Priors Farm Estate SuDS Retrofitting Project, Cheltenham

SuDS used

- *Detention basins*
- *Bioretention Planters 'Rain Gardens'*

Benefits

- *Reduction of surface water flooding*

1. Location

Priors Farm Estate, Oakley, Cheltenham, GL52 5LJ; 51°54'16.7"N 2°02'51.3"W

2. Description

Priors Farm Estate is a typical housing development built in the 1960's with large front gardens and predominately grassed public open spaces which was prone to flooding due to its location within the

Wymans Brook catchment area, and which consequently caused even more extreme flooding in the adjacent housing estate

The Wymans Brook is a tributary of the River Swilgate which has been classified as only being of moderate ecological status. It is currently failing to achieve the target of good ecological status due to urban diffuse pollution washed off from streets, and issues with flash flooding due to the increased amount of hard surfacing within the catchment. This coupled with capacity issues within the local surface water sewer network, were leading not only to flooding downstream but also impacts upon the biological quality of the river which has a knock-on effect on the plants and animals that live there.

The estate was highlighted in the Cheltenham Surface Water Management Plan (SWMP) as an area where disconnecting runoff from the surface water sewers and directing this runoff into local green spaces would have direct flood alleviation benefits and potentially assist in improving the quality of the water downstream.

Illman Young were commissioned by the EA (funded through the Gloucestershire Green Urban Rivers Project) to design and implement a SuDS retrofit scheme which could also act as a demonstration project for Cheltenham Borough Council. As many of the houses / flats and the public open space within the estate, were owned by the local housing association; Cheltenham Borough Homes were key partners within the project.

3. Main SuDS components used

An initial review and survey of the entire Estate was undertaken to establish the potential capacity to retrofit SuDS components into the existing landscape, including areas of public open space and private gardens.

Two types of SuDS components were then identified;

- Shallow detention basins within the existing areas of open grass that formed the public Open Spaces to take run-off from roads
- disconnection of down pipes, and small bioretention features or 'rain gardens' within front gardens to deal with roof run-off.

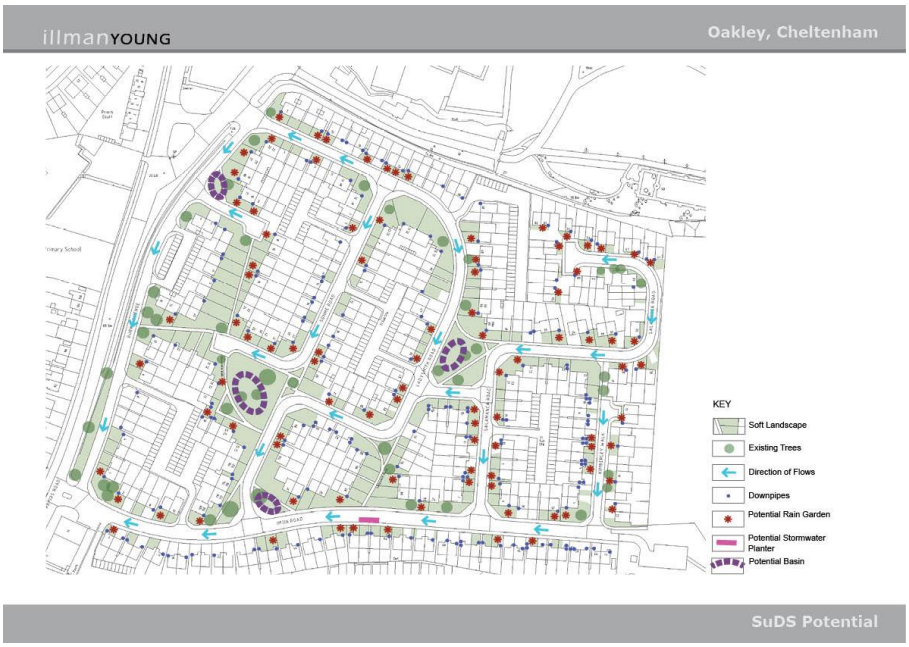

Fig 1: Potential Locations for SuDS features on Priors Farm Estate

4. How it works

Rain Gardens

A full survey of front gardens was undertaken to identify the suitability of each plot. They were assessed on size, topography and accessibility of the downpipe. All conditions had to be correct for the proposed rain gardens to function successfully.

