

# Scottish Water's Water Quality Programme

## £28.5 regional scheme improves water quality in NE corner of UK

by  
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**S**cottish Water's 'North Coast Regional Scheme', part of their Water Quality Undertakings Programme, comprises a new centralised water treatment works and over 80 kilometres of new trunk main – which will substantially improve water supplied to 30,000 customers in thirteen communities in Caithness and along the north coast of Sutherland. Pipelaying work is now drawing to a conclusion and mechanical installation at the new WTW will start in April 2003.



New central WTW at Loch Calder - early stages of construction - from south west (courtesy Scottish Water/Delta Scotland).



New central WTW at Loch Calder - early stages of construction - lime silo area (courtesy Scottish Water/Delta Scotland).



New central WTW at Loch Calder - early stages of construction - from north west (courtesy Scottish Water/Delta Scotland).



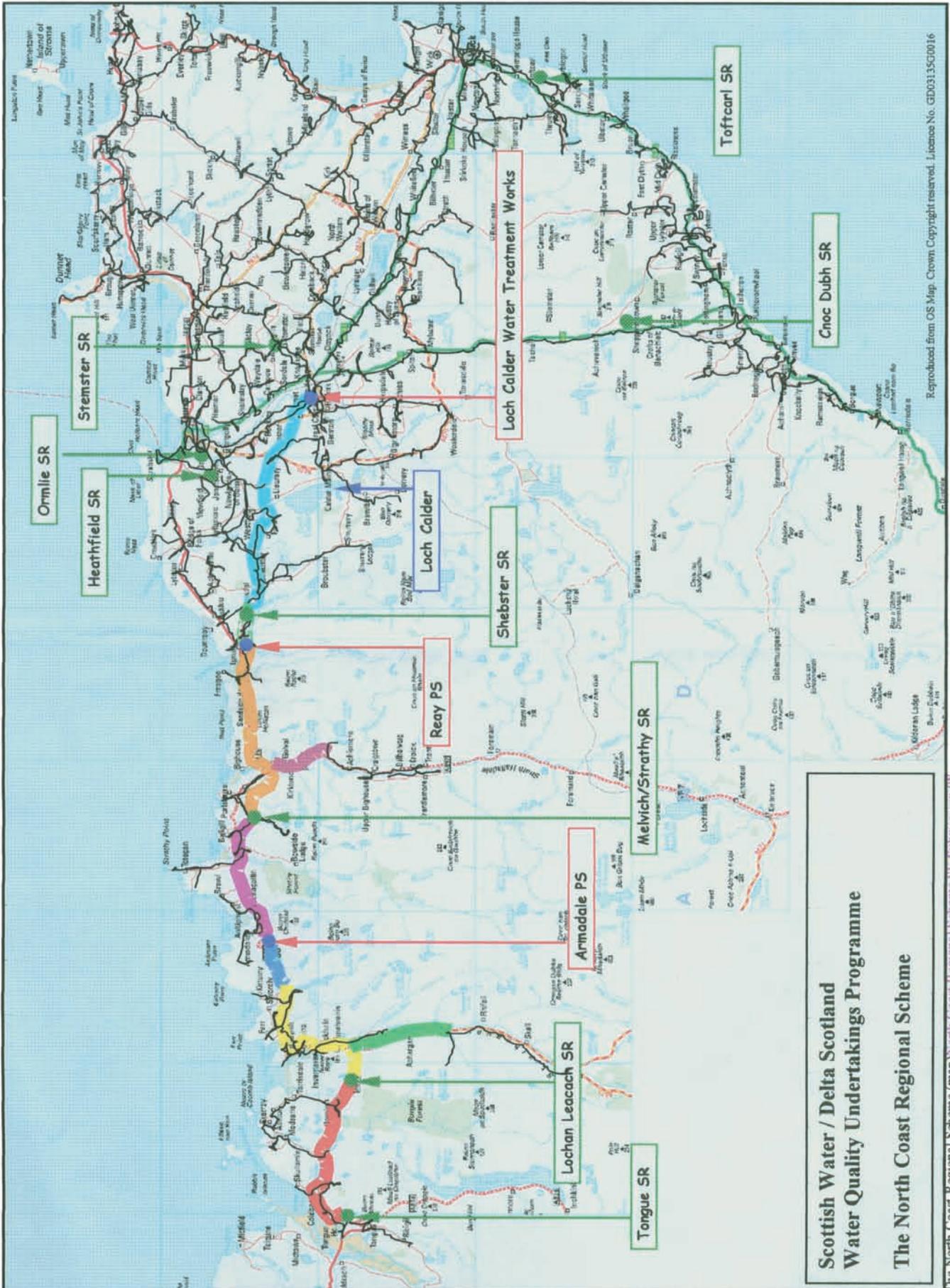
New central WTW at Loch Calder - early stages of construction - from south (courtesy Scottish Water/Delta Scotland).

