

**KINGMOOR**

## **Operation & Maintenance Manual**

Bryn Lane, Bowling Bank, Wrexham, LL13 9UT

KSW-BML-XX-XX-RP-C-0502

**THURSDAY, 23<sup>RD</sup> MARCH, 2023**

## Contents Amendment Record

This report has been issued and amended as follows:

| Revision | Description                           | Issued by | Checked by  | Date       |
|----------|---------------------------------------|-----------|-------------|------------|
| P04      | Amended appendices                    | R. Abbott | A. Mavhunga | 2023-03-23 |
| P03      | Amendments to drainage design         | R. Abbott | A. Mavhunga | 2023-03-21 |
| P02      | Amendments to masterplan and drainage | R. Abbott | A. Mavhunga | 2022-10-28 |
| P01      | Preliminary issue                     | R. Abbott | A. Mavhunga | 2022-07-28 |

Barnsley Marshall Limited have prepared this report in accordance with the instructions of their client, FI Real Estate Management, for their sole and specific use. Any other persons who use any information contained herein do so at their own risk.

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# Appendices

APPENDIX A : SUDS DRAINAGE PROPOSALS

# **1. Introduction**

## **1.1 Project Background**

Barnsley Marshall Ltd was appointed by FI Real Estate Management to provide a Flood Consequences Assessment & SuDS Drainage Strategy for the proposed development of 1 industrial unit on 25.42Ha of land off Bryn Lane, Wrexham, postcode LL13 9UT.

This report provides recommended maintenance regimes for SuDS assets proposed as part of the surface water drainage for the development based on government and local authority guidance with regard to maintenance.

The report is based on currently available and preliminary discussions.

Proposals contained or forming part of this report represent the design intent and may be subject to alteration or adjustment in completing the detailed design for this project. Where such adjustments are undertaken as part of the detailed design and are deemed a material deviation from the intent contained in this document, prior approval shall be obtained from the relevant authority in advance of commencing such works.

Where the proposed works to which this report refers are undertaken more than twelve months following the issue of this report, Barnsley Marshall shall reserve the right to re-validate the findings and conclusions by undertaking appropriate further investigations at no cost to Barnsley Marshall.

## **1.2 Scope of O&M Manual**

This manual is intended to give an overview of the operation and maintenance for the range of SuDS features included with the drainage strategy. Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

The recommended maintenance regimes and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation of the proposed asset, and thereafter adjusted to suit the site requirements.

## 2. Flow Control Units

### 2.1 Location and Description

The locations and details of flow control units are shown on the SuDS Drainage Strategy Layout drawing in **Appendix A**. The main flow control device is specified as Hydro-brake or similar approved and is a proprietary product; therefore, the manufacturer's recommendations should also be taken into consideration.

### 2.2 Operation

Three Hydro-brakes intended to be the main Surface Water Control Devices from the site, limiting the outflow from the development to the existing ditch/watercourses. The Hydro-brake limiting flow from Tank 1 is 26.9 l/s for all storm events up to, and including, the 100-year + 40 CC event. The Hydro-brake limiting flow from Tank 2 is 28.8 l/s for all storm events up to, and including, the 100-year + 40 CC storm event. The Hydro-brake limiting flow from Tank 3 is 60.9 l/s for all events up to, and including, the 100-year + 40 cc storm event.

### 2.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the flow control unit.

Being part of private drainage, whole life cycle maintenance of the Flow Control Chambers and Hydro-brakes shall be the responsibility of the owners of the proposed development – FI Real Estate Management. The responsible officer is Emily Armstrong, with email: [earmstrong@fi-rem.com](mailto:earmstrong@fi-rem.com), and telephone: 01257 263 010 (land) & 07740 546 216 (mobile).

**Table 2.1** gives the recommended maintenance regime for the asset.

**Table 2.1: Recommended Maintenance Regime for Flow Control Chamber and Hydro-brake**

| Maintenance Schedule                                                                                     | Required Action                                                                                                 |  | Frequency                                              |
|----------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|--|--------------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Inspect inlets for blockages, and clear if required. If faults persist jetting and CCTV survey may be required. |  | Monthly and after large storms.                        |
| Regular maintenance/inspection                                                                           | Inspect and identify any areas that are not operating correctly. If required, take remedial action.             |  | Six-monthly                                            |
|                                                                                                          | Remove sediment and debris from flow control chambers.                                                          |  | Annually (or as required after heavy rainfall events). |
| Remedial actions                                                                                         | Repair/rehabilitation of inlets.                                                                                |  | As required.                                           |

## 3. Geo-cellular Attenuation Tank

### 3.1 Location and Description

The locations and details of the Geo-cellular Attenuation Tanks are shown on the SuDS Drainage Strategy Layout drawing in **Appendix A**. Geo-cellular Attenuation Modules vary in strength and unit sizes, and are therefore a proprietary product therefore the manufacturer's recommendations should also be taken into consideration. The details shown are based on **Polystorm Xtra** modules, but the contractor may be able to find a cheaper supplier of a similar product. The engineer will evaluate the alternative product and approve before it can be used as an alternative.

