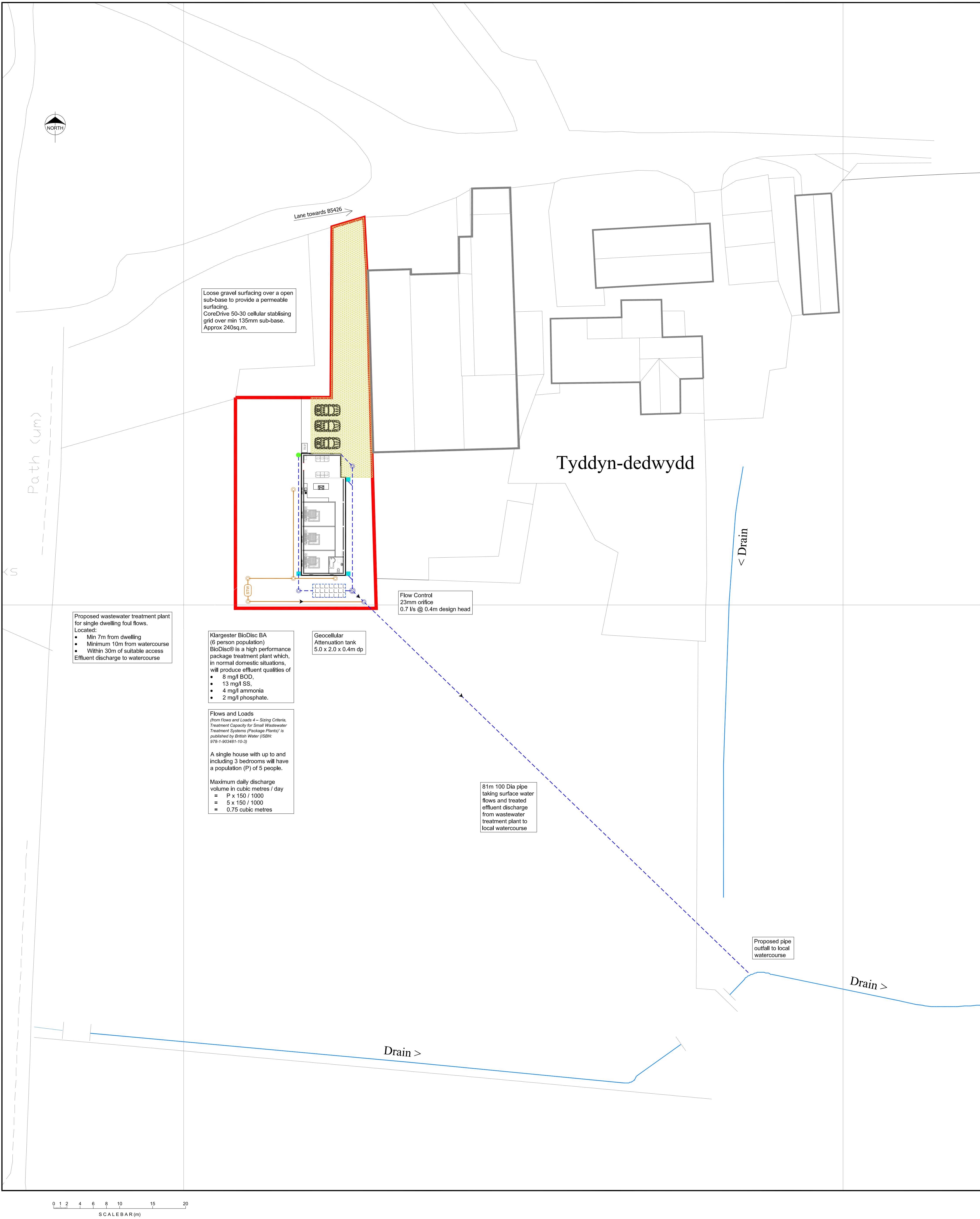




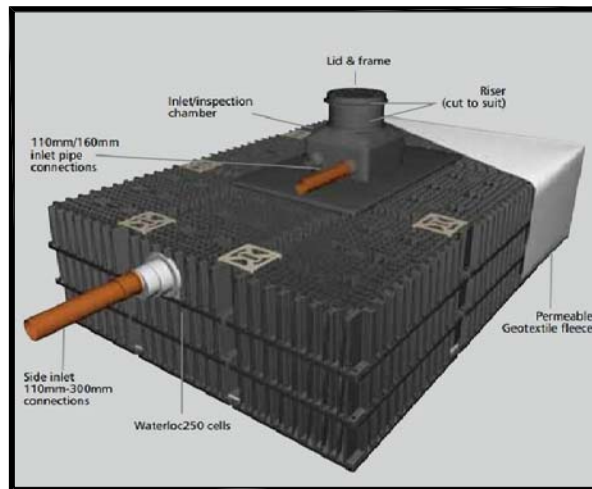
Water Butt



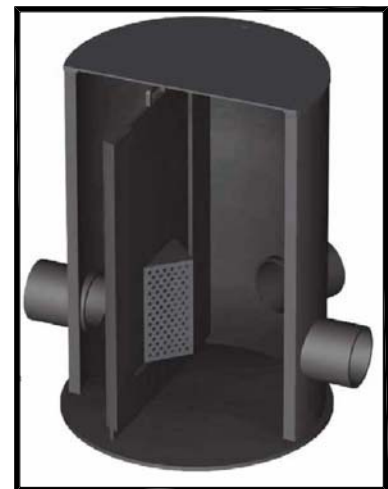
SUDS Planter



Wetland



Cellular Storage



Flow Control

SUDS Strategy

The prime function of SuDS, as with conventional drainage, is to provide effective surface water drainage, ensuring the greatest degree of flood risk protection over the long term both within and downstream of the development and prevent pollution. However, SuDS approaches can bring wider benefits too. Appropriately designed, constructed and maintained, SuDS are more sustainable than conventional drainage systems and can help to:

- Reduce run-off surface water flow-rates and/or volumes and hence reduce the risk of flooding
- Encourage natural groundwater re-charge
- Reduce pollutant concentrations in storm water
- Provide habitat for wildlife.

There are many site-specific factors which will influence the choice of any single or combination of SuDS devices used within a development. The primary factors are:

- Whether the development is domestic, commercial or industrial
- Whether the underlying ground is contaminated. If so, infiltration systems will most probably not be permitted.
- Whether the underlying ground is permeable enough for infiltration systems to be considered.
- Whether the ground water levels are deep enough for infiltration systems to be considered
- Whether the site is steeply sloping and its general topography
- The availability of space inside the development for each potential SuDS facility.
- Health & Safety aspects should the development be likely to be inhabited or used by children.

To ensure no increased flood risk to offsite land and development, disposal of surface water to the ground is encouraged and runoff volumes will be reduced through the SuDS management train where ground conditions permit. Where ground conditions are unsuitable, a discharge to an open water body / sewer will be necessary with rates restricted to the existing site conditions.

