GREY to GREEN projects in Sheffield

Roger Nowell – Natural Flood and Water Management Coordinator

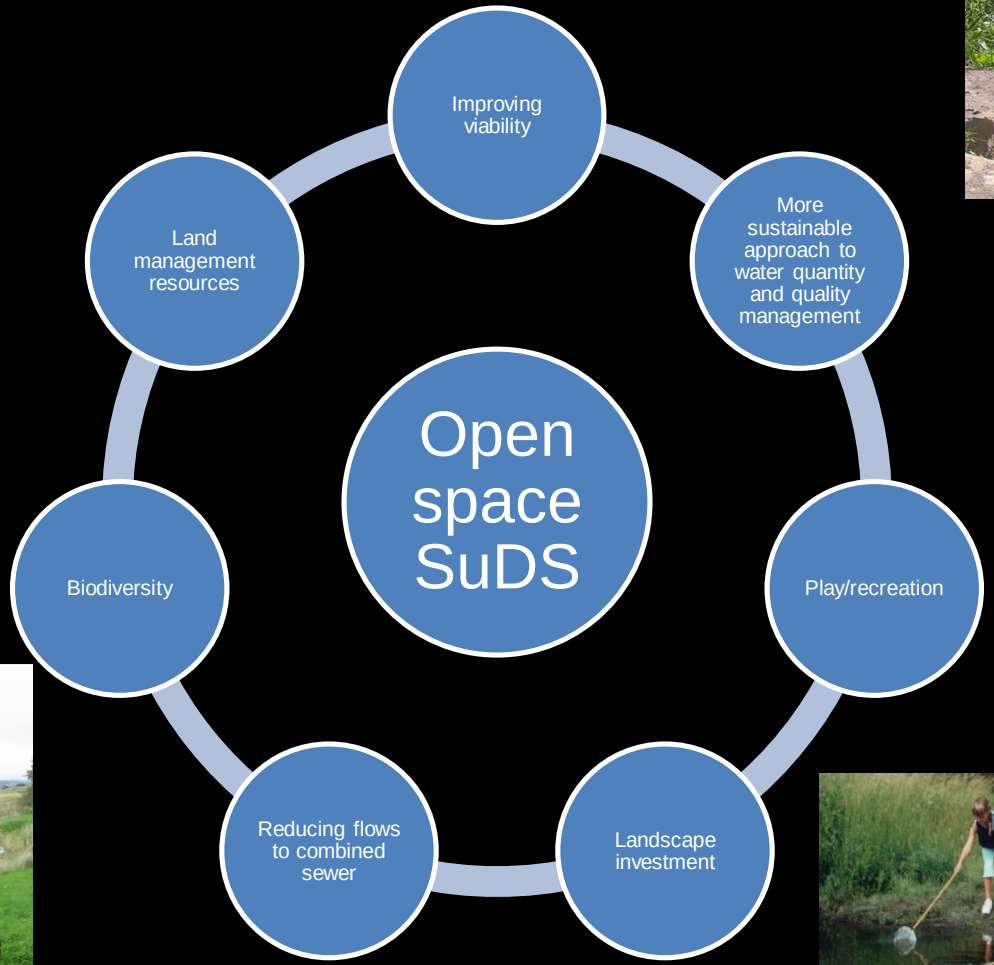
Sheffield City Council

Manor Fields 2007 Floods

2019 Floods

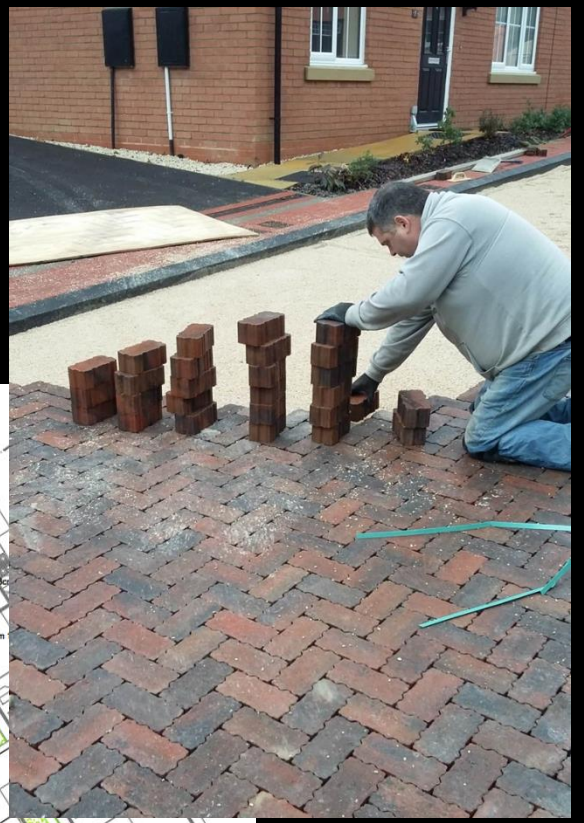
Still functioning effectively whilst providing biodiverse attractive landscape

Establishing a SuDS culture



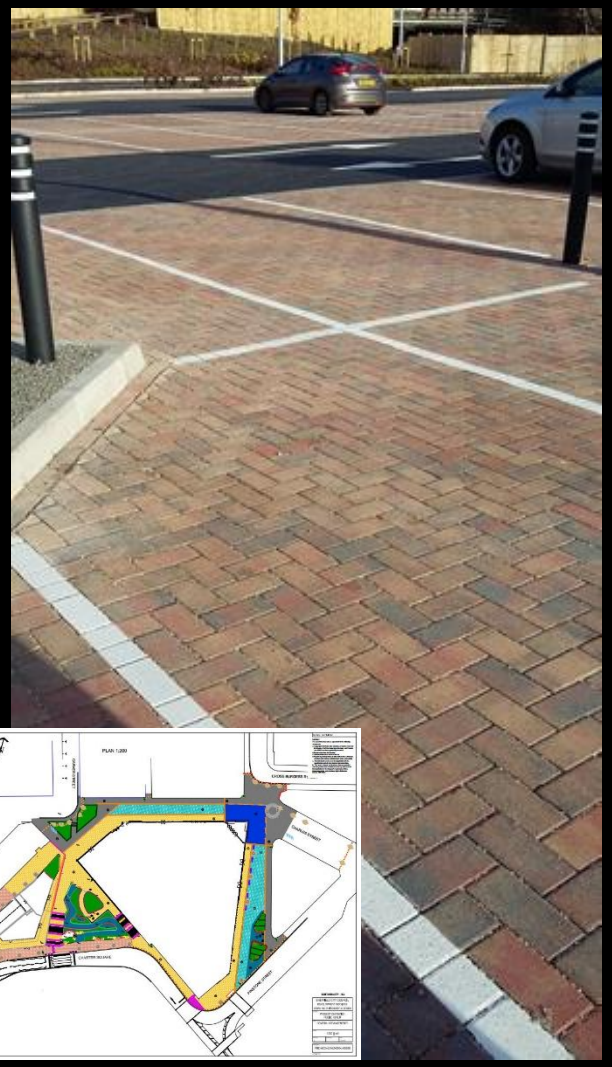
Pipworth Regional SuDS

Bringing highways into SuDS conversations



Challenge of new development

- We want new development in our city
- Developers expectations of developable site
- Every site is different in terms of constraints
- Negotiating a compromise landscape
- Schedule 3
- Interplay between retrofit and new build



