

Green Square - enabling urban renewal through effective flood risk management

COUNCIL NAME

City of Sydney

WEB ADDRESS

cityofsydney.nsw.gov.au

SIZE

26.7 square km

POPULATION

240,229

Overview

The collaboration between City of Sydney and Sydney Water on the Green Square Stormwater Drain project is an innovative approach to reducing flood hazard in a heavily built-up area with high community expectations. The project combines complex hydraulic analysis and assessment with innovative construction techniques. Through the provision of stormwater treatment, downstream water quality is improved and water is recycled for non-potable water use showcasing the way urban water resources should be used and managed in an uncertain environment where climate change plays an increasing role.

Background

Located between Sydney airport and the city, Green Square is home to one of NSW's fastest growing populations. A \$16 billion redevelopment will transform Green Square from an industrial hub into a vibrant major retail, residential and cultural hub. By 2030, the urban renewal area will create 30,500 new residential dwellings to cope with an anticipated population of 61,000 and 22,000 new workers.

Parts of the Sheas Creek catchment and the Green Square Town Centre are subject to high hazard flooding during heavy rainfall due to surcharging pits or ponding of flows at low-points. Several stormwater modelling investigations were completed to determine the feasibility of constructing a new large trunk drain from Link Road, Zetland to the Alexandra Canal, going through the Green Square Town Centre - known as the Green Square Stormwater Drain (GSSD).

For the liveability and accessibility of the precinct, the GSSD aimed to:

- Significantly reduce flood risk in the Green Square urban renewal area and Epsom Park precincts.
- Reduce stormwater pollution and improve water quality of Cooks River Catchment
- Reduce potable water usage within the Green Square precinct – capturing stormwater sources to recycle and use for non-potable purposes.

Implementation

The GSSD was delivered by the Drying Green Alliance - comprising client partners City of Sydney and Sydney Water and industry partners UGL Infrastructure, Seymour Whyte Constructions, Rob Carr, WSP and RPS group.

Delivered in stages, the project had many technical, logistical and community related challenges from solving complex hydraulic issues to installing large conduits in heavily built-up areas with extensive existing utility clashes and potential major traffic disruption. To address these challenges tunnel boring machines were used to install 1800 mm diameter pipes in long runs (known as micro-tunnelling) well below street level.

The GSSD takes significant flows from upstream catchments in Sydney's eastern suburbs and collects new and existing local drainage in the Green Square area, to convey 30 m³/s of flow to Alexandra Canal in the 100-year ARI storm event. Local flooding has been reduced at Huntley Street Alexandria by channel widening and replacement of a restrictive box culvert with a bridge.

The GSSD facilitates water reuse by using two large gross pollutant traps (GPTs) to treat stormwater. This delivers up to 320 million litres of recycled stormwater annually to new buildings and open spaces in the Green Square Town Centre. The non-potable demand to be supplied is estimated to be up to 900 kilolitres/day. The system also reduces pollution discharged to stormwater and downstream to the Cooks River, while simultaneously reducing potable water demand.



The total cost of the project was \$140 million (ex GST). Design and construction of the GSSD commenced in early 2015 and the project was practically completed in November 2019 with a 24 month defects liability period.

Outcomes

Areas of high flood hazard were reduced to low flood hazard in the 100-year ARI storm event. This was achieved by amplification of the existing Sheas Creek trunk drain with a combination of twin and triple DN1800 micro-tunnelled pipes, new local drain connections and widening of the existing Sheas Creek channel at Alexandra Canal.

Water quality of Cooks River Catchment was improved by installing two of the largest commercially available GPTs in Australia (4 metres in diameter and 7 metres deep) to achieve the following pollutant removal efficiencies:

- 98% removal of gross pollutants
- 70% removal of suspended solids
- 30% removal of total phosphorus
- captured organics and oils
- captured absorbed toxics and nutrients

Off-take structures from the GSSD direct up to 320 ML/year of stormwater flows to new buildings and open spaces in Green Square Town Centre. The recycled water from the scheme will be used for toilets, laundries, cooling towers, water features, landscaping and park irrigation. This significantly contributes to City of Sydney's Sustainable Sydney 2030 targets for a water sensitive city.

The GSSD project incorporated a shared pedestrian/cycle path between Maddox Street and Alexandra Canal with the works to widen the Sheas Creek open channel, connecting to the existing and planned cycleway network.

Key Learnings

The project demonstrated that the use of micro-tunnelling is a cost-effective construction methodology in heavily populated areas with major road crossings and potential utility conflicts. The selection of the type of tunnel boring machine is critical to the success of this type of project in challenging geotechnical conditions.

The project showed that Computational Fluid Dynamic (CFD) modelling has a definitive place in complex hydraulic modelling and can replace conventional physical modelling, speeding up the

design process. The project considered the installation of several smaller GPTs or fewer larger GPTs. The options analysis process found that the installation of fewer but larger GPTs provided the greatest environmental benefit.

In terms of geotechnical design, the pile and ground anchor system was effective in areas with restricted space and where settlement of structures immediately adjacent the retaining wall could not be tolerated. A comprehensive system of monitoring by survey and inclinometers, combined with a robust action plan should wall deflections exceed predicted values was established. This resulted in a durable solution with no impact to the neighbouring properties.

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**This project was the 2020 winner of the Water Management Award at the
 LGNSW Excellence in the Environment Awards**



Green Square stormwater drain

