

Application form for deployment of mobile plant for land and/or groundwater remediation



The Environmental Permitting (England and Wales) Regulations 2010

Please read through the MPP2 guidance notes before filling this form in.

This form may only be used for deployments for land and/or groundwater remediation activities where the operator holds a permit referring to:

- SR2008 No27 Mobile plant for the treatment of soils and contaminated material, substances or products; or
- Bespoke treatments for land and groundwater remediation.

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Section A: About your permit

A1 Your permit details

A1.1 Permit under which this deployment is taking place

Please specify the type of permit and the permit number (EPR number) that you will operate under. If you have more than one permit, you will need to specify which set of permit conditions you would like us to use to make our determination. Note: you can only select one permit type.

- ☒ SR2008 No27 Mobile plant for the treatment of soils and contaminated material, substances, or products.

Permit number: EA WML 65502 (QP 3592ZY)

- ☐ Bespoke permit for land and groundwater remediation.

Permit number:

A1.2 Name and address of permit holder (operator)

Name of the operator: Geo2 Remediation Ltd

Address 1: 11, The Mending Rooms, Sunnybank Mills

Address 2: Town Street, Farsley, Leeds

Address 3:

Post Code: LS28 5UJ

Section B: Deployment details

B1 Contact information

B1.1 Who can we talk to regarding this deployment application?

Name of contact: Adam Wilson

Organisation: Geo2 Remediation Ltd

Address 1: 11, The Mending Rooms, Sunnybank Mills

Address 2: Town Street, Farsley, Leeds

Address 3:

Post Code: LS28 5UJ

Phone Number(s) Office: 01132575397 Mobile: 07779604026

Email: adam.wilson@geo2.co.uk

B1.2 What is your preferred method of correspondence?

☒ Email; or

☐ Phone

B2 Consultations before your deployment application

**B2.1 Have we been consulted on your Conceptual Site Model/Risk Assessment/
Remediation Strategy?**

☐ Yes – please provide reference number and name of officer who was consulted.

☒ No

Consultation Reference:

Officer:

B2.2 Have there been any changes to your proposal since its consultation?

- ☐ Yes - please provide details of the changes below. If your proposal has changed, this may require further assessment and may extend the determination time.
- ☐ No
- ☒ N/A

Please provide details of the changes to the proposal (if applicable):

B2.3 If you have not received any planning or pre-application advice, would you like this application to be assessed without having remediation targets pre-agreed by us?

Please note it is your responsibility to ensure remediation has been completed to a satisfactory state.

- ☒ Yes
- ☐ No – please complete this pre application process before submitting this application by contacting our customer care center.
- ☐ N/A

B2.4 Have you had any other pre-application advice from us?

- ☐ Yes - please provide a reference number.
- ☒ No

Pre-application reference:

B3 About the site

B3.1 The site name and address

Site Name: Land West of Nantong Way

Address 1: Nantong Way

Address 2: Swansea

Address 3:

Post Code: SA1 2FA

12 Digit Grid Reference: 266801, 195429

B3.2 Is your site located within the boundary of another Environmental Permit?

- ☐ Yes – Please provide details.
- ☒ No

Operator Name:

Permit number:

Contact Name:

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Phone:

Email:

B3.3 Include a site plan showing area of land where the treatment will take place.

Please provide a site plan reference and ensure the site plan includes all items in section B3.4

Site plan reference: Figure 1. Site Location Plan and Figure 2. Current Site Layout

B3.4 Please tick to confirm your site plan contains the following;

- ☒ Operating boundary
- ☒ Security and access arrangements
- ☒ Areas of waste soils and contaminated material, substances or products for remediation by the mobile plant.
- ☒ Location/siting of principal plant and equipment
- ☒ Process, treatment, storage, and quarantine areas
- ☒ Drainage systems
- ☒ Location of boundary monitoring points and pollution control units
- ☒ Potential receptors (i.e. Housing, watercourses etc.)
- ☒ Protected sites (if applicable i.e. SAC, SPA, Ramsar or SSSI within 1 km)

B4 Waste Types and Quantities**B4.1 Specify the waste types, quantities, contaminants, and European Waste Catalogue (EWC) code for each waste to be treated on site. Also, provide the treatment technologies to be used for each waste.**

What material are you treating	Quantity (m ³)	Contaminants to be treated	Six digit EWC code	What treatment technology will you be using?
<i>Contaminated Soils</i>	<i>1,250</i>	<i>Lead</i>	<i>19/13/01*</i>	<i>Soil Stabilisation</i>

B5 Specified activities to be carried out on site**B5.1 Please supply details of how the specified technology is suitable for treatment.**

The potential contaminant of concern to be treated using soil stabilisation is lead, which is believed to be present as a result of historical activities on the site. Stabilisation trials are currently ongoing in order to determine a mix design which achieves the relevant geotechnical performance criteria. Contaminated material currently resides in stockpiles onsite awaiting treatment. Treated materials are to be reused on site as site-won materials, altered for geotechnical suitability as road sub base materials. Treated material will be recovered as a 'suitable for use' sub base material.

Chemical treatment of soils to modify the content creating a binding mix to immobilise the soil sorbed contamination in line with the pilot tested design, as a hydraulically bound materials (HBM). This material is designed to be suitable as a geotechnical sub base for pavement construction. This will be deployed in areas shown on EP Fig 2. These works will entail the transport from the stockpiles to the area of reuse (less than 50m) treatment in situ

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(using a mobile stabilisation machine to add the desired mix of binding agents), placement and compaction of materials. Following deposition, these materials will then be surfaced with hardstanding as part of the final design to use the deposition areas as a roadway / pavement.

Suitability for use of the final improved material will be demonstrated by validation sampling to be undertaken by Geotech SS, the stabilization contractors.

B5.2 Provide details how residual materials/waste which cannot be treated by the specified technology are to be handled at the site

This treatment method has been designed to suit the material stockpiled as such no materials will require quarantine or treatment by other methods. Pre-treatment of the stockpile, prior to piling, ensures no unidentified waste types will be encountered.

B5.3 Specify the maximum capacities of quarantine facilities to be used for the storage of contaminated materials destined for re-testing, re-processing or off-site disposal. (indicate the locations of such quarantine facilities on the site plan)

As detailed above, these will not be necessary for these works.

B6 Activities involving the import of waste

B6.1 Will your activity involve the import of wastes?

- ☐ Yes
☒ No – go to question B7

B6.2 Does the site form part of a Cluster project?

- ☐ Yes
☒ No – go to section B7

B6.3 If applicable, please supply details of the procedures to be adopted at the site to ensure that only those materials that are treatable with the specified technology will be accepted.

Insert details or provide supporting document reference, including section and page number.

B7 Duration of this deployment

B 7.1 How long do you need this deployment for?

- ☒ **12 Months or less**
☐ **More than 12 months** (Note: remediation activities lasting more than 12 months may not be approved as a mobile plant deployment. You may need to apply for a site based environmental permit. See MPP2 Guidance for more information)

B8 Management supervision

B8.1 Please tick the scheme you are using to show you have the suitable skills and knowledge to manage your facility.

- ☒ CIWM/WAMITAB
☐ ESA/EU
☐ Certificate of Technical Competence included with application

Name of TCM: Steven Jackson

Date of birth: 26/08/1983

Phone: 0113 2575397

Email: steven.jackson@geo2.co.uk

B8.2 Provide information on the site supervision plan for your technically competent manager. Specify what treatment methods can be operated unsupervised, and provide a justification why this should be the case. (See 'How to comply with your environmental permit' guidance document for more information)

Site attendance by a member of the TCM team will occur full time throughout the Stabilisation Works. TCM will discuss with site staff and subcontractors to appraise progress inspect and enforce licence conditions and monitor on a daily basis.

B9 Conceptual Site Model and Risk Assessment

Use this section to outline the likely impact of your operations on the environment.

B9.1 Please provide a conceptual site model (CSM) which identifies all plausible pollution linkages (source-pathway-receptor relationships) and potential impacts to the local environment which could arise as a result of the proposed treatment activities.

(A template and further information is available in the MPP2 guidance notes.)

CSM and remedial strategy reports are attached as an Appendix.

B10 Pollution Control *(for noise, dust, particulates, fibres, aerosols, odour, Volatile Organic Compounds, vapours, gases, fuel, oil and / or chemical storage, vibration, and pests)*

B10.1 Please provide details of any site specific measures needed to control/minimise emissions, and prevent pollution of the environment and/or harm to human health resulting from your treatment activities *(the potential risks should have been identified in your risk assessment)*

Proposed Control Measures

All monitoring and control measure assessment will be undertaken by trained Geo2 staff and supervised by a TCM.

€ Dusts

Dusts will be minimised by phasing works throughout the programme, reducing the areas open to wind at any one time. Where necessary damping down may be undertaken to minimise dust generation.

Should dust levels prove unacceptable, further damping down measures will be enacted or dust reducing stabilisation plant may be deployed.

€ Noise

Noise will arise as a result of site works and plant operation, with the noisiest activities associated with operation of the stabilisation plant itself.

The stabilisation plant is likely to represent the noisiest item of plant onsite. This is a McLoskey 512 generates 92dB of noise at the maximum, located immediately adjacent to the hopper, with high readings anticipated around this machine and also other construction plant used in transporting materials. This activity and all other construction phase noises will be restricted to working hours, 8am-6pm.

Site staff will each be required under health and safety guidance to wear appropriate personal protective equipment. Offsite receptors are likely to be sufficiently distant (in excess of 100m for commercial and 200m for residential) to be affected. Should further noise mitigation be required to avoid creating a nuisance, baffles of site won material or alternate screening may be erected to screen sensitive receptors.

€ Vapour / Odour + VOCs

Odours and vapours may emanate from disturbed contaminated materials.

As all excavated material is currently stockpiled on site, it is considered unlikely that any odour generating materials will be present, covering of the material will also limit any odour generation. Once stabilised no significant odour generation will occur.

In the event that odours are considered elevated, the treatment of odourous material is to be prioritised until such time that all such material have been treated and reintroduced to the ground.

€ Contaminant release

Is unlikely to occur during stabilisation works as all soils have been previously excavated, this will remain covered until stabilized to reduce leachability. This reduces any possibility for contamination release. Visual checks will made during daily walkovers of the site to ensure no contaminant release occurs.

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Should soils identified as outside of the stockpile, they will be returned immediately in order to control waste materials.

Releases may occur through leaks and spills from onsite plant, banded stockpiles and fuel storage. In order to control this, spill kits appropriate to the size of the fuel storage will be stored onsite.

Whilst operational daily inspections will be undertaken of the plant by the TCM to ensure no releases occur.

B11 Emission Monitoring Plans

B11.1 Provide a site specific monitoring plan for any emissions that may be generated by the proposed treatment activities. Monitoring plans must include information on all of the following (when applicable to your process):

- ☐ groundwater
- ☐ surface water
- ☐ soil gases
- ☒ air emissions
- ☒ noise
- ☐ vibration
- ☒ odour
- ☒ Volatile Organic Compounds

B11.2 Specify the indicator parameters you propose to use for each of the emissions being monitored and provide a justification on why they are the most appropriate parameters to detect impact and prevent pollution. Depending upon your technology the plan should include both point source and wider (fugitive) emissions monitoring.
(A template and further information is available in the guidance).

Emissions action plan - If trigger levels are exceeded, then works will be terminated until mitigation measures are put in place that will adequately address the situation. Mitigation measures may include a review of PPE to ensure staff safety, use of quieter equipment or methods or screening and dust suppression.

Indicator parameters to be used to assess pollution of the environment and harm to human health are as follows-

- € Soil gases and odour / VOCs –Monitoring will be undertaken with a Photo Ionisation Detector (PID- MiniRae) at the 5 MP points shown on EP Fig 2, throughout works twice daily, during stabilisation works. Odour will be monitored by olfactory methods. Should soil vapours at the site boundary exceed 5ppm above baseline then no further works will occur until odourous materials have been treated. An olfactory survey will be conducted at the same time as the PID survey, should non VOC odours be generated. Harmful vapours associated with hydrocarbons are readily detectable by olfactory methods at low concentrations, below that at which any harm may be caused. Therefore this acts as a suitable screening method.
- € Noise – Noise monitoring will be undertaken daily during site works, using a Casella noise meter and collecting readings at each of the 5 MP points on the plan (EP Fig 2) to monitor boundary and site conditions. All site activities undertaken by staff would be subject to the requirements of specific Health and Safety risk assessments, as such it can be assumed that these will not be a sensitive receptor. Due to the inherent noise associated with the works and the low sensitivity of the area (predominantly an commercial/industrial area) noise levels at the site boundary should not exceed limits which may cause harm to

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offsite receptors (i.e. 75dB). Noisy site works will only be conducted during working hours 8am-6pm. In line with BS4141 noise levels at MPs should not normally exceed 5dB above baseline conditions. A survey of baseline conditions will be undertaken prior to commencement.

- £ Dust – Dust monitoring will be undertaken around the perimeter of the site at 4 locations (MP1, 3, 5 and 7 on EP Fig 2.) located on the boundaries of the site nearest offsite receptors, using disc collectors. These will be monitored to ensure dust levels are not too significant, with the trigger level set at 200mg/m²/day averaged (Institute of Air Quality Management) taking into consideration background concentrations.
- £ Collected discs will be sent for analysis at an appropriately accredited laboratory. Analysis will be conducted for PAH and Asbestos fibres and other contaminants identified within the soils.
- £ All monitoring will be conducted by a TCM as part of the daily monitoring routine. Dust samples will be submitted weekly. WAMITAB Accreditation of TCMs for the job is appended to this application.
- £ All monitoring kit (noise meter and PID) will be calibrated by site staff prior to use where possible and submitted annually for calibration and maintenance to an appropriate supplier.

B12 Record Keeping - Commissioning, operating and maintenance

B12.1 Provide details of commissioning, operating and maintenance including documentation and record-keeping to ensure that emissions from the process do not cause pollution of the environment and harm to human health.

The site will be staffed on a full time basis during stabilisation works by a Geo2 TCM.

Monitoring and site inspection records will be retained. In addition to monitoring sheets a site diary will be retained onsite to detail dates of visits and works undertaken, to detail maintenance measures required and enacted.

All laboratory analysis would be held in a raw data format comprising the laboratory certificates, data would also be collated to permit interpretation of the data. This data would be made available in Microsoft excel spreadsheets and graphs, or as Adobe Acrobat files.

Monitoring of air quality during intrusive works would be recorded and compared to the trigger level and noted in the site diary. Copies would also be stored electronically.

Records maintained during the commissioning and operational phase of the works will entail the following-

- £ Details as recorded on monitoring sheets.
- £ Condition of site, security etc
- £ Results of laboratory analysis of any samples
- £ Volumes of soils stabilised
- £ Details of optimisations and changes to the programme of works
- £ Any disposal records

All records will be retained onsite and at the Geo2 head office for a period of not less than 6 years.

Section C: The Data Protection Act 1998

We, the Natural Resources Body for Wales (hereafter 'Natural Resources Wales'), will process the information you provide so that we can:

- deal with your application;
- make sure you keep to the conditions of the license, permit or registration;
- process renewals; and
- keep the public registers up to date.

We may also process or release the information to:

- offer you documents or services relating to environmental matters;
- consult the public, public organisations and other organisations (for example, the Health and Safety Executive, local authorities, the emergency services, the Department for Environment, Food and Rural Affairs) on environmental issues;
- carry out research and development work on environmental issues;
- provide information from the public register to anyone who asks;
- prevent anyone from breaking environmental law, investigate cases where environmental law may have been broken, and take any action that is needed;
- assess whether customers are satisfied with our service, and to improve our service; and respond to requests for information under the Freedom of Information Act 2000 and the Environmental Information Regulations 2004 (if the Data Protection Act allows).

We may pass the information on to our agents or representatives to do these things for us.

Section D: Confidentiality and National Security

We will normally put all the information in your application on a public register of environmental information. However, we may not include certain information in the public register if this is in the interests of national security, or because the information is confidential.

You can ask for information to be made confidential by enclosing a letter with your application giving your reasons. If we agree with your request, we will tell you and we will not include the information in the public register. If we do not agree with your request, we will let you know how to appeal against our decision, or you can withdraw your application.

You can tell the Secretary of State that you believe that including information on a public register would not be in the interests of national security. You must enclose a letter with your application telling us that you have told the Secretary of State and you must still include the information in your application. We will not include the information in the public register unless the Secretary of State decides that it should be included.

Only tick the box below if you are certain that you wish information to be confidential. This may delay your application.

- ☐ Please treat the information in my application as confidential

Tick the box below if you have written to the Secretary of State to claim national security for your application.

- ☐ I attach a letter stating that I have written to the Welsh ministers explaining why my information should not be included on the public register for national security reasons.

Section E: Declaration

Please read through the following information before ticking the box below.

If you knowingly or carelessly make a statement that is false or misleading to help you obtain a mobile plant deployment (for yourself or anyone else), you may be committing an offence under the Environmental Permitting (England and Wales) Regulations 2010.

I declare that the information in this application is true to the best of my knowledge and belief. I understand that this application may be refused or approval withdrawn if I give false or incomplete information.

If you deliberately make a statement that is false or misleading in order to get approval you may be prosecuted.

☒ **Tick this box to confirm that you understand and agree with the declaration above**

Section F: Fee and Payment

Please see published annual charging scheme and guidance for information on current fee.

This section is required to be completed for all deployments. Please tick and complete one of the boxes below indicating the payment method and correct fee.

Tick below to show how you will make the payment.

- ☐ **Cheque**
☐ **Postal order**

How to pay by cheque, postal order

You should make cheques or postal orders payable to 'Natural Resources Wales' and make sure they have 'A/c Payee' written across them if it is not already printed on.

Please write the name of your company and your permit reference number on the back of your cheque or postal order.

We will not accept cheques with a future date on them.

Cheque made payable to: Natural Resources Wales

Cheque number:

Amount:

- ☐ **Credit or debit card**

How to pay by credit or debit card

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If you are paying by credit or debit card, please fill in the separate form CC1. We will destroy your card details once we have processed your payment. We can accept payments by Visa, MasterCard or Maestro card only.

☒ **Electronic transfer (for example, BACS)**

How to pay by electronic transfer

If you choose to pay by electronic transfer and you are applying for a mobile plant deployment, you will need to use the following information to make your payment.

Company name:	Natural Resources Wales	Company address:	Income Dept, PO BOX 663, Cardiff, CF24 0TP
Bank:	RBS		
Address:	National Westminster Bank Plc, 2 ½ Devonshire Square,		
	London, EC2M 4BA		
Sort code:	60-70-80		
Account number:	10014438		
Payment reference number:	xxxxxxxxxxxx		

You should also email your payment details and permit reference number to online@naturalresourceswales.gov.uk or fax it to 03000 065 3001.

If you are making your payment from outside the United Kingdom, it must be in sterling. Our IBAN number is GB70 NWBK 6070 8010 0144 38 and our SWIFTBIC number is NWBKGB2L.

Electronic Transfer Details: BACS Payment will be made upon provision of a notice of payment for the appropriate sum. Please contact Geo2 to arrange upon receipt.

Electronic Transfer Reference:

Amount £:

Section G: Supporting Documents

Please ensure that you include the following relevant documents with your deployment application

- ☐ Pre-application consultation reference numbers (B2)
- ☒ Site Plan showing all required features (B3.3)
- ☒ Management supervision award certificate (B8.1)
- ☒ Conceptual Site Model and Risk Assessment (B9.1)
- ☐ Pollution Control (B10.1)
- ☐ Monitoring Plans (B11.1)
- ☐ Record Keeping details (B12.1)
- ☐ Fee and Payment Reference (Section F)

Section H: How to contact us

Where to post your form and how to contact us

Post your deployment form, fee and any supporting documents to the Natural Resources Wales office at the following address:
Permit Receipt Centre

Natural Resources Wales
29 Newport Road
Ty Cambria
Cardiff
CF24 0TP

Or email permitreceiptcentre@naturalresourceswales.gov.uk

If you need help filling in this form:

Please contact the person who sent you it or contact us as shown below.

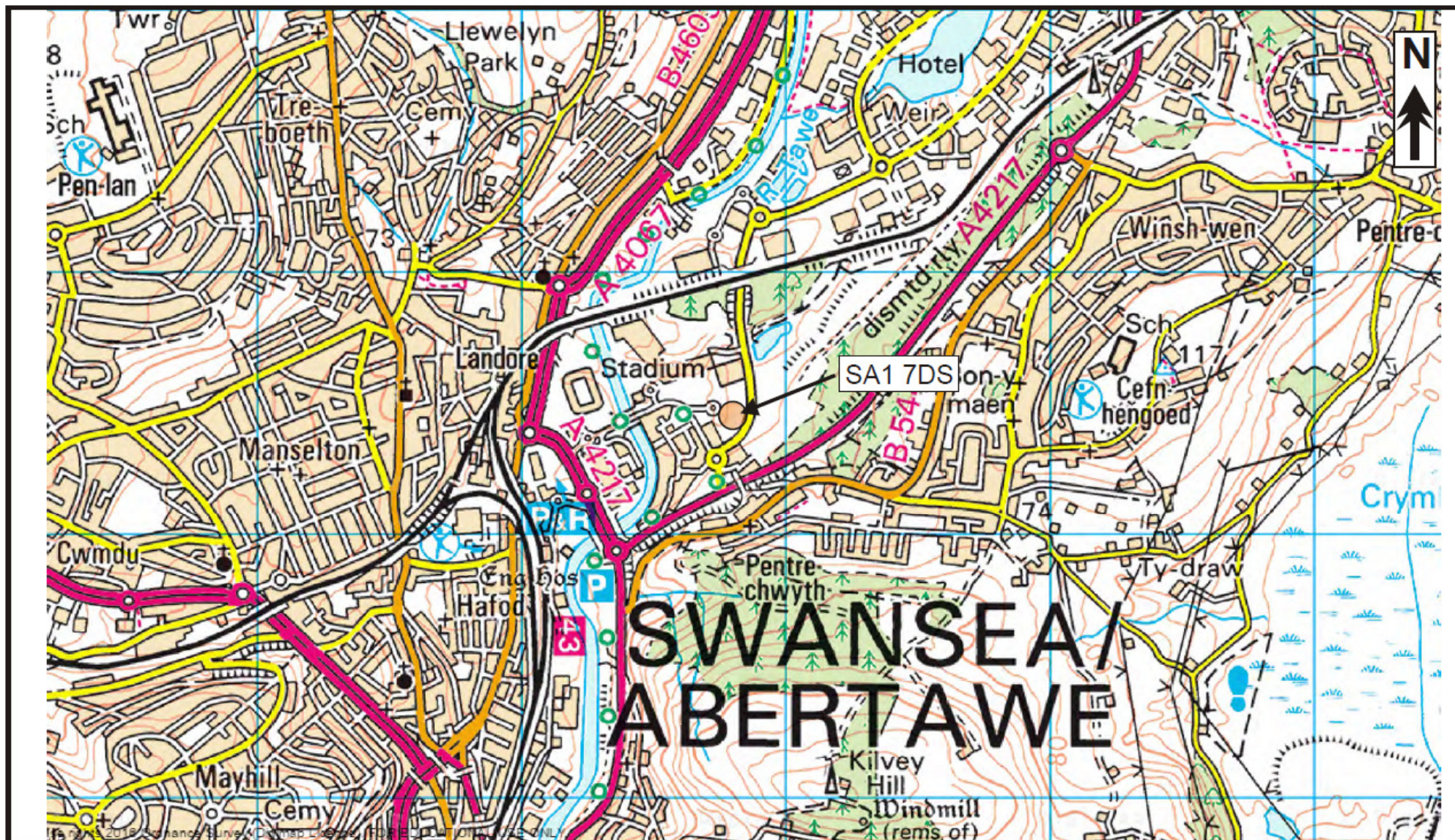
- General enquiries and customer service line: 0300 065 3000 (Monday to Friday, 8am to 6pm)
- Incident hotline: 0800 807060
- Floodline: 0845 988 1188 (24 hour service)
- Email: enquiries@naturalresourceswales.gov.uk
- Website: www.naturalresourceswales.gov.uk

If you are happy with our service, please tell us. It helps us to identify good practice and encourages our staff. If you're not happy with our service, please tell us how we can improve it.

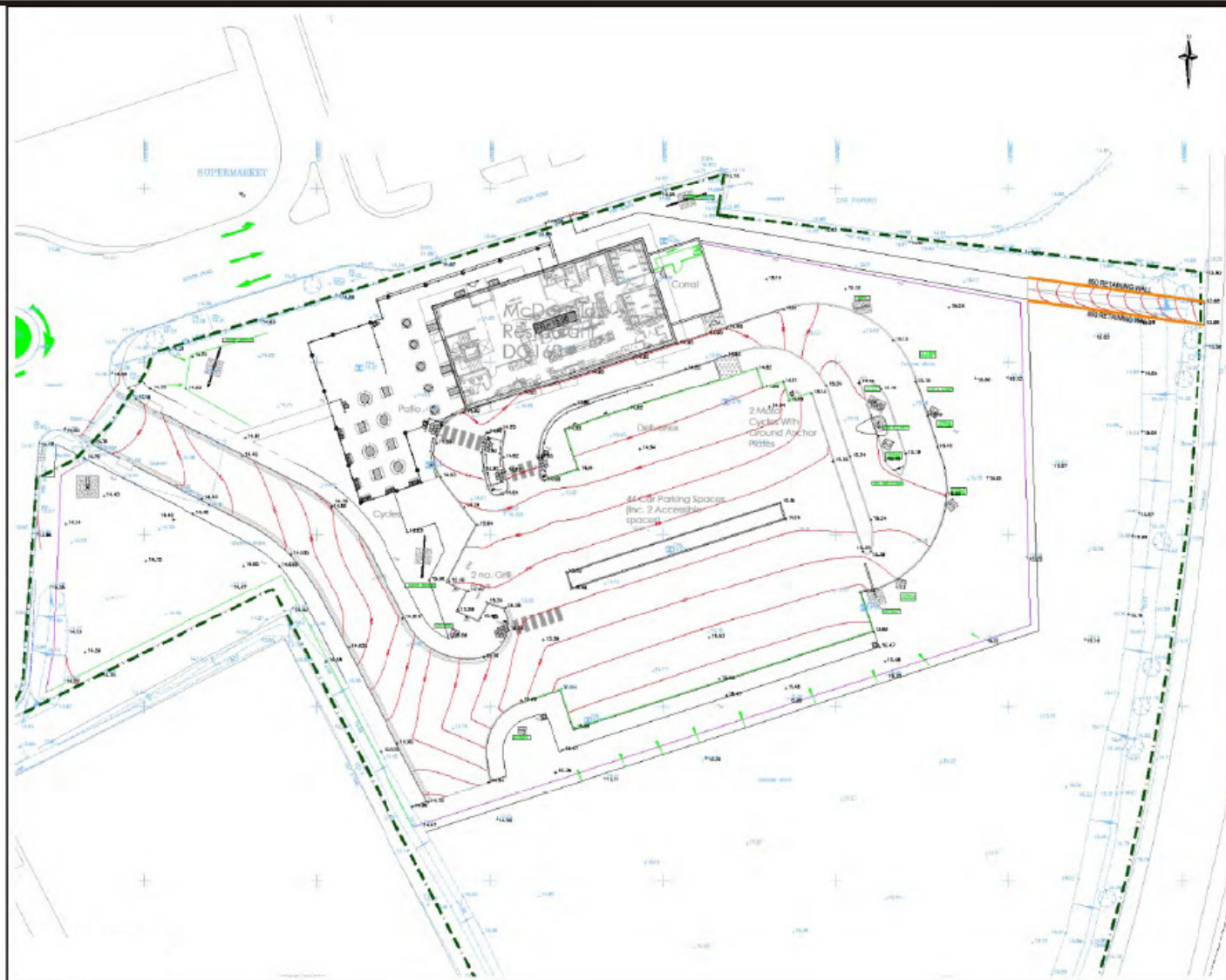
Please tell us if you need information in a different language or format (for example, in large print) so we can keep in touch with you more easily.

