

Mansfield Sustainable Flood Resilience

Severn Trent's investment in climate resilient infrastructure to divert stormwater from sewers and ease pressure on traditional drainage systems

by Nazen Smith, Angus Smith & Adam Boucher

Mansfield Sustainable Flood Resilience (MSFR) is the largest Sustainable Drainage Systems (SuDS) retrofit programme in the UK, with Severn Trent investing £76m in Mansfield, Nottinghamshire, on nature-based solutions to help protect 90,000 people in the community from flooding. The project provides storage for approximately 30 million litres of surface water and creates a blueprint for how to manage future surface water flood risk and reduce the impact of urban creep and climate change; making Mansfield a greener and fresher place to live. A key objective of this project was to trial a range of different SuDS in order to understand the costs, benefits and deliverability of each, and inform future strategy across the UK.



Goodwood detention basin - Courtesy of CPC Civils

Why was Mansfield chosen for this pilot scheme?

The Mansfield sewerage catchment serves 90,000 people and had the third highest number of CSO spills out of 23 catchments as per DWMP data. British Geological Survey (BGS) data showed that the permeability qualities of Mansfield's geology is well suited for SuDS, there is a good availability of green space, and the River Maun has Moderate Ecological status.

Project overview

The Programme has been delivered in phases from 2021-2025. Partner framework consultants, AECOM and Arup, were first engaged in October 2021 to help deliver the pilot phases of the project, produce initial template designs for the seven types of Sustainable Drainage Systems (SuDS) to be trialled across the town of Mansfield and develop a Site Selection Tool to expedite initial site identification using existing GIS data sets.

The seven types of SuDS identified and deployed in Mansfield are as follows:

1. **Permeable pavement:** Interlocking block paving with wider gaps between allowing infiltration through the surface and into the storage layers below.
2. **Bio-retention tree pits:** Sub-surface storage provision located around a central tree.
3. **Rainwater downpipe planter:** Above-ground planters accepting flow from a downpipe and providing temporary attenuation of flows.
4. **Verge rain garden:** Landscaped area located adjacent to carriageways, containing planting, filtration medium and storage layers.
5. **Street rain garden:** Landscaped area located within the carriageway, containing planting, filtration medium and storage layers.
6. **Bioswale:** Shallow landscaped areas, typically linear, comprising of above-ground storage, wildflower banks and planted channel, filtration medium and storage layers.
7. **Detention basin:** Large landscaped depressions with above ground storage, seeded with suitable meadow grass.

The interventions have been selected to:

- Provide an alternative to storm storage.
- Provide 'urban greening' and reverse creep.
- Infiltrate whenever possible, completely removing surface water flows from the combined sewer network.
- Fully drain down within 48-hours for detention basins and bioswales, and 96-hours for verge and street rain gardens, permeable pavements, tree pits and rainwater downpipe planters; ensuring availability of storage for repeat storm events and for public safety consideration.

Before intervention designs could be produced, the following steps were undertaken:

- Template designs and specifications for scale roll out of SuDS were created for each intervention type.
- A SuDS Volume Calculation tool was created to calculate the volumetric benefit of each SuDS without detailed hydraulic modelling (except for detention basins, where hydraulic modelling is required due to their size).
- A public communication/consultation strategy was created.
- A SuDS CoP (Community of Practise) was set up.

Mansfield District was then split in two areas (north-east and south-west), allocated to each consultant. Using the Site Selection Tool, thousands of potential locations for interventions were identified. The production of outline designs then started, feeding the SuDS 'production line' by hitting the various geographical areas in Mansfield sequentially (town centre, Ravensdale, Newlands, Ladybrook, Woodhouse, Old Mill Lane, Market Warsop, Forest Town, Chesterfield Road, Maun Valley etc).

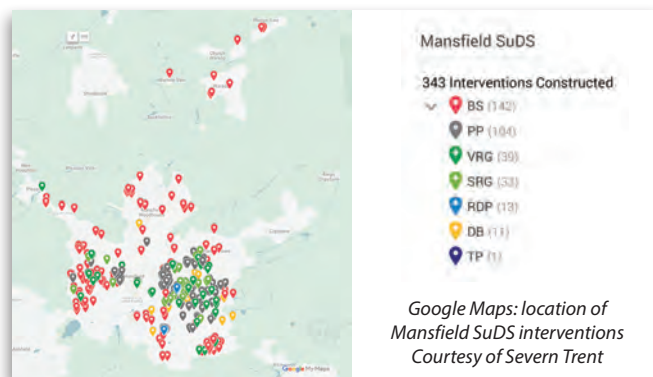
Batches of outline designs were then reviewed with regard to type of interventions, services in the area and customer feedback before proceeding to detailed design and construction. Each batch of constructed interventions fed back in the start of the process, similar to Kaizen concept, where continuous improvement was implemented for the next batches of interventions.

From receiving the first batch of outline designs in May 2022 and first five detailed designs accepted in January 2023, construction started immediately on this pilot batch. As more outline designs were produced, and with the project resource need increasing, further design and build and build-only contractors were on-boarded. The town was split into four different areas, with construction proceeding by Galliford Try, Kier, CPC Civils Ltd, Ground Control Ltd and Severn Trent, reaching a peak of 45 concurrent working sites towards the end of project.

A total of 343 interventions were delivered over the two-year construction phase in Mansfield District Council (MDC) public open space or housing land, Nottinghamshire County Council (NCC) adopted highway and Non-Household Customer sites, providing 31,156m³ of network equivalent storage and over 5.5 hectares of surface now covered by SuDS.