The emergence of Grey to Green

- Opportunities to reconfigure the city
- Chance to push innovation
- Learn from experience
- Establish ways of working
- No regrets, recognising accumulative benefits

Healthy and thriving attractive cities

- Setting for investment
- Low carbon active transport
- New public realm
- Cultural opportunities

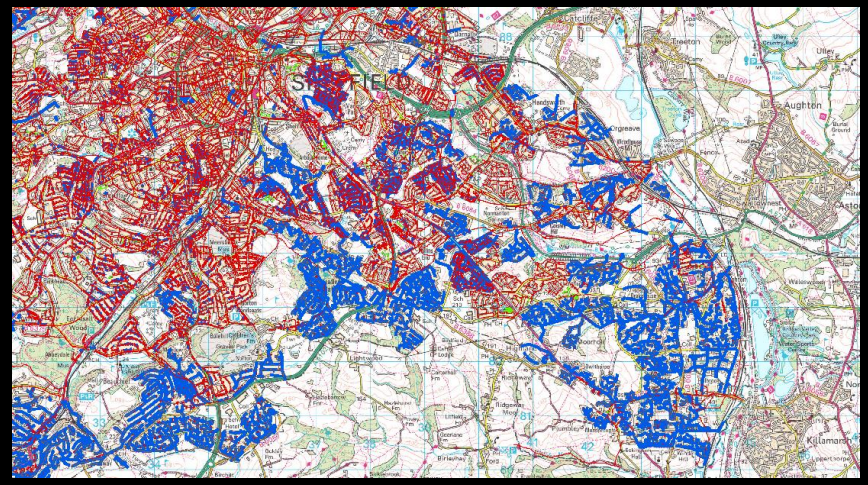
Demonstrating resilience to climate change – rainfall

- Systems that can manage increasing intensity of storms - pick up, contain, move

- Protecting receiving systems by losing and slowing:

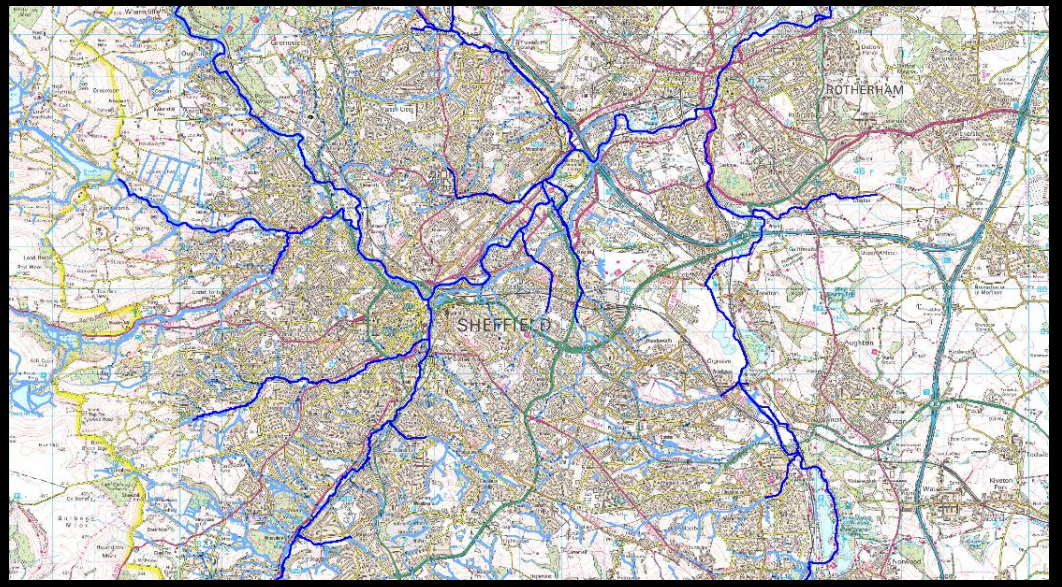
✓ Sewer (flooding, capacity to receive drainage, CSO)

✓ Watercourse - local or catchment wide impacts



Other drivers

- Urban heat – shade, retained moisture thriving vegetation
- Biodiversity loss
- Air quality
- Water quality – run-off
- Carbon



CONCEPT MASTERPLAN

Grey to Green 1 and 2

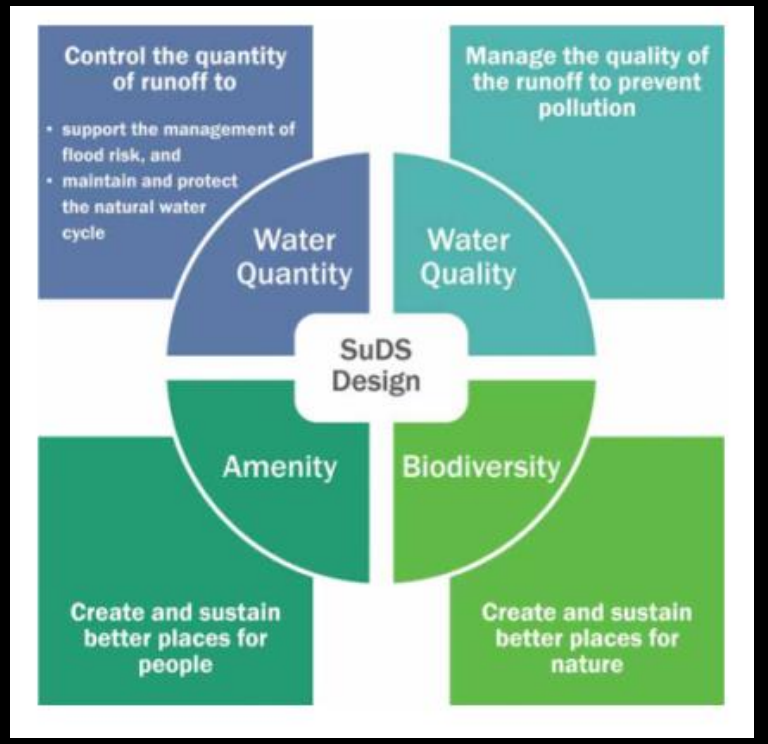
PRINCIPAL CONCEPTS

Create a safe and attractive setting that draws people and investments within a green and sustainable framework