Appendix A

Figures



	Project:	Title:	Scale: NTS
	Nantong Way, Swansea	Extracted from Pam Brown Associates Remediation Strategy	Job No.: 1600-16
		September 2016	Figure 1



Based on Drawing No:4150528-1100, Rev T1, July 2016, Site Layout and Levels by Glanville Consultants Limited

Geo²™



Project:

Nantong Way, Swansea

Title:

Extracted from Pam Brown
Associates Remediation Strategy

September 2016

Scale: NTS

Job No.: 1600-16

Figure 3

Appendix B

Conceptual Site Model



Geo2 Remediation Ltd
11, The Mending Rooms,
Sunny Bank Mills, Town St,
Farsley, Pudsey, LS28 5UJ

Phone 0113 257 5397
Email info@geo2.co.uk
Web www.geo2.co.uk

EP Ref: QP3592ZY

Supporting Information: Land West of Nantong Way, Swansea

Conceptual Site Model

This section aims to identify all plausible contaminant linkages which will result from the contamination at the site associated with the proposed treatment action, daughter products of the contamination, waste residues and resultant materials following remediation.

Potential sources of pollution would include the following;

- Contaminated soil stockpile and windblown dusts.
- Run off of contaminated surface water and infiltration.
- Residual contamination in soils following treatment.
- Treatment media (cement etc) as dust.
- Noise. From operational plant and generator.
- Odour from the stockpile.
- Fuel storage onsite to service remedial plant

Key receptors would be the following:

- Controlled Waters, namely the underlying groundwater, classified in the bedrock and superficial deposits as a Secondary A Aquifer.
- Surface water bodies, the nearest identified being a partially culverted stream adjacent to the site (this is unlikely to be fed by groundwater but in order to be conservative, will be considered in with groundwater borne risks)
- Construction workers onsite associated with treatment works, or separately employed.
- Neighbouring users of retail units bordering the site to the north and west, the leisure centre to the west at a closest point 100m from the stockpiles.
- Residential site users, at a point 200m to the southeast of the stockpiles.
- No sensitive additional receptors have been identified in the Pam Brown Associates report (Remediation Strategy, September 2016) or following a search of the designed environmentally sensitive sites in England.
- Groundwater abstractions have been identified within 1000m of the site, however the nearest one (800m west) is associated with commercial use, a low risk receptor.

Potential pathways by which receptors may become exposed to contaminants are as follows:

- Offsite migration of contaminated groundwater,
- Accumulation of vapours or odours onsite or offsite, in enclosed spaces.
- Direct exposure, inhalation or ingestion of contaminated materials and dust.
- Surface run off of waters onsite
- Exposure to noise.

Pollutant linkages identified from the sources, pathways and receptors described above are shown on the risk assessment, Table 1, overleaf. Table 1, also details proposed risk mitigation measures.

Source The agent or process with potential to cause harm	Receptor What is at risk? What do I wish to protect?	Harm The harmful consequences if things go wrong	Pathway How the receptor might come into contact with the source	Probability of exposure Severity of the consequences if this occurs	Consequence Severity of the consequences if this occurs	Magnitude of risk The overall magnitude of risk	Justification for Magnitude Basis of my judgement	Risk Management How can I best manage the risk to reduce the magnitude	Residual Risk Magnitude of the risk after management
Contaminant Contaminated soils stockpile	Site Workers	Potential adverse health effect	Associated with direct contact and ingestion	Likely due to proximity of staff to soils material	Mild, may result in dermatitis or illness from	Moderate	Consequence is not severe however potential	Ensure appropriate PPE for staff, and use of	Low
Emission Dusts associated with treatment of stockpile or use of stabilisation materials (e.g. cement) or asbestos fibres	Site Staff/ Office Workers	Nuisance	Windblown dusts	Likely due to proximity	Health effects unlikely due to exposure level, may present a nuisance.	Low	Office staff affected in outside areas only,	Site staff equipped with appropriate work wear. Stabilisation plant to deploy damping measures as required. Dust monitoring to be undertaken	Very Low
	Nearby Residents and industrial units downwind	Potential adverse health effect	Windblown dusts	Low likelihood, due to limited size of stockpiles and due to distance to offsite receptors	Health effects unlikely due to distance of treatment	Low	Prevailing winds would need to carry dusts circa 200m to nearest residents		Very Low
Contaminant Impacted groundwater	Groundwater, Secondary A aquifers.	Potential environmental harm	Run off from the stockpiles.	Low likelihood Contamination is present within the stockpile	Mild. Displaced waters may enter controlled waters,	Low	Stockpiles are of limited size (estimated 1,200m3) and therefore run off is unlikely to	Stockpiles are stored in an impermeable liner and covered. Preventing	Unlikely
Emission Noise. Particularly associated with soil modification works.	Site Staff	Hearing damage	Audible exposure	High	Medium	High	Use of stabilisation plant. Other activities may exceed 75dB	Site staff will wear appropriate ear defenders	Low
	Offsite receptors	Nuisance	Audible exposure	Unlikely	Mild	Very Low	Distance of offsite receptors from the area of treatment	None required, but may need to be reviewed should	Unlikely

Table 1a. Conceptual Site Model and Risk Assessment with proposed mitigation

[Type here]

Source The agent or process with potential to cause harm	Receptor What is at risk? What do I wish to protect?	Harm The harmful consequences if things go wrong	Pathway How the receptor might come into contact with the source	Probability of exposure Severity of the consequences if this occurs	Consequence Severity of the consequences if this occurs	Magnitude of risk The overall magnitude of risk	Justification for Magnitude Basis of my judgement	Risk Management How can I best manage the risk to reduce the magnitude	Residual Risk Magnitude of the risk after management
Emission. Vapours and odours	Site users	Potential adverse health effect	Inhalation of vapours released from stockpile.	High. Due to proximity.	Medium	Moderate	Vapours unlikely to be significant due to the low volatility of the contamination .	Vapours will be monitored using a PID. Treatment vessels will be covered. Appropriate H+S must be followed by site staff. Cover stockpiles when not in use.	Low
	Offsite receptors	Potential adverse health effect	Inhalation of vapours released from stockpile	Medium- subject to proximity, reducing with distance.	Mild	Low		Stockpile will remain covered.	Very low
Storage of Fuel Fuel storage for generator / plant supply.	Site Staff	Potential adverse health effect	Associated with direct contact and ingestion in the event of a release	Low likelihood as area of impact would likely be small.	Mild, may result in dermatitis or illness from short term exposure.	Low	Unlikely to be a large area of impact.	Ensure appropriate PPE for staff. Ensure fuel is stored within bunded appropriate containers on impermeable surface.	Low
Treated Material Modified soils	Groundwater, Secondary A aquifers.	Possible leaching of contaminated materials	Leaching to groundwater and the stream	Medium.	Likely to be mild	Low	Modification will reduce significantly potential risk.	Validation testing of modified soils to ensure stability and low leachability.	Very low
	Construction workers	Possible exposure to contaminated materials	Direct contact, ingestion and inhalation of fugitive dusts	Medium.	Likely to be mild	Low	Modification will reduce significantly potential risk.	Ensure appropriate PPE for staff, and use of health and safety inductions.	Very low
	Offsite receptors	Potential adverse health effect	Inhalation of fugitive dusts		Low likelihood	Low risk	Distance to offsite receptors makes duct	Stabilisation binds together materials,	Very low

Table 1b. Conceptual Site Model and Risk Assessment with proposed mitigation

Appendix C

WAMITAB Certification



Certificate No. CCC10657

Continuing Competence Certificate

This certificate confirms that

Adam Wilson

Has met the relevant requirements of the Continuing Competence scheme for the following award(s) which will remain current for two years from 26/01/2016

CLR Contaminated Land Remediation

Awarded: 26/01/2016

Expiry Date:
26/01/2018

Authorised

WAMITAB Chief Executive Officer

CIWM Chief Executive Officer



The Chartered Institution
of Wastes Management



00093374



Certificate No. CCC10656

Continuing Competence Certificate

This certificate confirms that

Steven Jackson

Has met the relevant requirements of the Continuing Competence scheme for the following award(s) which will remain current for two years from 26/01/2016

CLR Contaminated Land Remediation

Awarded: 26/01/2016

Expiry Date:
26/01/2018

Authorised

WAMITAB Chief Executive Officer

CIWM Chief Executive Officer



The Chartered Institution
of Wastes Management



00093375

Appendix D

Remediation Strategy

Pam Brown Associates



REMEDIATION STRATEGY

**LAND WEST OF NANTONG WAY
SWANSEA
SA1 2FA**

September 2016

REMEDIATION STRATEGY

NANTONG WAY SWANSEA SA1 7DS

	NAME	SIGNATURE	DATE
PREPARED BY:	ALEX TABB		02/Sept/2016
CHECKED BY:	DR. MELISSA MORALES		7/Sep/2016

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Report Status: Final

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1.0 INTRODUCTION

Pam Brown Associates Ltd (PBA) was appointed by Glanville Group to prepare a Remediation Strategy to support planning proposals as part of the McDonalds development scheme for the site at Nantong Way, Swansea.

The Remediation Strategy aims to provide an overview of the contaminative issues identified by the ground investigation carried out by ST Consult in June 2012 and additional trial pitting works undertaken in November 2015. This document also summarises the findings of the ground gas monitoring round undertaken by PBA during the period August-September 2016.

The document includes an assessment of the pollutant pathways which could affect human users and/or controlled waters and aims to provide an overview of the remedial works that will be implemented to address the pollutant pathways and ensure they do not present a significant risk.

This document provides a platform for discussion with the Regulatory Authorities, which once agreed, will constitute the basis on which the site will be remediated.

The strategy presented in this document has been developed in accordance with current guidance; Environment Agency (2004) 'Model Procedures for the Management of Land Contamination' (CLR11) and Environment Agency (2010) 'Guiding Principles for Land Contamination'

The present document must be read in conjunction with:

- ST Consult '*Site Investigation Report*'. Ref. J10988. 6th June 2012.

Limitations

The recommendations made within this document are restricted to those that can be determined from the information available to date and may be subject to amendment in the light of additional information/findings and/or after consultations with the pertinent authorities.

The information provided by previous studies carried out by 3rd parties is presented in good faith; however it is important to emphasise these studies were commissioned under different scopes. On this basis, PBA cannot accept any liability for the information derived from previous studies and/or for discrepancies and/or inaccuracies found in the data.

Whilst this report may express an interpretation of the ground conditions, groundwater, contaminative issues between and/or beyond exploratory hole positions and/or potential presence of features based on either visual, verbal, anecdotal or published evidence, this is for guidance only, and no liability can be accepted for its accuracy.

Whilst efforts have been made to ensure the information provided is accurate and current, contractors are ultimately responsible for corroborating the information for the benefit of their site presence and any discrepancies in the data should be reported to PBA.



This document has been prepared specifically for the use of Glanville Group as a guide to the remedial works likely to be required to render the site suitable for the proposed scheme, shown in Figure 3. It is by no means a definite list or specification of the works that will be required and may require amendment under the light of further findings. If the document is used/viewed by any other party for any other purpose than that specified, reference must be made to PBA to confirm its suitability for use. No responsibility will be accepted where a third party uses this report, either in part or in its entirety, unless formally re-assigned.



2.0 SITE SETTING

2.1 SITE LOCATION AND DESCRIPTION

The site is located off Nantong Way (A683) within the suburb of Morfa, approximately 2.2km northeast of Swansea City Centre and 500m east of Liberty Stadium, home of Swansea football club and the River Tawe. The approximate National Grid Reference (NGR) for the site is 266801, 195429. An extract of the 1:50,000 Ordnance Survey map showing the general location is included in Figure 1.

The site covers approximately one (1No.) acre and is currently an undeveloped parcel of open land. ST Consult recorded the most recent use of the site was as an overflow car park for the Liberty Stadium. Access into the site is from Brunel Way located to the west, via an access road to the Northeastern corner of the site. A plan of the current site layout is presented as Figure 2.

The site's surroundings comprise a mixture of industrial and recreational areas. The 'Morfa Shopping Park' is located immediately to the north. To the east is 'Nantong Way' that forms the site boundary, beyond this is a park. To the south, 'Nantong Way' runs parallel to the site boundary; beyond this is a depot along 'Morris Drive'. To the west is Swansea Tennis Centre, a filling station and a tank.

2.2 PROPOSED DEVELOPMENT

The proposals include the construction of a two storey restaurant/hot food take away with associated parking, "Drive-Through" facility, external seating patio, play area, landscaping and external works. The proposed site layout is included as Figure 3.

2.3 GEOLOGY

The British Geological Survey (BGS) mapping 1:50000 Series No.247– Swansea indicates the site is underlain by Alluvium deposits (superficial), consisting of clays, silts, sands and gravels. The Swansea Member (bedrock) underlies the alluvium deposits and is comprised of mudstones, siltstones and sandstones. Till deposits (Boulder clay) are recorded in very close proximity to the site, towards the southeast, which could possibly extend onto the site.

Coal Authority Report

A Coal Authority Mining Report obtained by ST Consult states that the site is in a likely zone of influence of a coal seam at a depth of 250m -270m which was last worked in 1902. Any ground movement associated with this feature is assumed to have ceased. The Coal Authority believes the site to be in an area where coal is at, or close to, the ground surface which may have been worked in the past.

There are no known coal mine entries within 20m of the site.



2.4 HYDROGEOLOGY

The Environment Agency has classed the superficial deposits and bedrock formations as Secondary A aquifers.

The permeability of the underlying Swansea Member has been classed as low to moderate. The superficial stratum has been classed as having very low to high permeability.

The site does not lie within a groundwater source protection zone.

Abstraction Consents

The closest abstraction consent is held by a railway maintenance depot located approximately 800m west of the site.

2.5 HYDROLOGY

A pond is recorded approximately 180m north east. A stream was noted by ST Consult during a site visit to the east of the site flowing (south-east to north-west) out of a tunnel/culvert (beneath Nantong Way) in open channel for a short distance and into another culvert; which appeared to flow in the direction of the supermarket (Morrison's) car park. Mapped data indicates this is a drain which carries water from issues arising to the east and northeast of the site on former railway land.

The River Tawe passes to the north and west of the site, approximately 800m and 350m from the site, respectively. The River is aligned north to south as it passes to the west and flows to the south discharging into Swansea Bay.

Discharge Consents

Four (4No.) discharge consents to the River Tawe were noted within 250m of the site. All of these consents are listed as expired or revoked.

Flooding

On the basis of Environment Agency data (2012) and National Resources Wales Maps (2016), the site is not in an area at risk of flooding due to rivers or the sea. The City and County of Swansea Flood Management Plan (2015) does not identify the site to be at risk from surface water flooding.

BGS data obtained by ST Consult shows the site has a 'very high' susceptibility to groundwater flooding due to the location of the site above alluvial deposits. However, site investigation works (Section 3.0) have recorded a significant depth of made ground across the site, up to 8.6m, and the groundwater table to be approximately 9.0m below ground level (bgl). The risk of flooding from groundwater is therefore concluded to be low.



2.6 SITE HISTORY

On-Site

In 1884, the site was noted as forming part of an industrial area. Spoil heaps were observed to the north western portion of the site; these are thought to be associated with the nearby copper/alkali/metal works. A railway was also noted running northeast to southwest through the southeastern area of the site.

The railway and spoil heap were no longer observed in the 1980s.

From 1989 to 2011, no further changes were made to the site layout and it remained vacant.

Off-Site

Historical activities that could give rise to contamination have been summarised in Table 1.

Table 1. Historical potentially polluting activities identified off-site

Date	Source	Distance
1884 - 1980	Spoil Heaps	North, west and south of site within 150m
1884 - 1989	Railway Line	20m south
1900 - 1950s	Engine Shed	80m east
1950s	Saw Mills	100m south east
1951 - 1990	Copper / alkali / metal works	150m west
1930s	Coal pit	250m north

Currently, a petrol filling station is located at the western site boundary however the risk of pollution from this activity has been deemed as 'low' on the basis its activities are controlled by current environmental and industry related regulations.



3.0 PREVIOUS INVESTIGATIONS

3.1 ST CONSULT 'SITE INVESTIGATION REPORT'. REF. J10988. 6TH JUNE 2012

ST Consult carried out a Desk Study and a Site Investigation in 2012 with the aim of assessing foundation bearing conditions and other soil parameters relevant to the proposed development and to assess the likely nature and extent of soil, groundwater and ground gas contamination on the site.

Scope of the investigation

The investigation comprised the following works:

- Desk study
- Walkover survey
- Ground investigation:
 - o One (1No.) 13.0m borehole located in the area of the proposed building
 - o Four (4No.) trial pits excavated to depths of 2.7-3.0m bgl.
 - o Three (3No.) trial pits excavated to depths of 1.1-1.7m bgl.
 - o One (1No.) 7.0m ground gas monitoring well
 - o Soil chemical testing, six (6No.) samples, including asbestos identification and quantification
 - o Geotechnical testing

The location of the ST Consult exploratory excavations are shown on Figure 4.

Ground Conditions

Made Ground

Three (3No.) types of made ground were identified with variable thickness between 0.15m to 8.6m. The surface made ground comprised compacted sandy gravel which was composed mainly of limestone and road planning's to a depth of 0.35m bgl.

Beneath the hardcore up to 2.4m depth, the made ground consisted of rubble, comprising fragments of brick, concrete, sandstone and slag in a sand/clay matrix. It also contained occasional pieces of timber, plastic, metal, plywood and fibrous material.

The deep made ground, recorded to a maximum depth of 8.6m bgl in the borehole, comprised reddish brown gravel, cobble and boulder size fragments of slag and sandstone in a sand/clay matrix.

No visual or olfactory evidence of possible significant contamination was found, apart from the presence of clinker/slag which can give rise to elevated contaminant concentrations.

Natural Stratum

Firm grey silty, slightly sandy CLAY; with occasional flint gravel/cobbles, sand lenses and organic patches. Natural soils were encountered in BH1 only from 8.6m bgl to termination of the exploratory hole at 13.0m bgl.



Groundwater

Groundwater was encountered at depths of 9.4m (bgl) rising to 8.7m (bgl) after 20 mins during site works. No long-term groundwater monitoring was undertaken.

Contamination Assessment

Six (6No.) made ground samples were subjected to a range of chemical analysis. The results were subsequently compared against EA soil guideline values (SGVs) and tier 1 screening values derived by ST Consult, based on LQM/CIEH¹ and CL:AIRE² generic assessment criteria (GAC), for a commercial land use, valid at the time of the investigation. It is worth noting some of these criteria have now been superseded by the CL:AIRE (2014) 'Category 4 Screening Levels'³ and LQM/CIEH (2015) 'Suitable 4 Use Levels'⁴.

Metals

ST Consult found that concentrations for most contaminants of concern were at concentrations below their respective assessment criterion, with the exception of Lead which recorded exceedances in five (5No.) samples when compared with the previous screening value of 750 mg kg⁻¹ (now withdrawn). However, if the most recent C4SL of 2300mg kg⁻¹ for this contaminant is applied for comparison purposes, only two (2No.) samples with concentrations of 3,000mg kg⁻¹ and 18000mg kg⁻¹ exceeded this value. The likely source of the contamination was considered to be the gravel of slag present in the made ground. Whilst not exceeding the soil assessment criteria values, arsenic, copper, chromium and zinc were considered by ST Consult to be slightly elevated.

Polyaromatic hydrocarbons and Total petroleum hydrocarbons

Selected made ground samples were subjected to determinations of organic compounds. Benzo(a)pyrene and Naphthalene concentrations observed in the materials were 0.1-2.7mg kg⁻¹ and <0.1mg kg⁻¹, respectively. Whilst very low concentrations of total petroleum hydrocarbons were recorded, between <10mg kg⁻¹ and 63 mg kg⁻¹.

Sulphates and Acidity

Water soluble sulphate contents of the six (6No.) made ground samples tested, were found in the range of 0.06g/l – 0.52g/l. The pH of the soil has been recorded in the range of 7.5 to 9.8, slightly alkaline to alkaline. The sulphate content of the fill and natural soil was found to fall within Class DS-2. The ACEC classification for the site was AC-2.

Asbestos

Asbestos containing materials or asbestos fibres were not detected by the screening carried out in selected samples.

Ground gases

A ground gas monitoring well was installed in BH1 but no monitoring was instigated at the time of the investigation.

ST Consult concluded that because the site was historically used as a slag/spoil heap associated with the nearby metal works rather than a refuse heap (comprising landfill), land gas issues were not anticipated to be a potential issue on site.

¹ LQM / CIEH (2009) 'Generic Assessment Criteria for Human Health Risk Assessment' 2nd Edition.

² EIC/AGS/CL:AIRE (2009) 'Soil Generic Assessment Criteria for Human Health Risk Assessment'.

³ CL:AIRE (2014) 'SP1010-Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination'.

⁴ LQM/CIEH (2015) 'Suitable for Use Levels (S4ULs) for human Health Risk Assessment'.



Services

Pressurised gas mains were identified in the vicinity running parallel with 'Nantong Way' and 'Brunel Way'.

Geotechnical Assessment

Given that a substantial depth of made ground was recorded, which is inherently variable, traditional strip/pad foundations were not recommended for the site. A piled foundation or foundations formed on vibro stone columns were considered to be the most suitable solutions. Suspended ground floor slabs or a piled slab/raft were recommended together with piled or vibro foundations.

Due to the predominantly granular nature of the made ground, the potential for swelling / shrinkage was considered negligible.

All dynamic cone penetrometer (CBR) tests attempted, were refused at <50mm (bgl) due to the compacted and variable nature of the made ground.

Due to the significant depth of made ground soakaways were not considered appropriate for use in the drainage strategy for the site.

Recommendations

ST Consult recommended for a 600mm of clean cover to be placed across soft landscaping areas above a physical barrier to prevent any contact with Lead contaminated fill.

Due to the elevated levels of Lead, health and safety precautions were advised to be followed by the contractor and ground workers including the use of PPE and good hygiene practises.

The relevant statutory authorities should be consulted in relation to the use of appropriate material for the pipework to be placed within the contaminated fills e.g. water supply pipe.

3.2 ST CONSULT 'TRIAL PITTING' NOVEMBER 2015

ST Consult completed a trial pitting exercise in November 2015 to obtain samples of the made ground for waste acceptance criteria (WAC) analysis.

Four (4No.) trial pits were excavated to a depth 0.5m bgl (TP101-104), principally within the central area of the site, as shown in Figure 4. Samples were taken at 0.5m bgl from the made ground materials, described as sand and gravel of flint, sandstone, slag and brick with occasional cobbles of metal/glass fragments.

Results of the WAC analysis indicated three of the samples would be classified as 'stable non-reactive' due to concentrations of Antimony, Arsenic, Molybdenum, Fluoride and Total organic carbon (TOC). One (1No.) sample presented an elevated TOC concentration which would indicate 'hazardous' classification for waste disposal purposes. Copies of the trial pit logs and WAC analyses are presented in Appendix 1.



4.0 ENVIRONMENTAL ASSESSMENT

4.1 SOIL QUALITY

The ST Consult ground investigation found most contaminants were present in concentrations below their respective soil assessment criteria (valid in 2011) for land under a commercial / industrial use. The only exception noted was the levels of Lead observed in the made ground materials across the site.

Table 2 provides a reassessment of the observed soil Pb concentrations in the context of the current CL:AIRE (2014) 'Category 4 Screening Level' for this contaminant⁴ (2300mg kg⁻¹). Results indicate made ground samples retrieved from the northeastern part of the site contain Pb levels which exceed the current soil assessment criteria, hence are considered to pose a potential risk to the health of ground workers and future users.

Table 2. Soil Lead Concentrations (mg kg⁻¹) observed on site

Sample	Depth (m bgl)	Soil Pb Concentration (mg kg ⁻¹)
TP1	0.40	3000
TP2	0.50	18,000
TP3	3.00	1900
TP4	0.50	1700
TP6	0.40	470
TP7	0.50	1600

4.2 RADON AND GROUND GASES

Local authority search results undertaken by ST Consult with Swansea Council indicated the site lies within a Radon affected area. A site specific radon report was requested from the British Geological Survey (BGS) by ST Consult, which concluded radon protective measures are not required for this site.

Ground gas concentrations on site have recently been monitored by PBA between the 2nd August and 6th September 2016. At total four (4No.) visits have been carried out and the maximum gas levels observed per visit are summarised in Table 3, below. Copies of the monitoring certificates can be consulted in Appendix 2.

Table 3. Ground gas concentrations observed in BH1 during Aug – Sep 2016

Date of monitoring visit	CH ₄ (%vol) Steady	CO ₂ (%vol) Steady	O ₂ (%vol) Steady	Flow Rate (l/hr)
02-Aug-16	<0.1	1.2	19.1	<0.1
09-Aug-16	<0.1	0.3	20.2	<0.1
19-Aug-16	<0.1	1.6	19.1	<0.1
06-Sep-16	<0.1	0.2	20.2	<0.1



Based on the guidance in BS 8485:2015⁵, a preliminary calculation of the hazardous gas flow rate (Q_{hg}) has been undertaken based on the maximum concentration of a hazardous gas observed on site, in this instance carbon dioxide, as no methane has been recorded. The preliminary Q_{hg} estimate is provided below:

$$Q_{hg} \text{ (BH1)} = 0.1 \times 1.6 / 100 = 0.0016 \text{ l/hr}$$

The findings of the site investigation would suggest a worst case Q_{hg} of 0.0016 l/hr for the site, which would indicate that Characteristic Situation 1 (CS1) - 'Very Low Risk' would be an appropriate classification with regard to new developments.

Details provided by the client about the proposed development suggest the building type would be 'Type C', as per Table 3 of the BS8485:2015, as it would comprise a small to medium commercial unit with a small area of hard standing covering some of the site. Based on the assumption that development will have central building management control and with the information available to date, the gas protection score for the site would therefore be '0' predicated by a 'CS1' designation, combined with building type C and determined using Table 4 of the BS guidance.

Specific gas protection measures are therefore unlikely to be required for the proposed development.

⁵ BS8485:2015 'Code of practice for the design of protective measures for methane and carbon dioxide ground gases for new buildings'.



5.0 CONCEPTUAL SITE MODEL

5.1 IDENTIFIED POLLUTANT PATHWAYS

A summary of the relevant pollutant linkages identified on site which will require remediation in order to allow for the proposed development to take place, is provided in Table 4.