SUDS Methods

Method	Comment	Suitability for Development
Green Roofs	Can be used on suitable low-rise buildings to provide retention, attenuation and treatment of rainwater, and promotes evaporation and local biodiversity.	Not suitable: Architectural proposals for the development involve a pitched roof arrangement which are not suitable for green roofs.
Rainwater Harvesting	Rainwater harvesting reduces the total runoff volume from the developed site, and reduces treated water consumption.	Not suitable: Additional costs of installation would have severe effect on viability of the development. Running and maintenance costs would not be acceptable to our client. The ability to restrict peak flow rates and short-term peak volumes is non-existent where a critical storm event occurs. Water butts will be provided on rear RWP for garden re-use
Infiltration	Reduces total run off volume from the development	Not suitable: Site Investigation has determined the site is underlain by clay which will not allow for infiltration
Permeable Surfacing (Infiltration)	Reduces total run off volume from the development. Can be used to enhance quality of run-off water.	Not suitable: Site Investigation has determined the site is underlain by clay which will not allow for infiltration
Permeable Surfacing (Tanked)	Can be used to enhance quality of run-off water. Sub-base provides 'source' storage and reduces the volume of storage downstream. The storage can be created with selection of the stone fill or use of plastic box systems. Impermeable membrane at base of construction to prevent impact on pavement stability	May be suitable: Long term maintenance required and risk of reduction in permeability. Specialist maintenance required to maintain porous surfaces. No services to run beneath areas of permeable surface (due to presence of base impermeable barrier which is very difficult to excavate through and reinstable if required). Spatial constraints of site do not allow alternative routes for services along plot frontages. Difficult to install small areas of tanked systems that require very small flow controls which can lead to maintenance issues. Construction sequence can make it difficult to construct without use of a sacrificial road base surface to provide protection during construction. Can be used to provide treatment only with no attenuation but will incur additional costs to non permeable surfacing.
Swales, basins and ponds	Provide areas for above ground surface run off storage. Swales also allow filtering of particulate matter, improving water quality.	Suitable: Small shallow dry SUDS basins can be considered appropriate providing sufficient space is available.
Bio-Retention Areas	Collect and retain run-off to help improve water quality, prior to discharge in piped system or infiltration	Suitable: SUDS Planters can be provided on RWPs at front of property.
Geocellular storage	Suitable for sites with insufficient space for basins etc. Suitable for sites where topography prevents the use of open basins etc. Can be very effective infiltration devices subject to ground conditions.	Suitable: May be required if sufficient above ground storage is not available due to site levels design.
Large Pipes, conduits and tanks	Suitable for sites with insufficient space for basins etc. Provide a volume of below ground storage with a high void ratio and good man entry provision to allow for future maintenance and cleaning. Generally, be suitable for adoption by the statutory water company.	Not Suitable: Other more sustainable means of drainage using SUDS methods is available within application boundary.

Surface Water Flow Rates

Site Area = 810sq.m.

Existing Brownfield Run-off Rates
(Based on 120sq.m. existing barn roof area only)

1yr = 0.8 l/s (26 mm/hr rainfall)
30yr = 2.1 l/s (65 mm/hr rainfall)
100yr = 2.7 l/s (83 mm/hr rainfall)

Existing Greenfield Run-off Rates

1yr = 0.6 l/s
30yr = 1.2 l/s
100yr = 2.5 l/s
QBAR = 0.7 l/s

Proposed Run-off Rates

1yr = 0.7 l/s
30yr = 0.7 l/s
100yr = 0.7 l/s

Drainage Strategy

Existing Drainage

A piped network currently drains into a holding tank serving the farm and all outbuildings before the flows are passed forward to the watercourse approximately 80m east of the application boundary.

Proposed Foul

There are no public sewers within the vicinity of the site. Therefore we are proposing a single property wastewater treatment plant with an effluent discharge into the watercourse. The site is located within the catchment of the River Dee and Bala Lake Special Area of Conservation (SAC) which will require consideration of any impact of increased phosphate levels within the catchment. We are proposing a Klargester BioDisc which has capability of reducing phosphate levels prior to being passed forward to the watercourse.

Proposed Surface Water

1. Collection for re-use
The developer is not proposing the use of rainwater harvesting for re-use within the dwellings. Rainwater harvesting alone would not be adequate to deal with the surface water flows from the site and provision will be required for an overflow to a Level 2 or lower priority runoff destination. Therefore RWH systems are not considered a cost effective solution for managing surface water and a lower priority runoff destination is required.

Water butts will be installed on rear RWPs for garden re-use.

SUDS Planters will be installed on front RWP's

2. Infiltration
Recent ground works on site have determined the site is underlain with clay and will therefore not be suitable for infiltration techniques to dispose of surface water flows from the site. The proposed access / driveway will be loose gravel with an open sub base. This will provide storage with slow infiltration to the cohesive strata and also allow for evapotranspiration. This will assist with meeting the 5mm interception requirement.

3. Watercourse
There is a network of un-named watercourses and ditches which flows east following the topography. Existing surface water connections from the existing farm and outbuilding barn have been confirmed and we are proposing to mimic the existing situation but with betterment on flow rates.