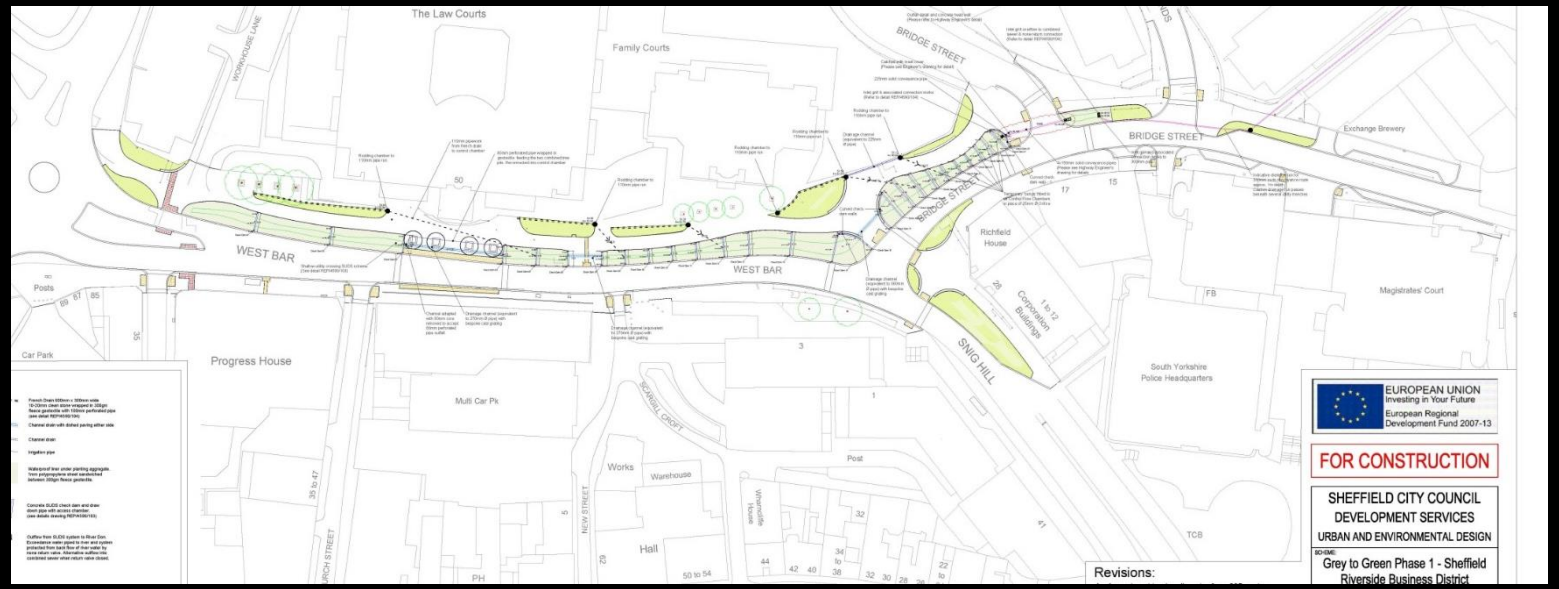
- Creating a setting for **investment**
- **SUDS** climate resilience managing rainwater discharge to the river, remove imp area
- **Sustainable transport** and connectivity to the wider city
- Innovative **Meadow** planting and developing the green linear route theme (Environmental benefits)
- **Reclaiming the highways**, activating urban spaces that better reflect the surrounding areas opportunities
- **The City Garden** building on Sheffield's city centre horticultural excellence.

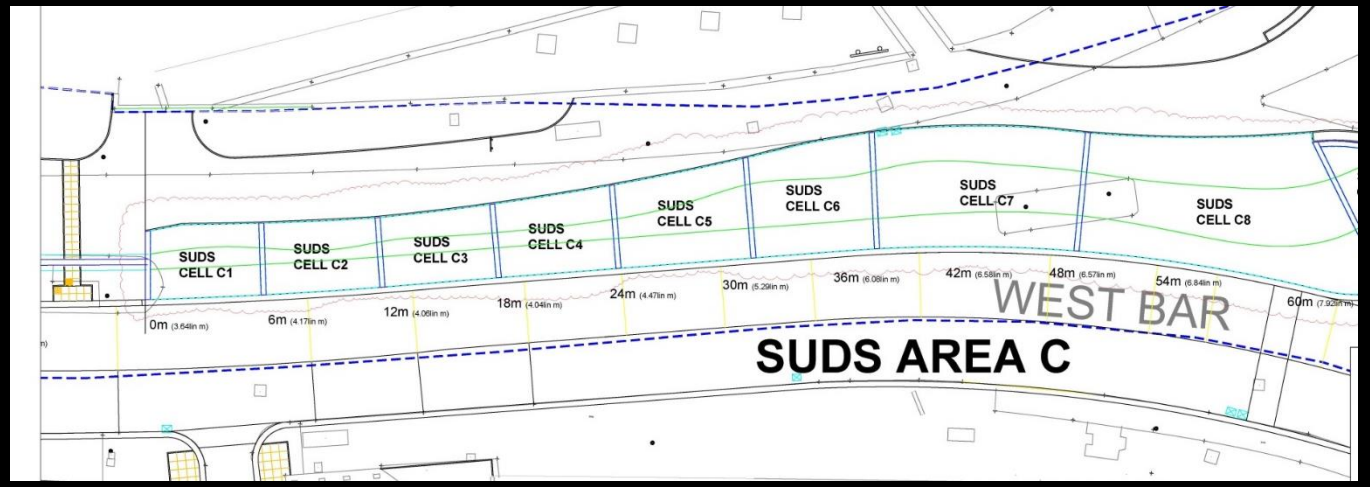
SuDS design

- Mimicking nature – keeping water on or near surface;
- Surface capture avoiding pushing water underground via gulleys
- Capture and treatment of pollutants in highly aerated environment
- Interception losses achieved for small events preventing discharge to watercourse
- Controlling flow using shallow landscapes before discharge to river- frequency, rate and volume



