BETTS HYDRO
CONSULTING ENGINEERS

LAND OFF LLAY ROAD, CEFN-Y-BEDD, WREXHAM

FLOOD CONSEQUENCE ASSESSMENT AND DRAINAGE MANAGEMENT STRATEGY

For

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NOVEMBER 2021

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EXECUTIVE SUMMARY

This Drainage Management Strategy was commissioned by Mr. Clint Shaw referred to hereafter as 'the client'. This assessment has been prepared to support a planning application for development located off Llay Road in Cefn-y-Bedd (Wrexham). The proposals are for the construction of a commercial building to provide an office, maintenance facility, hay/straw storage and sick/maternity bay for reindeer. The wider site will also be used as a tree farm for Christmas Trees.

In order for the development proposals to be justified in line with the guidance set out in SuDS Standards for Wales, new development must not increase flood risk elsewhere and where possible offer improvement on the pre-development situation. The sustainable drainage hierarchy has been considered in accordance with the Welsh SuDS Standards, which look to deal with surface water run-off as close to source as is practical.

Based on these published online datasets it is understood that infiltration may be able to offer a sustainable drainage solution in part or full. To confirm if infiltration will be feasible onsite given the mixed suitability for infiltration, it is recommended that Soakaway Testing (to BRE365) is undertaken at an early stage ascertain the specific onsite underlying ground conditions and suitability of such to achieve a full infiltration-based drainage approach for surface water run-off.

If infiltration is unable to offer a surface water management solution for the proposals (subject to onsite testing), it is proposed that the development proposals formally discharge surface water run-off into the onsite surface water body. It is understood based on anecdotal evidence that the existing body of water has incoming surface water flows from onsite overland flows and a conveyance route from the Ordinary Watercourse located adjacent to the eastern boundary of site. It is understood that this body of water infiltrates over an extended period of time.

The proposals will therefore be to formally discharge surface water run-off from the roof areas of the proposed development into this surface water body at a restrict greenfield rate (QBar). The proposals are also to increase the size of this existing surface water body to increase surface water attenuation and biodiversity properties. Detailed design will be required to confirm the feasibility of the strategy. and whether a site wide gravity system is achievable.

In accordance with the SuDS Standards for Wales (2018) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the nature and the size of the development, the pre-development greenfield rate (QBar) is calculated to be 3.4l/s. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in storm events up to and including the 1 in 100yr return period with allowance for climate change.

This Drainage Management Strategy is commensurate with the site and in summary, the development can be considered appropriate in accordance with Welsh Governments Statutory Standards for Sustainable Drainage Systems, providing the mitigation measures proposed within are included within the development proposals. Full approval for the proposed drainage strategy will need to be sought from the SuDS Approval Body (Wrexham County Borough Council) separately by the developer in due course.

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Abbreviations & Acronyms

BGS	British Geological Survey
CC	Climate Change
FCA	Flood Consequence Assessment
FEH	Flood Estimation Handbook
GC	Gwynedd Council
Ha	Hectare
HD	Hafren Dyfrdwy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
mAOD	metres Above Ordnance Datum
NGR	National Grid Reference
NRW	National Resources Wales
NSRI	National Soil Resource Institute
PFRA	Preliminary Flood Risk Assessment
PPW	Planning Policy Wales
QSE	Quick Storage Estimate
SFCA	Strategic Flood Consequence Assessment
SAB	SuDS Approving Body
SuDS	Sustainable Drainage Systems
TAN15	Technical Advice Note 15

1.0 INTRODUCTION

1.1 Planning Policy Context

1.1.1 All forms of flooding and their impact on the natural and built environment are material planning considerations. Planning Policy Wales (PPW) sets out the Government's objectives for the planning system, and how planning should facilitate and promote sustainable patterns of development, avoiding flood risk and accommodating the impacts of climate change. Government policy with respect to development in flood risk areas is contained within the PPW, Technical Advice Note 15, (TAN15) 'Development and Flood Risk' scheduled to be re-issued in December 2021.

Sustainable Drainage Approval Board (SAB) Requirements

1.1.2 From January 2019, all new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. Schedule 3 of the Flood and Water Management Act 2010 (FWMA) establishes Gwynedd Council as a SuDS Approving Body (SAB).

1.1.3 The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. The SAB application is undertaken separately to the planning permissions and developers are required to obtain both planning approval and SAB approval prior to commencement of any proposed construction works. This Flood Consequence Assessment and Drainage Management Strategy is to support the proposed planning application. SAB approval will need to be sought separately by the developer once more details are available for the drainage proposals.

1.2 Site Context

1.2.1 This DMS has been prepared to support a planning application for development located off Llay Road in Cefn-y-Bedd (Wrexham). The proposals are for the construction of a commercial building to provide an office, maintenance facility, hay/straw storage and sick/maternity bay for reindeer. The wider site will also be used as a tree farm for Christmas Trees.

1.3 Consultation

1.3.1 The preparation of this report has been undertaken in consultation with Natural Resources Wales (NRW), Wrexham County Borough Council (WCBC) and Welsh Water (WW). The responses can be seen in Appendix B, C and D. The Local Planning Authority (LPA), WCBC (also acts as the Lead Local Flood Authority), will make the final decision about any planning permission. The LPA should consult with NRW who will provide advice and guidance on flood issues at a strategic level and in relation to planning applications

2.0 EXISTING SITE BACKGROUND

2.1 Location

2.1.1 The site is located off Llay Road in Cefn-y-Bedd (Wrexham), the nearest Ordnance Survey National Grid Reference is E: 331724, N: 355636 and the nearest postcode is LL12 9UG (see location plan in Appendix E). The site is surrounded to the north, east, south, and west by undeveloped land. Adjacent to the northern boundary is Llay Road and adjacent to the west of site is Park Road, as illustrated in Figure 1.

Figure 1: Existing Site Features Plan (Google Maps, 2021)

2.2 Existing and Historical Land Use

2.2.1 The development site is currently undeveloped land and comprises of low to high density vegetation, with some taller shrubs along the field boundaries. The land is currently used for agricultural purposes and no other historical use has been identified as part of this assessment.

2.3 Topography

2.4.1 TAN15 requires all sources of flood risk to be considered, taking into consideration the existing terrain and ground levels. A site-specific topographic survey has not been carried out to support this assessment however LiDAR data has been obtained and

identified the ground levels onsite to vary from 84.0mAOD along the northern site boundary, down to 74.1mAOD within a low-lying depression to the south of the site (see Elevation Plan included in Appendix F).

2.5 Justification for Development

2.5.1 Planning Policy Wales (5th Ed. – November 2012) states that the Welsh Government is committed to promoting 'sustainable development' by providing for homes, infrastructure, investment and jobs in a way which is consistent with sustainable development principles PPW Sec. 2.2).

2.5.2 The FCA will be considerate to the nature and scale of the proposals and will review flood risk to and from the development along with considering any appropriate mitigation measures based on the identified risks.

2.5.3 The development proposals are of a Highly Vulnerable nature but will be located solely within Flood Zone A. Mitigation measures are proposed to safeguard the development against any potential residual flood risks identified and it is considered that the proposals can be justified in accordance with TAN15 Guidance.

3.0 DEVELOPMENT PROPOSALS

3.1 Nature of the development

3.1.1 This assessment has been prepared to support a planning application for the development of an agricultural building located off Llay Road in Cefn-y-Bedd. The proposals are for the construction of a commercial building to provide an office, maintenance facility, hay/straw storage and sick/maternity bay for reindeer. The wider site will also be used as a tree farm for Christmas Trees. The proposals will be complete with access, cark parking, boundary fencing and drainage (full plan in Appendix G).

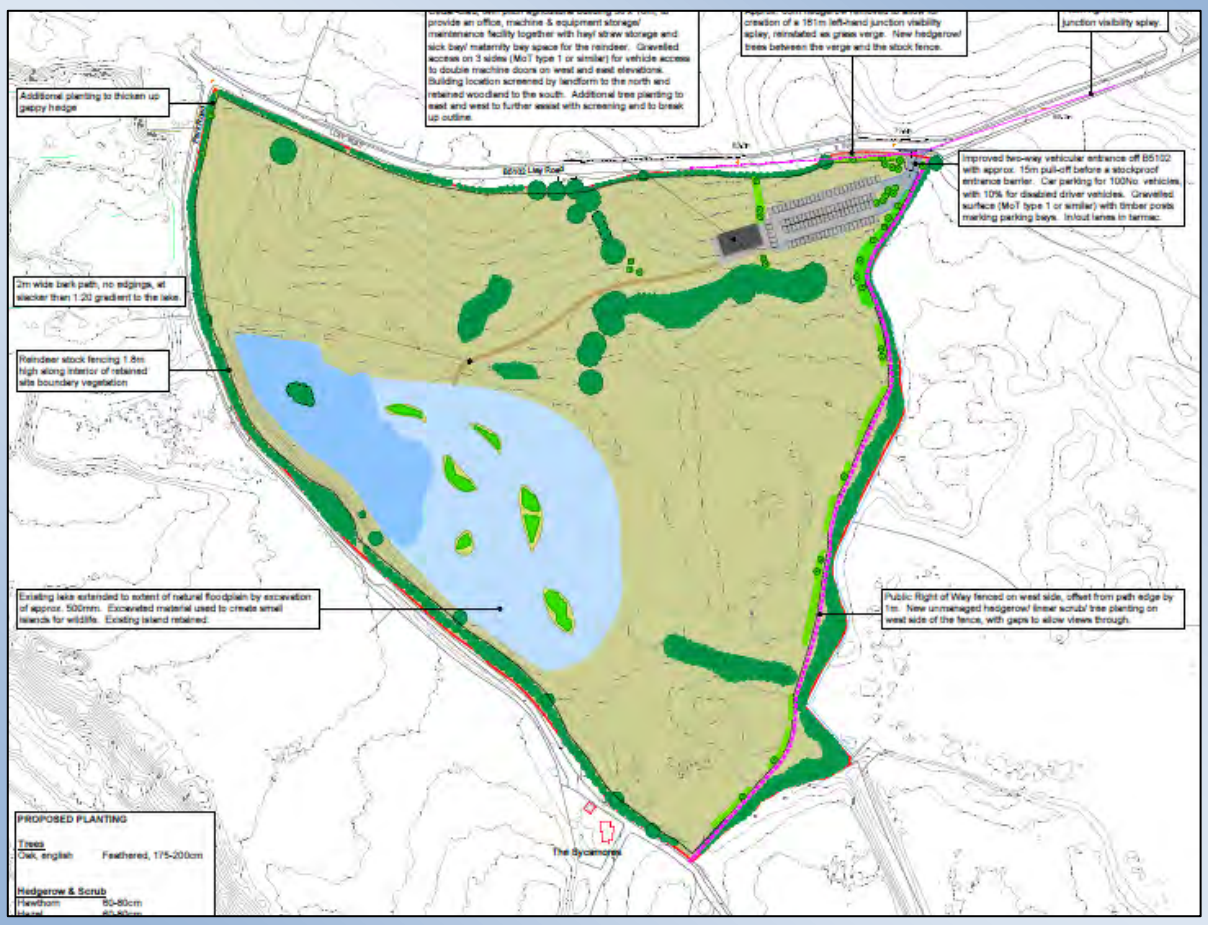

Figure 2: Proposed Planning Layout (Axis, 2021)

3.1.2 The total site area covers 17.0ha however the development area will cover a smaller 0.89ha. The development area excludes the land within the wider site that remain as greenfield. It is understood that the site is 100% permeable at present, however given the development proposals it is understood that the impermeable areas will increase to 14% (0.124ha) of the development area post-development.

3.1.3 All new developments over 100m² (or consisting of at least 2 properties) in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. The SAB (GC) have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments.

4.0 SURFACE WATER MANAGEMENT

4.0.1 In accordance with national and local drainage hierarchies, the principal focus of this assessment is on the effective management of surface water run-off generated by the new development. Surface water run-off management options have been assessed in accordance with the sustainable drainage hierarchy. The Welsh Government: 'Statutory standards for sustainable drainage systems' (2018) are aimed at ensuring that the most effective drainage scheme is delivered for protecting and enhancing both the natural and built environment, these are discussed further below.

4.1 Standard 1 – Surface Water Run-Off Destination

4.1.1 Standard S1 comprises of five levels, which are discussed in detail in this assessment subsequently. The Fixed Standards S2 to S6 do not have exception criteria and prioritised levels. They specify all the criteria that need to be met to show compliance to the Standards. The five levels for S1 are:

- Priority Level 1: Surface water runoff is collected for use.
- Priority Level 2: Surface water runoff is infiltrated to ground.
- Priority Level 3: Surface water runoff is discharged to a surface water body.
- Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.
- Priority Level 5: Surface water runoff is discharged to a combined sewer.

Priority Level 1: Surface water runoff is collected for use.

4.1.2 Surface water re-use is applicable for residential properties. An external water butt will be provided for each dwelling to collect rainwater from roof tops, to promote domestic external water re-use. Internal rainwater harvesting systems are not proposed. In line with section G1.4 of the 'Statutory standards for sustainable drainage systems', internal rainwater harvesting is not proposed for this site as:

- There is no foreseeable demand for non-potable water on the site throughout its design life.
- There is no foreseeable need to harvest water at the site and Welsh Water have not identified potential stresses on mains water supplies in this area.
- The use of internal rainwater harvesting is not a cost-effective part of the solution for managing surface water runoff on the site, taking account of the potential water supply benefits of such a system.

Priority Level 2: Surface water runoff is infiltrated to ground.

4.1.3 Any proposed impermeable areas that can drain to soakaway or an alternative method of infiltration would significantly improve the sustainability of any surface water systems. The published online datasets have been reviewed to consider how favourable the underlying strata is to support a potential infiltration-based solution.

4.1.4 The British Geology Survey (BGS) mapping data indicates that ground conditions comprise of Halesowen Formation (Mudstone, Siltstone and Sandstone). The Cranfield Soil and Agrifood Institute Soilscapes soil type viewer identifies the soils to be Freely draining slightly acid loamy soils. Furthermore, based on the FEH catchment data, the soil factor for the area has been identified to be 0.3, which suggests the soils may be permeable (based on a scale of 0.1 to 0.5, with 0.5 being impermeable).

4.1.5 Based on these published online datasets it is understood that infiltration may be able to offer a sustainable drainage solution in part or full. To confirm if infiltration will be feasible onsite given the mixed suitability for infiltration, it is recommended that Soakaway Testing (to BRE365) is undertaken at an early stage ascertain the specific onsite underlying ground conditions and suitability of such to achieve a full infiltration-based drainage approach for surface water run-off.

4.1.6 Discharge rates are limited by the rate of infiltration; it is therefore recommended that the chosen infiltration-based discharge method(s) are designed to BRE365 standards in accordance with the CIRIA SuDS Manual. Discussion with Wrexham County Borough Council and Welsh Water will also be required to ensure that the proposed infiltration methods conform to their design requirements.

4.1.7 By ensuring surface water run-off is managed appropriately the risk of increasing flooding offsite because of the proposals will be minimised which conforms with local and national planning guidance. The proposed onsite drainage will need to be designed to collectively cater for the run-off generated, during the storm events up to and including the 1 in 100-year return period event, with 40% allowance for climate change.

Priority Level 3: Surface water runoff is discharged to a surface water body.

4.1.8 If infiltration is unable to offer a surface water management solution for the proposals (subject to onsite testing), it is proposed that the development proposals formally discharge surface water run-off into the onsite surface water body. Review of the mapping had identified the presence of a large body of water located adjacent to the western boundary of the wider site area.

4.1.9 It is understood based on anecdotal evidence that the existing body of water has incoming surface water flows from onsite overland flows and a conveyance route from the Ordinary Watercourse located adjacent to the eastern boundary of site. It is understood that this body of water infiltrates over an extended period of time.

4.1.10 The proposals will therefore be to formally discharge surface water run-off from the roof areas of the proposed development into this surface water body at a restrict greenfield rate (QBar), as illustrated within Figure 3. The proposals are also to increase the size of this existing surface water body to increase surface water attenuation and biodiversity properties.

4.1.11 Detailed design will be required to confirm the feasibility of the strategy and whether a site wide gravity system is achievable. The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties. Consents for works to the onsite surface water body will be required from the landowner. Early investigations into this surface water body will be needed to be undertaken to identify any additional capacity constraints. This report is to support the proposed planning application. Full approval for the proposed drainage strategy will need to be sought from the SuDS Approval Body (Wrexham County Borough Council) separately by the developer in due course.

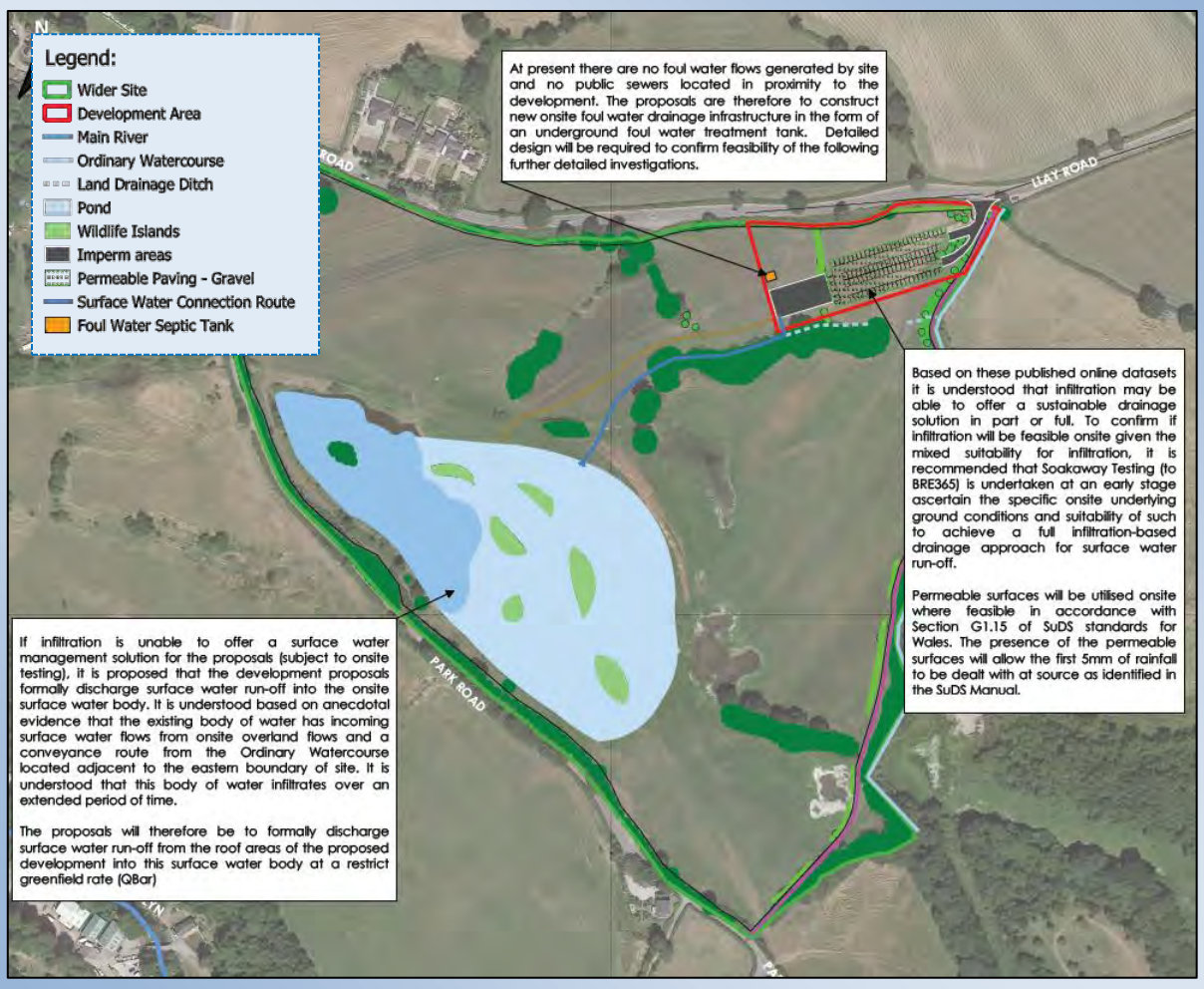

Figure 3: Proposed Drainage Strategy Plan Extract (Betts Hydro, 2021)

This drawing is not a drainage 'design' it is a plan showing the preliminary drainage strategy.

Proposed Discharge Rates

4.1.12 In accordance with the SuDS Standards for Wales (2018) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the nature and the size of the development, the pre-development greenfield rate (QBar) is calculated to be 3.4l/s (see calculations in Appendix I). Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The stormwater storage figures for the site have been included within Appendix I. The surface water scheme for the development will be designed to cater for the surface water run-off generated in storm events up to and including the 1 in 100yr return period with allowance for climate change.

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system.

4.1.13 Review of Welsh Water's sewer records show there are no public surface water sewers or highway drains in proximity for the site to discharge into. Furthermore, there are no proposals to connect into a surface water sewer, highway drain, or another drainage system, due to more primary drainage options being identified as feasible onsite.

Priority Level 5: Surface water runoff is discharged to a combined sewer.

4.1.14 As previously discussed, review of Welsh Water's sewer records show there are no public surface water sewers in proximity for the site to discharge into. Furthermore, there are no proposals to connect into a surface water sewer, highway drain, or another drainage system, due to more primary drainage options being identified as feasible onsite.

4.2 Standard 2 – Surface Water Run-Off Hydraulic Control

4.2.1 This Standard applies to discharges to surface water bodies, surface water sewers or combined sewerage systems. Should infiltration be identified as not feasible onsite (subject to testing), the proposals are to discharge surface water run-off from the site into the onsite surface water body located adjacent to the western boundary of the wider site. Appropriate detailed design will ensure no increased flood risk will result from the proposals when climate changes are considered in the future.

4.2.2 The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties. The proposed onsite attenuation will be sized to contain up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change. The site will discharge at a restricted greenfield rate controlled by a flow control device. Furthermore, all permeable surfaces will comply to standards set out in the SuDS Manual as discussed further in Section 4.6.

4.3 Standard 3 – Water Quality

4.3.1 The proposed drainage regime will look to address the design requirement associated with Water Quality in multiple ways. The key being the incorporation of multiple stages of water treatment prior to discharge from the site. Where feasible permeable surfaces will be considered to provide water quality improvements from filtration. Furthermore, as part of the development, areas of the wider site will be utilised as a tree farm for coniferous firs. It is understood that these trees will reduce soil and water movement by increasing water infiltration rates and slowing the flow of transported sediments. By trapping pollutants bound to soil particles, these trees will help reduce water pollutants from entering the onsite surface water body.

4.3.2 The proposed attenuation will be designed in accordance with the guidance and practice in the SuDS Manual, to ensure it provides an additional source of water quality treatment prior to flows leaving the site. As discussed, Planting will also be considered where appropriate to provide additional benefits for any run-off entering these SuDS features.

4.4 Standard 4 – Amenity

4.4.1 The developer will consider the use of external rainwater butts on the proposed building and gravelled vehicle access. As the proposed development is for the construction of a commercial building with an area to house reindeer, the majority of the wider site will remain undeveloped for grazing land for the deer. As part of the development the proposals are to increase the size of the existing onsite waterbody and use any

excavated material to create small islands for wildlife, as illustrated within Figure 2. The proposed tree farm will also provide amenity to the site by softening the surrounding urban environment.

4.5 Standard 5 – Biodiversity

4.5.1 The proposed drainage regime will look to address the design requirements associated with biodiversity by ensuring green open space onsite. As previously discussed, the proposed development is for the construction of a commercial building with an area to house reindeer, the majority of the wider site will remain undeveloped for grazing land for the deer. As part of the development the proposals are to increase the size of the existing onsite waterbody and use any excavated material to create small islands for wildlife therefore increasing the amount of land which can be used for biodiversity post-development. The proposed tree farm will also provide biodiversity for wildlife overing a degree of protection and assist in helping prevent Climate Change by providing a level of carbon absorption to the surrounding area.

4.5.2 Furthermore, the proposed permeable surfacing on the car parking and access route will be designed to promote the maximum benefits in terms of biodiversity. Any additional planting proposed will be native to the area and provide benefits to natural and local ecosystems, the specific design and criteria will be confirmed during detailed design, in conjunction with an appropriate ecologist.

4.6 Standard 6 - Design of Drainage for Construction, Operation and Maintenance

4.6.1 From January 2019, all new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government SuDS standards for Wales guidance and Schedule 3 of the Flood and Water Management Act 2010 (FWMA), which establishes GC as a SuDS Approval Board (SAB).

4.6.2 The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments. The SAB application is undertaken separately to the planning permissions and developers are required to obtain both planning approval and SAB approval prior to commencement of any proposed construction works.

