6	236
360 min Winter	14.585	0.0	78.3	350
480 min Winter	11.622	0.0	83.2	458
600 min Winter	9.738	0.0	87.3	560
720 min Winter	8.424	0.0	90.6	586
960 min Winter	6.697	0.0	95.9	732
1440 min Winter	4.839	0.0	103.5	1038
2160 min Winter	3.490	0.0	111.3	1468
2880 min Winter	2.766	0.0	116.5	1872
4320 min Winter	1.989	0.0	123.5	2596
5760 min Winter	1.573	0.0	127.9	3176
7200 min Winter	1.311	0.0	131.0	0
8640 min Winter	1.129	0.0	133.0	0
10080 min Winter	0.994	0.0	134.3	0

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

Date 16/01/2024 10:16 | Designed by ModellingMold
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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.115

Time (mins) From:	To:	Area (ha)
0	4	0.115

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	105.7
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	293.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.700	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2853 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	95.0	O K
30 min Summer	1.749	0.099	0.0	0.9	0.9	131.2	O K
60 min Summer	1.778	0.128	0.0	1.0	1.0	168.4	O K
120 min Summer	1.806	0.156	0.0	1.0	1.0	205.3	O K
180 min Summer	1.821	0.171	0.0	1.0	1.0	225.8	O K
240 min Summer	1.831	0.181	0.0	1.0	1.0	239.1	O K
360 min Summer	1.845	0.195	0.0	1.0	1.0	256.8	O K
480 min Summer	1.854	0.204	0.0	1.0	1.0	268.6	O K
600 min Summer	1.860	0.210	0.0	1.0	1.0	276.8	O K
720 min Summer	1.864	0.214	0.0	1.0	1.0	282.7	O K
960 min Summer	1.869	0.219	0.0	1.0	1.0	289.4	O K
1440 min Summer	1.871	0.221	0.0	1.0	1.0	292.3	O K
2160 min Summer	1.865	0.215	0.0	1.0	1.0	283.8	O K
2880 min Summer	1.856	0.206	0.0	1.0	1.0	272.5	O K
4320 min Summer	1.840	0.190	0.0	1.0	1.0	251.1	O K
5760 min Summer	1.827	0.177	0.0	1.0	1.0	233.3	O K
7200 min Summer	1.814	0.164	0.0	1.0	1.0	216.6	O K
8640 min Summer	1.802	0.152	0.0	1.0	1.0	200.9	O K
10080 min Summer	1.791	0.141	0.0	1.0	1.0	185.8	O K
15 min Winter	1.733	0.083	0.0	0.9	0.9	109.2	O K
30 min Winter	1.763	0.113	0.0	0.9	0.9	149.7	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	191.5	O K
120 min Winter	1.827	0.177	0.0	1.0	1.0	233.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	77.5	19
30 min Summer	90.705	0.0	78.8	34
60 min Summer	56.713	0.0	157.6	64
120 min Summer	34.246	0.0	160.0	124
180 min Summer	25.149	0.0	161.0	184
240 min Summer	20.078	0.0	161.5	244
360 min Summer	14.585	0.0	161.8	364
480 min Summer	11.622	0.0	161.6	482
600 min Summer	9.738	0.0	161.1	602
720 min Summer	8.424	0.0	160.4	722
960 min Summer	6.697	0.0	158.7	962
1440 min Summer	4.839	0.0	154.4	1440
2160 min Summer	3.490	0.0	310.8	2016
2880 min Summer	2.766	0.0	304.1	2340
4320 min Summer	1.989	0.0	285.1	3108
5760 min Summer	1.573	0.0	440.1	3920
7200 min Summer	1.311	0.0	448.3	4752
8640 min Summer	1.129	0.0	452.9	5536
10080 min Summer	0.994	0.0	455.1	6352
15 min Winter	138.153	0.0	78.1	19
30 min Winter	90.705	0.0	79.6	34
60 min Winter	56.713	0.0	159.5	64
120 min Winter	34.246	0.0	162.3	122

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.844	0.194	0.0	1.0	1.0	256.5	O K
240 min Winter	1.856	0.206	0.0	1.0	1.0	271.8	O K
360 min Winter	1.871	0.221	0.0	1.0	1.0	292.4	O K
480 min Winter	1.882	0.232	0.0	1.0	1.0	306.3	O K
600 min Winter	1.890	0.240	0.0	1.0	1.0	316.3	O K
720 min Winter	1.895	0.245	0.0	1.0	1.0	323.4	O K
960 min Winter	1.902	0.252	0.0	1.0	1.0	332.8	O K
1440 min Winter	1.907	0.257	0.0	1.0	1.0	339.4	O K
2160 min Winter	1.904	0.254	0.0	1.0	1.0	335.0	O K
2880 min Winter	1.894	0.244	0.0	1.0	1.0	322.6	O K
4320 min Winter	1.874	0.224	0.0	1.0	1.0	295.4	O K
5760 min Winter	1.855	0.205	0.0	1.0	1.0	271.0	O K
7200 min Winter	1.837	0.187	0.0	1.0	1.0	246.8	O K
8640 min Winter	1.819	0.169	0.0	1.0	1.0	223.2	O K
10080 min Winter	1.802	0.152	0.0	1.0	1.0	200.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	163.5	182
240 min Winter	20.078	0.0	164.1	240
360 min Winter	14.585	0.0	164.7	358
480 min Winter	11.622	0.0	164.7	476
600 min Winter	9.738	0.0	164.3	594
720 min Winter	8.424	0.0	163.7	710
960 min Winter	6.697	0.0	162.2	942
1440 min Winter	4.839	0.0	158.1	1400
2160 min Winter	3.490	0.0	318.4	2072
2880 min Winter	2.766	0.0	312.0	2680
4320 min Winter	1.989	0.0	295.7	3328
5760 min Winter	1.573	0.0	502.6	4264
7200 min Winter	1.311	0.0	513.5	5120
8640 min Winter	1.129	0.0	520.6	6048
10080 min Winter	0.994	0.0	513.1	6864

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Broncoed Bus Park
Wrexham Rd Mold