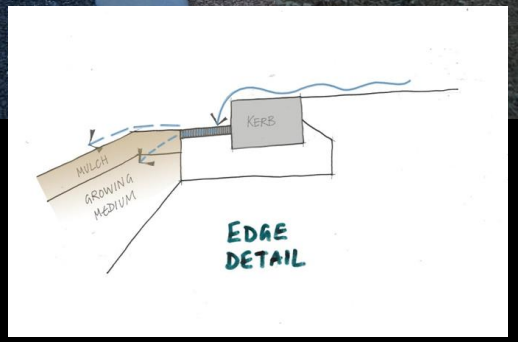
Art of the possible





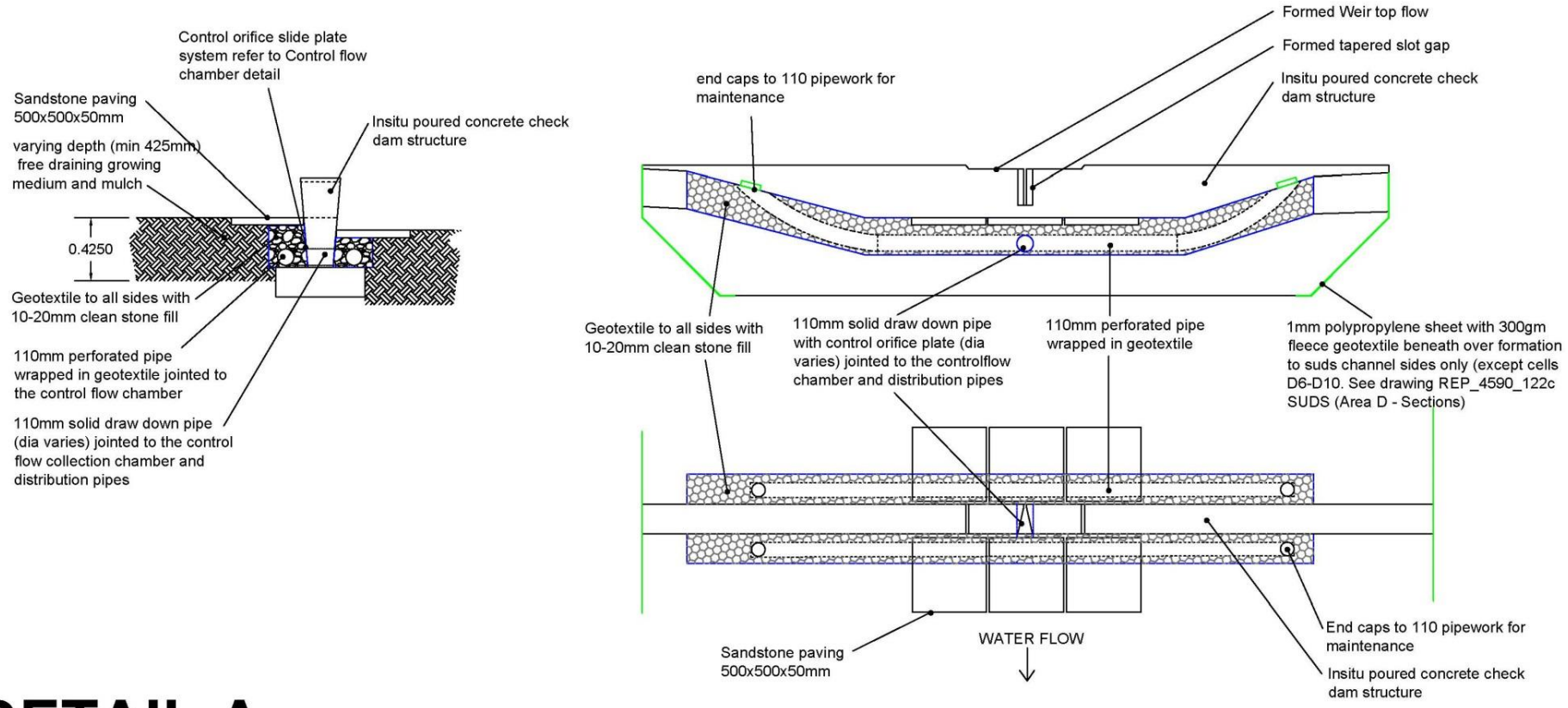
Controlling quantities

- Capture is through over-edge sheet flow or regular surface kerb inlets
- Control through dozens of almost level swale cells
- Modelling of inflow and transfer down the system informed resultant controls.
- Where beneficial protected orifice controls allow accumulation of flows above a particular return period followed by drawdown 2-4 hours
- As flows increase can overtop check dams –
- Infiltration rates not accurately known for whole site



WATER CONTROL

Draw Down system at check dams (Scale 1:20)

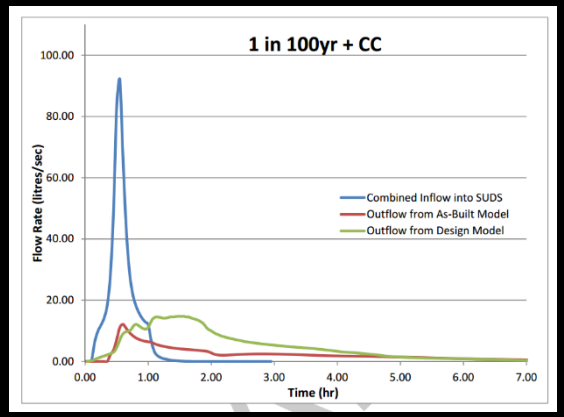


DETAIL A

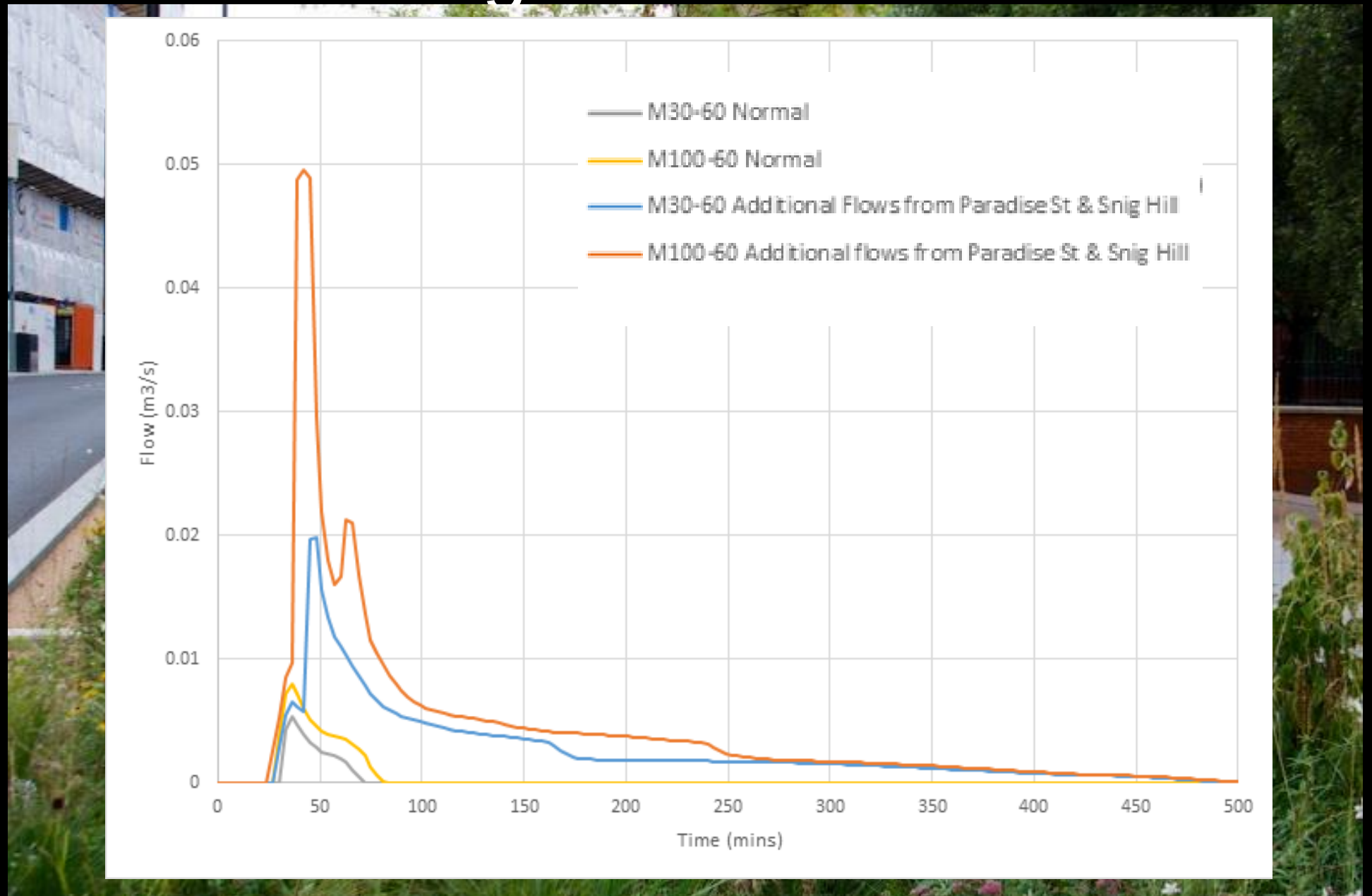
Design model to as built comparison (G2G1)