Permeable Surfaces

4.6.3 Permeable surfaces will be utilised onsite where feasible in accordance with Section G1.15 of SuDS standards for Wales. The presence of the permeable surfaces will allow the first 5mm of rainfall to be dealt with at source as identified in the SuDS Manual (Appendix K for full details).

4.6.4 An extract from the SuDS Manual has been included within Appendix K identifying the design guidance for the different types of permeable surfacing that has been identified as one of the primary options for handling surface water runoff from site.

Maintenance

4.6.5 Regular inspection and maintenance are important for the effective operation of SuDS. The property owner should be inspecting any assets regularly, preferably during and after heavy rainfall to check effective operation.

4.6.6 Maintenance activities can be broadly defined as: 1) regular, 2) occasional and 3) remedial maintenance. It is proposed that maintenance regime for permeable paving follows table 20.15 in the CIRIA 753 SuDS Manual guidance (Appendix K). Maintenance of shared permeable surfaces (permeable paved access roads and parking areas) however can be arranged through appointment of a site management company.

4.7 Climate Change

4.7.1 There are significant indications that the UK climate is changing; the nature of this change will vary based on regional and catchment differences, consensus is that effects will become more pronounced over the coming decades. With reference to TAN15 the most likely effects to be experienced within Wales are:

- Increases in sea levels.
- Greater inflow into estuaries and the sea
- Significant changes in rainfall patterns seasonally
- Increased evapotranspiration

4.7.2 Making 'provisions' for these anticipated future changes to flood risk is an important action, ensuring future 'sustainable development' within Wales as identified within TAN15; Section 2.1. Current expert opinion indicates the likelihood of more frequent short duration and high intensity rainfall events and the addition of more frequent periods of long duration rainfall meaning future flooding events will have a greater impact on the environment and society.

4.7.3 Furthermore, in accordance with SuDS Standards for Wales; Section G2.5 the proposed SuDS methods will be used to support development resilience to climate change by reducing the risk of localised surface water flooding, mitigating pollution that may arise from surface water runoff and helping to safeguard water supplies. The development proposals also take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep.

4.7.4 Any increase in the level of flood risk to the potential development from Climate Change is likely to be related to the increase in rainfall intensity and duration and its impact upon the surface water drainage system. Climate Change will therefore be accounted for within the design with an increase in peak rainfall intensity of 40%.

4.8 Foul Water Management

4.8.1 At present there are no foul water flows generated by site and no public sewers located in proximity to the development (see sewer records in Appendix C). The proposals are therefore to construct new onsite foul water drainage infrastructure in the form of an underground foul water treatment tank. Detailed design will be required to confirm feasibility of the following further detailed investigations.

5.0 SUMMARY AND CONCLUSIONS

5.1 This assessment has been prepared to support a planning application for development located off Llay Road in Cefn-y-Bedd (Wrexham). The proposals are for the construction of a commercial building to provide an office, maintenance facility, hay/straw storage and sick/maternity bay for reindeer. The wider site will also be used as a tree farm for Christmas Trees. The proposals will be complete with access, cark parking, boundary fencing and drainage.

5.2 In order for the development proposals to be justified in line with the guidance set out in SuDS Standards for Wales, new development must not increase flood risk elsewhere and where possible offer improvement on the pre-development situation. The sustainable drainage hierarchy has been considered in accordance with the Welsh SuDS Standards, which look to deal with surface water run-off as close to source as is practical.

5.3 Based on these published online datasets it is understood that infiltration may be able to offer a sustainable drainage solution in part or full. To confirm if infiltration will be feasible onsite given the mixed suitability for infiltration, it is recommended that Soakaway Testing (to BRE365) is undertaken at an early stage ascertain the specific onsite underlying ground conditions and suitability of such to achieve a full infiltration-based drainage approach for surface water run-off.

5.4 Discharge rates are limited by the rate of infiltration; it is therefore recommended that the chosen infiltration-based discharge method(s) are designed to BRE365 standards in accordance with the CIRIA SuDS Manual. Discussion with Wrexham County Borough Council and Welsh Water will also be required to ensure that the proposed infiltration methods conform to their design requirements.

5.5 If infiltration is unable to offer a surface water management solution for the proposals (subject to onsite testing), it is proposed that the development proposals formally discharge surface water run-off into the onsite surface water body. Review of the mapping had identified the presence of a large body of water located adjacent to the western boundary of the wider site area.

5.6 It is understood based on anecdotal evidence that the existing body of water has incoming surface water flows from onsite overland flows and a conveyance route from the Ordinary Watercourse located adjacent to the eastern boundary of site. It is understood that this body of water infiltrates over an extended period of time.

5.7 The proposals will therefore be to formally discharge surface water run-off from the roof areas of the proposed development into this surface water body at a restrict greenfield rate (QBar). The proposals are also to increase the size of this existing surface water body to increase surface water attenuation and biodiversity properties.

5.8 Detailed design will be required to confirm the feasibility of the strategy and whether a site wide gravity system is achievable. The specific drainage infrastructure to be implemented will be confirmed during the detailed design stage following discussion with all relevant parties. Consents for works to the onsite surface water body will be

required from the landowner. Early investigations into this surface water body will be needed to be undertaken to identify any additional capacity constraints.

5.9 In accordance with the SuDS Standards for Wales (2018) all sites should endeavour to achieve as close to pre-development greenfield rates as is viable. Based on the nature and the size of the development, the pre-development greenfield rate (QBar) is calculated to be 3.4l/s. Restricting the rate of discharge will generate a requirement to provide onsite stormwater storage for the extreme rainfall events. The surface water scheme for the development will be designed to cater for the surface water run-off generated in storm events up to and including the 1 in 100yr return period with allowance for climate change. This report is to support the proposed planning application. Full approval for the proposed drainage strategy will need to be sought from the SuDS Approval Body (Wrexham County Borough Council) separately by the developer in due course.

5.10 This Drainage Management Strategy is commensurate with the site and in summary, the development can be considered appropriate in accordance with Welsh Governments Statutory Standards for Sustainable Drainage Systems, providing the mitigation measures proposed within are included within the development proposals.

6.0 RECOMMENDATIONS

6.1 The development parcels are located wholly within Flood Zone 1 and are at little risk of fluvial/tidal flooding. To observe a conservative approach however, mitigation measures have been proposed below to safeguard against other potential residual sources of flood risk. The mitigation measures also consider the uncertainties of climate change in accordance with the revised TAN15.

6.2 For 'less vulnerable' development located within Flood Zone 1, it is typical to set the Finished Floor Levels (FFL) of proposed buildings a minimum of 150mm above the existing ground levels. By ensuring the FFLs are raised sufficiently above the external levels (following any re-grade) should mitigate any risk of flooding from a variety of sources, including groundwater and surface water risks.

6.3 Any overland flows generated by the development must be carefully controlled and safe avenues directing overland flows way from any proposed properties is advised. Any natural conveyance routes should be maintained through the site, where practical. Where this is not practical then provision will need to be made to intercept and convey flows safely through the proposals to outfall as they would naturally.

6.4 The site walkover confirmed the presence of an unnamed Ordinary Watercourse located adjacent to the eastern boundary of site, identified to be routed into the site via a land drainage ditch. It is recommended that further investigation is undertaken to understand the exact condition, capacity and routing of the watercourses and waterbodies located onsite.

6.5 All new developments of at least 2 properties or over 100m² in Wales will be required to have Sustainable Drainage Systems (SuDS) to manage surface water run-off generated by the proposals. These SuDS must be designed and constructed in accordance with the Welsh Government standards for sustainable drainage. The SAB have statutory responsibility for approving and where appropriate adopting the proposed drainage systems on new developments.

6.6 To minimise the flood risk to the neighbouring properties and conform to the guidance set out in TAN15, it is proposed that surface water run-off be managed effectively and sustainably in accordance with best practice and standard guidance. It is recommended that the peak rates of surface water run-off generated by the proposals be restricted to the equivalent of the pre-development greenfield situation.

6.7 The proposed onsite surface water drainage system will need to be sized to contain the 1 in 30yr return period event below ground with exceedance from storm events up to and including the 1 in 100yr return period storm event with a 40% allowance for climate change being contained onsite.

6.8 As with any drainage system blockages within either the foul or surface water system have the potential to cause flooding or disruption. It is important that should any drainage systems not be offered for adoption to either the Water Company or the Local Authority then an appropriate maintenance regime should be scheduled with a suitably qualified management company for these private drainage systems.

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Flood Forum – http://www.floodforum.org.uk/
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Welsh Water - http://www.dwrcymru.com/

APPENDIX A: SuDS STANDARDS FOR WALES EXTRACTS

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Early design thinking to deliver multifunctional spaces and effective drainage for phased development

Drainage systems should be considered at the earliest stages of site design to influence the layout of the roads, buildings and public open spaces. Planning of a new site layout should be informed by the topography and the requirements of surface water management systems to both effectively drain and treat the runoff. Any existing watercourses, ditches, and other drainage features both within and adjoining the site should help inform proposals. By doing so, biodiversity, amenity and cost effectiveness can be maximised through using areas of land for a range of multifunctional purposes in addition to surface water management e.g. landscaping, car parking, recreational areas, rainwater harvesting etc. Early conceptual design will require that infiltration tests are also undertaken early to inform the conceptual design of the drainage system.

Where a development is phased, the design of the SuDS scheme should consider the effects of each stage as well the whole development on the performance of the surface water drainage system.

Development design should take account of existing flood risk policies in the Local Flood Risk Management Strategy, any flood consequence assessments, surface water management plans, the catchment flood management plan and the river basin management plan (see Section 4, Regulatory Framework). It should also take account of any relevant local planning documents.

How the National Standards work

To assist in understanding the basis for the required Standards to be complied with, there is an introductory **Principles** section. There are two types of Standards. Standard S1 is a **Hierarchy Standard** while S2 to S6 are **Fixed Standards.**

- **Principles** for SuDS drainage design explain the objectives for applying the Standards;
- The **Hierarchy Standard** gives criteria for prioritising the choice of runoff destination (Standard S1);
- **Fixed Standards** (Standards S2 to 6) give:
    - Design Standards which state the minimum design criteria that all SuDS should satisfy; and
    - Standards which state how SuDS should be built, maintained and operated.

The SuDS Standards are aimed at ensuring that the most effective drainage scheme is delivered for protecting and enhancing both the natural and built environment.

Standard S1 comprises 5 Levels with the most preferred level represented by Level 1, and movement from Level 1 to lower levels determined by demonstration that the exception criteria apply. Level 1 should be met to the maximum extent possible, with lower levels used where required and where appropriate justification can be provided. Different levels may be suitable for different parts of a site, and more than one level may be required to effectively drain the site to meet the requirements of the Standards.

Fixed Standards S2 to S6 do not have exception criteria and prioritised levels. They specify all the criteria that need to be met in order to show compliance to the Standards.

Links with the planning system

Developers should demonstrate compliance with these standards in submitting planning applications. For major developments, where a drainage strategy document may be required as part of a local validation requirement, this should demonstrate how these standards have been met in the site design.

It should be noted that a number of planning authorities in Wales have adopted guidance on sustainable drainage which should be taken into account in any development proposal.

Glossary

Note that Section 5 contains a glossary which aims to explain and clarify any unfamiliar terms or specialist words used in this document.

3. Standards

Standard S1 – Surface water runoff destination

This Standard addresses the use of surface water by the development and where it should be discharged. The aim is to ensure that runoff is treated as a resource and managed in a way that minimises negative impact of the development on flood risk, the morphology and water quality of receiving waters and the associated ecology. This will ensure that early consideration is given to the use of rainwater harvesting systems to both manage runoff and deliver a source of non-potable water for the site where practical. Where it is not, prioritisation should be given to infiltration. Discharges to sewerage systems must be limited where possible.

S1 Surface water runoff destination

Priority Level 1: Surface water runoff is collected for use;

Priority Level 2: Surface water runoff is infiltrated to ground;

Priority Level 3: Surface water runoff is discharged to a surface water body;

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system;

Priority Level 5: Surface water runoff is discharged to a combined sewer.

Note that Priority Levels 1 is the preferred (highest priority) and that 4 and 5 should only be used in exceptional circumstances.

Guidance on Standard S1 – Surface water runoff destination

G1.1 As much of the runoff as possible (subject to technical or cost constraints) should be discharged to each destination before a lower priority destination (level) is considered.

G1.2 Depending on the site characteristics, drainage from different parts of the site could have different drainage destinations.

G1.38 Provision should be made for separation and removal of sediments and oils before connection to a combined sewer.

G1.39 The possibility of the developer funding disconnection of surface water entering the combined sewer at locations either upstream or downstream of the site connection should be investigated with the sewerage undertaker and the local authority to mitigate the impact of the runoff into the sewer from the development.

Standard S2 – Surface water runoff hydraulic control

The aim of Standard S2 is to manage the surface water runoff from and on a site to protect people on the site from flooding from the drainage system for events up to a suitable return period, to mitigate any increased flood risk to people and property downstream of the site as a result of the development, and to protect the receiving water body from morphological damage.

S2 Surface water runoff hydraulic control

1) Surface water should be managed to prevent, so far as possible, any discharge from the site for the majority of rainfall events of less than 5mm.
2) The surface water runoff rate for the 1 in 1 year return period event (or agreed equivalent) should be controlled to help mitigate the negative impacts of the development runoff on the morphology and associated ecology of the receiving surface water bodies.
3) The surface water runoff (rate and volume) for the 1% (1 in 100 year) return period event (or agreed equivalent) should be controlled to help mitigate negative impacts of the development on flood risk in the receiving water body.
4) The surface water runoff for events up to the 1% (1 in 100 year) return period (or agreed equivalent) should be managed to protect people and property on and adjacent to the site from flooding from the drainage system.
5) The risks (both on site and off site) associated with the surface water runoff for events greater than the 1% (1 in 100 year) return period should be considered. Where the consequences are excessive in terms of social disruption, damage or risk to life, mitigating proposals should be developed to reduce these impacts.
6) Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure or

Standard S3 - Water Quality

Standard S3 addresses the drainage design requirements to minimise the potential pollution risk posed by the surface water runoff to the receiving water body.

S3 Surface water quality management

Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

Guidance on Standard S3 - Water Quality

G3.1 Runoff from roads, commercial and other urban environments can, in particular, contain grit, sediments, oils and poly-aromatic hydrocarbons (PAHs), metals, and dissolved salts – each of which has the potential to cause pollution of receiving surface water or groundwater. SuDS can be effective at reducing a wide range of these pollutants through enabling sedimentation, filtration and a range of photolytic, chemical and biological processes.

G3.2 This Section provides guidance on Standard S3, which aims to ensure SuDS effectively manage sediment and other pollutants, ensuring discharges from the systems are of an acceptable quality and will not cause a pollution risk.

G3.3 The effective management of surface water runoff is essential, even if the receiving water body is already polluted. Consideration should be given to supporting current or future quality objectives for the water body over the lifetime of the development.

G3.4 The effectiveness of components in improving water quality is strongly linked to the reduction in the volume of runoff. Well-designed SuDS, designing for water quality management, should maximise volume reduction when designing conveyance and attenuation measures, preferably using vegetated, surface-based systems.

G3.5 This guidance does not supersede the requirements of the Water Framework and Groundwater Directives, but provides options for compliance in line with Natural Resources Wales advice.

Standard S4 - Amenity

Standard S4 addresses the design of SuDS components to ensure that, where possible, they enhance the provision of high quality, attractive public space which can help provide health and wellbeing benefits, they improve liveability for local communities and they contribute to improving the climate resilience of new developments.

S4 - Amenity

The design of the surface water management system should maximise amenity benefits.

Guidance on Standard S4 - Amenity

G4.1 The aim of standard S4 is to ensure that, wherever possible, and having regard to the need to prioritise infiltration drainage and rainwater harvesting (Standard S.1), the SuDS scheme makes the best contribution to development design by maximising benefits for amenity as well as for biodiversity, water quantity and quality.

G4.2 It is likely that multiple components will be required, linked in series across the site, to achieve a SuDS scheme that integrates well with the environment of a new development. Keeping water at or close to the ground surface will help to promote amenity benefits. Managing runoff at source will promote the use of smaller, distributed features, rather than large retention or detention features which are often inappropriate.

G4.3 A key aim for sustainable drainage is to provide an improved local environment which integrates the surface water drainage function with open space, providing amenity and recreation opportunities where possible. Examples of successful schemes in the UK and abroad are available[24]. This Section (and Section 5 Biodiversity standard) provides guidance on how to ensure that SuDS can work for people and nature. This section shows how SuDS can add amenity value by contributing towards:

- making sites pleasant places to live or work;
- reducing hazards from climate change;
- creation of amenity space - contributing to green space accessibility standards; and
- promoting the well-being of site users.

[24] www.susdrain.org

Standard S5 - Biodiversity

Standard S5 addresses the design of SuDS to ensure, where possible, they create ecologically rich green and blue corridors in developments and enrich biodiversity value by linking networks of habitats and ecosystems together. Biodiversity should be considered at the early design stage of a development to ensure the potential benefits are maximised.

S5 - Biodiversity

The design of the surface water management system should maximise biodiversity benefits.

Guidance on Standard S5 - Biodiversity

G5.1 The aim of standard S5 is to ensure that, wherever possible, and having regard to the need to prioritise infiltration drainage and rainwater harvesting, the SuDS scheme makes the best use of a site to maximise benefits for biodiversity, as well as for amenity, water quantity and quality. Biodiversity benefits will usually be best achieved by drainage systems which are on the surface and visible with vegetated components, forming part of the local green infrastructure and local ecosystem structure. It is important to ensure that the SuDS design does not damage existing sensitive habitats. Amenity is addressed by Standard S4.

G5.2 The provision of biodiversity enhancement in developments is a requirement of Planning Policy Wales and Technical Advice Note (TAN) 5[28].

G5.3 A key aim for sustainable drainage is to provide an improved local environment which integrates the surface water drainage function with open space providing habitat opportunities where possible. This Standard and Standard 4 (Amenity) provide guidance on how to ensure that SuDS can work for people and nature. SuDS can add biodiversity value by:

- Supporting and promoting natural local habitat and species,
- Contributing to the delivery of local biodiversity objectives,
- Contributing to habitat connectivity, delivering wider biodiversity benefits,
- Creating diverse, self-sustaining, resilient local ecosystems.

[28] TAN 5 Nature Conservation and Development
http://gov.wales/topics/planning/policy/tans/tan5/?lang=en

Standard S6 – Design of drainage for Construction, Operation and Maintenance and Structural Integrity

Standard S6 deals with designing robust surface water drainage systems so they can be easily and safely constructed, maintained and operated, taking account of the need to minimise negative impacts on the environment and natural resources.

S6 – Design of drainage for Construction, Operation and Maintenance

1) All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

2) All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).

3) The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

Guidance on Standard S6 – Design of drainage for Construction, Operation and Maintenance

Construction

G6. 1 The design should take full account of the method of construction, including any specific programming requirements, to minimise the potential for poor construction of any drainage component. For phased developments, the design should indicate how SuDS features will be managed, protected and commissioned, especially where their use may change through the construction programme. The SuDS Manual includes detailed guidance on planning a SuDS scheme.

G6.2 The Construction (Design and Management) Regulations 2015 include requirements for designers to take account of the health and safety risks

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APPENDIX B: NRW CORRESPONDENCE & FLOOD MAPPING

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Hannah Buchanan

From: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Sent: 11 October 2021 14:13
To: Hannah Buchanan
Subject: ATI22214a P5&6, Land at Cefyn-y-Beth, Wrexham, LL12 9UG

Dear Ms Buchanan,

Further to your recent request concerning the above, please note that we do not have any detailed models for this location.

Self Service Open Data:

You can now make the most of open data provided **free online:**

- **NRW Flood Risk Map Viewer**: create and export an A4 or A3 PDF map at a scale of 1:5000. You will find many spatial risk layers, including the Development Advice Map, flood zones, surface water, reservoir hazard data and historic flooding.

- **"Lle" the Welsh Government Portal for Open Spatial data**: Spatial data is free to download, view and use within your own GIS system. The flood datasets includes Flood Zones, Flood Defences, Historic Flood Outlines, Areas Benefiting Defences, Surface Water, Development Advice Map, and LiDAR Composite Dataset. You can also download the 'Coastal Design – Extreme Sea Levels' report and data covering still water levels for the Welsh Coastline (wave overtopping is **not** calculated).

Please Note the Following:

- All information supplied will need to be verified by the recipient **PRIOR** to using in a Flood Consequences Assessment (FCA). We would expect to see a review of hydrology, in-channel survey, floodplain topography etc. to demonstrate the data is suitable for the purposes of producing an FCA.

- As of 1st of December, 2016 you will need to apply climate change allowances carefully to ensure compliance with Welsh Government climate change allowances and flood consequence assessments.

- **Pre-application Advice:** NRW are changing the way in which we provide advice to developers. We will continue to meet our duties as an adviser. In addition, we will offer a free initial opinion on your proposal. However, in cases where you would like to access any extra advice that falls outside of our statutory duties, we can only offer this as part of our Discretionary Planning Advice Service (DPA Service). For more information regarding free service and our discretionary planning can be found in the following links: Welsh Version / English version.

Your request for our free or charged discretionary advice service needs to be accompanied by the relevant 'Request Form' which is available to download from our website. You will then need to send the form to northplanning@cyfoethnaturiolcymru.gov.uk who will coordinate our response.

Apologies we could not have been of any further assistance to you on this occasion.

Yn gywir / Yours sincerely,

Michelle Lewis

Cyfoeth Naturiol Cymru / Natural Resources Wales
Ffôn/ Phone: 03000 653577
Symudol / Mobile: 07917243096
Office Location Llys Afon, Hwlffordd / Office Location River Court, Haverfordwest
Cwsmer, Cyfarthrebu a Masnach - Customer, Communications and Commercial

Oriau gwaith arferol/Normal working hours – Mon-Fri, 9 to 5

Yn falch o arwain y ffordd at ddyfodol gwell i Gymru trwy reoli'r amgylchedd ac adnoddau naturiol yn gynaliadwy.

Proud to be leading the way to a better future for Wales by managing the environment and natural resources sustainably.

cyfoethnaturiol.cymru / naturalresources.wales

Twitter | Facebook | LinkedIn | Instagram

From: Hannah Buchanan <hannahbuchanan@betts-associates.co.uk>
Sent: 15 September 2021 17:03
To: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Subject: Flood Risk Information Request

To whom it may concern,

Land at Cefyn-y-Beth, Wrexham, LL12 9UG

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site, please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

BETTS HYDRO
Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0)1244 289041

hannahbuchanan@betts-associates.co.uk
www.betts-associates.co.uk

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APPENDIX C: WW SEWER CORRESPONDENCE

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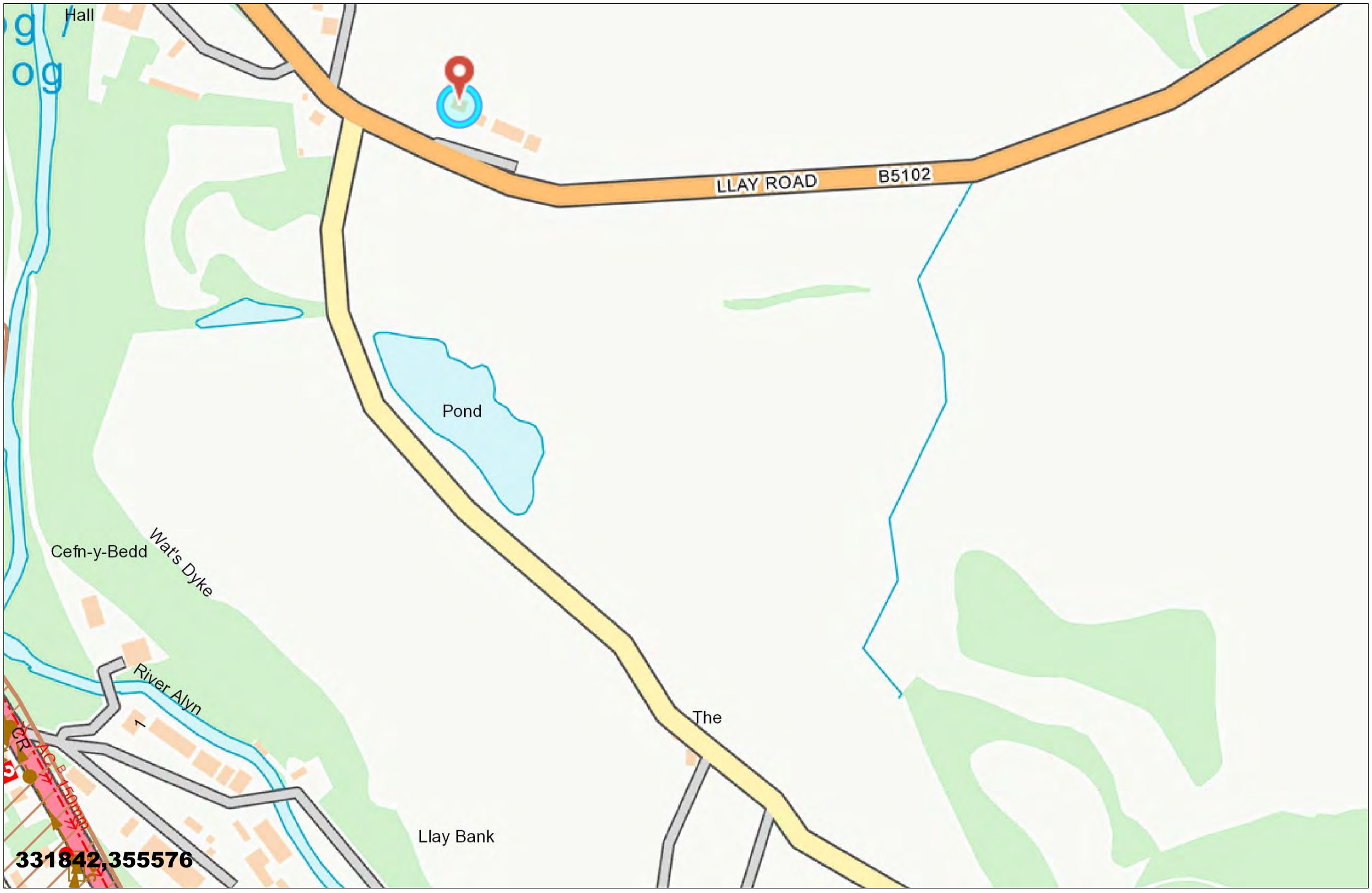
Dŵr Cymru
Welsh Water

Land off Llay Road, Cefn-y-Bedd, Wrexham

14/10/2021

N
W E
S

Scale: 1: 5000



LEGEND

Clean Water

- Sluice Val
- Air Val, SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- BULK Meter
- FH
- Cap
- Existing Main
- NON COMPANY

Sewerage External

- Foul
- Surface Water
- Combined
- Rising Main
- Private
- Treatment Works
- Pumping Station
- Special Purpose
- Unknown End
- Change, Combined Overflow
- Outfall, FOUL
- Lamp Hole, Foul
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

Dwr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon In the event of excavations or other works made in the vicinity of the company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby the company, is done so in accordance with statutory requirements of sections 198 and 199 f the water industry Act 1991 based upon the best Information available and in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclosure the existence of a drain sewer or disposal main laid before 1 September 1989, or if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information us entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the company's right to be compensated for any damage to its apparatus.