Table 4. Relevant Pollutant Pathways identified on site

Pollutant linkage	Source	Exposure Pathway	Receptor
1	High Lead concentrations in made ground	• Inhalation of contaminated dust • Ingestion of contaminated soil / dust • Dermal contact with contaminated soil / dust	• Site Users • Construction Workers • Maintenance Workers

It is considered the presence of lead within the made ground on the northeastern part of the site could pose a risk to the health of future site users and construction/maintenance workers if present within areas of soft landscaping. Therefore, remedial works are recommended to mitigate the risks associated with such lead levels to ensure it does not pose an unacceptable risk to human health.

The risk to controlled waters is considered to be 'low' due to the increasing depth at which the groundwater table was found to be present and the fact proposed development will cover the majority of the site area with hardstanding surfaces and building, which in turn would reduce infiltration and minimise the potential for leachate generation.

5.2 OTHER POTENTIAL ISSUES OF CONCERN

The site investigations have not identified any other contaminants in exceedance of generic guideline values protective of human health for a commercial land use scenario.

Due to the variability associated with the made ground, there is potential for other contaminative issues to be encountered on site as a result of the spoil heaps or due to the industrial activities in the surrounding area. These may include the presence of contamination by heavily impacted materials including: asbestos, metals, metalloids, aromatic hydrocarbons, chlorinated aliphatic hydrocarbons (CAHs), oil/fuels hydrocarbons, phenols, polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs). The presence of asbestos containing materials (ACMs) and/or fibres across the site cannot be discounted.



6.0 REMEDIATION OPTIONS APPRAISAL

An appraisal of remedial options has been undertaken in accordance with Environment Agency (2004) 'Model Procedures for the Management of Land Contamination' CLR11. The objective of the appraisal was to determine the most suitable remedial methodologies that will remove or minimise the risk of harm posed by the aforementioned pollutant pathways originated on site.

The appraisal included an assessment of the currently available technologies, their benefits and limitations. The applicability of each methodology has been graded as 'High', 'Medium' or 'Low' based on their estimated advantages and disadvantages in dealing with the pollutant pathways.

In terms of priority, the remediation options assessment matrix shown below takes account of the areas to be remediated and places emphasis on remedial options on the basis that:

- The site conditions such as its setting, ground conditions, area to be treated and access/spatial constraints are considered.
- The remediation of the area can be achieved within a reasonable timescale.
- The remediation protects identified receptors.
- There is a high degree of confidence the remedial targets can be achieved.
- Remedial works may overlap with development activities.

The technologies reviewed which address both inorganic and organic contaminant issues and the rationale for their grading is included in the table below:

Table 5. Remedial Options Considered as part of the Appraisal Process

Remediation option	Applicability	Rationale
Soil Stabilisation	High	Advantages - • Reduced cost compared with excavation and off-site disposal, no transportation costs or import of soils required. • Stabilisation has a high capability to successfully encapsulate the contaminants observed on site • Stabilised materials would have a very low permeability and be geotechnically suitable for proposed development • Reduce infiltration and hence potential for leachate generation • Granular and alkaline nature of the arisings makes them a good candidate for stabilisation, as they could be mixed effectively with the selected binder mixture. • High degree of confidence on the effectiveness and long-term performance of the stabilised materials. • Treatment capable of achieving remediation criteria protective of controlled waters. • Can treat lateral and vertical extent of the contamination • Will meet development timescales • Stabilised materials beneath the site will be protected from weathering by buildings and engineered parking areas and service road



Remediation option	Applicability	Rationale
Soil Stabilisation (continued)		Disadvantages - - Exposure of workers to contaminated soils may require pre-treatment e.g. handpicking of asbestos fragments. - Temporary drainage/dewatering may be required, disposal of contaminated wash water. - May require a long term monitoring of groundwater and a contingency plan (and funds) if contaminant levels do not meet the targets within a suitable timescale. - Subsurface conditions may change over time and may result in renewed mobility of previously stabilised contaminants.
Excavation and Disposal	Medium	Advantages - - Allows complete removal of contaminated material to achieve site specific remedial target - Can be targeted to affected areas only - Economically feasible - Short timescale which suits development plans - Improved protection of human health - Economically viable Disadvantages - - Potential exposure of workers to contaminated soils - Requires a considerable volume of materials to be excavated - High transport/disposal costs to licensed facilities - May require the stabilisation and/or securing of the excavation area if deeper than 1.2m bgl. - Temporary drainage/dewatering may be required, disposal of contaminated wash water. - Potential cost of imported soils for backfill - Least favourable option according to Waste Hierarchy
Clean Cover	Medium	Advantages - - Can prevent contact with contaminated materials by acting as a physical barrier - Can prevent contaminative dust generation - Have the ability to sustain vegetation in landscape areas - Increased amenity value Disadvantages - - Could be breached in the future by maintenance works
Soil Flushing / Washing	Low	Advantages - - Can be design to treat specific contaminants including inorganic and organic compounds - Can be used in both pathway management and source control - May prevent the need for excavation - Treatment can be undertaken whilst site redevelopment is ongoing – provided there is sufficient space Disadvantages - - Risk of worsening situation by producing more toxic or mobile compounds - High risk of polluting the underlying aquifer - Good understanding of the hydrogeological conditions is required to prevent loss of contaminant and flushing agent beyond the capture zone - High separation and treatment costs



After consideration of the potentially applicable remediation methods which may be able to address the complex contaminant footprint and pollutant pathways, it is considered soil stabilisation constitutes the 'Best Practicable Option' capable of dealing with the sorbed contamination in terms of development timescales and also from a financial perspective.

Soil stabilisation has the additional benefit of allowing the re-use of arisings in a designated part of the site, where materials are needed to create hardstanding surfaces across the development areas but also as an additional mitigation measure to reduce the infiltration on site. It is also worth noting the use of this methodology provides additional advantages as it helps to minimise any adverse impacts of construction activities such as noise, dust, traffic, etc.

It is also considered the use of a clean cover across landscaping areas should help to further mitigate/prevent any potential exposures of future users or maintenance workers to contaminated materials.



7.0 REMEDIATION STRATEGY

7.1 GENERAL

The remediation works aim to remove or mitigate the pollutant pathways identified within a realistic framework and a suitable timescale for the development. The works shall comprise:

- Stabilisation of made ground materials across the site area; beneath buildings and hardstanding.
- Placement of a clean cover over soft landscaping areas

7.2 REMEDIATION OBJECTIVES

The main objective of the Remediation Scheme is to remove or mitigate the risks from the identified pollutant linkages, which as a result, will render the site suitable for its intended commercial use.

The specific objectives of the remedial works are:

- To stabilise made ground materials in order to mitigate the risks from lead contamination.
- To place a cover system across landscaping areas to prevent / minimise exposure of future site users or maintenance workers to contaminated materials.

7.3 REMEDIATION CRITERIA

A set of Soil Remediation Criteria (SRCs) will be applied to the stabilised materials to verify the effectiveness of the treatment and ensure these don't pose a risk of harm to human health and controlled waters. The criteria are listed in Appendix 3.

A second set of SRC will be applied for the validation of the clean cover system to be placed across landscaping areas, with the aim to ensure the materials (assumed mostly to be imported) do not contain contamination, which may pose a risk to humans/controlled waters. The criteria are listed in Appendix 4.



7.4 LICENSES / PERMITS

The remedial works shall be undertaken in accordance with the relevant Health and Safety regulations and CDM regulations.

All remedial works must be overseen by a competent Environmental Consultant operating under a full time watching brief.

A mobile plant treatment license will be required in order to carry out the stabilisation of the shallow made ground materials and allow their re-use as part of a stabilised layer. A deployment notice to carry out the works shall be submitted to the Environment Agency (depending on volumes to be treated). A copy of the deployment notice/notification will be included as part of verification reporting.

The re-use of materials on site shall be carried out under a Material Management Plan in accordance with the CL:AIRE 'Definition of Waste-Code of Practice'. This document shall be produced prior commencement of works on site and maintained throughout the project, with the aim to record and control the movement and adequate use of materials around site in accordance with current waste management legislation and guidance.

Off-site disposal of materials (if required) is also subjected to current Waste Management Legislation. If the total quantity of waste material to be produced at or taken off site is hazardous waste and is 500kg or greater in any 12 month period, the developer will need to register the site as a hazardous waste producer.

Appropriately licensed waste carriers and disposers shall be employed for the movement of materials as part of these works.



7.5 PHASING OF THE REMEDIATION WORKS

The remediation works are proposed to be undertaken in 3 phases:

Phase I – Preparation of the site for stabilisation

Phase II – Stabilisation of materials

Phase III – Placement of clean cover across landscaping areas

7.5.1 PHASE I – PREPARATION OF THE SITE FOR STABILISATION

The site will require some preparatory work to ensure the area is suitable for the stabilisation process. These works may include:

- Removal of redundant services/obstructions (if any)
- Removal of weed cover from the area due to be stabilised
- Excavation of service/drainage runs
- Cut & fill

The thin layer of topsoil/weed cover which currently covers the site (circa 50mm) shall be removed to expose the materials which require stabilisation.

Drainage / Service Runs

Where possible, drainage/service runs shall be excavated in advance of the stabilisation of materials to maintain the integrity of the stabilised layer. High specification water pipes are likely to be required by the utility provider, but this shall be confirmed. The trench to the drainage runs will be backfilled with either suitable granular site-won arisings or clean imported fills (type 1).

The chemical quality of any imported clean materials used for infill purposes will need to be confirmed on the basis of 1 sample every 500m³ prior to import or placement. Materials shall be validated following the protocol described in Section 8.2.

Arisings from the drainage runs will be used for the construction of the stabilised capping layer as far as practicable, it is not anticipated at this stage that any arisings will be removed from site.

If required, it will be the responsibility of the Main Contractor to ensure materials taken off-site are characterised in accordance with Technical Guidance WM3⁶ and that appropriate haulage contractors are used for the transfer of the materials into licensed waste facilities. Details of the waste carrier, volumes taken off site and final disposal location as well as copies of the waste consignment notes shall be kept and collated on completion of works for their inclusion in the Remediation Verification Report.

Cut/Fill

Site levels will also be rationalised prior to stabilisation works being undertaken, generally site levels will require raising to the proposed finished level of 15.22m AOD.

⁶ Environment agency (2015) 'Guidance on the classification and assessment of waste - Technical Guidance WM3' 1st edition.



7.5.2 PHASE II – STABILISATION OF MATERIALS

Surface materials found across the proposed car park and roadways (see Glanville's DWG NO. 4150528-1101 Rev T1 'Proposed External Finishes', Appendix 6) will be stabilised using a proprietary binder – Geobind™ and/or binder mixture which is capable of successfully encapsulating contaminants present in the soils, hence mitigating pathways by which future site users, construction and maintenance workers could be exposed to contamination.

Stabilisation has the additional advantage of allowing the re-use of materials on site in a sustainable manner and sealing the area, preventing percolation of rain/surface water. Moreover, the use of Geobind™ as a primary binder has several advantages in terms of its application, workability, rapid setting times and performance under similar scenarios.

Bench Scale Trials

A series of bench-scale trials are currently being conducted in order to determine the most efficient binder mix based on the contaminant profile and relevant physicochemical properties of the materials due to be treated. Representative samples of the materials due to be treated have been collected across the site and subsequently mixed with binders such as cement, Geobind™, etc. to determine the optimum mixture in terms of performance and cost-effectiveness. The trials will also consider the use of multi-component mix designs, e.g.: addition of Pulverised Fuel Ash (PFA) to a CEM IV formulation, to reduce potential for sulphate attack.

Geochemical performance of the binder mixtures is based on an assessment of leaching trajectories for potential Contaminants of Concern, in this particular case lead. Semi-dynamic tank testing datasets will be used to estimate groundwater/leachate concentrations over a range of time frames and compare them against the specific targets for stabilised materials, listed in Appendix 3.

A report with the findings of the stabilisation trials will be submitted to the regulatory authorities prior to implementation.

Stabilisation Process

The stabilisation works will need to be carried out under a Mobile Plant Licence. A Deployment notice for the use of a mobile treatment plant on site will be submitted prior commencement of works to the Environment Agency.

It is proposed to stabilise materials using a direct mixing method (rotavator) to mix the binder mixture with the made ground materials (top 320mm). They will be then compacted using a vibro-roller and form as a result, a structurally and chemically stable cap, which will provide a hardstanding/building platform for construction purposes. If additional materials are generated for other site works (i.e. drainage, foundation excavations) these can be placed in thin layers and also stabilised if needed.

A watching brief will be maintained by the Environmental Consultant during the placement of stabilised materials and a photographic record of the works will be kept. A final record of treated areas and a location plan will be issued on completion of works.

After materials have undergone stabilisation, the efficacy of the process will be verified as described in Section 8.1. If stabilised materials fail to comply with the remediation criteria (Appendix 3), further consideration will be given to carry out further treatment or alternatively disposed materials into a licensed facility.



The stabilisation approach assumes that no heavily impacted materials will require treatment (i.e. heavily saturated with tar/creosote, hydrocarbons, organic material). However, if materials of this nature are found, it is possible these could not be stabilised and that they will require excavation and off-site disposal into a licensed facility. Details of the waste carrier, waste consignment notes and disposal facility will be provided on completion of works as part of the Verification Report.

No stabilisation works will take place across the areas of soft landscaping.

Environmental Monitoring

A programme of environmental monitoring will be implemented throughout the stabilisation works i.e. dust generation. Mitigation measures to be implemented as part of the works include dampening down materials to suppress dust generation. Further details will be specified in the Deployment Notice for the Mobile Treatment license, due to be submitted to the EA to allow for the treatment of materials on site.

7.5.3 PHASE III – PLACEMENT OF CLEAN COVER ACROSS LANDSCAPING AREAS

It is recommended to place a layer of clean materials within landscaped areas as a precautionary measure to ensure future users do not come in contact with residual contamination, minimise the release of contaminated dust and limit any potential plant uptake.

For the landscaping areas (as shown in Figure 3), the capping layer should be at least 600mm thick, of which at least the top 300mm must comprise topsoil to provide a suitable plant-growing medium. The topsoil should be supplied from a reliable source and certified clean prior to its placement.

The clean cover will require to be formally validated by the appointed environmental consultant following the protocol described in Section 8.3. The chemical quality and suitability for use of any imported materials to be used as part of clean covers should be confirmed prior to their placement, as stated in the same section.



7.6 UNEXPECTED SITE CONDITIONS

Due to the nature of the historic activities that took place in the area, unexpected contamination/features may be encountered during the works on site. No current investigation method is capable of identifying all contaminant issues in a given area, hence contamination may not have been fully identified by previous studies due to access constraints, easement restrictions associated with services, or because it was outside the scope of such investigations. It is also worth noting previous studies were carried out by a 3rd party and not by PBA, hence any inaccuracies/omissions or discrepancies in the ground conditions should be reverted back to ST Consult. Therefore, the potential for unexpected contamination to be encountered across the site should not be discounted.

In the event unexpected contamination and/or asbestos containing materials are found, excavation works should cease in the area, the Main Contractor should cordon-off the area and arrange for a preliminary inspection of materials in question to be carried out by the Environmental Consultant. Sampling and chemical testing of the materials in question (as per Appendix 5) may be required in order to characterise the contamination and determine if contaminant levels exceed the SCR in Appendix 2. If this is the case, materials will be deemed 'contaminated' and could be either stabilised or excavated and disposed off-site into a licensed facility.

Any unexpected contamination will be reported to the City and County of Swansea.



8.0 VERIFICATION OF REMEDIAL WORKS

Verification is defined by Environment Agency as '*confirmation through the provision of objective evidence that specified requirements have been fulfilled*'⁷. Hence, in order to demonstrate the remediation objectives have been met, the following verification works will be carried out:

- Verification of stabilised materials
- Verification of imported materials
- Verification of clean cover

8.1 VERIFICATION OF STABILISED MATERIALS

Stabilised materials will be subject to a validation procedure to assess the efficiency of the treatment and ensure the encapsulated contaminants do not pose risk to controlled waters.

The validation process will consist of:

- Sampling of stabilised materials on a grid basis
- Verification leaching tests
- Comparison stabilisation verification results vs soil remediation criteria

Samples of the stabilised materials will be retrieved based on a 40x40m grid, as shown in Figure 5. The samples will be either compacted monoliths of the treated materials or site-mixed materials.

Verification of the long term leaching behaviour of the stabilised materials will be assessed by carrying out physical and leach tests in accordance with the approach outlined in ENV12920 (CEN, 1997). Leaching trajectories for cores obtained as built from the stabilised soil mass will be analysed over several leaching fractions and compared against those determined during the stabilisation trials and ultimately the remediation criteria (Appendix 3). If the results of the above show contaminant leachate concentrations comply with the criteria, it shall be considered that compliance has been achieved.

In the event materials fail to meet the aforementioned criteria, these will either be retreated or the extent of the failing materials delimited followed by their excavation and disposal off-site.

Stockpile locations prior treatment (if any) and areas where stabilised materials will be placed will be accounted for as part of the MMP. Relevant plans and photographic records of the works will be included in the verification report due to be submitted on completion of works.

⁷ Environment Agency (2010) 'Verification of Remediation of Land Contamination' SC030114/R1.



8.2 VERIFICATION OF IMPORTED MATERIALS

Imported materials must be subject to a validation procedure to demonstrate their suitability for use on site.

The validation process will consist of:

- Visual inspection of materials
- Sampling of imported materials at a frequency of 1 sample per 500m³
- Laboratory chemical analysis of soil samples
- Review of results vs. Soil Remediation Criteria

The quality of any imported materials should be demonstrated ideally prior to their import, with the supplier providing the information to prove the materials are suitable for use. Alternatively, materials can be stockpiled in a designated area and sampled at a rate of one (1No.) sample for every 500m³.

Samples obtained will be stored in suitable containers, placed within cool boxes maintained at a temperature of 4°C or below and sent to a UKAS/MCERTs accredited laboratory to be subjected to a full suite of chemical analysis, as per Appendix 5.

The analytical results will be compared against SRC shown in Appendix 4 to confirm the import suitability for use.

Records of the sources, types, volumes of materials brought to site; their movement and placement areas will be collated by the Main/Groundworks contractor under a Material Management Plan (MMP) in accordance with CL:AIRE Definition of Waste Code of Practice.

8.3 VERIFICATION OF CLEAN COVER

The suitability for use of the materials to be used as part of the clean cover system should be verified, ideally prior to their placement. One sample should be retrieved for every 500m³ and subjected to a full suite of chemical analysis (as per Appendix 5) at a UKAS/MCERTs accredited laboratory. In addition, topsoil materials should also meet the requirements of BS3882:2015 'Specification for topsoil and requirements for use'.

The results of the analysis will be compared against the SCR, listed in Appendix 4, to ensure the materials are suitable for use.

The thickness of clean cover material will be confirmed by excavating small pits across the landscaping areas and measure the thickness of the layer. Supporting photographs will be taken as part of the validation process and included in the final verification report.



9.0 COMPLETION OF REMEDIAL WORKS

A final verification report will be produced on completion of the remedial works and post-remediation monitoring period, if required. The report will provide a detailed account and photographic evidence of the on-site operations (remediation and validation) as well as final assessment of the ground and groundwater conditions on site.

The report will also include:

- A description of the remedial works
- A statement of the remediation objectives
- As built drawings/plans based on survey data e.g. final location of stabilised materials, etc
- Photographic record of the remedial works
- Records of consultations with regulators, if required
- Records of material movements and final locations
- Validation sampling plans and chemical test certificates for the stabilised materials
- Validation chemical tests certificates for the imported materials, as well as their type, volumes, origin and location on site
- Validation chemical tests certificates for the clean cover materials as well as measurements of the thickness of the layer across landscaping areas
- Consignment notes for materials disposed off site (if any)
- Any post remediation arrangements that require further management
- A final summary of the ground conditions across the site

The report will be submitted on completion of works to the Regulatory Authorities for their approval. The remediation and verification works can only be considered as completed once written approval is provided by the Environment Agency and City and County of Swansea.

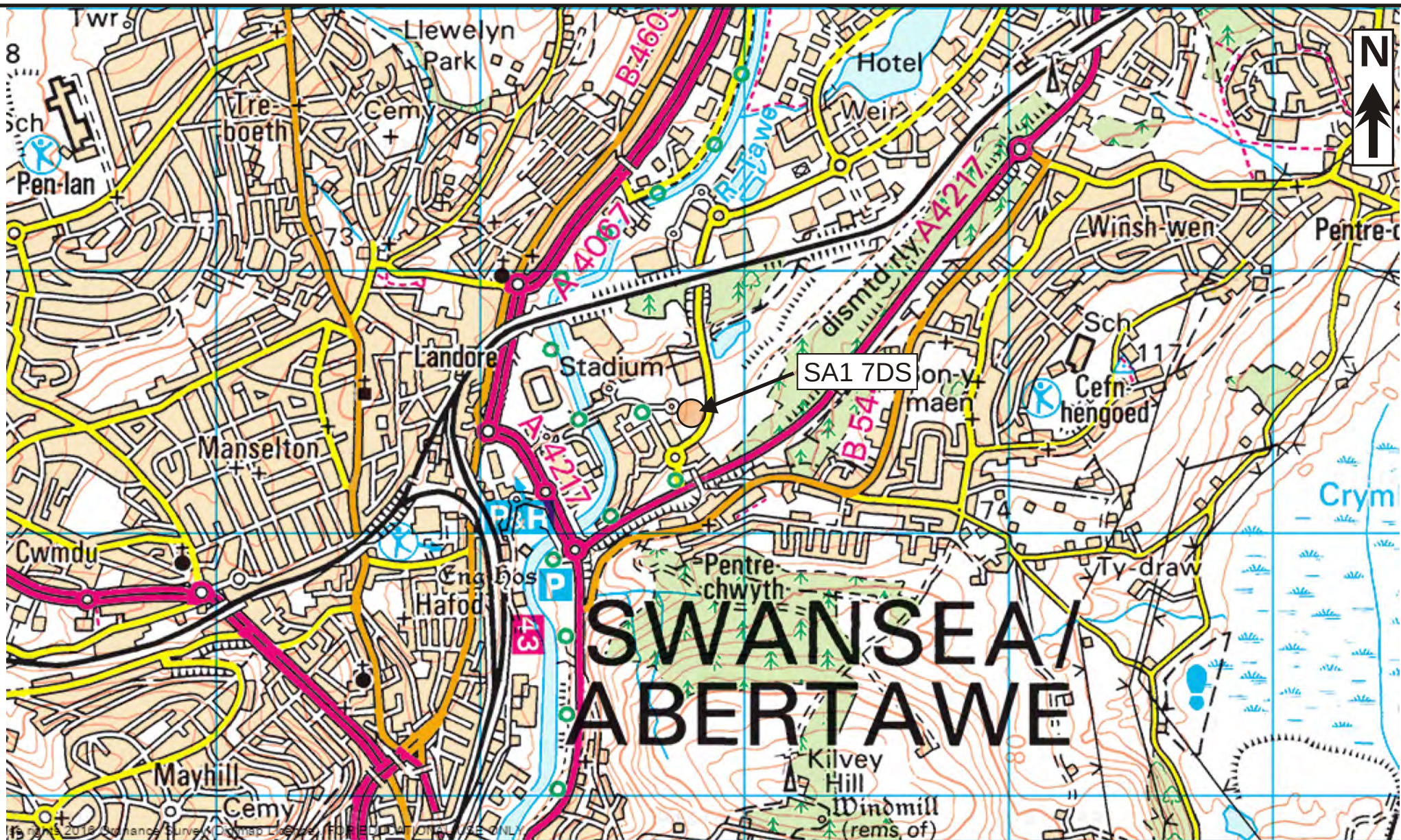
Pam Brown Associates
September 2016



Terms and Conditions

1. Interpretative assessments are based upon the ground conditions as revealed by trial pits and boreholes, together with the results of any field or laboratory testing, plus other relevant data, which may have been obtained including previous site investigations. Due to the nature of geotechnical or contamination issues, there can be no certainty that any or all such areas will have been located and/or sampled.
2. Should at a future date, any additional information be made available with regard to special conditions associated with the site, the findings may be subject to amendment.
3. Where any data supplied by the client or from other sources, including that from previous site investigations, has been used it has been assumed that the information is correct. However it is always advised that without the appropriate indemnification all data supplied by others should be verified, and no responsibility can be accepted by Pam Brown Associates Ltd for inaccuracies within the data.
4. Whilst an opinion may be expressed on possible ground conditions between or beyond trial pit or borehole locations, or on the possible presence of features based on either visual, verbal or published evidence this is for guidance only and no liability can be accepted for the accuracy thereof.
5. Comments on groundwater conditions will be based upon observations made at the time of the investigation unless otherwise stated. Groundwater conditions may vary due to seasonal or other effects. Where possible an assessment of likely changes will be made for guidance purposes. Additional investigation may be required for confirmation.
6. The quotation has been prepared in the context of an agreed scope of work and should not be used in a different context. Furthermore, new information, improved practices and changes in legislation may necessitate a re-interpretation of the findings in whole or part after its original submission.
7. The copyright in the written materials shall remain the property of Pam Brown Associates Ltd, but with a royalty-free perpetual licence to the Client deemed to be granted on payment in full to Pam Brown Associates Ltd by the Client of the outstanding amounts.
8. The report is provided for sole use by the Client and is confidential to them and their professional advisers. No responsibility whatsoever for the contents of the report will be accepted to any persons other than the Client.
9. These terms apply (or in addition to another written contract which may be in place instead thereof) unless specifically agreed otherwise in writing.
10. Fees are based on the methods and evaluation stated in this proposal. This fee proposal will be void and a revised fee proposal will be produced if the client alters or requires an alteration to be made to the proposal. This quote will remain valid for three months from the date of this quote
11. The client shall be entitled to use documents prepared by the consultant in the execution of this agreement provided that: i) all fees due to the consultant at that stage have been paid, ii) the use relates only to the project or part of the project for which the material was prepared.
12. If either party to this agreement considers modifications to the project to be necessary, full details must be provided in writing.
13. Terms of payment are 30 days from date of invoice.

