

Objectives and Actions

Our Local Flood Risk Management Strategy objectives have been developed considering historic and predicted flood risk, relevant plans and strategies and the views of local residents, businesses and other Risk Management Authorities.

The supporting Action Plan brings together the actions and priorities set out in our Strategy and plans for investment in flood alleviation from all partners across Staffordshire and Shropshire. Progress will be monitored and annual reports will be published on our website. The Action Plan sits within Part 2 of the Strategy and a summary can be viewed below.

Objective 1

Develop a strategic understanding of flood risk from all sources

Actions:

- Manage local flood risk using a risk-based and evidence-based programme
- Investigate flooding incidents, working with all RMAs and local communities
- Produce local flood risk management plans for high priority locations.
- Improve evidence, information, and mapping and modelling tools to understand better the risks of flooding and to support better decisions and greater resilience (EA to lead)
- Support the Environment Agency to implement the Humber Flood Risk Management Plan and update the Staffordshire Preliminary Flood Risk Assessment

Objective 2

Promote effective management of drainage and flood defence systems

Actions:

- Use Land Drainage powers to manage the watercourse network
- Update and improve the Asset Register
- Maintain existing main river flood defences (EA to lead)
- Maintain the public sewer network (Sewerage Companies to Lead)
- Maintain watercourses in IDB areas (Sow and Penk IDB to lead)

Objective 3

Support communities to understand flood risk and become more resilient to flooding

Actions:

- Support communities at risk of flooding to take action to increase their resilience.
- Provide flood warnings to local communities
- Support communities at risk in fast responding catchments prone to flash flooding to take appropriate action

Objective 4

Manage local flood risk and new development in a sustainable manner

Actions:

- Seek the inclusion of Sustainable Drainage Systems wherever possible within new developments and prepare a Local Sustainable Drainage System (SuDS) Handbook
- Regarding Sustainable Drainage Systems, respond to planning applications within 21 days as Statutory / Non-Statutory Consultee
- Regarding river flood risk, respond to planning applications within 21 days as Statutory Consultee (Environment Agency to lead)
- Assist with the development of planning policies, site allocations, neighbourhood plans and identification of future infrastructure needs
- Work with developers and Local Planning Authorities to secure appropriate connections to sewers / IDB assets (water companies and IDBs to lead)

Objective 5

Achieve results through partnership and collaboration

Actions:

- Raise awareness of the roles of all Risk Management Authorities and work in partnership to effectively manage flood risk
- Work collaboratively with Shropshire Council
- Support the delivery of the Council's Climate Change Strategy

- Work with Infrastructure Plus, the Councils Highways Delivery Partnership, to integrate programmes of work
- Work with landowners, communities and other organisations to influence land management practices

Objective 6

Be better prepared for flood events

Actions:

- Work with the Staffordshire Civil Contingencies Unit to help inform flood preparedness, response and recovery planning
- Work with local communities to develop Local Flood Action Plans
- Maintain and, where possible, seek to improve accuracy of flood forecasting and warning where these services currently exist (Environment Agency to lead)

Objective 7

Secure and manage funding for flood risk management in a challenging financial climate

Actions:

- Work in partnership with other Risk Management Authorities to deliver flood alleviation schemes on a six year rolling programme.
- Maximise external fundraising opportunities
- Work with local communities to develop Flood Alleviation Schemes that meet local needs
- Work with other Risk Management Authorities in partnership where there are interactions with the sewer network (water companies to lead)

APPENDIX I: SURFACE WATER RUN-OFF CALCULATIONS

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SURFACE WATER RUN-OFF CALCULATION SHEET

| | |
|-------------|------------------------|
| Development | FROGHALL ROAD, CHEADLE |
| Project No. | HYD618 |

| | | | |
|----------|------------|--------------|----|
| Revision | B | Completed by | MB |
| Date | 16/08/2021 | Checked by | KW |

| | | | |
|-----------------------------------|-------|----|-----|
| Areas | | | |
| Total Site | 8.540 | ha | |
| Development Area ¹ | 5.550 | ha | |
| Existing Impermeable | 0.000 | ha | |
| Existing Impermeable ² | 0.000 | ha | |
| Existing Pervious | 8.540 | ha | |
| Existing Pervious ² | 0.000 | ha | |
| Proposed total impermeable | 3.660 | ha | 66% |

| | | | |
|----------------------------------|-------|-------|-------------------|
| Catchment Characteristics | | | |
| SAAR | 878 | mm | |
| SPR | 0.44 | | |
| BFI | 0.538 | | |
| i_1 | 17.8 | mm/hr | d_1 24.9 mm |
| i_{30} | 34.1 | mm/hr | d_{30} 52.1 mm |
| i_{100} | 46.1 | mm/hr | d_{100} 70.6 mm |

| | | | |
|-------------------------------------------|----------------------|-------|-----|
| Run-off Rates | | | |
| <i>Pre-development</i> | | | |
| Impermeable ----- | 1yr | 0.0 | l/s |
| | 30yr | 0.0 | l/s |
| | 100yr | 0.0 | l/s |
| | 40mm/hr ³ | 0.0 | l/s |
| Pervious ⁴ ----- | 1yr | 23.3 | l/s |
| | 30yr | 56.2 | l/s |
| | 100yr | 72.2 | l/s |
| | QBar ⁵ | 28.1 | l/s |
| Total ----- | 1yr | 23.3 | l/s |
| | 30yr | 56.2 | l/s |
| | 100yr | 72.2 | l/s |
| <i>Post-development (without control)</i> | | | |
| Impermeable ⁶ ----- | 1yr | 180.9 | l/s |
| | 30yr | 346.2 | l/s |
| | 100yr+40%CC | 656.2 | l/s |

| | | | |
|--------------------------------|----------------------|--------|------|
| Volumes | | | |
| <i>Pre-development</i> | | | |
| Impermeable ----- | 1yr | 0.0 | cu.m |
| | 30yr | 0.0 | cu.m |
| | 100yr | 0.0 | cu.m |
| | 40mm/hr ³ | 0.0 | cu.m |
| Pervious ⁴ ----- | 1yr | 659.5 | cu.m |
| | 30yr | 1244.0 | cu.m |
| | 100yr | 1685.0 | cu.m |
| | QBar ⁵ | 28.1 | l/s |
| Total ----- | 1yr | 659.5 | cu.m |
| | 30yr | 1244.0 | cu.m |
| | 100yr | 1685.0 | cu.m |
| <i>Post-development</i> | | | |
| Impermeable ⁶ ----- | 1yr | 91.2 | cu.m |
| | 30yr | 190.8 | cu.m |
| | 100yr+40%CC | 258.3 | cu.m |

| | | | | |
|------------------------------------------------------------------|----------|-------|-------|-------------|
| Stormwater Storage Estimates | | | | |
| <i>Based on Greenfield run-off QBar</i> | | | | |
| Microdrainage Quick Storage Estimates (using FEH catchment data) | | | | |
| Return Period | Rate | lower | upper | mean |
| 1yr | 28.1 l/s | 377 | 687 | 532 cu.m |
| 30yr | 28.1 l/s | 1062 | 1471 | 1266.5 cu.m |
| 100yr+40%CC | 28.1 l/s | 2437 | 2997 | 2717 cu.m |

1/ The 'development area' removes areas of POS and/or landscaped areas of the wider site that are to remain as existing.
 2/ On occasion the existing impermeable area cannot be evidenced to connect and a reduction is applied.
 3/ 50mm/hr is used for BRegs calculations and often used by Water Companies when considering allowable post-development rates of discharge. (Rational Method)
 4/ The Greenfield rates and of run-off have been calculated using the UK SUDS Calculator
 5/ QBar is the estimated flood flow for the 2.33yr return period event and is often used as a post-development rate restriction.
 6/ Post-development run-off is only considered from the impermeable area when the proposed post-development impermeable area >50% in accordance with the EA Guidance Preliminary rainfall runoff management for developments (W5-074/ATR1/1 rev E (2012)).

NB. The catchment characteristics are from the FEH catchment, the UK SUDS Calculator and Microdrainage.
 NB. The rainfall intensities and depths are calculated for the 6hr duration rainfall event (peak summer intensity)

| | |
|----------------|-------------|
| Calculated by: | Megan Berry |
| Site name: | FROGHALL RD |
| Site location: | CHEADLE |

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

Site Details

| | |
|------------|-------------------|
| Latitude: | 53.00161° N |
| Longitude: | 1.98138° W |
| Reference: | 3150748471 |
| Date: | Aug 16 2021 10:55 |

Runoff estimation approach

FEH Statistical

Site characteristics

| | |
|-----------------------|------|
| Total site area (ha): | 5.55 |
|-----------------------|------|

Methodology

| | |
|---------------------------------------------|-----------------------------|
| Q _{MED} estimation method: | Calculate from BFI and SAAR |
| BFI and SPR method: | Specify BFI manually |
| HOST class: | N/A |
| BFI / BFIHOST: | 0.538 |
| Q _{MED} (l/s): | |
| Q _{BAR} / Q _{MED} factor: | 1.12 |

Hydrological characteristics

| | Default | Edited |
|--------------------------------|---------|--------|
| SAAR (mm): | 881 | 881 |
| Hydrological region: | 4 | 4 |
| Growth curve factor 1 year: | 0.83 | 0.83 |
| Growth curve factor 30 years: | 2 | 2 |
| Growth curve factor 100 years: | 2.57 | 2.57 |
| Growth curve factor 200 years: | 3.04 | 3.04 |

Notes

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

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

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

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


(3) Is $SPR/SPRHOST \leq 0.3$?

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

Greenfield runoff rates

| | Default | Edited |
|-------------------------|---------|--------|
| Q _{BAR} (l/s): | | 28.1 |
| 1 in 1 year (l/s): | | 23.33 |
| 1 in 30 years (l/s): | | 56.21 |
| 1 in 100 year (l/s): | | 72.22 |
| 1 in 200 years (l/s): | | 85.43 |