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

Reproduced from the Ordnance Survey's maps with the permission of the Controller of Her Majesty's Stationary Office. Crown Copyright. Licence No: WU298565.

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be Asbestos Cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Hannah Buchanan

From: Environmental Information Requests <EnvironmentalInformationRequests@dwrcymru.com>
Sent: 24 September 2021 09:38
To: Hannah Buchanan
Subject: Request for Information - Sewer Flood Risk Information

Our Reference: EIR/903/2021

Dear Ms Buchanan,

Request for Information

RE: Land at Cefyn-y-Beth, Wrexham, LL12 9UG

We write further to your request for information dated 16th September 2021, which we have been considering under the Environmental Information Regulations 2004.

We can confirm that we have reviewed our flooding database and we have no flooding history within the location or vicinity requested.

Turning to your query on specific drainage requirements, we have a dedicated Planning Team within our Developer Services function that can provide advice on the capacity in our infrastructure to accommodate new development.

Our pre-planning service will review the capacity available in our sewerage network, wastewater treatment works and clean water network to accommodate the flows/demand from a proposed development. It will also raise awareness of any of our assets crossing the site which will need to be factored into the layout of your development and provide general advice on surface water drainage.

An application for pre-planning advice can be submitted online via the following address https://developers.dwrcymru.com/en/applications/planning/pre-planning. If you wish to discuss in more detail our Planning Team are contactable on 08009172652 or alternatively by email developer.services@dwrcymru.com.

We hope that this response is clear. Should you have any questions, please contact us by email at EnvironmentalInformationRequests@dwrcymru.com.

If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. Internal review requests should be submitted within 40 working days of the date of receipt of this response and should be addressed to Company Secretary, Linea, Fortran Road, St Mellons, Cardiff CF3 0LT

If you are not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision.

Yours sincerely,

R.Stevens

Dŵr Cymru Welsh Water

_____ Dwr Cymru Welsh Water is firmly committed to water conservation and promoting water efficiency. Please log on to our website www.dwrcymru.com/waterefficiency to find out how you can become water wise. Mae Dwr Cymru Welsh Water

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APPENDIX D: LLFA/LPA CORRESPONDENCE

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Hannah Buchanan

From: Hannah Buchanan
Sent: 15 September 2021 17:07
To: 'sab@wrexham.gov.uk'
Subject: Historic Flood Risk Information
Attachments: Location Plan.pdf

To whom it may concern,

Land at Cefyn-y-Beth, Wrexham, LL12 9UG

Please could you confirm whether you have any information that you feel would be valuable to a Flood Risk Assessment and Drainage Management Strategy for the above site (location plan attached), including details of historical flooding and any predicted flood water levels; this would be greatly appreciated. If there are any specific requirements that you require in a scope of works for this site, please can you advise at this stage so that it can be fully incorporated into the proposals at an early stage.

Please do not hesitate to contact me on the details below to discuss further should you require additional information or clarification.

Kind Regards,

Hannah Buchanan *BSc (Hons)*
Graduate Flood Risk Analyst

BETTS HYDRO
Consulting Engineers

Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire, CH5 2LY
Chester +44 (0)1244 289041

hannahbuchanan@betts-associates.co.uk
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APPENDIX E: LOCATION PLAN

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LOCATION PLAN

Land at Cefn-y-Beth, Wrexham, LL12 9UG

OS X (Eastings)	331724
OS Y (Northings)	355636
Nat Grid	SJ317556 / SJ3172455636
Nearest Post Code	LL12 9UG
Lat (OSGB36)	N53:05:36 (53.09326230543045)
Long (OSGB36)	W3:01:11 (-3.0196803096816653)
Lat, Long (OSGB36)	53.09326230543045, -3.0196803096816653
Lat (WGS84)	N53:05:37 (53.09354523464698)
Long (WGS84)	W3:01:16 (-3.021011306649778)
Lat, Long (WGS84)	53.09354523464698, -3.021011306649778

APPENDIX F: TOPOGRAPHIC SURVEY

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DO NOT SCALE

Legend:

- Wider Site
- Development Area
- Topographic Fall
- Contours
- Main River
- Ordinary Watercourse
- Land Drainage Ditch
- Pond

REV	DATE	BY	DESCRIPTION	CHK
A	17/09/21	HB	PRELIMINARY FOR ISSUE	MB

DRAWING STATUS:

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

GOODWIN
PLANNING SERVICES

PROJECT:

LAND OFF LLAY ROAD
WREXHAM

TITLE:

ELEVATION PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
17/09/21	2500@A3	HB	MB

PROJECT No:	DRAWING No:	REV:
HYD666	100	A

APPENDIX G: PROPOSED PLANNING LAYOUT

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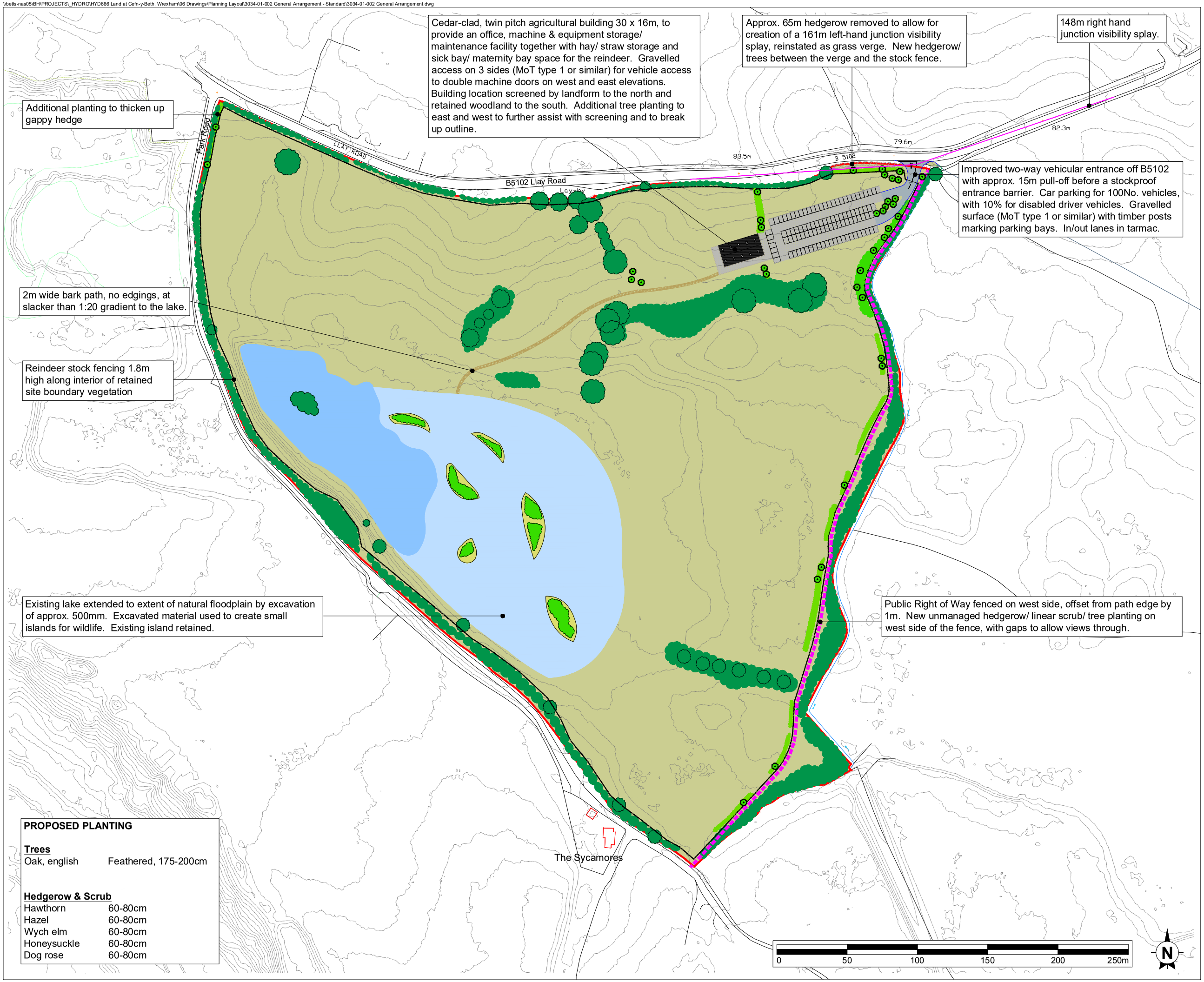
\\betts-nas05\BH\PROJECTS_HYDRO\HYD666 Land at Cefn-y-Beth, Wrexham\06 Drawings\Planning Layout\3034-01-002 General Arrangement - Standard\3034-01-002 General Arrangement.dwg



PROPOSED PLANTING

Trees

Oak, english	Feathered, 175-200cm

Hedgerow & Scrub

Hawthorn	60-80cm
Hazel	60-80cm
Wych elm	60-80cm
Honeysuckle	60-80cm
Dog rose	60-80cm

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Follow any figured dimensions - do not scale for construction purposes. IF IN DOUBT ASK.

Revision History	Date

KEY

- Site application boundary
- Contour at 1m vertical interval
- Public right of way (Llay 12)
- Existing tree, retained
- Existing woodland/ hedgerow/ scrub, retained
- Existing hedgerow, removed
- Existing waterbody, retained
- Existing grassland, retained
- Building, proposed
- Native hedgerow tree, proposed
- Mixed native species hedge, proposed
- Perimeter fence, proposed. 1.8m high stockproof fence on timber posts.
- Island, proposed. Scrub planting.
- Waterbody extension, proposed
- Path, proposed. Bark surface.

Note - the junction visibility splays shown on this drawing are commensurate with the observed 85th percentile design speed of traffic, recorded by ATC in July 2021.

Chester Office:
Well House Barns
Bretton
Chester
CH4 0DH

South Manchester Office:
Camellia House
76 Water Lane
Wilmslow
SK9 5BB

0844 8700 007 - www.axisped.co.uk

axis

client: Tarvin Sands Fishery

project: Christmas Farm Cefn-y-Bedd

drawing title: General Arrangement --

date: 03.08.21	drawn by: AR	checked: LK
drawing number: 3034-01-001	status: Planning	
scale(s): 1:2500@A3	rev: --	

planning environment design

APPENDIX H: PFRA/SPRA INFORMATION

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Volume Pumps (HVP's) pumps were brought in to extract the excess surface water in to the river system.

In Wrexham County Borough there were no areas identified as significant risk threshold with an affected population, greater than 5,000 people. Within the Wrexham County Borough Council Preliminary Flood Risk Assessment (PFRA) 2011[6], 20 1km square areas of 200 properties, 20 businesses or 1 critical infrastructure have been identified. These are areas which do not meet the statutory flood risk areas of 5,000 people but areas which are locally significant. These areas are concentrated around Wrexham, Llay Industrial Estate, Wrexham Industrial Estate and urban villages of Gwersyllt, Rhosllanerchrugog, Ruabon, Coedpoeth, Cefn Mawr, Acrefair, Chirk and Glyn Ceiriog, Ceiriog Valley. This local threshold will continue to form the basis of the LFRMS supported by continuing collection of information on local flood events.

The PFRA (2011) 1km2 squares show that local flood risk could potentially affect 20,696 properties. The Environment Agency maps on surface water show a total number of 451 properties within areas susceptible to surface water flooding. The Environment Agency Flood map for surface water shows that 1922 properties could potentially be affected by 1 in 30 flood event, and 5312 properties are shown at risk from the 1 in 200 flood map for surface water. To date, the County Borough has received 383 flooding incidents.

The flooding events that have occurred this year 2012-2013 within the County Borough l have varied in size and caused different patterns of events. In April prolonged and heavy rainfall caused problems associated with surface water run off and river flooding alerts in Acrefair and Rossett. The events in July and August were associated with surface water flooding and flash flooding in urban villages of Gwersyllt, Gresford, Marford, Llay and Burton Green. In September, flooding events covered the borough causing surface water and river flooding to the Alyn and surrounding farmland around Holt, Farndon and Rossett.

The flood risk areas for Wrexham are listed in Figure 1.8 shows the PFRA squares in relation to the community council areas and shows how many properties, business or infrastructure could be affected. The table compares this information in relation to the EA Areas Susceptible to Surface Water Flooding and Flood Map for Surface Water, groundwater flooding areas, the historic flood outline and flood zones, canal flooding from Civic Canal and River Trust and sewer flooding from Welsh Water and the historical flooding data captured by the LLFA. The table also shows how these areas relate to the policy areas of the River Dee Catchment Plan and River Dee Basin Management Plan. Figure 1.9 will help identify the highest risk areas for the implementation of measures (L1-11) and forthcoming flood risk maps and flood risk management plans.

Environment Agency River Dee Catchment Flood Management Plan (2010)
Flood risk is the combination of the likelihood (or probability) of a particular flood event occurring and the consequence (or impact) of the flood event if it occurred. within a one year period. This is known as an Annual Exceedance Probability which is expressed as a % AEP and is the probability of a particular flood event (or size) occurring in one year. Flood risk is likely to be exacerbated by climate

[6] WCBC (2011) Preliminary Flood Risk Assessment

change, and UKC09 projections indicate that rainfall will change significant with 90% probability, wetter winters causing higher river flow, especially when combined with sea level rise and more frequent and intense extreme rainfall events. The main sources of flood risk in Wrexham County Borough include river flooding, surface water flooding, some sewer, ground water and ordinary watercourse flooding.

Flooding has occurred at many locations throughout the River Dee Catchment Flood Management (CFMP) area, mostly from the main River Dee and its major tributaries but also from several small watercourses. Significant floods were recorded in 1890, 1946, and 2000.
The River Dee CFMP [7] identifies a number of populated areas which are affected include Rossett, Holt, Wrexham, Coedpoeth and Rhosllanerchrugog. In 2000, flooding was widespread across the catchment to places which have never flooded before

In the River Dee catchment area, a 1% AEP event could affect approximately 4,200 properties. In the County Borough of Wrexham there are considered to be 100-500 number of properties within Wrexham and Bangor on Dee and between 50-100 properties in Cefn Mawr at risk from flooding. This would equate to a flood risk to 0.5% of the population in 2010 and is because large amounts of area that are at risk of flooding from fluvial sources forms agricultural low land areas. There are limitations to this data given the lack of historic records associated with surface water flooding.

The CFMP (2010) has six policy areas cross the catchment area. These policy areas are incorporated into sub area action plans. The key policy options 2, 3 and 4 for Wrexham are listed in Figure 1.7 below.

Figure 1.7 River Dee Catchment Management Policies for Wrexham

Policy 2: Middle Dee, Bangor on Dee and East of the Borough
Areas of low to moderate flood risk where we can generally reduce existing flood risk management actions.
This policy will tend to be applied where the overall level of risk to people and property is low to moderate. It may no longer be value for money to focus on continuing current levels of maintenance of existing defences if we can use resources to reduce risk where there are more people at higher risk. We would therefore review the flood risk management actions being taken so that they are proportionate to the level of risk

Policy 3: Lower Dee (Rossett, Holt Farndon and Main Alyn West of Wrexham
Areas of low to moderate flood risk where we are generally managing existing flood risk effectively;
This policy will tend to be applied where the risks are currently appropriately managed and where the risk of flooding is not expected to increase significantly in the future. However, we keep our approach under review,
looking for improvements and responding to new challenges or information as they emerge. We may review our approach to managing flood defences and other flood

[7] EA (2010) The River Dee Catchment Management Plan

risk management actions, to ensure that we are managing efficiently and taking the best approach to managing flood risk in the longer term.

Policy 4: Wrexham (Rossett to Erddig and Rhostyllen)
Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change;
This policy will tend to be applied where the risks are currently deemed to be appropriately-managed, but where the risk of flooding is expected to significantly rise in the future. In this case we would need to do more in the future to contain what would otherwise be increasing risk. Taking further action to reduce risk will require further appraisal to assess whether there are socially and environmentally sustainable, technically viable and economically justified options.

The sub areas relevant to Wrexham County Borough include, Sub area 1:Upper Dee, Sub Area 2: Main Alyn, Sub Area 3: Middle Dee , Sub Area 4 Wrexham and Sub Area 5: Lower Dee. For each of these sub areas there are a list of partners, an outline of the issues, and outline of the policy approach required and actions required to implement them.

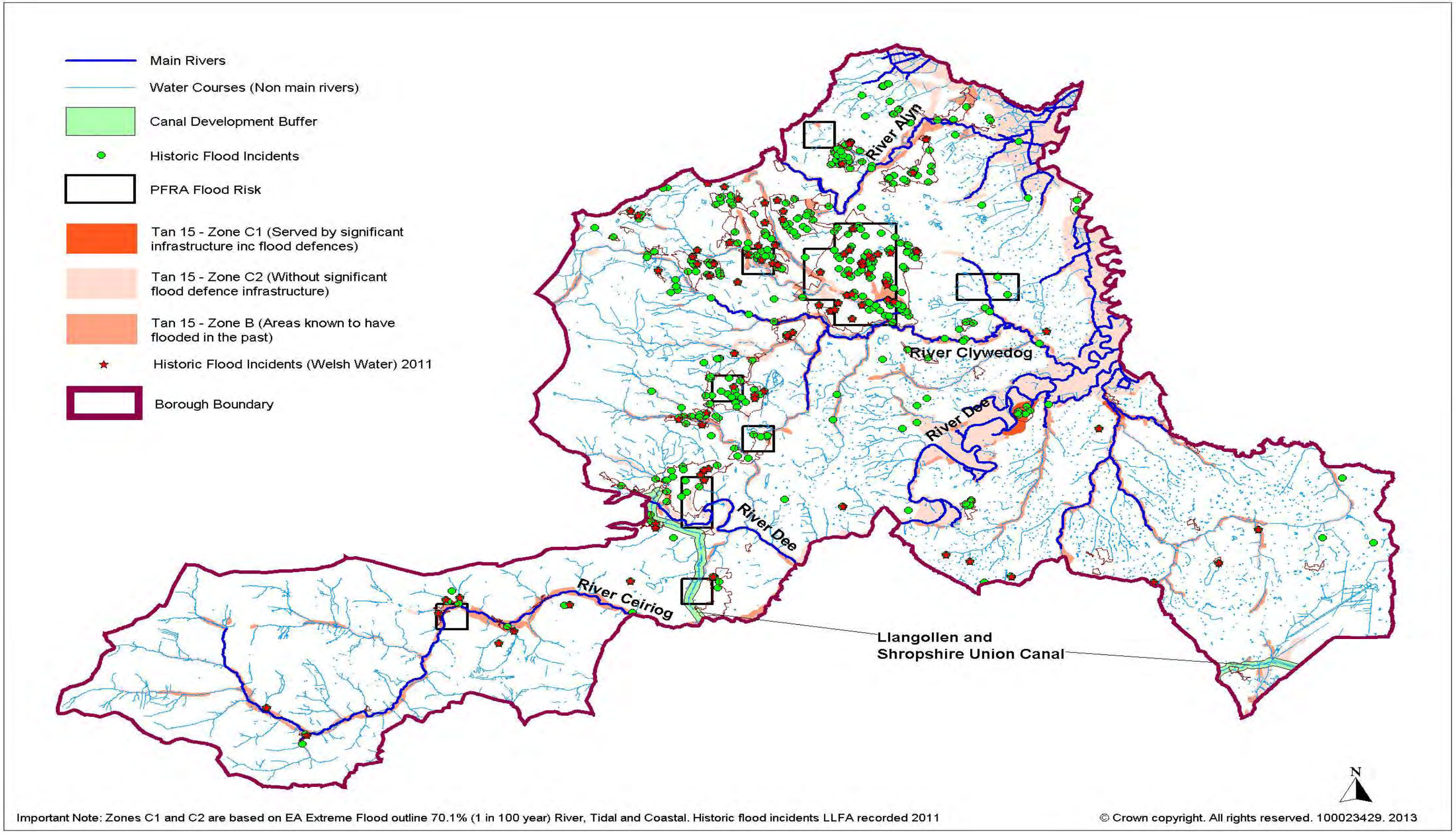
Environment Agency River Dee Basin Management Plan (2009)
The River Dee is considered as part of a wider river basin including the river, its tributaries and estuary. The source of the Dee is near Bala and the whole basin includes Llyn Tegid Special Area of Conservation (SAC) through to the Dee Estuary (SPA) including reservoirs at Llyn Tegid, Celyn and Brenig. The Dee is of high biodiversity value due to its originally low nutrient status and high quality riparian habitats. Its interest includes a number of species that are typical of high quality rivers with low nutrient levels in the water. Of particular note is the use of the River Dee as a migration route by Atlantic salmon, up to spawning grounds in the river, some of which are within Wrexham County Borough.

The River Basin Management Plan current status of the water environment states that 28% of the surface waters are at good or better ecological/potential status now. 51% of the assessed surface waters are at a good or better ecological status now. 108 surface water bodies have been assessed for ecology and 72 have been assessed for biology. The River Dee and Bala lake is a SAC, is vulnerable to specific flood risk management measures and pressures in relating to canalised stretches altering habitats, collapsing embankments, nutrient levels, provision of water resource locally and to parts of the West Midlands and North West of England, recreational disturbance, siltation from construction and invasive species.

Limitations

There are limitations to the data provided with each source of information varying in format and level of detail. Improvements in the recording system have been identified and are included as a measure of the LFRMS. Once adopted and monitored improvements in flood risk information held by the Lead Local Flood Authority will inform local flood risk management approach and ongoing review of the strategy.

Figure 1.8 Flood Risk Assessment across Wrexham County Borough (Local Flood Risk Management Strategy 2012)



and mapping them against green spaces, initiatives for investment and improvements can be identified. It provides evidence of existing initiatives within the regional area which includes Stamford Brook and Northern Gateway which demonstrate the principles of this policy approach to Lower River Dee and actions required. This action plan forms one of two areas that have been prioritised for green infrastructure investment under the Green Infrastructure Framework.

