Robert Welch Warehouse & Distribution Office, Evesham

SuDS used

- *Linear raised wetland*
- *Permeable block paved car parking*
- *Porous reinforced gravel service paths*
- *Surface channels*
- *Ornamental raingardens*
- *Swales*
- *Wildlife meadow basins*
- *Low flow channels*
- *Kerb inlets*
- *Filter strips*
- *Wetland basin*
- *Orifice flow controls*
- *Slot weir flow controls*
- *Stone-filled basket inlet and outlets*
- *No-dig woodland berms*
- *Approach 1 (Long-term storage) hydraulic approach*

Benefits

- *SuDS integrated into wider site design creating a beautiful and biodiverse landscape for warehouse and office workers to enjoy.*
- *Enhanced site biodiversity through the use of a range of habitat features including wet meadow basins, wildlife swales, woodland berms and biodiverse wetland area.*

- *Cost-effective SuDS on a site constrained by perched water table and elevation of discharge to adjacent watercourse.*
- *High volume losses through the use of extensive, shallow SuDS features and expansive 'long-term storage' no-dig features within woodland area exploiting the naturally high infiltration and evapotranspiration rates therein.*
- *Effective demonstration of SuDS Approach 1 separating specific volumes to be discharged via slow infiltration and very low controlled flow rates (<2L/sec/ha.) over long-term time-scales.*

1. Location

Robert Welch Warehouse

Unit 820, vale park, Evesham WR11 1JW

2. Description

Despite the industrial park setting and the poor quality of SuDS and landscape on neighbouring sites, the client, renowned cutlery and homeware designers and manufacturers Robert Welch, recognised that quality of environment was important for all their workers – not just those working in the head office in the historic centre of Evesham, but also those working at their proposed new warehouse development on the outskirts of the town.

Like the building itself, the landscape and SuDS took basic and cost-effective materials and techniques, exploited them to maximum effect to meet the budget of the development and provided enhanced features where they could give maximum beneficial impact.

Set within low-lying flatlands of the Vale of Evesham, the site benefitted from the presence of a small stream and historic, now fragmented, ditch-lines, however this location also presented significant constraints to SuDS – clay soils with perched groundwater and high relative water levels in the receiving stream.

The design sought to overcome these constraints without resorting to heavily engineered and expensive lined structures to prevent groundwater ingress and pumped systems to discharge to elevated watercourses as is demonstrated on neighbouring developments on the expanding industrial estate.

The design also utilised a parcel of woodland within the site area to demonstrate the long-term losses required in SuDS Approach 1, using no-dig construction methods within existing woodland to create large, shallow infiltration basins.

The result is a landscape that balances the formal aesthetics associated with the 'front-of-house' entrance areas, with biodiverse meadow, wetland and woodland areas typical of the wider vale landscape.

3. Main SuDS components used

Roof runoff is managed in a number of ways depending upon the direction of discharge as the SuDS creates a network surrounding the building on all sides.

To the front, a biodiverse raised linear wetland feature, linear raingarden and long-term storage raingarden manage initial runoff from the front office part of the building, with the wetland basin to the south-east managing extreme event volumes.

Pedestrian footways to the front of the building drain into adjacent raingardens or basins where their runoff is managed.

The main carpark is constructed in permeable concrete block providing source control. All runoff landing on this surface is managed within the CGA sub-base, including the long-term storage volume. Onward controlled flows pass to the wetland basin to the south.

The large warehouse roof drains to the north, southwest and southeast.

The south-east quadrant of the warehouse roof drains to two wildlife basins and the wetland basin before discharge to the adjacent ditched watercourse – a section of which was deculverted as part of the project.

To the north, a raingarden and meadow basins manage the roof runoff and also receive runoff from the access road, external storage areas and vehicle loading area. The runoff from vehicular areas passes through filter strips and a chain of multiple vegetated features to ensure sufficient pollution removal/treatment.

Further long-term storage is provided within the woodland area in a large no-dig bermed basin.

