Galva Estate Suds Retrofit

SuDS used

- *Rain Gardens*
- Swales
- Overland flow paths
- Tree Planting

Benefits

- *Reduction in flooding from intense rainfall*
- *Reduced surface water pollution to receiving water bodies*
- *More aesthetically pleasing housing green space & public highway with increased biodiversity*
- *Promotion of community cohesion through community engagement during feasibility of design*

1. Location

Galva Close, Enfield, EN4 0AA

Cockfosters Road, Enfield, EN4 0AA

Mount Pleasant, Enfield, EN4 9EB

2. Description

Galva Estate SuDS Retrofit and the surrounding highway works is situated in Cockfosters, this area is in the north west of Enfield and part of the Salmons Brook Catchment.

Salmons Brook is a highly urbanised catchment with a large proportion of impermeable areas generating runoff and hence a rapid or 'flashy' response to rainfall. Due to the highly urbanised nature of the catchment, pollutants from vehicles build up on the roads and are washed into the surface water network.

The Majority of Enfield has separate foul and surface water drainage system; however most surface water sewers discharge directly into the nearest watercourse. The implications of the discharge mean local rivers suffer from poor water quality as a result of urban diffused pollution and increasing the risk of flooding to high. Cockfosters is known to suffer some localised surface water flooding, particularly in connecting roads. The increased expanse of hard surfaces, a lack of green spaces and inadequate capacity in the existing drainage system exacerbate the flood risk. This is an increasingly common occurrence on many roads in Enfield.

The project was made up of 3 Phases:

Phase 1: Retrofitting SuDS in an existing housing site was Phase 1. The main purpose was to work with our Senior Housing Horticultural officer who was planning on a shrub bed in this location, by working with him we adapted the design to take the down pipes form the surrounding sheltered housing flats into swales that lead to the shrub bed. We adapted the shrub bed to become an under-drained rain garden instead. There is also a domed gully inside the rain garden for exceedance events.

Fig 1: Custom made domed gully cover

Phase 2: Our Highways Maintenance team made us aware that gullies on Cockfosters road could not deal with heavy rainfall and ponding frequently occurs as a result. Working with our Senior Housing Horticultural officer, we identified an opportunity to take highway runoff into the Galva estate, extending and enhancing the Phase 1 measures. The officer was looking at regenerating an existing shrub area, we used this site to remove the shrub bed and turn it into a rain garden. Side offlet kerbs were installed to take the road runoff under the footway and into swales which connect into the new rain garden area.

Phase3: Mount Pleasant road suffered badly from ponding on the kerbside, this was due to the fact there are no gullies on this section of road. To solve this issue, we installed 2 roadside raingardens in

the large existing grass verges. We also removed a tree which was in decline and replaced this with 2 new trees in its place.

All 3 Phases help reduce the pressure on the existing drainage system.

Key Objectives:

1. Reduce surface water flood risk and increase source storage
2. Reduce the pressure on the existing drainage system
3. Improve the public realm
4. Increase bio-diversity

3. Main SuDS components used

1. Rain Gardens
2. Swales
3. Overland flow paths
4. Tree Planting

4. How it works

A total of 4 Rain gardens were built over the 3 phases of the scheme. 2 of which were inside housing land on existing green space and 2 on existing roadside grass verges.

Phase 1 of the scheme was to take the roof run off from the flats into swales from the downpipes and into a new central rain garden. The rainwater had to be taken over some cobbles and the footway using exposed aggregate concrete and tactile paving. This minimised the impact on the footway for the residents. The swales have been wildflower seeded to provide some colour and varity in the summer.

Fig 2: Phase 1: Overland flow via cobbles and footway

Phase 2 involved diverting road run off across a footway and into long naturally falling swales on housing land, under the footway and into a new rain garden. To do this we used 3 side offlet kerbs which have a 90mm hole built into them, we used a steel pipe to then take this under the footway as

the cover over the pipe was fairly minimal. From there the water runs along some shallow graded swales on the housing land untill the come to a pipe surrounded in gravel which then takes the water under the footway again and into the rain garden. The swales have been wildflower seeded to provide some amazing colour, be olfactorily and aesthetically pleasing as well as providing biodiversity and support flora and fauna.