Natural approaches to flood risk management is more sustainable and cost effective than hard engineering defences and can bring added benefits to wildlife and amenity to regenerated areas and urban spaces. The Environment Agency has conducted research and there evidence to demonstrate the benefits of this approach. Natural approaches can include techniques which use land to temporarily store water away from high risk areas, reconnect rivers to floodplains, lengthening watercourses to a more natural alignment, restoring peat bogs, blocking artificial drainage channels, reforesting floodplains, green roofs, permeable paving, and surface water attenuation ponds

Improvements to the collection of data onto a single mapping system for the local authority ensures that different functions take account or have regard to local flood risk and their interrelatedness. That will facilitate the analysis and monitoring of flood event patterns in relation to existing assets and infrastructure. Highlighting repeat issues or issues in regards to maintenance. The development of an annual asset maintenance schedule will ensure that the required ordinary watercourse consents will be scheduled and pre-application discussions can limit the issues in regards to design, ecology or proposed methods involved. The investigation process and asset register can reduce costs associated with flood damage from flood events and reduce the costs from repetitive actions which do not resolve the issues associated with the source of the flooding. Small measures, that could save long term higher costs associated with the continued flood risk we can anticipate from Climate Changes.

The Lead Local Flood Authority has permissive power to designate structures which affect flood risk so the owners can not alter or remove the structures. This designation procedure is assessed and has to satisfy four conditions for the consideration of formal designation. These four conditions are;
Condition 1: that the designating authority thinks the existence or location of the structure or feature affects a flood risk or coastal erosion risk;
Condition 2: that the designating authority has flood or coastal erosion risk management functions in respect of the risk which is affected;
Condition 3: that the structure or feature is not already designated by another authority;
Condition 4: that the owner of the structure or feature is not a designating authority;

Designation and asset maintenance can reduce the consequences and improve the approaches of flood risk management within the Borough. The flooding events that have occurred this year 2012-2013 within the Borough Council have varied in size and caused different patterns of events. In April prolonged and heavy rainfall caused problems associated with surface water run off and river flooding alerts in Acrefair and Rossett. The events in July and August were associated with surface water flooding and flash flooding in urban villages of Gwersyllt, Gresford, Marford, Llay and Burton Green. In September, flooding events covered the borough

The identification of communities at risk and vulnerable people can be assessed through the careful use of datasets across the Authority. Using the principles of the Community Flood Plans in Rossett and Bangor on Dee, and utilising the databases held on the private rented sector, council owned assets.

Wrexham County Borough Council in partnership with Environment Agency is committed to ensuring that everyone in the County Borough of Wrexham is informed or aware of the risks of local flooding. This awareness and information sharing is important to enable households and businesses to adopt suitable resistance and resilience measures.

In Wales, six pilot studies have been completed, two of these areas include Prestatyn and Pwllheli and provide important lessons in regards to the importance of awareness rising and adaptation to climate change. Climate change and adaptation forms an important role within all flood risk management measures.

The Multi-agency Flood Plan (MAFP) (2010) provides the framework produced by North Wales Resilience Forum and Multi Agency Response Plan for Major Emergencies (2010) for Emergency responses within the Borough. There are flood warning systems in place for Alyn Catchment, Rossett, Lower Dee Valley Llangollen to Chester, Lower Dee and Bangor on Dee.

The Area Flood Partnership includes representatives from the Council's Emergency Management Response Teams, Lead Local Flood Authority, Flood Risk Management Authorities and communities of Bangor on Dee, Rossett .This group hold meetings throughout the year and exercises every three years.

The Local Authority has an Emergency Planning Team (EP) and out of hours service with contact numbers, information and advice available on the website. During working hours flood event calls are dealt with by the Contact Centre through the Pride in Your Streets and passed to; Emergency Planning, Environment, Housing, or Public Protection. Most of the calls received are directed to Environment Street Scene section because of their responsibilities in regards to highways and land drainage.

In an Emergency flooding event, an established emergency response will be initiated. Flooding events are monitored carefully and co-ordination of information and updates across the various departments, external organisations and emergency responders are very important

The LFRMS has the potential to adversely affect such features, especially aquatic features as a result of any flood management measures that are implemented. Construction, land use change, changes in flood regime and frequency or changes in water levels that have the potential to adversely affect nature conservation and biodiversity features. Conversely, such changes present opportunities to enhance the condition of existing habitats and create new habitats. Trees form important character and functions within areas for biodiversity and drainage and flood risk alleviation. Trees within urban areas and Green Networks are important to flood risk management approach of quality, quantity and amenity.

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APPENDIX I: SURFACE WATER CALCULATIONS

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Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Megan Berry
Site name:	Land off Llay Road
Site location:	Cefn-Y-Bedd, Wrexham

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:	53.09284° N
Longitude:	3.01883° W
Reference:	2925284142
Date:	Oct 26 2021 10:56

Runoff estimation approach FEH Statistical

Site characteristics

Total site area (ha): 0.89

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Specify BFI manually
HOST class:	N/A
BFI / BFIHOST:	0.544
Q_{MED} (l/s):	
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics	Default	Edited
SAAR (mm):	798	798
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

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

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

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

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

(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):		3.39
1 in 1 year (l/s):		2.98
1 in 30 years (l/s):		6.03
1 in 100 year (l/s):		7.38
1 in 200 years (l/s):		8.33

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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SURFACE WATER RUN-OFF CALCULATION SHEET

Development	Land off Llay Road, Cefn-Y-Bedd, Wrexham
Project No.	HYD666

Revision	A	Completed by	MB
Date	26/10/2021	Checked by	RDN

Areas

Total Site	17.000	ha	
Development Area[1]	0.890	ha	
Existing Impermeable	0.000	ha	
Existing Impermeable[2]	0.000	ha	
Existing Pervious	17.000	ha	
Existing Pervious[2]	0.000	ha	
Proposed total impermeable	0.124	ha	14%

Catchment Characteristics

SAAR	799	mm
SPR	0.544	
BFI	0.51	

i_1	17.7	mm/hr	d_1	21.5	mm
i_{30}	37.5	mm/hr	d_{30}	57.4	mm
i_{100}	49.5	mm/hr	d_{100}	75.8	mm

Run-off Rates

Pre-development

Impermeable ------	1yr	0.0	l/s
	30yr	0.0	l/s
	100yr	0.0	l/s
	50mm/hr[3]	0.0	l/s
Pervious[4] ------	1yr	3.0	l/s
	30yr	6.0	l/s
	100yr	7.4	l/s
	QBar[5]	3.4	l/s
Total ------	1yr	3.0	l/s
	30yr	6.0	l/s
	100yr	7.4	l/s

Post-development (without control)

Impermeable[6] ------	1yr	6.1	l/s
	30yr	12.9	l/s
	100yr+40%CC	23.9	l/s

Volumes

Pre-development

Impermeable ------	1yr	0.0	cu.m
	30yr	0.0	cu.m
	100yr	0.0	cu.m
Pervious[4] ------	1yr	106.3	cu.m
	30yr	201.0	cu.m
	100yr	271.9	cu.m
Total ------	1yr	106.3	cu.m
	30yr	201.0	cu.m
	100yr	271.9	cu.m

Post-development

Impermeable[6] ------	1yr	2.7	cu.m
	30yr	7.1	cu.m
	100yr+40%CC	9.4	cu.m

Stormwater Storage Estimates

Based on Greenfield run-off QBar

Microdrainage Quick Storage Estimates (using FEH catchment data)

Return Period	Rate		lower	upper	mean	
1yr	3.4	l/s	6	13	9.5	cu.m
30yr	3.4	l/s	24	39	31.5	cu.m
100yr+40%CC	3.4	l/s	62	89	75.5	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/A/TR1/1 rev E (2012).

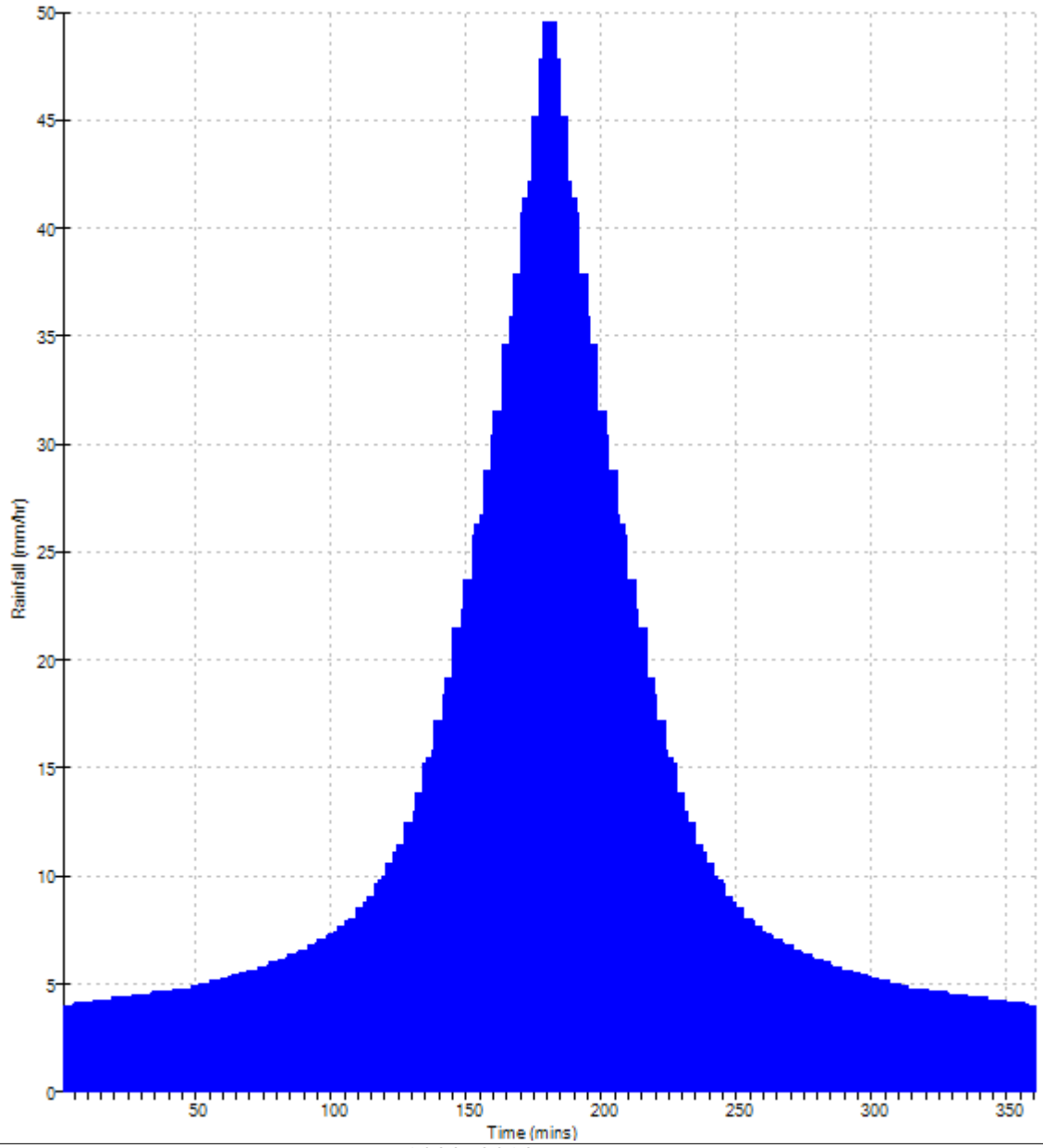
NB. The catchment characteristics are from the FEH catchment, the UK SUDS Calculator and Microdrainage.
NB. The rainfall intensities and depths are calculated for the 6hr duration rainfall event (peak summer intensity)

Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 331767 355649 SJ 31767 55649
Data Type	Point
Peak Intensity (mm/hr)	49.530
Ave. Intensity (mm/hr)	12.635
Return Period (years)	100.0



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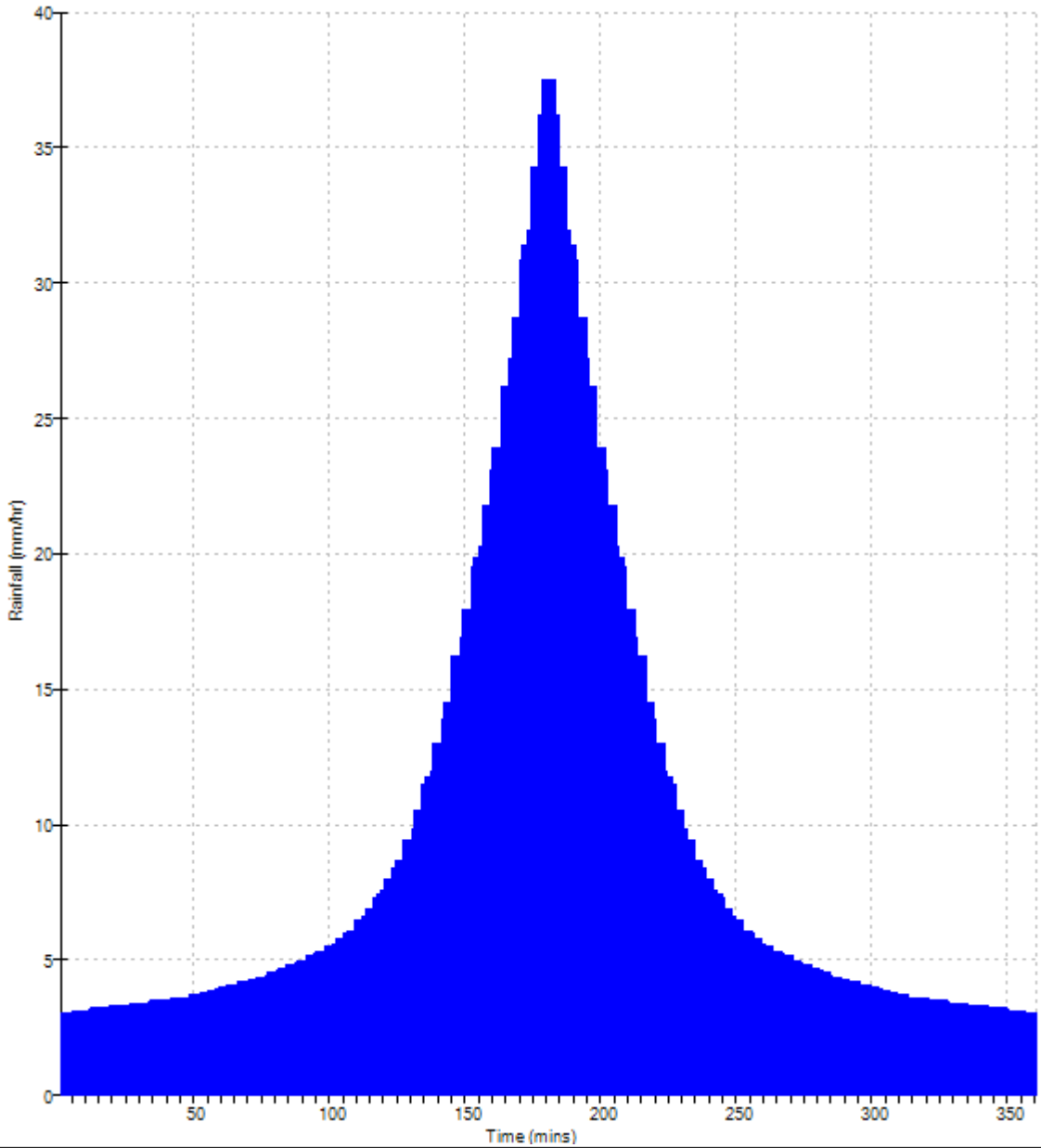
Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 331767 355649 SJ 31767 55649
Data Type	Point
Peak Intensity (mm/hr)	37.522
Ave. Intensity (mm/hr)	9.572
Return Period (years)	30.0



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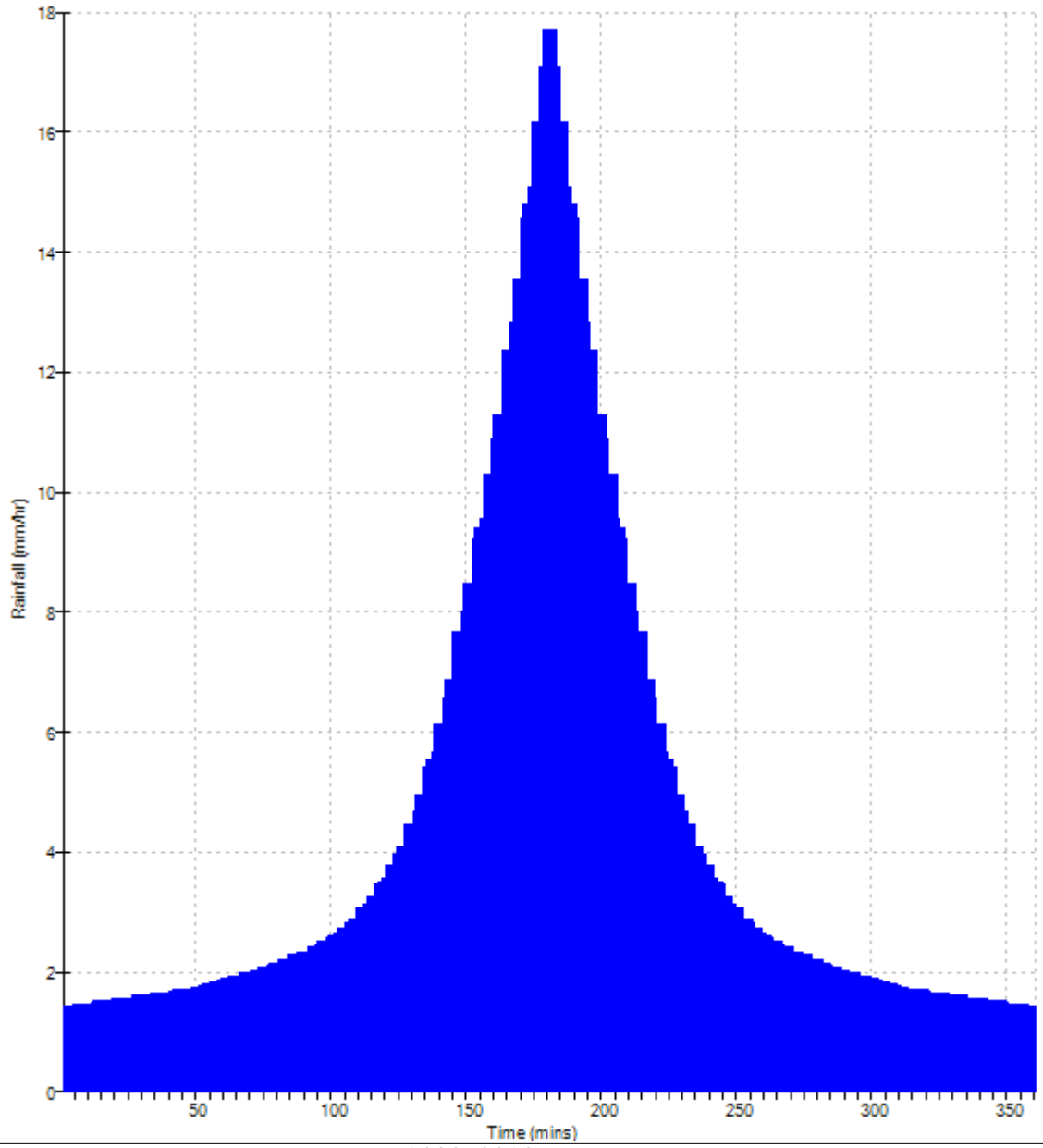
Rainfall profile

Storm duration (mins) 360

FEH Data

FEH Rainfall Version	2013
Site Location	GB 331767 355649 SJ 31767 55649
Data Type	Point
Peak Intensity (mm/hr)	17.716
Ave. Intensity (mm/hr)	4.519
Return Period (years)	2.0



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Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.320
Areal Reduction Factor	1.00
Area (ha)	0.890
SAAR (mm)	799
CWI	117.291
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	49.03
Greenfield Runoff Volume (m^3)	271.934

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Greenfield Runoff Volume

FSR Data

Return Period (years)	30
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.320
Areal Reduction Factor	1.00
Area (ha)	0.890
SAAR (mm)	799
CWI	117.291
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	47.01
Greenfield Runoff Volume (m^3)	201.048

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Greenfield Runoff Volume

FSR Data

Return Period (years)	2
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	18.000
Ratio R	0.320
Areal Reduction Factor	1.00
Area (ha)	0.890
SAAR (mm)	799
CWI	117.291
Urban	0.000
SPR	47.000

Results

Percentage Runoff (%)	45.07
Greenfield Runoff Volume (m^3)	106.361

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1 YEAR RETURN PERIOD STORM EVENT

Variables

FEH Rainfall	
Return Period (years)	2
Version	2013 Point
Site	GB 331767 355649 SJ 31767 55649
Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	0.124
Maximum Allowable Discharge (l/s)	3.4
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	0

Variables
Results
Design
Overview 2D
Overview 3D
Vt

Results

Global Variables require approximate storage of between 6.0 m³ and 13 m³.

These values are estimates only and should not be used for design purposes.

30 YEAR RETURN PERIOD STORM EVENT

Variables

FEH Rainfall	
Return Period (years)	30
Version	2013 Point
Site	GB 331767 355649 SJ 31767 55649
Cv (Summer)	0.750
Cv (Winter)	0.840
Impermeable Area (ha)	0.124
Maximum Allowable Discharge (l/s)	3.4
Infiltration Coefficient (m/hr)	0.00000
Safety Factor	2.0
Climate Change (%)	0

Variables
Results
Design
Overview 2D
Overview 3D
Vt

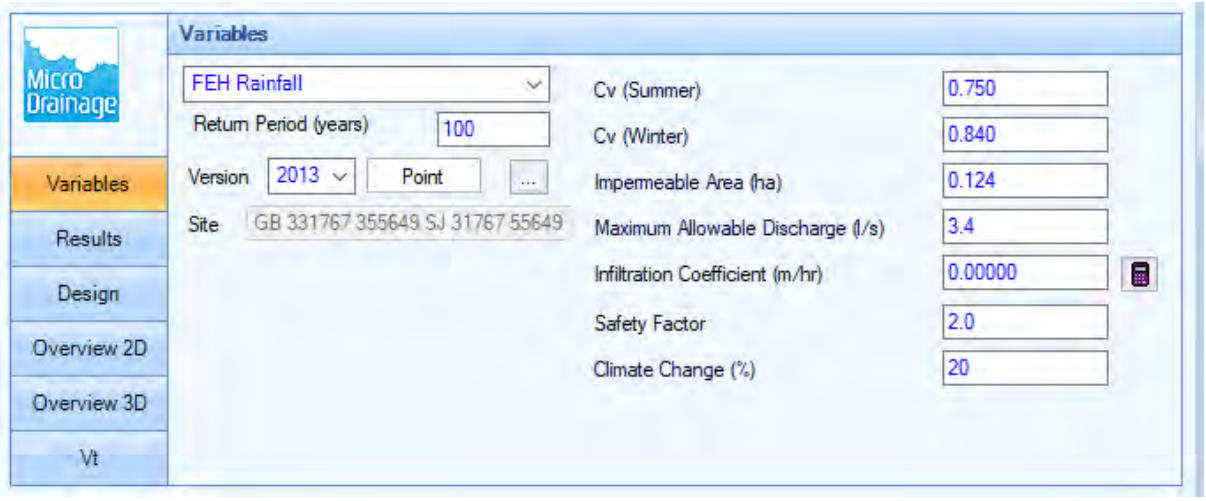
Results

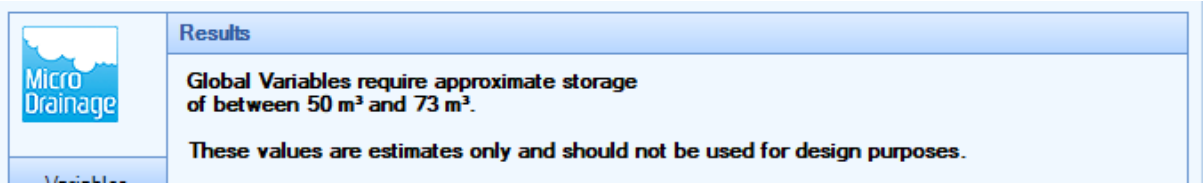
Global Variables require approximate storage of between 24 m³ and 39 m³.

These values are estimates only and should not be used for design purposes.