The existing gullies at the base of the down pipes were capped, and a new channel built from setts to divert the water across the lawns into the raingardens. In order to define the extent of the SuDS, retain a tidy appearance and allow for easier maintenance a formal edge was proposed to define each of the rain gardens from either timber sleepers or setts depending upon the shape selected.

A layered construction was used within each raingarden consisting of an open stone storage layer at the base, filter layer formed by use of a geotextile and the bioretention filter growing medium formed by mix of sand, site won soil and compost.

A perforated pipe is installed within the base, connecting back into the existing storm water sewer; however, this water will be entering the system at a considerably reduced flow rate, and due to infiltration into the soil and uptake by plants; at a reduced volume.

An overflow constructed of a 'top hat' outlet (used for flat roof drainage) was included to deal with exceedance events, should water levels at the surface of the planter reach more than the 150mm depth. A further exceedance route was created by cutting a small channel from the edge of the timbers to allow overflow down to the road.

Fig 2: Complete rain gardens within open space

Fig 3: Completed rain garden within a private garden

Detention Basins in public open spaces

The existing areas of public open Space consisted of open mown grass with occasional trees and were very uninspiring, providing little biodiversity or seasonal interest for surrounding residents. It was therefore proposed to create shallow basins to take run-off from the road and planted to create attractive features within the estate. Four potential sites were identified, although only two taken were forward as part of the initial phases.

Flows are conveyed from the road, across the footpaths via wide shallow inlets under the surfacing. To reduce the velocity of the flows, a channel of raised setts was used to convey the water into the basin. Boulders were set at the end of these channels to add interest and reduce the flow rates entering the basins.

In the most frequent rainfall events the water simply infiltrates into the ground, and is taken up by the new planting. In heavier and prolonged rainfall events the water is stored for short periods (a few hours) and is then released slowly back into the existing storm water sewer via an outfall with flow control and new pipe connection.

	Somme Road Basin	**Ladysmith Road Basin**	**Individual houses**
Catchment area	830m^2	420m^2	32m^2
Greenfield runoff rate	0.26l/s	0.51l/s	0.02l/s – see below re minimum orifice size
Outlet flow control orifice size assuming max head of water above	20mm at 0.6m head gives flow of 0.65l/s	20mm at head of 0.4m gives flow of 0.51l/s	20mm – head of 0.15m gives a flow of 0.26l/s
Maximum water depth in basin	600mm	400mm	150mm
Total storage	35m^3	50m^3	0.9m^3

fig 4: Somme Road Detention Basin

5. Specific project details

Design Issues

To minimise projects costs and avoid working at height, no changes to downpipe locations or guttering were allowed as part of the project – therefore to ensure that flows could enter the raingardens, in places timber sleepers are used to support the end of downpipes over lower ground, or channels created under garden footpaths.

Open channels across the public footpaths were seen as a trip hazard, and therefore a creative solution was required to convey run-off from the road across the footpath into the basins, with no disruption to surfacing. A steel 'tray' was proposed which provided a wide shallow inlet beneath.

Fig 5: Inlet construction and complete with steel tray.

Three different styles of rain gardens were established depending on the conditions found within the gardens with use of raised timber edges allowing the rain gardens to be built on sloping ground.

The site was already subject to a term maintenance contract, which specified that all mown grass areas must not be more than 1:6 gradients. Therefore, all steeper banks to the detention basins were sown with wildflower seed that could be strimmed twice per year. Overall it was confirmed that the scheme would be cost natural in terms of its maintenance.

Consultation

Community consultation and stakeholder engagement was a very important aspect of the project. Cheltenham Borough Homes were involved with the project from the beginning as they could see the wider benefits of allowing the SuDS interventions on their land. Detailed discussions were undertaken to agree the details to ensure there were no issues with future maintenance.