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.455

Time (mins) From:	To:	Area (ha)
0	4	0.455

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	44.0
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	1222.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 2979 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.615	0.115	0.0	0.9	0.9	100.4	O K
30 min Summer	1.655	0.155	0.0	0.9	0.9	135.9	O K
60 min Summer	1.697	0.197	0.0	0.9	0.9	172.5	O K
120 min Summer	1.739	0.239	0.0	0.9	0.9	208.9	O K
180 min Summer	1.762	0.262	0.0	0.9	0.9	229.1	O K
240 min Summer	1.776	0.276	0.0	1.0	1.0	242.1	O K
360 min Summer	1.797	0.297	0.0	1.0	1.0	259.8	O K
480 min Summer	1.810	0.310	0.0	1.0	1.0	271.6	O K
600 min Summer	1.819	0.319	0.0	1.0	1.0	279.7	O K
720 min Summer	1.826	0.326	0.0	1.0	1.0	285.6	O K
960 min Summer	1.834	0.334	0.0	1.0	1.0	292.5	O K
1440 min Summer	1.838	0.338	0.0	1.0	1.0	295.9	O K
2160 min Summer	1.829	0.329	0.0	1.0	1.0	287.8	O K
2880 min Summer	1.815	0.315	0.0	1.0	1.0	275.8	O K
4320 min Summer	1.792	0.292	0.0	1.0	1.0	255.4	O K
5760 min Summer	1.773	0.273	0.0	1.0	1.0	239.0	O K
7200 min Summer	1.756	0.256	0.0	0.9	0.9	223.9	O K
8640 min Summer	1.739	0.239	0.0	0.9	0.9	209.5	O K
10080 min Summer	1.723	0.223	0.0	0.9	0.9	195.7	O K
15 min Winter	1.630	0.130	0.0	0.9	0.9	114.3	O K
30 min Winter	1.676	0.176	0.0	0.9	0.9	154.2	O K
60 min Winter	1.723	0.223	0.0	0.9	0.9	195.3	O K
120 min Winter	1.770	0.270	0.0	1.0	1.0	236.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	70.5	19
30 min Summer	90.705	0.0	72.7	34
60 min Summer	56.713	0.0	145.6	64
120 min Summer	34.246	0.0	149.8	124
180 min Summer	25.149	0.0	152.1	184
240 min Summer	20.078	0.0	153.5	244
360 min Summer	14.585	0.0	155.0	364
480 min Summer	11.622	0.0	155.8	482
600 min Summer	9.738	0.0	156.2	602
720 min Summer	8.424	0.0	156.2	722
960 min Summer	6.697	0.0	155.6	962
1440 min Summer	4.839	0.0	153.1	1440
2160 min Summer	3.490	0.0	302.9	2096
2880 min Summer	2.766	0.0	299.6	2416
4320 min Summer	1.989	0.0	284.3	3152
5760 min Summer	1.573	0.0	456.3	3968
7200 min Summer	1.311	0.0	468.4	4760
8640 min Summer	1.129	0.0	477.4	5616
10080 min Summer	0.994	0.0	473.4	6360
15 min Winter	138.153	0.0	71.3	19
30 min Winter	90.705	0.0	73.9	34
60 min Winter	56.713	0.0	148.4	64
120 min Winter	34.246	0.0	153.3	122

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.796	0.296	0.0	1.0	1.0	259.3	O K
240 min Winter	1.813	0.313	0.0	1.0	1.0	274.3	O K
360 min Winter	1.837	0.337	0.0	1.0	1.0	294.8	O K
480 min Winter	1.852	0.352	0.0	1.0	1.0	308.8	O K
600 min Winter	1.864	0.364	0.0	1.0	1.0	318.7	O K
720 min Winter	1.872	0.372	0.0	1.0	1.0	326.0	O K
960 min Winter	1.883	0.383	0.0	1.0	1.0	335.5	O K
1440 min Winter	1.891	0.391	0.0	1.0	1.0	342.8	O K
2160 min Winter	1.887	0.387	0.0	1.0	1.0	339.4	O K
2880 min Winter	1.874	0.374	0.0	1.0	1.0	327.9	O K
4320 min Winter	1.843	0.343	0.0	1.0	1.0	300.6	O K
5760 min Winter	1.818	0.318	0.0	1.0	1.0	278.8	O K
7200 min Winter	1.794	0.294	0.0	1.0	1.0	257.2	O K
8640 min Winter	1.769	0.269	0.0	0.9	0.9	236.0	O K
10080 min Winter	1.746	0.246	0.0	0.9	0.9	215.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	155.8	182
240 min Winter	20.078	0.0	157.4	240
360 min Winter	14.585	0.0	159.1	358
480 min Winter	11.622	0.0	160.0	476
600 min Winter	9.738	0.0	160.3	594
720 min Winter	8.424	0.0	160.4	712
960 min Winter	6.697	0.0	159.7	944
1440 min Winter	4.839	0.0	157.0	1400
2160 min Winter	3.490	0.0	311.8	2072
2880 min Winter	2.766	0.0	307.8	2708
4320 min Winter	1.989	0.0	295.5	3368
5760 min Winter	1.573	0.0	517.3	4272
7200 min Winter	1.311	0.0	532.2	5192
8640 min Winter	1.129	0.0	527.5	6056
10080 min Winter	0.994	0.0	503.3	6960