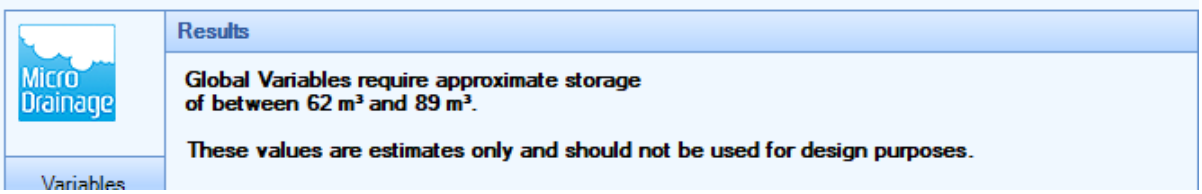
Variables

100 YEAR RETURN PERIOD STORM EVENT + 20% CLIMATE CHANGE





100 YEAR RETURN PERIOD STORM EVENT + 40% CLIMATE CHANGE



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APPENDIX J: DRAINAGE PLANS

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DO NOT SCALE

Legend:

- Wider Site
- Development Area
- Main River
- Ordinary Watercourse
- Land Drainage Ditch
- Pond

REV	DATE	BY	DESCRIPTION	CHK
A	19/10/21	HB	PRELIMINARY FOR ISSUE	MB

DRAWING STATUS:

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

GOODWIN
PLANNING SERVICES

PROJECT:

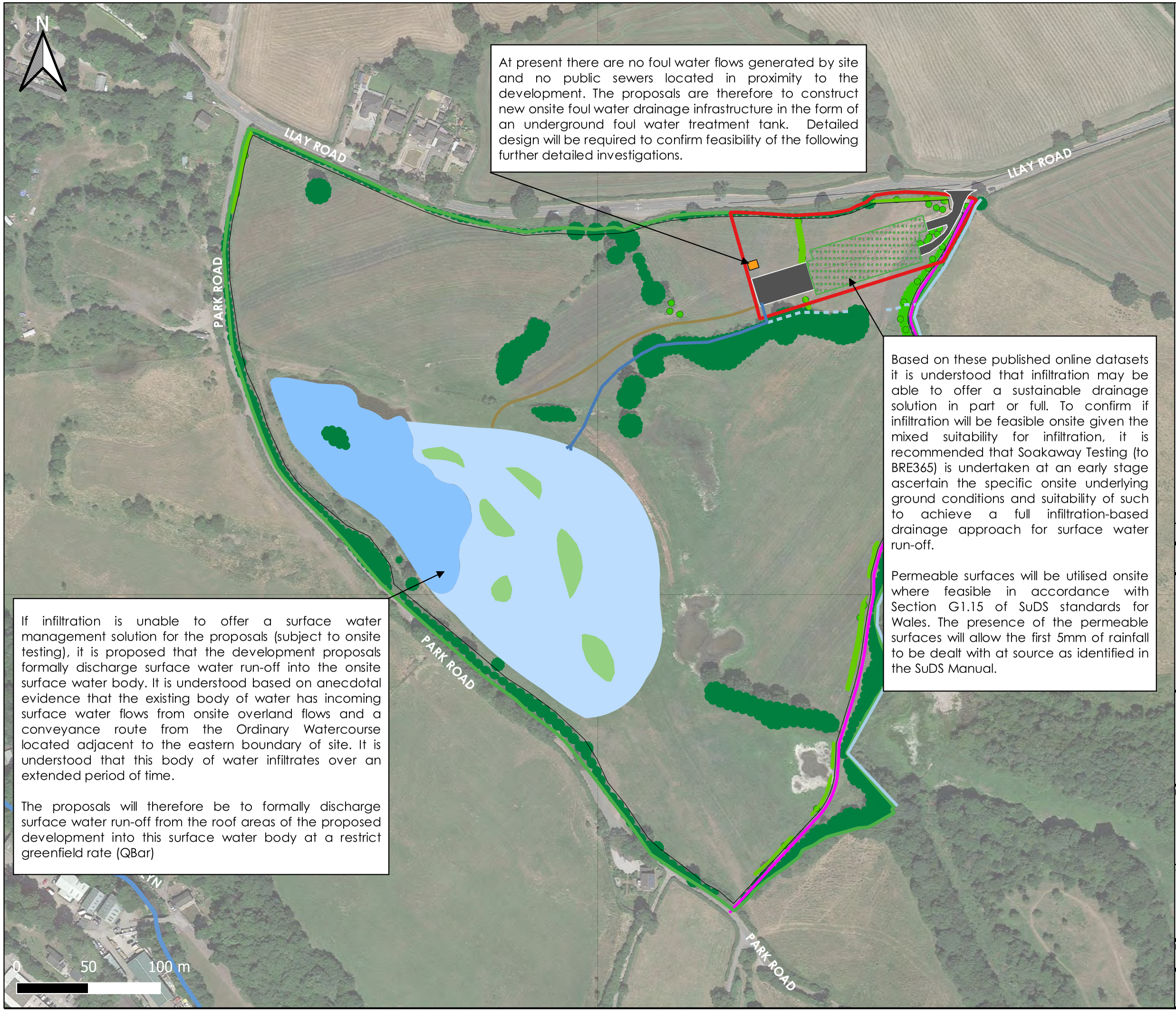
LAND OFF LLAY ROAD
WREXHAM

TITLE:

EXISTING DRAINAGE PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
19/10/21	4000@A3	HB	MB

PROJECT No:	DRAWING No:	REV:
HYD666	103	A



At present there are no foul water flows generated by site and no public sewers located in proximity to the development. The proposals are therefore to construct new onsite foul water drainage infrastructure in the form of an underground foul water treatment tank. Detailed design will be required to confirm feasibility of the following further detailed investigations.

Based on these published online datasets it is understood that infiltration may be able to offer a sustainable drainage solution in part or full. To confirm if infiltration will be feasible onsite given the mixed suitability for infiltration, it is recommended that Soakaway Testing (to BRE365) is undertaken at an early stage ascertain the specific onsite underlying ground conditions and suitability of such to achieve a full infiltration-based drainage approach for surface water run-off.

Permeable surfaces will be utilised onsite where feasible in accordance with Section G1.15 of SuDS standards for Wales. The presence of the permeable surfaces will allow the first 5mm of rainfall to be dealt with at source as identified in the SuDS Manual.

If infiltration is unable to offer a surface water management solution for the proposals (subject to onsite testing), it is proposed that the development proposals formally discharge surface water run-off into the onsite surface water body. It is understood based on anecdotal evidence that the existing body of water has incoming surface water flows from onsite overland flows and a conveyance route from the Ordinary Watercourse located adjacent to the eastern boundary of site. It is understood that this body of water infiltrates over an extended period of time.

The proposals will therefore be to formally discharge surface water run-off from the roof areas of the proposed development into this surface water body at a restrict greenfield rate (QBar)

DO NOT SCALE

Legend:

- Wider Site
- Development Area
- Main River
- Ordinary Watercourse
- Land Drainage Ditch
- Pond
- Wildlife Islands
- Imperm areas
- Permeable Paving - Gravel
- Surface Water Connection Route
- Foul Water Septic Tank

REV	DATE	BY	DESCRIPTION	CHK
A	17/09/21	HB	PRELIMINARY FOR ISSUE	MB

DRAWING STATUS:

BETTS HYDRO
CONSULTING ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 enquiries@betts-associates.co.uk

GOODWIN
PLANNING SERVICES

PROJECT:

LAND OFF LLAY ROAD
WREXHAM

TITLE:

PRELIMINARY PROPOSED
DRAINAGE STRATEGY PLAN

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
17/09/21	2500@A3	HB	MB

PROJECT No:	DRAWING No:	REV:
HYD666	104	A

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APPENDIX K: SUDS EXAMPLES

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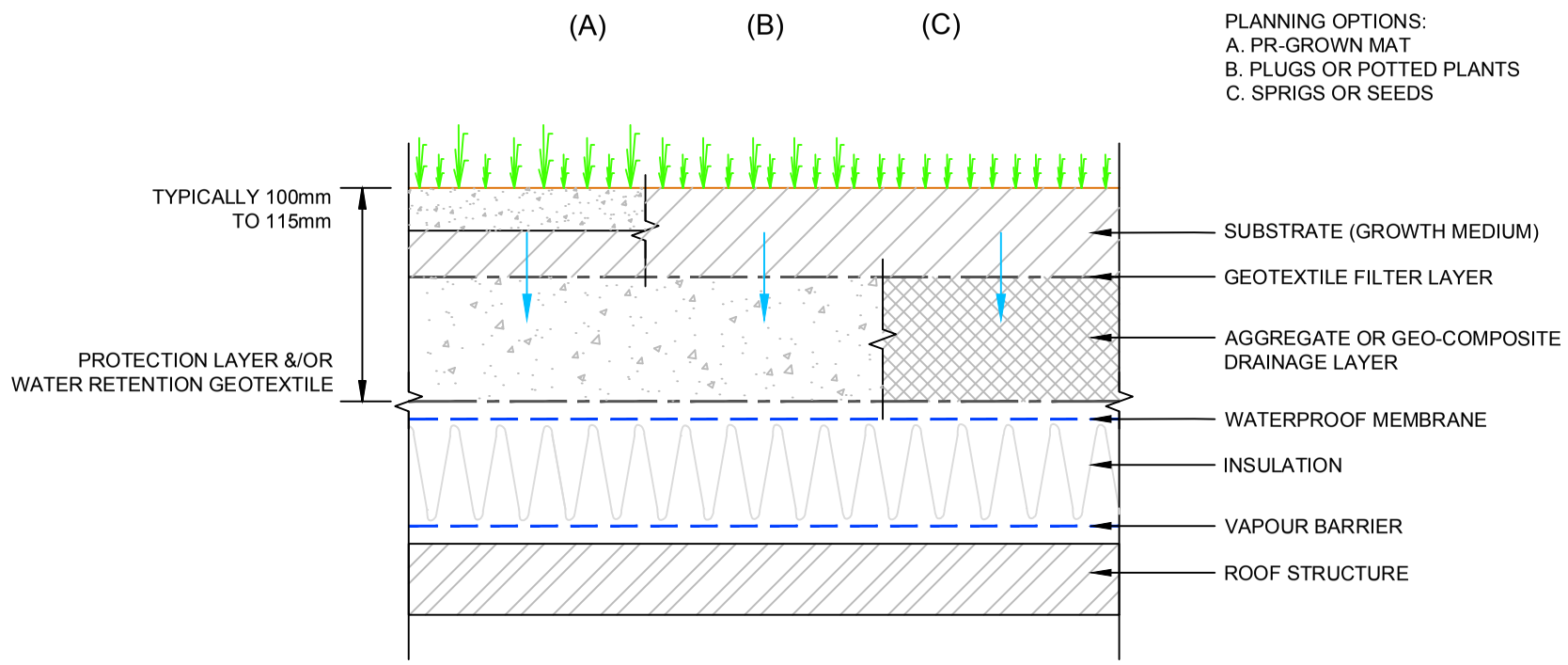
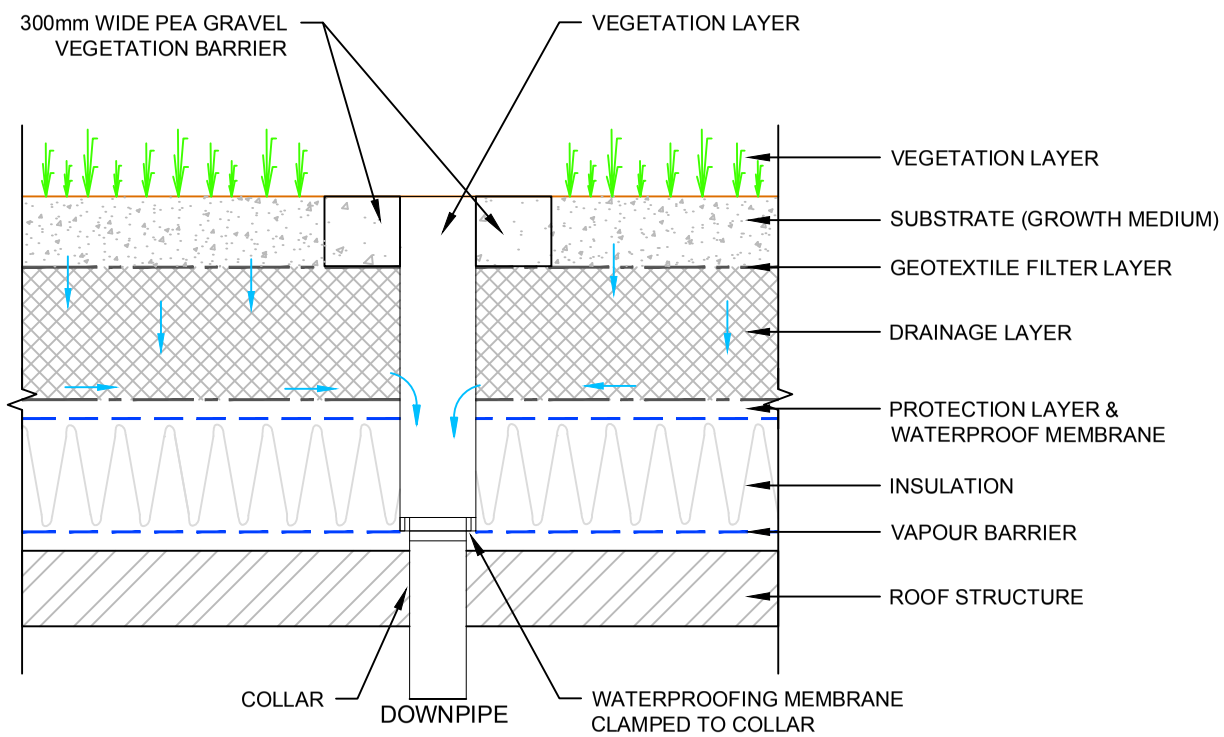
DO NOT SCALE

VEGETATION LAYER (TYPICAL HEIGHT 50 - 200mm)

PLANNING OPTIONS:
A. PR-GROWN MAT
B. PLUGS OR POTTED PLANTS
C. SPRIGS OR SEEDS



GREEN ROOF



OUTLET FROM GREEN ROOF

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

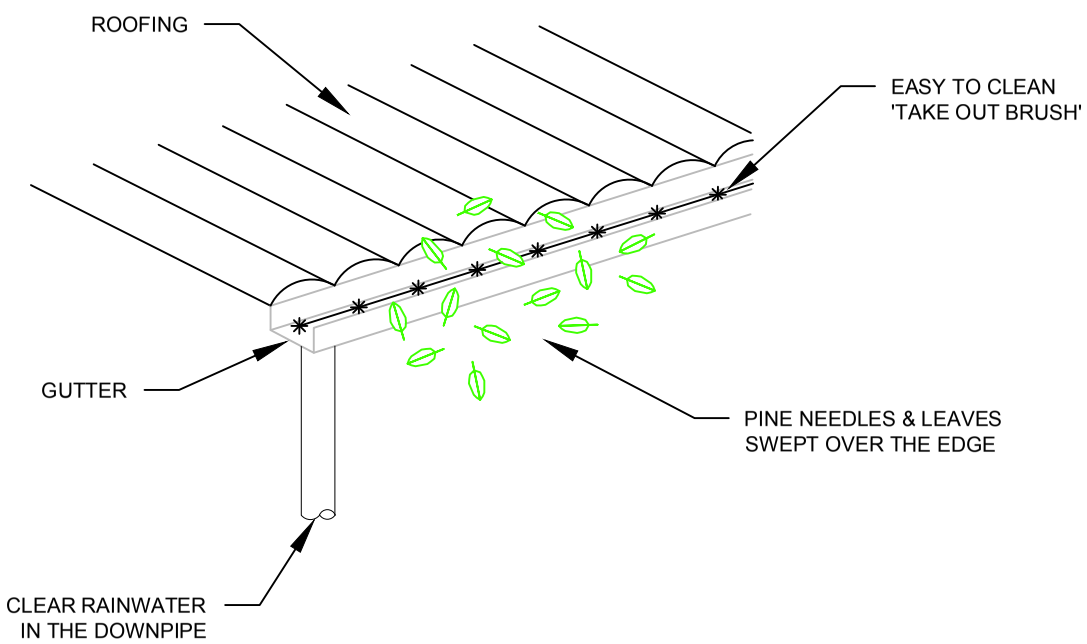
PROJECT: TYPICAL SUDS DETAIL

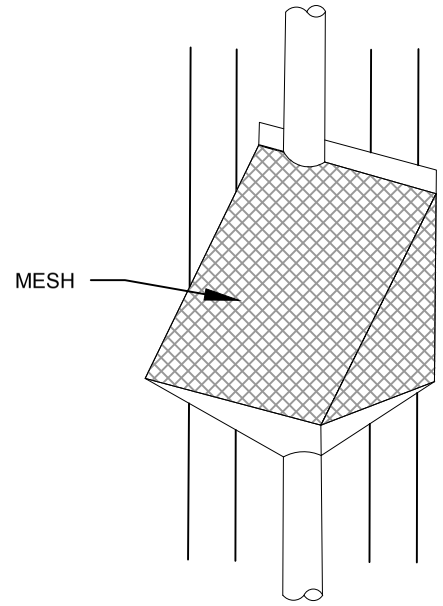
TITLE: GREEN ROOFS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	101	A

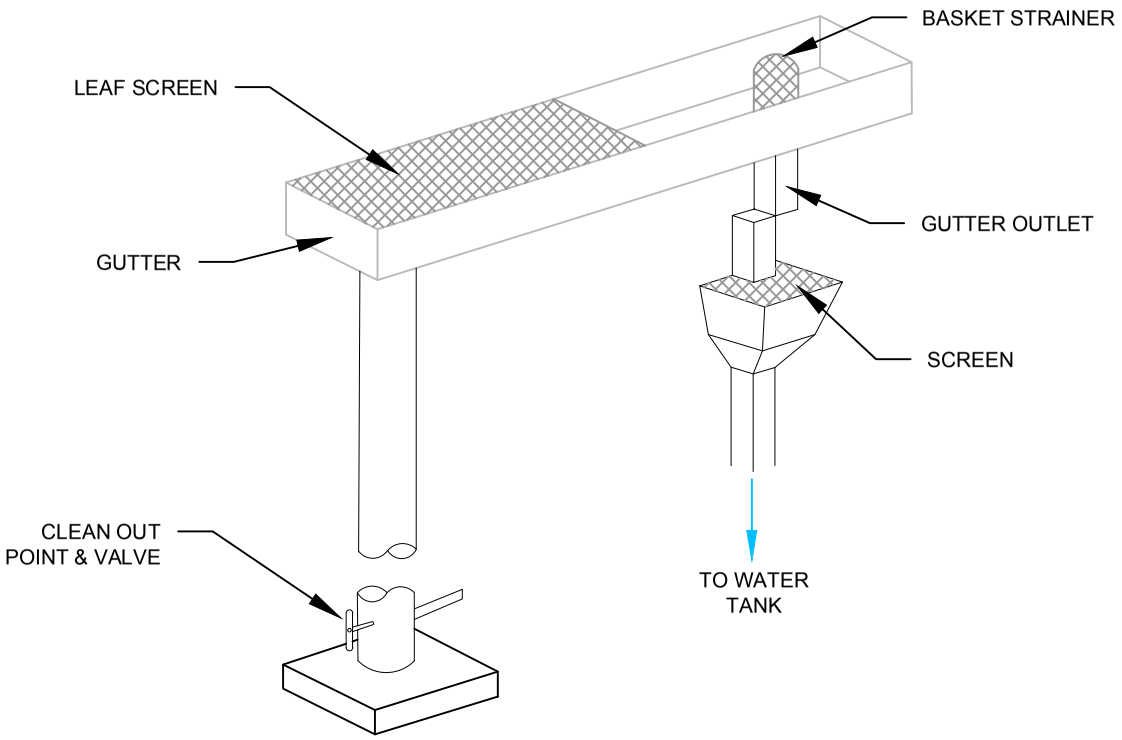
DO NOT SCALE

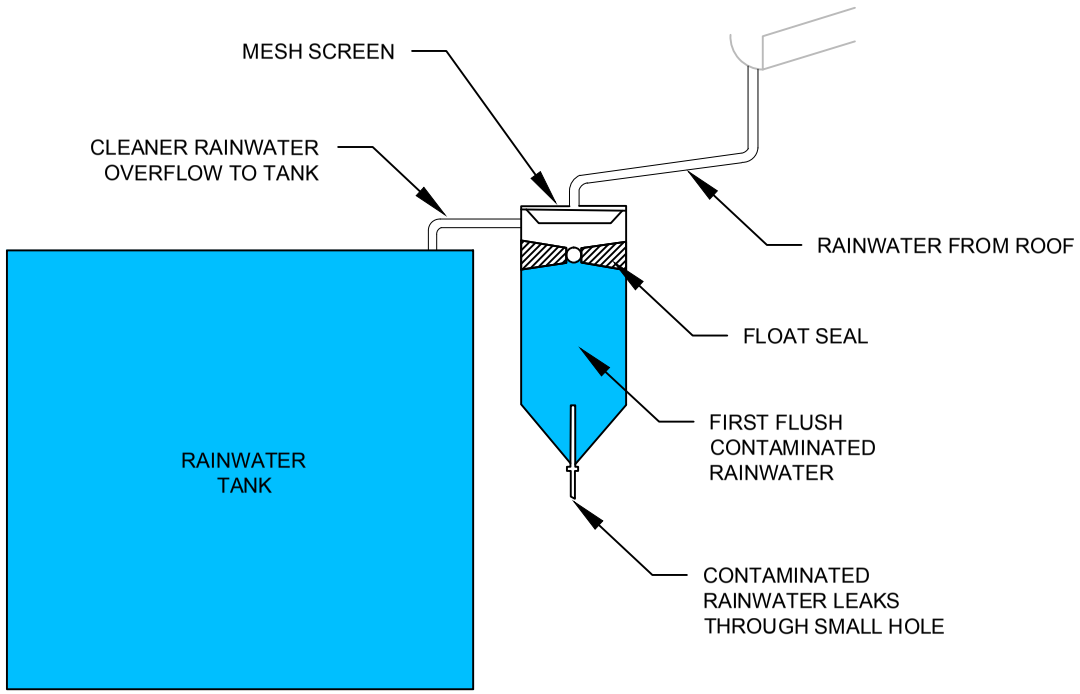




RAINWATER HARVESTING

RAINWATER HARVESTING





RAINWATER HARVESTING

RAINWATER HARVESTING

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: RAINWATER HARVESTING

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	102	A

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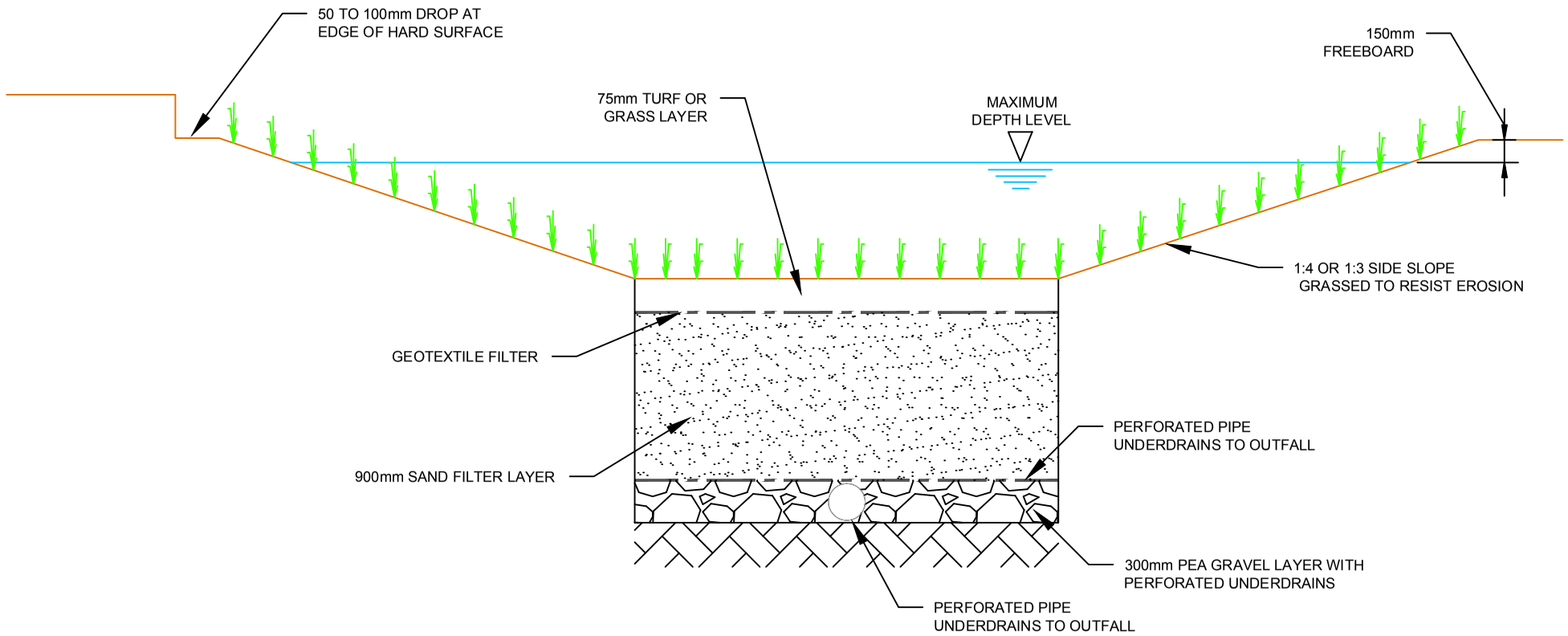
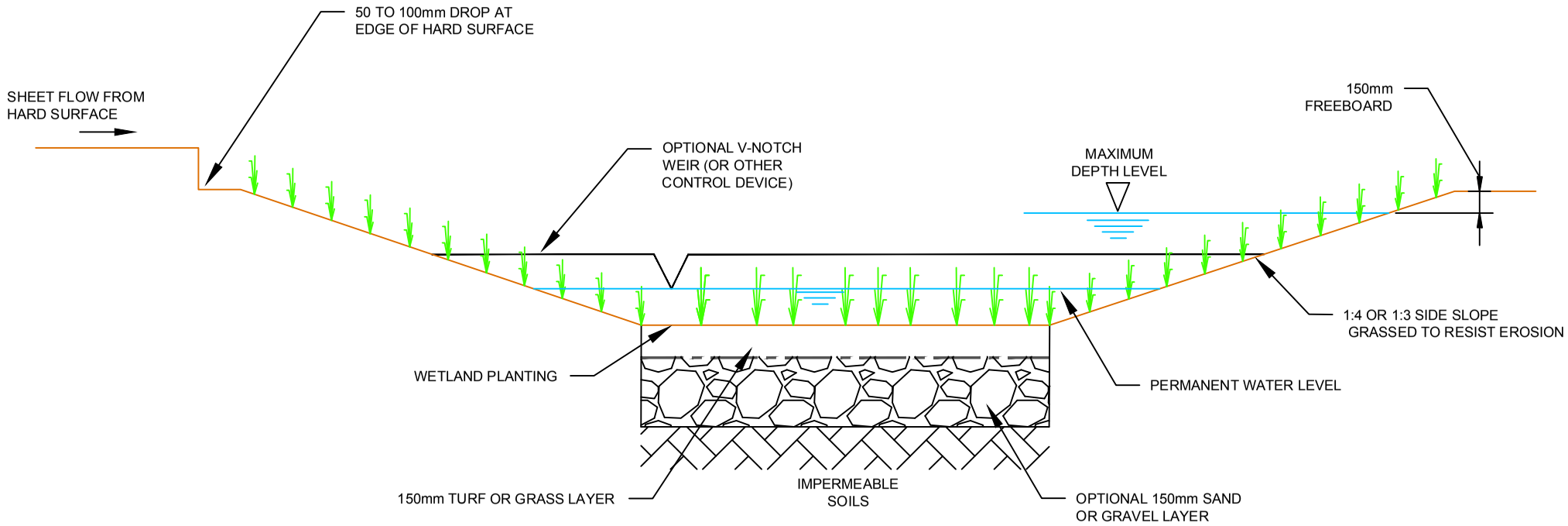


