Godmanchester Flood Alleviation Scheme

delivering a series of flood defences to protect 560 homes and properties in Godmanchester, Cambridgeshire

by Richard Chubb CEng MICE

Situated on the River Great Ouse in Cambridgeshire, Godmanchester – population 6000 – is steeped in Saxon and Roman history. After widespread flooding in 1998, the Environment Agency secured £10m to construct flood defences to protect the town over the next 100 years. The Great Ouse Valley has a long history of flooding. Godmanchester and many other communities flooded in 1947, and three major floods in recent years prompted a string of flood alleviation schemes to be constructed in the area. Godmanchester is the last major scheme to be implemented.

Works around historic Town Hall - Courtesy of Atkins

Godmanchester has a 1 in 25 chance of flooding in any given year. Existing garden embankments and walls act as informal flood defences, but do not comply with engineering standards and would not provide a sufficient barrier against a significant flood. The scheme has been designed to reduce the risk of flooding to a 1 in 100 chance in any given year, and will benefit 560 residential and commercial properties in Godmanchester. The design also takes account of the anticipated effects of climate change in which severe floods are more likely to occur in the future.

The solution

The scheme comprises three main elements:

1. A 1.5km continuous line of engineered defences, mainly through residential gardens backing onto the River Great Ouse.
2. River widening and dredging around the Cooks Bridge crossing to improve conveyance.
3. Two pumping stations to control seepage through the underlying soils.

The flood defences will tie into the A14 embankment which runs across the floodplain to the northeast of the town, and will follow a path close to the river through private gardens until it reaches high ground to the south of the town. The defences, ranging in height from 0.4m to 1.8m, will be a mixture of walls and embankments in public realm areas, private gardens and open fields.

Peak flood flow of the river during the design event is approximately 450 cubic metres per second. Dredging around Cooks Bridge, an 18th Century masonry multi-arch crossing and Grade II* listed structure, will maximise conveyance of the river and reduce water levels upstream along the line of the defence.

Part of the town at risk from flooding lies across a shallow valley. The valley is underlain with River Terrace Deposits (RTD) comprising a 3-4m thick coarse granular band at the centre of the valley, reducing in grade and thickness towards the edges. At the centre of the valley, where the RTD is most coarse, a sheet piled curtain has been installed to prevent floodwater from seeping through the underlying soils into the town. Piling along the full length of

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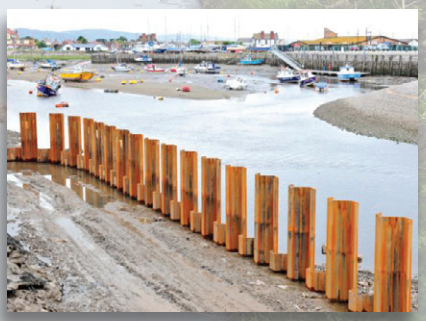

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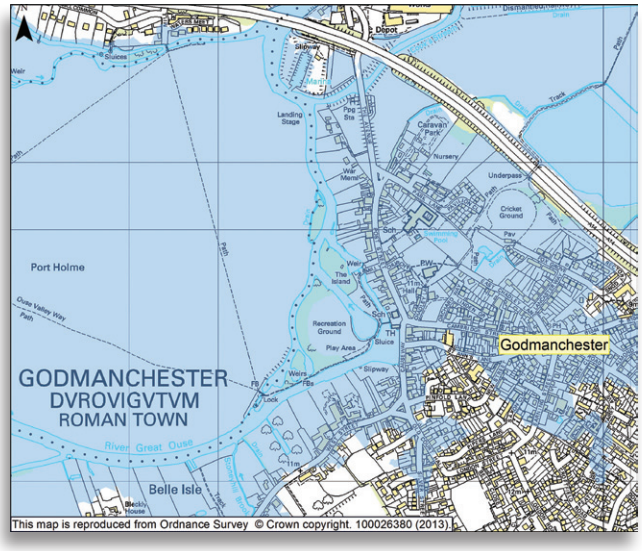
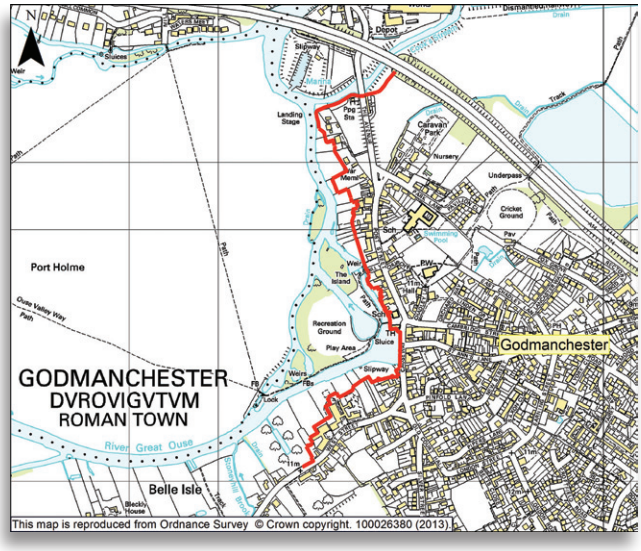


