Langford recycling scheme

new works recycles wastewater to augment river water

by C.D Herring

Essex & Suffolk Water, part of Northumbrian Water Ltd., supplies drinking water to over 1.7 million customers of which 1.4 million are located in the Essex supply area. Essex is the driest county in the UK and needs to import 50% of the water it requires. To determine the best water resource option to meet present and future demand requirements, demand management initiatives, and new water resource schemes were considered. Adjacent Langford an existing pipeline transports wastewater from Chelmsford sewage treatment works and discharges it into the tidal River Chelmer near Beeleigh weir. An opportunity to recycle wastewater was identified at Langford and a pilot scheme was trialed which proved successful. Recycling was demonstrated to provide sufficient water sustainably, quickly and cost effectively with minimal impact on the environment. This innovative scheme is thought to be the first large scale example in the UK of planned indirect reuse of recycled wastewater.

Biofor plant *(courtesy Essex & Sussex Water)*

The Environment Agency issued a discharge consent in April 2000 to enable Essex and Suffolk Water to discharge a maximum of 40Mld of recycled wastewater to the River Chelmer. Planning permission for the scheme was granted in July 2000.

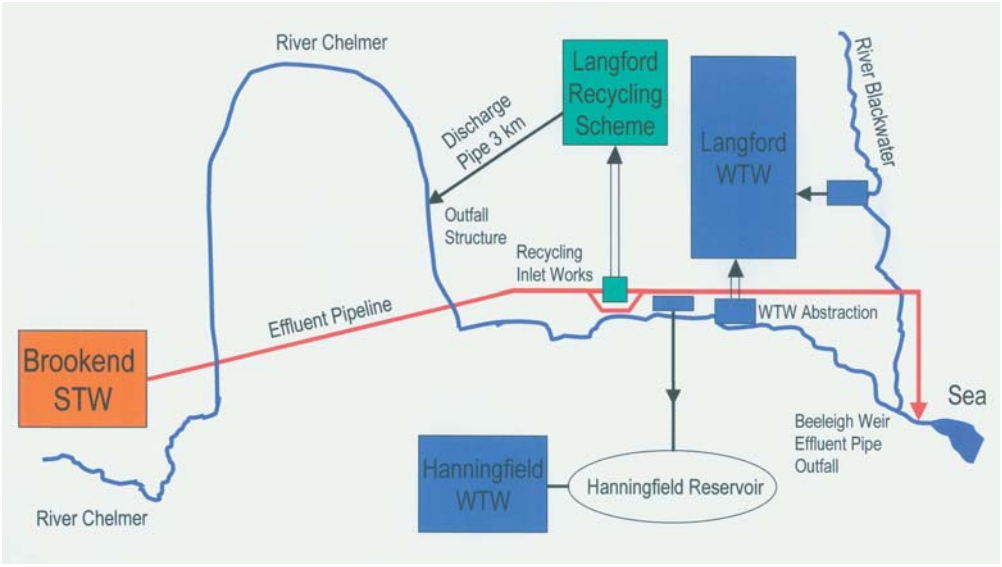
Scheme overview

The recycling scheme will use wastewater from the sewage works at Chelmsford from an existing pipeline. The Recycling Plant will remove nutrients (phosphates and nitrates) and disinfect the waste water to a high standard for discharge into the River Chelmer. The recycled water will add to the flow in the river and will allow more water to be abstracted from the river downstream of the discharge point. This water will then be pumped either into Hanningfield reservoir or Langford WTW raw water reservoirs for subsequent treatment to provide potable water.

Scheme & process elements

Inlet storage , screening & pumping plant

Wastewater from Anglian Water's Chelmsford sewage treatment works is discharged into a pipeline that runs adjacent Langford



Schematic overview of the project *(courtesy Essex & Sussex Water)*

WTW. A series of diversion chambers have been constructed around the pipeline to enable interception and control of flow in the pipeline. A feature of the interception chamber is a weir and auto penstock which allows storm flows to pass the new works. The flow is screened and then pumped by two submersible pumps from the inlet works to the densadeg clarifier.

Densadeg clarifier

The densadeg clarifier removes phosphates by chemical precipitation and consists of three elements. The effluent flow enters into a flash mixing chamber where ferric sulphate is introduced. Flow then enters a flocculation chamber where polyelectrolyte and recirculated sludge is mixed with it by a turbine mixer. The final element is the main settling/clarification chamber where the flocculated solids are settled to be drawn off by sludge pumps and then pumped to the chemical sludge storage tank. The final clarification is enhanced by lamella packing. The flow then gravitates to the Biofor DN filters.

Biofor DN Filters

The plant has three Biofor DN upflow filters of 28.4m^2 surface area filled with expanded clay media to a depth of 3m. These remove nitrate from the flow by a biological process. Methanol dosing is introduced in the common inlet line to the filters to feed the biomass residing in the media. The flow from the outlet channel gravitates the Biofor N filters.

Biofor N Filters

The three Biofor N upflow filters of 73m^2 surface area are filled with expanded clay media 2.9m in depth. The filters remove ammonia from the effluent flow. The biomass uses Ammonia & BOD in the effluent and the oxygen in process air to produce CO2 nitrates and additional biomass.

UV disinfection system

The final treatment process is UV disinfection to kill harmful bacteria. A *Wedeco* system has been installed which incorporates two banks of UV reactors to achieve the required removal of coliform and E coli.

Outlet pumping station

Submersible pumps are installed to pump the wastewater to the outfall chamber and into the River Chelmer. Alternatively the wastewater can be returned to the inlet works to be recirculated into the process flow or discharged to the effluent pipeline.

Dirty and clean backwash water tanks

The dirty washwater holding tank is located underneath the densadeg. It contains backwash water from the downstream biological filters. Submersible pumps feed the backwash water to the Dissolved Air Flotation (DAF) plant. The clean washwater tank is located underneath the Biofor DN filters and contains filtered effluent for backwashing both the Biofor DN and N filters.

Sludge treatment

Two separate streams of sludge are produced from the plant. The biological sludge produced is thickened by a Dissolved Air Flotation plant to 5% dry solids and can then either be tankered away or further thickened to 17% dry solids by centrifuge. The chemical sludge produced is thickened to 24% dry solids by plate press and transported to landfill.

Plant control system

The plant is designed to be fully automatic with manual override facilities both locally and on SCADA. The plant is controlled by two Motor Control Centres (MCC) and four Programmable Logic Controllers (PLC). A field bus system links all control and data points.

Environmental considerations

A new site access road was constructed to the works. A landscaping scheme was prepared and planning conditions relating to noise, odours and lighting are to be observed. The site contained protected reptile species and a translocation process was carried out by Essex Wildlife trust. A badger proof fence was erected as a main badger sett was identified nearby.

Project management

A partnering approach was implemented with the following team: *MJ Gleeson Group plc.* civil design and construction; *Ondeo-Degremont Ltd,* process design and MEICA; *MWH,* project management and planning supervisor services; *Faithful & Gould Ltd* - cost management.

Design was carried out by the team and target costs were agreed with the civil and process contractors. ECC Option C contracts were awarded with a gain/pain share element. A partnering arrangement was entered into and work began on site on 5th February 2001. Project completion is expected at the end of October 2002. ■

Note: *The author, Clive Herring, team leader in investment delivery, Essex & Suffolk Water Ltd., wishes to thank MWH, MJ Gleeson and Ondeo-Degremont for help in producing the above paper.*