- Allowance for infiltration 1x 10-5m/s in as built

Rainfall Return period	Design model outflow volume (m^3)	As built model outflow volume (m^3)	Percentage reduction in predicted volume (%)
1 in 30 year	67.7	25.0	63
1 in 100 year	97.1	42.6	56
1 in 100 year + CC	126.3	62.8	50

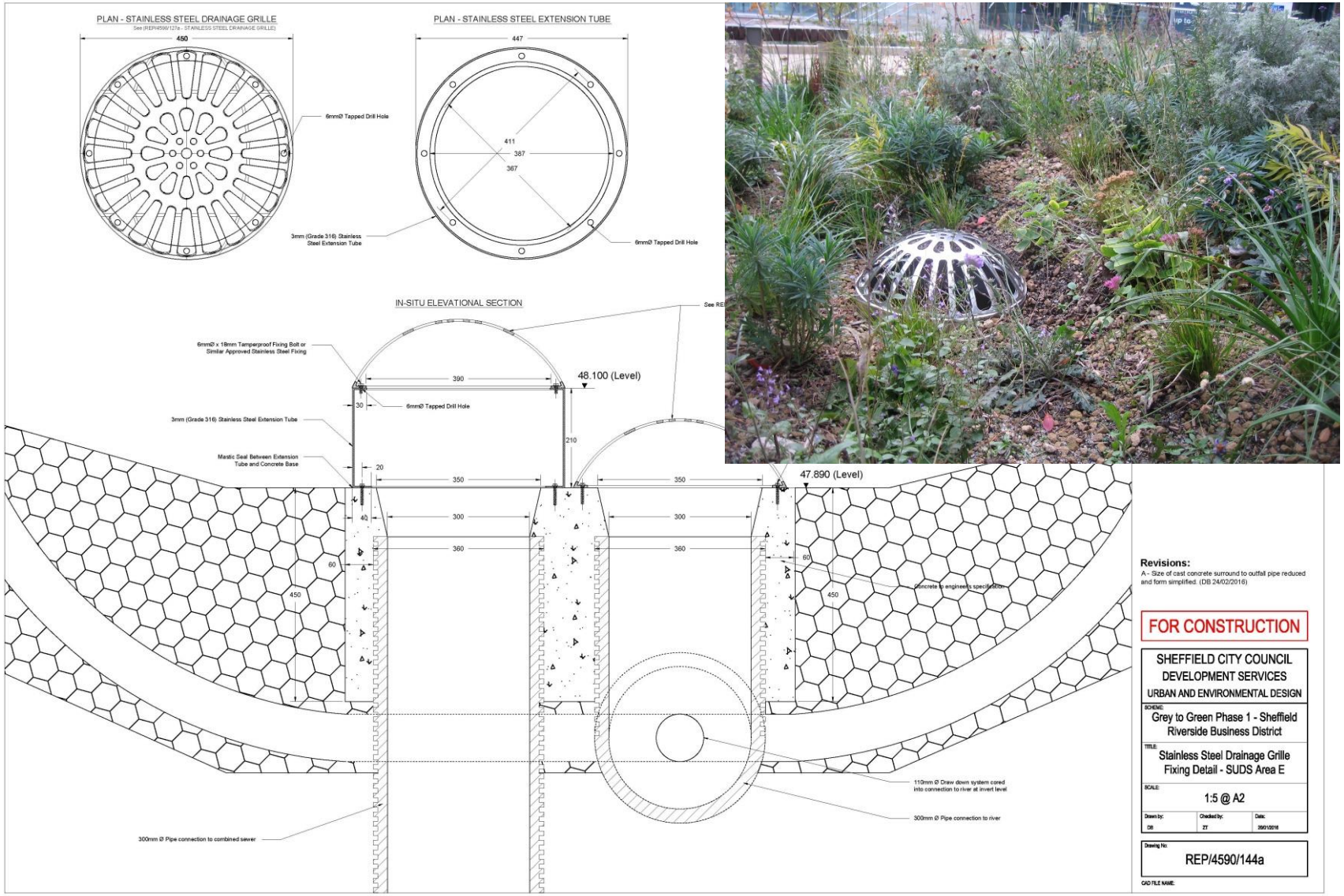


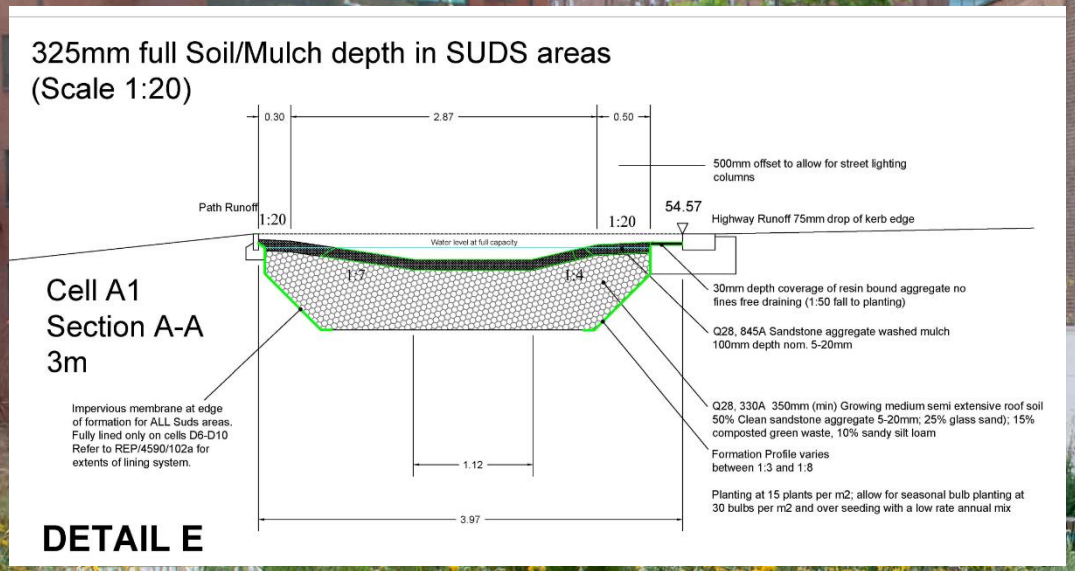
Inheriting overland flows



Challenging the norm

Details adding value / legibility





Planting &‘Meadow like’ habitats

Image:N.Dunnett


2014 Snig Hill


2016 Snig Hill

Benefits

City Cooling – a healthy urban climate
Flood mitigation, and future proofing
Carbon Capture and long term storage
Drought tolerant public planting with low maintenance
Increased urban biodiversity