In the year 2000, the North of Scotland Water Authority appointed three teams' to deliver their Water Quality Undertakings Programme as a method of providing solutions to the large number of Water Quality Regulations requirements on numerous projects. One of these teams, *Delta Scotland*, a joint venture between *AWG Construction Services Limited* and *Earth Tech Engineering Limited* was given all the schemes north of Inverness and extending onto Orkney and Shetland Islands.

**Most significant of these projects was the 'North Coast Regional Scheme' described in this article, where design work commenced in late 2000 under an NEC Option C (Target Cost) Form of Contract..**

One of the key elements of this large project has been the need to minimise early potential impact on the local environment or on the surprisingly numerous areas of archaeological interest. This has involved the employment of specialist consultants to identify ecological, archaeological or landscape issues, to assist in the identification of mitigation measures and to provide specialist advice on reinstatement methods.

Vital to progress of the scheme has been the extensive consultation work between *Delta Scotland* and the Highland Council, Scottish Natural Heritage and Scottish Environment Protection Agency.



Map shows Scottish Water/Delta Scotland Water Quality Programme - North Coast Regional Scheme (courtesy Scottish Water/Delta Scotland).

## Background

The £28.5m 'North Coast Regional' scheme covers a large area of Caithness and North Sutherland, stretching more than 100km from John o'Groats in the east to Tongue in the west. The customer base is varied, including some 30,000 domestic customers located in both towns and rural communities, as well as industrial customers, most notably United Kingdom Atomic Energy Authority (UKAEA).

Caithness currently has three separate water treatment works at Calder/Hoy, Shebster and Toftcarl, which serve Thurso/John O'Groats and southwards to Berriedale, Dounreay and Wick respectively. The area also benefits from an extensive network of trunk mains, which enables water to be transferred around the region to deal with peak demands and bursts or other failures.

Eight water treatment works, none of which are inter-connected by trunk mains, currently serve North Sutherland. The majority of the existing works were commissioned in the 1950's and 60's and their condition is generally poor.

Various options were considered during the initial design phases of the project but it was concluded that up-rating some or all of the existing works was not a realistic proposal and that the regional scheme provided the most effective and efficient solution to discharge the legislative undertakings. *Delta Scotland*, working as a fully integrated JV, and in close partnership with *Scottish Water* and programme auditors *Mott MacDonald/EC Harris*, are responsible for the design and construction of this important scheme. To date it has required considerable consultation work with external authorities and the employment of numerous sub-consultants and sub-contractors in addition to the in-house personnel of *AWG Construction Services Limited* and *Earth Tech Engineering*.

## Engineering

The new WTW has a design capacity of 17.5MI/d, based on the average day peak week demand. Higher instantaneous peak demands will occur, but these will be met by storage within the extensive distribution system and future leakage reduction work.

Raw water will be abstracted from Loch Calder, a good quality high yield source, which currently supplies the existing works at Calder/Hoy. Existing infrastructure will be used to convey water to the new WTW but improvements to the existing intake include the provision of mechanically raked fine screens and extension of the draw-off point further out into the relatively shallow loch.