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

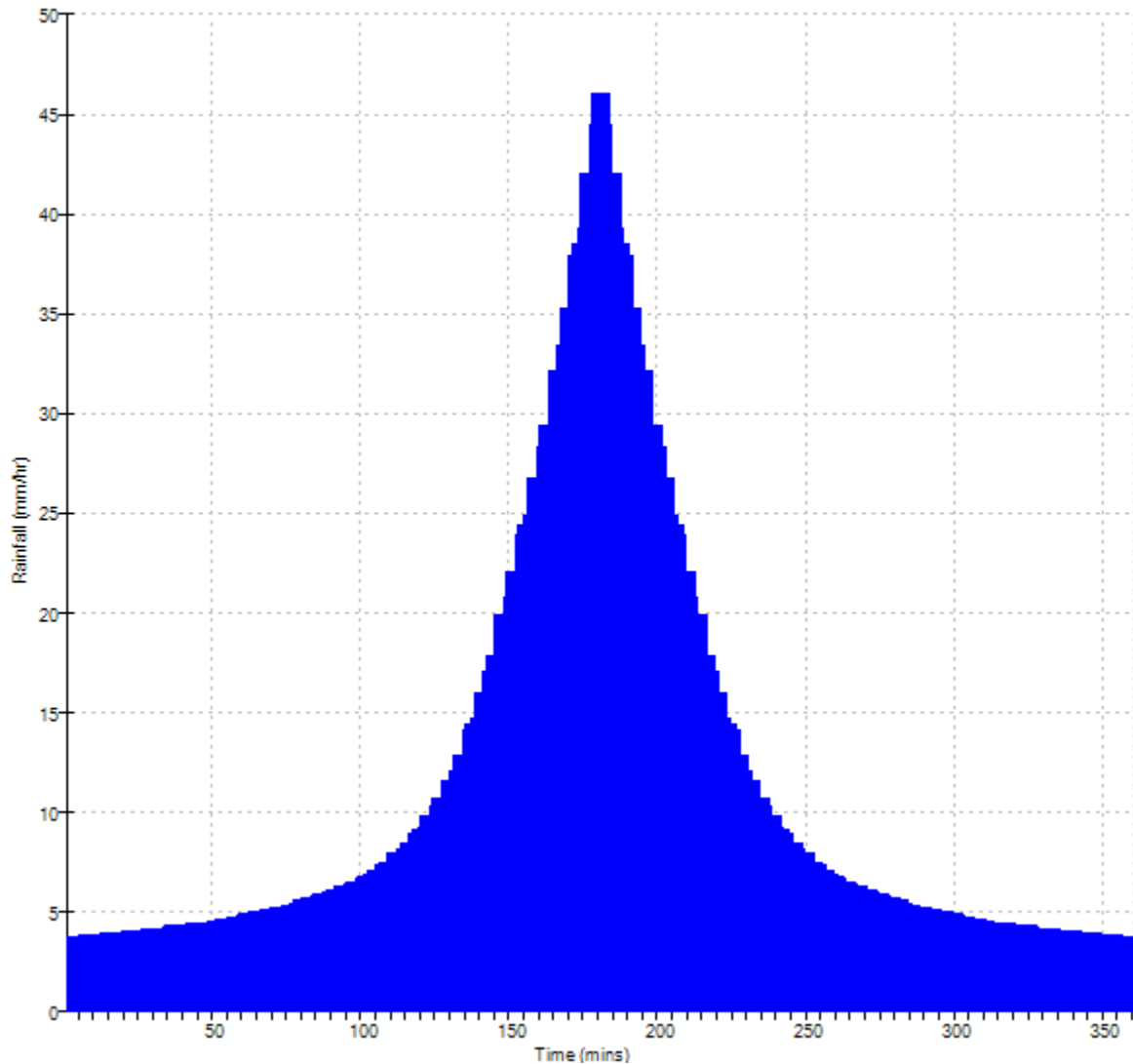
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| Betts Associates Ltd | | Page 1 |
| Old Marsh Farm Barns Welsh Road Sealand Flintshire CH5 2LY | |  |
| Date 03/06/2021 10:44 | Designed by MeganBerry | |
| File | Checked by | |
| Micro Drainage | | Network 2018.1 |


Rainfall profile

Storm duration (mins) 360

FEH Data

| | |
|------------------------|---------------------------------|
| FEH Rainfall Version | 2013 |
| Site Location | GB 401240 344781 SK 01240 44781 |
| Data Type | Point |
| Peak Intensity (mm/hr) | 46.104 |
| Ave. Intensity (mm/hr) | 11.761 |
| Return Period (years) | 100.0 |



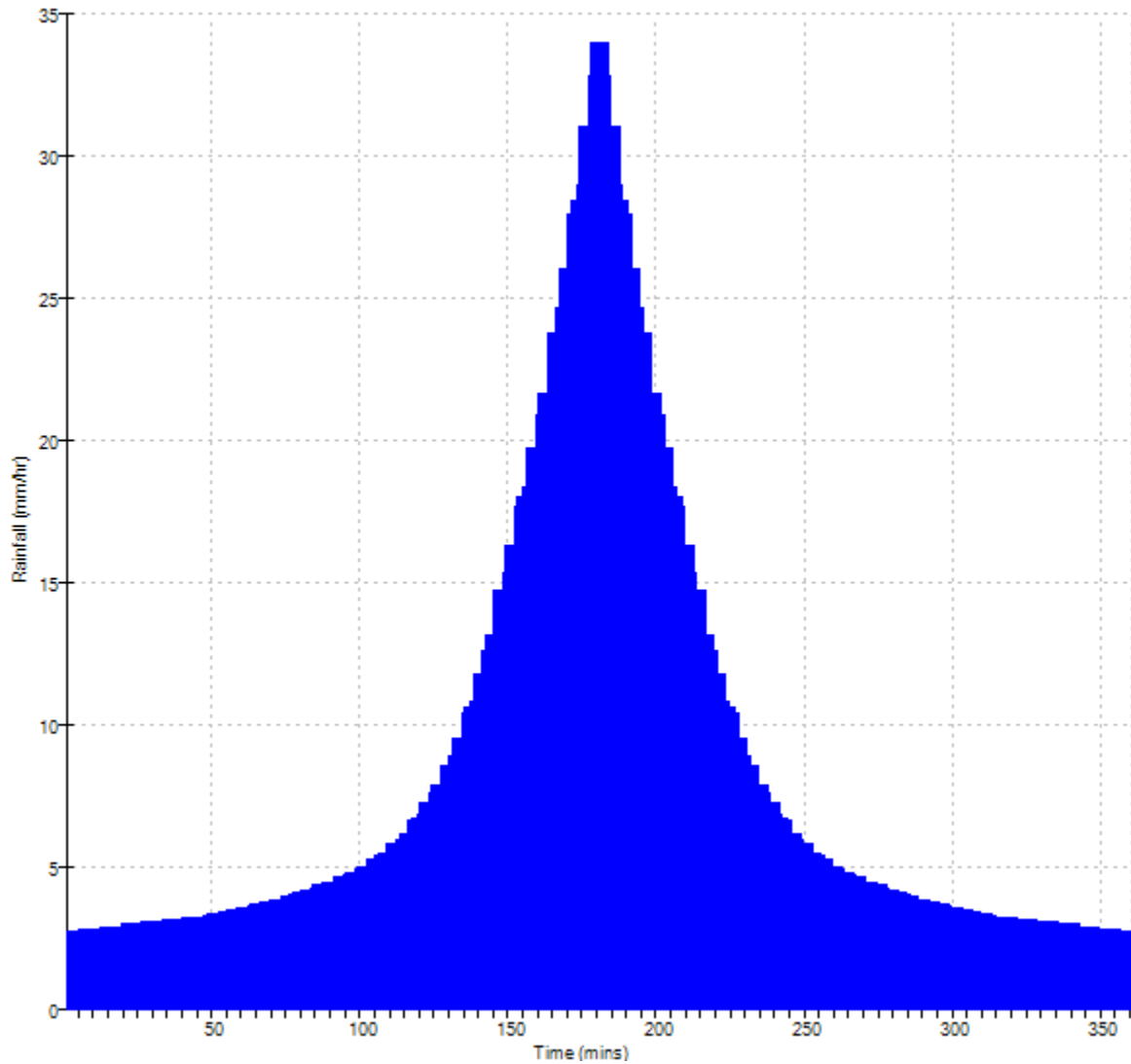
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| File | Checked by | |
| Micro Drainage | | Network 2018.1 |


Rainfall profile

Storm duration (mins) 360

FEH Data

| | |
|-----------------------------------------------|--------|
| FEH Rainfall Version | 2013 |
| Site Location GB 401240 344781 SK 01240 44781 | |
| Data Type | Point |
| Peak Intensity (mm/hr) | 34.053 |
| Ave. Intensity (mm/hr) | 8.687 |
| Return Period (years) | 30.0 |



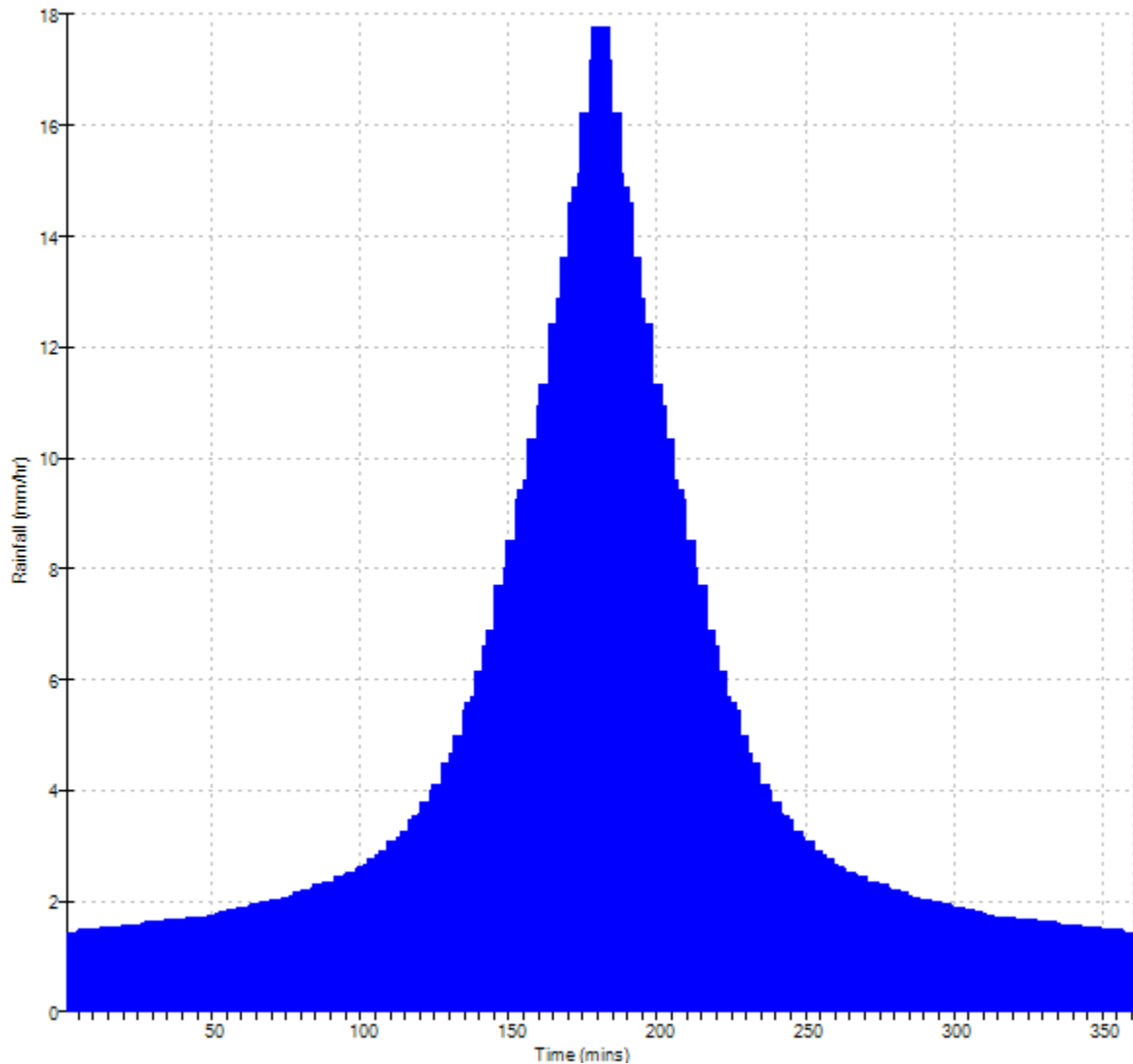
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| File | Checked by | |
| Micro Drainage | | Network 2018.1 |


