

Killingworth and Longbenton, Surface Water Management Scheme, North Tyneside



Fig1 Surface water retention pond at Longbenton High School

SuDS used

- *Retention ponds*
- *Detention areas*
- *Two stage channels*
- *Wetland areas*

Benefits

- *Property flood risk reduction to over 3500 properties*
- *Increased biodiversity with the creation of 1 hectare of new wetland habitat*
- *Improved water quality*
- *Improved amenity to the area*
- *Reduced flow to wastewater treatment as a result of disconnection of a main river and lake overflow from sewerage system*
- *Improved recreational areas including a storage area that doubles an amphitheatre*
- *New educational opportunities including a storage area with a raised viewing platform*
- *Reduced transport disruption from flooding*

1. Location

Various sites in North Tyneside, England:

- Longbenton High School, NE12 8ER; 55°01'07.5"N 1°34'33.4"W
- Killingworth Moor, NE12 6BP; 55°01'54.9"N 1°33'18.2"W
- Killingworth Lake, NE12 6TN; 55°02'06.7"N 1°34'41.4"W

2. Description

Killingworth and Longbenton are areas of North Tyneside, England with a history of flooding and a need for changes to surface water management to improve water quality and enable growth. Together Northumbrian Water Group, North Tyneside Council, and the Environment Agency delivered this innovative multi-site partnership project using SuDS to manage surface water and to provide opportunities for biodiversity, new habitat creation and educational facilities. Over 3,500 properties in Killingworth and Longbenton have benefitted from increased flood protection from the sewer network, surface water and river improvements as a result of this scheme.

3. Main SuDS components used

In the catchment there was property flooding, highway flooding, fluvial flooding, a watercourse connecting into sewer system and taking up capacity, a lake spilling into sewer system and taking up capacity, and growth constrained by infrastructure. To resolve these issues, the scheme separated the watercourse and lake from the sewer system and provided attenuation throughout the catchment to slow flows and reduce flooding. The drainage strategy included surface water retention ponds, detention areas, two stage channels, wetland areas, surface water separation, and source controls to manage surface water in the catchment. The multi-site scheme was delivered in a phased approach through a three year construction programme.



Figs 2 and 3 Longbenton High School

Surface water storage is provided in a detention area on the school grounds adjacent to the Longbenton Letch. The photo on the left shows the detention area in nearly dry weather conditions. The photo on the right shows the surface water runoff filling the area via the weir. This was completed as part of Phase 1 work.



Figs 4 and 5 Killingworth Moor

SuDS attenuation is provided on the Forest Hall Letch with two stage channels. The photo on the left shows Forest Hall Letch in normal dry weather conditions flowing in the narrow channel. The photo on the right shows the attenuation working to manage surface water runoff by filling the wider storage channel, by the controlling flow downstream with the orifice, and by maintaining top water level with the weir. This work was completed as part of Phase 2 work.

4. How it works

A main river, the Longbenton Letch, flowed into the combined sewer taking up critical capacity within the drainage network and directed river flow to the wastewater treatment plant. This project disconnected the Longbenton Letch from the combined sewer and diverted it north into another main river, Forest Hall Letch. In order to make space for the incoming watercourse, attenuation areas were provided upstream on Forest Hall Letch to enable flows to be controlled prior to the confluence of the two watercourses. This attenuation has been provided in Killingworth Moor adjacent to Forest Hall Letch by constructing a two stage channel (See Figures 4 and 5) that fills when flows increase in a rainfall event. Across three attenuation areas, 5000m³ of surface water storage has been provided along Forest Hall Letch. Flow control devices regulate the pass forward flow and weirs are provided to maintain the top water level and protect nearby properties.

At Longbenton High School, a detention area has been provided near the confluence to slow flows in the watercourse. This detention area is filled via a weir from the watercourse and provides 6000 m³ of storage. There is also a 1000 m³ surface water retention pond built to attenuate flows from the new school. Source control measures such as planters, wet scrapes and tree planting were included at the school, village green, and cemetery. This work was completed as Phase 1 of the project.

Upstream in the same drainage area, Killingworth Lake is a large seven hectare lake holding the majority of the surface water generated by the town of Killingworth and provides a recreational open space in a mainly urban area. The Lake overflows into the combined sewer, taking up critical capacity and putting properties at risk of flooding. As part of this scheme, the level of the lake will be lowered by 100mm, which inexpensively provides 7000 m³ of surface water storage within this existing asset. In addition, detention areas with 3000 m³ of storage are being created along the southern perimeter to enable safe spilling of the Lake during large storm events before the overflows are directed into an existing watercourse, the West Moor Tributary. This open green space will be flooded intentionally rather than allowing properties or transport links to flood. This work will be completed in 2018 as Phase 3 of the project. A plan of this multi-site SuDS project is shown below.