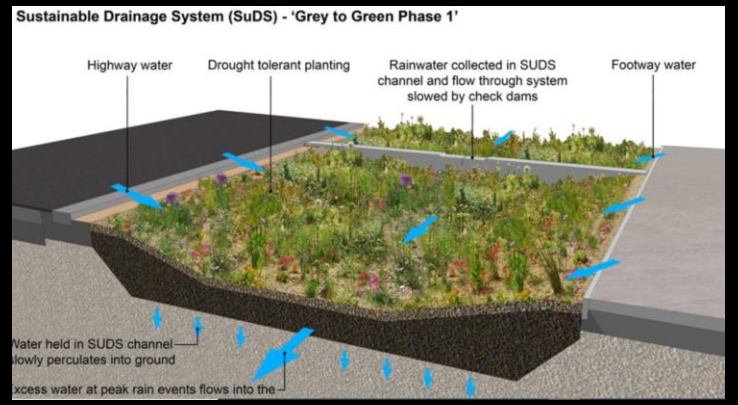
Behaviour change

Preferred routes

Cultural setting

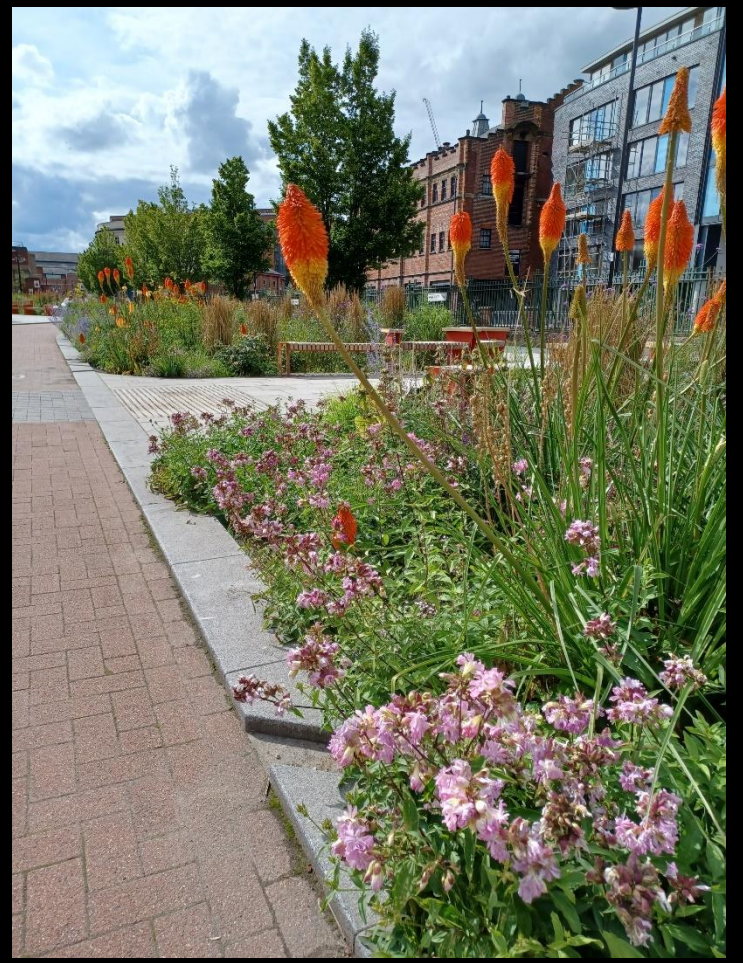
Pollen Market

Public art and interpretation



Management

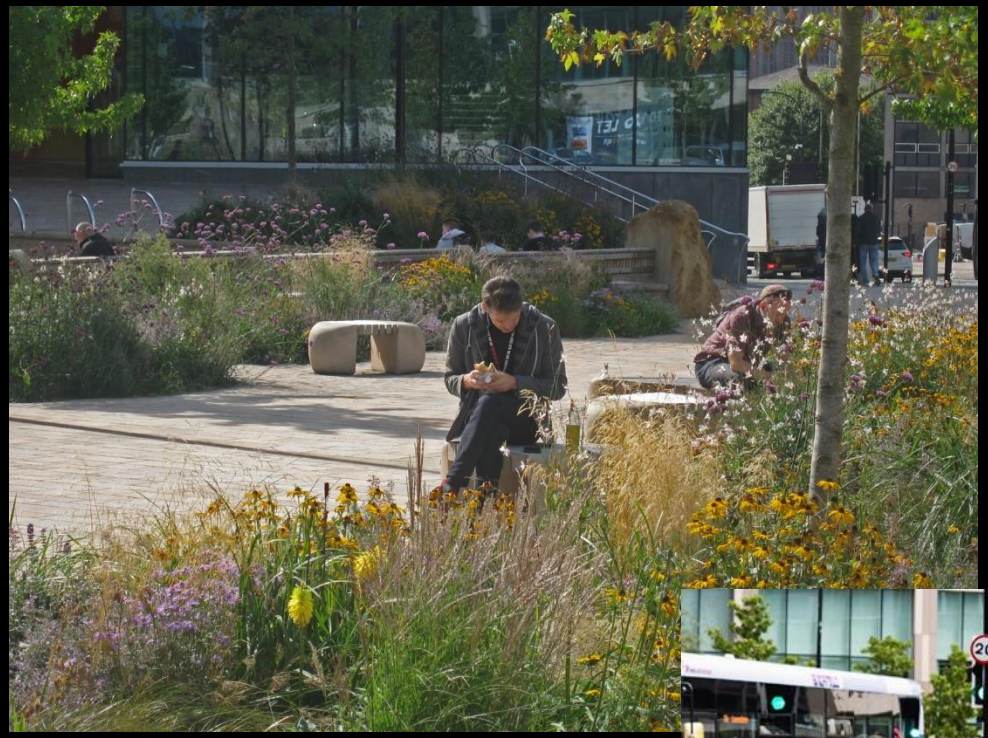
- Robust design reduces risks of management need
- Water falls off highway
- Design for eventualities – blockage /exceedance
- inflow spread as much as possible to reduce erosion and sediment build up
- Main issue is vegetation management – simple maintenance allowing annual deep litter
- Vegetation dynamics – allow for some future intervention

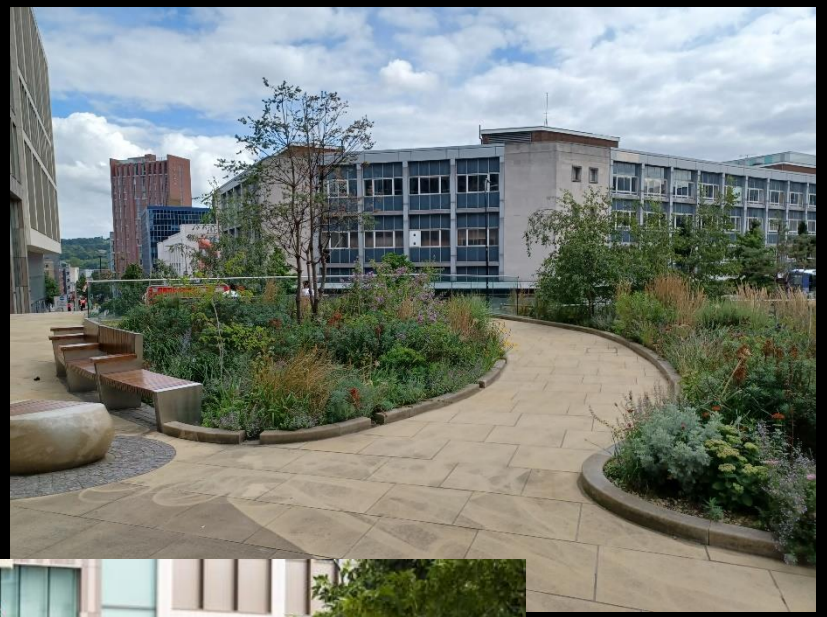


Management

- Some schemes are an overall reduction in management resource need for the area
- G2G1 initial 3 years of experimental maintenance to refine the optimal regime to take forward in the future
- Provided an opportunity for Amey and Sheffield Council to resolve management issues for a bespoke SuDS
- Amey and City Centre management ongoing learning