Rainfall profile


Storm duration (mins) 360

FEH Data

| | |
|-----------------------------------------------|--------|
| FEH Rainfall Version | 2013 |
| Site Location GB 401240 344781 SK 01240 44781 | |
| Data Type | Point |
| Peak Intensity (mm/hr) | 17.790 |
| Ave. Intensity (mm/hr) | 4.538 |
| Return Period (years) | 2.0 |



| | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Micro Drainage | | Source Control 2018.1 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p style="text-align: center;"><u>Greenfield Runoff Volume</u></p> <p style="text-align: center;">FSR Data</p> <table> <tr> <td>Return Period (years)</td> <td>100</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.300</td> </tr> <tr> <td>Ratio R</td> <td>0.351</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>5.550</td> </tr> <tr> <td>SAAR (mm)</td> <td>879</td> </tr> <tr> <td>CWI</td> <td>121.121</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>47.000</td> </tr> </table> <p style="text-align: center;">Results</p> <table> <tr> <td>Percentage Runoff (%)</td> <td>49.82</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>1685.305</td> </tr> </table> | | | Return Period (years) | 100 | Storm Duration (mins) | 360 | Region | England and Wales | M5-60 (mm) | 18.300 | Ratio R | 0.351 | Areal Reduction Factor | 1.00 | Area (ha) | 5.550 | SAAR (mm) | 879 | CWI | 121.121 | Urban | 0.000 | SPR | 47.000 | Percentage Runoff (%) | 49.82 | Greenfield Runoff Volume (m³) | 1685.305 |
| Return Period (years) | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Storm Duration (mins) | 360 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | England and Wales | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| M5-60 (mm) | 18.300 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ratio R | 0.351 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Areal Reduction Factor | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Area (ha) | 5.550 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAAR (mm) | 879 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CWI | 121.121 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban | 0.000 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SPR | 47.000 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Percentage Runoff (%) | 49.82 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Greenfield Runoff Volume (m³) | 1685.305 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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| Micro Drainage Source Control 2018.1 | | |

Greenfield Runoff Volume


FSR Data

| | |
|------------------------|-------------------|
| Return Period (years) | 30 |
| Storm Duration (mins) | 360 |
| Region | England and Wales |
| M5-60 (mm) | 18.300 |
| Ratio R | 0.351 |
| Areal Reduction Factor | 1.00 |
| Area (ha) | 5.550 |
| SAAR (mm) | 879 |
| CWI | 121.121 |
| Urban | 0.000 |
| SPR | 47.000 |

Results

| | |
|--------------------------------------------|----------|
| Percentage Runoff (%) | 47.78 |
| Greenfield Runoff Volume (m ³) | 1244.553 |

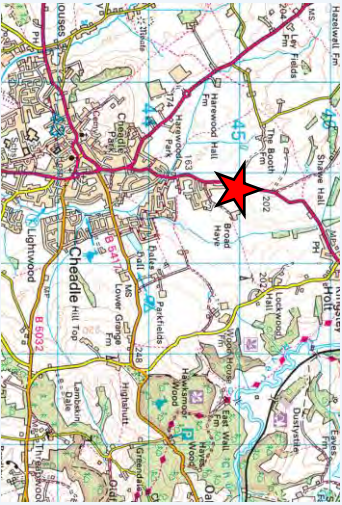
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| Micro Drainage Source Control 2018.1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p style="text-align: center;"><u>Greenfield Runoff Volume</u></p> <p style="text-align: center;">FSR Data</p> <table> <tr> <td>Return Period (years)</td> <td>2</td> </tr> <tr> <td>Storm Duration (mins)</td> <td>360</td> </tr> <tr> <td>Region</td> <td>England and Wales</td> </tr> <tr> <td>M5-60 (mm)</td> <td>18.300</td> </tr> <tr> <td>Ratio R</td> <td>0.351</td> </tr> <tr> <td>Areal Reduction Factor</td> <td>1.00</td> </tr> <tr> <td>Area (ha)</td> <td>5.550</td> </tr> <tr> <td>SAAR (mm)</td> <td>879</td> </tr> <tr> <td>CWI</td> <td>121.121</td> </tr> <tr> <td>Urban</td> <td>0.000</td> </tr> <tr> <td>SPR</td> <td>47.000</td> </tr> </table> <p style="text-align: center;">Results</p> <table> <tr> <td>Percentage Runoff (%)</td> <td>46.03</td> </tr> <tr> <td>Greenfield Runoff Volume (m³)</td> <td>659.537</td> </tr> </table> | | | Return Period (years) | 2 | Storm Duration (mins) | 360 | Region | England and Wales | M5-60 (mm) | 18.300 | Ratio R | 0.351 | Areal Reduction Factor | 1.00 | Area (ha) | 5.550 | SAAR (mm) | 879 | CWI | 121.121 | Urban | 0.000 | SPR | 47.000 | Percentage Runoff (%) | 46.03 | Greenfield Runoff Volume (m³) | 659.537 |
| Return Period (years) | 2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Storm Duration (mins) | 360 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Region | England and Wales | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| M5-60 (mm) | 18.300 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Ratio R | 0.351 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Areal Reduction Factor | 1.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Area (ha) | 5.550 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SAAR (mm) | 879 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CWI | 121.121 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Urban | 0.000 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| SPR | 47.000 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Percentage Runoff (%) | 46.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Greenfield Runoff Volume (m³) | 659.537 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
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APPENDIX J: PRE/POST DRAINAGE PLANS

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LEGEND

Site Area (Phase 1)

Existing Drainage Features

General Topographic Fall

Ordinary Watercourse

Existing Sewer Network

Public Surface Water Sewer

Public Foul Water Sewer

FURTHER NOTES:

This drawing is not a drainage 'design' it is a preliminary drainage plan showing existing key sewer location. It should also be noted the drainage plan only shows key public sewers within proximity to the site. Please see sewer records in Appendix C for full details.

The location, size and nature of the proposed drainage assets included within the plan are also only indicative and are subject to change.

SITE: FROGHALL RD, CHEADLE

REF: HYD618

REV: A

DATE: 03/06/21



EXISTING DRAINAGE PLAN

PLAN



Site Area (Phase 1)




Existing Drainage Features

- ■ ■ Ordinary Watercourse
- Land Drainage Ditch

Existing Sewer Network

- Public Surface Water Sewer
- Public Foul Water Sewer

Proposed Drainage Connections

- | Attenuation/SuDS | Surface Water Connection | Foul Water Connection |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|  |  |  |

This drawing is not a drainage 'design' it is a preliminary drainage plan showing existing key sewer location. It should also be noted the drainage plan only shows key public sewers within proximity to the site. Please see sewer records in Appendix C for full details.

The location, size and nature of the proposed drainage assets included within the plan are also only indicative and are subject to change.



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APPENDIX K: STORMWATER STORAGE ESTIMATES


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QUICK STORAGE ESTIMATES


FROGHALL RD, CHEADLE


1 YEAR RETURN PERIOD STORM EVENT

| | | | |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------|-------|
|  Variables Results Design Overview 2D Overview 3D Vt | Variables | | |
| | FEH Rainfall | | |
| | Return Period (years) | 2 | |
| | Version | 2013 | Point |
| | Site | GB 401240 344781 SK 01240 44781 | |
| | Cv (Summer) | 0.750 | |
| | Cv (Winter) | 0.840 | |
| | Impemeable Area (ha) | 3.660 | |
| | Maximum Allowable Discharge (l/s) | 28.1 | |
| | Infiltration Coefficient (m/hr) | 0.00000 | |
| | Safety Factor | 2.0 | |
| | Climate Change (%) | 0 | |

| | |
|-------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
|  Results Variables | Global Variables require approximate storage of between 377 m³ and 687 m³. |
| | These values are estimates only and should not be used for design purposes. |

30 YEAR RETURN PERIOD STORM EVENT

| | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------------------------|-------|
|  Variables Results Design Overview 2D Overview 3D Vt | Variables | | |
| | FEH Rainfall | | |
| | Return Period (years) | 30 | |
| | Version | 2013 | Point |
| | Site | GB 401240 344781 SK 01240 44781 | |
| | Cv (Summer) | 0.750 | |
| | Cv (Winter) | 0.840 | |
| | Impemeable Area (ha) | 3.660 | |
| | Maximum Allowable Discharge (l/s) | 28.1 | |
| | Infiltration Coefficient (m/hr) | 0.00000 | |
| | Safety Factor | 2.0 | |
| | Climate Change (%) | 0 | |

| | |
|--------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
|  Results Variables | Global Variables require approximate storage of between 1062 m³ and 1471 m³. |
| | These values are estimates only and should not be used for design purposes. |

QUICK STORAGE ESTIMATES

FROGHALL RD, CHEADLE

100 YEAR RETURN PERIOD STORM EVENT + 20% CLIMATE CHANGE

| Variables | |
|--------------------------------------|-----------------------------------------|
| FEH Rainfall | Cv (Summer) 0.750 |
| Return Period (years) 100 | Cv (Winter) 0.840 |
| Version 2013 Point | Impervious Area (ha) 3.660 |
| Site GB 401240 344781 SK 01240 44781 | Maximum Allowable Discharge (l/s) 28.1 |
| | Infiltration Coefficient (m/hr) 0.00000 |
| | Safety Factor 2.0 |
| | Climate Change (%) 20 |

| Results | |
|-------------------------------------------------------------------------------------------------------|--|
| Global Variables require approximate storage of between 2005 m ³ and 2518 m ³ . | |
| These values are estimates only and should not be used for design purposes. | |

100 YEAR RETURN PERIOD STORM EVENT + 40% CLIMATE CHANGE

| Variables | |
|--------------------------------------|-----------------------------------------|
| FEH Rainfall | Cv (Summer) 0.750 |
| Return Period (years) 100 | Cv (Winter) 0.840 |
| Version 2013 Point | Impervious Area (ha) 3.660 |
| Site GB 401240 344781 SK 01240 44781 | Maximum Allowable Discharge (l/s) 28.1 |
| | Infiltration Coefficient (m/hr) 0.00000 |
| | Safety Factor 2.0 |
| | Climate Change (%) 40 |