Existing flood risk in Godmanchester - Courtesy of Atkins



Line of new flood defences - Courtesy of Atkins

the scheme was neither practical nor economically viable. Two pumping stations are to be installed to collect and discharge any remaining seepage.

Constraints

Godmanchester is an attractive market town with Roman history. The works are taking place within a Conservation Area made up of mature trees, historic architecture and landscape views. There are 94 Listed Buildings, two of which are Grade II* which presented a key constraint to the scheme. The new flood defences pass through the rear gardens of 30 private properties running alongside the river. The majority of gardens are landscaped and contain many curtilage listed structures and walls.

Godmanchester lies adjacent to Portholme Meadow, Europe's largest area of natural wet meadow and a designated Special Area of Conservation (SAC). It is also a Site of Special Scientific Interest (SSSI) for the grassland communities it supports, which are typical of an alluvial flood meadow.

Design and construction

Construction began with a sod cutting ceremony held in April 2012 and is due to complete ahead of schedule in October 2013.

Key participants:	
Client	Environment Agency
Design Consultant	Atkins
Principal Contractor	Jackson Civil Engineering
Commercial Consultant	EC Harris
CDM-Coordinator	Atkins
Partnership Funding Organisations: • Regional Flood and Coastal Defence Committee • Cambridgeshire County Council • Huntingdonshire District Councils • Private residents	

Stakeholder engagement

Dialogue with local residents, councils and other third parties has been ongoing since the initial study in 2005. The project team has held public exhibitions, presented to the local Town Council and maintained a relationship with residents, interest groups and statutory bodies. The project team also visited local schools to present the scheme, host engineering workshops and deliver health and safety messages.

Construction access

Access and sequencing of works presented a challenge because of the linearity of the site and the constraints imposed by retaining as many trees as possible. By careful programming and planning with an emphasis on segregating the main construction activities, the contractor managed access constraints and gave better resource utilisation across the scheme.

The acute shortage of space is illustrated by the contractor's policy of excavating site fencing feet flush with the surface. Segregated pedestrian routes were established in areas where space was at a premium, avoiding the trips hazards normally associated with site fencing.

Good relationships with landowners helped secure access. Initially, one area was available only from the river, but a landowner gave access through a driveway, providing significant savings to costs and programme.

Flood walls

The designs through the private gardens were tailored to complement existing features and avoid disturbing significant trees. A composite masonry and concrete standard wall detail, developed between Atkins and Jacksons Civil Engineering during the ECI stage, was used throughout.

Discussions were held with the local authority and residents to agree all finishes and materials to preserve the historic local character.

Throughout construction, the design was continuously monitored. On several occasions significant condition and stability issues to adjacent structures were brought to the attention of landowners. Additional works were undertaken to reinstate ageing structures.

Works to raise walls throughout the main public realm areas near landmark structures such as the town hall and the ancient Chinese Bridge were managed closely by the team. The original auger pile foundation supporting the southern face of the town hall was changed to a mass concrete solution. The benefits included shorter construction time and reduced risk of damage to the town hall.