4. Highway Drain
There are no surface water sewers within the vicinity of the site

4. Surface water sewer
There are no surface water sewers within the vicinity of the site

5. Combined sewer
There are no surface water sewers within the vicinity of the site

5mm Interception

Interception - The retention of the first part of a rainfall event to prevent surface water runoff occurring.

Key facts:

- The majority of rainfall events in the UK are less than 5 mm in depth
- Rainfall runoff from paved surfaces contains a range of pollutants: many associated with vehicle emissions.
- Pollutant concentrations tend to be highest in the early stages of a rainfall event
- If the first 5 mm of every event was prevented from leaving the site, the total volume of runoff discharged into the receiving streams and rivers through the year would be a relatively small proportion of the total runoff generated by the site

Porous paving driveway meets criteria
120sq.m. roof area requires 0.6cu.m. interception
This can be provided with a 300 litre water butt (garden re-use and car washing) and 3 No. Planters min 1.0 x 0.6 x 0.6m deep.

Maintenance / Responsibilities

Maintenance of all surface water components will be subject to SAB approval and will be maintained by the property owner for the lifetime of the development

Maintenance requirements will be considered further at detailed design stage and a 'SUDS Management Plan' will be produced to address the frequency and type of maintenance activities.

Notes

1. This proposal provides a betterment on the surface water drainage from the existing situation with the incorporation of SUDS features and a flow control to limit the flows from the site.
2. The specification in all respects shall be in accordance with the current Wrexham County Borough Council Specification and Construction publication in force in the county at the time of construction.
3. All private drainage works are to comply fully with Part H of the Building Regulations.
4. All existing invert levels to be checked by the contractor at the start of works and any other discrepancies notified to the Engineer prior to commencing works. All levels are based on topographical survey information provided by others.
5. It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works.
6. The Contractor shall adhere to the CDM Regulations at all times.
7. Only trained personnel shall be permitted to enter confined spaces.
8. Drain trenches should not be excavated lower than the foundations of any building nearby unless either:
a) The trench is within 1m of the foundation, the trench is filled with concrete up to the lowest level of the foundation, or
b) Where the trench is further than 1m from the building, the trench is filled with concrete to a level below the lowest level for the building equal to the distance from the build, less 150mm.
9. All SVP and RWP connections are indicative and shall be confirmed by the client.
10. Pipe gradients out of the building to connecting manhole to be laid at 1:40 in accordance with Building Regulations, Part H, Table 6.
11. Where pipe sizes are not indicated:
1000 to be used for foul
1000 to be used for surface water unless stated otherwise.
12. Minimum surface water gradients shall be:
1000 laid at 1:100 with the exception of the first connection which shall be minimum 1:80
13. Minimum 1000 foul drainage gradient to be 1:80 with the exception of the first connection which shall be minimum 1:40.
14. Manhole covers to be marked FWS or SW as appropriate.
15. All manhole covers and frames shall comply with BS EN124. Covers in roads to be grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be grade B125 and covers in landscaping areas to be grade A15. All to be sized in accordance with Building Regulations Part H, Tables 11 & 12.
16. Private drains laid under adopted / private roads to be Class S granular bed and surround with a minimum of 1.2m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
17. Private drains located under landscape areas or driveways / car parking bays to be Class B granular bed and surround with a minimum 0.6m cover, where this cannot be achieved a Class Z concrete bed and surround shall be provided.
18. Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.

Legend

- Site Boundary
- Proposed Foul Drain
- Proposed Surface Water Drain
- Water Butt (garden re-use)
- SUDS Planter (at RWP Outlet)
- Cellular attenuation
- Porous Gravel Paving

Client MARK BAKER

Project UPPER BARN
TYDDYN DEDWYDD
RHOSTYLLLEN, WREXHAM

Title DRAINAGE STRATEGY

DRAWING NUMBER	REVISION	SCALE at A1	1:250
SK / 01	B	DATE	July 2021
		DRAWN	AJ