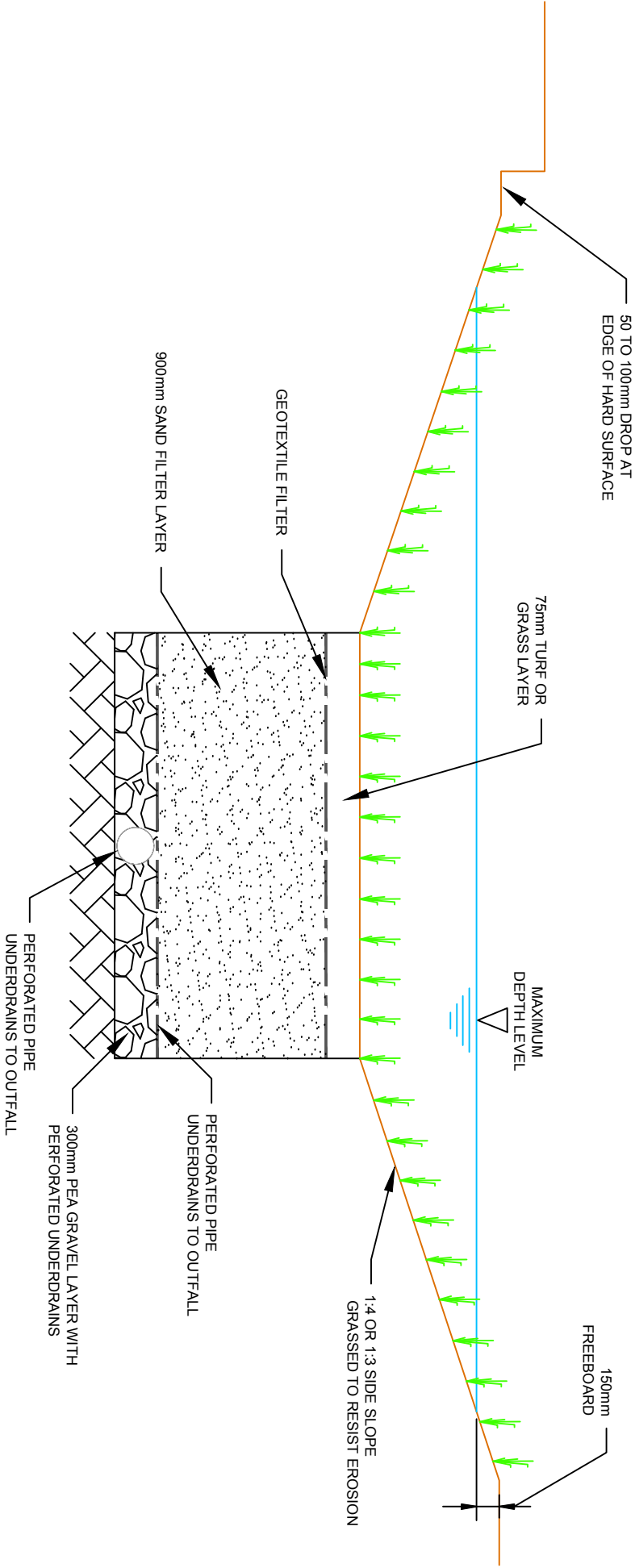
| Results | |
|-------------------------------------------------------------------------------------------------------|--|
| Global Variables require approximate storage of between 2437 m ³ and 2997 m ³ . | |
| These values are estimates only and should not be used for design purposes. | |

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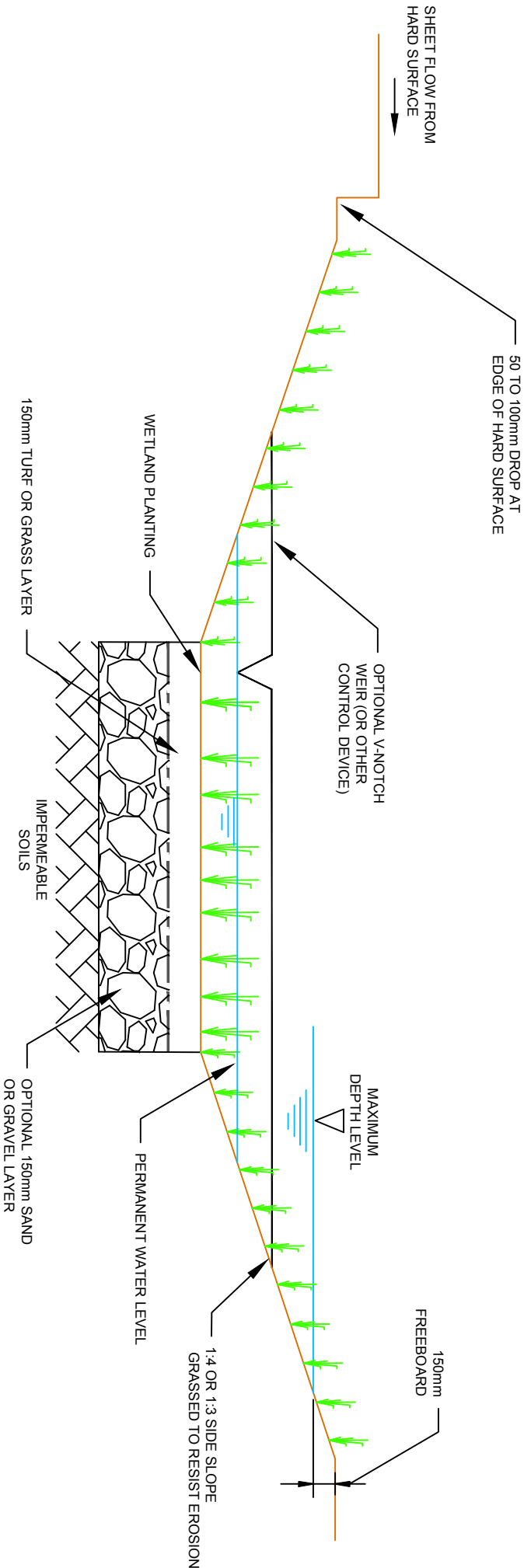
APPENDIX L: TYPICAL SUDS DETAILS

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DO NOT SCALE




DRY SWALE



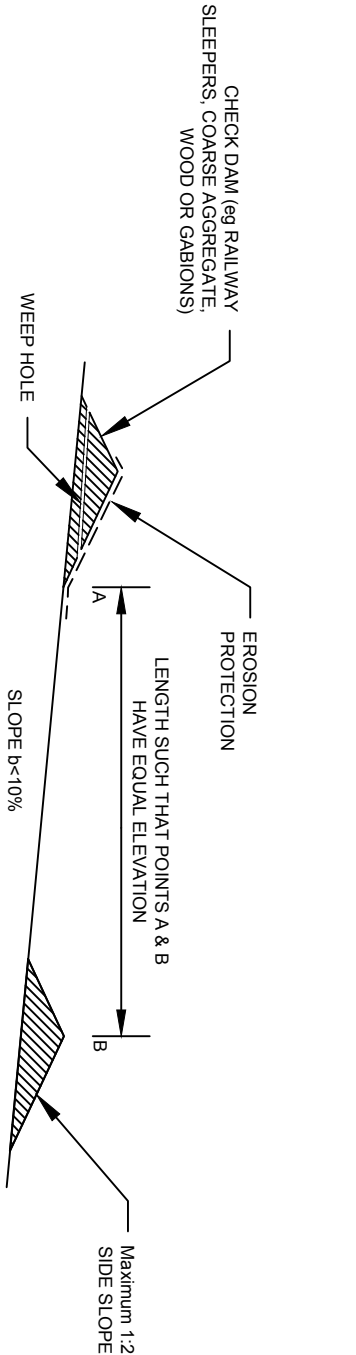
WET SWALE

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| REV | DATE | BY | DESCRIPTION | CHK |
| DRAWING STATUS: PRELIMINARY | | | | |

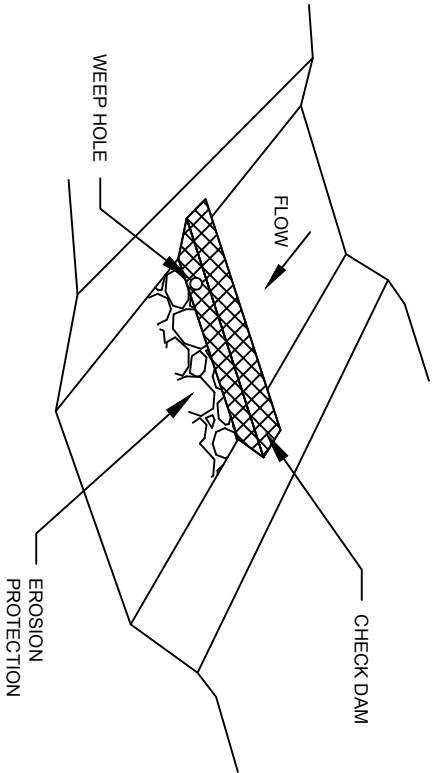


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| | | | | |
|---------------------|---------------|--------|----------|---|
| PROJECT: | | | | |
| TYPICAL SUDS DETAIL | | | | |
| TITLE: | | | | |
| SWALES (1 of 2) | | | | |
| DATE: | SCALE @ SIZE: | DRAWN: | CHECKED: | |
| SEP 2014 | A3 | CP | RDN | |
| PROJECT No: | DRAWING No: | 103 | REV: | A |
| BETTS | | | | |