Sheet piling

A leader piling rig was used to install 350m of sheet piled seepage control curtain. Careful planning enabled the contractor, Ivor King (C.E.C.) Ltd, to undertake all piling from land, avoiding the need to deploy waterborne equipment.

Vibration monitoring equipment was installed to avoid damage to the 200-year-old Grade II listed Cooks Bridge. Sheet piles close to the bridge structure were installed using dig and push techniques to provide the necessary ground water cut off.

Pumping stations

Two pumping stations installed at Cooks Stream and Rectory Gardens will control seepage through the underlying gravels. Cooks Stream pumping station, with a capacity of 500 litres per second, lies within the embankment profile, reducing its visual impact on the rural setting.

Rectory Gardens pumping station has a capacity of 300 litres per second and will connect to the main surface water network within the town. It will discharge through a single 400mm diameter rising main installed under the A14 embankment, discharging to a receiving watercourse downstream. The rising main will be installed using a thrust bore technique, emanating from a 14m x 8m thrust pit on the upstream side, travelling under the 7m high embankment using a laser guided auger boring machine.

The thrust bore will be installed through a dense gravel layer below the water table. The system enables earth pressures at the cutting head to be balanced to prevent cavitations during the boring operation. However, it does not require a reception pit to install the outer steel sleeves as all works can be undertaken from the launch site. Once the steel sleeves are installed, a slit trench will be excavated to facilitate installation of the 500mm diameter outfall pipe which will be grouted into position within the outer sleeve.

Environmental mitigation

A suite of mitigation measures were implemented, including a public exhibition, a drop-in session and notice boards advising of the works.

Mature trees and planted areas were retained where possible, and tree protection fencing was erected. Ecology surveys identified Great Crested Newts within a nature reserve pond. During construction, one Great Crested Newt found within the working area was successfully relocated by a licensed ecologist to the pond outside the site.

Nesting birds and waterfowl are a regular feature of Godmanchester. Swans use the causeway in the centre of town, which is also an important fish spawning habitat. All vegetation and tree removal activities were undertaken outside of the nesting bird season. However, nesting ducks and other birds were encountered within the working areas. By ensuring access routes to and from active nests, viability of the nests has been managed whilst maintaining the overall construction programme. A temporary improved area for nesting swans within the causeway has also been installed.

Flooding

2012 was one of the wettest years on record, and much of the site was regularly waterlogged. Loss of construction time was mitigated through effective re-sequencing.

On more than one occasion after prolonged flooding, Atkins and Jacksons Civil Engineering collaborated to redesign foundations in saturated soils, allowing construction to recommence as quickly as possible.

Health, safety and environment

Management of health, safety and the environment has been achieved to an extremely high level. The contractor's policies are fully integrated with the Environment Agency's own *'Safety is Paramount'* Code of Practice and its Beyond Zero campaign. The contractor's unique *'marginal gains'* approach breaks everything down to finite detail and improves everything by a small margin, significantly increasing overall standards and performance.

Local MP and dignitaries at the sod cutting ceremony - Courtesy of Atkins

Completed flood embankment - Courtesy of Atkins

The project team was awarded the Environment Agency's Exemplar Award for Health, Safety and Environmental performance. ECO units identified up to 74% in potential energy savings and up to 91% in water usage savings. Access and attendance has been recorded using a biometric workforce management and reporting system. Inductions are short and punchy with regular toolbox talks, daily briefings, quizzes and behavioural-based incentives, supplemented with a hard copy induction brochure.

Conclusion

This challenging scheme will reduce the risk of flooding to over 560 residential and commercial properties in Godmanchester. The project has overcome many environmental and heritage constraints. Considerate design and attention to detail has minimised impact to private gardens and the historical landscape.

Excellent teamwork is at the heart of this project's success, which is scheduled to complete ahead of programme and below budget. The team has received the highest Environment Agency award for health and safety management, and some of the highest team performance (KPI) scores across the region.

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