### 3.2 Operation

Three attenuation tanks are intended to be the surface water storage features to attenuate the discharge from the site up to and including the 100-year plus 40% climate change event. The tanks are intended to be empty between rainfall events. Access for maintenance has been provided from the manhole chambers upstream and downstream of the tanks.

### 3.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the attenuation tank. The Inspection Chamber (Catchpit with 450mm sump) immediately upstream of the attenuation tank should be cleansed of silt annually to prevent silt from entering the tank.

Being part of private drainage, whole life cycle maintenance of the geo-cellular tanks shall be the responsibility of the owners of the proposed development – FI Real Estate Management. The responsible officer is Emily Armstrong, with email: [earmstrong@fi-rem.com](mailto:earmstrong@fi-rem.com), and telephone: 01257 263 010 (land) & 07740 546 216 (mobile).

**Table 3.1** gives the recommended maintenance regime for the asset.

**Table 3.1: Recommended Maintenance Regime for Geo-cellular Attenuation Tank**

| Regular Maintenance                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|----------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monthly                                                                                                                                | <ul style="list-style-type: none"> <li>Inspect and identify any areas that are not operating correctly. If required, take remedial action. (for 3 months following installation)</li> <li>Debris removal from catchment surface (where may cause risks to performance)</li> <li>Inspect systems as specified by the manufacturer</li> <li>Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.</li> </ul> |
| Sixth Monthly                                                                                                                          | <ul style="list-style-type: none"> <li>Inspect and identify any areas that are not operating correctly. If required, take remedial action. (following initial 3-month period)</li> </ul>                                                                                                                                                                                                                                                                                                                                                  |
| Annually                                                                                                                               | <ul style="list-style-type: none"> <li>Remove sediment from pre-treatment structures (e.g. upstream silt traps or Vortex flow control upstream) and geo-cellular system where required (High pressure water jetting)</li> <li>Inspect and document the presence of wildlife</li> </ul>                                                                                                                                                                                                                                                    |
| Remedial Actions: Significant storms may cause significant damage to SuDS. As such, many actions may be required following such events |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Following all significant storm events                                                                                                 | <ul style="list-style-type: none"> <li>Inspect and carry out essential recovery works to return the feature to full working order</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              |

## 4. Permeable Pavements

### 4.1 Location and Description

The permeable pavements are proposed as the construction make-up for proposed parking bays throughout the site as shown on drainage strategy drawing KSW-BML-XX-XX-SK-C-0501 included in **Appendix A**.

Permeable pavement underlaid by a drainage blanket (0-40mm sub-base) wrapped in impermeable geo-membrane will allow runoff to undergo cleansing by the sand layer and sub-base before being collected by the proposed Permavoid Diffuser Unit. The permeable pavement shall be System C to BS 7533-13:2009 Figure 4, with an impermeable liner and collection pipe at the base of the sub-base.

### 4.2 Operation

The pavement has been designed to mimic the hydrological behaviour of soft landscaping by allowing the water to permeate into a sub-base at the same rate as it would naturally occur thus slowing the flow prior to entering the main surface water drain. The permeable paving is designed to treat and store runoff prior to discharge to surface water system downstream.

### 4.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the Permeable Pavements.

Being part of private drainage and pavement, whole life cycle maintenance of Permeable Pavements shall be the responsibility of the owners of the proposed development – FI Real Estate Management. The responsible officer is Emily Armstrong, with email: [eamstrong@fi-rem.com](mailto:eamstrong@fi-rem.com), and telephone: 01257 263 010 (land) & 07740 546 216 (mobile).