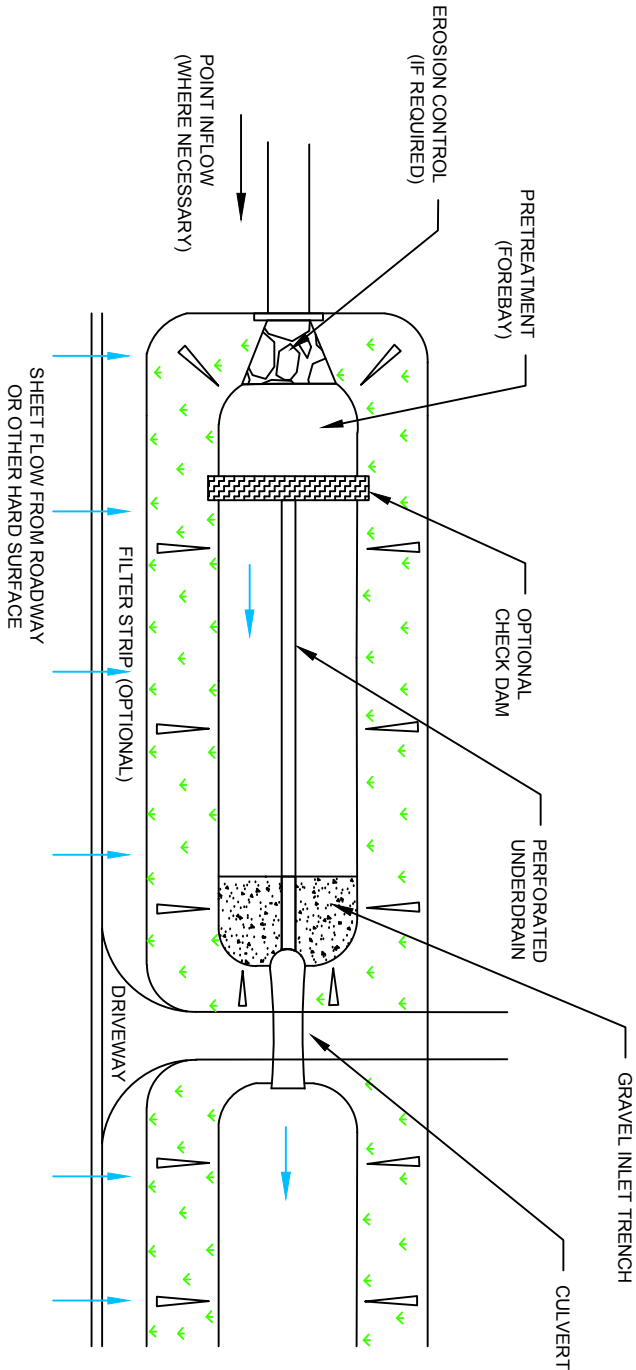


ELEVATION




SCHEMATIC

CHECK DAM



ENHANCED DRY SWALE

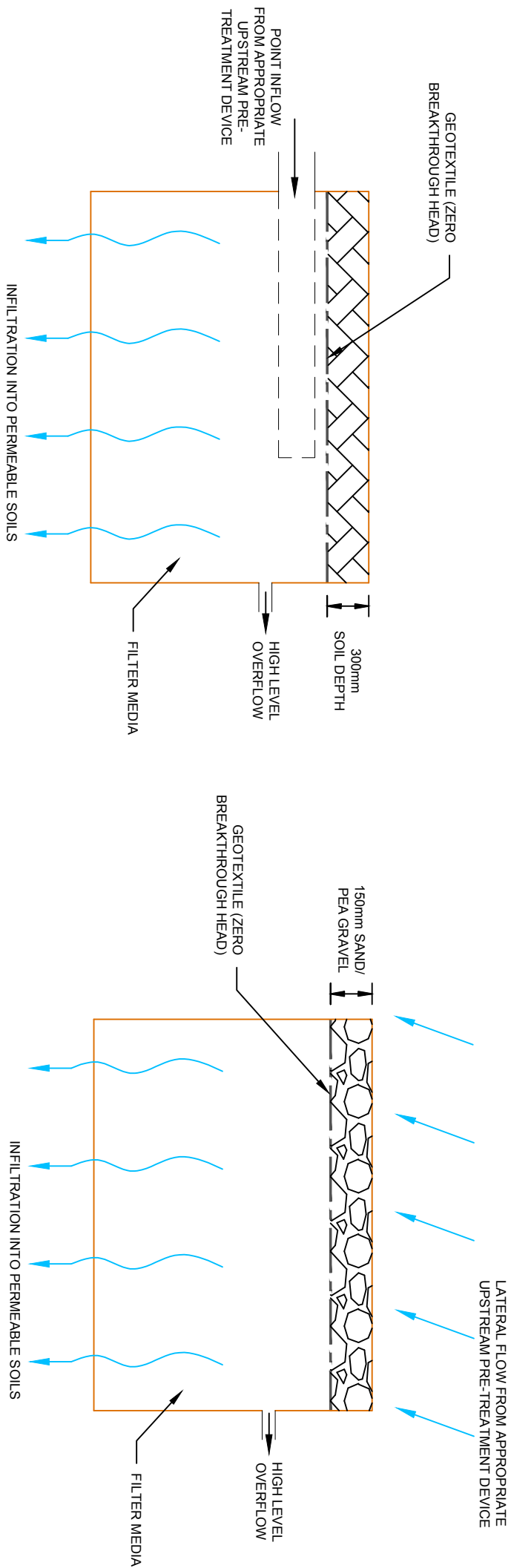
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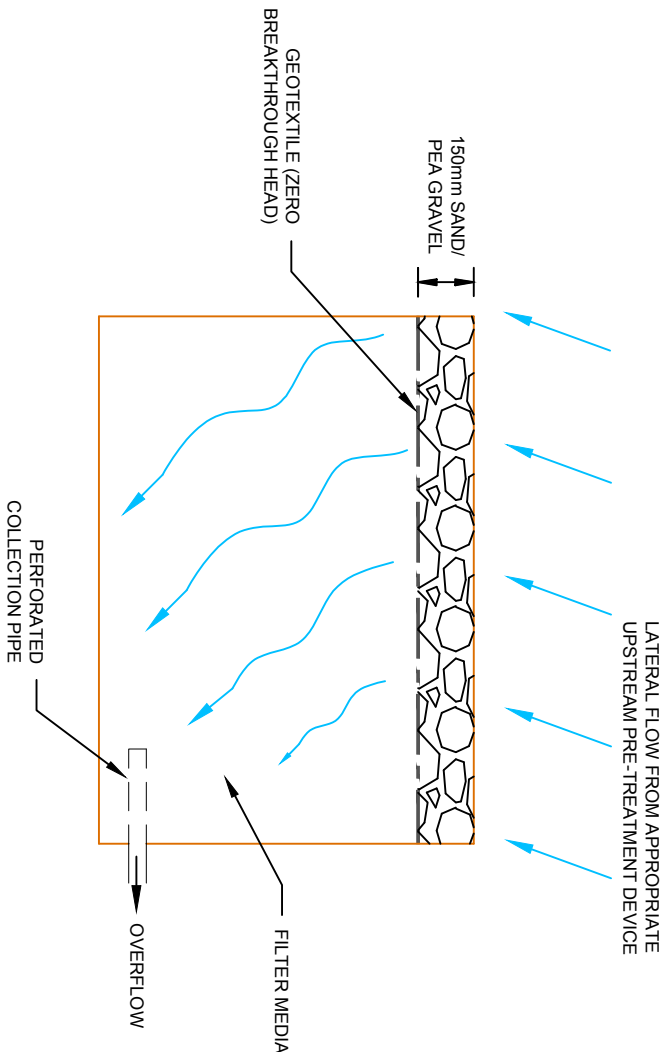
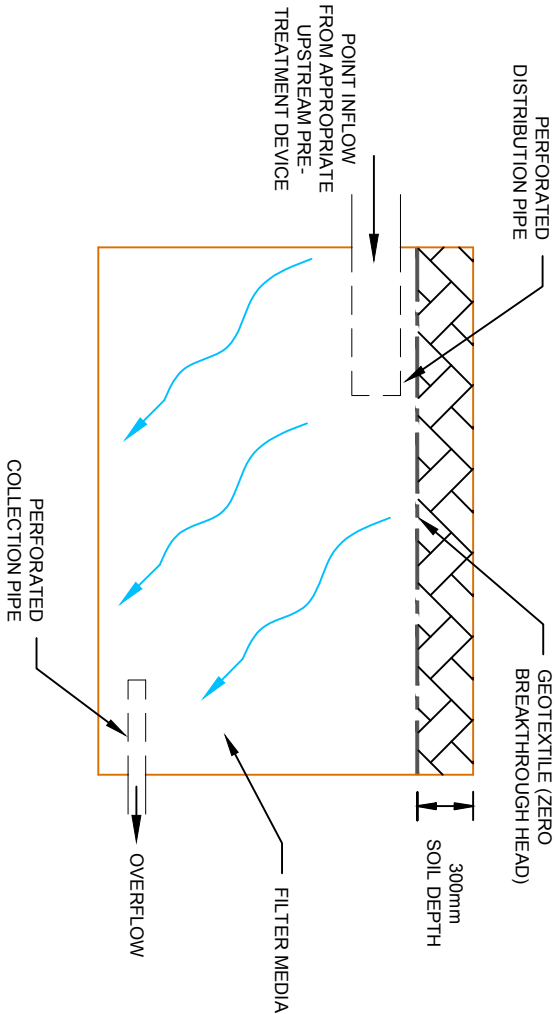
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| | | | | |
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| PROJECT: | | | | |
| TYPICAL SUDS DETAIL | | | | |
| TITLE: | | | | |
| SWALES (2 of 2) | | | | |
| DATE: | SCALE @ SIZE: | DRAWN: | CHECKED: | |
| SEP 2014 | A3 | CP | RDN | |
| PROJECT No: | DRAWING No: | 104 | REV: | A |
| BETTS | | | | |

DO NOT SCALE



INFILTRATION TRENCH SCHEMATICS



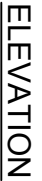
FILTER TRENCH SCHEMATICS

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| REV | DATE | BY | DESCRIPTION | CHK |
| DRAWING STATUS: PRELIMINARY | | | | |
| PROJECT: TYPICAL SUDS DETAIL | | | | |
| TITLE: TRENCHES | | | | |
| DATE: SEP 2014 | | | | |
| SCALE: A3 | | SIZE: CP | | CHECKED: RDN |
| PROJECT No: BETTS | | DRAWING No: 105 | | REV: A |



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DO NOT SCALE

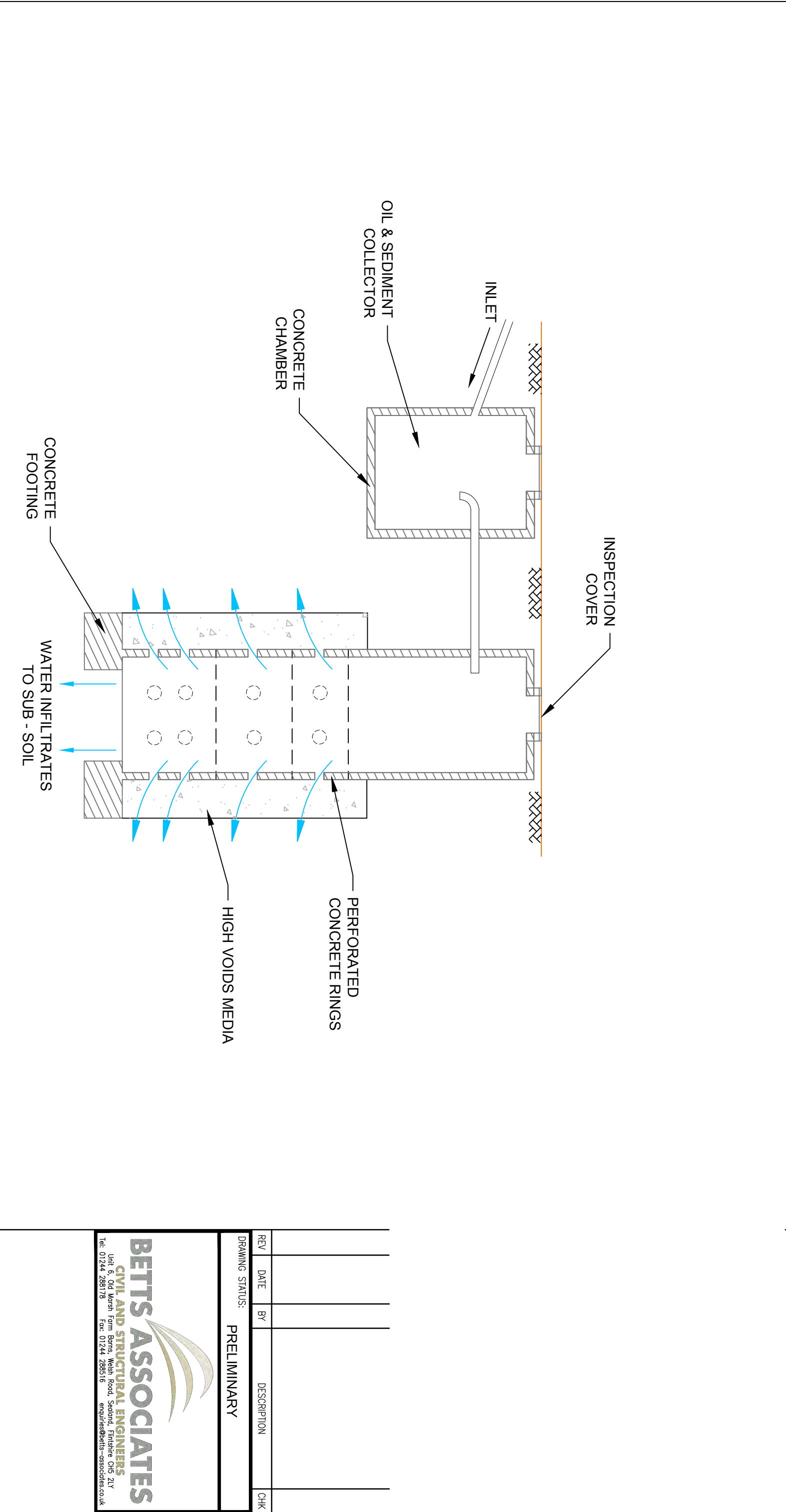


DRAWING STATUS: **PRELIMINARY**

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| PROJECT: _____ | | | |
| DATE: _____ | | TITLE: _____ | |
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| BETTS | | | |
| 107 | | | |