The south-west roof quadrant drains into a renovated ditch on the edge of the woodland with further storage within the bermed woodland basin and discharge via the existing field ditch to the watercourse to the west.

The maintenance access path around the building perimeter is constructed in reinforced porous gravel surface.

The 19 flow controls throughout the scheme are embedded within protective stone-filled basket inlets and outlets set within the gradient of feature side-slopes for maximum protection against blockage, ease of maintenance and low visual intrusion.

A multiple-orifice flow control chamber is utilised to manage both up to the 1-in-100 +CCA event and long-term storage discharge within the sub-base storage zone.

Surface paved channels convey roof runoff at the surface into raingardens and basins.

Drop-kerb inlets with erosion and silt aprons inlet road runoff into basins.

4. How it works

Clay soils and perched groundwater.

Due to the clay soils, perched groundwater and lack of gradient to the watercourse discharge point, the approach was to keep attenuation storage features as shallow as practicable.

Sub-catchments and rainfall hierarchy.

Sub-catchments were defined resulting in multiple branched SuDS trains enabling the SuDS features to be integrated throughout the development landscape and defined rainfall event volumes managed in discreet features.

The segregation of different rainfall event volumes means that prominent features such as raingardens and the raised wetland are seen to be filling with water more regularly and ensures that runoff is used to irrigate the ornamental planting that is less drought tolerant, reducing the demand for potable water use for irrigation.

Managing at or very near the surface.

Runoff is managed predominantly within the landscape surface with the car park managing runoff within the CGA sub-base construction. Piped connections have been avoided in the design with pipe runs kept to a minimum for ease of maintenance and improved legibility.

Key SuDS parameters

The system manages up to the 1-in-100 rainfall event plus 30% CCA with discharge increasing from the 1-in-1 up to the 1-in-100 greenfield runoff rates in the corresponding events.

In accordance with Approach 1, long-term storage volumes have been calculated and treated separately in a range of features with discharge either at less than 2L/sec/ha or through infiltration and natural losses.

Due to the extensive landscape nature of the SuDS, 5mm interception losses have been accounted for.

Exceedance is via natural falls and defined routes through the site, away from the building and directed to adjacent ditches.

Primary discharge is to the adjacent ditched watercourse via a direct outlet and an attached field ditch.

Water quality.

We have used the matrix approach to managing pollution in runoff.

Roof runoff passes through a range of features including raingardens, wetlands, swales and vegetated basins providing treatment of pollutants.

Car park runoff is treated through the permeable construction and further treatment within the wetland basin before discharge.

Access road and loading area runoff is treated via grass filter strips, vegetated low flow channels, swale and meadow basins.

Biodiversity.

The design creates a diversity of habitat types bringing wildlife to the heart of the development in often interconnected features.

The formal wetland rill and flowering and seeding ornamental planting to the front of the building encourage invertebrates and pollinating insects. Native meadow-seeded basins and the wetland basin provide extensive valuable natural habitat with direct surface connectivity to existing features

of biodiversity value such as the hedgerow, watercourse and woodland. Woodland habitat diversity has been enhanced through the carefully constructed no-dig long-term storage basin which introduces more variety of ground conditions and resulting vegetation types.

A barrier to biodiversity connectivity – a culverted section of the existing watercourse – has been deculverted as part of the project.

Amenity.

Every worker deserves to work in a pleasant environment and have an external landscape that encourages them to take breaks, socialise with colleagues, get fresh air and sunshine and enjoy all the health and wellbeing benefits that a rich landscape offers – even in industrial environments.

This project does not shy away from this responsibility and the design provides access and seating into the SuDS landscape so that people can enjoy the wildlife and natural beauty that it creates.

Ornamental planting to the front of the building ensures that workers and visitors alike experience a beautiful start and finish to their working day and the high quality of the environment reflects the investment and commitment of the company to its staff.

Putting SuDS features such as the raised linear wetland and raingardens that fill up regularly at 'front of stage' increases awareness of the SuDS functionality at the same time as reconnecting people to natural climatic cycles in dramatic and engaging ways.