FIGURES



Pam Brown Associates

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Project:

Nantong Way, Swansea

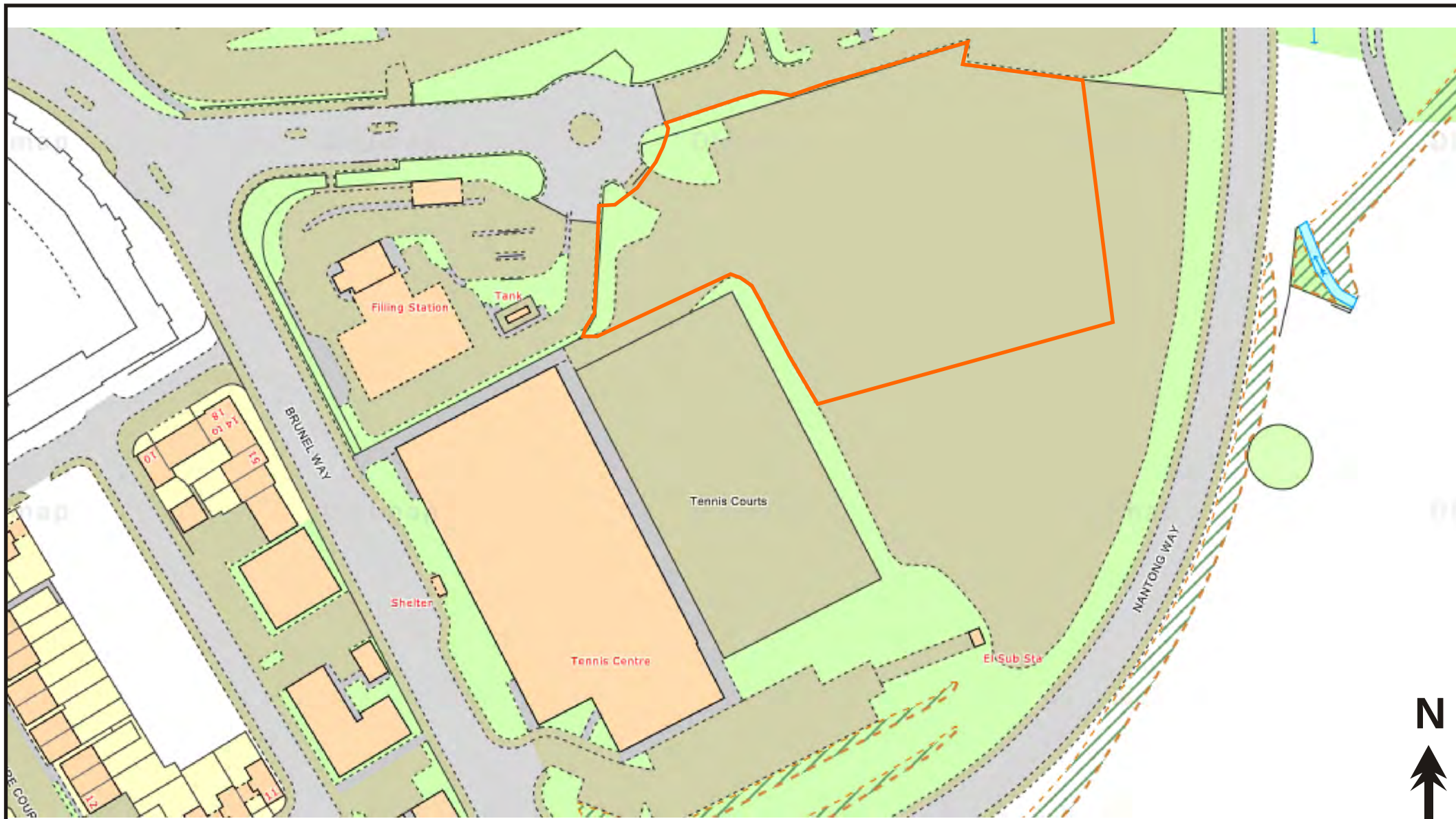
Title:

Site Location Plan

Scale: NTS

Job No.: 1600-16

Figure 1



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Project:

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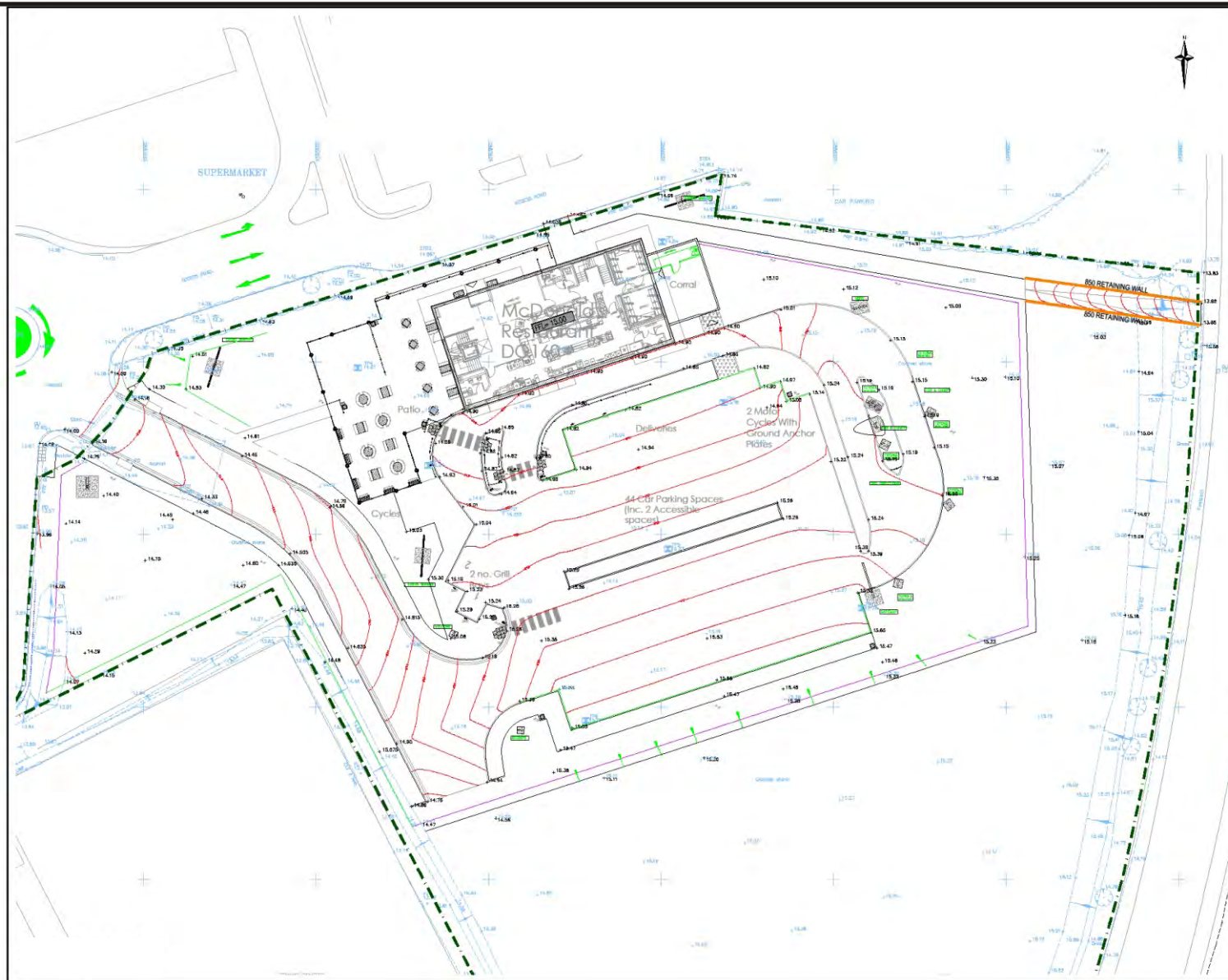
Title:

Current Site Layout

Scale: NTS

Job No.: 1600-16

Figure 2



Based on Drawing No:4150528-1100. Rev T1. July 2016. Site Layout and Levels by Glanville Consultants Limited

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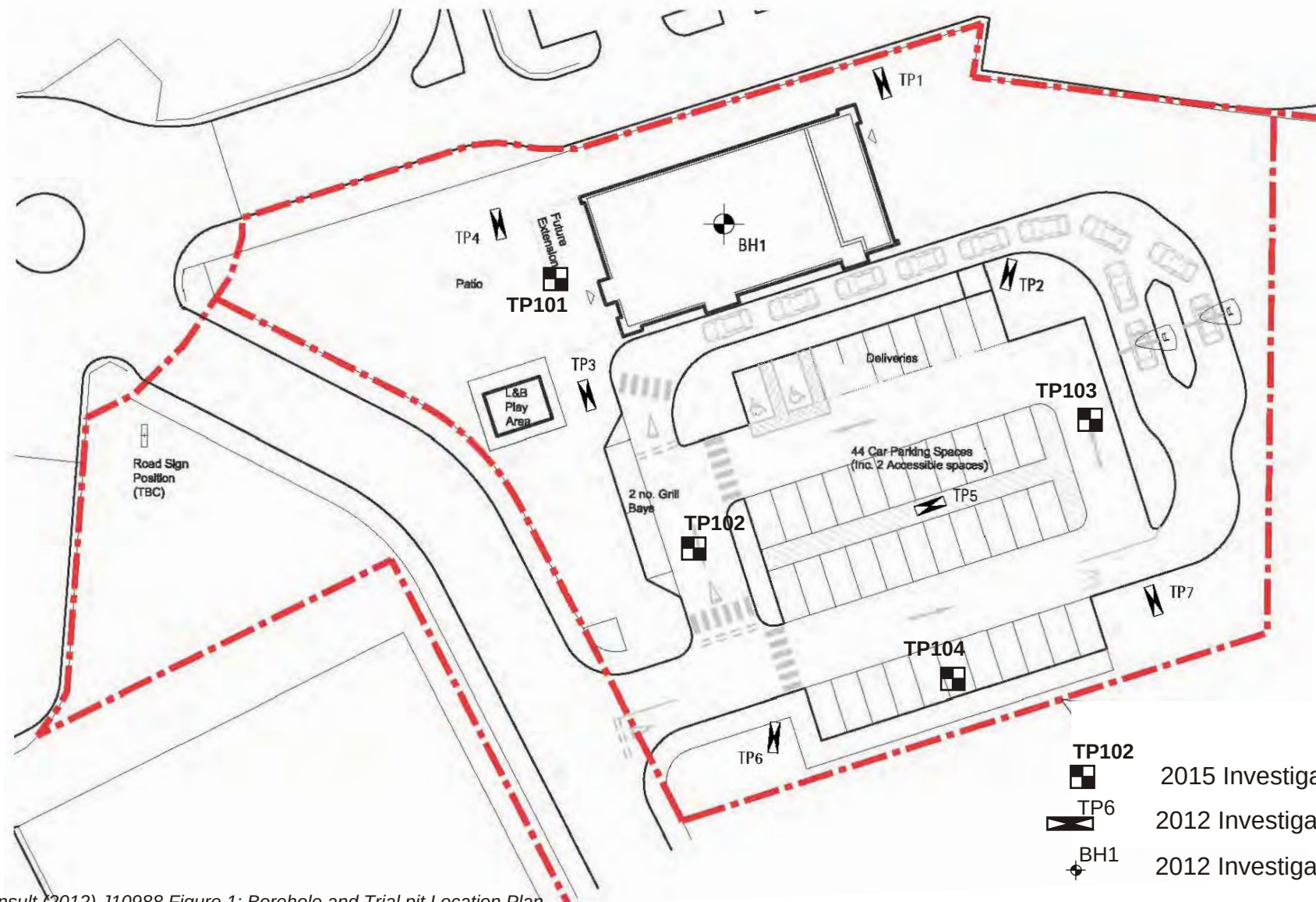
Title:

Proposed Site Layout

Scale: NTS

Job No.: 1600-16

Figure 3



Based on ST Consult (2012) J10988 Figure 1: Borehole and Trial pit Location Plan

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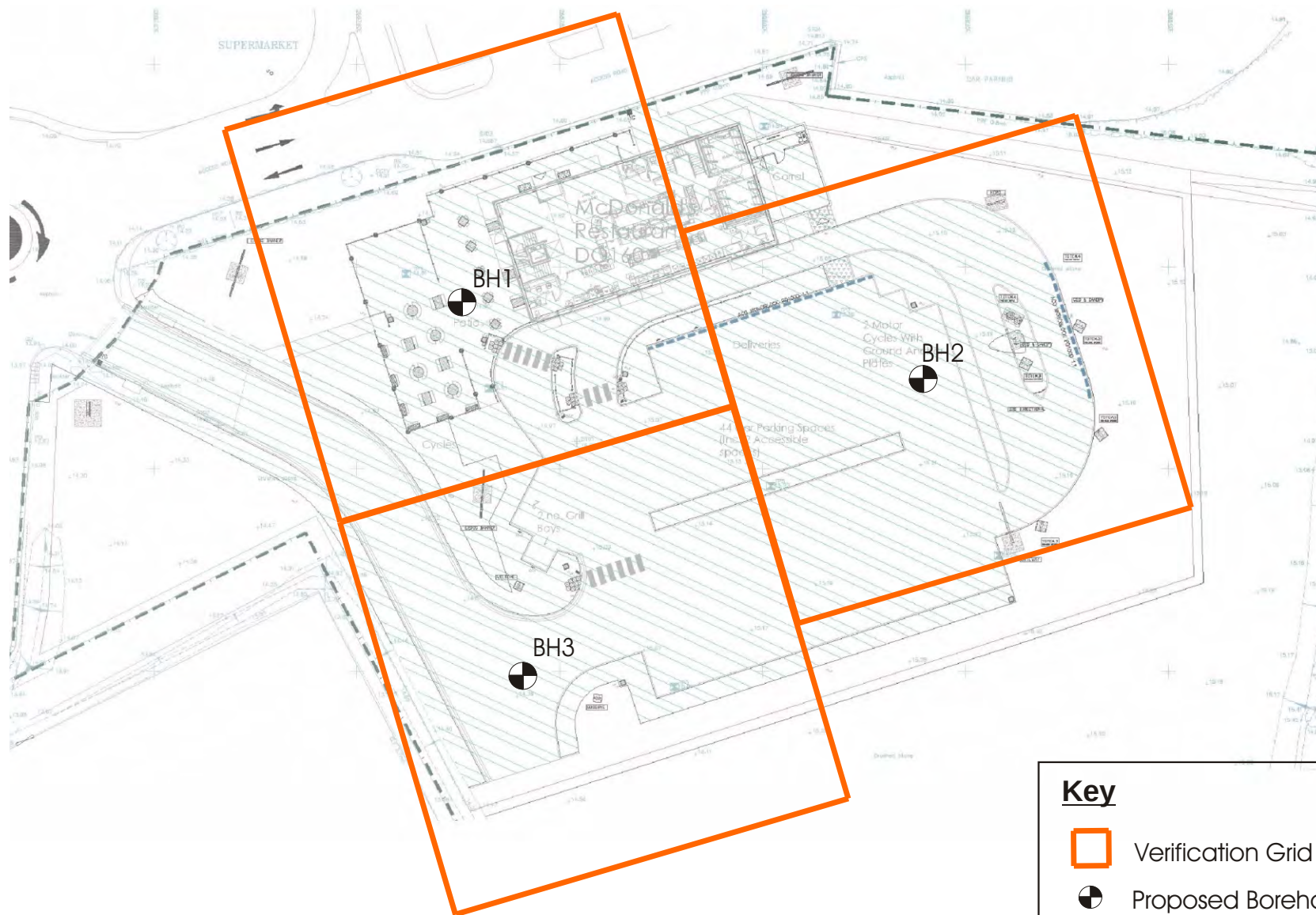
Title:

Location of ST Consult BH-TP
Exploratory Excavations

Scale: NTS

Job No.: 1600-16

Figure 4



Based on Drawing No:4150528-1100 Rev T1. July 2016. Site Layout and Levels by Glanville Consultants Limited

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Title:

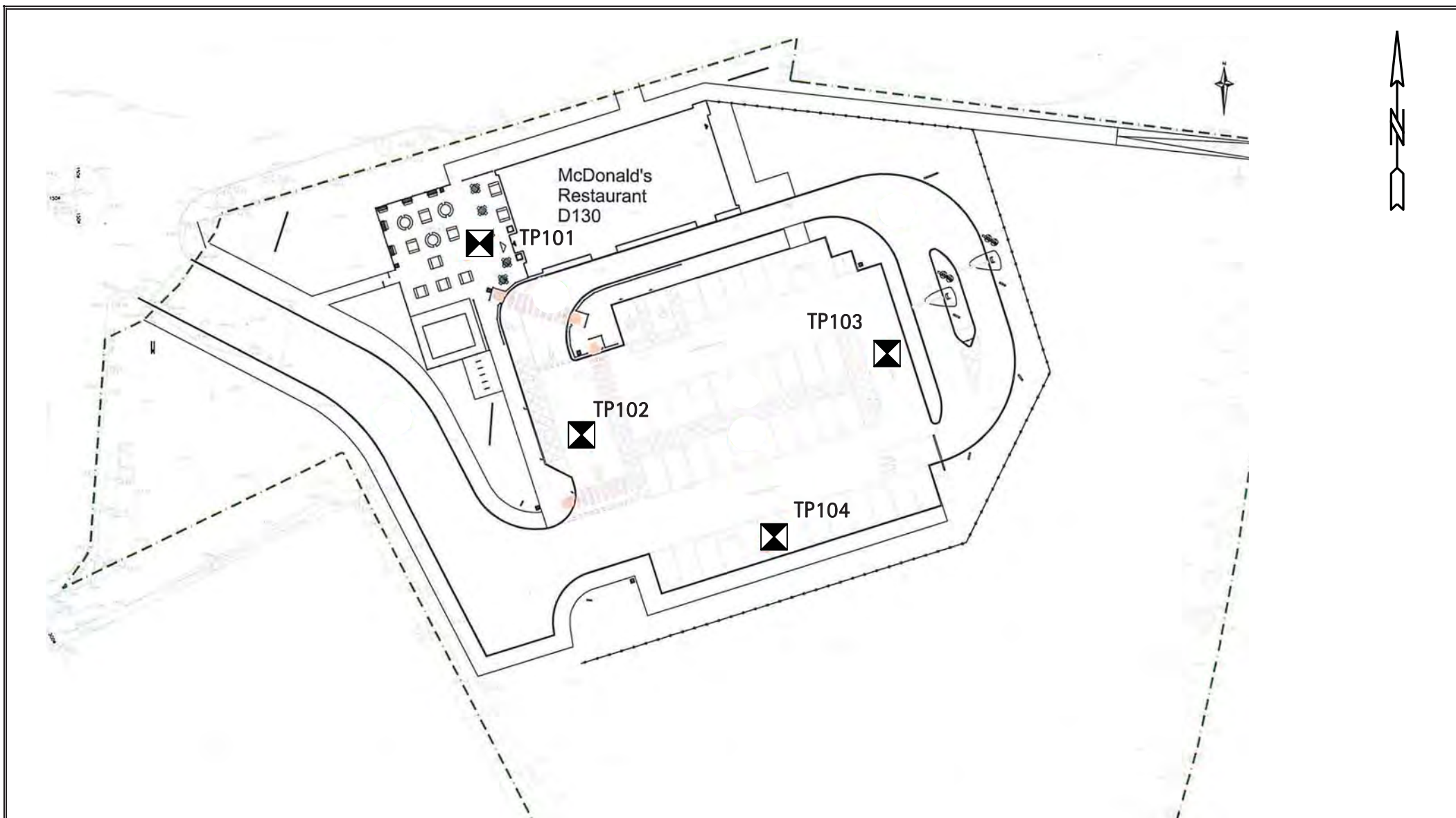
Verification Grid

Scale: NTS

Job No.: 1600-16

Figure 5

APPENDIX 1



NB: Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned

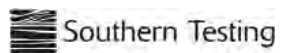
Site: Brunel Way, Swansea

STL: J12424

Fig No: 1

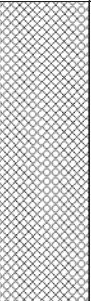
Date: 24 November 2015

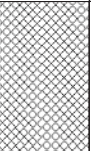
Trial Pit Location Plan

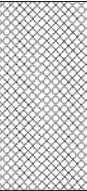


Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN



 www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020				Start - End Date:		Project ID:		Machine Type:		TP101		
				24/11/2015		J12424		JCB 3CX		Sheet 1 of 1		
Project Name: Brunel Way, Swansea				Remarks:		Co-ordinates:		Level (m AOD):		Logger:		
										CL		
Location:												
Client:												
Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description					
Depth (m)	Type	Results										
0.5	ES			(0.40)		0.40	Dark brown grey, slightly clayey, fine to coarse SAND and fine to coarse, sub-angular to angular GRAVEL, with occasional cobbles, concrete blocks. Gravel comprises road planings, limestone, flint, sandstone, slag and brick (MADE GROUND).					
							0.50	Dark brick red, fine to coarse SAND, with occasional gravel and cobble size slag fragments (MADE GROUND).				
								Pit terminated at 0.50m.				
Pit Dimension (m)			Pit Stability:				Water Strikes:					
Width:												
Length:												
Depth:		0.50										

 www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020				Start - End Date:		Project ID:		Machine Type:		TP102	
				24/11/2015		J12424		JCB 3CX		Sheet 1 of 1	
Project Name: Brunel Way, Swansea				Remarks:		Co-ordinates:		Level (m AOD):		Logger:	
										CL	
Location:											
Client:											
Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description				
Depth (m)	Type	Results									
0.5	ES			(0.20)		0.20	Dark brown grey, fine to coarse SAND, with frequent gravel/cobble-size fragments of limestone and road planings (MADE GROUND).				
							Dark brown grey and occasionally brick-red, slightly clayey, fine to coarse SAND and fine to coarse, sub-angular to angular GRAVEL, with occasional cobbles and metal fragments. Gravel comprises flint, sandstone, slag and brick. (MADE GROUND).				
										0.50	Pit terminated at 0.50m.
Pit Dimension (m)			Pit Stability:				Water Strikes:				
Width:											
Length:											
Depth:		0.50									

 www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020				Start - End Date:		Project ID:		Machine Type:		TP104	
				24/11/2015		J12424		JCB 3CX		Sheet 1 of 1	
Project Name: Brunel Way, Swansea				Remarks:		Co-ordinates:		Level (m AOD):		Logger: CL	
Location:											
Client:											
Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description				
Depth (m)	Type	Results									
0.5	ES			(0.25)		0.25	Dark brown grey, fine to coarse SAND, with frequent gravel/cobble-size fragments of limestone and road planings (MADE GROUND).				
							Dark brown grey, slightly clayey, fine to coarse SAND and fine to coarse, sub-angular to angular GRAVEL, with occasional cobbles and metal/glass fragments. Gravel comprises flint, sandstone, slag and brick. (MADE GROUND).				
						0.50					Pit terminated at 0.50m.
Pit Dimension (m)			Pit Stability:				Water Strikes:				
Width:											
Length:											
Depth:		0.50									



Scientific Analysis Laboratories Ltd

Certificate of Analysis

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Fax : 01376 552923

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

Report Number: 528785-1

Date of Report: 04-Dec-2015

Customer: Southern Testing Laboratories
Keeble House
Stuart Way
East Grinstead
West Sussex
RH19 4QA

Customer Contact: Mr Chris Lennard

Customer Job Reference: J12424

Customer Purchase Order: J12424_1 Chris

Customer Site Reference: Brunel Way (Swansea)

Date Job Received at SAL: 26-Nov-2015

Date Analysis Started: 30-Nov-2015

Date Analysis Completed: 04-Dec-2015

The results reported relate to samples received in the laboratory and may not be representative of a whole batch.

Opinions and interpretations expressed herein are outside the scope of UKAS accreditation

This report should not be reproduced except in full without the written approval of the laboratory

Tests covered by this certificate were conducted in accordance with SAL SOPs

All results have been reviewed in accordance with Section 25 of the SAL Quality Manual



Report checked
and authorised by :
Simi Okanlami
Project Manager

Issued by :
Simi Okanlami
Project Manager

Waste Acceptance Criteria

Customer Sample Reference : TP101 @ 0.50m

SAL Sample Reference : 528785 001

Project Site : Brunel Way (Swansea)

Customer Reference : J12424

Test Portion Mass (g) : 175

Date Sampled : 24-NOV-2015

Type : Fill

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			U	7.6		>6.0	
Loss on Ignition @450C	Ign 450C/Grav	0.1	%	U	7.5			10.0
Total Organic Carbon	OX/IR	0.1	%	N	18	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.14	1.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	U	<10	500.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	22			
Retained on 2mm	Grav	0.1	%	N	(32) <0.1			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.078	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.053	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	1.9	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	0.012	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	<10	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.029	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	56	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	20	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	0.074	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.067	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.023	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.0072	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.0	mg/kg	N	510	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	1200	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	3.0	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as amended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

Waste Acceptance Criteria

Customer Sample Reference : TP102 @ 0.50m

SAL Sample Reference : 528785 002

Project Site : Brunel Way (Swansea)

Customer Reference : J12424

Date Sampled : 24-NOV-2015

Test Portion Mass (g) : 175

Type : Fill

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			U	8.3		>6.0	
Loss on Ignition @450C	Ign 450C/Grav	0.1	%	U	4.6			10.0
Total Organic Carbon	OX/IR	0.1	%	N	3.3	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.14	1.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	U	<10	500.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	12			
Retained on 2mm	Grav	0.1	%	N	(32) <0.1			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.060	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.28	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.36	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	0.00038	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	<10	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.018	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.056	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	100	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	8.5	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	0.039	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	<0.00050	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.061	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.0074	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.0	mg/kg	N	85	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	800	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	0.066	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as ammended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

Waste Acceptance Criteria

Customer Sample Reference : TP103 @ 0.50m

SAL Sample Reference : 528785 003

Project Site : Brunel Way (Swansea)

Customer Reference : J12424

Test Portion Mass (g) : 175

Date Sampled : 24-NOV-2015

Type : Fill

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			U	8.9		>6.0	
Loss on Ignition @450C	Ign 450C/Grav	0.1	%	U	5.5			10.0
Total Organic Carbon	OX/IR	0.1	%	N	4.9	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PAH (Sum)	Calc	1.6	mg/kg	N	<1.6	100.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.14	1.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	U	440	500.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	11			
Retained on 2mm	Grav	0.1	%	N	(32) <0.1			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.083	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.33	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.24	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	0.00046	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	13	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.013	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.13	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	100	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	7.9	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	0.14	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	0.0010	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.052	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.013	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.0	mg/kg	N	190	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	820	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	0.10	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as amended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

Waste Acceptance Criteria

Customer Sample Reference : TP104 @ 0.50m

SAL Sample Reference : 528785 004

Project Site : Brunel Way (Swansea)

Customer Reference : J12424

Test Portion Mass (g) : 175

Date Sampled : 24-NOV-2015

Type : Fill

Soil Summary					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
pH	Probe			U	8.2		>6.0	
Loss on Ignition @450C	Ign 450C/Grav	0.1	%	U	7.4			10.0
Total Organic Carbon	OX/IR	0.1	%	N	5.4	3.0	5.0	6.0
Acid Neutralising Capacity (pH 7)	Titration	2.0	Mol/kg	N	<2.0			
BTEX (Sum)	Calc	0.040	mg/kg	U	<0.040	6.0		
Coronene	GC/MS (MCERTS)	0.1	mg/kg	N	<0.1			
PAH (Sum)	Calc	1.6	mg/kg	N	8.9	100.0		
PCB EC7 (Sum)	Calc	0.00035	mg/kg	U	<0.14	1.0		
TPH (C10-C40)	GC/FID (SE)	10	mg/kg	U	<10	500.0		
Moisture @105C	Grav (1 Dec) (105 C)	0.1	%	N	13			
Retained on 2mm	Grav	0.1	%	N	(32) <0.1			