**Table 4.1** gives the recommended maintenance regime for the asset.

**Table 4.1: Recommended Maintenance Regime for Permeable Pavements**

| Maintenance Schedule                                                                                     | Required Action                                                                                                                                                                                                                     | Frequency                                                                                                                                                                |
|----------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monitoring (to be undertaken more regularly within the first year of operation and adjusted as required) | Initial inspection.                                                                                                                                                                                                                 | Monthly for three months after installation                                                                                                                              |
|                                                                                                          | Inspect for evidence of poor operation and/or weed growth. If required take remedial action.                                                                                                                                        | 3-monthly, 48 hours after large storms.                                                                                                                                  |
|                                                                                                          | Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving.             | Annually.                                                                                                                                                                |
|                                                                                                          | Monitor inspection chambers.                                                                                                                                                                                                        | Annually.                                                                                                                                                                |
| Regular maintenance\inspection                                                                           | Brushing and vacuuming.                                                                                                                                                                                                             | Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations. |
| Occasional maintenance                                                                                   | Stabilise and mow contributing and adjacent areas.                                                                                                                                                                                  | As required and as per landscape architect's specification.                                                                                                              |
|                                                                                                          | Removal of weed.                                                                                                                                                                                                                    | As required.                                                                                                                                                             |
| Remedial actions                                                                                         | Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.                                                                                           | As required.                                                                                                                                                             |
|                                                                                                          | Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.                                                                                   | As required.                                                                                                                                                             |
|                                                                                                          | Rehabilitation of surface and upper sub-structure. This could include replacement of the jointing and bedding material. The upper geotextiles layer may also need replacing if clogged and Terram 1000 has a life span of 25 years. | As required (if infiltration performance is reduced as a result of significant clogging).                                                                                |

## 5. Swale

### 5.1 Location and Description

The proposed swales are shown on the SuDS Drainage Strategy Layout drawing, in **Appendix A**. The grass seeding, flowers, shrubs, and plants within the pond area will be recommended by a Landscape Architect.

### 5.2 Operation

The planted flora will require periodic replacement to get rid of the accumulated adsorbed pollutants. The overflow pipe should be periodically cleansed of accumulated grass or debris to keep it fully effective.

### 5.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the swale.

Being part of private drainage, whole life cycle maintenance of the swales shall be the responsibility of the owners of the proposed development – FI Real Estate Management. The responsible officer is Emily Armstrong, with email: [earmstrong@fi-rem.com](mailto:earmstrong@fi-rem.com), and telephone: 01257 263 010 (land) & 07740 546 216 (mobile).

**Table 5.1** gives the recommended maintenance regime for the asset.

**Table 5.1: Recommended Maintenance Regime for Storage Pond and Swale**

| Regular Maintenance                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Monthly                                                                                                                                        | <ul style="list-style-type: none"> <li>• Litter and debris removal</li> <li>• Mulching (where required)</li> <li>• Inspect/check all inlets, outlets, surface and overflow (where required) to ensure that they are in good condition, free from blockages and operating as designed.</li> <li>• Take action where required.</li> </ul>                                                                                                                                                                                                                                                                   |
| Six Monthly                                                                                                                                    | <ul style="list-style-type: none"> <li>• Remove nuisance and invasive vegetation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Annually                                                                                                                                       | <ul style="list-style-type: none"> <li>• Pruning and trimming of trees</li> <li>• Inspect and document the presence of wildlife</li> <li>• Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where required</li> </ul>                                                                                                                                                                                                                                                                                                                |
| As Required                                                                                                                                    | <ul style="list-style-type: none"> <li>• Repair erosion or other damage by re-mulching or re-seeding</li> <li>• Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required</li> <li>• Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface (typically every 60-month period)</li> <li>• Remove build-up of sediment, reinstate design levels (typically every 60-month period)</li> <li>• Remove and dispose of oils or petrol residues using safe standard practices</li> </ul> |
| Remedial Actions: Significant storms may cause significant damage to SuDS. As such, a number of actions may be required following such events. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Following all significant storm events                                                                                                         | <ul style="list-style-type: none"> <li>• Inspect and carry out essential recovery works to return the feature to full working order.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

## 6. Vortex Separator

### 6.1 Location and Description

The location of the Vortex Separator is indicated on the SuDS Drainage Strategy Layout drawing in **Appendix A**.

### 6.2 Operation

The Vortex Separator reliably captures and retains sediments, oil, trash and floatables from surface water runoff. This prevents all these impurities from reaching the storage tanks and public sewers, and hence protect natural water bodies downstream from pollution as a result of development of once greenfield catchments.

### 6.3 Inspection and Maintenance Regime

Regular inspection and maintenance are important for the effective operation of the Vortex Separator.

Being part of private drainage, whole life cycle maintenance of the swales shall be the responsibility of the owners of the proposed development – FI Real Estate Management. The responsible officer is Emily Armstrong, with email: [earmstrong@fi-rem.com](mailto:earmstrong@fi-rem.com), and telephone: 01257 263 010 (land) & 07740 546 216 (mobile).