DO NOT SCALE



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| PROJECT: | |
| TITLE: | TYPICAL SUDS DETAIL |

SOAKAWAYS

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| DATE: SEP 2014 | SCALE @ SIZE: @ A3 | DRAWN: CP | CHECKED: RDN |
| PROJECT No: | DRAWING No: | REV: | |
| BETTS | 108 | A | |

DO NOT SCALE



DRAWING STATUS:

PRELIMINARY

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enquiries@bets-associates.co.uk

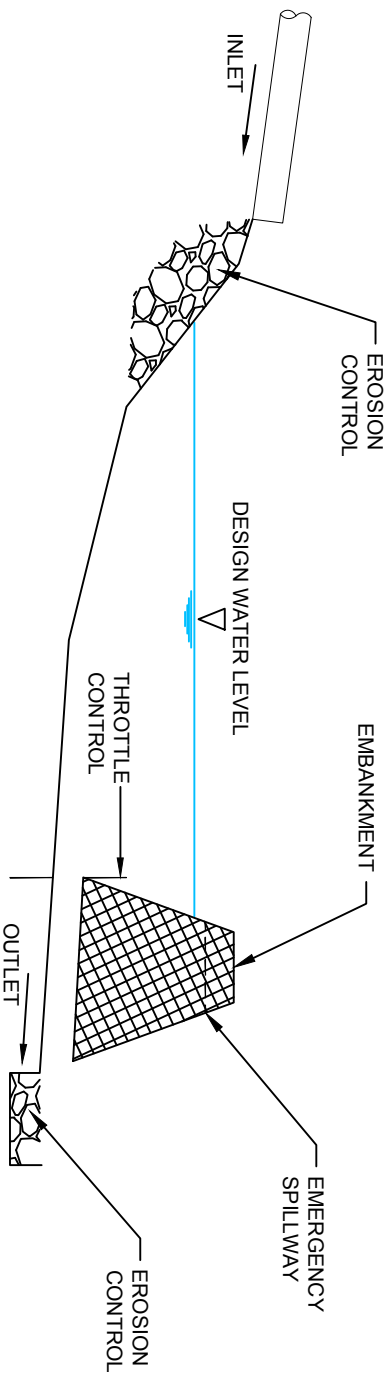
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TYPICAL SUDS DETAIL

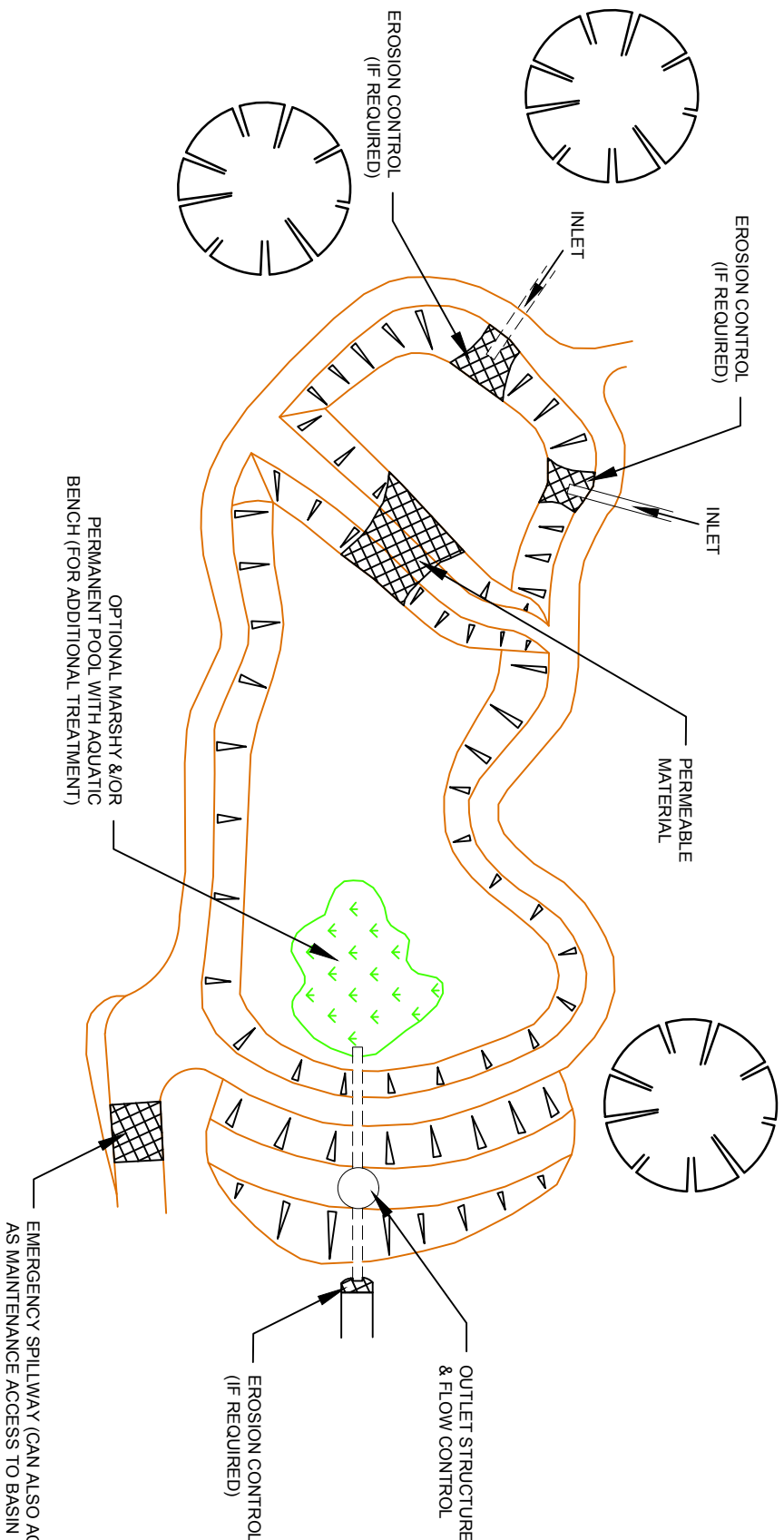
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| PROJECT No: | DRAWING: No: | REV: | |
| BETTS | 109 | A | |