Eastern and Western flow paths

The SuDS proposals comprise two distinct primary surface water flow paths each with a discharge point into an existing ditch. Each primary path contains branched SuDS management trains servicing both building and hard-surfaced areas. The two primary paths are named the Western Flow Path and the Eastern Flow Path.

The Eastern Flow Path - front of building, south-eastern warehouse roof quadrant and car park area.

To the front, the timber clad office part of the building discharges into a formal raised native-planted wetland feature. Working closely with the architect, Mark Element, the rainwater pipes were designed to fall down the formal entrance colonnade columns and angle into the raised wetland to create a highly visible demonstration to show off the sustainable way the development manages rainwater.

The raised wetland features creates a lush, biodiverse feature that complements the Oak clad building entrance, softening its interface with the landscape and, along with the adjacent swale planting, providing a visual buffer between the parking and the colonnade access footway and entrance.

The raised wetland has a degree of attenuation storage capacity over the permanent water level, with a series of slot weirs, incorporated into the walls, managing up to the 1-in-1 rainfall event and controlling onward flow into the adjacent linear raingarden.

The linear raingarden in front of the raised wetland, planted with flowering perennials and grasses to create a dramatic and beautiful entrance to the building, manages up to the 1-in-30 rainfall event from the front roof with a separate volume diverted via a simple non-return valved flow control to a small raingarden to the north end of the parking ('Basin M'). This volume is managed as a long-term-storage' volume, discharging back through the linear raingarden at a 2L/sec/ha rate.

Roof runoff in extreme events up to the 1-in-100 +CCA pass onto the wetland basin ('Basin P') where it joins flow from the warehouse roof to be attenuated and discharged via a flow control to the adjacent ditch.

The south-east quadrant of the warehouse roof drains via a very short section of pipe to a basin that manages up to the 1-in-30 event volume, a second basin managing the long-term-storage volume and the wetland basin to the south east which manages up to the 1-in-100 +CCA volume.

The permeable block paved car park provides source control for polluted runoff and manages all its runoff within the CGA sub-base up to the 1-in-100 +CCA event and including long-term storage volumes. The different flow control requirements of the 1-in-1, 1-in-30, 1-in-100 +CCA and long-term storage volumes are managed through multiple orifices within a flow control chamber.

Onward flows from the car park pass through the wetland basin and the combined discharge point into the ditch to the south.

The Western Flow Path – Warehouse roof and delivery access and loading areas.

Runoff from the asphalt access road, reinforced concrete vehicle loading area and asphalt external storage areas drains to the large shallow basins to the north of the building via drop kerb inlets and flush kerb sheet flow over grass filter strips. Roof runoff is directed to these same basins via surface channels or, in one case where that wasn't practical, via a short length of pipe. The north-east roof quadrant drains via an ornamental raingarden that manages up to the 1-in-10 event volume.

The large basins are planted with native wet meadow seed mixtures and are designed to be shallow to lie above the perched groundwater level. A perimeter low-flow channel ensures that the basins are usable and maintainable most of the time by routing day-to-day flows in the defined channel.

The long-term storage volume is separated via multi-level flow controls and diverted to the woodland bermed basin to be infiltrated and evapotranspired.

The south-west roof quadrant drains via surface channels to a renovated field ditch at the edge of the woodland, where the 1-in-100 +CCA volume it managed with a flow control managing discharge to the ditch leading to the watercourse to the west and diverting the long-term storage volume to the woodland bermed basin.

5. Specific project details

The project is a new warehouse and office building with associated car parking access and loading on a site within an expending industrial estate on the outskirts of Evesham, Worcestershire.

The overall budget was circa £3 million.

Adjacent new developments manage runoff in deep lined and reinforced basins to prevent groundwater ingress, and pumps to discharge to the adjacent watercourse which is at a higher level

compared to the storage features. The client and Evesham Borough Council were keen to avoid this approach for cost, maintenance, effectiveness, biodiversity, aesthetic, water quality and robustness reasons.