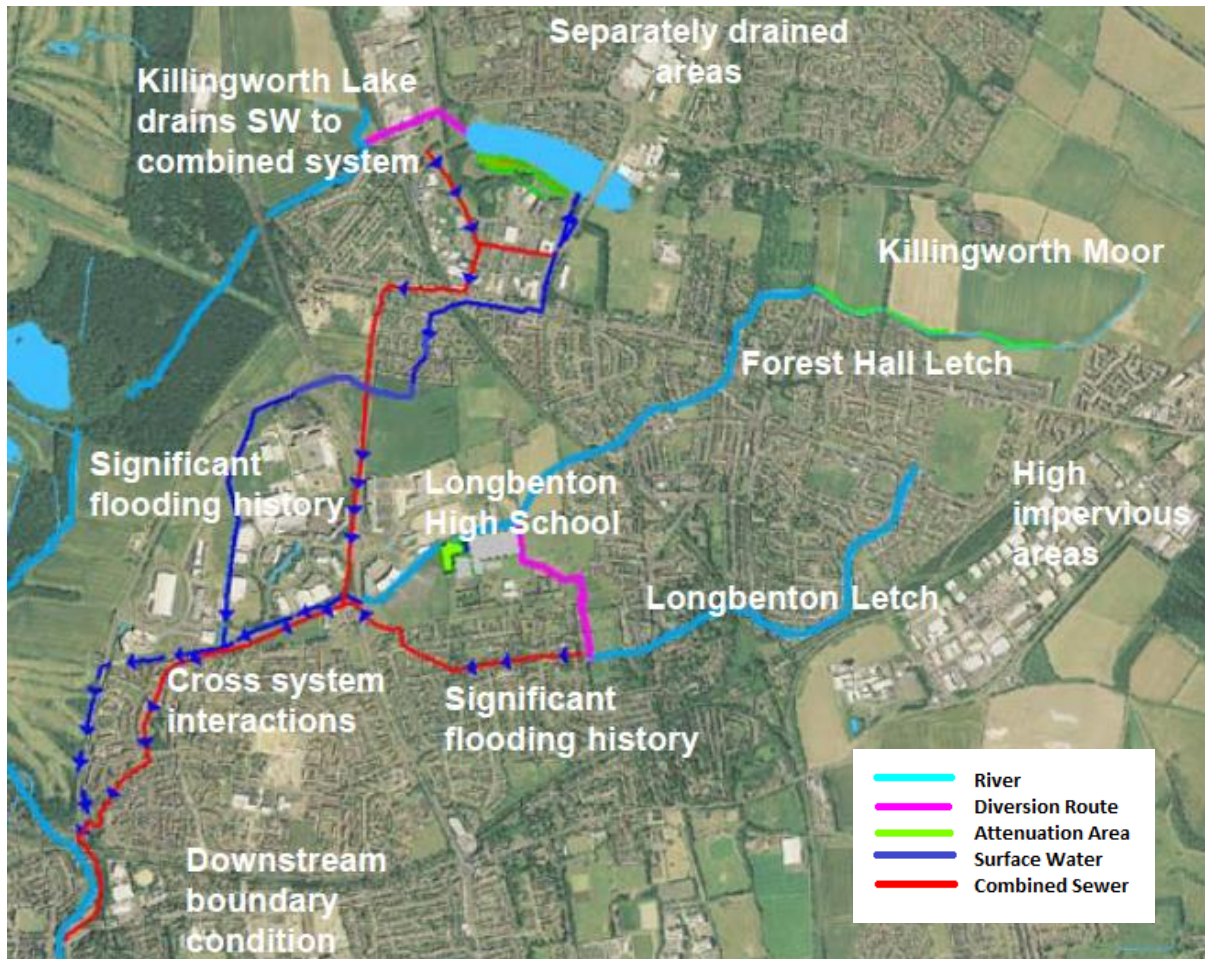


Fig 6 Plan of schematic of system and location of SuDS features

Across these sites, all measures manage the run-off above ground and total 22,000m³ volume of surface water storage. The attenuation upstream in the catchment allows storage closer to the runoff and slows flows before reaching further down in the catchment. The scheme is designed to protect against a 1 in 100 year storm in accordance with EA requirements.