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.447

Time (mins) From:	To:	Area (ha)
0	4	0.447

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	29.2
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	811.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.500	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 3189 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	104.2	O K
30 min Summer	1.749	0.099	0.0	0.9	0.9	143.9	O K
60 min Summer	1.777	0.127	0.0	1.0	1.0	184.8	O K
120 min Summer	1.805	0.155	0.0	1.0	1.0	225.7	O K
180 min Summer	1.821	0.171	0.0	1.0	1.0	248.3	O K
240 min Summer	1.831	0.181	0.0	1.0	1.0	263.2	O K
360 min Summer	1.845	0.195	0.0	1.0	1.0	283.1	O K
480 min Summer	1.854	0.204	0.0	1.0	1.0	296.7	O K
600 min Summer	1.861	0.211	0.0	1.0	1.0	306.2	O K
720 min Summer	1.866	0.216	0.0	1.0	1.0	313.1	O K
960 min Summer	1.872	0.222	0.0	1.0	1.0	321.7	O K
1440 min Summer	1.875	0.225	0.0	1.0	1.0	327.1	O K
2160 min Summer	1.871	0.221	0.0	1.0	1.0	320.6	O K
2880 min Summer	1.863	0.213	0.0	1.0	1.0	309.1	O K
4320 min Summer	1.847	0.197	0.0	1.0	1.0	286.2	O K
5760 min Summer	1.834	0.184	0.0	1.0	1.0	267.4	O K
7200 min Summer	1.822	0.172	0.0	1.0	1.0	250.0	O K
8640 min Summer	1.811	0.161	0.0	1.0	1.0	233.5	O K
10080 min Summer	1.800	0.150	0.0	1.0	1.0	217.7	O K
15 min Winter	1.732	0.082	0.0	0.9	0.9	119.7	O K
30 min Winter	1.763	0.113	0.0	0.9	0.9	164.2	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	210.2	O K
120 min Winter	1.826	0.176	0.0	1.0	1.0	256.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	77.6	19
30 min Summer	90.705	0.0	78.9	34
60 min Summer	56.713	0.0	158.1	64
120 min Summer	34.246	0.0	160.4	124
180 min Summer	25.149	0.0	161.6	184
240 min Summer	20.078	0.0	162.0	244
360 min Summer	14.585	0.0	162.3	364
480 min Summer	11.622	0.0	162.1	482
600 min Summer	9.738	0.0	161.6	602
720 min Summer	8.424	0.0	160.9	722
960 min Summer	6.697	0.0	159.1	962
1440 min Summer	4.839	0.0	154.8	1442
2160 min Summer	3.490	0.0	312.6	2140
2880 min Summer	2.766	0.0	305.9	2448
4320 min Summer	1.989	0.0	287.9	3160
5760 min Summer	1.573	0.0	482.2	3976
7200 min Summer	1.311	0.0	491.1	4760
8640 min Summer	1.129	0.0	496.4	5616
10080 min Summer	0.994	0.0	489.7	6448
15 min Winter	138.153	0.0	78.2	19
30 min Winter	90.705	0.0	79.7	34
60 min Winter	56.713	0.0	160.1	64
120 min Winter	34.246	0.0	162.8	122

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.844	0.194	0.0	1.0	1.0	282.1	O K
240 min Winter	1.856	0.206	0.0	1.0	1.0	299.0	O K
360 min Winter	1.872	0.222	0.0	1.0	1.0	322.2	O K
480 min Winter	1.883	0.233	0.0	1.0	1.0	338.1	O K
600 min Winter	1.891	0.241	0.0	1.0	1.0	349.5	O K
720 min Winter	1.897	0.247	0.0	1.0	1.0	357.9	O K
960 min Winter	1.904	0.254	0.0	1.0	1.0	369.3	O K
1440 min Winter	1.911	0.261	0.0	1.0	1.0	378.7	O K
2160 min Winter	1.910	0.260	0.0	1.0	1.0	377.0	O K
2880 min Winter	1.902	0.252	0.0	1.0	1.0	366.0	O K
4320 min Winter	1.882	0.232	0.0	1.0	1.0	337.3	O K
5760 min Winter	1.865	0.215	0.0	1.0	1.0	312.2	O K
7200 min Winter	1.848	0.198	0.0	1.0	1.0	287.5	O K
8640 min Winter	1.831	0.181	0.0	1.0	1.0	263.1	O K
10080 min Winter	1.815	0.165	0.0	1.0	1.0	239.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	164.0	182
240 min Winter	20.078	0.0	164.6	240
360 min Winter	14.585	0.0	165.2	358
480 min Winter	11.622	0.0	165.1	476
600 min Winter	9.738	0.0	164.7	594
720 min Winter	8.424	0.0	164.2	712
960 min Winter	6.697	0.0	162.6	944
1440 min Winter	4.839	0.0	158.4	1402
2160 min Winter	3.490	0.0	320.2	2076
2880 min Winter	2.766	0.0	313.8	2712
4320 min Winter	1.989	0.0	298.0	3376
5760 min Winter	1.573	0.0	550.8	4320
7200 min Winter	1.311	0.0	562.9	5192
8640 min Winter	1.129	0.0	548.4	6128
10080 min Winter	0.994	0.0	521.6	6960

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.499

Time (mins) From:	To:	Area (ha)
0	4	0.499

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	48.4
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	1344.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 1857 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.722	0.072	0.0	0.9	0.9	65.9	O K
30 min Summer	1.750	0.100	0.0	0.9	0.9	90.8	O K
60 min Summer	1.777	0.127	0.0	1.0	1.0	116.2	O K
120 min Summer	1.805	0.155	0.0	1.0	1.0	141.0	O K
180 min Summer	1.819	0.169	0.0	1.0	1.0	154.4	O K
240 min Summer	1.829	0.179	0.0	1.0	1.0	162.8	O K
360 min Summer	1.840	0.190	0.0	1.0	1.0	173.4	O K
480 min Summer	1.847	0.197	0.0	1.0	1.0	179.9	O K
600 min Summer	1.852	0.202	0.0	1.0	1.0	183.9	O K
720 min Summer	1.854	0.204	0.0	1.0	1.0	186.2	O K
960 min Summer	1.856	0.206	0.0	1.0	1.0	187.4	O K
1440 min Summer	1.850	0.200	0.0	1.0	1.0	182.8	O K
2160 min Summer	1.839	0.189	0.0	1.0	1.0	172.4	O K
2880 min Summer	1.828	0.178	0.0	1.0	1.0	162.7	O K
4320 min Summer	1.810	0.160	0.0	1.0	1.0	146.3	O K
5760 min Summer	1.794	0.144	0.0	1.0	1.0	131.2	O K
7200 min Summer	1.778	0.128	0.0	1.0	1.0	117.0	O K
8640 min Summer	1.764	0.114	0.0	0.9	0.9	103.7	O K
10080 min Summer	1.750	0.100	0.0	0.9	0.9	91.2	O K
15 min Winter	1.733	0.083	0.0	0.9	0.9	75.7	O K
30 min Winter	1.764	0.114	0.0	0.9	0.9	103.6	O K
60 min Winter	1.795	0.145	0.0	1.0	1.0	132.2	O K
120 min Winter	1.826	0.176	0.0	1.0	1.0	160.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	66.1	19
30 min Summer	90.705	0.0	78.1	34
60 min Summer	56.713	0.0	118.4	64
120 min Summer	34.246	0.0	145.9	124
180 min Summer	25.149	0.0	158.2	184
240 min Summer	20.078	0.0	158.7	244
360 min Summer	14.585	0.0	159.1	362
480 min Summer	11.622	0.0	158.9	482
600 min Summer	9.738	0.0	158.5	602
720 min Summer	8.424	0.0	157.9	722
960 min Summer	6.697	0.0	156.3	960
1440 min Summer	4.839	0.0	152.2	1370
2160 min Summer	3.490	0.0	268.5	1704
2880 min Summer	2.766	0.0	280.8	2076
4320 min Summer	1.989	0.0	270.3	2896
5760 min Summer	1.573	0.0	305.6	3696
7200 min Summer	1.311	0.0	311.4	4536
8640 min Summer	1.129	0.0	314.9	5280
10080 min Summer	0.994	0.0	316.6	6056
15 min Winter	138.153	0.0	75.9	19
30 min Winter	90.705	0.0	78.9	34
60 min Winter	56.713	0.0	134.4	64
120 min Winter	34.246	0.0	159.4	122