**Table 6.1** gives the recommended maintenance regime for the asset.

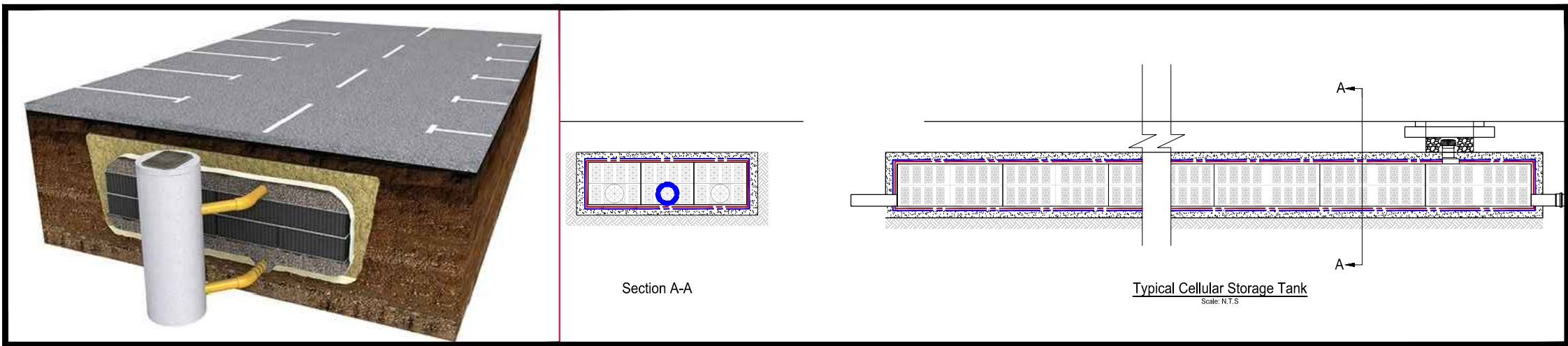
**Table 6.1: Recommended Maintenance Regime for the Vortex Separator**

| Regular Maintenance     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| After first large storm | <ul style="list-style-type: none"> <li>Check that the unit is operating as usual soon after the large storm</li> </ul>                                                                                                                                                                                                                                                                                                                                                                               |
| Six Monthly             | <ul style="list-style-type: none"> <li>Opening to the immediate upstream and downstream structures from the Vortex Separator should be inspected to ensure debris is not preventing stormwater from being collected in the drainage system and directed into the unit. Any debris should be removed and properly disposed of.</li> <li>The unit should be inspected for floatables and sediment accumulation. Maintenance logs for the treatment should be completed for each site visit.</li> </ul> |
| Annually                | <ul style="list-style-type: none"> <li>Removal of floatables and sediments from the Vortex Separator using a vacuum tanker or similar equipment.</li> <li>Every time the unit is emptied the internal components should be checked and any damage repaired. Any damage liable to affect the unit's operation should be reported immediately to the supplier.</li> </ul>                                                                                                                              |