DRY SWALE



WET SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

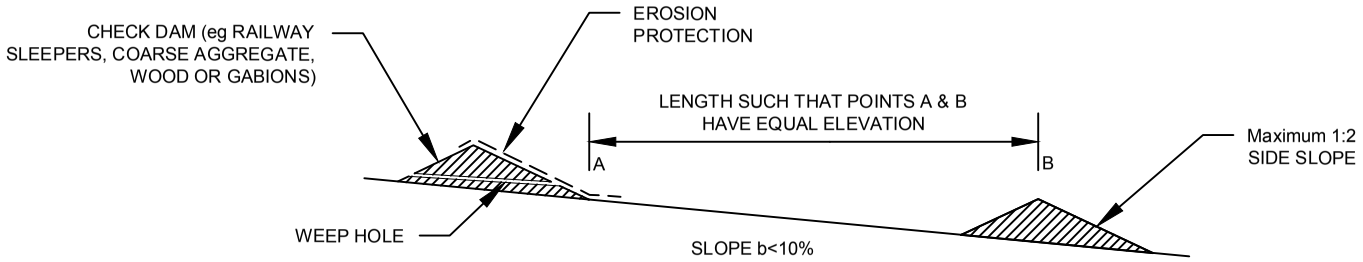
PROJECT: TYPICAL SUDS DETAIL

TITLE: SWALES (1 of 2)

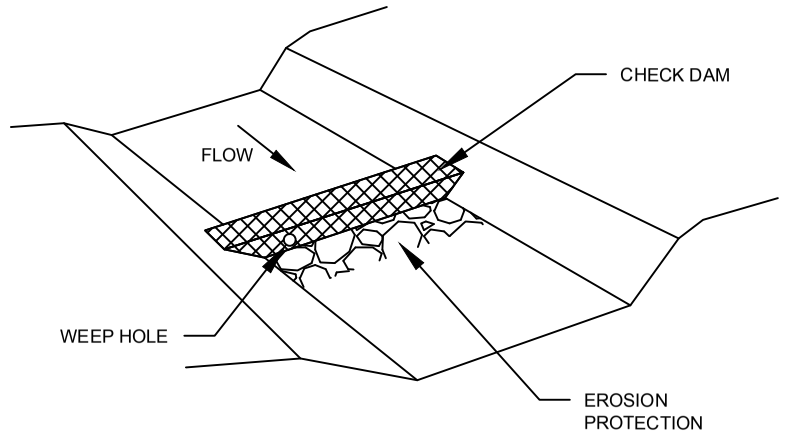
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	103	A

DO NOT SCALE

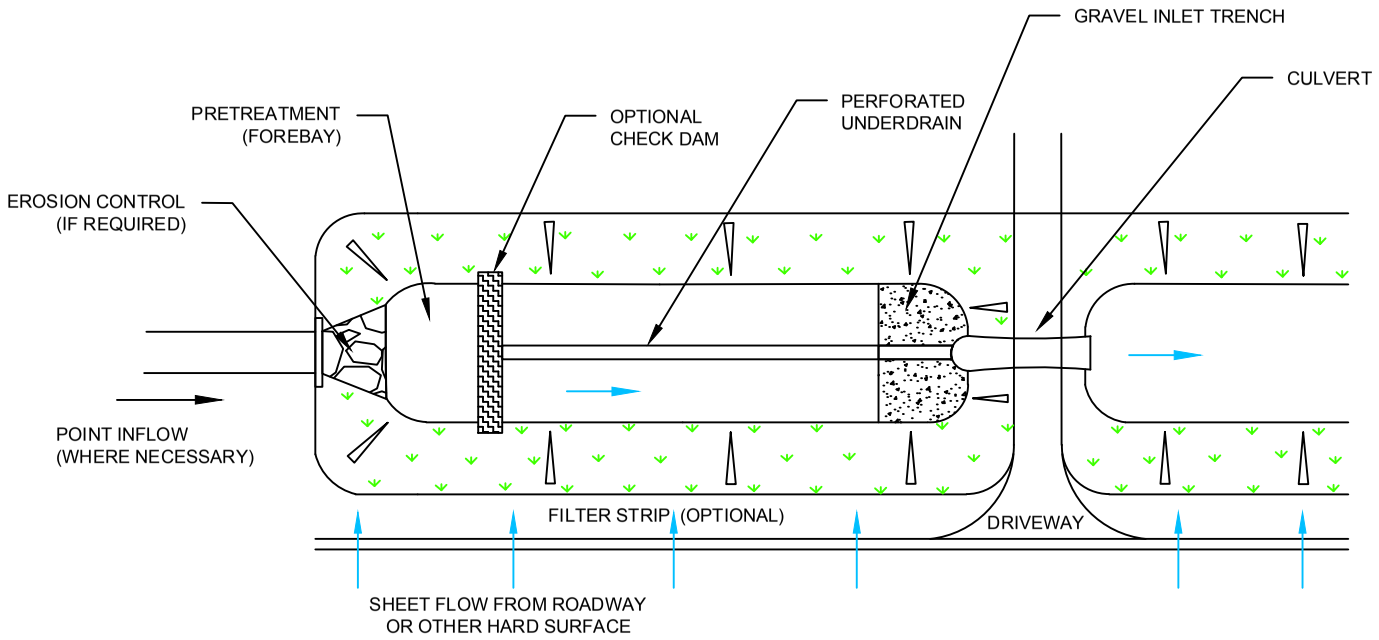


ELEVATION



SCHEMATIC

CHECK DAM



ENHANCED DRY SWALE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

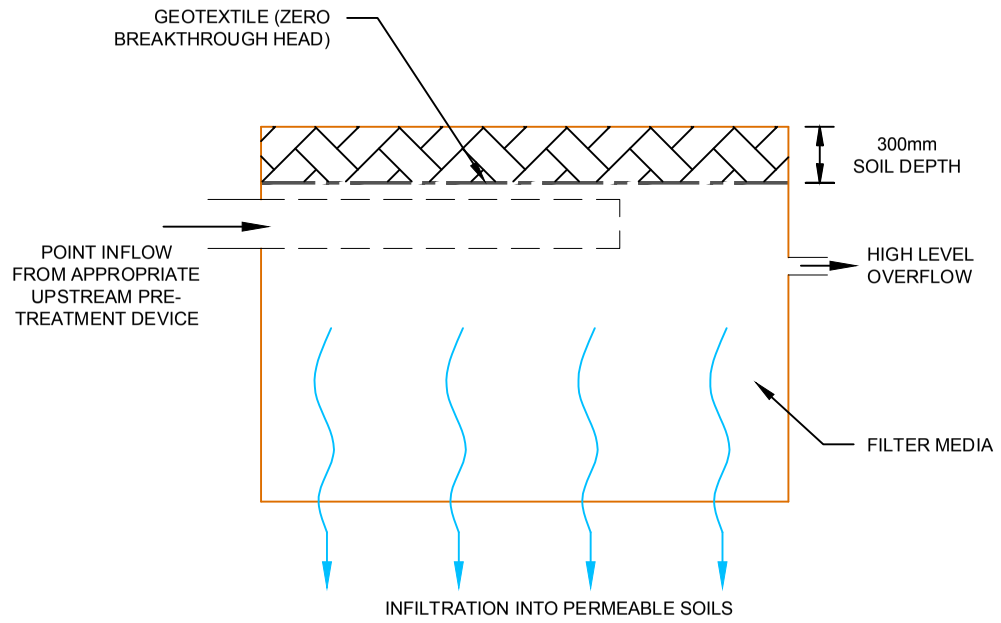
PROJECT: TYPICAL SUDS DETAIL

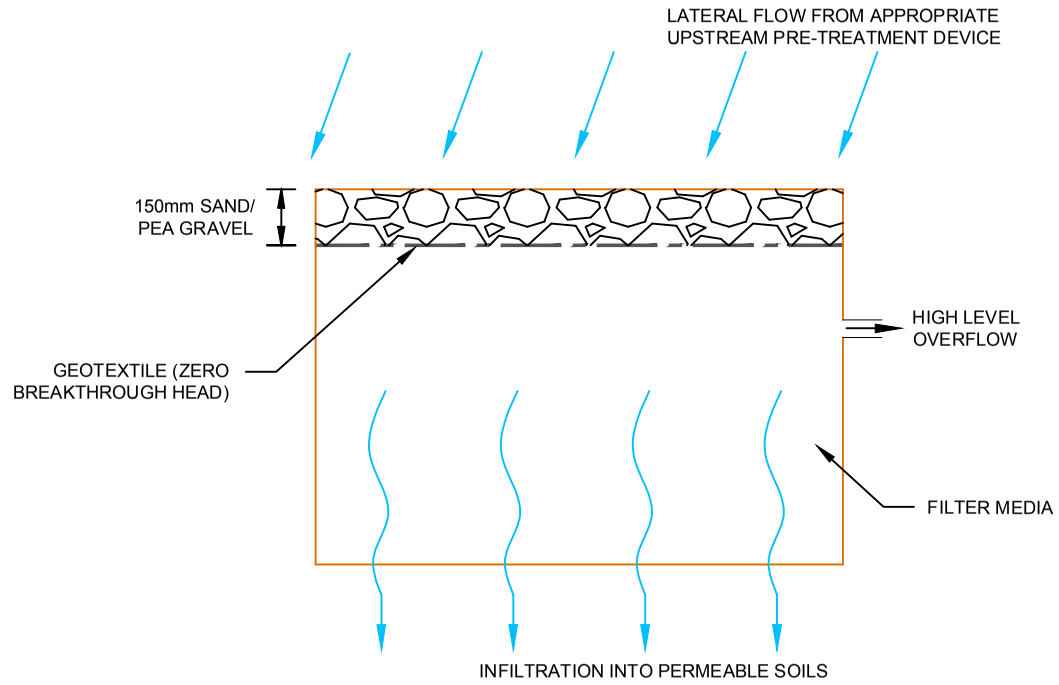
TITLE: SWALES (2 of 2)

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

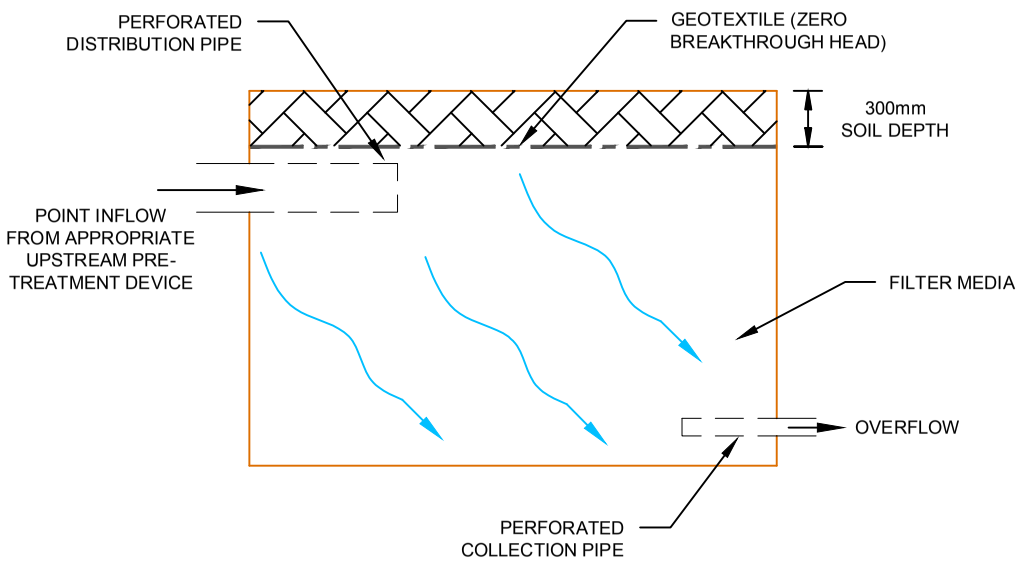
PROJECT No:	DRAWING No:	REV:
BETTS	104	A

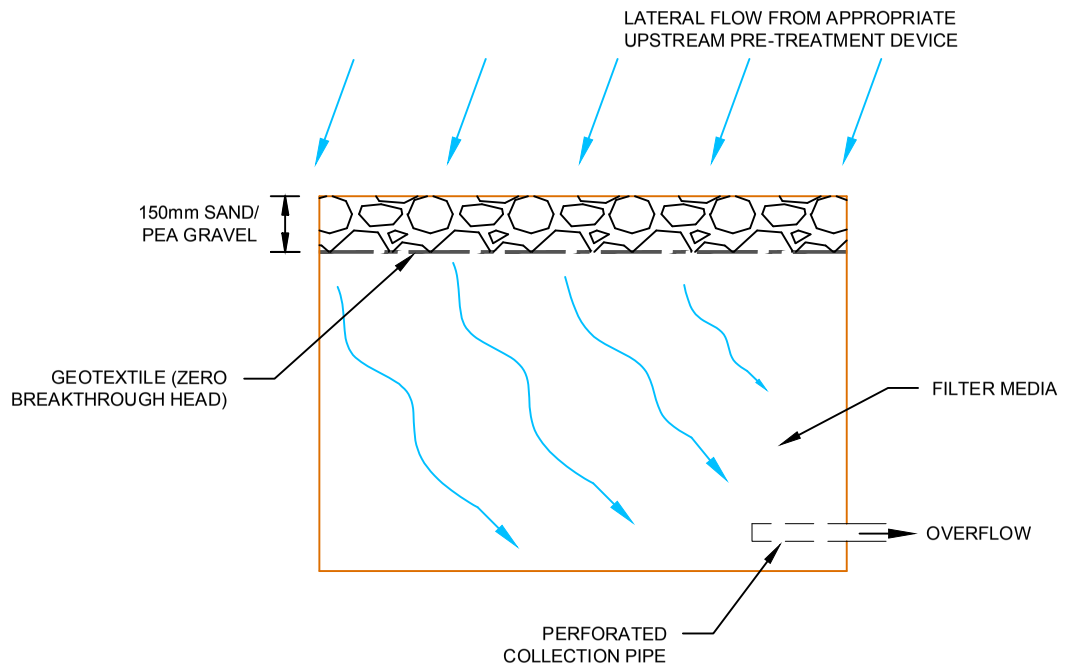
DO NOT SCALE





INFILTRATION TRENCH SCHEMATICS





FILTER TRENCH SCHEMATICS

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
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PROJECT: TYPICAL SUDS DETAIL

TITLE: TRENCHES

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	105	A

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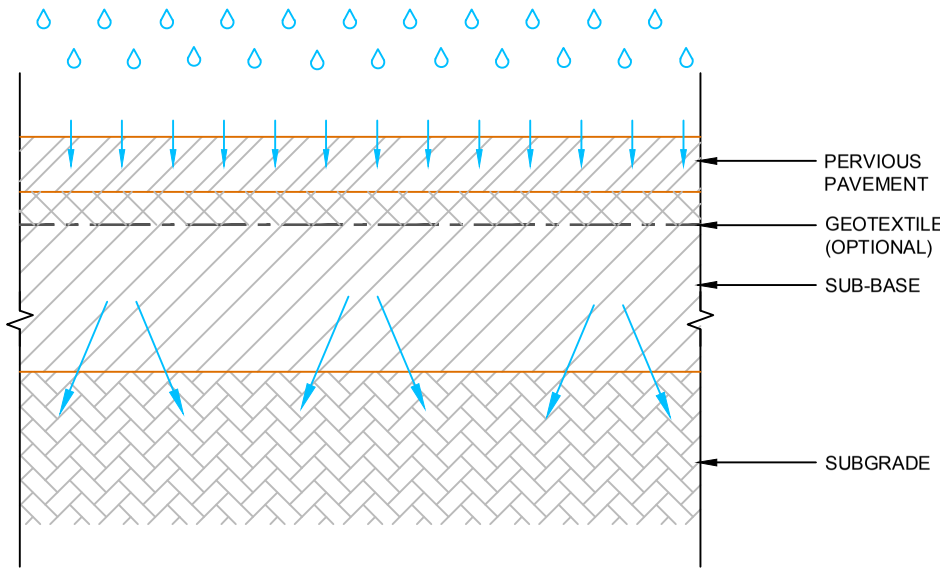
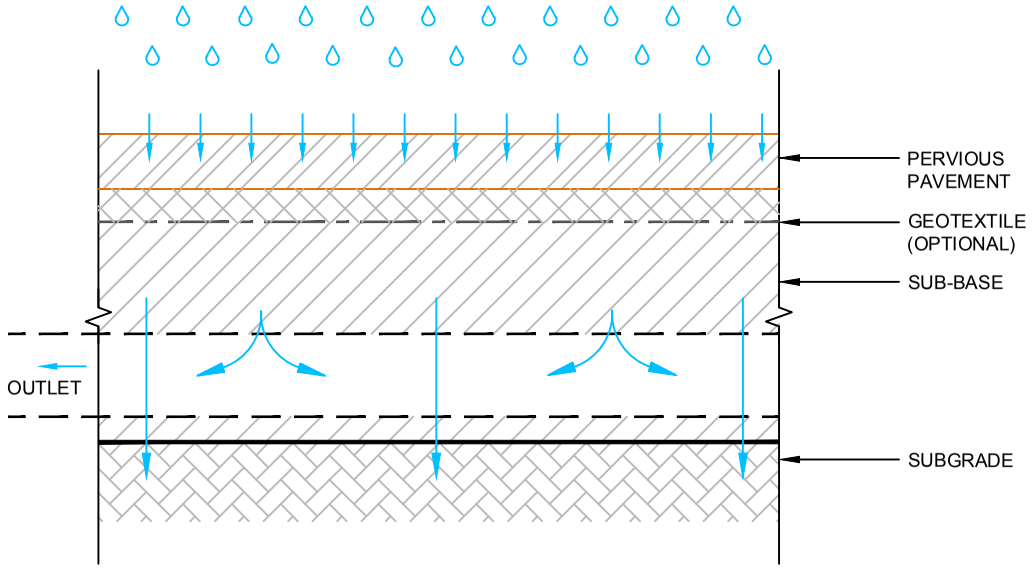
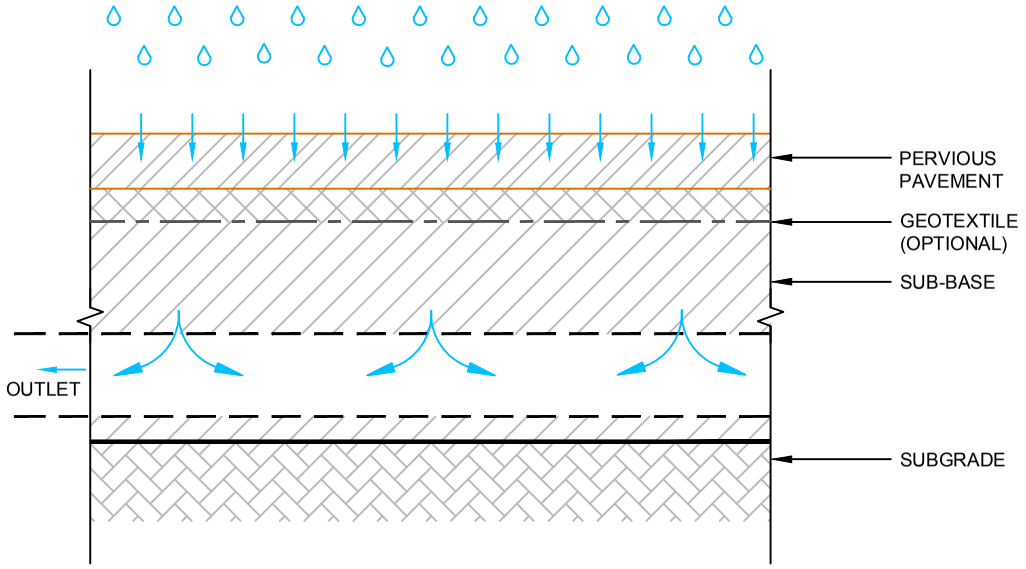


TYPE A: TOTAL INFILTRATIPN



TYPE B: PARTIAL INFILTRATION



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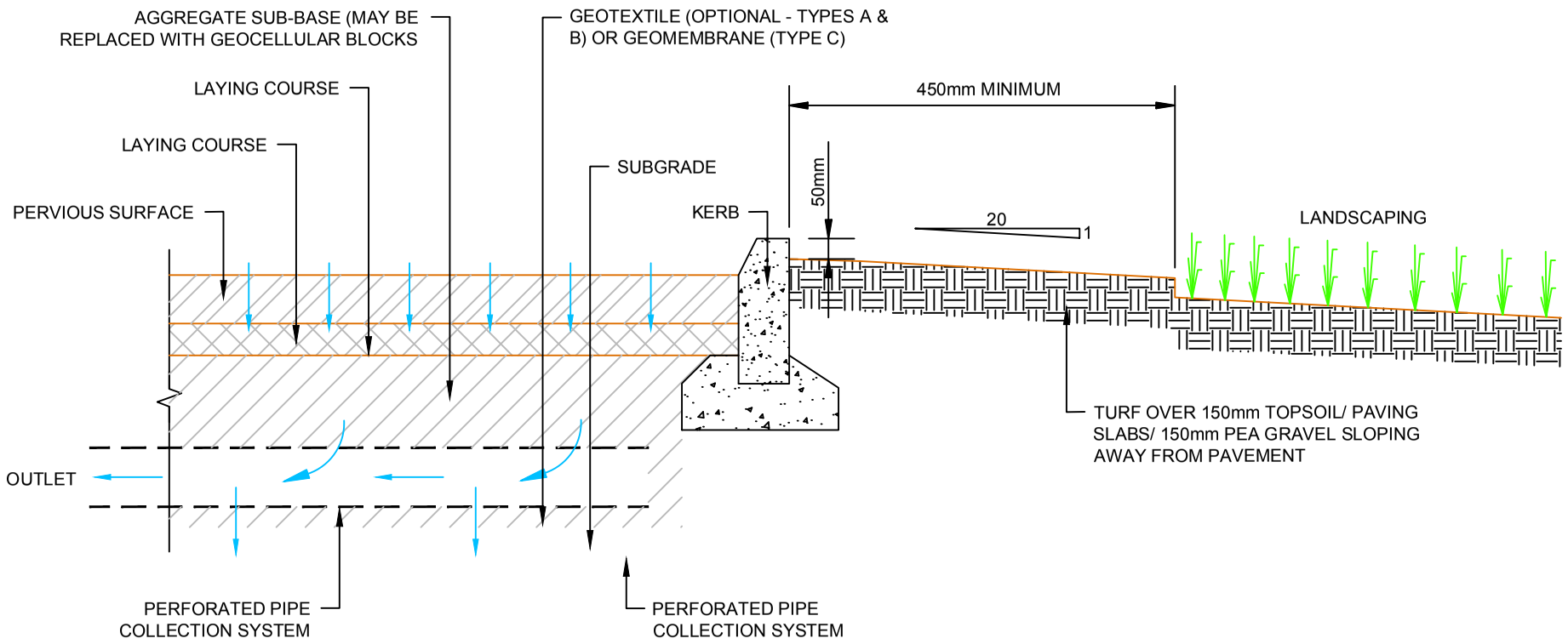