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.843	0.193	0.0	1.0	1.0	175.7	O K
240 min Winter	1.853	0.203	0.0	1.0	1.0	185.4	O K
360 min Winter	1.867	0.217	0.0	1.0	1.0	198.1	O K
480 min Winter	1.876	0.226	0.0	1.0	1.0	206.0	O K
600 min Winter	1.882	0.232	0.0	1.0	1.0	211.2	O K
720 min Winter	1.885	0.235	0.0	1.0	1.0	214.5	O K
960 min Winter	1.889	0.239	0.0	1.0	1.0	217.5	O K
1440 min Winter	1.886	0.236	0.0	1.0	1.0	215.6	O K
2160 min Winter	1.873	0.223	0.0	1.0	1.0	203.7	O K
2880 min Winter	1.860	0.210	0.0	1.0	1.0	191.5	O K
4320 min Winter	1.835	0.185	0.0	1.0	1.0	168.7	O K
5760 min Winter	1.810	0.160	0.0	1.0	1.0	146.3	O K
7200 min Winter	1.787	0.137	0.0	1.0	1.0	124.9	O K
8640 min Winter	1.765	0.115	0.0	0.9	0.9	105.0	O K
10080 min Winter	1.745	0.095	0.0	0.9	0.9	86.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	160.7	180
240 min Winter	20.078	0.0	161.4	240
360 min Winter	14.585	0.0	162.0	358
480 min Winter	11.622	0.0	162.0	474
600 min Winter	9.738	0.0	161.7	590
720 min Winter	8.424	0.0	161.2	706
960 min Winter	6.697	0.0	159.7	934
1440 min Winter	4.839	0.0	155.8	1382
2160 min Winter	3.490	0.0	304.3	1968
2880 min Winter	2.766	0.0	302.3	2220
4320 min Winter	1.989	0.0	282.6	3152
5760 min Winter	1.573	0.0	349.3	4032
7200 min Winter	1.311	0.0	356.7	4896
8640 min Winter	1.129	0.0	361.7	5704
10080 min Winter	0.994	0.0	365.1	6456

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.316

Time (mins) From:	To:	Area (ha)
0	4	0.316

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	30.4
Membrane Percolation (mm/hr)	1000	Length (m)	100.0
Max Percolation (l/s)	844.4	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.650	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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Wrexham Rd Mold

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Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 586 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	1.772	0.072	0.0	1.0	1.0	25.7	O K
30 min Summer	1.799	0.099	0.0	1.0	1.0	35.2	O K
60 min Summer	1.825	0.125	0.0	1.0	1.0	44.4	O K
120 min Summer	1.847	0.147	0.0	1.0	1.0	52.5	O K
180 min Summer	1.858	0.158	0.0	1.0	1.0	56.1	O K
240 min Summer	1.862	0.162	0.0	1.0	1.0	57.7	O K
360 min Summer	1.864	0.164	0.0	1.0	1.0	58.4	O K
480 min Summer	1.861	0.161	0.0	1.0	1.0	57.5	O K
600 min Summer	1.858	0.158	0.0	1.0	1.0	56.2	O K
720 min Summer	1.854	0.154	0.0	1.0	1.0	54.8	O K
960 min Summer	1.846	0.146	0.0	1.0	1.0	51.9	O K
1440 min Summer	1.832	0.132	0.0	1.0	1.0	47.0	O K
2160 min Summer	1.813	0.113	0.0	1.0	1.0	40.1	O K
2880 min Summer	1.795	0.095	0.0	1.0	1.0	33.8	O K
4320 min Summer	1.764	0.064	0.0	0.9	0.9	22.7	O K
5760 min Summer	1.739	0.039	0.0	0.9	0.9	14.0	O K
7200 min Summer	1.722	0.022	0.0	0.9	0.9	7.7	O K
8640 min Summer	1.709	0.009	0.0	0.9	0.9	3.3	O K
10080 min Summer	1.702	0.002	0.0	0.9	0.9	0.8	O K
15 min Winter	1.783	0.083	0.0	1.0	1.0	29.6	O K
30 min Winter	1.813	0.113	0.0	1.0	1.0	40.2	O K
60 min Winter	1.842	0.142	0.0	1.0	1.0	50.7	O K
120 min Winter	1.869	0.169	0.0	1.0	1.0	60.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	138.153	0.0	26.3	19
30 min Summer	90.705	0.0	36.3	33
60 min Summer	56.713	0.0	46.9	64
120 min Summer	34.246	0.0	57.8	122
180 min Summer	25.149	0.0	64.1	182
240 min Summer	20.078	0.0	68.6	242
360 min Summer	14.585	0.0	75.0	360
480 min Summer	11.622	0.0	79.9	458
600 min Summer	9.738	0.0	83.6	508
720 min Summer	8.424	0.0	86.9	570
960 min Summer	6.697	0.0	92.0	694
1440 min Summer	4.839	0.0	99.2	966
2160 min Summer	3.490	0.0	106.3	1364
2880 min Summer	2.766	0.0	111.3	1760
4320 min Summer	1.989	0.0	117.5	2512
5760 min Summer	1.573	0.0	121.4	3232
7200 min Summer	1.311	0.0	123.5	3896
8640 min Summer	1.129	0.0	124.8	4576
10080 min Summer	0.994	0.0	125.7	5152
15 min Winter	138.153	0.0	30.1	19
30 min Winter	90.705	0.0	41.4	33
60 min Winter	56.713	0.0	53.3	62
120 min Winter	34.246	0.0	65.5	120

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Suite 1 Park House
Broncoed Bus Park
Wrexham Rd Mold

Date 16/01/2024 10:20 | Designed by ModellingMold
File 2023-01-03 5086 Storage Estimate ... | Checked by
Micro Drainage | Source Control 2020.1