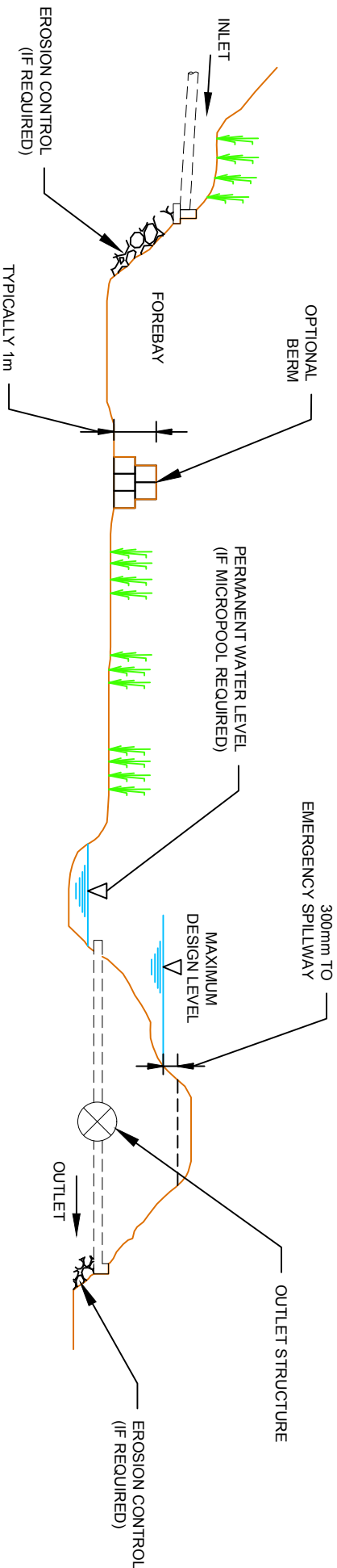
DO NOT SCALE



SCHEMATIC OF DETENTION
BASIN PROFILE

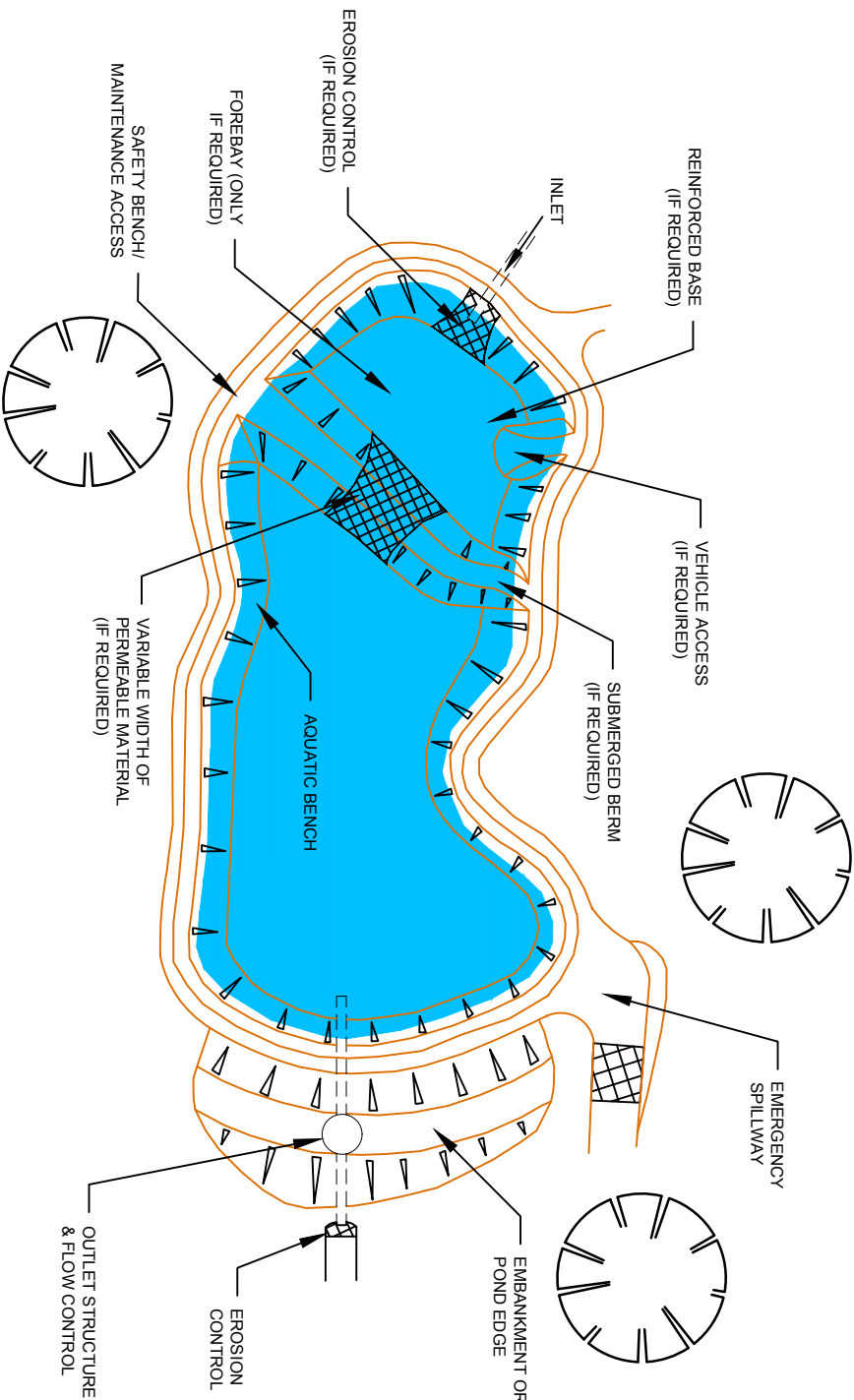


PLAN VIEW

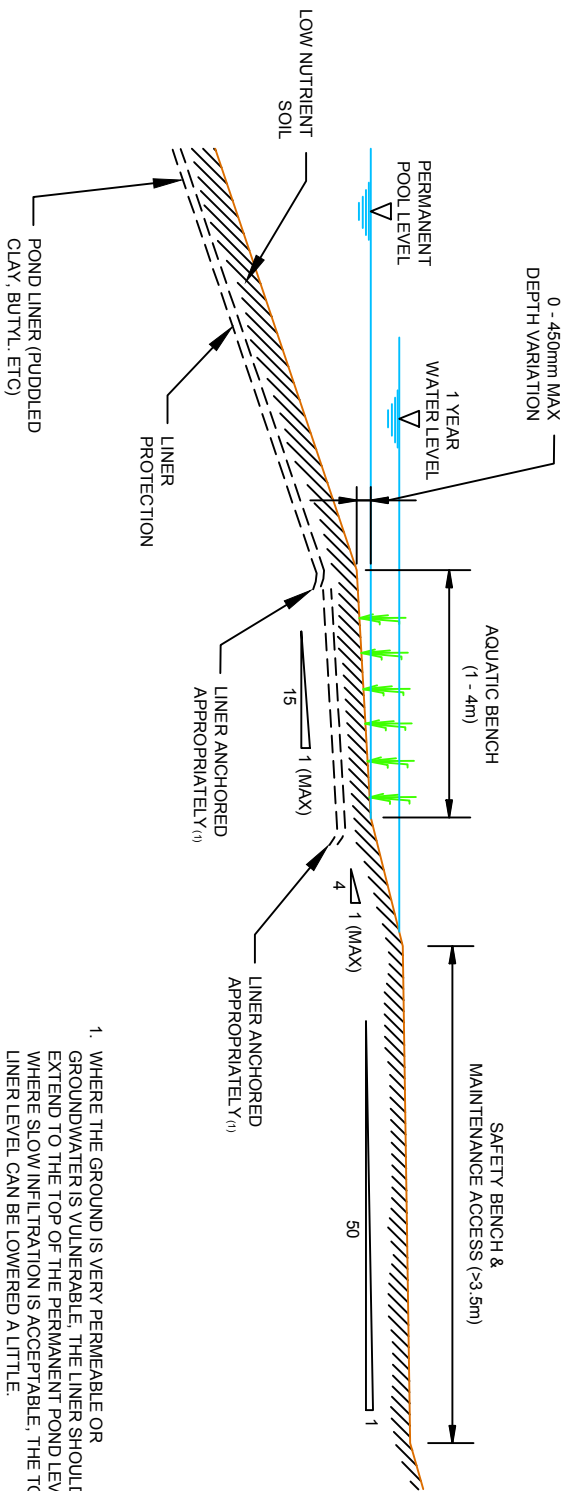


ELEVATION

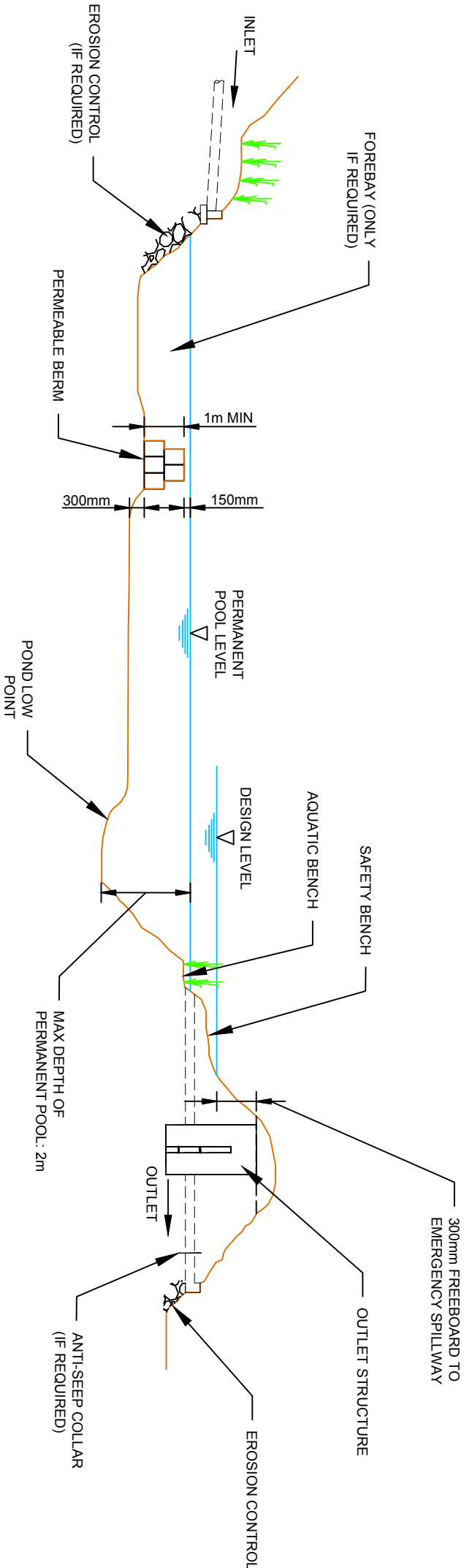
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| PROJECT: | | | |
| TYPICAL SUDS DETAIL | | | |
| TITLE: | | | |
| DETENTION BASINS | | | |
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| SEP 2014 | A3 | CP | RDN |
| PROJECT No: | DRAWING No: | 110 | REV: |
| BETTS | | | A |



PLAN VIEW



TYPICAL POND EDGE GEOMETRY



PROFILE

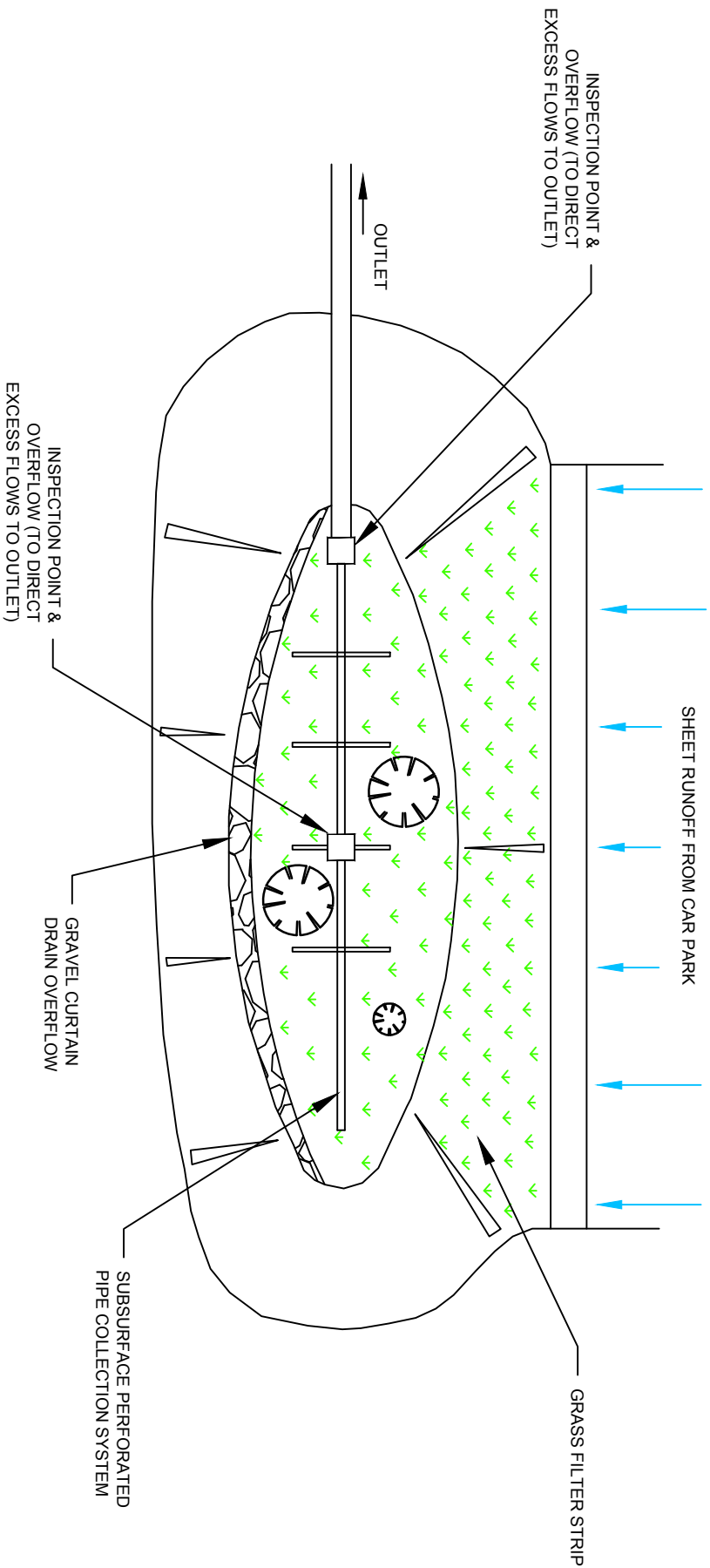
1. WHERE THE GROUND IS VERY PERMEABLE OR GROUNDWATER IS VULNERABLE, THE LINER SHOULD EXTEND TO THE TOP OF THE PERMANENT POND LEVEL, WHERE SLOW INFILTRATION IS ACCEPTABLE, THE TOP LINER LEVEL CAN BE LOWERED A LITTLE.