The design team was small comprising client, architect, structural engineer and combined Landscape Architects and SuDS Designers, Robert Bray Associates. The ensured an efficient, effective and collaborative design process resulting in a successful scheme that the client was very happy with.

6. Maintenance & operation

Maintenance is carried out by routine landscape maintenance paid for by the client as part of their overall site maintenance. The use of 'pasive maintenance' approah to the design of the SuDS, using landscape features throughout to manage runoff means that no routin specialist maintenance is required with all maintenance, bar the rare grit joint replacement of the permeable carpark, being carried out by conventional grounds/landscape maintenance contractors.

A comprehensive O&M manual was provided as part of the package tabling what maintenance activities are required, how often, how and by whom.

One of the part-time members of warehouse staff has had her hours extended to do gardening services on the ornamental planting to the front of the building. She is very happy to be earning more money, contributing to the image of the company and most of all, to be working with plants which is her passion.

7. Monitoring and evaluation

There is no formal monitoring of the scheme. We carry out our own evaluation of the project through occasional site visits and discussion with the management staff to ensure that the project remains a continued success and get first hand reporting on how the system is functioning. All feedback so far is very positive and this is reflected in the investment that they have put into maintaining and ensuring staff use of the landscape.

8. Benefits and achievements

Demonstration of the range of landscape-based SuDS techniques that are equally applicable within an industrial setting and alternatives to deep basin, storage tanks and pumped systems that the local council can use as an exemplar to encourage future development on the estate.

Extensive biodiversity enhancements and connectivity designed throughout the site and enhanced by the management of rainwater.

Integrated design of landscape and SuDS ensuring a balance between habitat creation, image, experience and amenity benefits.

Integration of features that create drama and raise awareness of SuDS such as the raised wetland feature and raingardens that are designed for lesser rainfall events and so visibly fill up more regularly.

A demonstration of SuDS Approach 1 using careful design, new innovations and exploiting the value of existing woodland to manage dedicated long-term volumes.

Innovations:

- Affordable and small non-return valve flow control embedded in a protective stone-filled basket inlet/outlet enabling the separation of a long-term storage volume in 'Basin M' with a very low discharge rate of 0.1L/sec.
- Integrated slot weirs in raised wetland.
- Multi-orifice flow control chambers managing increasing dischage rates with corresponding rainfall events and separate management of the long-term storage volume at very low flow rates.
- Basin creation within existing woodland without tree removal, damage to root zones and minimising redution in existing soil percolation using no-dig berm construction.

9. Lessons learnt

We explored various formats and approaches to managing long-term storage volumes separately and although not all were utilised within this project, we will carry the findings on to future projects.

An investment in quality of design, materials and valuing recreational space for workers generates a pride and value amongst staff and owners and increases investment in the landscape and associated SuDS.

Quality of environment for staff in industrial environments is just as valuable as any other environment that people inhabit and possibly more so given the nature of their internal working environments – this has been much appreciated by staff.

10. Interaction with local authority

Our concept proposals were discussed with the local authority at an early stage to ensure that we were moving in a direction that they supported. This meant that the designs were approved quickly, without modification, through planning.

11. Project details

Construction completed: *Practical completion Autumn 2017 – final completion Autumn 2018.*

Cost: *£3 million overall. All external works/landscape including SuDS: £480,000.*

Extent:

Overall site: 10,416m^2

Roof area: 3334m^2

Hard surfaces: 2707m^2

Remaining landscape: 4375m^2

SuDS part: approx. 30-40% of landscape

12. Project team

Clients	• Robert Welch	
Designers	• Robert Bray Associates	
Contractors	• M F Freeman	
Other	• Mark Element - Architect	

Schematic diagram of the SuDS scheme highlighting the sub-catchment design with multi-stage, branched SuDS trains and hierarchical management of different rainfall events.