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
180 min Winter	1.881	0.181	0.0	1.0	1.0	64.4	O K
240 min Winter	1.887	0.187	0.0	1.0	1.0	66.5	O K
360 min Winter	1.891	0.191	0.0	1.0	1.0	68.1	O K
480 min Winter	1.891	0.191	0.0	1.0	1.0	67.8	O K
600 min Winter	1.887	0.187	0.0	1.0	1.0	66.6	O K
720 min Winter	1.882	0.182	0.0	1.0	1.0	64.7	O K
960 min Winter	1.872	0.172	0.0	1.0	1.0	61.1	O K
1440 min Winter	1.852	0.152	0.0	1.0	1.0	54.2	O K
2160 min Winter	1.823	0.123	0.0	1.0	1.0	43.9	O K
2880 min Winter	1.796	0.096	0.0	1.0	1.0	34.3	O K
4320 min Winter	1.751	0.051	0.0	0.9	0.9	18.2	O K
5760 min Winter	1.718	0.018	0.0	0.9	0.9	6.5	O K
7200 min Winter	1.701	0.001	0.0	0.9	0.9	0.2	O K
8640 min Winter	1.700	0.000	0.0	0.8	0.8	0.0	O K
10080 min Winter	1.700	0.000	0.0	0.7	0.7	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
180 min Winter	25.149	0.0	72.7	178
240 min Winter	20.078	0.0	77.6	236
360 min Winter	14.585	0.0	84.8	350
480 min Winter	11.622	0.0	90.3	462
600 min Winter	9.738	0.0	94.6	566
720 min Winter	8.424	0.0	98.3	658
960 min Winter	6.697	0.0	104.0	744
1440 min Winter	4.839	0.0	112.3	1052
2160 min Winter	3.490	0.0	120.5	1492
2880 min Winter	2.766	0.0	126.1	1904
4320 min Winter	1.989	0.0	133.7	2640
5760 min Winter	1.573	0.0	138.4	3288
7200 min Winter	1.311	0.0	141.7	3744
8640 min Winter	1.129	0.0	143.7	0
10080 min Winter	0.994	0.0	145.0	0

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Broncoed Bus Park
Wrexham Rd Mold

Date 16/01/2024 10:20 | Designed by ModellingMold
File 2023-01-03 5086 Storage Estimate ... | Checked by
Micro Drainage | Source Control 2020.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.400	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.125

Time (mins) From:	To:	Area (ha)
0	4	0.125

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Model Details

Storage is Online Cover Level (m) 2.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	118.7
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	329.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	1.700	Membrane Depth (m)	0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0050-1000-0750-1000
Design Head (m)	0.750
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	50
Invert Level (m)	1.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.750	1.0	Kick-Flo®	0.445	0.8
Flush-Flo™	0.222	1.0	Mean Flow over Head Range	-	0.9

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.9	0.800	1.0	2.000	1.6	4.000	2.1	7.000	2.8
0.200	1.0	1.000	1.1	2.200	1.6	4.500	2.3	7.500	2.9
0.300	0.9	1.200	1.2	2.400	1.7	5.000	2.4	8.000	2.9
0.400	0.9	1.400	1.3	2.600	1.7	5.500	2.5	8.500	3.0
0.500	0.8	1.600	1.4	3.000	1.9	6.000	2.6	9.000	3.1
0.600	0.9	1.800	1.5	3.500	2.0	6.500	2.7	9.500	3.2

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ANNEX 5

Preliminary Surface Water Drainage Layout

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM AXIS 'GENERAL ARRANGEMENT' DRAWING (REF: 2920-01-03 REV E RECEIVED ON 06.11.2023).
3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.

EXISTING WATERCOURSE
PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

N

KEY PLAN
1:10,000

1
2
3
4
5
6

Path (um)

DRAINAGE AREA 1

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 1,057.3 m²
DEPTH = 0.300 m
MAXIMUM CAPACITY = 95.1 m³

DRAINAGE AREA 3

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 2,920.2 m²
DEPTH = 0.500 m
MAXIMUM CAPACITY = 438.0 m³

S1
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

SUB-BASE OUTLET PIPE

7.5m
100Ø

HEADWALL
IL =1.00

S3.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

2.7m
100Ø

Drain

2m

2.0

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Drawing Status
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Date
JAN 2024

Scale (A0)
1:500

Project
BICKER FEN
LINCOLNSHIRE

Drawn
WC

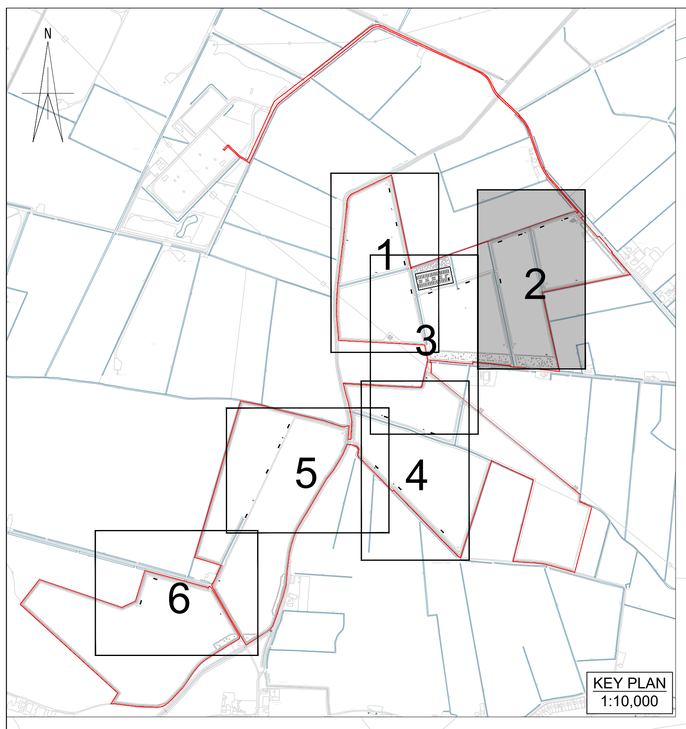
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Project No
5086

Title
PROPOSED SURFACE WATER DRAINAGE LAYOUT
1 OF 6

Drawing No
101

Revision
P1



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PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

DRAINAGE AREA 2

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 4,400.5 m²
DEPTH = 0.350 m
MAXIMUM CAPACITY = 462.1 m³