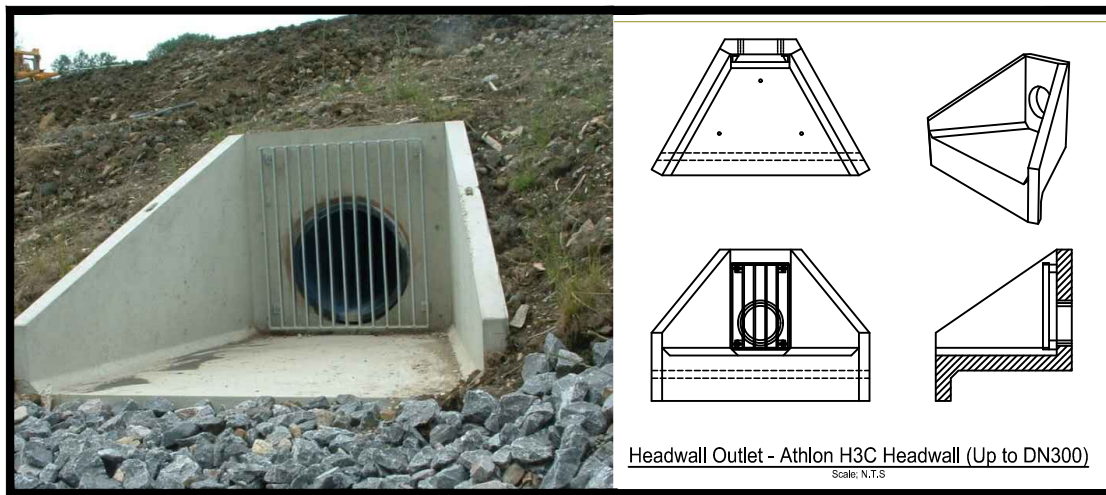
## APPENDICES

# Appendix A

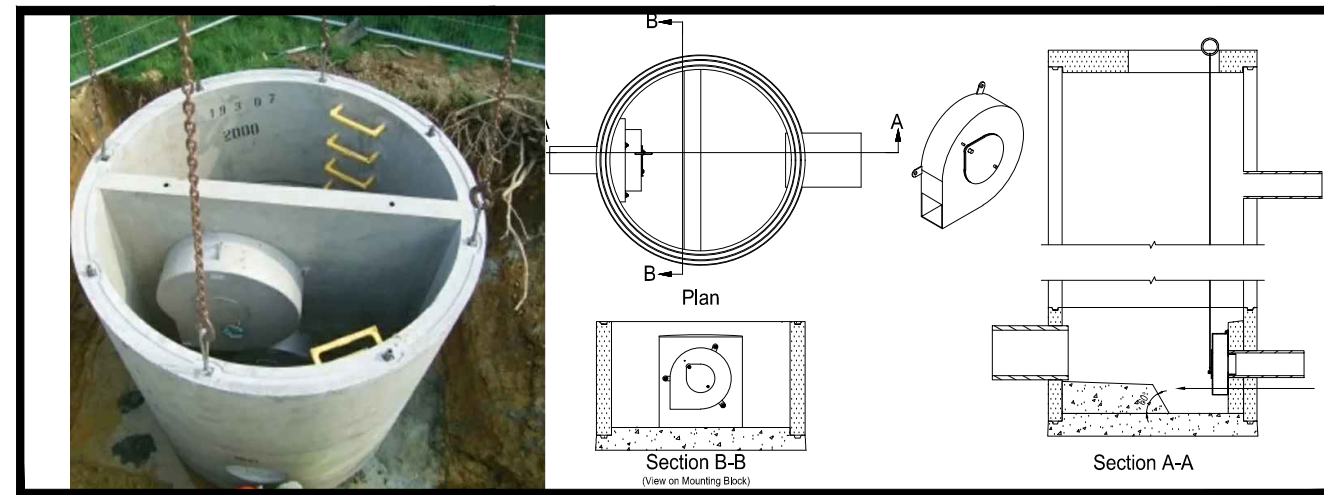
## SuDS Drainage Proposal



Insert 1  
n.t.s



Insert 2  
n.t.s



Insert 3  
n.t.s

#### Safety, Health & Environmental Information:

In addition to the hazards and risks normally associated with the types of work detailed on this drawing, please note the significant hazards identified by symbols below,

INDICATES A RESIDUAL RISK AS A WARNING

INDICATES A RESIDUAL RISK FOR INFORMATION

and described below:

#### Construction/Maintenance/Cleaning/Demolition

Refer to Drawing:

#### General Notes:

1. Do not scale from this drawing.
2. All dimensions are in millimetres (mm), all levels in metres (m) unless noted otherwise.
3. Discrepancies or omissions are to be reported to the Engineer prior to work commencing.
4. Materials and workmanship are to comply in all respects with current British Standard Specifications, Codes of Practice, and Building Regulations Approved Documents.
5. The copyright of this drawing is vested in the Engineer and must not be copied or reproduced without written consent.
6. The Contractor is to check and verify all building and site dimensions, levels and sewer invert levels at connection points before work commences.
7. This drawing is to be read in conjunction with all relevant specifications and drawings issued by the Engineer, Architect and other Specialists.

#### Key

|  |                            |
|--|----------------------------|
|  | Drainage Sub - Catchment 1 |
|  | Drainage Sub - Catchment 2 |
|  | Drainage Sub - Catchment 3 |
|  | Dock Levellers Locations   |

|     |           |            |                                                  |
|-----|-----------|------------|--------------------------------------------------|
| P05 | RA/AM     | 23/03/2023 | Addition of New Pond                             |
| P04 | RA/AM     | 20/03/2023 | Treatment Pond 2 split to avoid new pond         |
| P03 | RA/AM     | 25/10/2022 | Masterplan amended, Drainage amended to suit     |
| P02 | DH/AM     | 03/10/22   | Foul Drainage revised to include treatment tanks |
| P01 | DH/AM     | 29/07/22   | Preliminary Issue                                |
| Rev | By / Chkd | Date       | Description                                      |

**PRELIMINARY DRAWING**  
This drawing is not to be used for construction

Client



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Project

Kingmoor Site, Wrexham

Drawing

High Level Drainage Strategy

|             |                         |          |            |
|-------------|-------------------------|----------|------------|
| By          | DH/AM                   | Date     | 09/02/2022 |
| Drawing No. | KSW-BML-XX-XX-SK-C-0501 | Revision | P05        |
| BML Job No. | 1000-03                 | Status   | -          |