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| REV | DATE | BY | DESCRIPTION | CHK | |
| DRAWING STATUS: PRELIMINARY | | | | | |
| PROJECT: TYPICAL SUDS DETAIL | | | | | |
| TITLE: WET PONDS | | | | | |
| DATE: SEP 2014 SCALE: A3 PROJECT No: BETTS | | | | | |
| DRAWING No: 111 CHECKED: RDN REV: A | | | | | |

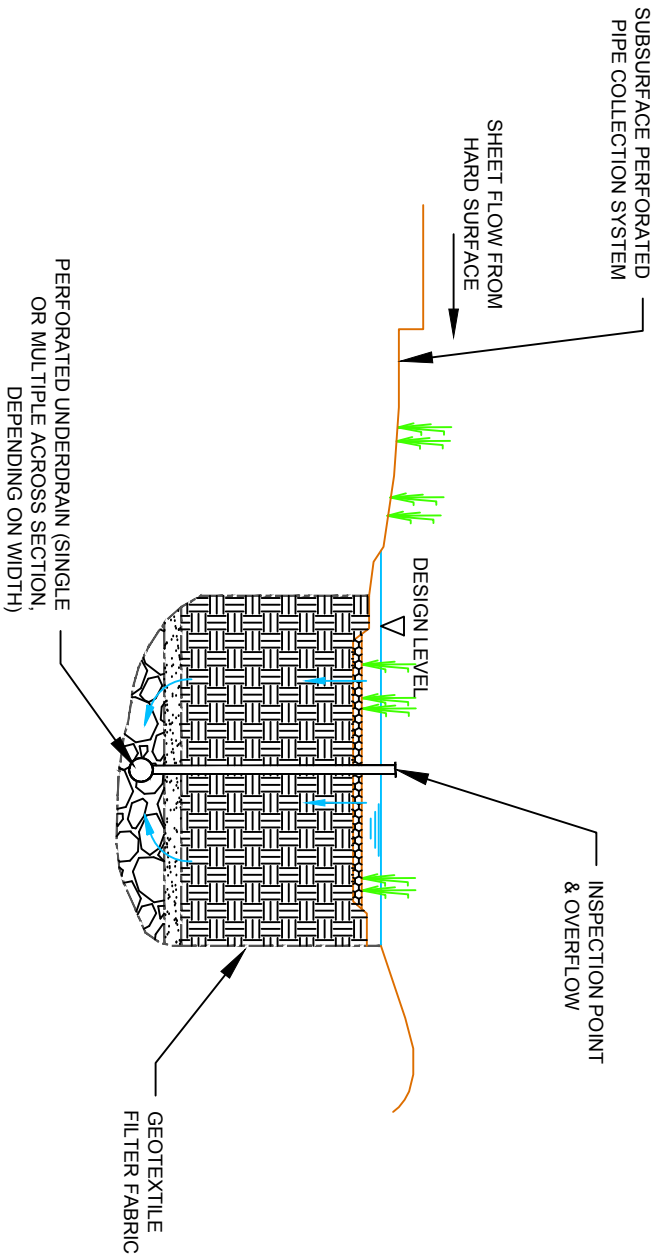


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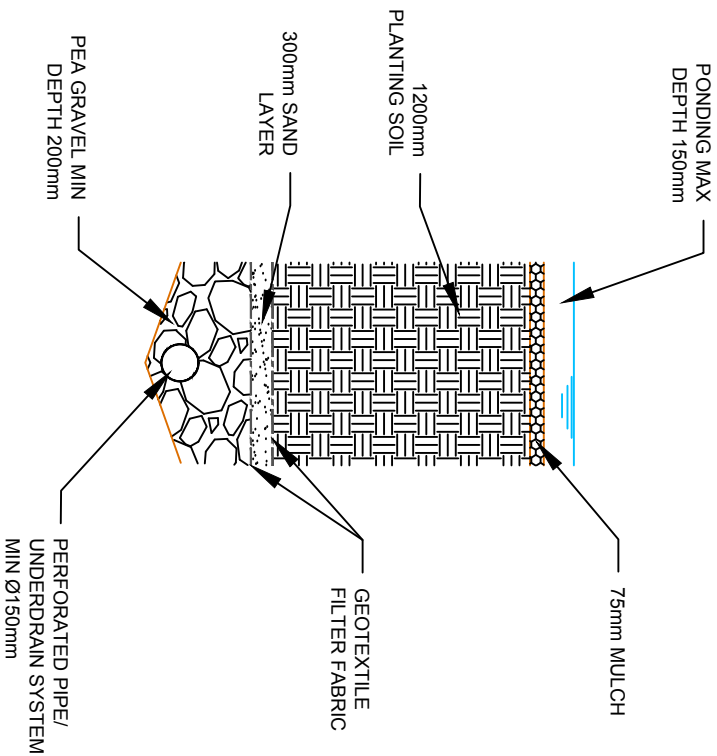
DO NOT SCALE



PLAN VIEW




PROFILE



TYPICAL SECTION

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| | | | | |
| REV | DATE | BY | DESCRIPTION | CHK |
| DRAWING STATUS: PRELIMINARY | | | | |

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| | | | | |
|---------------------------|---------------|--------|----------|---|
| PROJECT: | | | | |
| TYPICAL SUDS DETAIL | | | | |
| TITLE: | | | | |
| BIORETENTION APPLICATIONS | | | | |
| DATE: | SCALE @ SIZE: | DRAWN: | CHECKED: | |
| SEP 2014 | A3 | CP | RDN | |
| PROJECT No: | DRAWING No: | 112 | REV: | A |
| BETTS | | | | |

DO NOT SCALE



PLAN

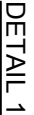
PLAN



SECTION A - A'

SECTION A - A'

ALL DIMENSIONS AND DEPTHS DEPENDENT ON REQUIRED VOLUME AND LOCAL GROUND CONDITIONS



| REV | DATE | BY | DESCRIPTION | CHK |
|-----|------|----|-------------|-----|
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DRAWING STATUS: **PRELIMINARY**

DRAWING STATUS: **PRELIMINARY**

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enquiries@betts-associates.co.uk

PROJECT:

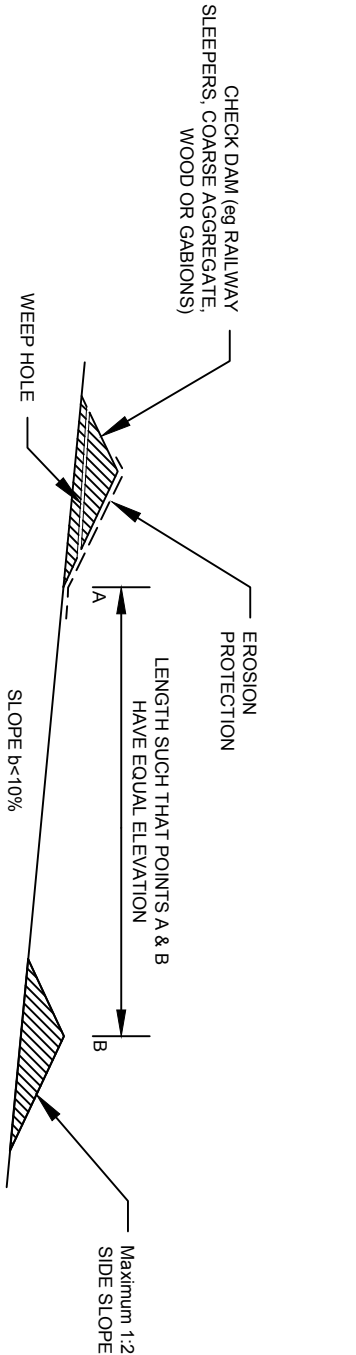
TYPICAL SUDS DETAIL

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| TITLE: | |
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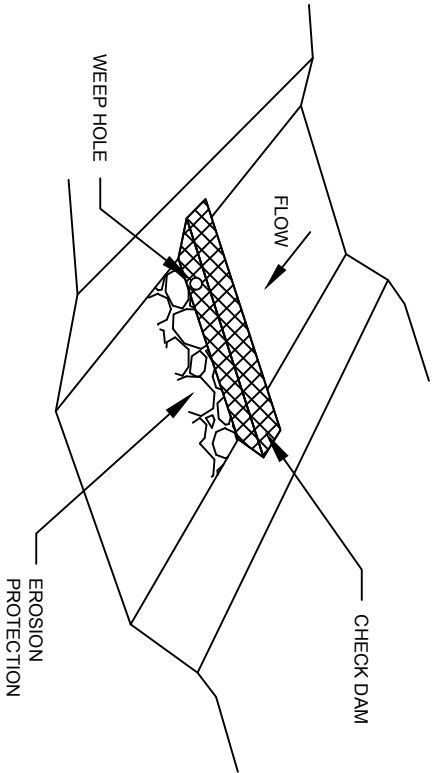
CELLULAR STORAGE

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|-------------|---------------|--------|----------|
| DATE: | SCALE @ SIZE: | DRAWN: | CHECKED: |
| SEP 2014 | @ A3 | CP | RDN |
| PROJECT No: | DRAWING No: | REV: | |
| BETTS | 113 | A | |

DO NOT SCALE

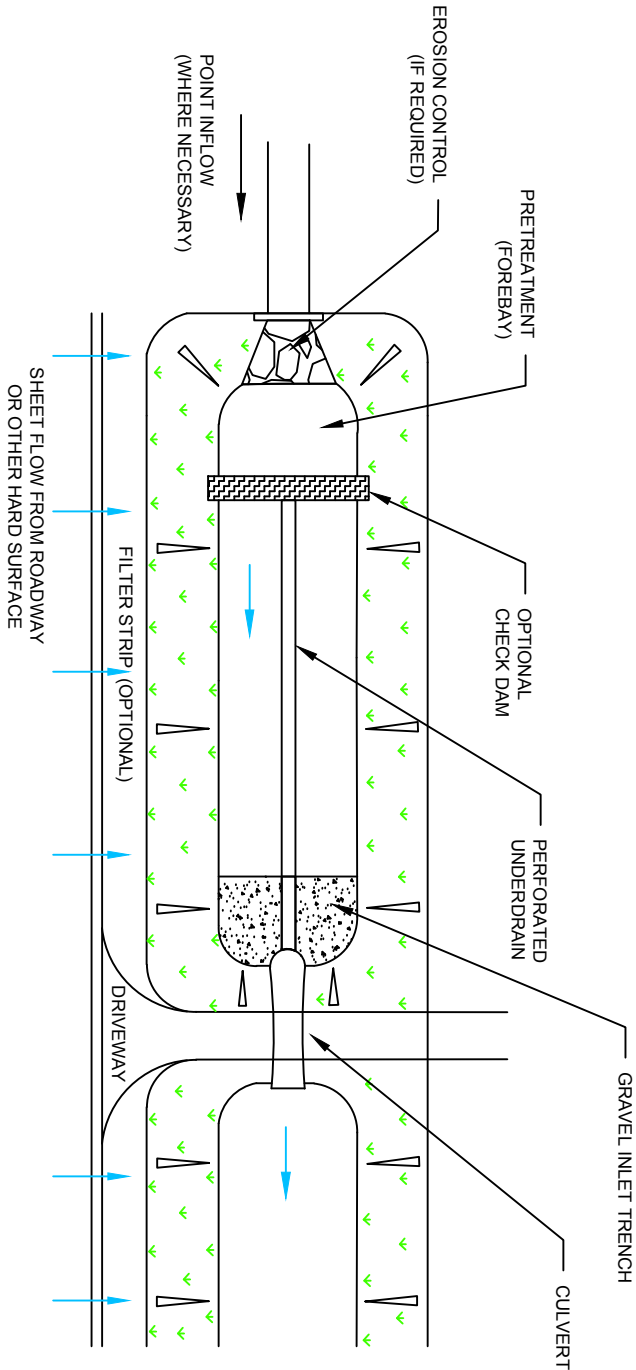


ELEVATION



SCHEMATIC

CHECK DAM



ENHANCED DRY SWALE

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| REV | DATE | BY | DESCRIPTION | CHK |
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DRAWING STATUS:

PRELIMINARY

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APPENDIX M: NOTES OF LIMITATIONS

The data essentially comprised a study of available documented information from various sources together with discussions with relevant authorities and other interested parties. There may also be circumstances at the site that are not documented. The information reviewed is not exhaustive and has been accepted in good faith as providing representative and true data pertaining to site conditions. If additional information becomes available which might impact our conclusions, we request the opportunity to review the information, reassess the potential concerns and modify our opinion if warranted.

It should be noted that any risks identified in this report are perceived risks based on the available information.

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