Fig 3: Phase 2: Wildflowers in bloom in the swale and the rain garden

Phase 3 was to build 2 large rain gardens alongside a section of road which lacked any highway drainage. Again we used side offlet kerbs and some dropped kerbs with granite sett aprons. We used the side offlet kerbs as this enabled us to mainatain kerb heights as they are next to roadside parking and also help solved the issue of mulitple low spots on the existing carriageway. We had to remove one tree which was in decline but we replaced this with 3 new trees split between the northa nd south rain gardens.

All of the rain gardens have been under-drained with a perforated pipe which means during a larger storm the rain gardens can drain away excess water faster and help to reduce pondind/flooding.The rain gardens maximise infiltration of highway and roof runoff into the ground. Each individual rain garden has a different standard of protection with respect to its contributing area. All are designed to manage at least a 1 in 1 year, 6 hour storm event. These calculations were based on very conservative infiltration rates and did not include interception losses. A total of over 1400 m^2 of Highway and roof runoff has been intercepted by the 4 rain gardens and swales.

5. Specific project details

Phase 1 of this project takes the water form 7 downpipes into shallow swales and into a new rain garden. The swales are all different depths due to the changing ground levels which enabled us to generate a gradual 1:100 fall to allow infiltration in the swale before the water gets to the rain garden. The rain garden is made up of 450mm of type 3 gravel, 300mm of top soil (BS3882 rain garden topsoil 60% sand, 30% topsoil and 10% compost mix) There is then a 200mm freeboard in the middle of the rain garden.

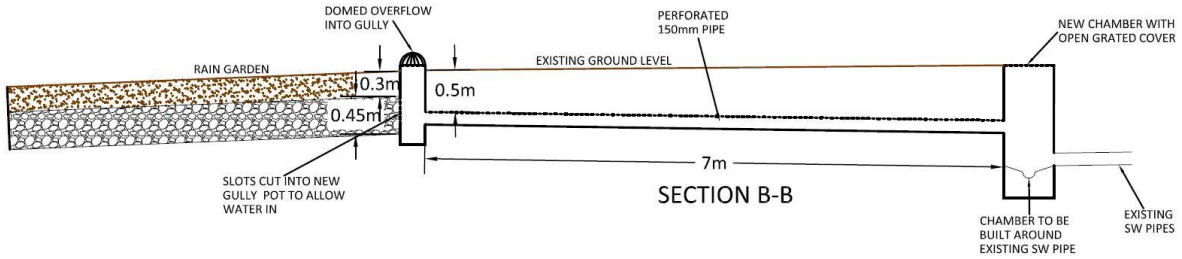

Fig 4: Section through Phase 1 rain garden and connection to existing drainage system

For phase 2 we tried a product we haven't used before for SuDS projects, which has many benefits for retrofitting, side offlet kerbs. These kerbs have a drainage slot built into them and allow for a 90mm solid pipe to connect into the back so they can be used with minimal cover under an existing footway. This meant we could keep the swales the other side of the footway, on housing land, shallow which was key. These swales are 150mm deep in the middle. The swales lead to another solid pipe which is used to get the rain water under another existing footway. This pipe sticks out past the path into the swale and has slots which allow the water to enter from the top and the end. The end has a mesh over it and then gravel used to bury the pipe. This will stop leaves etc from blocking up the pipe. The rain garden has been constructed in our standard format of an 800mm dig, 300mm type 3, 300mm top soil and 200mm freeboard. It is also under drained with a perforated pipe which connects back into the existing system.