This investment includes several large detention basins in public parkland and a mixture of smaller SuDS interventions in residential areas. The completed mosaic of SuDS interventions offers inspiring blue green infrastructure, placemaking, climate resilience and community wellbeing.

A total of 213 of the interventions infiltrate fully or partially amounting to (20,500m³). The impact of the surface water removed from the network is being hydraulically modelled currently to determine the catchment wide benefits delivered. All detentions basins and a number of smaller bioswales and raingardens are also being monitored by Sheffield University to obtain data on their performance over time.



Mansfield SuDS Supply chain: key participants

Programme management: Turner & Townsend
Outline & detailed design: AECOM
Outline & detailed design: Arup
Detailed design: Galliford Try
Detailed design: Arcadis
Detailed design: KPS
Detailed design: WSP
Detailed design: Metis
Detailed design: AtkinsRéalis
Detailed design: Environmental Protection Group
Detailed design: KDS
Land & planning: Dalcour Maclaren
Land & planning: Fisher German
Research partners: University of Sheffield
Commercial management: Aqua

Surveys: Dene-Tech Services Limited
Design & build: Galliford Try
Design & build: Kier
Build: CPC Civils Ltd
Design & build: Ground Control Ltd
Construction: CR Civil Engineering - RSK Group
Construction: TEJ Civil Engineering
Construction: MAC Groundwork Contractors Ltd
Construction: Alliance Group Solutions Ltd
Construction: M2 Civils Ltd
Construction: K Rouse Civil Engineers Ltd
Groundworks & construction: TJ Brayne Ltd
Permeable block paving: Brett Landscaping
Flow control chambers: SEL Environmental
SuDS turf & growing medium: The Green Estate

To coordinate such an extensive project with multiple partners and wider supply chain at pace whilst operating in a safe manner has required exemplar and innovative Programme and Contract Management. Over 50 contracts have been executed on various NEC4 Options, trialling various intervention sizes and location to enable learning for future green installations to alleviate flood risk and spills across the network.

Collaborative partnership working & community engagement

The success of the project from Severn Trent is down to the unwavering support from partners MDC, NCC and their Highways partner, Via East Midlands. The close working relationship developed over the project duration has been fundamental to our collective success and delivering at such pace.

Engagement from each framework consultant and contractor has also been pivotal to deliver the right interventions across Mansfield, working closely with the client and stakeholders.

Given the proposed permanent change to the landscape and the period of temporary disruption, public engagement was crucial to foster community support. The team engaged extensively and carefully with the communities and businesses of Mansfield, supplementing face to face consultation with a virtual consultation room. The team also enjoyed offering STEM activities to 32 schools across Mansfield as a catalyst for community engagement.

MDC have provided over 1.8 hectares of public open spaces for intervention construction in 2024, turning green space into multi-functional areas and providing significant wider biodiversity and amenity benefits. NCC has approved over 150 intervention designs constructed in public adopted highway in 2024 and well as undertaking a three-stage road safety audit process for every intervention interacting with the adopted highway and creating a first of its kind Section 278 agreement under the Highway Act to create the formal agreement with Severn Trent for intervention construction.



Melbourne Court detention basin - Courtesy of CPC Civils

Innovation, long-term adaptive approaches & excellence

The pace and scale of this programme is unprecedented and demanded innovation and excellence at every stage to provide a long-term adaptive approach to climate resilience. The completed interventions were put to the test during named storms in 2024, providing significant hydraulic benefit, successfully alleviating surface water flooding hotspots and receiving positive feedback from residents.

A number of innovations were adopted including:

- **Partnership:** The partnership with Mansfield District Council and Nottinghamshire County Council kick-started the programme and resulted in £100k of partnership funding from MDC's Town Fund.
- **Bespoke tools:** Tools to avoid time-consuming hydraulic modelling were developed in early design phases and developed template designs with approval from project partners and RoSPA to ensure public safety.
- **Design:** Through collaboration with suppliers including SEL Environmental, flow control chambers with a 10mm diameter orifice were optimised; crucial to hydraulic performance.
- **Monitoring:** Water level monitors were installed to assess intervention performance. This data-driven evaluation will inform the design approach for future SuDS projects and offer longer term industry learning.
- **Modelling:** The catchment hydraulic model is being developed to include interventions and monitoring data, experimenting with innovative SuDS modelling methodologies.

Industry knowledge sharing

The knowledge gained and processes developed and delivered will underpin future SuDS projects in the UK, ensuring consistency from design, local government partnership, through to maintenance. The Mansfield Sustainable Flooding Resilience Scheme has significantly boosted green jobs and skills, utilising local design teams, contractors, subcontractors and suppliers.

A wealth of knowledge has been shared in industry press and presented at numerous events, with combined audiences of 1,500+ delegates. Knowledge will continue to be shared to inspire others to create climate resilient infrastructure and take the learning from Mansfield into future National SuDS standards through sharing with CIRIA Susdrain and CIWEM. In addition, we have committed to a long-term monitoring programme through sponsored PhD with Sheffield University and are capturing the wider benefits of SuDS through partnership with Nottingham University.

Benefits

The project is expected to achieve National Flood & Coastal Erosion Risk Management (FCERM) related economic benefits of approximately £34m, including approximately £2.4m of people related benefits. By providing additional storage capacity for surface water and also creating network robustness for the future 96 households previously at risk are better protected, 34 of which were at a 'very significant risk'. Additionally, a further 128 households assessed to be at risk by 2040 have been moved to a lower risk category; 31 of which were at a 'very significant risk'.

Finally, specific locations that have historically suffered during heavy rainfall events have been targeted for interventions to reduce the impact and frequency of surface water flooding on our customers, providing benefits for years to come.

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