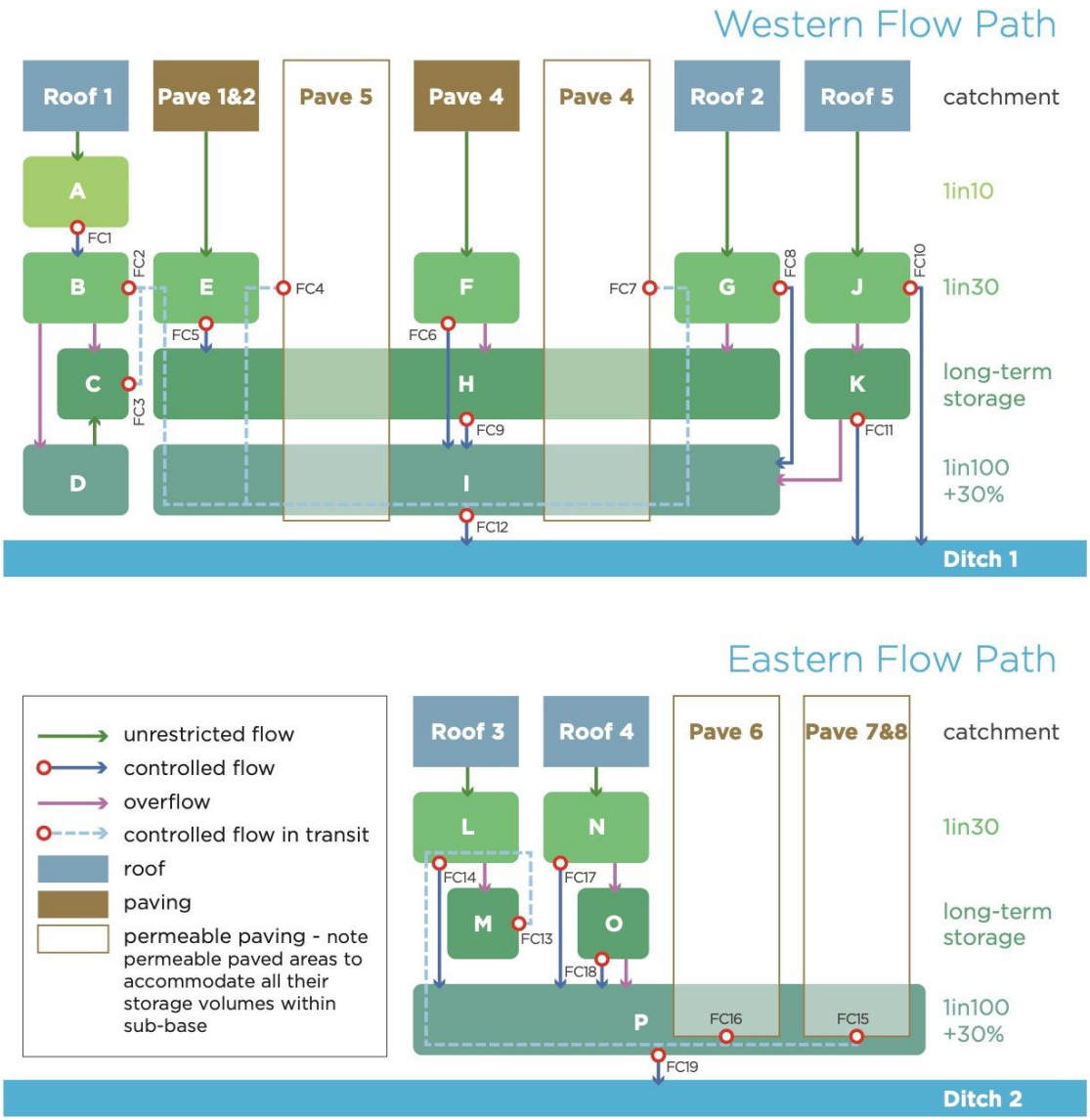