Building confidence - Cavendish



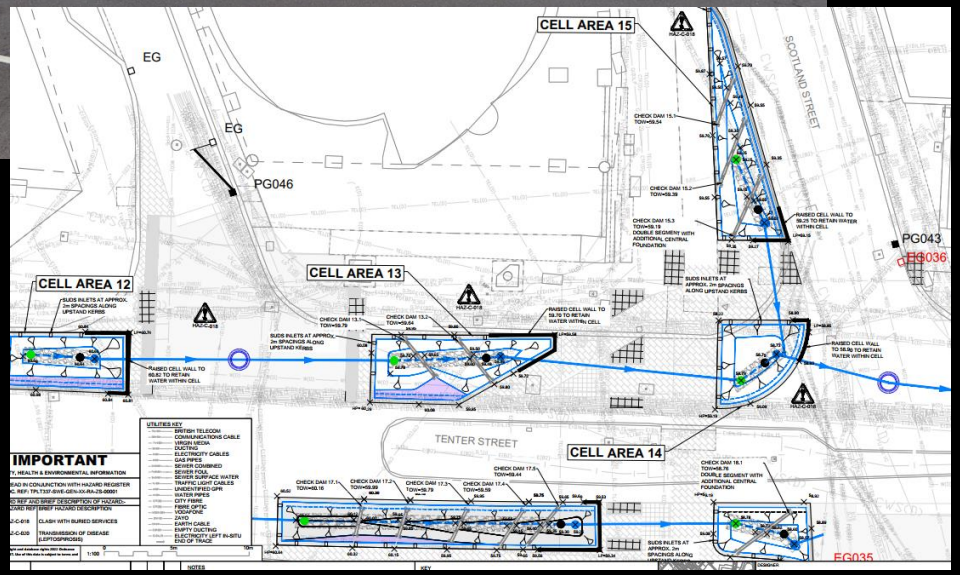


Extending G2G Angel Street

Pounds Park

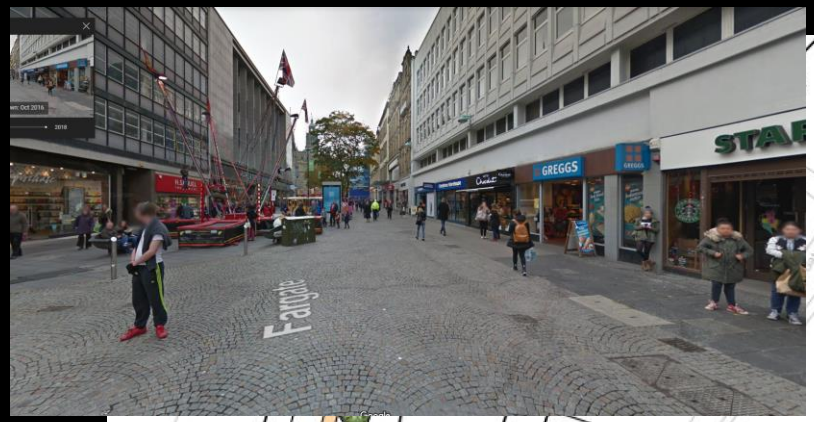
Carver Street

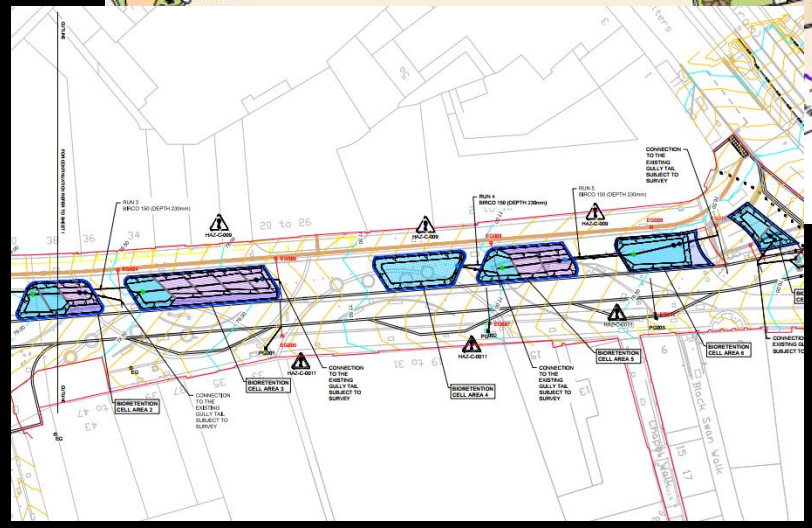
Mainstreaming -Transforming Cities Fund



Housing Zone North - 20 SuDS cells under construction

Future High Street Fund





Fargate 10 SuDs cells with play works commenced

Retrofit challenges in urban areas

- Iterations through increasing levels of stats knowledge

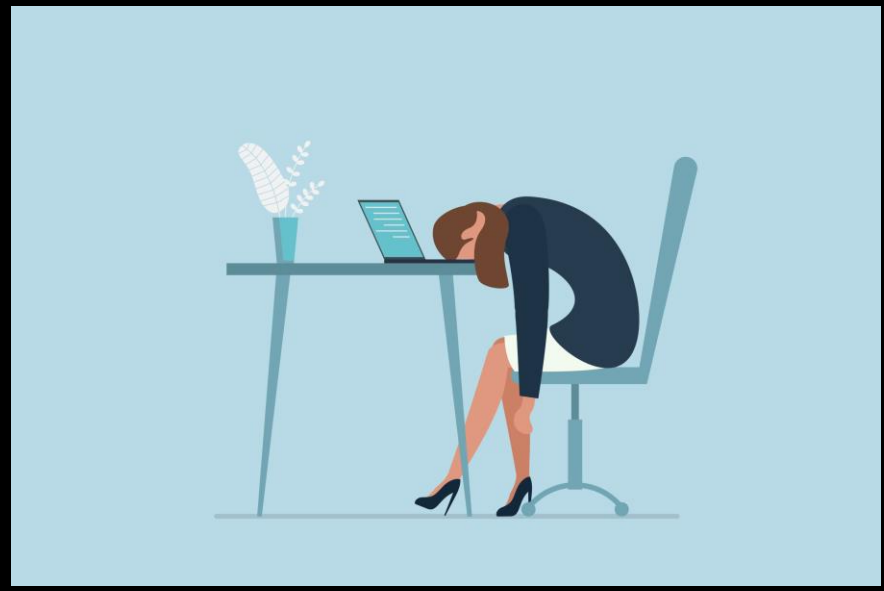
Challenging those around you

- Contamination doubts – often default to line
- Not in favour of sealing – planting viability
- Geo-environmental assessment suggested very low risk of mobilisation
- Risk to the sewer from groundwater
- However risk associated with unpredictable infiltration