Straights (A,B,C,D) are the most common type of kerb. Half battered is the most popular profile, because the face of the kerb is slightly battered back to allow traffic to run close to it, without damaging the kerb or the vehicle. Other kerb profiles are available (see table adjacent).

Droppers (E) are designed to take us from full kerb height down to the crossing level.

Centre Stones (F) are used at a drop crossing to indicate this is an appropriate place to cross.

Transitions (G) allow a smooth change from one kerb profile to another to suit the project design and overall alignment of the kerb run.

Side offlet (H) a very simple kerb for use with traditional behind kerb drainage systems. Marshalls now offer a range of innovative linear drainage products to support modern day loading and applications requirements.

Angles (I,J) are ideal for creating spaces where rigid or precise demarcation is required making them ideal for designing car parking spaces.

All Marshalls angles are at a 90°, which negate the need to cut down kerbs, allowing an easier, tidier and faster installation.

Fig 5: An example showing the different kerb types including 'H' side offlet kerb

Finally phase 3 consists of 2 roadside rain gardens constructed on existing grass verges. We have used a mixture of dropped kerbs with a granite set apron and side offlet kerbs to minimise ponding. The advantage of the offlet kerbs in these locations was due to the existing road surface having many low spots, and by installing every other kerb as an offlet kerb we minimised the risk of ponding on the carriageway. These rain gardens were built to our standard rain garden construction as stated in phase 2 above.

Fig 6: Phase 3: Mount Pleasant north and south rain gardens

Catchment areas:

- Phase 1 Galva – 500m^2
- Phase 2 Cockfosters Road – 315m^2
- Phase 3 Mount Pleasant – 600m^2

Rain Garden Areas:

- Phase 1 Galva –60m^2
- Phase 2 Cockfosters Road – 50m^2
- Phase 3 Mount Pleasant – 100m^2

Rain Garden Storage Areas:

- Phase 1 Galva –27m^3
- Phase 2 Cockfosters Road – 17m^3
- Phase 3 Mount Pleasant – 30m^3

Swale Areas:

- Phase 1 Galva –80m^2
- Phase 2 Cockfosters Road – 100m^2
- Phase 3 Mount Pleasant – N/A

6. Maintenance & operation

As the rain gardens and swales are within housing land and public highway, the adoption and maintenance is carried out by the Highway Services team in Enfield Council. A general cost analysis has shown that the additional cost of maintaining the SuDS is not significant when the cost savings

achieved by reducing the maintenance required for grass cutting areas, gullies and underground drainage are accounted for.

The maintenance programme is as follows:

- Litter Picking – conducted on a weekly basis;
- Vegetation management – cutting and pruning plants, and weeding carried out once or twice a year as part of routine Highway grounds maintenance contract. The visits include cleaning inlets into the rain gardens. Additional contributions were made to ensure the establishment of plants for the first few years, which included replacement of plants, additional mulching and additional watering during the summer months. The plants themselves have been reviewed by the Highways grounds maintenance officers and landscape architects to denote which species are thriving, as a means to inform future rain garden planting;
- Silt removal – carried out infrequently as part of long-term maintenance.

7. Monitoring and evaluation

The monitoring regime is as follows:

- Enfield's Highway Engineers conduct site visits during and after rainfall events to monitor the function of the rain gardens, along with other flood risk assets. So far, the rain gardens have been functioning well during storm events;
- New Rain Garden signs are installed within the 4 Rain gardens which give a basic explanation of what a rain garden is and a way to contact us for further information and to report any issues.
- A series of surveys to monitor the change in attitude/public perception about the Highway SuDS has yet to be conducted, however there has been positive feedback from local residents on the look of the street;

8. Benefits and achievements

Key benefits:

