Cramond Wastewater Improvement Scheme

£4.5m project to end untreated discharge into Firth of Forth

by
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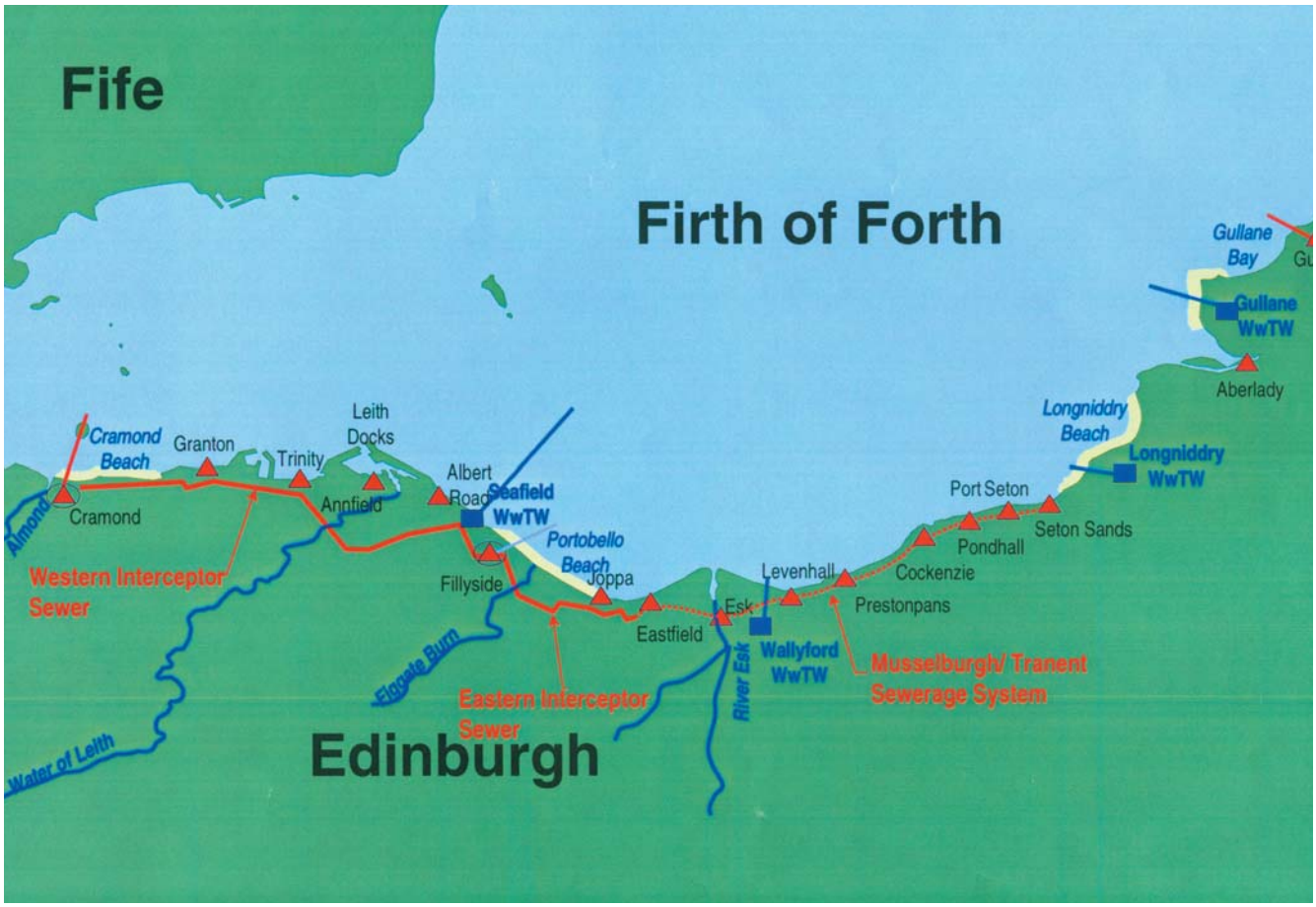
Cramond Wastewater Improvement Scheme, an East of Scotland Water 'Watermark Initiative Project' is aimed at ending the discharge of untreated wastewater to the Firth of Forth at Cramond, a small village on the edge of Edinburgh, which is in a conservation area, has important Roman remains and is considered to be environmentally sensitive. The scheme involves construction of a new wastewater pumping station and rising main, upgrading of an existing marine outfall and provision of screens for existing CSOs. It has a capital value of approximately £4.5 million.