HEADWALL
IL =1.00

4.4m
1000

S2.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

SUB-BASE OUTLET PIPE

Drain
2.0
+2m
ING ROAD

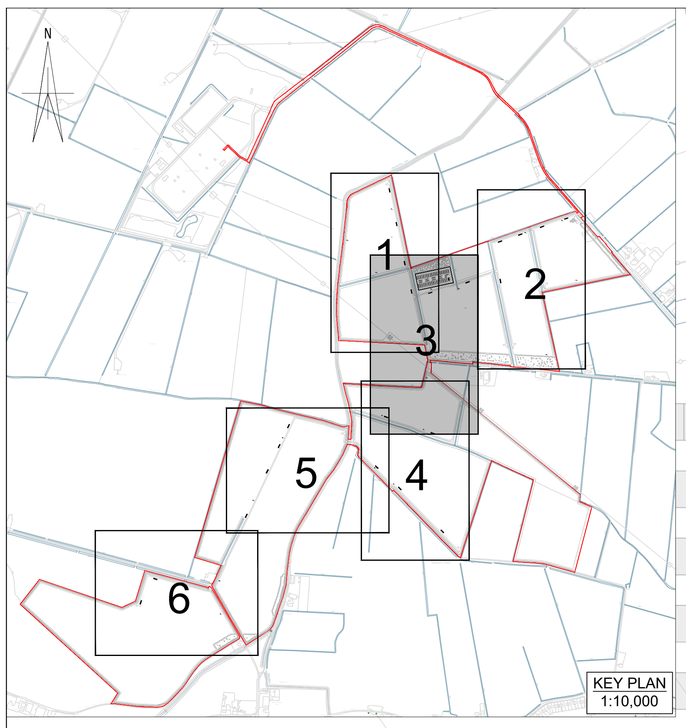
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Project: BICKER FEN, LINCOLNSHIRE	Drawn: WC
	Checked: TB
	Project No: 5086
Title: PROPOSED SURFACE WATER DRAINAGE LAYOUT 2 OF 6	Drawing No: 102
	Revision: P1

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NOTES

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3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.

EXISTING WATERCOURSE
PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

S1
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

SUB-BASE OUTLET PIPE

7.5m 100Ø

HEADWALL
IL =1.00

DRAINAGE AREA 3

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 2,920.2 m²
DEPTH = 0.500 m
MAXIMUM CAPACITY = 438.0 m³

SUB-BASE OUTLET PIPE

HEADWALL
IL =1.00

2.7m 100Ø

S3.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

4.1m 100Ø

HEADWALL
IL =1.00

SUB-BASE OUTLET PIPE

S4.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

DRAINAGE AREA 4

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 4,842.6 m²
DEPTH = 0.350 m
MAXIMUM CAPACITY = 508.5 m³

Drain
Drain
Drain
Ing Farm
2m
2.0

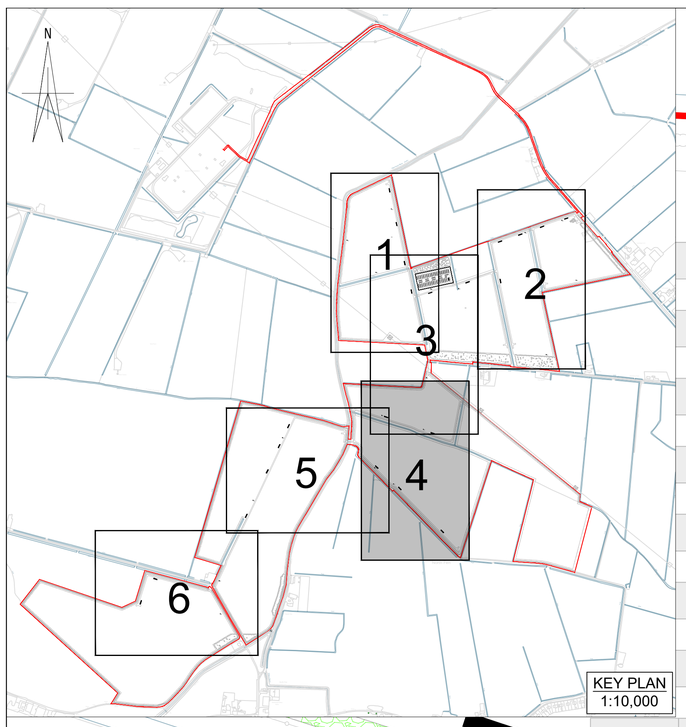
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	Scale (A0): 1:500
Project: BICKER FEN, LINCOLNSHIRE	Drawn: WC
	Checked: TB
	Project No: 5086
Title: PROPOSED SURFACE WATER DRAINAGE LAYOUT 3 OF 6	Drawing No: 103
	Revision: P1

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KEY PLAN
1:10,000

Drain

Drain

Drain

Drain

Track

Co Const, CP & ED Bdy

4.1m
100Ø
HEADWALL
IL =1.00

SUB-BASE
OUTLET PIPE

S4.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

DRAINAGE AREA 4

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 4,842.6 m²
DEPTH = 0.350 m
MAXIMUM CAPACITY = 508.5 m³

+2m

+2.5m

+2m

3.0

3.0

3.0

3.0

3.0

NOTES

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3. EXISTING LEVEL INFORMATION TAKEN FROM LIDAR DATA.

EXISTING WATERCOURSE
PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

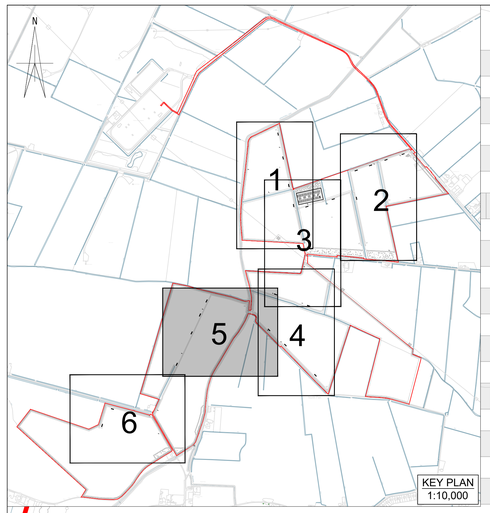
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Scale (A0): 1:500
Project: BICKER FEN
LINCOLNSHIRE
Drawn: WC
Checked: TB
Project No: 5086
Title: PROPOSED SURFACE WATER DRAINAGE LAYOUT
4 OF 6
Drawing No: 104
Revision: P1