- Reduction in flooding caused by intense rainfall
- Increased resilience of infrastructure to flooding
- More aesthetically pleasing public highway with increased biodiversity
- Inspiring more SuDS development across the borough – more SuDS are being incorporated in the Council's Housing regeneration and Highway Schemes, and the Galva estate SuDS Retrofit Scheme's approach to SuDS will inspire a similar approach for other developments
- Reduced surface water pollution to receiving water bodies
- Positive public perception of green infrastructure and SuDS development and retrofitting
- Galva estate consists of sheltered social housing, the improvements made here have numerous benefits for the water quality, ecology and local residents. The site is now far more aesthetically pleasing, the improvements and implementation of blue green infrastructure are well known to have excellent benefits for mental health and

wellbeing. The flowers provide pleasant scents and support an array of invertebrates, particularly pollinating insects, bees, butterflies, dragonflies and hoverflies, which support the wider area and lead to the area being more biodiverse.

9. Lessons learnt

The plants utilised for the rain gardens are drought resilient and the topsoil used was engineered to be highly permeable. Though the frequency of failure is generally low and despite drought tolerance, the younger plants require frequent watering in order to fully establish. Therefore, a more intensive maintenance regime was agreed within Highway Services for these rain gardens for the first two years, and the standard landscape maintenance regime would be in place thereafter.

Fig 7: Phase 1: Example of the thriving plants inside the rain garden

Creating overland flow paths over existing block paving footways meant that we did get some low points which ponded when it was initially installed. After going back and relaying some portions of the existing block paving this has now been solved but has made us aware that when working on existing paving we may sometimes need to alter a larger area to make sure no pre existing low points begin to pond as we encourage more water to cross the footway.

Using side offlet kerbs work well for roads which have undualting surface levels as it means we can encourage water to enter rain gardens at multiple points without losing the security of a full height kerb. Kerbs were needed on Mount plesant as its next to parking bays and stops vechiles damaging the rain gardens. The Bays are used by lager vechiles for deliveries ofr the local shops and some became loose due to being hit by this veichles. This has meant we need to have more substantial hornching behind the kerbs on roads near shops or used by HGV's when using side offlet kerbs.

10. Interaction with local authority

The scheme came about by working alongside different teams within Enfield Council. The Housing team who we work closely with came to us about whether we could investigate improving their shrub planting scheme by including SuDS as the block of flats had external down pipes. We worked

alongside Housings Senior Horticultural officer to change the design of the shrub bed and use swales to get the downpipes linked to it.

The routine reactive team had complaints about highway flooding on Cockfosters Road and Mount Pleasant. The Watercourses team work closely with the Routine and Reactive maintenance team (R&R) to try to solve highway drainage issues with SuDS rather than hard engineering. Rather than install gullies down Mount Pleasant we used the verges to create Rain Gardens. Cockfosters Road had some gullies but they did not have the capacity and a few low spots caused ponding along the road, the solution was to use side offlet kerbs and steel pipes to take the rainwater under the footway and into housing land, it then travels along swales which take the water to a new Rain garden located where the housing officer was looking to modify an existing shrub bed.

11. Project details

Construction completed:

Galva Back: Completed November 2019

Galva Front/Cockfosters: Completed January 2020

Mount Pleasant: Completed February 2020

Cost:

Phase 1 costs: Galva Back;

- Costs: Construction: £9,100
- Top soil and Planting: £4,700

Phase 2 costs: Galva Front/Cockfosters;

- Costs: Construction: £12,700
- Top soil and Planting: £3,500

Phase 3 costs: Mount Pleasant;

- Costs: Construction: £28,500
- Top soil and Planting: £8,550

Extent: 390m^2 *of SuDS, plus an additional 80*m^2 *of wildflower turf to replace what was left of the existing grass verge.*