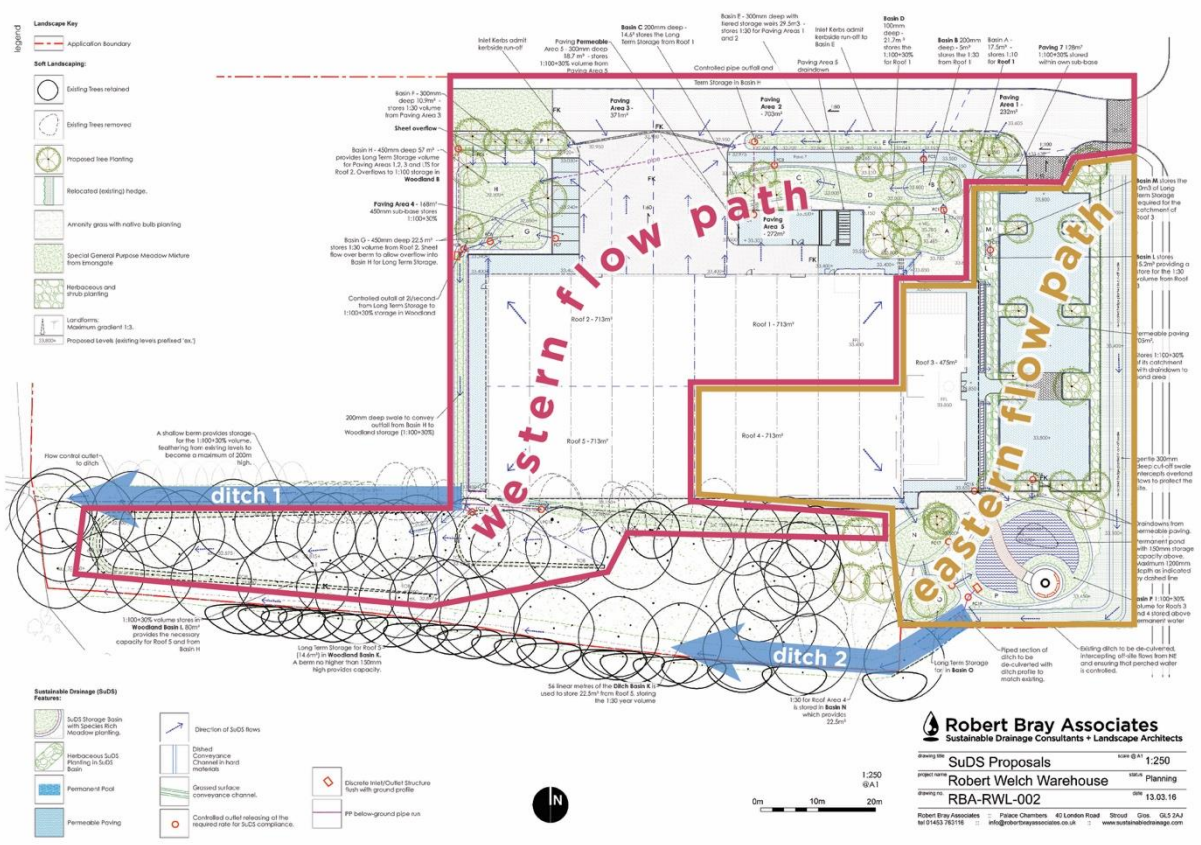