LANDSCAPING DETAIL

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

PROJECT: TYPICAL SUDS DETAIL

TITLE: PERVIOUS PAVEMENTS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	105	A

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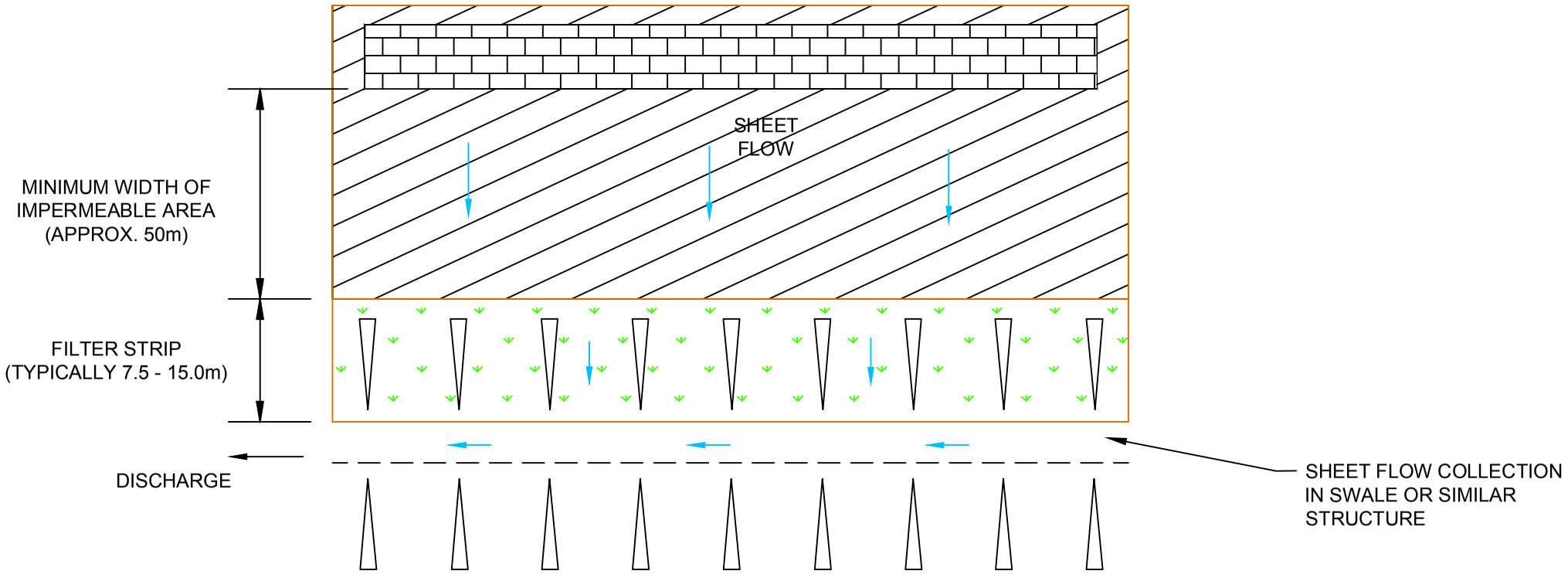
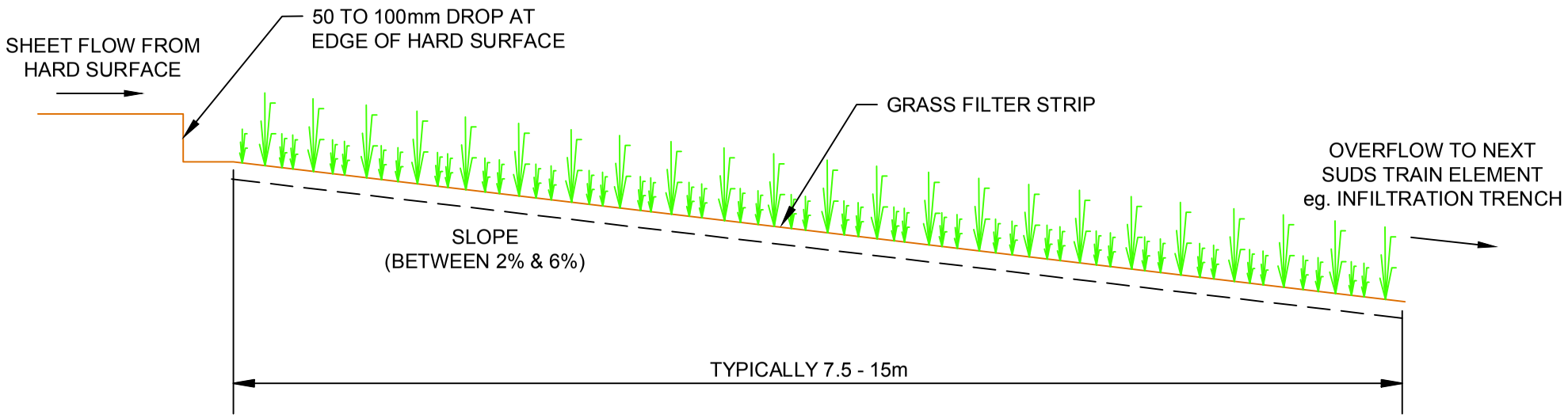


PLAN



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

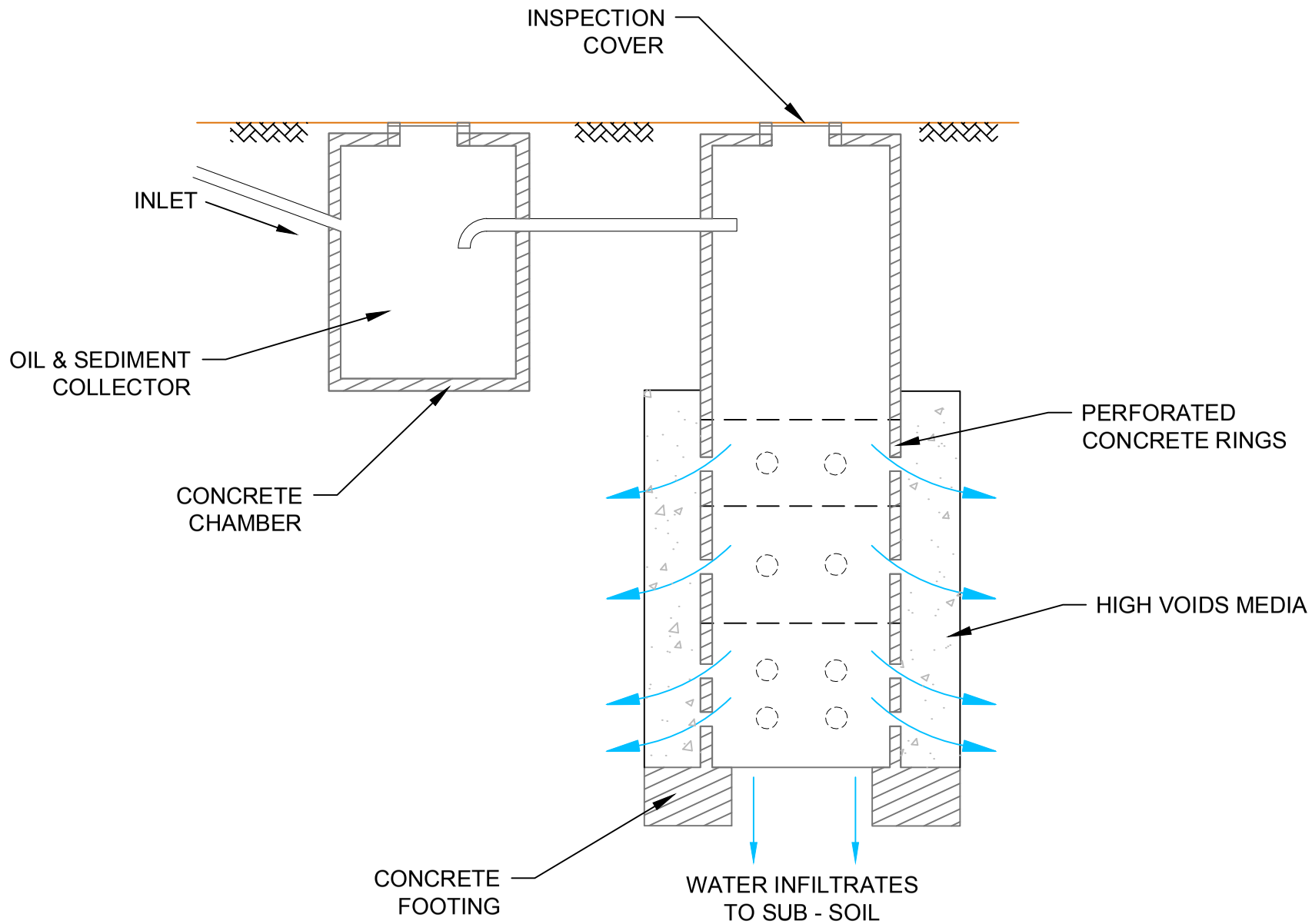
PROJECT: TYPICAL SUDS DETAIL

TITLE: FILTER STRIPS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	107	A

DO NOT SCALE



SOAKAWAY DETAILS
(INCLUDING PRE-TREATMENT DEVICE)

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

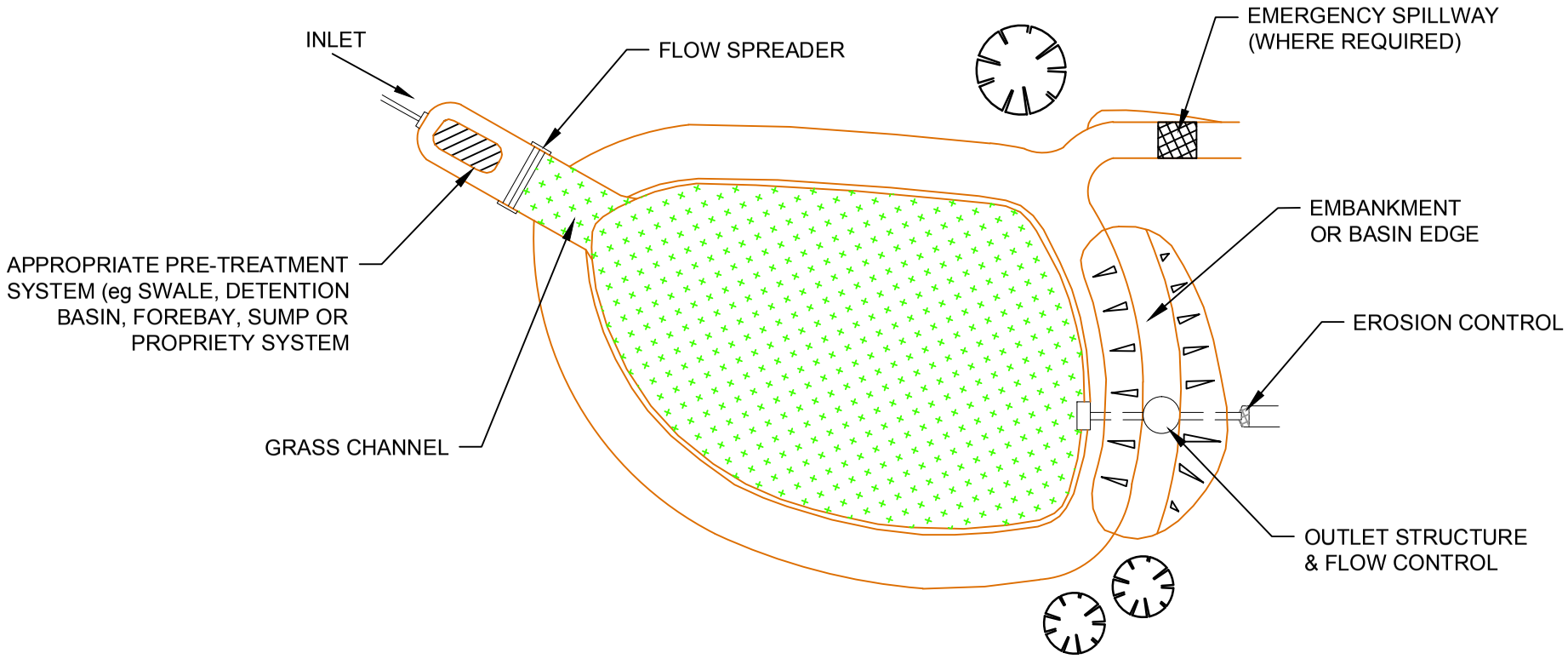
PROJECT: TYPICAL SUDS DETAIL

TITLE: SOAKAWAYS

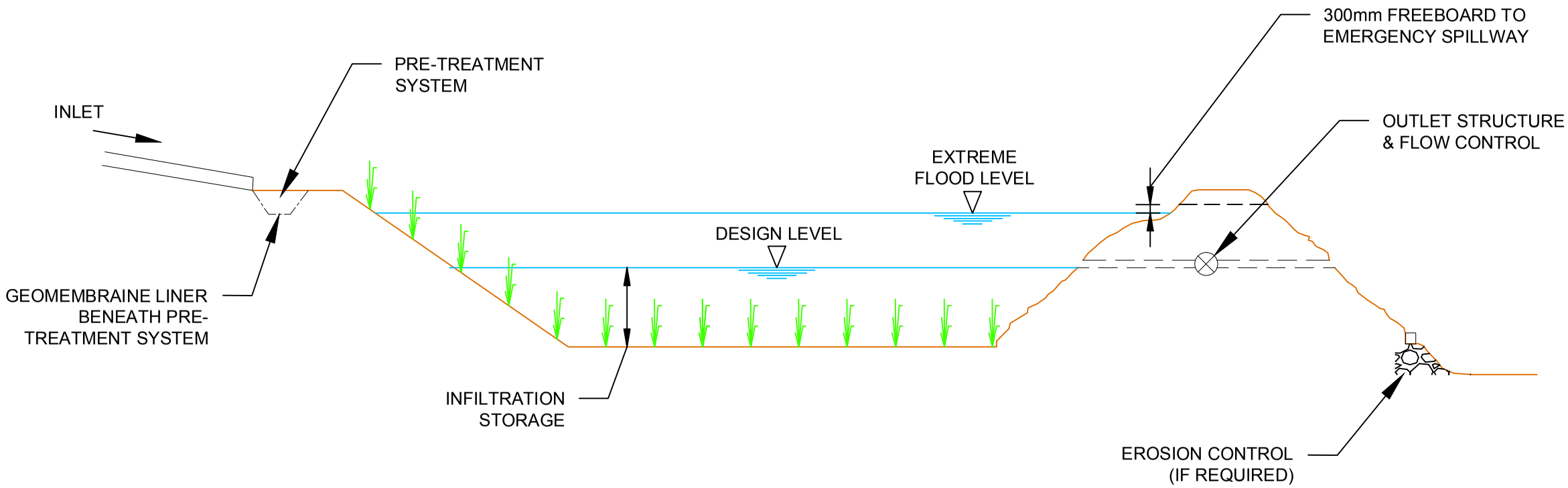
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	108	A

DO NOT SCALE



PLAN VIEW



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

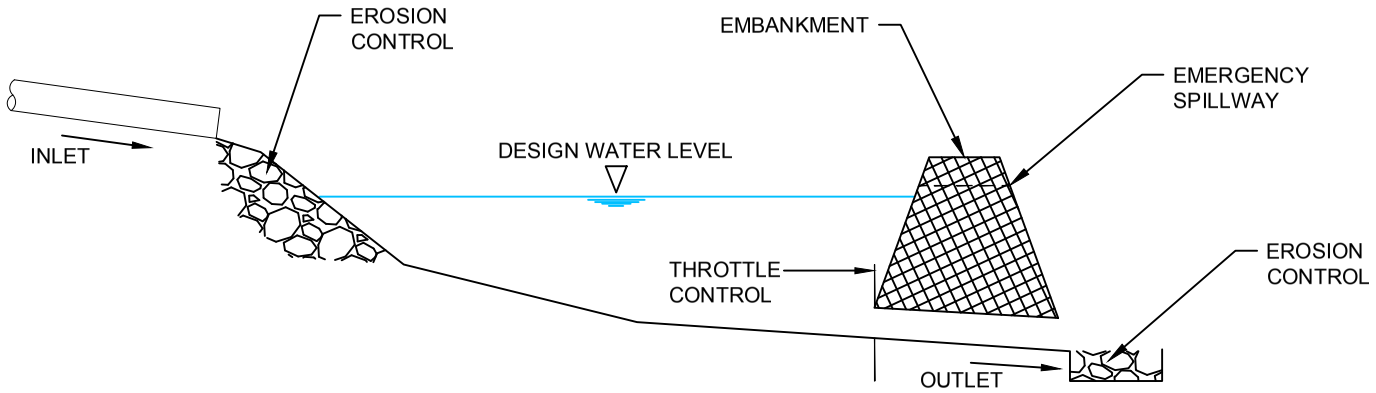
PROJECT: TYPICAL SUDS DETAIL

TITLE: INFILTRATION BASINS

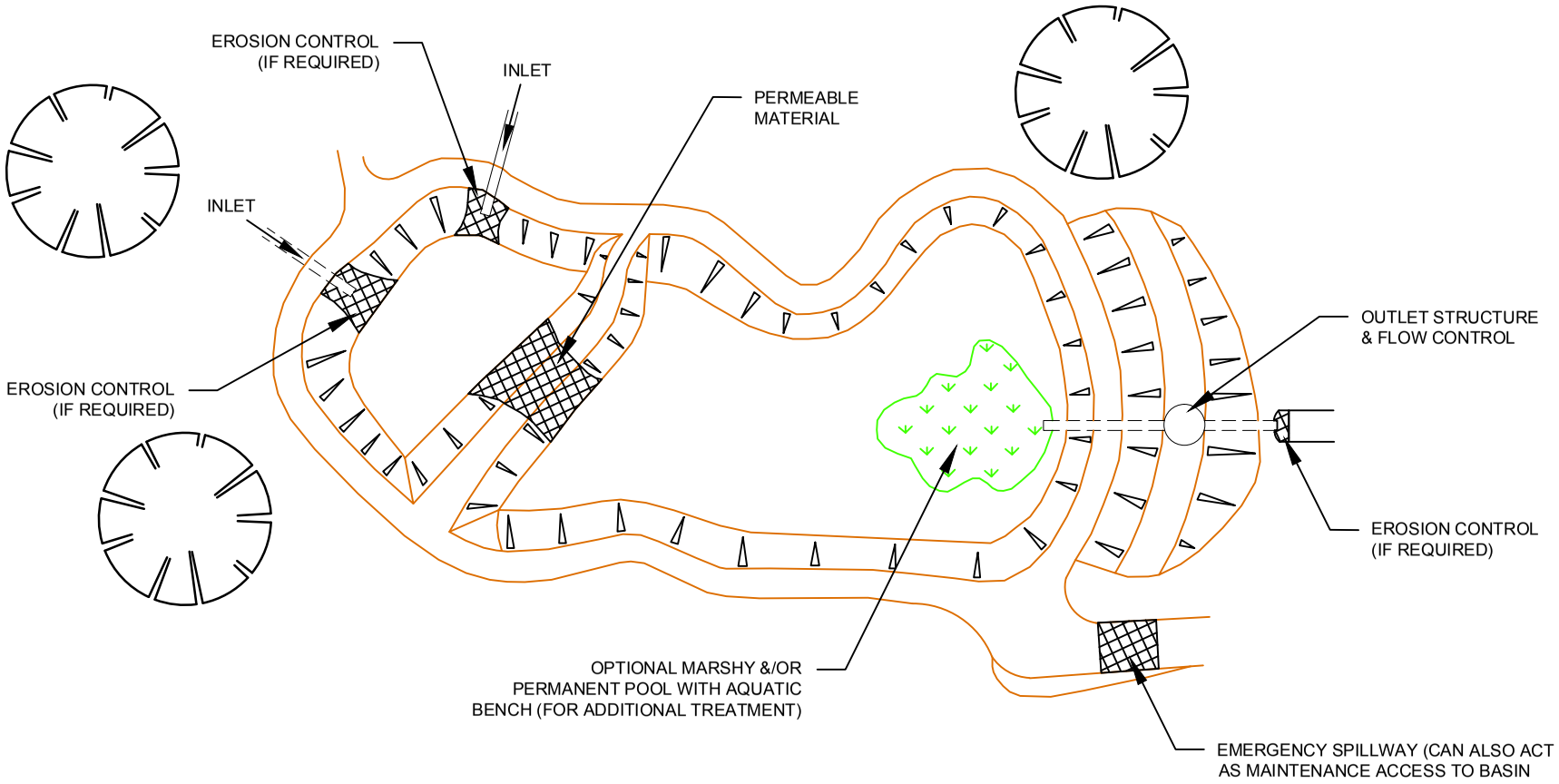
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	109	A