10:1 Leachate					Result	Inert Waste Landfill	Stable non reactive	Hazardous Waste Landfill
Determinand	Technique	LOD	Units	Symbol				
Antimony (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.28	0.06	0.7	5.0
Arsenic (Dissolved)	Calc / ICP/MS (Filtered)	0.0020	mg/kg	N	0.55	0.5	2.0	25.0
Barium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.50	20.0	100.0	300.0
Cadmium (Dissolved)	Calc / ICP/MS (Filtered)	0.00020	mg/kg	N	0.0014	0.04	1.0	5.0
Chloride	Calc / Discrete Analyser	10	mg/kg	N	14	800.0	15000.0	25000.0
Chromium (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	<0.010	0.5	10.0	70.0
Copper (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.13	2.0	50.0	100.0
Dissolved Organic Carbon	Calc / OX/IR	10	mg/kg	N	95	500.0	800.0	1000.0
Fluoride	Calc / Discrete Analyser	0.50	mg/kg	N	15	10.0	150.0	500.0
Lead (Dissolved)	Calc / ICP/MS (Filtered)	0.0030	mg/kg	N	0.018	0.5	10.0	50.0
Mercury (Dissolved)	Calc / ICP/MS (Filtered)	0.00050	mg/kg	N	0.00091	0.01	0.2	2.0
Molybdenum (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.34	0.5	10.0	30.0
Nickel (Dissolved)	Calc / ICP/MS (Filtered)	0.010	mg/kg	N	0.014	0.4	10.0	40.0
Phenols(Mono)	Calc / Colorimetry	1.0	mg/kg	N	<1.0	1.0		
Selenium (Dissolved)	Calc / ICP/MS (Filtered)	0.0050	mg/kg	N	0.014	0.1	0.5	7.0
SO4--	Calc / Discrete Analyser	5.0	mg/kg	N	330	1000.0	20000.0	50000.0
Total Dissolved Solids	Calc	100	mg/kg	N	1200	4000.0	60000.0	100000.0
Zinc (Dissolved)	Calc / ICP/MS (Filtered)	0.020	mg/kg	N	0.060	4.0	50.0	200.0

From: EC Directive 99/31/EC and Landfill Regulations 2002 (as ammended)

Notes:- Cumulative release at L/S=10 (mg/kg of dry matter) in accordance with BS EN 12457. Soil leaching procedure is not covered by our UKAS accreditation

SAL Reference: 528785								
Project Site: Brunel Way (Swansea)								
Customer Reference: J12424								
Soil Analysed as Soil								
Total and Speciated USEPA16 PAH (SE) (MCERTS)								
SAL Reference					528785 001	528785 002	528785 003	528785 004
Customer Sample Reference					TP101 @ 0.50m	TP102 @ 0.50m	TP103 @ 0.50m	TP104 @ 0.50m
Test Sample					AR	AR	AR	AR
Date Sampled					24-NOV-2015	24-NOV-2015	24-NOV-2015	24-NOV-2015
Type					Fill	Fill	Fill	Fill
Determinand	Method	LOD	Units	Symbol				
Naphthalene	GC/MS	0.1	mg/kg	U	<0.1	0.1	<0.1	0.1
Acenaphthylene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	<0.1	0.2
Acenaphthene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	<0.1	<0.1
Fluorene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	<0.1	0.1
Phenanthrene	GC/MS	0.1	mg/kg	U	0.1	0.2	0.2	1.1
Anthracene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	<0.1	0.2
Fluoranthene	GC/MS	0.1	mg/kg	N	0.3	0.1	0.2	1.7
Pyrene	GC/MS	0.1	mg/kg	N	0.2	0.1	0.2	1.5
Benzo(a)Anthracene	GC/MS	0.1	mg/kg	U	0.2	<0.1	0.2	0.7
Chrysene	GC/MS	0.1	mg/kg	U	0.2	0.1	0.2	0.7
Benzo(b)fluoranthene	GC/MS	0.1	mg/kg	U	0.1	<0.1	0.1	0.6
Benzo(k)fluoranthene	GC/MS	0.1	mg/kg	N	<0.1	<0.1	0.1	0.5
Benzo(a)Pyrene	GC/MS	0.1	mg/kg	U	0.1	<0.1	0.1	0.6
Indeno(123-cd)Pyrene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	0.1	0.4
Dibenzo(ah)Anthracene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	<0.1	0.2
Benzo(ghi)Perylene	GC/MS	0.1	mg/kg	U	<0.1	<0.1	0.1	0.5
Polyaromatic Hydrocarbons (Total)	GC/MS	0.1	mg/kg	U	1.1	0.7	1.5	8.9

SAL Reference: 528785								
Project Site: Brunel Way (Swansea)								
Customer Reference: J12424								
Soil		Analysed as Soil						
BTEX								
SAL Reference			528785 001	528785 002	528785 003	528785 004		
Customer Sample Reference			TP101 @ 0.50m	TP102 @ 0.50m	TP103 @ 0.50m	TP104 @ 0.50m		
Test Sample			AR	AR	AR	AR		
Date Sampled			24-NOV-2015	24-NOV-2015	24-NOV-2015	24-NOV-2015		
Type			Fill	Fill	Fill	Fill		
Determinand	Method	LOD	Units	Symbol				
Benzene	GC/MS(Head Space)(MCERTS)	10	µg/kg	U	<10	<10	<10	<10
EthylBenzene	GC/MS(Head Space)(MCERTS)	10	µg/kg	U	<10	<10	<10	<10
Meta/Para-Xylene	GC/MS(Head Space)(MCERTS)	10	µg/kg	U	13	<10	<10	<10
Ortho-Xylene	GC/MS(Head Space)(MCERTS)	10	µg/kg	U	<10	<10	<10	<10
Toluene	GC/MS(Head Space)(MCERTS)	10	µg/kg	U	<10	<10	<10	15

SAL Reference: 528785											
Project Site: Brunel Way (Swansea)											
Customer Reference: J12424											
Soil		Analysed as Soil									
PCBs EC7 (SE)											
SAL Reference				528785 001		528785 002		528785 003		528785 004	
Customer Sample Reference				TP101 @ 0.50m		TP102 @ 0.50m		TP103 @ 0.50m		TP104 @ 0.50m	
Test Sample				AR		AR		AR		AR	
Date Sampled				24-NOV-2015		24-NOV-2015		24-NOV-2015		24-NOV-2015	
Type				Fill		Fill		Fill		Fill	
Determinand		Method	LOD	Units	Symbol						
Polychlorinated biphenyl BZ#101		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#118		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#138		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#153		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#180		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#28		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20
Polychlorinated biphenyl BZ#52		GC/MS	20	µg/kg	U	<20	<20	<20	<20	<20	<20

Index to symbols used in 528785-1

Value	Description
A40	Assisted dried < 40C
2:1	Leachate to BS EN 12457-3 (2:1)
8:1	Leachate to BS EN 12457-3 (8:1)
AR	As Received
32	Whole sample was crushed
U	Analysis is UKAS accredited
N	Analysis is not UKAS accredited

Notes

Retained on 2mm is removed before analysis
TOC analysis transferred to SAL Scotland
Reported results on as received samples are corrected to a 105 degree centigrade dry weight basis except ANC
pH, LOI & TOC were performed on assisted dried samples (<40 degree centigrade). All other results relate to samples as received.



APPENDIX 2

In-situ Analysis: PBA/4639

Client: Pam Brown Associates Ltd
Project: Nantong Way, Swansea

02/08/16

Borehole	Gas Flow (l/hr)	Borehole Pressure (mb)	Methane (%vol)		Methane (%LEL)		Carbon Dioxide (%vol)		Oxygen (%vol)		Other Gases (ppm)		Water Level (Meters)
			Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	H ₂ S	CO	
BH 1	<0.1	0.04	<0.1	<0.1	<2	<2	1.2	1.2	19.1	19.1	<1	<1	Dry 8.29m
Notes: Monitoring order is from left to right. Steady concentrations are measured up to 3 minutes.													

Additional Information

Date Monitoring Undertaken:	2 nd August 2016
Monitoring Undertaken By:	P Cosgrove
Equipment Used:	GA2000+ S/N 11567
Atmospheric Pressure Swansea a.m. (mb):	1011mb*
Atmospheric Pressure On-site (mb):	1010mb
Atmospheric Pressure Swansea p.m. (mb):	1007mb*
Weather During Visit:	Overcast, Raining, Wind SW, 1m/s, 16°C
Comments:	*Met Office Data

In-situ Analysis: PBA/4646

Client: Pam Brown Associates Ltd
Project: Nantong Way, Swansea

09/08/16

Borehole	Gas Flow (l/hr)	Borehole Pressure (mb)	Methane (%vol)		Methane (%LEL)		Carbon Dioxide (%vol)		Oxygen (%vol)		Other Gases (ppm)		Water Level (Meters)
			Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	H ₂ S	CO	
BH 1	<0.1	0.02	<0.1	<0.1	<2	<2	0.3	0.3	20.2	20.2	<1	<1	Dry 8.29m
Notes: Monitoring order is from left to right. Steady concentrations are measured up to 3 minutes.													

Additional Information

Date Monitoring Undertaken:	9 th August 2016
Monitoring Undertaken By:	P Cosgrove
Equipment Used:	GA2000+ S/N 11567
Atmospheric Pressure Swansea a.m. (mb):	1027mb*
Atmospheric Pressure On-site (mb):	1029mb
Atmospheric Pressure Swansea p.m. (mb):	1029mb*
Weather During Visit:	Sunny, Dry, Wind NW, 1m/s, 18°C
Comments:	*Met Office Data

In-situ Analysis: PBA/4659

Client: Pam Brown Associates Ltd
Project: Nantong Way, Swansea

19/08/16

Borehole	Gas Flow (l/hr)	Borehole Pressure (mb)	Methane (%vol)		Methane (%LEL)		Carbon Dioxide (%vol)		Oxygen (%vol)		Other Gases (ppm)		Water Level (Meters)
			Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	H ₂ S	CO	
BH 1	<0.1	0.03	<0.1	<0.1	<2	<2	1.6	1.6	19.1	19.1	<1	<1	Dry 8.29m
Notes: Monitoring order is from left to right. Steady concentrations are measured up to 3 minutes.													

Additional Information

Date Monitoring Undertaken:	19 th August 2016
Monitoring Undertaken By:	P Cosgrove
Equipment Used:	GA2000+ S/N 11567
Atmospheric Pressure Swansea a.m. (mb):	1001mb*
Atmospheric Pressure On-site (mb):	0998mb
Atmospheric Pressure Swansea p.m. (mb):	0999mb*
Weather During Visit:	Raining, Wind SW, 2m/s, 14°C
Comments:	*Met Office Data

In-situ Analysis: PBA/4675

Client: Pam Brown Associates Ltd
Project: Nantong Way, Swansea

06/09/16

Borehole	Gas Flow (l/hr)	Borehole Pressure (mb)	Methane (%vol)		Methane (%LEL)		Carbon Dioxide (%vol)		Oxygen (%vol)		Other Gases (ppm)		Water Level (Meters)
			Peak	Steady	Peak	Steady	Peak	Steady	Peak	Steady	H ₂ S	CO	
BH 1	<0.1	0.02	<0.1	<0.1	<2	<2	0.2	0.2	20.2	20.2	<1	<1	Dry 8.29m
Notes: Monitoring order is from left to right. Steady concentrations are measured up to 3 minutes.													

Additional Information

Date Monitoring Undertaken:	6 th September 2016
Monitoring Undertaken By:	P Cosgrove
Equipment Used:	GA2000+ S/N 11567
Atmospheric Pressure Swansea a.m. (mb):	1023mb*
Atmospheric Pressure On-site (mb):	1024mb
Atmospheric Pressure Swansea p.m. (mb):	1020mb*
Weather During Visit:	Overcast, Dry, Wind SW, <1m/s, 19°C
Comments:	*Met Office Data

APPENDIX 3

Appendix 3. Remediation Criteria to be applied for the assessment of stabilised materials and groundwater quality.

Parameter	Stabilised Soil (leachate) & GW Assessment Criteria¹ (µg/l)
Inorganics	
Sulphate	250 000
Sulphide	0.25
Cyanide (total)	50
Arsenic	10
Boron	1000
Cadmium	5
Chromium (total)	150
Copper	5
Mercury	1
Nickel	50
Lead	20
Selenium	10
Zinc	300
Hydrocarbons	
Total Petroleum Hydrocarbons	10
Naphthalene	10
Acenaphthylene	-
Acenaphthene	-
Fluorene	-
Phenanthrene	-
Anthracene	-
Fluoranthene	-
Pyrene	-
Benzo[a]anthracene	-
Chrysene	-
Benzo[a]pyrene	0.01
Dibenzo[a,h]anthracene	-
Indeno[1,2,3-cd]pyrene^	0.1
Benzo[g,h,i]perylene^	
Benzo[b]fluoranthene^	
Benzo[k]fluoranthene^	
Phenols (total)	30

^ Criterion applies to the Sum of these 4 compounds

¹ EA (2003) Hydrogeological Risk Assessments for Landfills and the Derivation of groundwater control and trigger value levels. LFTGN01. pp. 75-79.

APPENDIX 4

Appendix 4. Soil Assessment Criteria for Imported soils

Parameters	Soil Remediation Criteria ¹⁻⁵ (mg kg ⁻¹)
Inorganics	
Arsenic	640
Boron	240000
Cadmium	410
Chromium	8600
Chromium (hexavalent)	49
Copper	68000
Cyanide (Total)	50
Lead	2300
Mercury	3600
Nickel	1800
Selenium	13000
Zinc	730000
Petroleum Hydrocarbons	
TPH aliphatic >C5-C6	3200
TPH aliphatic >C6-C8	7800
TPH aliphatic >C8-C10	2000
TPH aliphatic >C10-C12	9700
TPH aliphatic >C12-C16	59000
TPH aliphatic >C16-C35	1600000
TPH aliphatic >C35-C44	1600000
TPH aromatic >C5-C7	26000
TPH aromatic >C7-C8	56000
TPH aromatic >C8-C10	3500
TPH aromatic >C10-12	16000
TPH aromatic >C12-C16	36000
TPH aromatic >C16-C21	28000
TPH aromatic >C21-C35	28000
TPH aromatic >C35-C44	28000
Polyaromatic Hydrocarbons	
Napthalene	190
Acenaphthylene	83000
Acenaphthene	84000
Fluorene	63000
Phenanthrene	22000
Anthracene	520000
Fluoranthene	23000
Pyrene	54000
Benzo[a]anthracene	170
Chrysene	350
Benzo[b]fluoranthene	44
Benzo[k]fluoranthene	1200
Benzo[a]pyrene	35
Dibenzo[a,h]anthracene	3.5
Indeno[1,2,3c-d]pyrene	500
Benzo[g,h,i]perylene	3900
Phenols (total)	3200

References

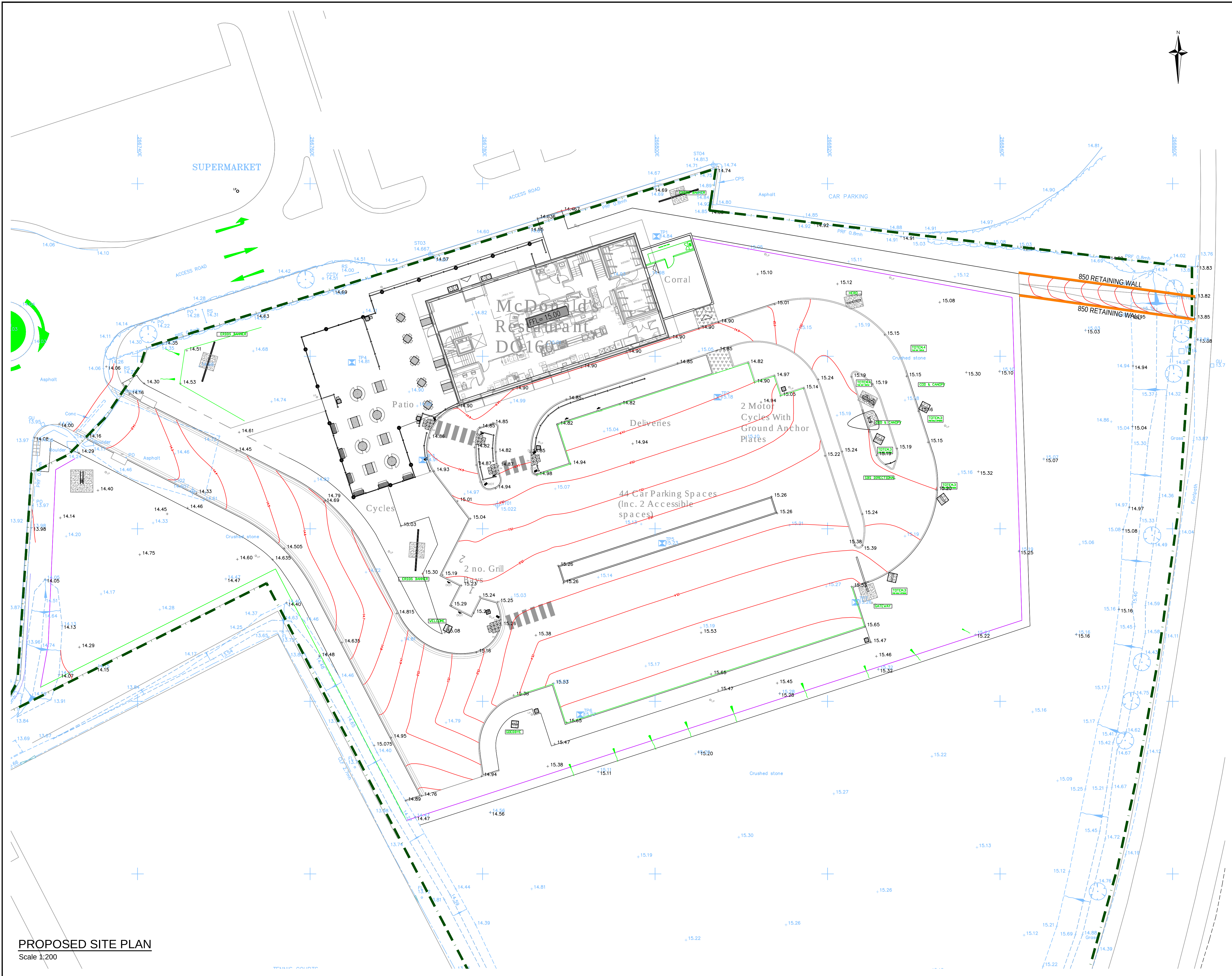
- ¹ Environment Agency (2009) 'Soil Guideline Values for 'Arsenic', 'Cadmium', 'Mercury', 'Nickel', 'Selenium', 'Benzene', 'Ethylbenzene', 'Toluene', 'Xylenes', 'Phenol', 'Dioxins, Furans and Dioxin-like PCBs in soil'. Science Report SC050021. UK.
- ² Nathanail, C.P., McCaffrey, C., Gillett, A.G., Ogden, R.C. and Nathanail, J.F. (2015) 'The LQM/CIEH S4ULs for Human Health Risk Assessment'. Land Quality Press, Nottingham, UK.
- ³ CL:AIRE (2014) SP1010-Development of Category 4 Screening Levels for assessment of Land Affected by Contamination. Final Project Report (Revision 2). Appendix H - Provisional C4SL.
- ⁴ Dutch Ministry of Housing Spatial Planning and Environment (2000) Circular on target values and intervention values for soil remediation.
- ⁵ Swartjes F.A., Tromp, P. (2008) 'A tiered approach for the assessment of the human health risks of asbestos in soils'. Soil and Sediment Contamination .Vol. 17(2), 137–149.

APPENDIX 5

Appendix 5. Analytical Testing Suite for imported materials.

Parameters	
Inorganics	
pH	Cadmium
Organic matter content	Chromium
Sulphate (total)	Copper
Sulphate (2:1 water soluble)	Mercury
Sulphide	Nickel
Sulphur (elemental)	Lead
Cyanide (total)	Selenium
Arsenic	Zinc
Boron	Chromium (hexavalent)
Petroleum Hydrocarbons	Polycyclic Aromatic Hydrocarbons
TPH aliphatic >C5-C6	Naphthalene
TPH aliphatic >C6-C8	Acenaphthylene
TPH aliphatic >C8-C10	Acenaphthene
TPH aliphatic >C10-C12	Fluorene
TPH aliphatic >C12-C16	Phenanthrene
TPH aliphatic >C16-C21	Anthracene
TPH aliphatic >C21-C35	Fluoranthene
TPH aliphatic >C35-C44	Pyrene
TPH aromatic >C5-C7	Benzo[a]anthracene
TPH aromatic >C7-C8	Chrysene
TPH aromatic >C8-C10	Benzo[b]fluoranthene
TPH aromatic >C10-C12	Benzo[k]fluoranthene
TPH aromatic >C12-C16	Benzo[a]pyrene
TPH aromatic >C16-C21	Dibenzo[a,h]anthracene
TPH aromatic >C21-C35	Indeno[1,2,3-cd]pyrene
TPH aromatic >C35-C44	Benzo[g,h,i]perylene
Total Petroleum Hydrocarbons	Total (of 16) PAHs
Phenols (total)	

APPENDIX 6



This drawing should not be scaled. For construction purposes work to figured dimensions only.

0mm 40mm 80mm
ORIGINAL SHEET SIZE A1

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LEGEND

- SITE BOUNDARY
- +15.16 EXISTING GROUND LEVEL
- +15.220 PROPOSED FINISHED LEVEL
- 1in60 PROPOSED GRADIENT
- PROPOSED NEW BANKING
- PROPOSED RETAINING WALL
- ▲ BUILDING ENTRANCE

T1	TENDER ISSUE	29/07/16	HBG
Rev.	Description	Date	Chkd

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Client : **McDonald's** RESTAURANT

Project : **MCDONALD'S RESTAURANT
MORFA RETAIL PARK
BRUNEL WAY, SWANSEA**

Title : **SITE LAYOUT & LEVELS**

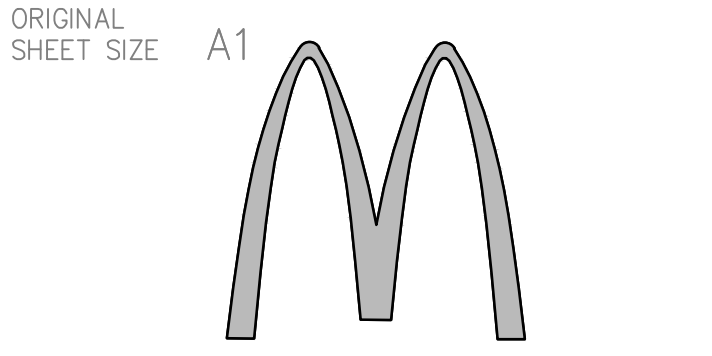
Project Engineer :	FG	Scale :	1:200 @ A3
Project Director :	N.P.	Date :	JULY 2016
Status :	TENDER		

Drawing No.	4150528-1100	Rev	T1
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ORIGINAL
SHEET SIZE A1

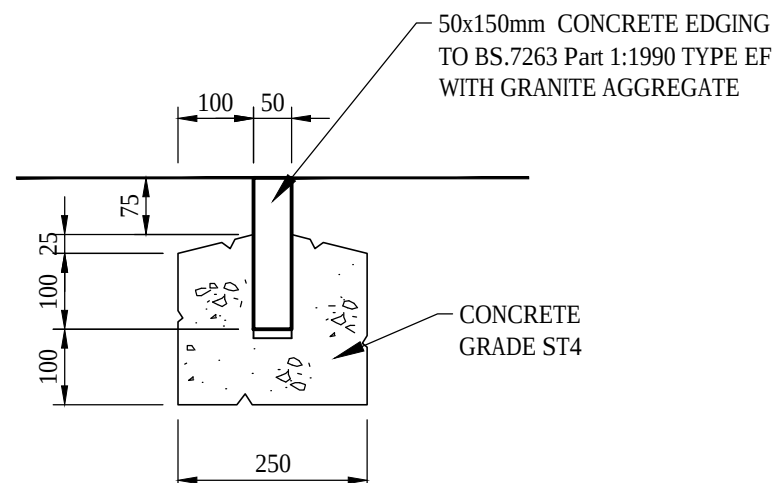


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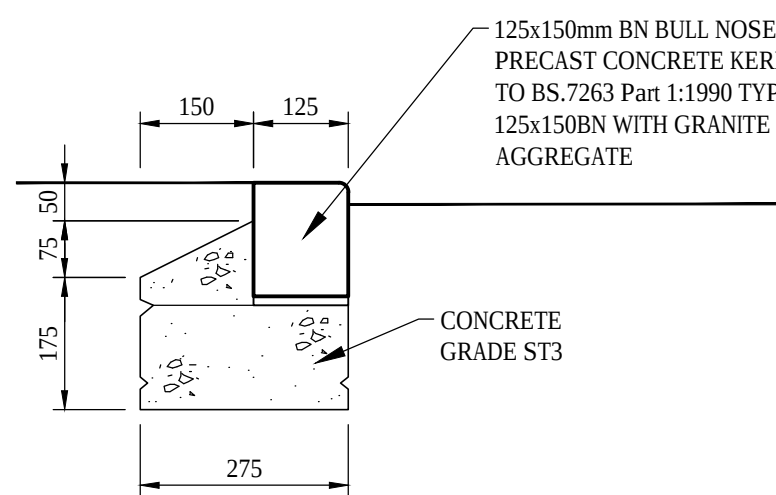
SPECIFICATION NOTES:

- PCC BLOCK PAVIOURS AND PAVING SLABS SHALL BE IN ACCORDANCE WITH BS 7533, PARTS 2 : (2001) & 3 (2005).
- TYPE 1 SUB BASE MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 803 OF THE SPECIFICATION FOR HIGHWAY WORKS (SHW), WITH A MINIMUM LAB CBR OF 30%.
- TYPE 6F1 / 6F2 CAPPING MATERIAL SHALL BE IN ACCORDANCE WITH CLAUSE 613, SHW, WITH A MINIMUM LAB CBR OF 15%.
- SMA DESIGN MIX TO BE APPROVED PRIOR TO LAYING. ASPHALT SHALL BE LAID IN ACCORDANCE WITH BS 594987:2007. PAVING GRADES SPECIFIED ARE APPROPRIATE TO MACHINE LAYING. IF HAND LAYING IS REQUIRED THE CONTRACTOR IS TO NOTIFY THE ENGINEER AND REQUEST A REVISED SPECIFICATION. AGGREGATES AND DESIGN SHALL BE IN ACCORDANCE WITH PD 6691:2007. PENETRATION GRADE TO BE 40/60 PEN FOR ALL SURFACE COURSES U.N.O. 100/150 PEN FOR BINDER COURSE TO CAR PARKING AREAS. 40/60 PEN FOR BINDER & BASE COURSES UNDER HEAVY DUTY FLEXIBLE PAVEMENTS. TACK COAT TO BE USED AS REQUIRED.
- CONCRETE TO DRIVE-THROUGH AND REFUSE AREAS SHALL BE GRADE C40 WITH 20mm MAX LIMESTONE AGGREGATE SIZE. MIN CEMENT CONTENT 340kg/m³. MINIMUM CURING PERIOD 7 DAYS. CHARCOAL THROUGHOUT. WATER CEMENT / RATIO 0.45. AIR ENTRAINMENT 3.5%. SURFACE IS PICS COLOUR SURFACE HARDENER (CSH), WITH A RELEASE AGENT (RA) A MIX OF HYDROPHOBIC POWDERS TO CURE THE CSH. ALL TO PICS INSTALLATION METHOD.
- FOR FROST SUSCEPTIBLE SUB-GRADES (FORMATION LAYER) MINIMUM PAVEMENT CONSTRUCTION DEPTH SHALL BE 450mm.
- SOFT SPOTS ARE TO BE REMOVED AND FILLED TO A MINIMUM DEPTH OF 600mm WITH 6F1/6F2 MATERIAL AND FORMATION TO BE PROOF ROLLED PRIOR TO CONSTRUCTION.
- WHERE THE WATER TABLE IS WITHIN 600mm OF THE FORMATION LEVEL, THE EFFECTIVE CBR VALUE SHALL BE HALVED FOR DESIGN PURPOSES.
- IF CBR UNKNOWN. CARRY OUT IN-SITU TESTS ON THE SUBGRADE AND UTILISE APPROPRIATE FOUNDATION LAYERWORKS AS PER TABLE 1
- TACTILE PAVING TO BE INSTALLED TO DETR REQUIREMENTS, ON 30mm MORTAR BED AND 150mm TYPE 1 SUB-BASE.
- WHERE REQUIRED THE INTERGRID SHOULD BE INCORPORATED AT THE INTERFACE BETWEEN THE TWO LAYERS OF SUB-BASE. THE INTERGRID SHOULD BE LAID ON THE SUB-BASE AND JOINTS SHOULD BE OVERLAPPED BY 300mm. THE UPPER SUB-BASE LAYER (20mm-4mm) SHOULD THEN BE LAID ON TOP OF THE INTERGRID AND COMPACTED AS BEFORE.
- LAY GEOTEXTILE ON TOP OF THE SUB-BASE OVERLAPPING JOINTS BY 300mm INBITEX SHOULD BE BROUGHT UP TO THE HAUNCHED KERB/EDGING AND CUT-OFF FLUSH WITH THE SURFACE OF THE PAVING.