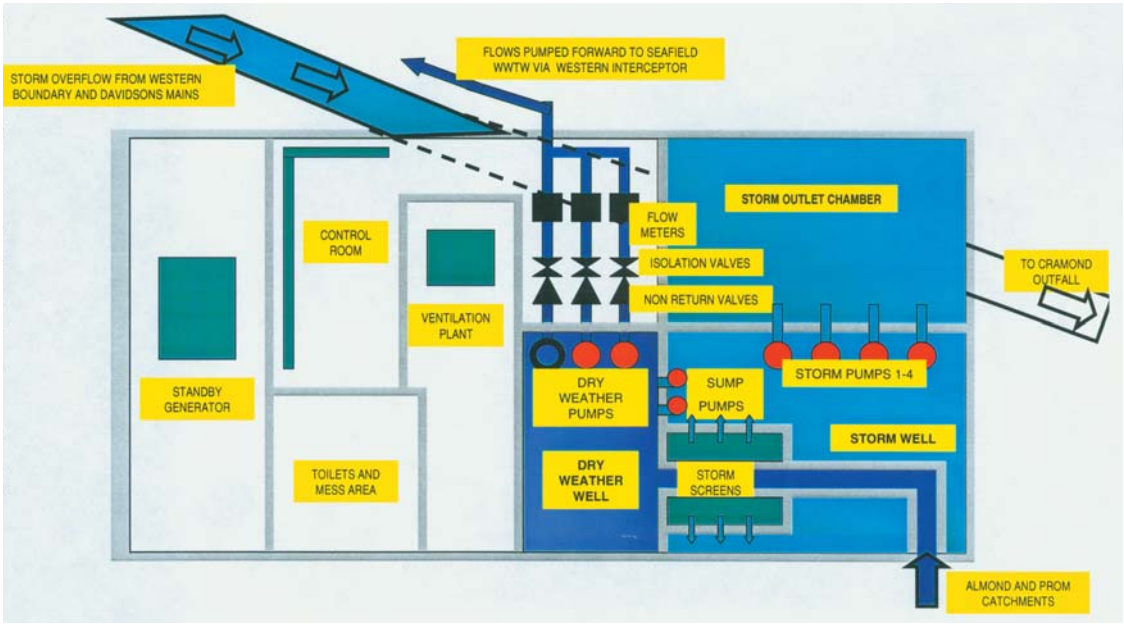
Location of Cramond within Edinburgh area *(courtesy Scottish Water)*

Cramond Village lies to the north west of the City of Edinburgh. Much of the village dates from the seventeenth century and is designated as a conservation area in the local area plan[1]. Within the village are the remains of a Roman Fort and these are amongst the most important in Scotland. The remains are protected as a Scheduled Ancient Monument. The River Almond discharges to the Firth of Forth immediately to the west of the village. Cramond Island is situated around one kilometre to the north of the shoreline. Between the island and the shore there is an area of tidal mudflats which form part of a Site of Special Scientific Interest (SSSI) and a Special Protection Area (SPA).

Leakage

Two combined sewers, the River Almond sewer and the Promenade sewer discharged to the Forth at Cramond, via a sea outfall. These served a population of approximately 4,000 and were subject to tidal influence, causing the operation of a number of CSOs. A comminutor station provided preliminary treatment. The outfall is approximately 1.5km in length and crosses the tidal mud flats prior to being tunnelled through Cramond Island, discharging 50 metres past its north shore. The outfall changes in diameter from 915mm to 1525mm, approximately 860m from the shore. The 915mm diameter section was in poor condition with leakage occurring to the mud flats in a number of places. The tunnelled section of the pipe, together with the 50m past the north shore of the island, was badly silted up.

The Western Interceptor Sewer (WIS) takes discharges from the major trunk sewers in the western part of Edinburgh to treatment at Seafield WwTW. In fields to the south east of Cramond, two trunk sewers: Davidson's Main Sewer (DMS), and the Western Boundary Sewer (WBS) discharged into the WIS via stilling pond overflows.The DMS and WBS serve a population of over 50,000 and flows to the WBS overflow can be as high as 4



Operation of pumping station under storm conditions *(courtesy Scottish Water)*

cumecs. The overflows form these two CSOs combined, before discharging at Cramond.

The Urban Waste Water Treatment Directive (UWWTD)[2], required secondary treatment to be provided for discharges of wastewater from agglomerations with a population equivalent of 15,000 or more by 31 December 2000. Cramond as part of the Edinburgh agglomeration was subject to this deadline. The discharge at Cramond had resulted in contamination of the foreshore by sewage and the Scottish Environmental Protection Agency (SEPA) required that any work to improve discharges[3] should not compromise the EC Bathing Water Directive[4] guideline standards.

Brief

From initial studies of Cramond[5], a brief was developed This was to transfer flows up to Formula A (78 l/s) to the WIS, with the provision for increasing it to 200 l/s at a later date. The outfall was to be upgraded to have enough capacity for a one in five year storm and 6mm screens were to be provided for the WBS and DMS CSOs and for any overflows from the pumping station.

Civil engineering design and project management were carried out by ESW Waterways Consultancy, ESW's in-house consultant with assistance provided by specialist archaeological, wildlife and architectural consultants as required. The mechanical and electrical consultant for the project was *Faber Maunsell.* Extensive public consultation was carried out during the design phase to ensure that the public were fully aware of the proposals and that the impact of the project on the village would be minimised.