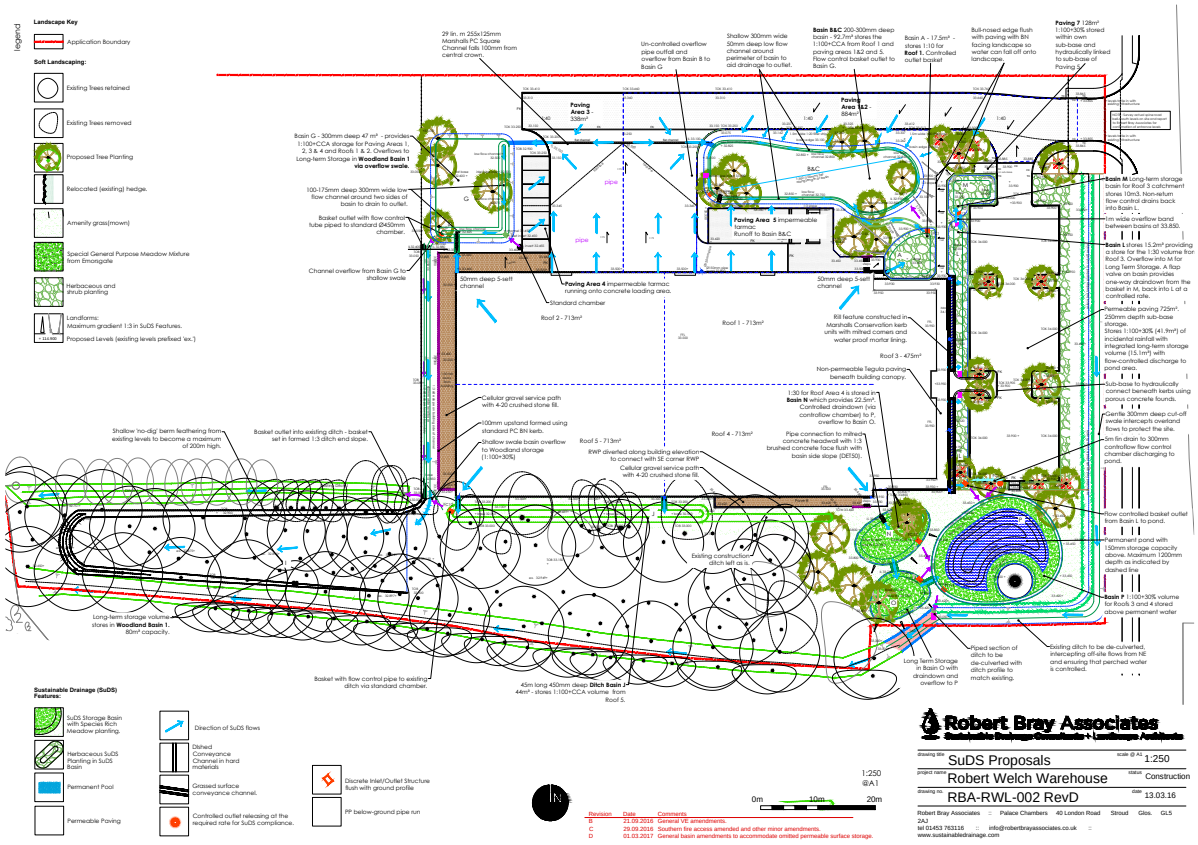