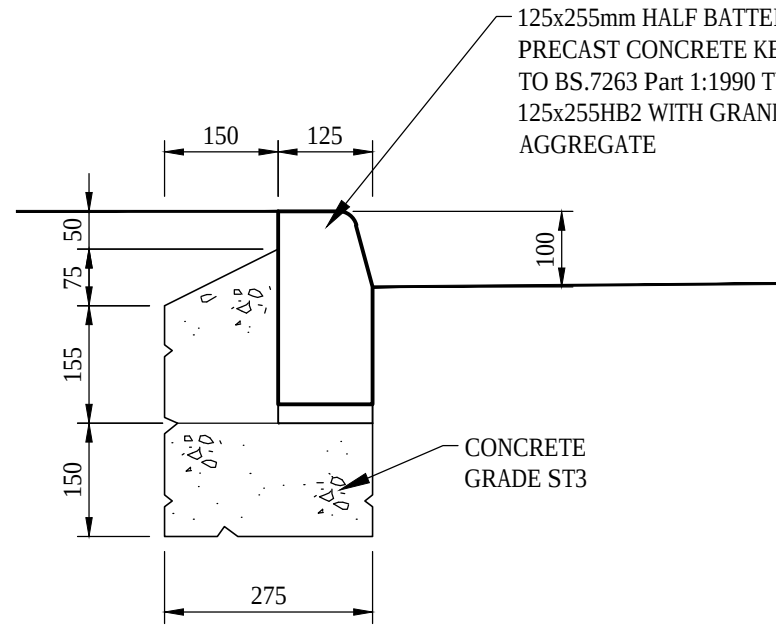
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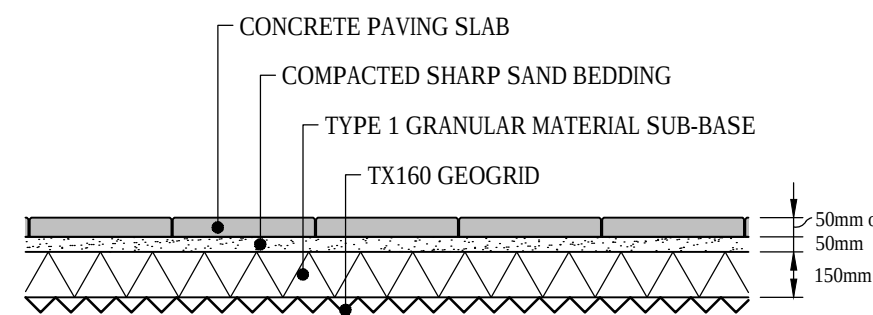
TYPE BN KERB

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TYPE HB2 KERB

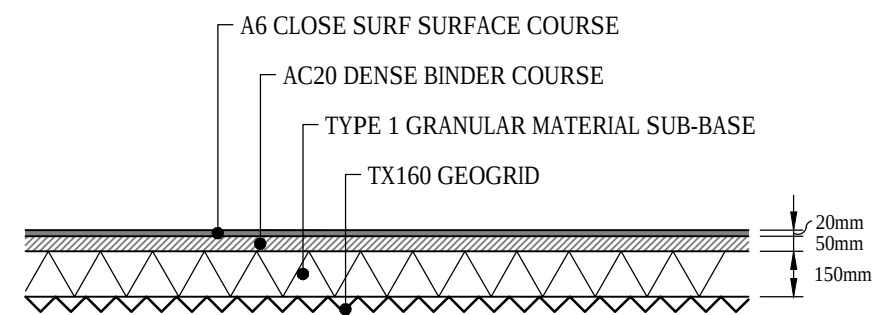
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**PEDESTRIAN AREAS
CONCRETE SLAB PAVED**

Scale 1:25

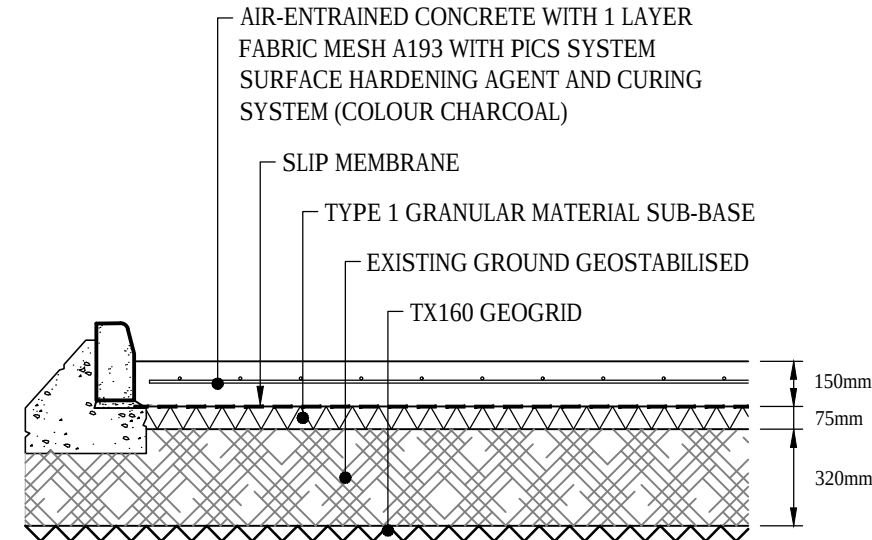
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**PEDESTRIAN AREAS
ASPHALT CONSTRUCTION**

Scale 1:25

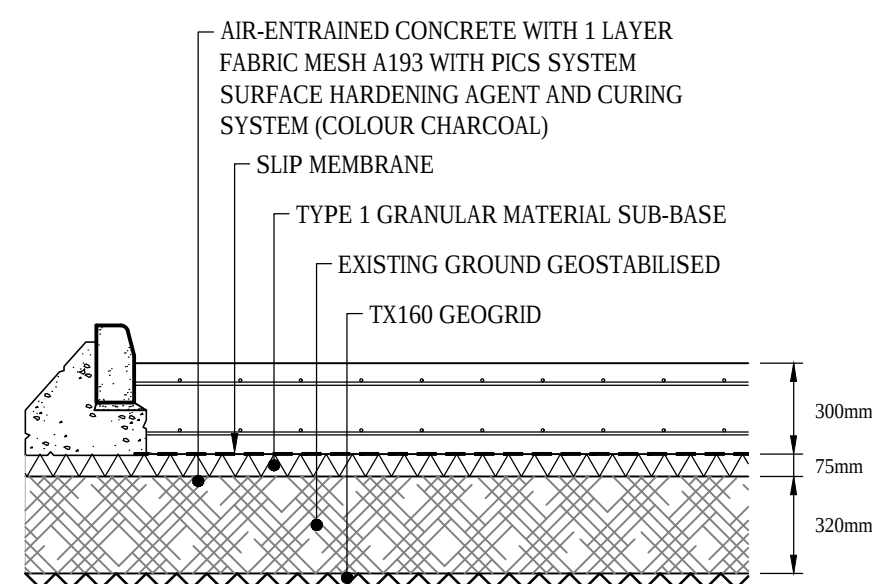
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**MEDIUM DUTY VEHICULAR AREAS
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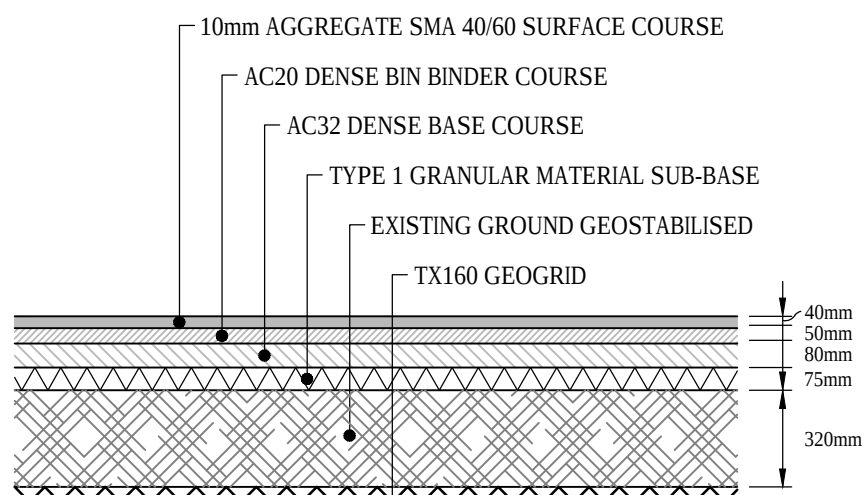
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DRIVE THRU SLAB ON PILES

Scale 1:25

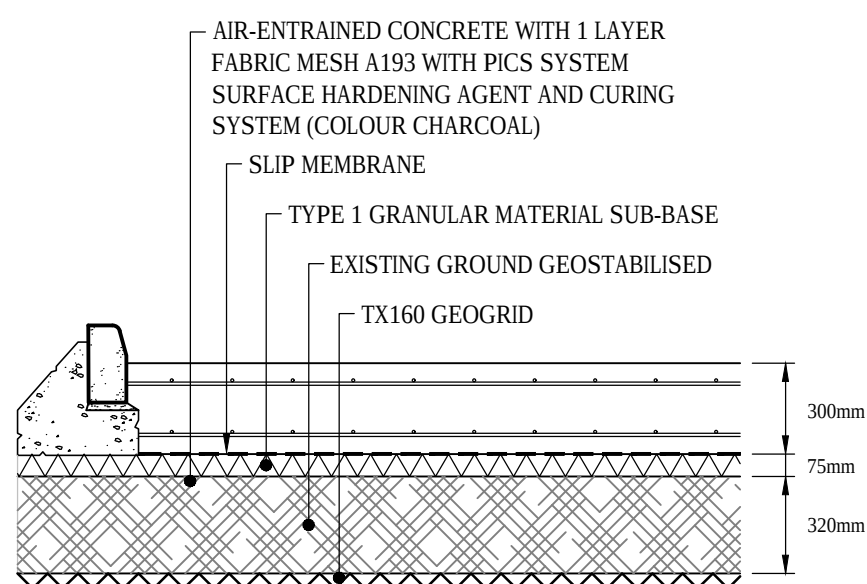
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**MEDIUM DUTY VEHICULAR AREAS
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Scale 1:25

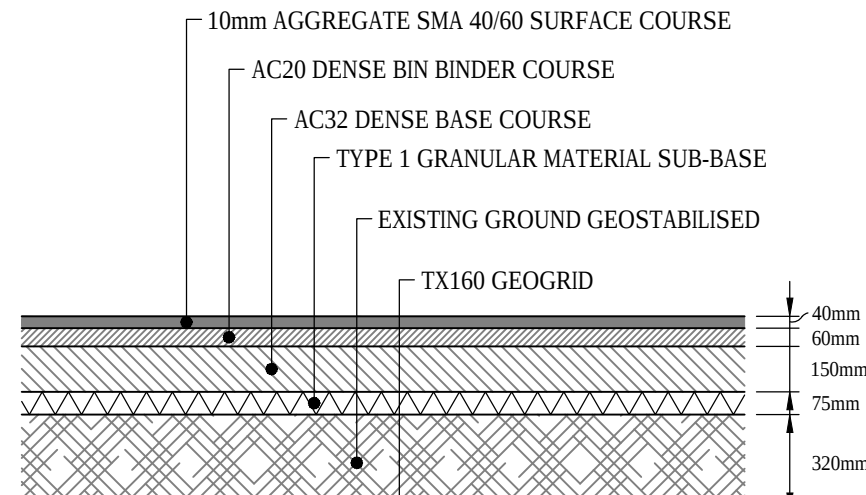
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**TRANSFER SLAB
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Scale 1:25

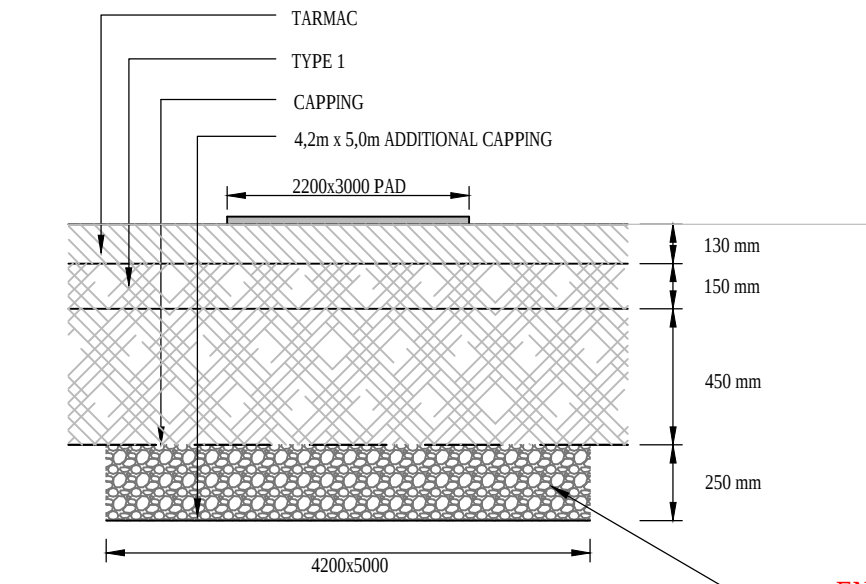
INDICATED ON PLAN THUS:



**HEAVY DUTY VEHICULAR AREAS
BITUMINOUS CONSTRUCTION**

Scale 1:25

INDICATED ON PLAN THUS:



**BUILDING CRANE FOUNDATION
REQUIREMENTS**

Scale 1:25

INDICATED ON PLAN THUS:

ENSURE EXISTING SUBGRADE IS GRANULAR AND WELL COMPACTED NO TOPSOIL!

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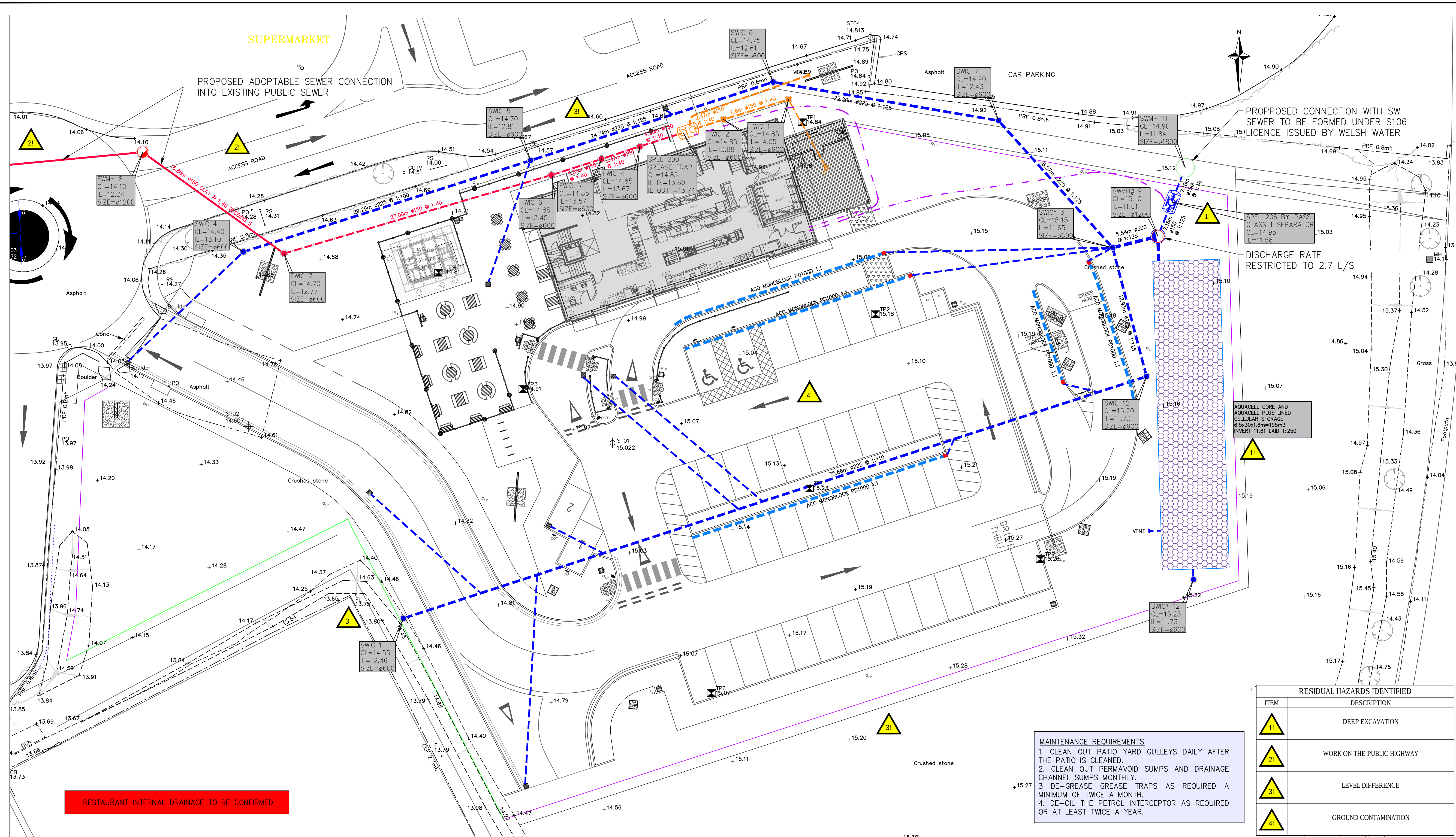
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Project : **MCDONALD'S RESTAURANT
MORFA RETAIL PARK
BRUNEL WAY, SWANSEA**

Title : **PROPOSED EXTERNAL FINISHES**

Project Engineer :	FG	Scale :	1:200 @ A1
Project Director :	N.P.	Date :	JULY 2016
Status :	TENDER		

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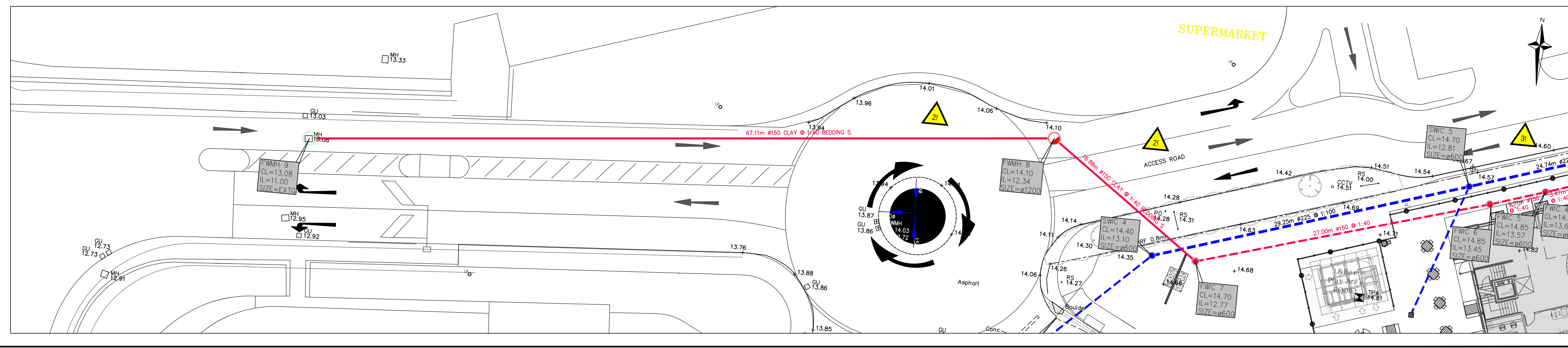
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ORIGINAL SHEET SIZE A1

- NOTES
- ANY IRREGULARITIES, INCONSISTENCIES OR QUERIES WITH THE DRAWINGS MUST BE RAISED WITH THE ENGINEER PRIOR TO COMMENCEMENT OF ANY WORKS.
 - ALL PRIVATE PIPEWORK UPVC OSMIA DRAIN AND OSMIA ULTRA RIB UNDER ROAD, OR SIMILAR APPROVED.
 - MINIMUM GRADE FOR 1000 SURFACE WATER PIPES 1:100. MINIMUM FOR 1000 FOUL WATER 1:80. MINIMUM FOR 1500 1:150.
 - ALL DRAINS UNDER BUILDINGS TO BE 1000 MINIMUM GRADE 1:40, UNLESS NOTED OTHERWISE.
 - ALL WORKS TO BE INSTALLED IN ACCORDANCE WITH BUILDING REGULATIONS PART H.
 - SEE DWG 4150528 - 1107-1109 FOR DRAINAGE AND PIPE BEDDING DETAILS.

- KEY
- PPIC x
CL=xx.xx
IL=xx.xx
SIZE=xx" DRAINAGE LABEL
 - PROPOSED ROAD GULLEY WITH 1500 PIPE D400 COVER
 - PROPOSED SURFACE WATER DRAINAGE PIPEWORK SHOWING LENGTH, PIPE DIAMETER AND GRADE
 - PROPOSED BUILDING SURFACE WATER CATCHPIT 300mm SUMP DRAINAGE POLYPIPE INSPECTION CHAMBER. ALL CHAMBERS TO BE CATCH PIT TYPE WITH 300mm SUMP
 - PROPOSED BUILDING SURFACE WATER PPIC CHAMBER
 - RWP PROPOSED RAINWATER DOWN PIPE INVERT 500mm BELOW PROPOSED EXTERNAL LEVEL (ALL OUTLETS 1000 & TO HAVE RODDING ACCESS UNLESS OTHERWISE INDICATED)
 - DRAINAGE CHANNEL AS NOTED
 - PROPOSED FOUL WATER DRAINAGE PIPEWORK SHOWING LENGTH, PIPE DIAMETER AND GRADE
 - PROPOSED BUILDING FOUL WATER DRAINAGE INSPECTION CHAMBER 4750 MAX DEPTH 1.2m. DEEPER ONES TO BE WOVIN RANGE 450 OR 600 UP TO 3m.
 - PROPOSED BUILDING WC OR DP (STUB STACK) OR FLOOR GULLY LATERAL (ALL 1000 WITH A MINIMUM GRADE OF 1:40 AND MINIMUM REST BEND INVERT 450mm BELOW LOWEST PROPOSED FLOOR LEVEL U.N.O
 - 1100 DUCTS FOR GREASE TRAP/ PETROL ELECTRICS CUPBOARD

- LINED IMPERMEABLE HEAVY DUTY CELLULAR STORAGE AQUACELL CORE & AQUACELL PLUS (OR SIMILAR APPROVED)
- ALARMED BY PASS PETROL INTERCEPTOR SPEL C206 C1/SC
- ALARMED 2000I SPEL GREASE TRAP WITH HARD WIRE TO MANAGERS OFFICE
- FLOW CONTROL MANHOLE CHAMBER 1200
- DP DRAIN POINT WC WC (TOILET)
- RE RODDING EYE G
- PROPOSED SURFACE WATER DRAINAGE MANHOLE

RESIDUAL HAZARDS IDENTIFIED	
ITEM	DESCRIPTION
1	DEEP EXCAVATION
2	WORK ON THE PUBLIC HIGHWAY
3	LEVEL DIFFERENCE
4	GROUND CONTAMINATION



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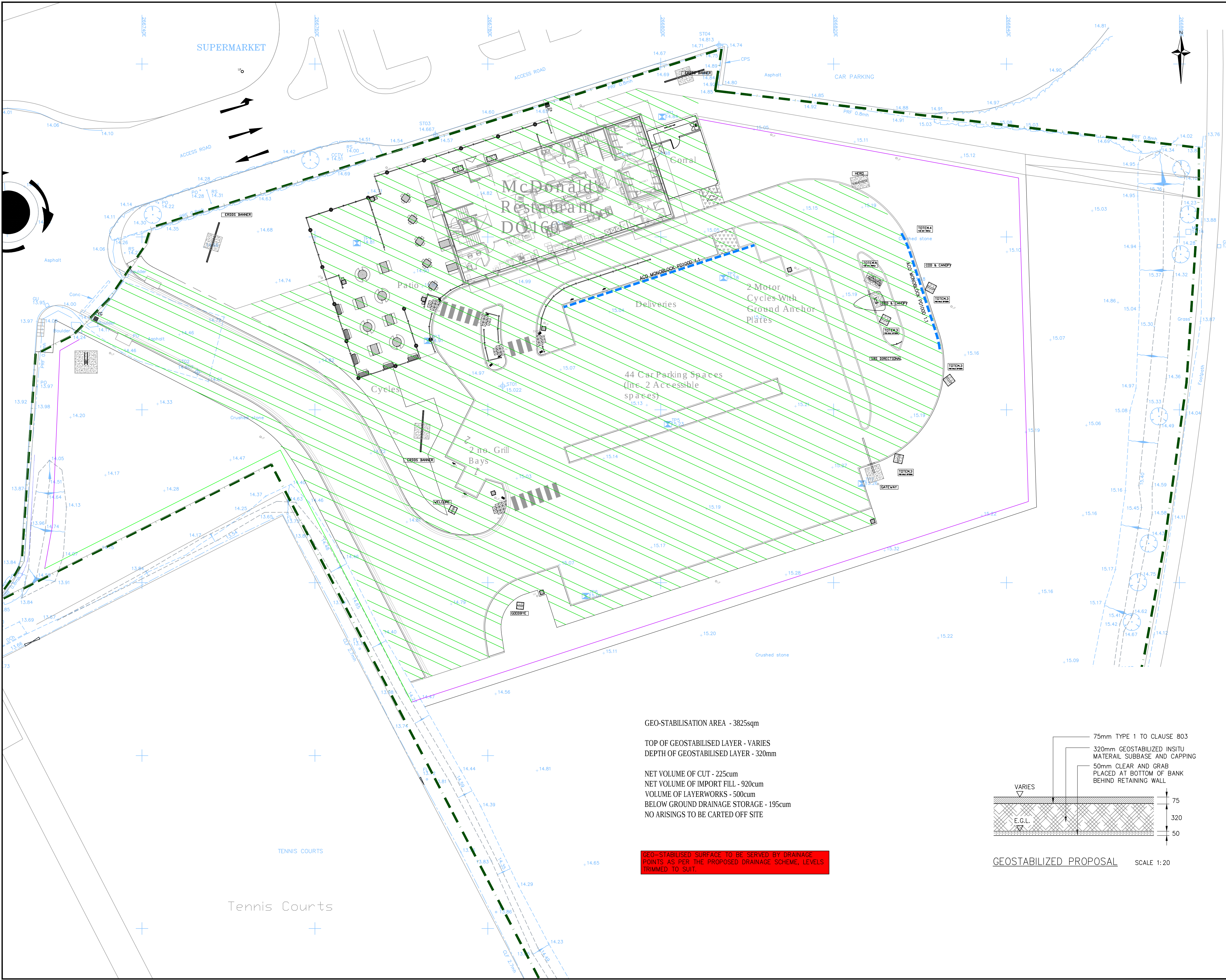
Client: **McDonald's**