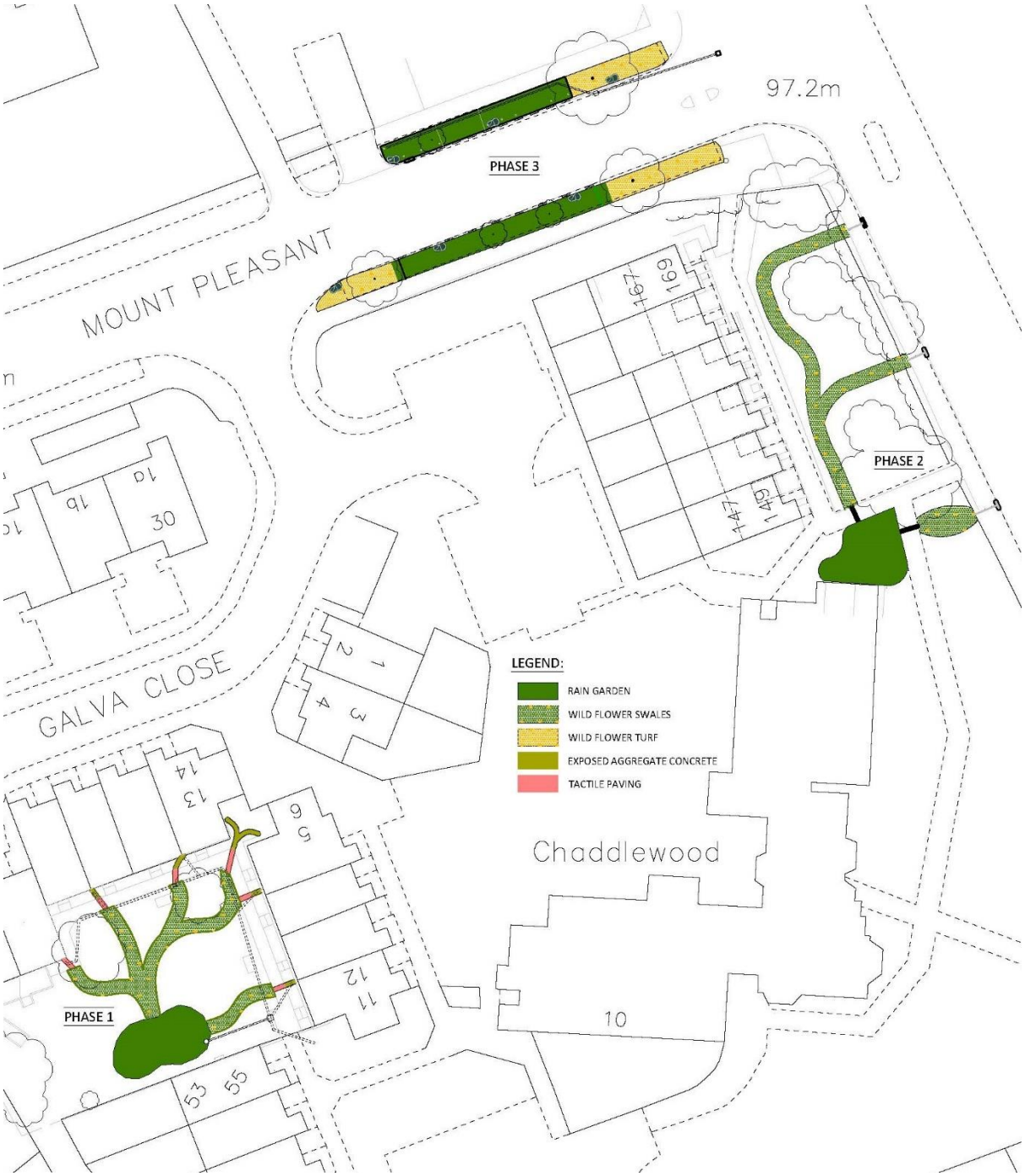

Fig 8: Plan showing the 3 phases

12. Project team

Funders	• London Borough of Enfield	
Clients	• London Borough of Enfield	
Designers	• London Borough of Enfield	
Contractors	• AH Nicholls & Sons	
Other	• Glendale Services	

Additional Photos

Phase 1 swales and rain garden

Phase 2 swales showing wildflower mix blossoming

Phase 3 roadside rain gardens and wildflower turf