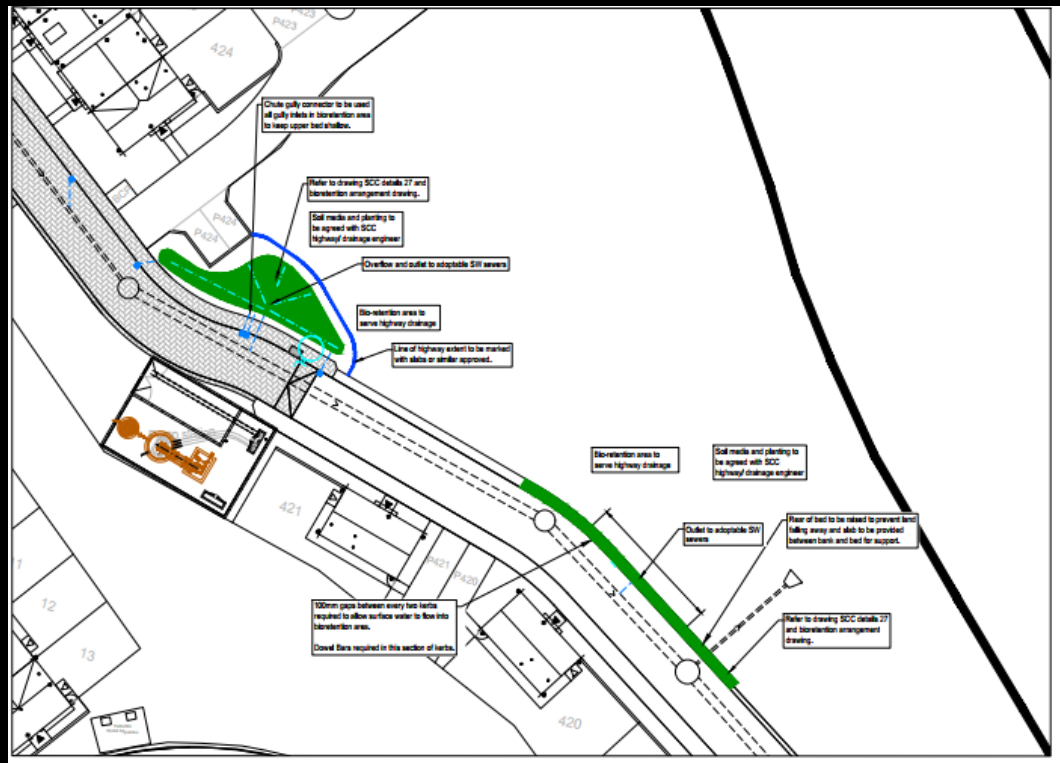
Challenge of design iterations

- Do green and blue fit with the contributing topography?
- Robustness of SuDS planting in- bed width, people movement
- Multiple design factors impact on SuDS
- Maintaining the argument in the face of funding challenges and other agendas seen as a priority
- Easy to drop easy to pave!

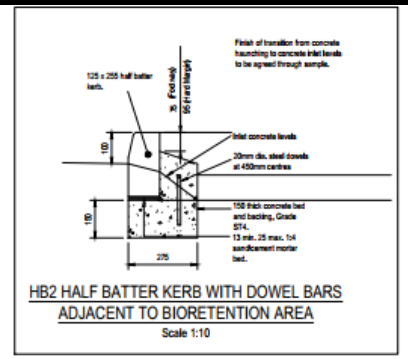
- Art of the possible -knowledge of water benefits at the end.



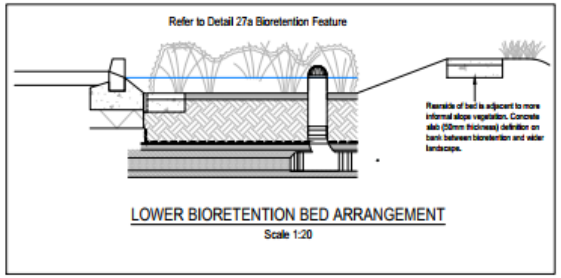
Taking retrofit learning into new build



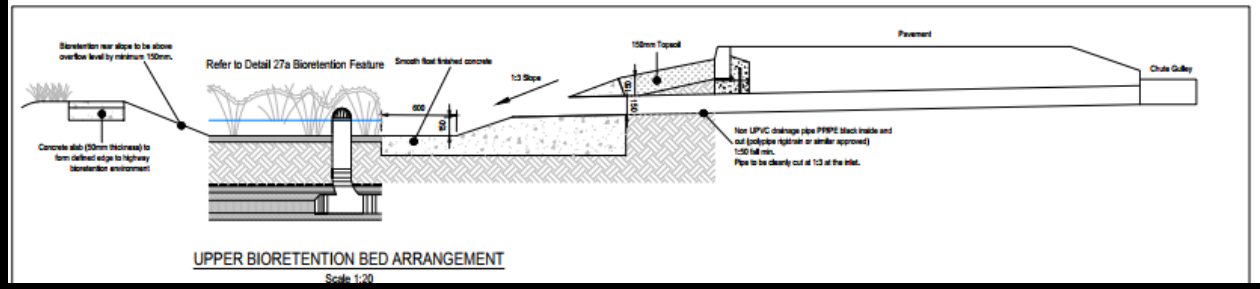
BIORETENTION AREA GENERAL ARRANGEMENT
Scale 1:250



HB2 HALF BATTER KERB WITH DOWEL BARS ADJACENT TO BIORETENTION AREA
Scale 1:10



LOWER BIORETENTION BED ARRANGEMENT
Scale 1:20



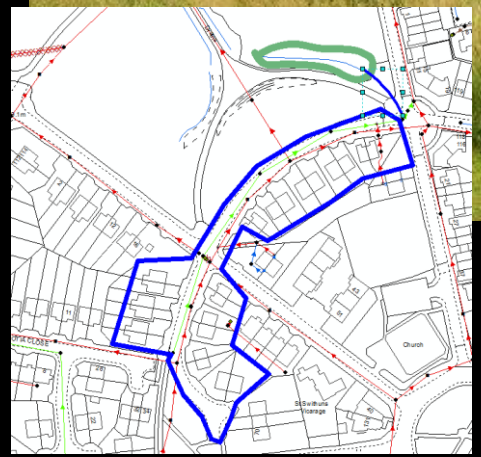
UPPER BIORETENTION BED ARRANGEMENT
Scale 1:20

The future for retrofit in Sheffield

- Perhaps the more easily delivered well funded no regrets schemes are completed or in progress?
- Need to explore with partners investment synergies –coinvestment where possible
- Moving from no regrets to predominantly water driven
- Focus on the wider city. Low hanging fruit providing multiple benefits can help direct investment programmes.
- there will be limits to SuDS as a solution but partners need to give time to explore.

Retrofit opportunities

- Diverting surface water flows to SuDS features from existing development
- Disconnecting/attenuating wider highway networks, institutional buildings with at source and/or regional SuDS



Questions

Thank You

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