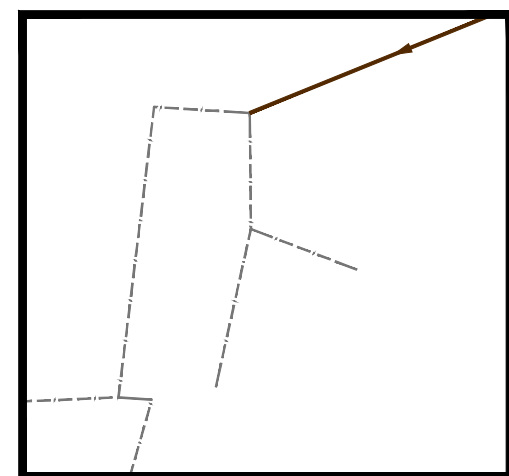
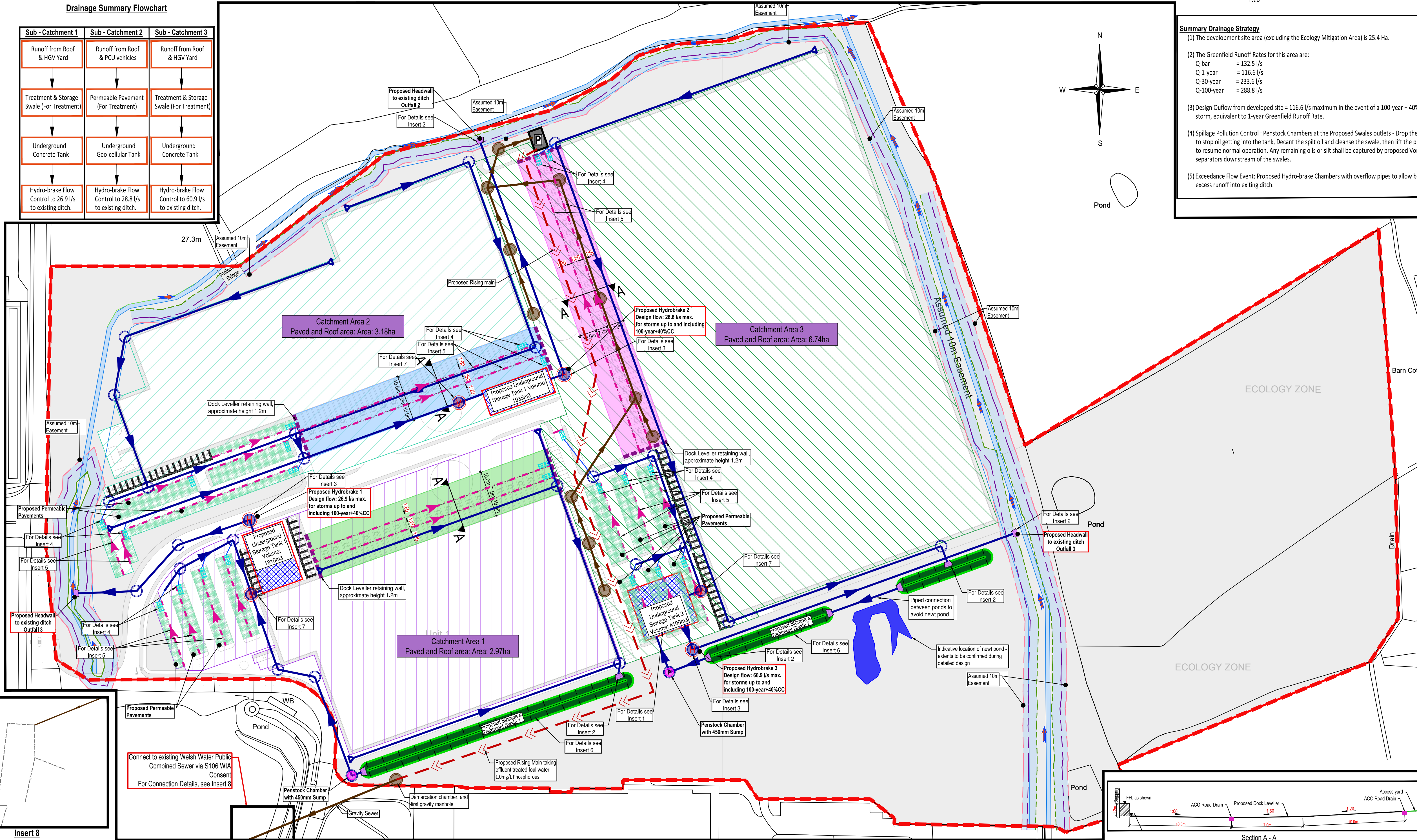
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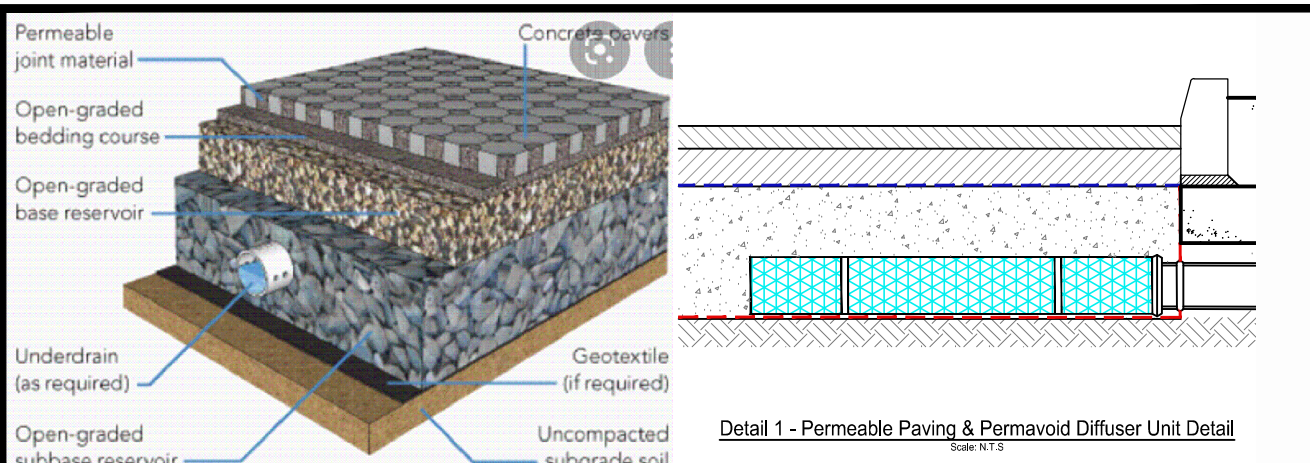
Insert 4  
n.t.s