Site

A suitable site for the pumping station was identified in an embankment at the edge of the pedestrian esplanade. This offered the opportunity to bury most of the structure, with only the front elevation visible. To ensure that the station would blend in with its surroundings, natural stone was used to face the exposed areas and extensive use of landscaping was made.

To minimise the size of the pumping station it was decided that screening for DMS and WBS CSOs would be provided remotely at the site of the CSOs. *Hydro-Jet Screens,* manufactured by *HRD Ltd,* were adopted. These operate hydraulically and are self cleaning. They have no moving parts and require no power supplies and very little maintenance. These were significant advantages over powered screens for ESW. The installations could be kept entirely below ground, with no requirements for access roads and no ongoing power costs.

Final design of the pumping station consisted of a reinforced concrete sub-structure containing a foul well, storm well, screen chamber and storm outlet chamber. A reinforced concrete superstructure contains the control room, mess facilities, ventilation plant room and standby generation facilities.

The project was let under the ICE 6th Edition Conditions. *George Leslie Ltd* was appointed as main contractor with *Brent (Scotland) Ltd* as mechanical and electrical sub-contractors. Construction commenced in April 2000.

The reinforced concrete sub-structure of the pumping station is approximately 7.5m deep below the esplanade level and the rear section of the sub-structure is 13m deep below the top level of the existing embankment.

The site was extremely restricted due to the site of the Scheduled Ancient Monument and the requirement of keeping part of the Esplanade open to the public. The structure was built within a sheet piled cofferdam, which was further complicated by the 1500mm diameter overflow line from the WBS and DMS CSOs which ran directly through the site and had to be kept operational prior to being incorporated in the station. Ground conditions consisted of sand overlying mudstone and rotary bored in situ concrete piles were used to support shallow parts of the structure.

Upgraded

The outfall was upgraded by twinning the initial 860m long, 915mm diameter pipe with a 1050mm *Asset* twin-walled pipe, connecting back to the original outfall at the change of section to 1500mm. The existing 915mm diameter pipe was refurbished by using a cured in-place liner for its full 860m length – the first time this work has been carried out in the UK in tidal conditions. Scaffold platforms were constructed in the inter-tidal zone to carry the necessary plant and allow the required 24 hour working. The specialist lining contractor was *Ferro Monk Systems Ltd,* who also de-silted the tunnelled section of the outfall. A diffuser was fitted to the discharge point of the outfall to prevent silt ingress recurring.

During normal operation, flows up to 78 l/s enter the foul well of the pumping station, via a suspended concrete inlet channel and are transferred to the WIS by two *Flygt N-Type* submersible pumps operating on a duty/standby basis. If the flow exceeds 78 l/s it over tops weirs on the inlet channel and discharges to the storm well via two *Huber Rotamat R0K1* Storm Screens. Four *Flygt* submersible pumps then lift the overflows to a raised storm outlet chamber from where they discharge by gravity via the main outfall. In the event that a one in five years storm is exceeded a remote overflow chamber allows spills to the River Almond via a short outfall. A *CSO Technik Ltd Terminodour* odour control system was installed. This utilises 'ionised' air to neutralise odours and has proved extremely successful.

Protracted negotiations to obtain the necessary consents and permission meant that it was not possible to meet the legislative deadline of December 2000 for the provision of secondary treatment to the flows from Cramond. However, pumping commenced on 30 May 2001 in time for the start of the 2001 bathing season. Cramond has since met all of SEPA's requirements for water quality.

In summary the Cramond Wastewater Improvement Scheme involved the construction of new wastewater pumping station and rising main, provision of screens to existing CSOs and upgrading of an existing sea outfall in a historic and environmentally sensitive area. The scheme shows a significant commitment to the customer and the environment by ESW and has resulted in a marked improvement in water quality at Cramond Beach. ■

Note: *The author of this article, Ross Tulloch, is Engineer with ESW Waterway Consultancy.*

Construction work at Cramond *(courtesy Scottish Water)*

Pumping station under construction *(courtesy Scottish Water)*

Main hall - pumping station *(courtesy Scottish Water)*

References: 1. *CEC. 1998. North-West Edinburgh Local Plan. City of Edinburgh Council;* **2.** *The Council of the European Communities. 1991. Council Directive of 21 May 1991 Concerning Waste Water Treatment.* **3.** *Scottish Environmental Protection Agency 1998. Water Quality Standards in the Firth of Forth. SEPA.* **4.** *The Council of European Communities. 1975. Council Directive 76/160/EEC of 8 Dec 1975 Concerning the Quality of Bathing Water.* **5.** *East of Scotland Water. 1999. Edinburgh Coastal Strategy Phase II Study – Value Management Workshop Notes. ESW.*