Drain

Def

SD

Hammond Beck (Drain)

Path (um)

2m

2.5m

2.0

3.0

DRAINAGE AREA 4

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 4,842.6 m²
DEPTH = 0.350 m
MAXIMUM CAPACITY = 508.5 m³

4.1m 1000

HEADWALL
IL =1.00

SUB-BASE OUTLET PIPE

S4.0
FLOW CONTROL HYDRO-BRAKE
FLOW=1.0 l/s
CL=2.00
IL=1.10

DRAINAGE AREA 5

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 3,036.3 m²
DEPTH = 0.350 m
MAXIMUM CAPACITY = 318.8 m³

HEADWALL
IL =1.00

4.1m 1000

SUB-BASE OUTLET PIPE

S5.0
FLOW CONTROL HYDRO-BRAKE
FLOW=1.0l/s
CL=2.00
IL=1.10

NOTES

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EXISTING WATERCOURSE
PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

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Project
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LINCOLNSHIRE

Drawn
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Checked
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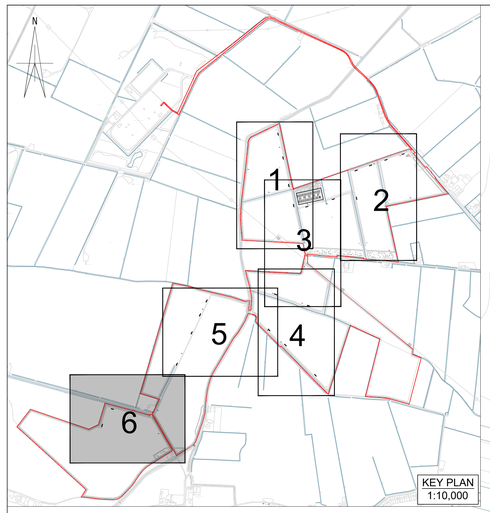
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Title
PROPOSED SURFACE WATER DRAINAGE LAYOUT
5 OF 6

Drawing No
105

Revision
P1

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MIDDLE FEN DROVE

S6.0
FLOW CONTROL
HYDRO-BRAKE
FLOW=1.0l/s
CL=2.00
IL=1.10

HEADWALL
IL=1.00

0.300m
100dia

SUB-BASE OUTLET PIPE

DRAINAGE AREA 6

ATTENUATION STRUCTURE:
TYPE 3 SUB-BASE MATERIAL (30% VOIDS) TO PROPOSED ACCESS ROAD

AREA = 1187.9 m²
DEPTH = 0.300 m
MAXIMUM CAPACITY = 106.9 m³

2m

2m

Beck Cottage

Cow Bridge

3.2m

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EXISTING WATERCOURSE
PROPOSED SURFACE WATER SEWER
PROPOSED SURFACE WATER MANHOLE
PROPOSED TYPE 3 PERMEABLE SURFACE
1.000 EXISTING LEVEL
SITE BOUNDARY

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Drawing Status
PLANNING

Project
BICKER FEN
LINCOLNSHIRE

Title
PROPOSED SURFACE WATER DRAINAGE LAYOUT
6 OF 6

Date: JAN 2024
Scale (A0): 1:500
Drawn: WC
Checked: TB
Project No: 5086
Drawing No: 106
Revision: P1

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Flood Consequences Assessments
Surface Water Drainage
Foul Water Drainage
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River Realignment and Restoration
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Environmental Permit and Land Drainage Applications
Sequential, Justification and Exception Tests
Utility Assessments
Expert Witness and Planning Appeals
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Appendix E – Site Rules

Working Hours

i) Normal Working Hours Monday to Friday 07:30 until 18:00. Saturday - Sunday 08:30 until 18:00;
ii) Piling shall only be undertaken between 09:00 and 17:00 Monday to Friday; and
iii) HGV delivery hours – During Normal Working Hours but Monday to Saturday, Monday to Friday 07:30 to 18:00 and Saturday 07:30 to 13:00. No deliveries on Sundays with the exception of on-off abnormal loads or large vehicles such as cranes.

Site Inductions

All personnel will complete a Site Induction.

All operatives must be competent and suitably trained to complete their works. Everyone during the Site Induction process will be asked to provide proof of professional competence, for example CSCS / IPAF. Failing to comply to prove proof will result in being refused entry to Site.

On Completion of the Site Induction when reporting to Site for the first time the Site Manager, or their designated deputy, will escort operatives around the welfare compound and their work area to identify any site hazards and to allow the operative to familiarise themselves with the environment of the construction site.

Risk Assessments and Method Statements

No works shall be permitted to take place unless appropriate Risk Assessments and Method Statements (RAMS) have been submitted to and agreed by the Site Manager. RAMS should be submitted a minimum of 1 week in advance of the planned works. The Site Manager will respond to submitted RAMS using the Contractor RAMS Review form.

As instructed by the Ecological Clerk of Works an Ecological Reasonable Avoidance Measures (EcRAMs) Method Statement may be required in addition to RAMS. All measures identified in the EcRAMs must be incorporated in the RAMS to manage not only health and safety matters but potential ecological risks.

All operatives must read, agree and sign on to their RAM’s.

All works will be carried out according to the agreed RAMS. No deviations from the RAMS without prior approval. It is the duty of individual operatives to know the content of the method statement for their works. Everyone is responsible for knowing the contents of the COSHH

assessment for any material they are working with and adhering to the control measure(s) detailed within.

Where works are required to deviate from agreed RAMS, or in the case of unplanned 'urgent' works then a Point of Work Risk Assessment must be completed and agreed by the Site Manager, and in situations that may give rise to ecological risks the Ecological Clerk of Works too.

Signing In and Out

Every contractor and visitor MUST sign in and out of Site. Signing in/out forms will be held in contractors Site Offices.

Safe Working

Every individual has a duty to take care of the health and safety of themselves and those who may be affected by their works.

Permits are required, these will be requested prior to work commencing. The range of Permits include:

Issued by Site Manager

i) General Permit to Work;
ii) Permit to Work at Height;
iii) Permit to Excavate;
iv) Permit for Hot Works; and
v) Permit to work in an Enclosed Space

Issued by Commissioning Senior Authorised Person:

i) Limitation to Access Permit
ii) LV Sanction to Test Permit
iii) HV Sanction to Test Permit
iv) LV Permit to Work
v) HV Permit to Work

No work will proceed until Permits have been authorised and issued.