Highways were also consulted at length to ensure that all details regarding the inlets into the basin were to an adoptable standard and suitable for potential over-run of bin lorries. The steel trays were therefore designed to take a 20-tonne loading.

Many of the rain gardens were proposed within private front gardens and therefore required agreement from residents to allow transformation of their space. However, the local residents had very little or no knowledge of what SuDS were or what improvements and benefits they could provide. A programme of consultation was devised therefore to firstly explain what SuDs were and what was proposed. Following on from an initial open event in the local park, a flyer was produced illustrating what we were trying to achieve and distributed to all houses on the estate. This was then followed up with door knocking to find home owners whose gardens fitted the criteria and were willing to have a rain garden located within their garden. A local resident became a 'champion' for the project and assisted in participation spreading a positive voice through the neighbourhood network.

To further engage homeowners and encourage a sense of ownership the homeowners were allowed to assist in selecting the shape of the raingarden and the plants to be used. Planting palettes were established, and residents given choice over the range of colours and which specimen plant they preferred. This has been very successful and we now see evident a real sense of pride and personalisation of the features within garden areas.

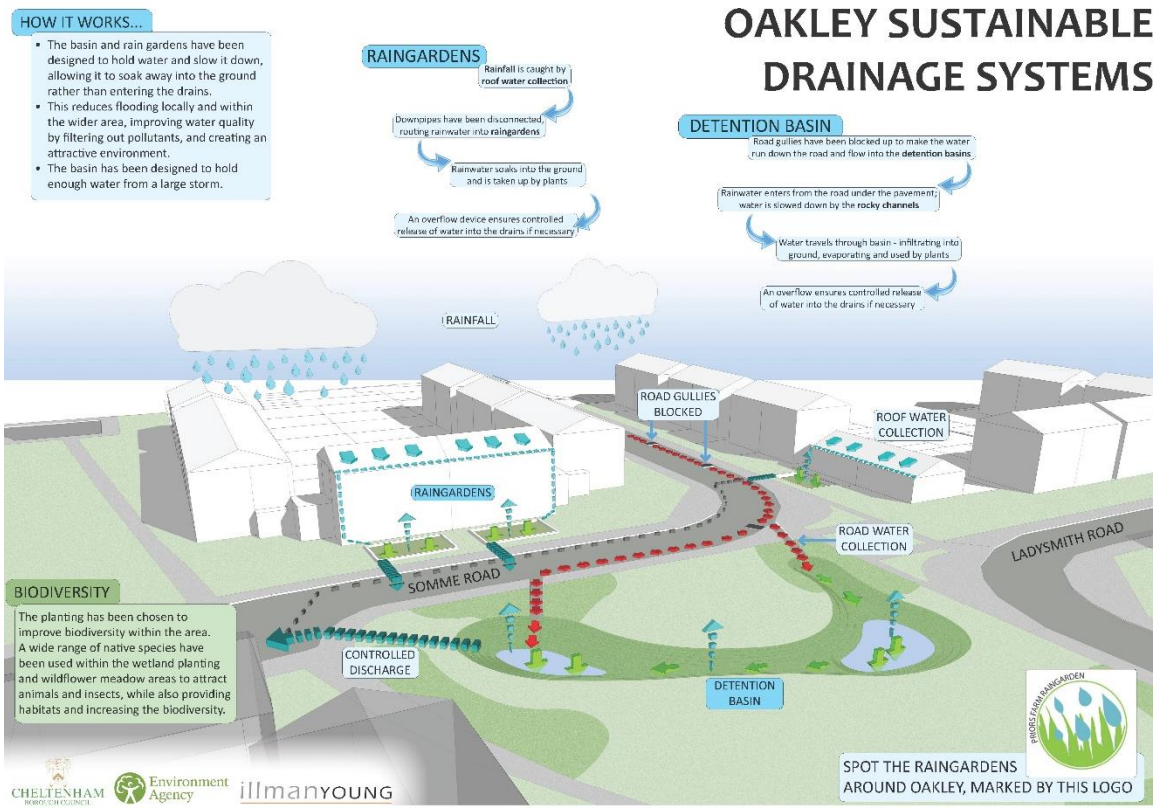

Fig 6: Information board produced to inform the local community

6. Maintenance & operation

A 10 year managemnt plan was produced which detailed the required maintenance for the rain gardens, the basins and additional amenity planting.