#### Drainage Summary Flowchart

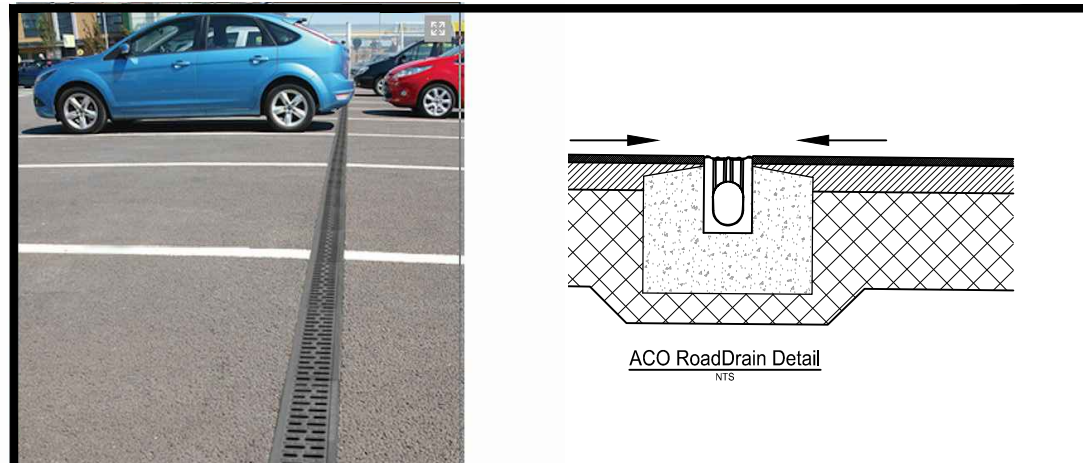
| Sub - Catchment 1                                       | Sub - Catchment 2                                       | Sub - Catchment 3                                       |
|---------------------------------------------------------|---------------------------------------------------------|---------------------------------------------------------|
| Runoff from Roof & HGV Yard                             | Runoff from Roof & PCU vehicles                         | Runoff from Roof & HGV Yard                             |
| Treatment & Storage Swale (For Treatment)               | Permeable Pavement (For Treatment)                      | Treatment & Storage Swale (For Treatment)               |
| Underground Concrete Tank                               | Underground Geo-cellular Tank                           | Underground Concrete Tank                               |
| Hydro-brake Flow Control to 26.9 l/s to existing ditch. | Hydro-brake Flow Control to 28.8 l/s to existing ditch. | Hydro-brake Flow Control to 60.9 l/s to existing ditch. |