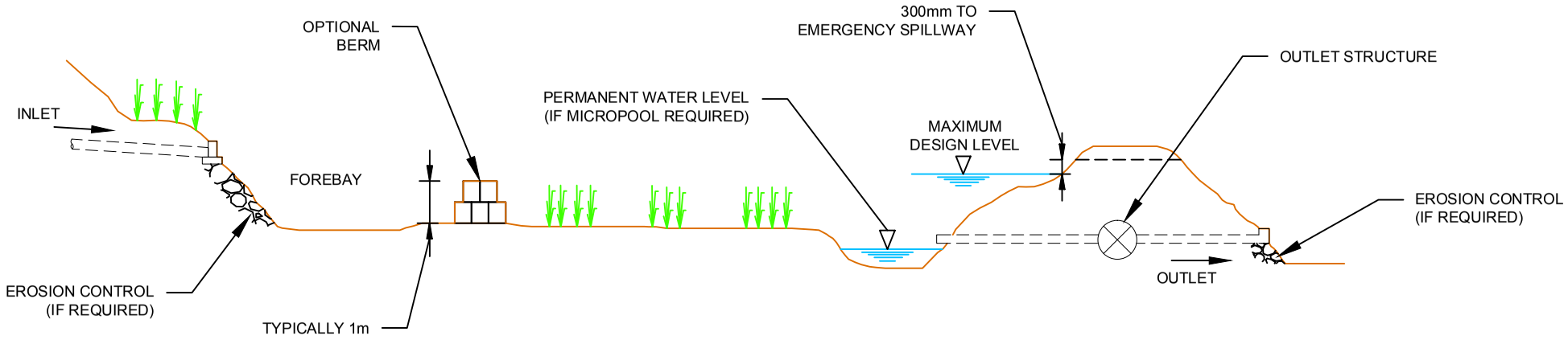
DO NOT SCALE



SCHEMATIC OF DETENTION BASIN PROFILE



PLAN VIEW



ELEVATION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

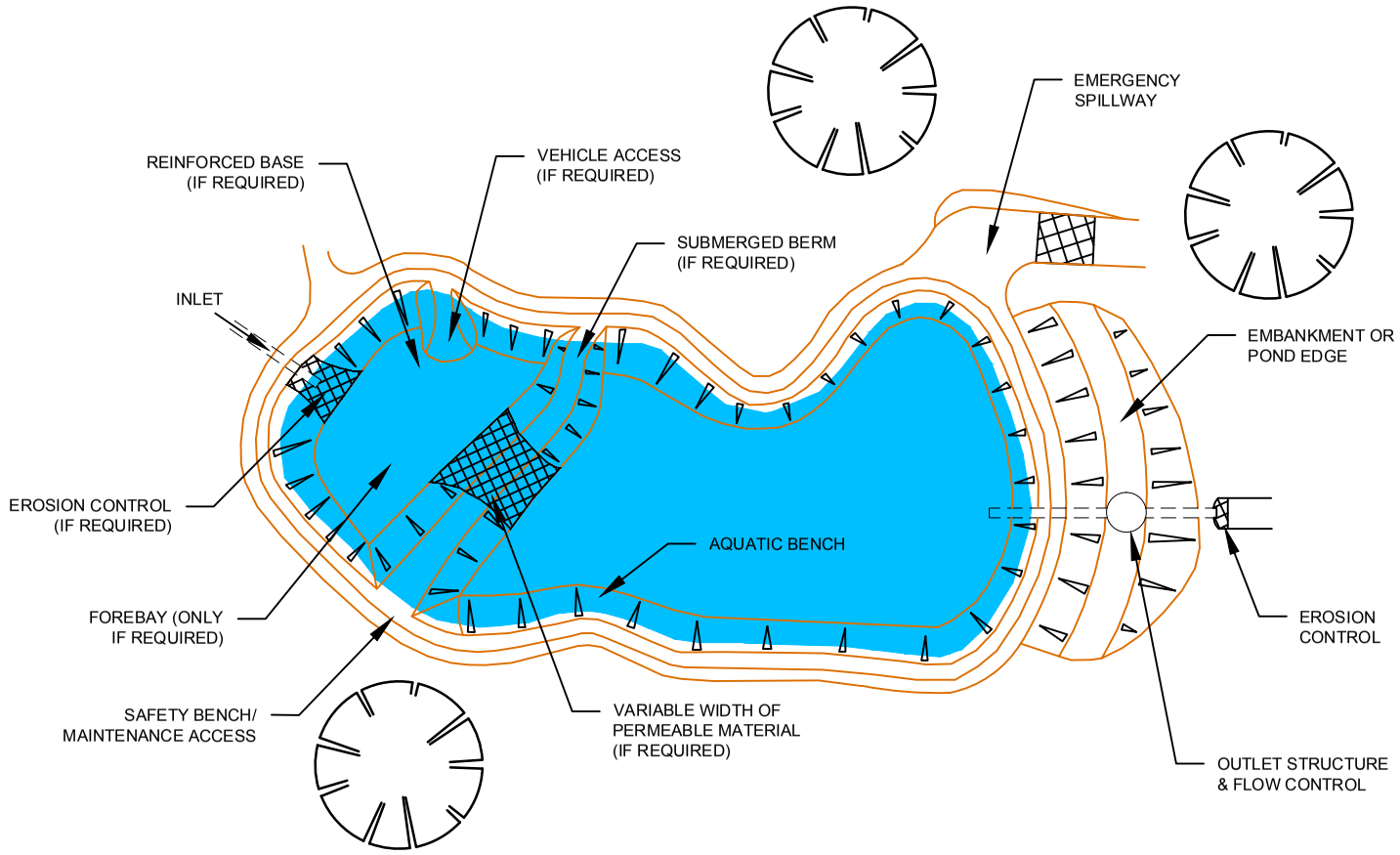
PROJECT: TYPICAL SUDS DETAIL

TITLE: DETENTION BASINS

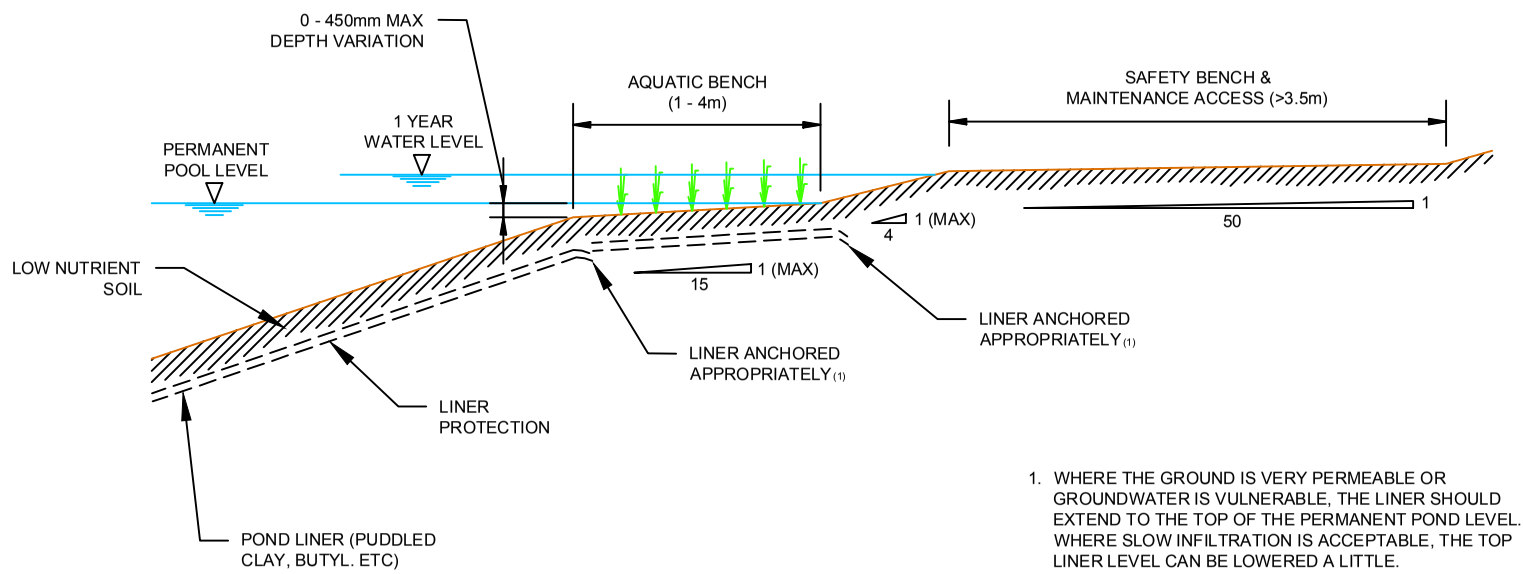
DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	110	A

DO NOT SCALE

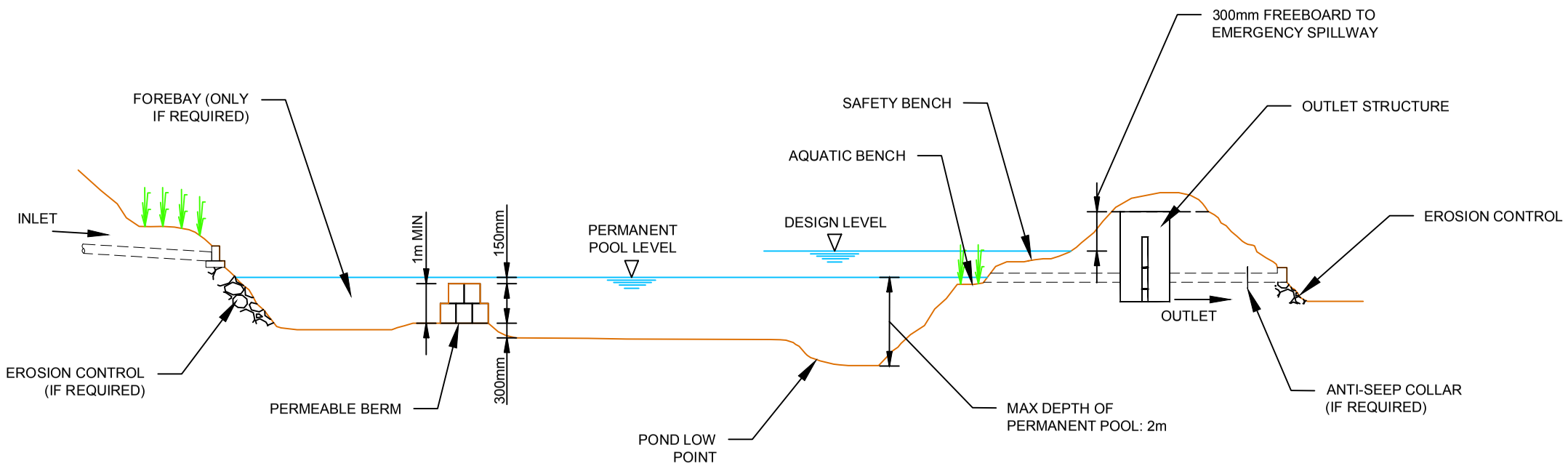


PLAN VIEW



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.

TYPICAL POND EDGE GEOMETRY



PROFILE

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
CIVIL AND STRUCTURAL ENGINEERS
Unit 6, Old Marsh Farm Barns, Welsh Road, Sealand, Flintshire CH5 2LY
Tel: 01244 288178 Fax: 01244 288516 enquiries@betts-associates.co.uk

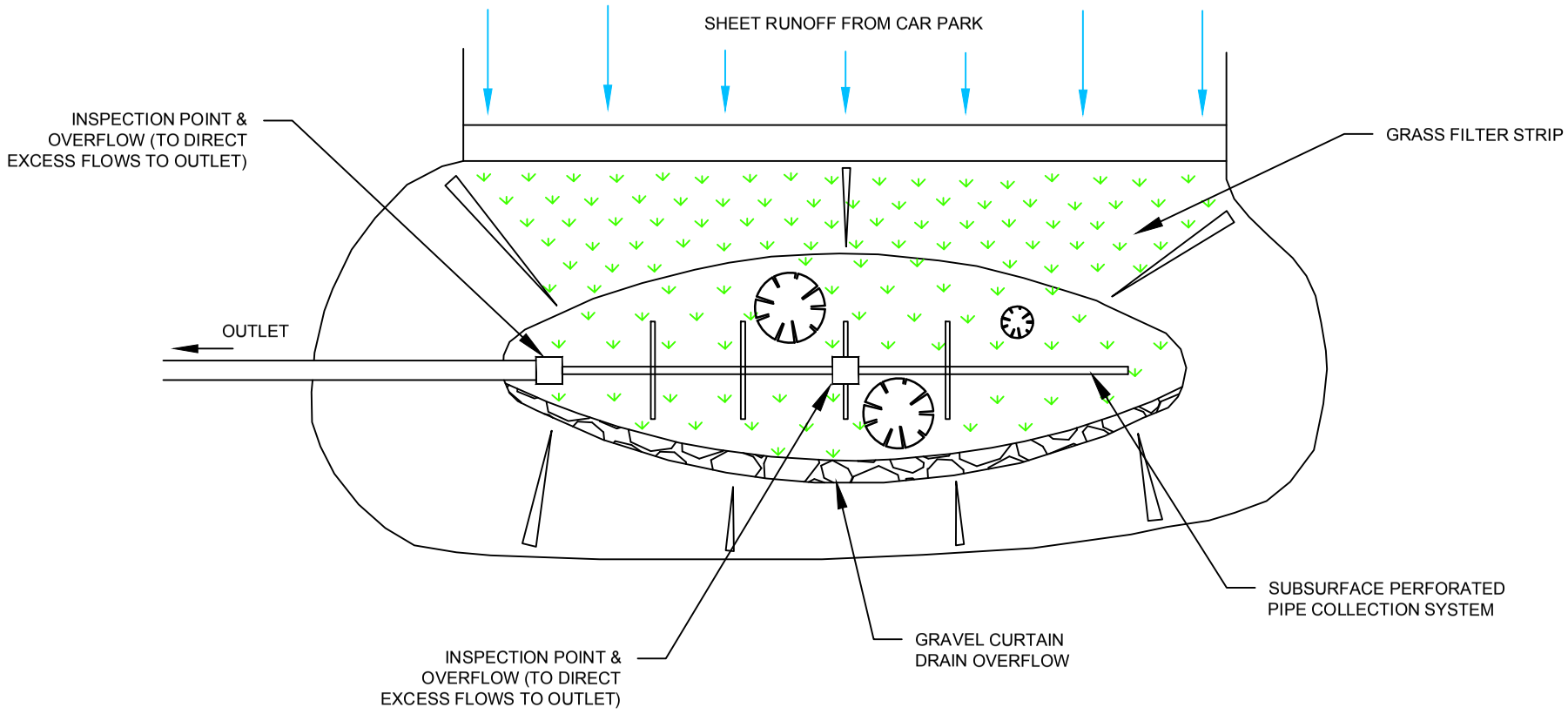
PROJECT: TYPICAL SUDS DETAIL

TITLE: WET PONDS

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	111	A

DO NOT SCALE



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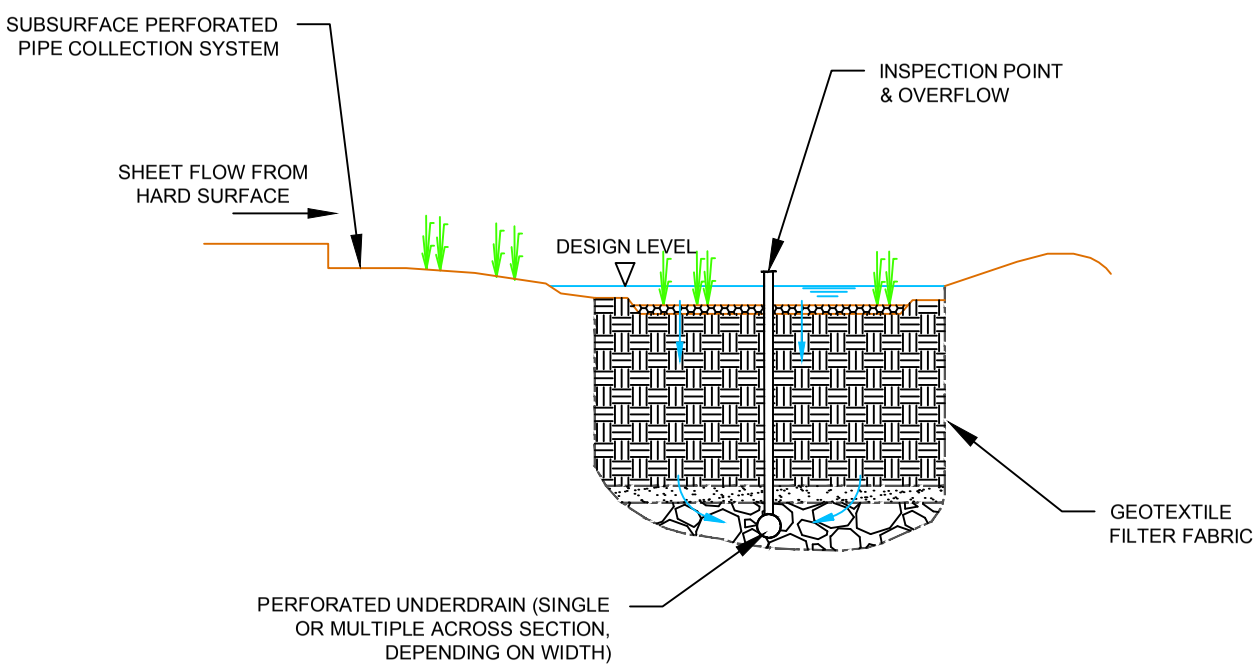

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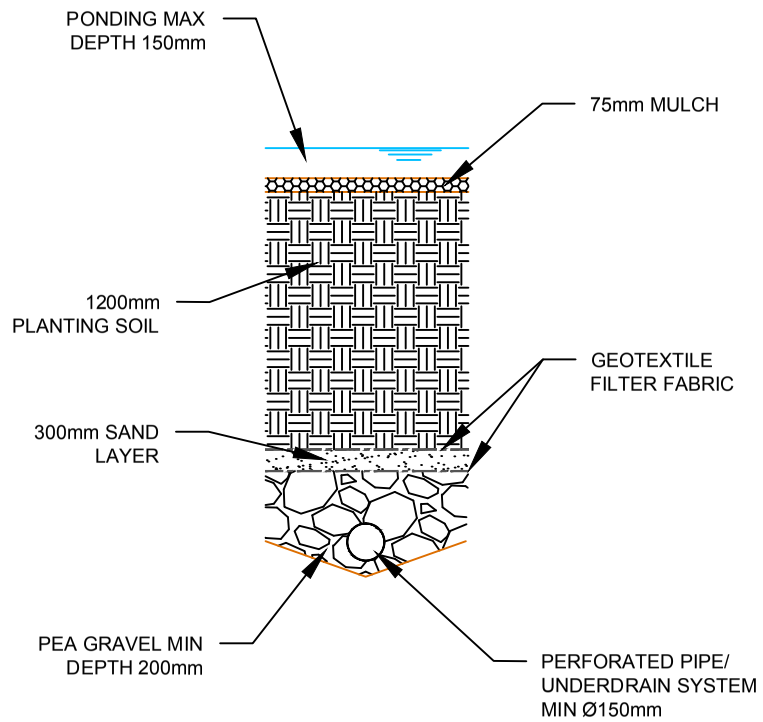

TYPICAL SECTION

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

BETTS ASSOCIATES
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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:	REV:
BETTS	112	A

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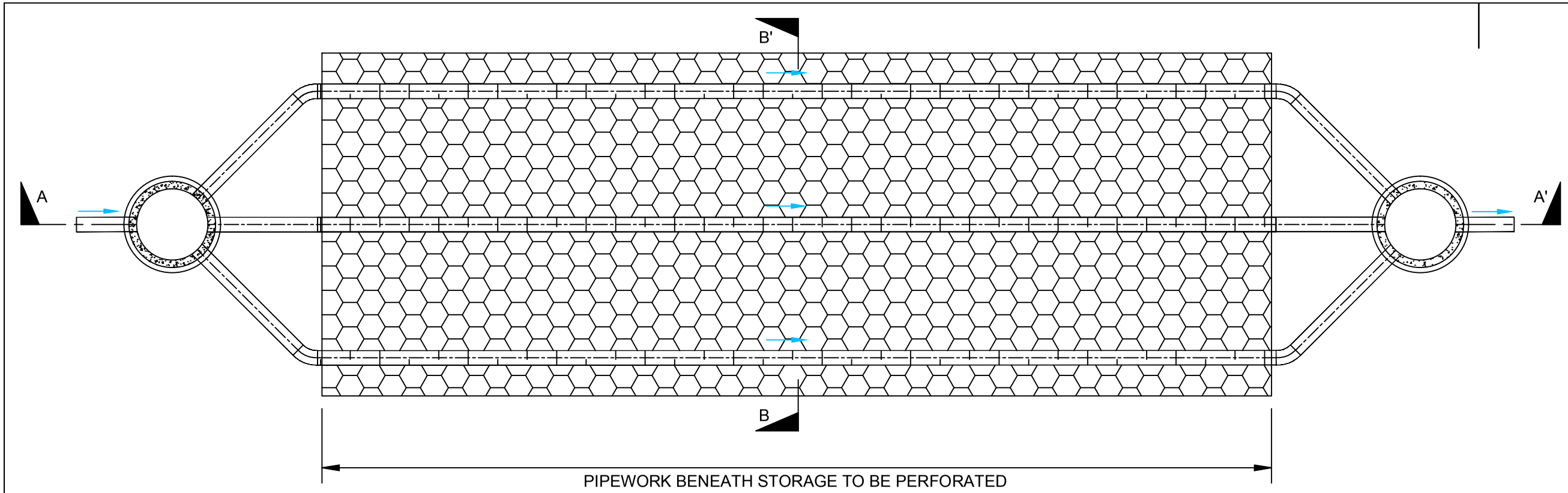
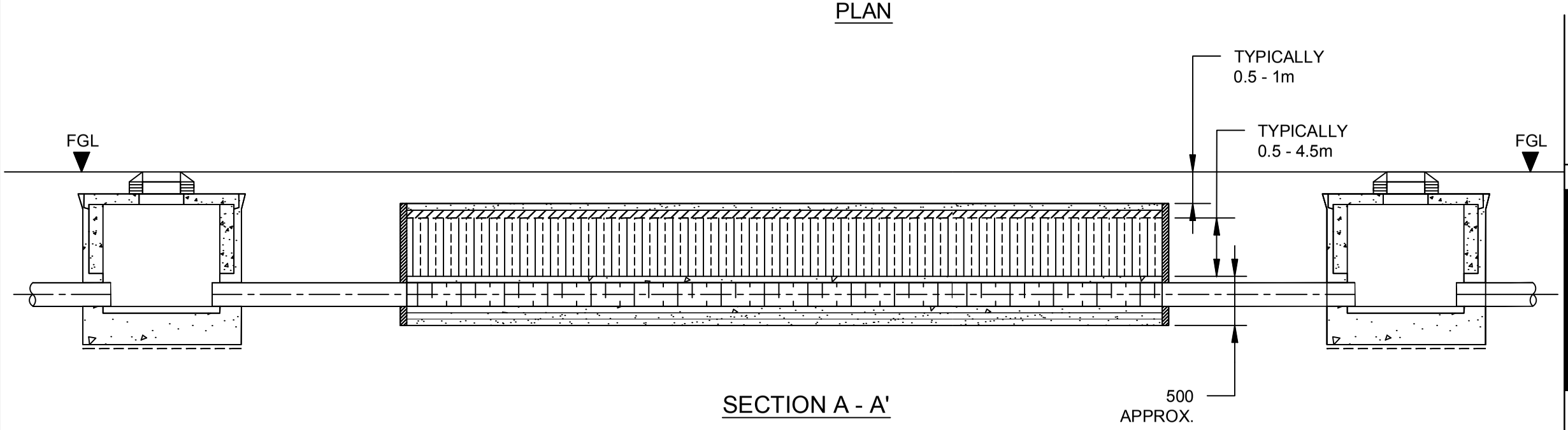
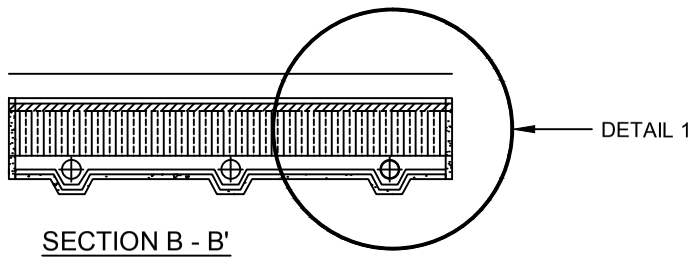


PLAN



SECTION A - A'

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



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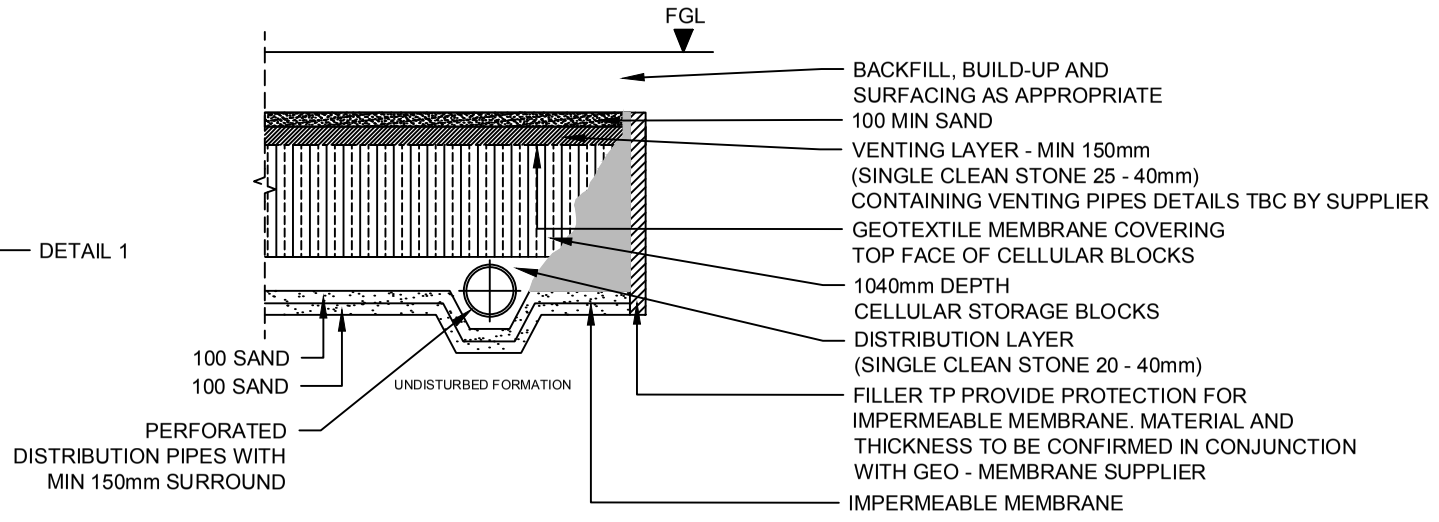

DETAIL 1

REV	DATE	BY	DESCRIPTION	CHK

DRAWING STATUS: PRELIMINARY

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PROJECT: TYPICAL SUDS DETAIL

TITLE: CELLULAR STORAGE

DATE:	SCALE @ SIZE:	DRAWN:	CHECKED:
SEP 2014	@ A3	CP	RDN

PROJECT No:	DRAWING No:	REV:
BETTS	113	A

APPENDIX L: 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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