5. Specific Project Details

In 2010 the Risk Management Authorities for the Tyneside drainage catchment came together to complete a risk based assessment to identify at greatest risk of performance failure. This process identified Killingworth and Longbenton as areas of high risk. The RMAs Northumbrian Water Group (NWG), North Tyneside council (NTC), and the Environment Agency (EA) then carried out a feasibility study in 2012 which identified that sustainable surface water improvements would deliver significant benefits to both the residents and the environment, particularly in the area of flood risk reduction to over 3,500 properties. Based on a detailed Integrated Catchment Model, the property flood risk was identified and this was validated by historic evidence. It was not practical or affordable for the solution to be delivered by a single RMA. Therefore a partnership approach was taken forward to deliver the scheme.

Cost estimates indicated that the implementation of traditional underground storage tanks to perform to the same level as the SuDS would be in the order of £4.2million additional cost to the SuDS option without any of the wider recreational, amenity or biodiversity benefits.

Delivery of the option required civil engineering design and construction and was led by NWG and delivered by Esh-MWH. The design included input from a range of disciplines including civil engineers, hydraulic modellers, geotechnical engineers, landscape architects, ecologists, 3D graphic specialists, and contractors. This team worked together to develop effective, attractive SuDS features that would provide multiple benefits to the community.

The scheme was accelerated by a year to align with construction of a new school. This required extensive stakeholder liaison, meetings with the contractor for the school rebuild, and securing funding to avoid further disruption to the school. As part of this liaison, additional benefits to the scheme were developed. These included the creation of the dual purpose attenuation amphitheatre, a wetland area with a viewing platform (See Figure 7), and the decision to provide the new school’s surface water attenuation in above ground storage (See Figure 1) rather than as below ground storage that was originally envisioned by the developer. The team has also worked with local groups to enhance the local village green with the planting of a new orchard, installation of accessible raised planters and seating, and the seeding of a wild flower meadow (See Figure 8).



Figs7 and 8 Educational Facilities

The photo on the left shows a wetland attenuation area with an educational viewing platform that provides storage for surface water drainage from the new school. The photo on the right shows the updated village green, which includes wet scrapes and raised planters to attenuate flows. This was completed as part of Phase 1 work.

Community events that were co-sponsored and attended by all the project partners to explain the scheme and take feedback were held with local residents and businesses. At these events, residents were encouraged to do local source control, reduce water use, connect downpipes to water butts, reduce hardstanding, and use permeable paving. In addition, a community portal was set up to provide regular updates and allow direct communication between the public and project team.

Regular updates were provided to the head teachers at the schools during construction on the school sites to ensure safe working conditions and liaise with school activities. Prior to the start, contractors visited to explain the work and talk about sustainability, engineering, and construction. The school children designed safety signs that were displayed around the site.

Local environmental groups including the Tyne Rivers Trust, Northumberland Wildlife Trust and the Natural History Society were stakeholders who contributed to the scheme. The Natural History Society were liaised with regarding pass forward flows through Gosforth Lake (SSSI), where the project team committed to ensure the design would take care not to pass forward any issues in terms of quality or quantity.

Stakeholder and community engagement were a key to the success of this partnership project by understanding local issues, concerns, and desired outcomes.

6. Maintenance and operation

Maintenance of new assets has been carefully considered as part of the design and is shared between the Risk Management Authorities: Northumbrian Water Group, North Tyneside Council, and the Environment Agency. A Legal Agreement was devised and signed by all parties which set out who was responsible for what aspects of the work and ongoing maintenance. Once the assets are built, the health and safety files are prepared in accordance with the operating authority's requirements.

7. Monitoring and evaluation

The SuDS features have performed well during rainfall events, and monitoring is ongoing. There have been significant environmental improvements following implementation of the scheme including less sewage spill into the Ouseburn main river via Combined Sewer Overflows of up to 81,000m³ annually.

Depth gauges have been installed to enable the EA to monitor levels in the watercourses. The flow controls on the watercourses are inspected regularly to ensure the system will operate as designed in a rainfall event. In addition to the watercourse monitoring, a flow monitor will be installed on the lake overflow to monitor spill rates and frequency.

There is ongoing liaison with the local school where the attenuation amphitheatre and attenuation area with a viewing platform are located to ensure these provide the benefits envisioned. There is also ongoing liaison with the village green group and Killingworth Lake users group.