Diagram showing the two main flow paths and their catchment areas.



The SuDS Proposals plan



Aerial view of the front of the building from the east.

Building entrance showing the permeable parking area and rich vegetation to the building frontage associated with the raised wetland feature and linear raingarden.

View of the car park and front of building

Aerial view of the car park area with extensive ornamental planting, permeable car park surface and raingardens and raised wetland features to the right side.

View of main building entrance showing the softening effect of the raised wetland and raingarden planting between the parking and building.

Permeable parking surface

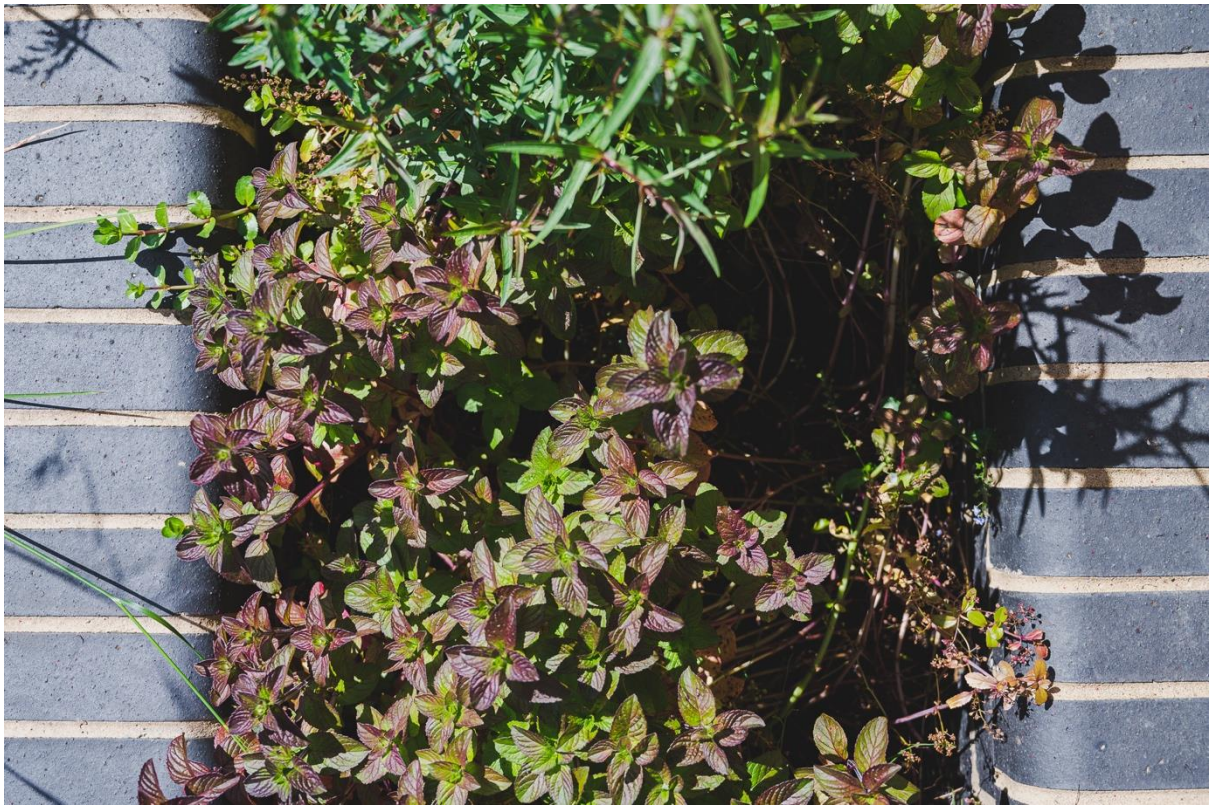
The lush raised wetland feature creates a formal colonnade footpath entrance to the building and screens views of the parked cars.

Detail of bottom of rainwater pipe dropping into the raised wetland feature with water mint growing happily.

Detail of the integrated slot weir in the brick-built raised wetland feature. A curved, dished splash-pad catches flows and guides them to the planted raingarden in the foreground.

The raised wetland features native marginal planting such as Water Mint, Brooklime, Purple Loosestrife and Water Forget-me-not. The raingarden to the left features a range of ornamental grasses and flowering perennials.

Close up detail of the raised wetland feature and flourishing Water Mint.



Raised wetland feature and one of a number of rainwater pipe inlets.

The wetland and surrounding wide basin area with staff picnic seating. The wider area was seeded with native meadow seed whilst the wetland was left to colonise from adjacent waterbodies.

One of two large, shallow meadow seeded basins to the north of the building featuring a low flow channel seen here conveying a low flow after a modest rainfall event.

An inlet into one of the meadow basins.

The renovated woodland edge storage swale collecting runoff from the roof via surface channels.

Reinforced porous gravel service/emergency access path in foreground.

View into the woodland basin area with local stone roof runoff channel in the foreground and stone-filled basket flow control feature.

Renovated swale in location of existing historical ditch at the woodland edge.

A rich diversity of wildlife supporting vegetation exists throughout the SuDS features.

A carefully designed arrangement of ornamental grasses and flowering perennials provide year-round colour and interest, a variety of textures, high infiltration rates and food sources and foraging for wildlife.

A local stone surface channel from roof rainwater pipe into meadow basin. The swale connection to the woodland is visible on the right.

A paved channel keeps water flow visible and directs it to shallow raingarden features, keeping water flow high – above groundwater and the receiving stream level.