Project: **MCDONALD'S RESTAURANT MORFA RETAIL PARK BRUNEL WAY, SWANSEA**

Title: **PROPOSED DRAINAGE**

Project Engineer: FG Scale: 1:200 @ A1
Project Director: N.P. Date: JULY 2016
Status: TENDER

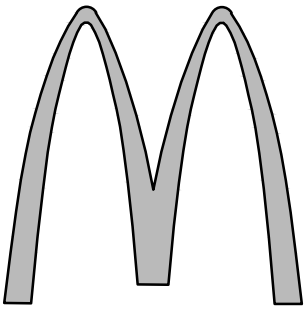
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LEGEND

- SITE BOUNDARY
- +15.16 EXISTING GROUND LEVEL
- +15.220 PROPOSED FINISHED LEVEL

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Client : 

Project : **McDONALD'S RESTAURANT**
MORFA RETAIL PARK
BRUNEL WAY, SWANSEA

Title : **SITE LAYOUT & LEVELS**

Project Engineer :	FG	Scale :	1:200 @ A1
Project Director :	N.P.	Date :	JULY 2016
Status :	TENDER		

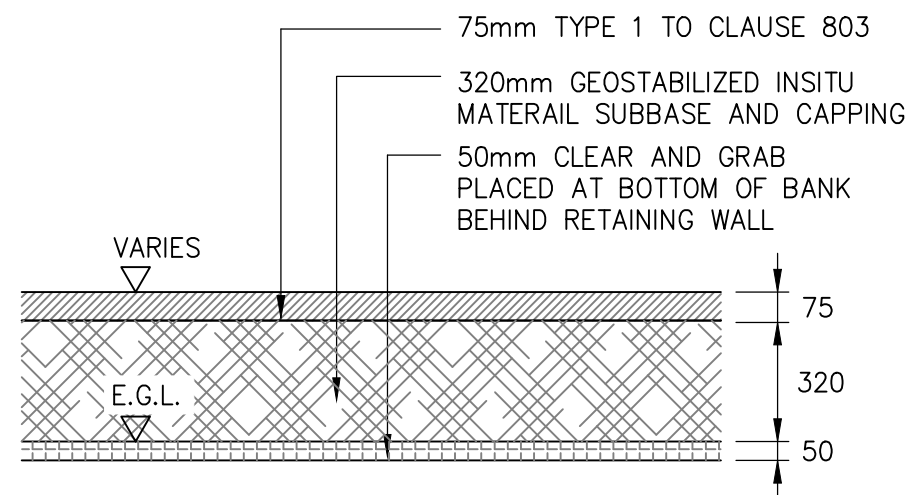
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GEO-STABILISATION AREA - 3825sqm

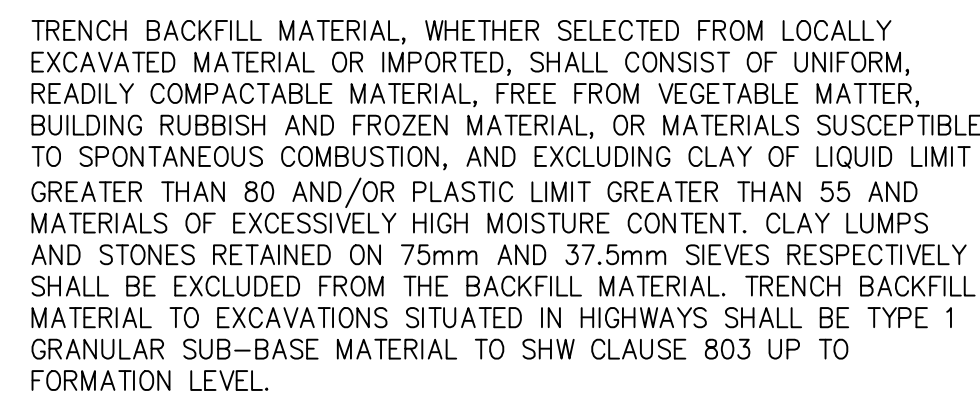
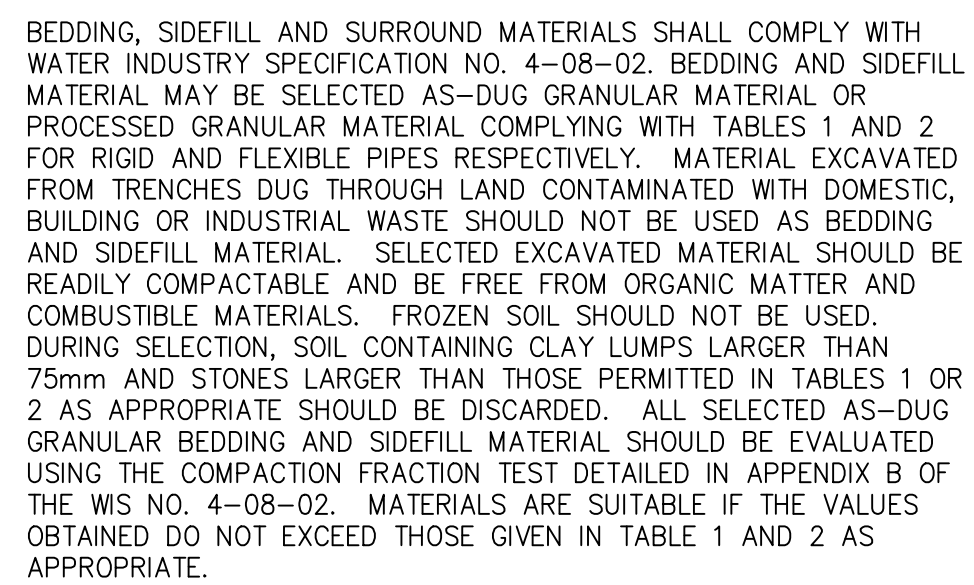
TOP OF GEOSTABILISED LAYER - VARIES
DEPTH OF GEOSTABILISED LAYER - 320mm

NET VOLUME OF CUT - 225cum
NET VOLUME OF IMPORT FILL - 920cum
VOLUME OF LAYERWORKS - 500cum
BELOW GROUND DRAINAGE STORAGE - 195cum
NO ARISINGS TO BE CARTED OFF SITE

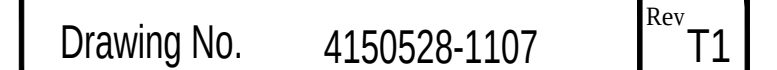
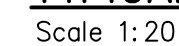
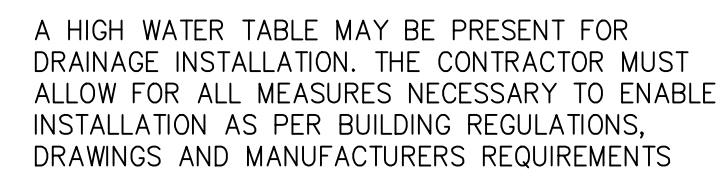
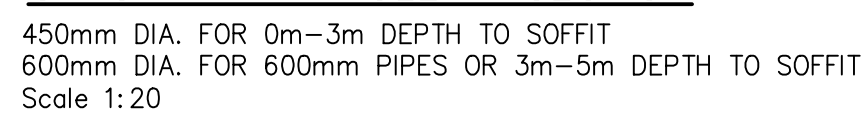
GEO-STABILISED SURFACE TO BE SERVED BY DRAINAGE POINTS AS PER THE PROPOSED DRAINAGE SCHEME, LEVELS TRIMMED TO SUIT.

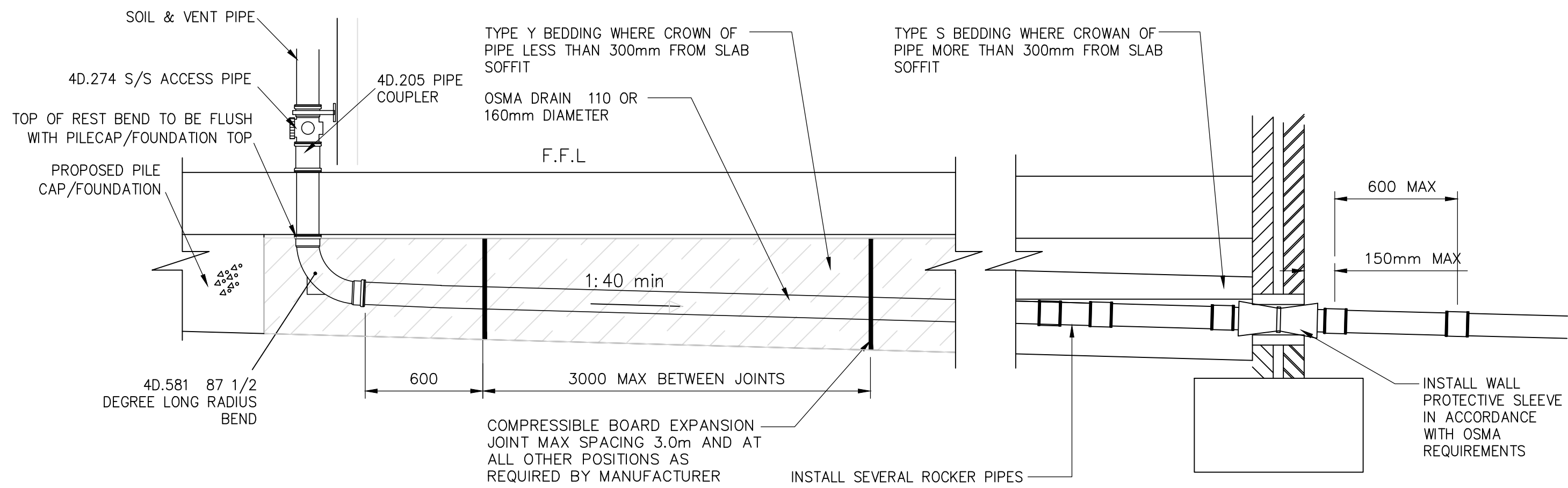


GEOSTABILIZED PROPOSAL SCALE 1:20

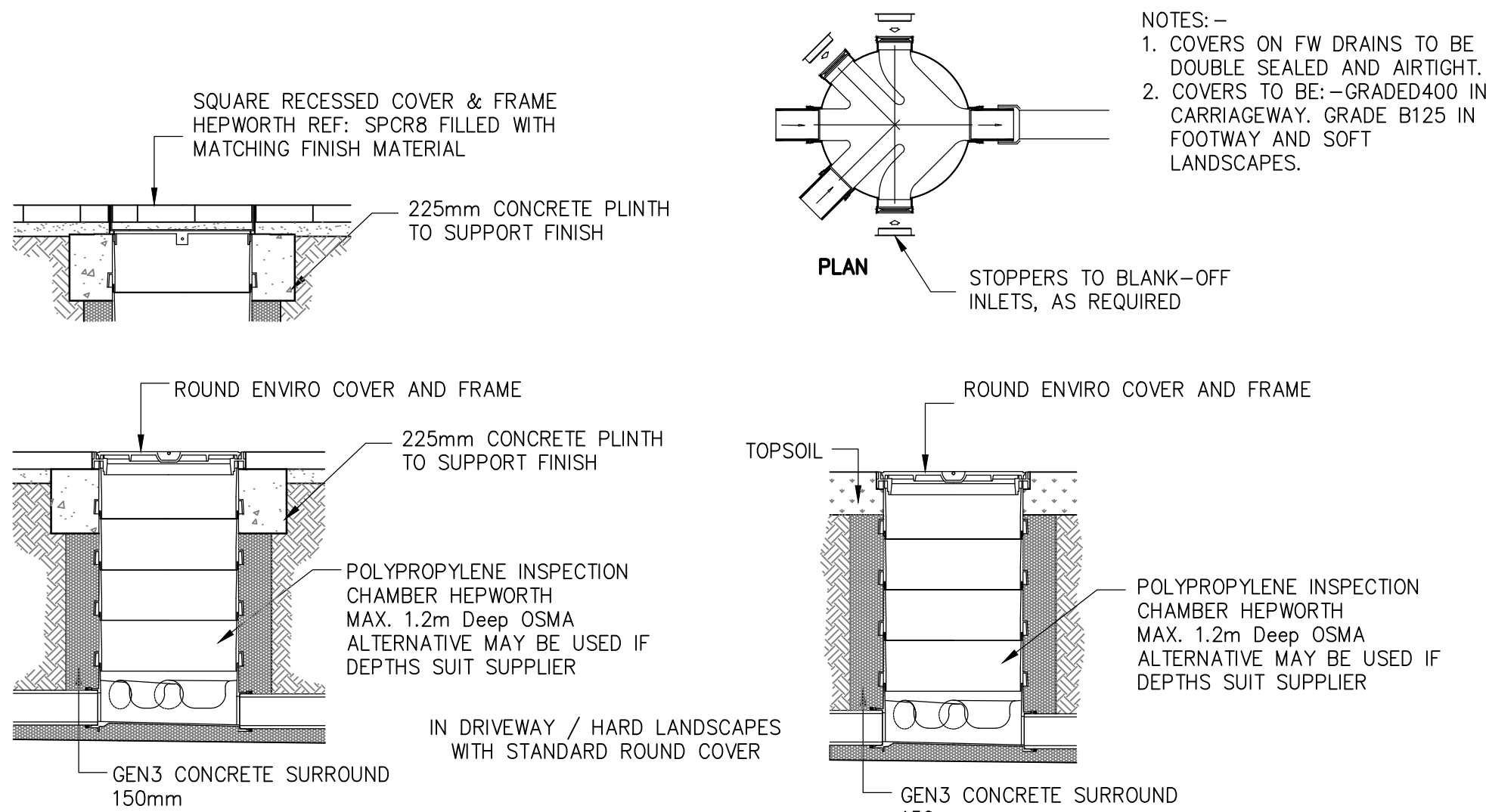


PIPE BEDDING DETAILS



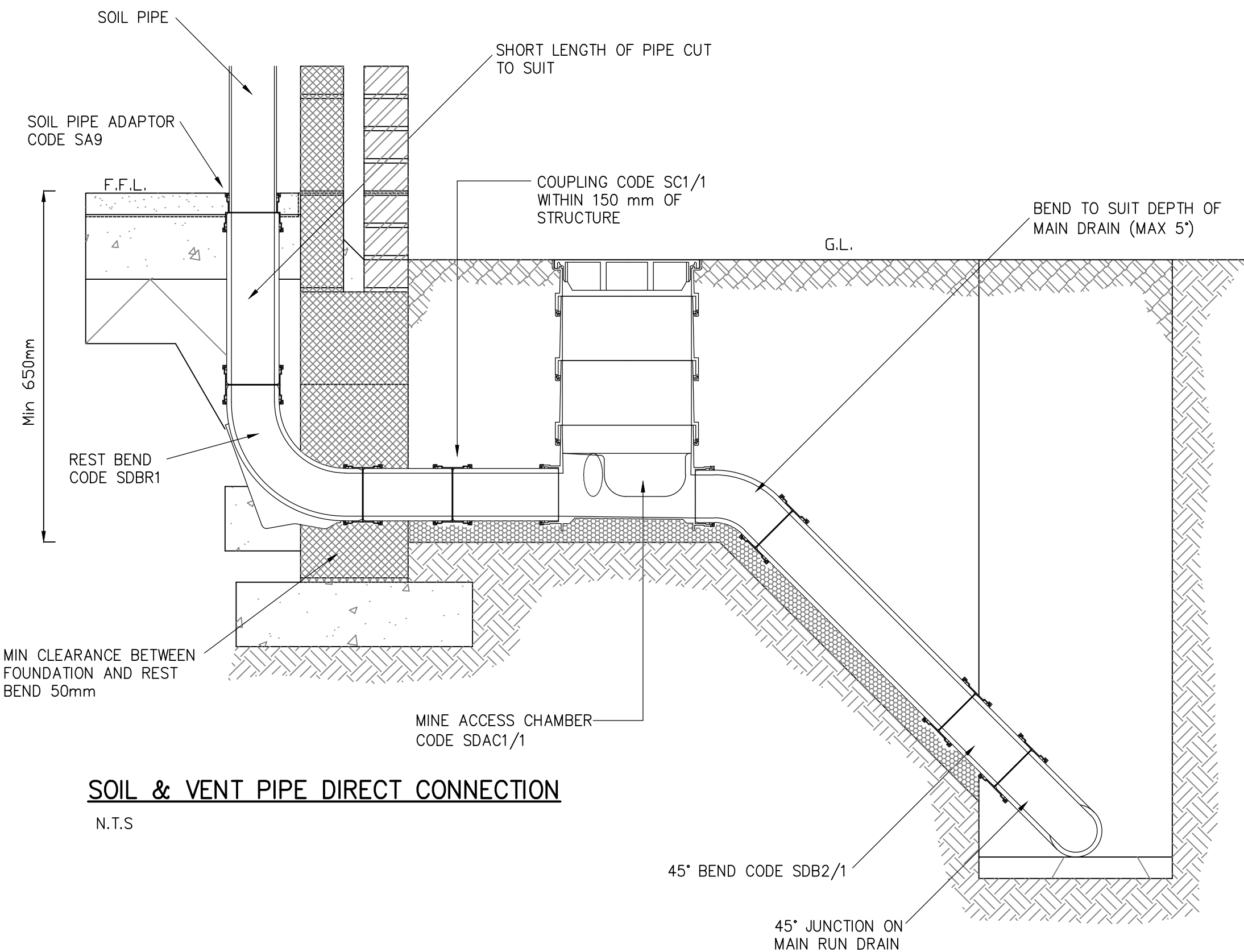


TYPICAL DETAIL OF BELOW SLAB OSMa DRAIN INSTALLATION
SCALE 1:20

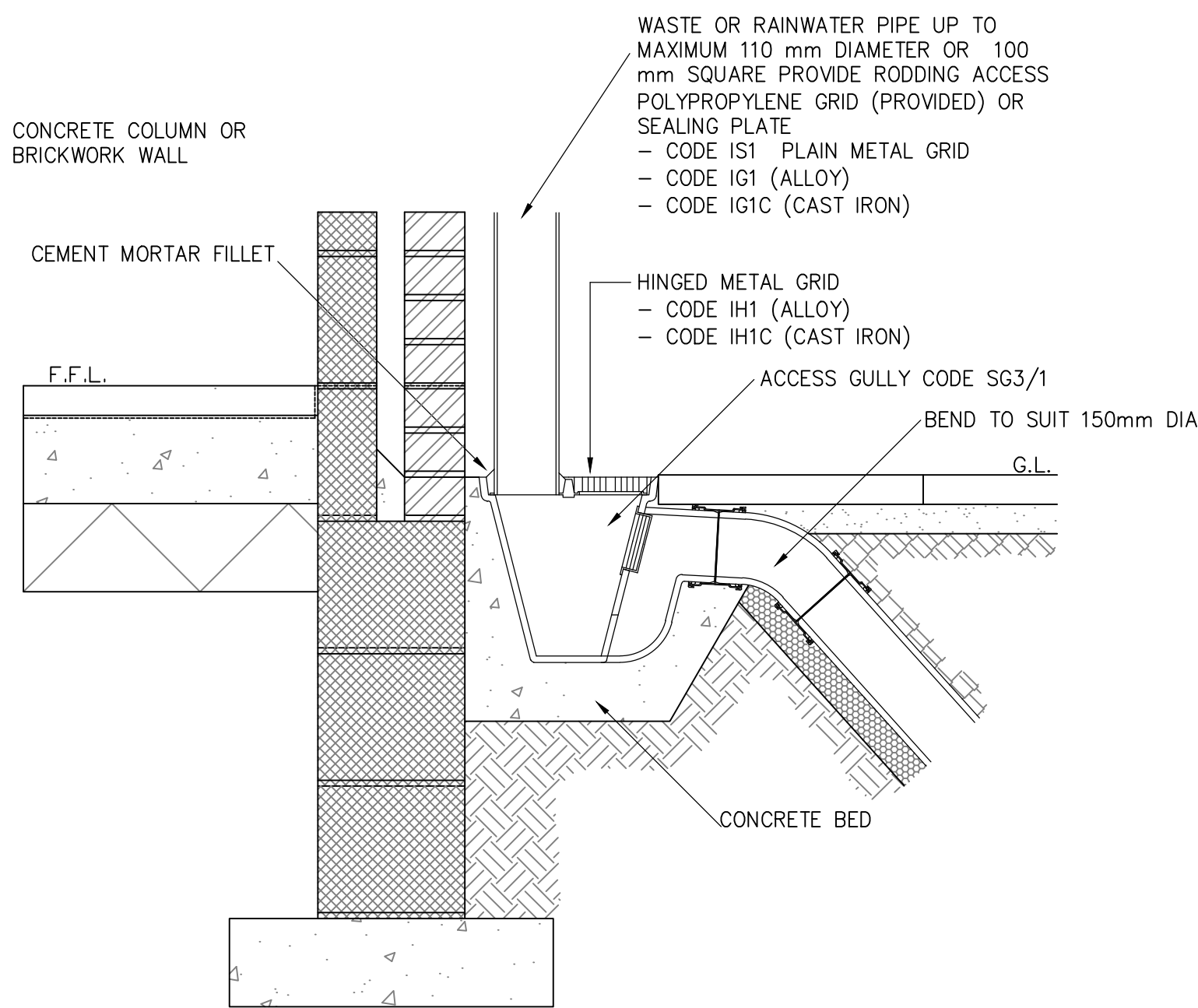


**MANHOLE DETAIL - TYPE PPIC
POLYPROPYLENE INSPECTION CHAMBER
(MAXIMUM DEPTH 1.2m)**
Scale 1:20

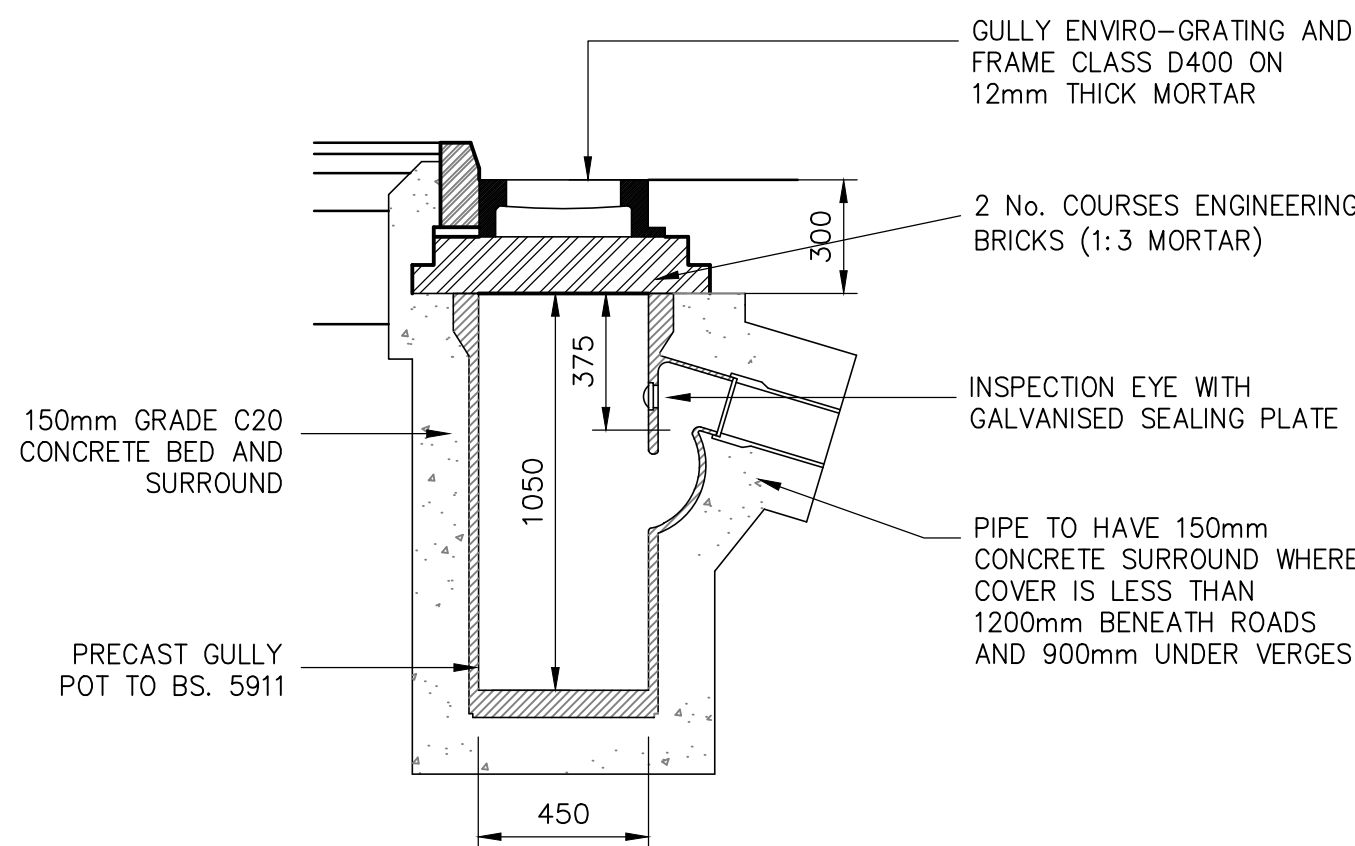
NOTE:
FOR MANHOLES DEEPER THAN 1.2m (UPTO 3m) AND PIPE SIZES UPTO 150Ø THEN USE WAVIN 450.
FOR MANHOLES DEEPER THAN 1.2m (UPTO 3m) AND PIPE SIZES GREATER THAN 150Ø USE WAVIN 600.