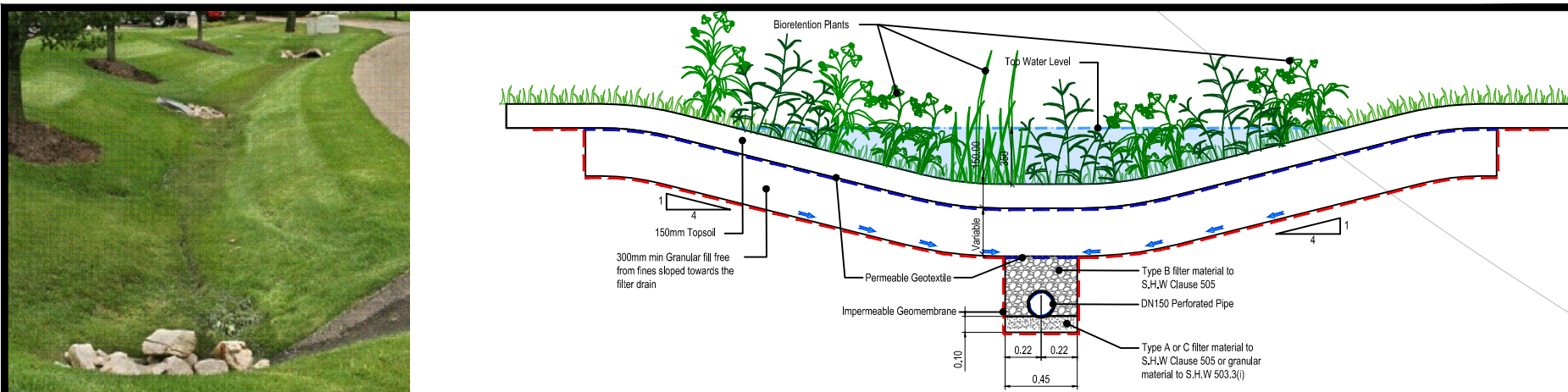
Insert 8  
Scale 1:10,000



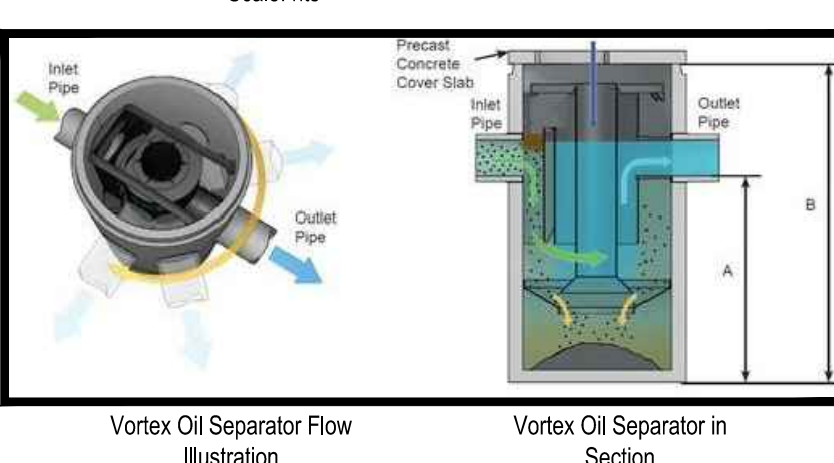
Insert 4  
n.t.s



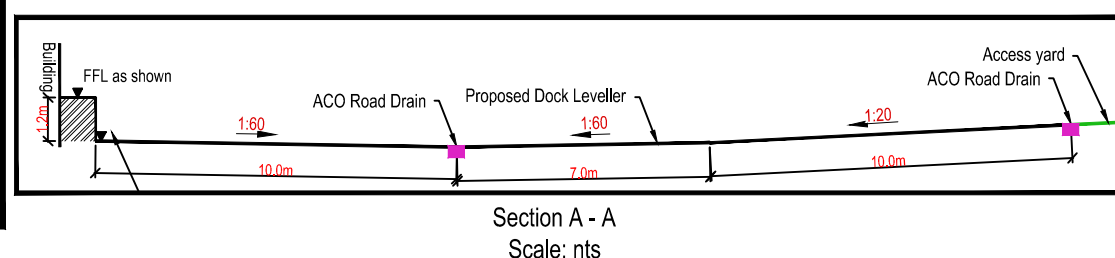
Insert 5  
n.t.s



Insert 6  
n.t.s



Insert 7  
n.t.s



Section A - A  
Scale: n.t.s