## Automatic flow control

The plant operators will set the abstraction rate from the loch but flow into the works itself will be controlled automatically depending on demand from the five outlying service reservoirs to be fed from the plant. Incoming flow passes through the inlet turbine with spent water passing forward into the works or overflowing as compensation water to the River Thurso.

Two flash mixers are used to aid lime and alum dosing for pH correction/coagulation before flow passes via eight flocculation tanks into the DAF cells (4 No.) then into the rapid gravity filters (5 No.). Floating DAF sludge is removed by decanting and passes to the dirty washwater tanks (2 No.). Each rapid gravity filter comprises a plenum floor with dual media (sand/anthracite) and central washwater outlet channels. Working on an inlet channel operating band the control system manages filter washing with air scouring and re-grade washes etc. Wash water drains into the same system as the DAF sludge. Filtered water passes through an inter-stage pumping station with sodium hypochlorite being dosed via a static mixer for disinfection purposes. On exit from the twin contact tanks the water will be dosed with lime (for final H correction) and with ammonium sulphate (for chlorination). Final water is held

temporarily in two treated water buffer tanks before being pumped to five existing twin compartment service reservoirs. Dirty washwater is kept in suspense by means of submersible mixers and is then pumped into two lamellas of *Earth Tech design*. Supernatant water is returned to the front of the filters and thickened sludge is pumped to the sludge dewatering facility, which will be installed in the extra pressure filter works. Two storage tanks will be constructed as part of the advance works and sludge produced during commissioning will be treated in a temporary system, whilst the permanent sludge press is installed once the existing works is taken out of supply. Surge suppression systems are provided on the majority of outlet mains some of which operate at working pressures of up to 16 BAR and run for over 20km. The treated water will then be distributed throughout Caithness including Thurso and Wick by the existing network of trunk mains and service reservoirs.

## 80kms of pipeline

To allow closure of the small treatment works in North Sutherland, over 80km of pipeline ranging from 250mm ID to 75mm ID will be laid from the new WTW through to Tongue. The first leg of this new pipeline transfers water to Shebster SR, which supplies Dounreay, and also from which the 'North Coast Pipeline' runs westwards to Tongue. These booster pumping stations and two service reservoirs (twin compartment steel tanks) will be provided as part of the pipeline works.

## Programme & commissioning

Detailed design commenced mid 2001, with pipelaying starting on the first section of pipeline in November 2001. Working around the numerous environmental constraints, bird-nesting season(s), river crossings and the variable terrain, pipelaying continued through 2002 and is due for completion in early summer 2003. Work on the main WTW started in March 2002, when extremely wet ground conditions were encountered. Structural steel erection and cladding is due for completion in mid April 2003, at which stage the mechanical installation will commence in earnest, closely followed by the electrical installation works. Work on the intake screens at Loch Calder should be complete by late spring, allowing them to be put into service to initially improve operation of the existing Calder/Hoy works. Commissioning of the main works will commence towards the end of the year, with the intention of going into supply in March 2004. At this time the remaining sludge dewatering work will take place, allowing a full take-over in August 2004.

It is anticipated that the North Coast Pipeline will be put into limited service by autumn 2003, initially using water from one of the existing works, before final connection to Loch Calder WTW in March 2004.

This is a major project where the names of almost all the major partner have changed. The Employer's name has changed from *North of Scotland Water Authority* to *Scottish Water*, the design and build JV contractor has changed its name from *Delta North* to *Delta Scotland*, and of the two JV partners *Morrison Construction* and *Earth Tech Engineering*, the former has changed name to *AWG Construction Services Limited*.

One of the most notable changes during the design and construction period has been the formation of *Scottish Water*, which has seen a relatively smooth transition for this scheme in which the majority of project staff have remained in post.

**However, with all these changes of name, the aims of the project team have remained constant - to deliver improved quality drinking water to the northeast corner of the UK mainland. ■**

**Note.** *The author of this article, Adam Bateman, is Project Manager for Delta Scotland, a joint venture between AWG Construction Services Limited and Earth Tech Engineering Ltd.*