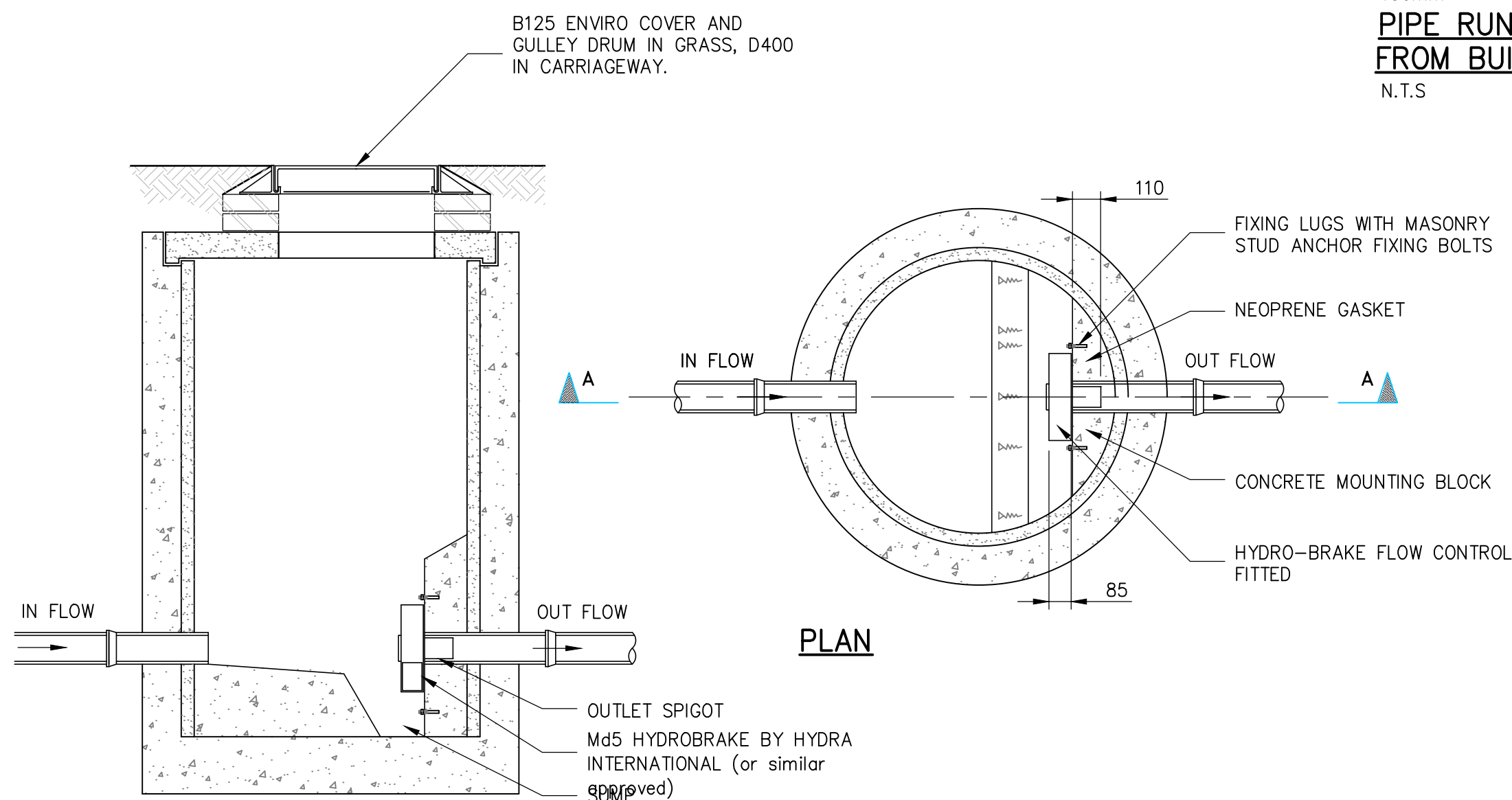
SOIL & VENT PIPE DIRECT CONNECTION
N.T.S



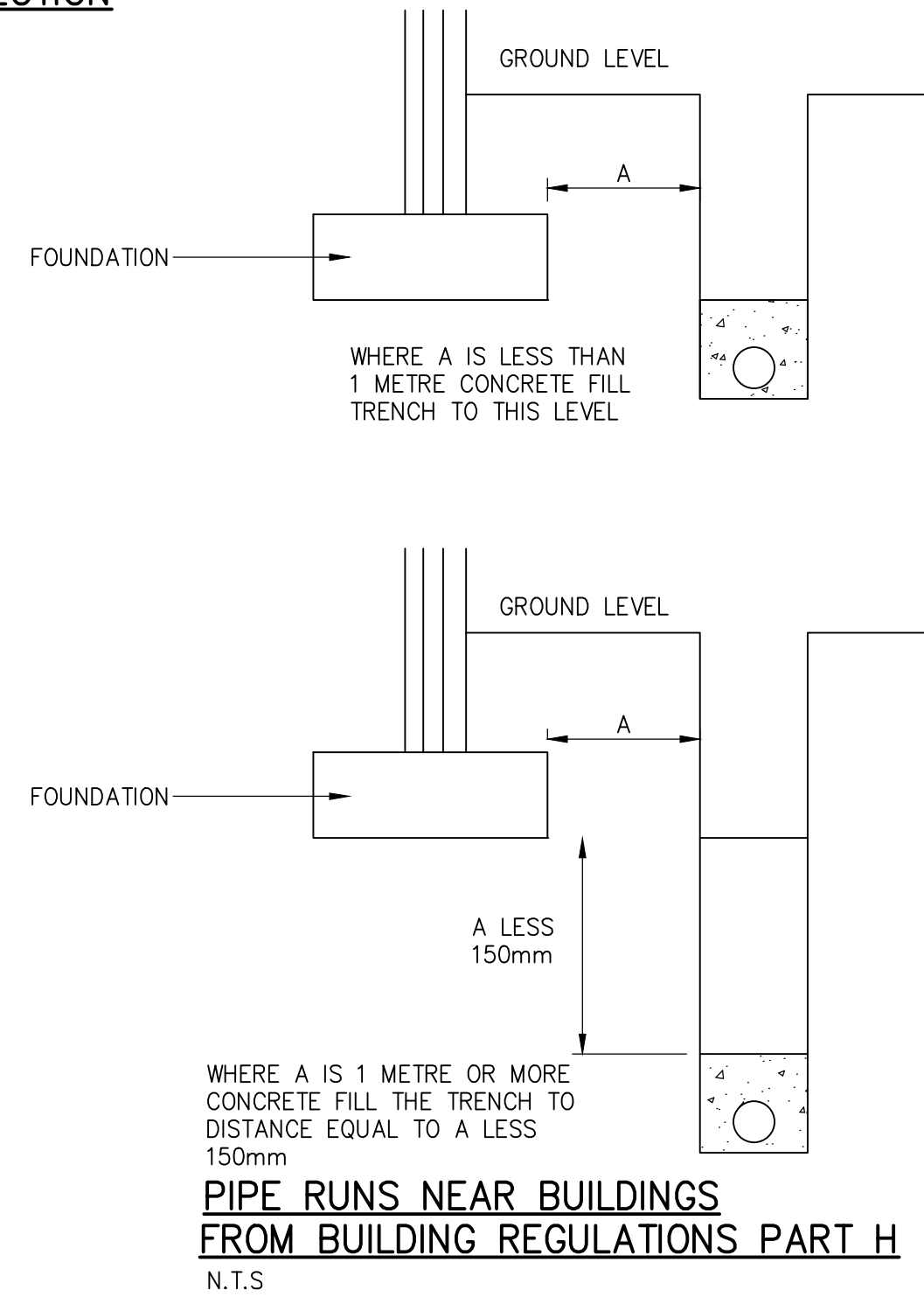
ALTERNATIVE RAIN WATER PIPE CONNECTION
N.T.S



TYPICAL ROAD GULLY DETAIL
SCALE 1:20



**SECTION A-A
PRE-FABRICATED HYDRO-BRAKE BY HYDRA INTERNATIONAL**
N.T.S



**PIPE RUNS NEAR BUILDINGS
FROM BUILDING REGULATIONS PART H**
N.T.S

This drawing should not be scaled. For construction purposes work to figured dimensions only

0mm 40mm 80mm

ORIGINAL SHEET SIZE A1

NOTES:

NOTES AS PER DRAWING 4160427-1107

FOR TENDER

T1 TENDER ISSUE 29.07.16 SB HBG

Rev. Description Date Chkd

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Client : **McDonald's RESTAURANT**

Project : **MCDONALD'S RESTAURANT
MORFA RETAIL PARK
BRUNEL WAY, SWANSEA**

Title : **DRAINAGE DETAILS
SHEET 2 OF 3**

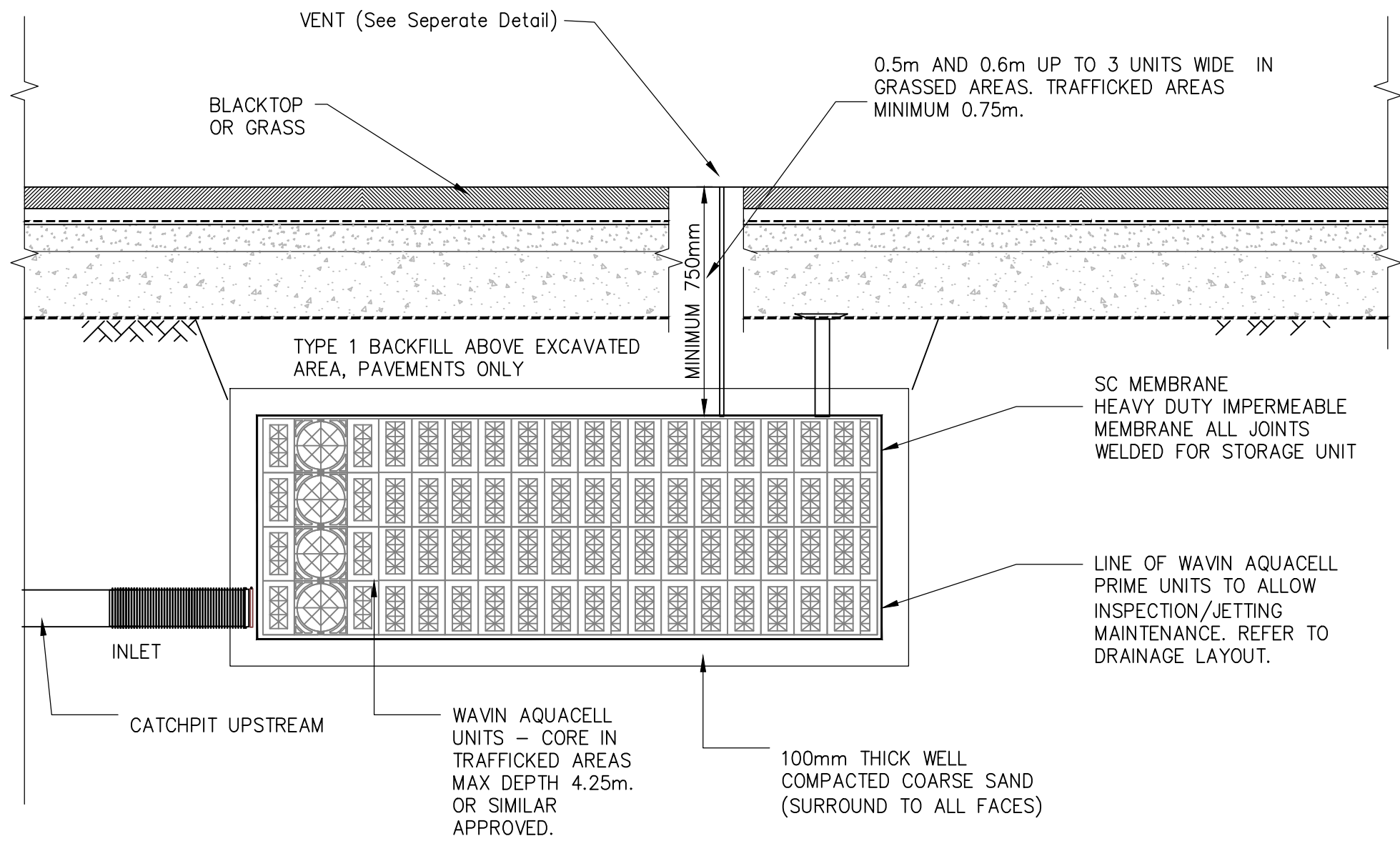
Project Engineer : HBG Scale : AS SHOWN @ A1

Project Director : NP Date : JULY 2016

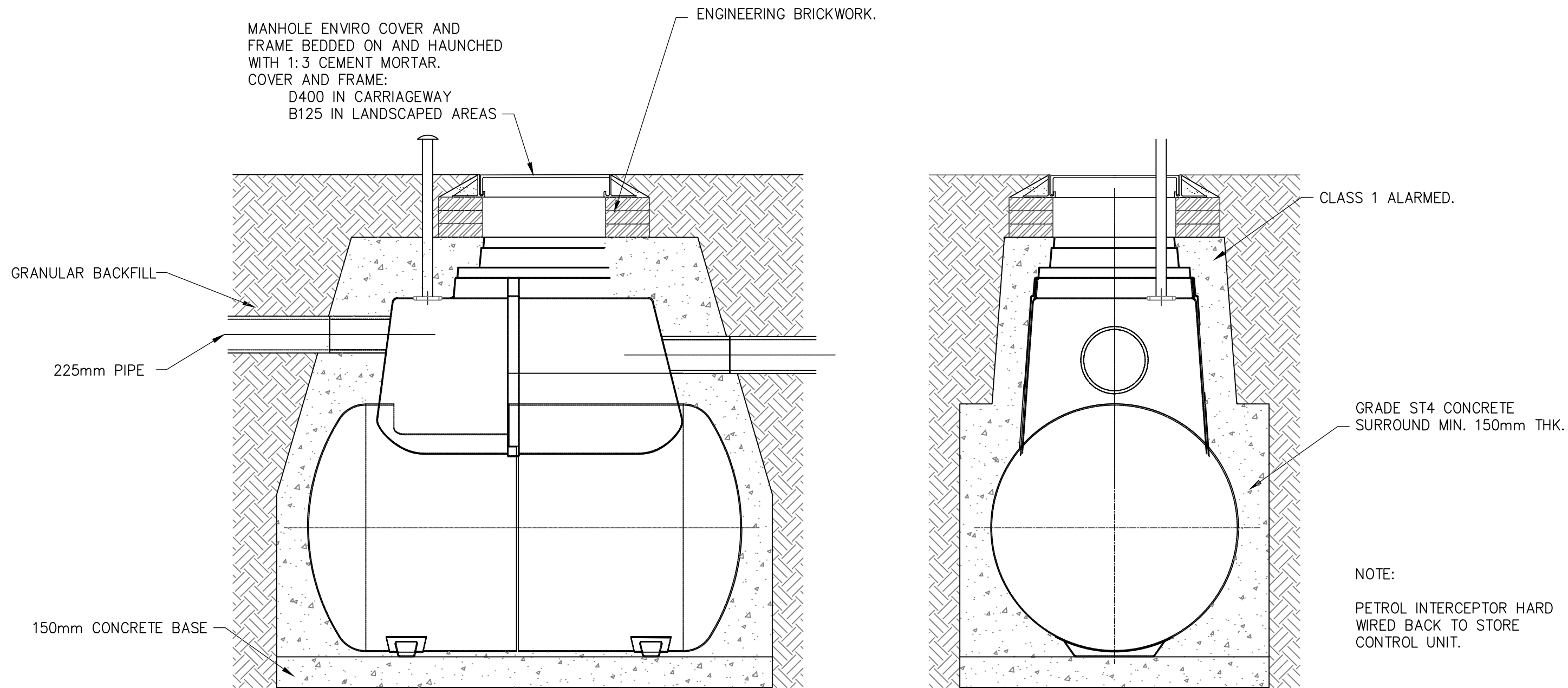
Status : CONSTRUCTION

Drawing No. 4150528-1108 Rev T1





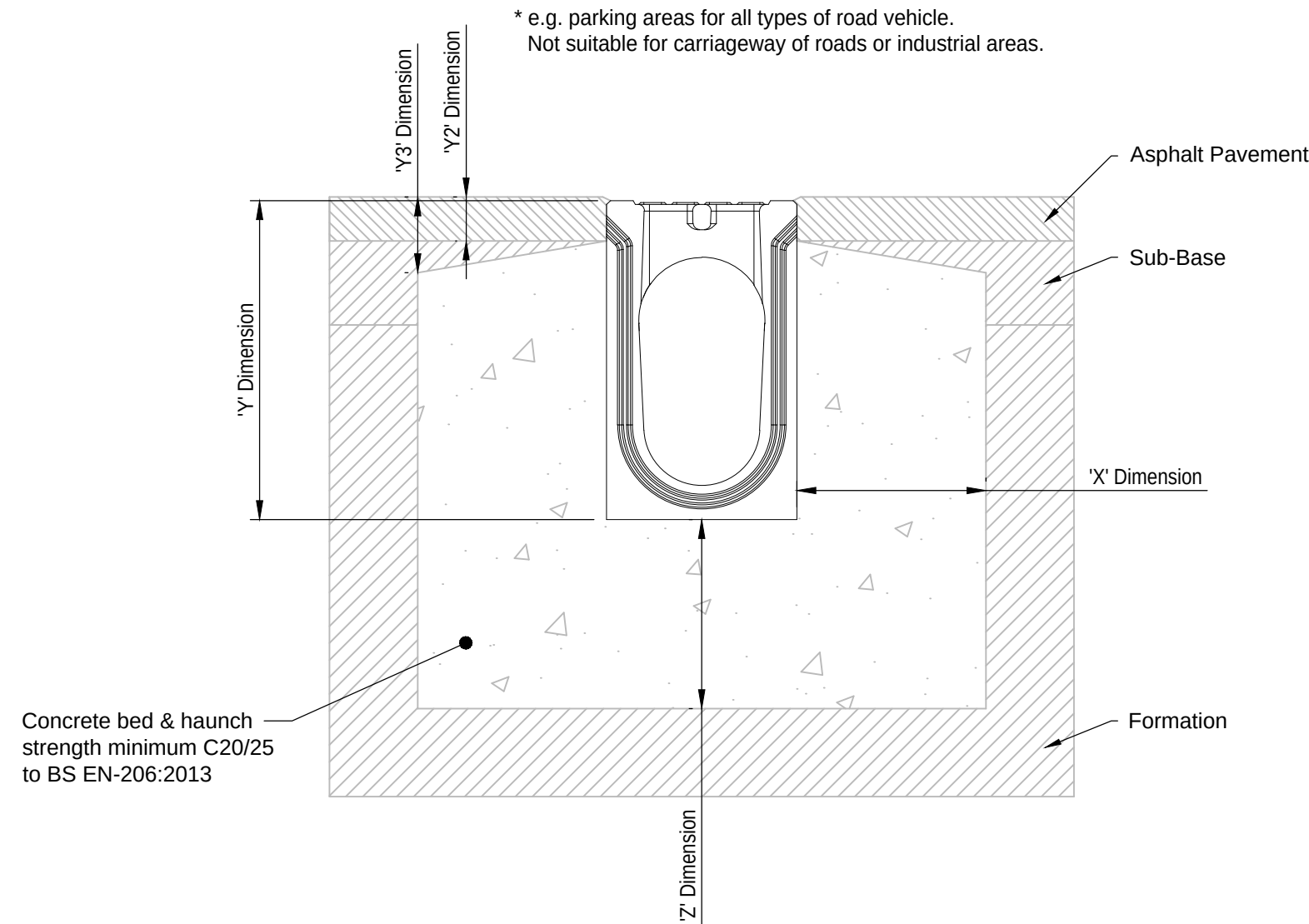
TYPICAL SECTION THROUGH STORAGE CELLS
Scale 1:20



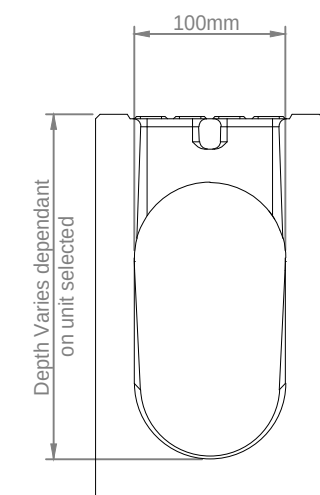
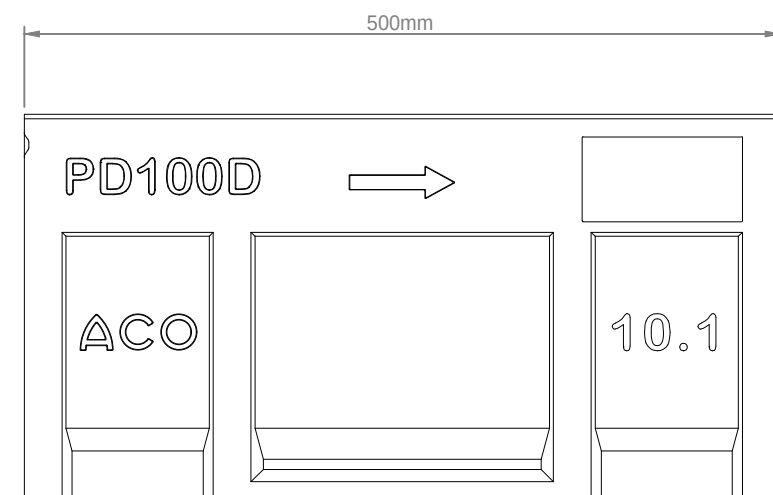
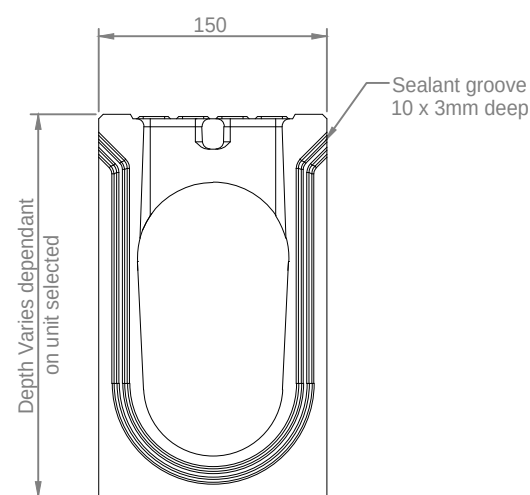
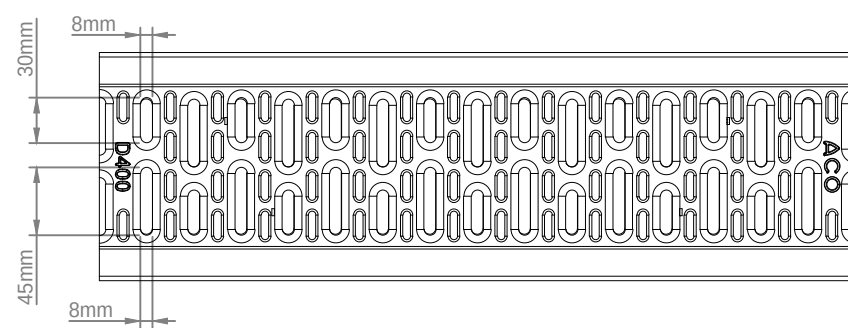
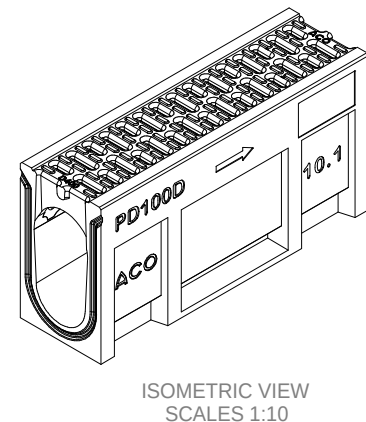
SPEL 206 C1 PETROL INTERCEPTOR (OR SIMILAR APPROVED). CONCRETE SURROUND
Scale 1:20

Load Class	Refer to Layout Drawings	
Minimum	X	150
Dimensions (mm)	Y	Full Channel Height (Less Y2 where applicable)
	Z	150
Maximum	Y2	35
Dimensions (mm)	Y3	60

* e.g. parking areas for all types of road vehicle.
Not suitable for carriageway of roads or industrial areas.



TYPICAL 'ACO' MONOBLOCK PD100D10.1 DRAINAGE CHANNEL DETAILS
Scale 1:10



0mm 40mm 80mm

ORIGINAL
SHEET SIZE A1
This drawing should not be scaled. For construction purposes, work to figured dimensions only

NOTES:

1. THIS DRAWING MUST BE READ IN CONJUNCTION WITH ALL RELEVANT ENGINEERS DRAWINGS. ANY DISCREPANCIES FOUND BETWEEN INFORMATION SHOWN ON THIS OR ANY OTHER DRAWING SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY AND PRIOR TO WORKS COMMENCING ON SITE.
2. DO NOT SCALE FROM THIS DRAWING. WORK TO FIGURED DIMENSIONS ONLY. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE.
3. INVERT LEVELS OF EXISTING DRAINAGE & CONNECTIONS SHALL BE VERIFIED PRIOR TO ANY WORKS COMMENCING ON SITE. ANY DISCREPANCY SHALL BE REPORTED TO DRAINAGE ENGINEER IMMEDIATELY.
4. INVERT LEVELS GIVEN AT MANHOLES ON DRAWING ARE THAT OF THE LARGEST DIAMETER PIPE UNLESS OTHERWISE STATED.
5. ALL PIPEWORK SHALL JOIN AT SOFFIT LEVEL UNLESS OTHERWISE STATED.
6. ABOVE GROUND DRAINAGE DETAILS AND ROUTES ARE TO BE FINALISED BY OTHERS.
7. ALL WORKS TO BE TO BUILDING REGULATIONS PART H
8. BEDDING DEPTHS APPLY TO FINISHED ROAD DEPTHS. CONTRACTOR TO PROVIDE ADEQUATE PROTECTION TO PIPES IF LOADED PRIOR TO FINISHING ROAD LAYERWORKS OR FIELD TOPSOIL.
9. ALL PRIVATE DRAINAGE WORKS SHALL BE IN ACCORDANCE WITH BS EN 752-4: 1998, SEWERS FOR ADOPTION 6TH EDITION BUILDING REGULATIONS PART H, AND OSMO DRAIN INSTALLATION SPECIFICATIONS.
10. ALL EXTERNAL DRAINAGE WORKS SHALL BE OSMO ULTRA RIB PIPEWORK, SPIGOT AND SOCKET WITH CONCRETE BED AND SURROUND IF COVER TO SOFFIT IS LESS THAN 900 IN ROADS AND 600 IN FIELDS.
11. RWP OUTLETS 110mm DIAMETER UNLESS OTHERWISE STATED ON DRAINAGE LAYOUT.
12. MINIMUM FOUL WATER DRAINAGE SHALL BE 110mm DIAMETER UNLESS OTHERWISE STATED.ALL FOUL SEWERS 160mm DIAMETER U.N.O.
13. ALL PIPEWORK SHALL JOIN AT SOFFIT LEVEL UNLESS OTHERWISE STATED ON DRAINAGE LAYOUT.
14. ALL CONCRETE AT OR BELOW GROUND LEVEL SHALL BE TO BS 8500-1:2002 DESIGN CLASS DS-1, ACEC CLASS AC-1S WITH RESPECT TO CHEMICAL ATTACK (BRE SPECIAL DIGEST 1).
15. ALL GULLIES ARE TO BE TRAPPED AND TO BS. 5911. GRATINGS AND FRAMES ARE TO BE TO BS EN 124. GULLY CONNECTIONS ARE TO BE 150mm DIAMETER AND SHALL BE LAID IN TYPE Z BEDDING WHERE UNDER PROPOSED CARRIAGEWAY.
16. IT IS THE CONTRACTORS RESPONSIBILITY TO ENSURE THAT ALL SERVICES THAT ARE AFFECTED BY THE PROPOSED WORKS ARE LOCATED PRIOR TO WORKS COMMENCING. TRIAL HOLES ARE TO BE DUG IF NECESSARY.

FOR TENDER

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Project : **MCDONALD'S RESTAURANT
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SWANSEA**

Title : **DRAINAGE DETAILS
SHEET 3 OF 3**

Project Engineer :	FG	Scale :	AS SHOWN @ A1
Project Director :	NP	Date :	JULY 2016
Status :	TENDER		

Drawing No. 4150528 - 1109 Rev T1