All personnel must ensure that they are wearing and using the appropriate PPE and that it is in good condition with no defects. Any defects will be reported your site supervisor and will not be used. PPE must be worn in accordance with the method statement and Site minimum ('three-point') requirements of safety helmet, hi-vis and safety footwear.

Before starting work, the work area will be inspected by the operative to make sure the area is safe to start work. If the area is deemed unsafe this will be reported to the Site Manager, and until the area has been deemed safe to work, no work will proceed.

All tools and equipment will be inspected prior to use to ensure they are in good condition and suitable for the task required. Any defects will be reported to your site supervisor and will not be used.

Site operatives will strictly adhere to designated work areas (Zones) and access routes. These areas are to be kept in good order throughout the works.

All plant and equipment will be maintained in good condition. Inspection of tools and equipment will be carried out at regular intervals and records kept on site for inspection as and when requested.

No person shall be within 5m of moving plant. Exceptions to this rule shall only be permitted where adequate physical barriers exist separating the moving plant from people, or if the movement of plant is undertaken under the control of a competent banks person to ensure the safety of anybody potentially affected by the moving plant.

All reverse manoeuvres must always have a competent banks person in place.

General

Welfare facilities will be kept clean and tidy. Good housekeeping will be maintained always, and before the end of the working day Sub-contractors will offer up work areas for inspection, to the Site Manager, making sure that the areas are clean, tidy and safe.

Smoking only in designated areas only.

Use of mobile phones: Stop work move to a suitable safe location. (DO NOT WALK AND TALK and DO NOT DRIVE AND TALK).

Waste management is the reasonability of all sub-contractors. The Site Manager will agree a location where skips can be place. Skips to be exchanged/removed when full. Skips must be enclosed / sheeted to prevent waste from being blown out onto the site.

No food or drink with working areas, with the exception of bottled water.

No Horseplay. Bullying and discrimination of any kind is not tolerated on Site.

A zero-tolerance drug and alcohol policy exist throughout the Site. Testing may be carried out.

All personnel must adhere to site signage and measures to safeguard archaeological or ecological features.

Incident Reporting

Any accident, incident, near misses or uncontrolled hazards will be reported as soon as practicable to the Site Manager in addition to following and own company procedures.

Traffic Management

Access to the sites will be as indicated in the Site's Construction CDM Zones and Construction Traffic Management Plan.

CDM Zones and Construction Traffic Access Routes may change during different phases of the development. When changes occur, all personnel will be briefed and the latest copy of Construction CDM Zones and Construction Traffic Management Plan will be displayed on Health and Safety Noticeboard throughout the site.

Drivers shall:

i) Stick to designated routes;
ii) Not use mobile phones or two-way radios when driving on site these can distract attention;
iii) Observe on site 10mph speed limit. Reduce speed on rough ground or in adverse conditions (e.g. ice, mist and fog);
iv) Be aware of pedestrians;
v) Ensure the vehicle is not overloaded; loads are evenly distributed and secured;
vi) Not reverse without a Banksman, observe all signals. Ensure the reversing beacon is operational;
vii) Ensure that visibility aids (mirrors, cameras, etc.) are fitted to vehicles to remove blind spots, that they are serviceable and properly adjusted;
viii) Be aware of any services, bollard, over ground pipe and structure support;
ix) Be aware of overhead services (e.g. power lines, telephone cables, etc.);
x) Report large potholes, ruts, debris and other obstructions on traffic routes;
xi) Regularly check vehicles for leaks (e.g. engine oil, fuel, hydraulic oil) especially during periods of extreme frost and repair before commencing work;
xii) Regularly check vehicle tyres, brakes, lights, steering, note & repair faults before driving;
xiii) Before leaving site, check the vehicle for build-up of mud, stone or other debris. If necessary, clean vehicle / wheels to avoid the tracking out of mud or debris onto the Public Highway. Ensure all loads are enclosed / sheeted to ensure no dust or debris is blown from the vehicle when driving on the Public Highway;
xiv) Use high level beacons when driving on site;

xv) Use hazard warning lights where beacons are not available;
xvi) When leaving the vehicle wear PPE (minimum safety boots and hi visibility vest). Beware of rough ground when stepping off the vehicle;
xvii) Park the vehicle where it is safe to gain access and egress, i.e. not on slopes; and
xviii) Be competent to drive the vehicle under their control. Where the driver is also expected to operate vehicle mounted plant and equipment (e.g. lifting equipment) additional competency requirements will apply

Transport used on site should be assessed and selected for suitability so as to be safe and right for the job to deal with site conditions, e.g. rough terrain, enforced speed limits. Subject to proper maintenance, repair and inspection. Only driven or operated by suitably trained persons. Certain plant and equipment may need a Banksmen and/ or Supervisor as set out in the task specific Risk Assessment and Method Statement (RAMS).

All plant and materials must be correctly stored to prevent traffic routes being blocked.

Any item of plant not in use or awaiting repair must have a sign “This item of plant is out of use” placed on it.

ALL vehicles, plant and machinery not in use must have the keys removed and remain locked at all times. When vehicles and materials are being stored on site permission must be sought from the Site Manager prior to the works being undertaken. This will ensure traffic routes and work areas remain clear.

All plant operators are required to hold on their person a suitable CSCS/CPCS training certificate or equivalent to operate that particular type of plant.

All vans must be kept in a tidy manner to ensure that loose material does not interfere with pedal control.

Seat belts should be worn at all times whilst driving a company or personal vehicle, it will be considered a breach of Site Rules should any person be seen operating plant / machinery or driving their vehicle on site without one. Seat belts must only be removed when the vehicle is parked in reverse position at the workplace.

Operators of plant / machinery must ensure they carry out a daily pre use check of their machine prior to starting work each morning and in particular during spells of cold weather to ensure that hydraulic systems are working effectively.

Weekly checks will be made, and any defects will be noted on the weekly vehicle defects sheet.

The use of mobile phones / radios is not permitted under any circumstances whilst operating plant / machinery or whilst driving any vehicle on site.

Flashing beacons / reversing beacons / hazard lights must always be used whilst operating plant on site.

Re-fuelling is only permitted in authorised and designated areas. These areas are clearly signed and are within the designated materials Laydown areas. No re-fuelling of vehicles within the areas where construction work is taking place (unless prior permission is obtained from the Site Manager).