8. Benefits and achievements

The scheme has provided a wide range of benefits to the local community including:

Flood risk reduction

- Flood risk reduction to over 3,500 residential and commercial properties across the catchment;
- Reduction in disruption to travel caused by flooding;

Biodiversity

- Increased amenity and wildlife habitat along Killingworth Moor and at Killingworth Lake;
- New wetland areas at Longbenton High School and Killingworth Lake;

Water quality

- Removal of siltation and pollutants by wetland and source control measures;
- The removal of the Longbenton Letch watercourse flow from the sewerage network and the removal of the Killingworth Lake spills into the drainage network both result in a reduction of combined sewer overflow spills into the Ouseburn watercourse, which results in improved water quality.

Amenity

- Improved amenity to local area including at Benton Village Green, Longbenton High School, along Killingworth Moor, near Killingworth Lake, and Jesmond Dene park;

Education

- Educational facilities including a dry weather amphitheatre and a wetland viewing platform for use of local schools;
- Increased awareness of SuDS and flood protection in the local area;
- Increased awareness of source control opportunities through examples built and information shared at community events;

Enable development

- Increased capacity within the drainage network and the reduction of local flood risk has enabled new development to go ahead, which adds to the economic growth and prosperity to this region; and
- Reduced treatment of surface water at the wastewater treatment works;

The CIRIA BEST (Benefits of SuDS Tool) was used to calculate and monetise the environmental benefits of the scheme demonstrating over £30m benefits. The tool considers amenity value, biodiversity and ecology, flooding, recreation and education among other criteria. Reduction in flood risk generated the majority of this value.

This project was delivered by working as one team and taking on the challenges brought about by this integrated approach. The long term relationships and trust that have been built between NWG, NTC, and the EA are resulting in other sustainable projects progressing.

9. Lessons learnt

The project demonstrates that working together to find a common solution benefits all parties by aligning funding and creating shared ownership. Lessons learnt include:

- Strong leadership was essential to deliver the multi-organisational and multi-stakeholder project.
- Working in collaboration takes longer. This is a result of multiple approval processes, the need to align funding, and the need to put legal agreements in place.
- Ongoing liaison and negotiation with landowners is necessary in order to gain trust and help understand SuDS.
- Operation and maintenance can be agreed to be completed by multiple organisations. Appropriate legal agreements can be put into place. Everyone can 'do their bit'.
- At the beginning of the design phase, the design requirements such as design return period, inclusion of climate change uplifts, and flooding threshold levels must be agreed to meet different authority's standards.

10. Interaction with local authority

This scheme was a partnership project planned, designed, funded by North Tyneside Council, the Environment Agency, and Northumbrian Water Group.

North Tyneside Council was a partner on the scheme and has been involved from the start. Initially the funding for the study came from Local Levy which was on the EA's Medium Term Plan and the local authority was the Lead Authority. As NWG led the feasibility study, it became clear that the lead role sat better with them and the lead role was subsequently changed.

In support of the project, a Councillor Cabinet Member stated *“The project complements our Local Plan by facilitating future housing development and managing surface water in the most sustainable way. The other benefits, such as amenity and habitat improvement, provide significant added value and would be most welcome by our local communities.”*

The Environment Agency was also essential to the success of the project. The EA is responsible for the main rivers included in this scheme and made decisions to improve the fluvial flood risk from these watercourses. The EA is also a key project partner having guided NWG and Esh-MWH through the PAR process in a bid to secure the funding towards the project. The EA also provided an innovative solution for survey of Killingworth Lake, a remote control boat with hydro acoustic equipment to measure the depth profile of the lake and aid in the design of the solution.

11. Project details

Construction completed: Phases 1 and 2 construction complete 2016 and 2017. Phase 3 is in design with construction starting in spring 2018 with completion in 2018.

Cost: £5.2 million cost, which was funded by EA: £2,240,000; NWG: £2,520,000; NTC: £440,000.

Extent: Total of 31,000m² of SuDS built across a catchment of 1200 hectares for a total of 22,000m³ of surface water attenuation storage.

Programme:

- Feasibility Study: 2012
- Project Appraisal Report / Outline Design: 2014-2016
- Detailed Design: 2015-2018 (ongoing as each phase progresses)
- Construction (Phase 1): 2016 - complete
- Construction (Phase 2): 2017 - complete
- Construction (Phase 3): 2018 - ongoing

12. Project team

Funders	Northumbrian Water Group, North Tyneside Council, Environment Agency
Clients	Northumbrian Water Group, North Tyneside Council, Environment Agency
Designers	Esh-MWH
Contractors	Esh-MWH
Other	Northumberland Wildlife Trust, Tyne Rivers Trust, and Natural History Society