Maintenance of the planting beds, has unfortuantely been subject to pressures that we often see in our public spaces, with a more reactive approach to anything other than regular mowing.

However all the raingardens and basins are functioning effectively.

7. Monitoring and evaluation

The improvements to water quality downstream, are difficult to attribute directly to this retro-fit scheme due to the other interventions that were proposed as part of the SWMP, and catchment management, and therefore no specific data is available.

However, as the site is local to us we are fortunate to be able to visit on regular occasions to review the schemes performance following all kinds of rain events, throughout the year. This has allowed us to see in action the discharge from downpipe disconnections into the raingardens, and levels of water within the basins, which allows for lessons learned to inform future projects.

8. Benefits and achievements

Many benefits have been created from the creation of the retro-fit scheme:

Reduced localised flooding – a significant volume of water can be seen held within the basins and high velocity flows diverted from down pipes, reducing peak pressure on the local sewer network and a reduction in surface water flooding, both within the estate and further downstream.

Improved amenity benefits to local residents: – the public open spaces have been transformed into attractive areas with new tree and shrub planting that provides seasonal interest. The basins act as great natural play features and encourage children to use the space; the new undulating contours are ideal for running and cycling over, and the 'stepping stones' within the base provide further play value.

Improved bio-diversity: previously the gardens and public areas were a 'green desert' of short mown amenity grass, offering little to no species diversity. Following completion of the scheme considerable new planted areas have been created containing both native and ornamental species, and a range of habitats from damp grassland in the summer to. Areas of wildflower meadow were also incorporated. Mallard ducks have even been seen in the basins following high flood event.

Fig 7: A completed rain garden with homeowner personalisation

9. Lessons learnt

A number of lessons were learned from the project both during construction and following review of performance from evidence reviewed on site:

Construction

- Asbestos was found within the soil once construction had begun on site, this led to considerable delays to the contract and additional costs as all material had to be removed from site. Ground Investigation reports prior to commencement would have been benefical.
- The rain gardens are functioning very efficiently, and even in extreme flood events, have not been seen to reach the overflow. Reducing the size of this feature (or potential complete omission) could be considered.

- Between phase 1 and phase 2 the planting pallette was reviewed and plants which had not established well were omitted in favour of the more robust species.

Maintenance

- Although a mowing strip (line of setts against the raised rain garden edge) was designed to facilitate easier grass cutting, weed killing of the grass at all edges is still undertaken as standard. Removal of the setts would have allowed a small cost saving or better commincation with the maintenance team prior to the weed killing.
- Despite radial kerbs being used at the inlets from the road, to encourage water to enter the basin, due to a lack of maintenance and no removal of leaf litter / silt deposits at the road edge some of the flows now miss the inlet. Locally lowering the level of the road at the inlet would have ensured no run-off by-passed the system. (although this idea was not favourably received by)

10. Interaction with local authority

Cheltenham Borough Council were heavily involved and engaged with the project in both providing part of the funding and providing support during the consultation and construction phases. Gloucestershire County Council Highways department were also consulted to agree permission for the blocking up the road gullies and help in designing and approval of the steel plates required for the pavement cross-overs.

11. Project details

Construction completed:

Phase one completed – November 2014

Phase two completed – August 2015

Cost:

Phase one £65K,

Phase two £86K

Extent:

Phase one - 1280m^2

Phase two - 950m^2

12. Project team

Funders	• Environment Agency • Cheltenham Borough Council
Clients	• Cheltenham Borough Council
Designers	• Illman Young Landscape Design
Engineers	• EPG Ltd
Contractors	• HFN Landscape – Phase one • JPR Environmental – Phase two