

New Civil Engineer



The £500M Strategic Pipeline Alliance project offers lessons for the delivery of future water infrastructure schemes. Sotiris reports.

Enhancing water supply resilience is challenging for Anglian Water. The East of England, where it operates, is the UK's driest region and is experiencing considerable population growth. In addition, it has important wetland ecosystems, meaning that it must minimise water abstraction.

The company is focusing on demand management solutions – such as smart meters – and supply-side measures to future proof supplies. Measures include minimising leaks, new reservoirs and water transfer schemes.

Anglian Water's Strategic Pipeline Alliance (SPA) project involves the creation of approximately 330km of interconnecting pipelines. They transfer up to 55M litres of water a day from areas in the north of the Anglian region with surplus water to areas in the south and east with a deficit.

The pipeline network being built is creating a main spine which stretches from Elsham in North Lincolnshire down to Great Horkeley in Colchester in Essex. It is designed to connect with existing and planned infrastructure assets and networks. Work also involves the construction of pumping stations, valve stations and service reservoirs.

The original plan was for the £500M-plus project to be constructed within asset management period 7 (AMP7), between 2020 and 2025.

Even though construction started during AMP7, several factors such as the pandemic, the war in Ukraine, adverse winter weather and more than anticipated planning processes pushed the expected completion of the project into AMP8.

Anglian Water decided to implement Project 13 principles for the delivery of SPA, with Farrans, Mott MacDonald Bentley (MMB), Costa Jacobs working with the company as enterprise partners in the Strategic Pipeline Alliance.

Anglian Water's Strategic Pipeline Alignment

Route Overview

£500m

Approximate project value

330km

Length of pipeline installed

Planning authorities

Number of separate sections of SPA alignment



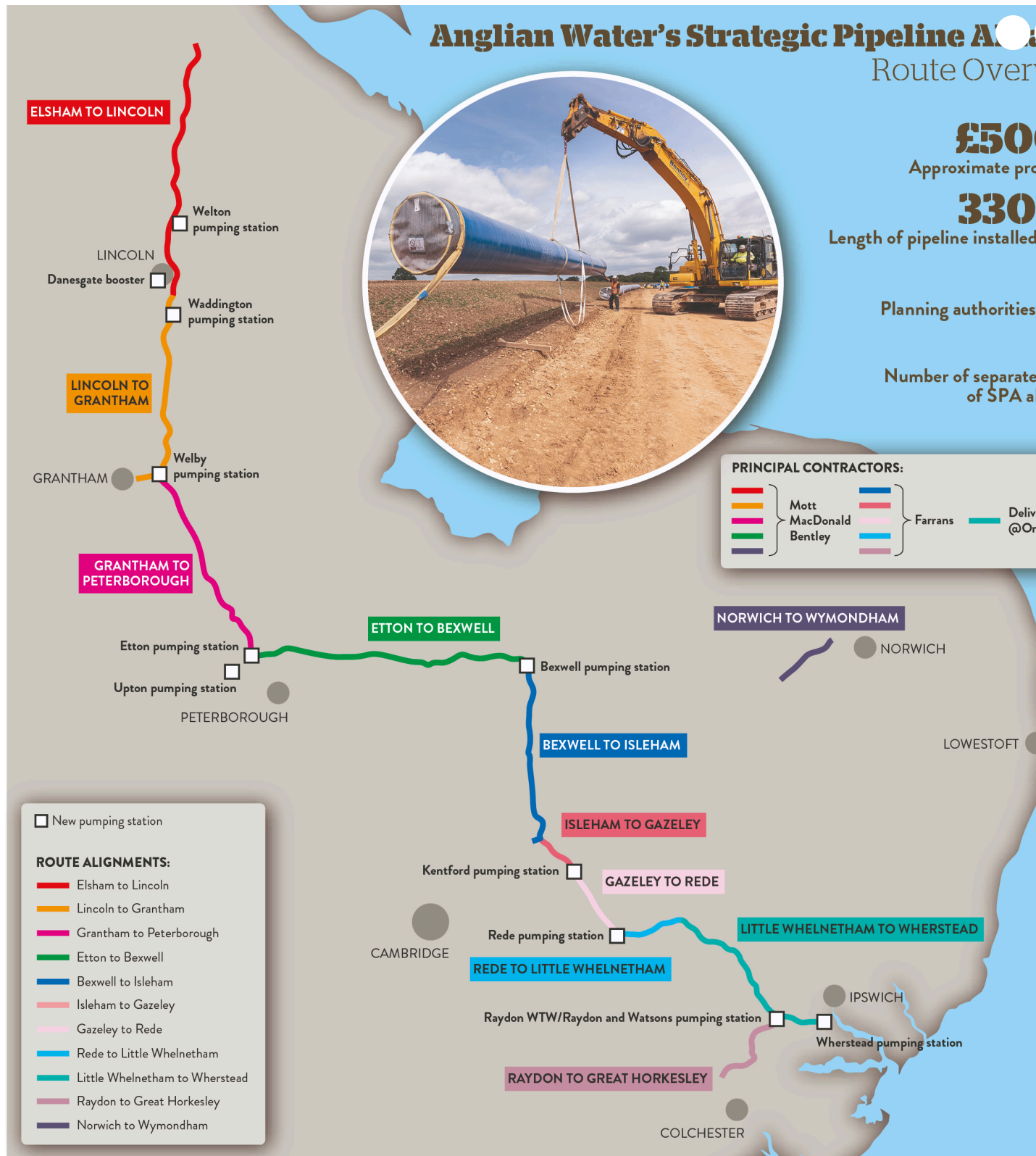
PRINCIPAL CONTRACTORS:

█	Mott	█	} Farrans	█ Delivered @ On
█	MacDonald	█		
█	Bentley	█		
█		█		

New pumping station

ROUTE ALIGNMENTS:

- █ Elsham to Lincoln
- █ Lincoln to Grantham
- █ Grantham to Peterborough
- █ Etton to Bexwell
- █ Bexwell to Isleham
- █ Isleham to Gazeley
- █ Gazeley to Rede
- █ Rede to Little Wheltenham
- █ Little Wheltenham to Wherstead
- █ Raydon to Great Horkesley
- █ Norwich to Wymondham



Progress

Anglian Water head of strategic supply integration Rob Slade characterises the planning process as the project's biggest challenge. He explains that the size of the new pipeline network has meant that 14 planning authorities have been involved and engagement with several planning authorities was necessary for all individual sections.

"Local planning authorities are not set up to deal with infrastructure projects of this scale and size," Slade says. He adds that a lot of pre-work was required before submitting the environmental impact assessments and that getting approvals took longer than anticipated.

MMB programme area manager for SPA's north infrastructure Colin Wilkinson says: "We didn't anticipate the amount of archaeology work that would have to be done as part of the planning applications."

The project did not receive all of its planning approvals until the end of last year. Slade says planning hurdles meant that work could not be carried out simultaneously on as many sites as originally planned.

The SPA network is being built in 11 sections of varying lengths. Even though there is collaborative work across the project, a principal contractor has to be selected for each section to comply with the Construction Design and Management regulations.

Reduction of carbon footprint was a massive challenge put to the alliance from Anglian Water

MMB was appointed principal contractor for the four northernmost sections between Elsham and Bexwell as well as for the Norwich to Wymondham section to the east of the main spine. Farrans was appointed as principal contractor for five sections between Bexwell and Horkesley. The @One Alliance, which has been delivering Anglian Water's wider capital works since 2005, is building the 36km section Little Whelnetham to Wherstead, in the south east of the network.

Construction started in summer 2021 and more than 100km of pipeline had been installed by the end of 2023. Pipe laying activities have been completed in three sections – 34km between Lincoln to Grantham, 12km between Gazeley and Rede and 12.5km between Norwich and Wymondham.

The diameter of the pipes varies according to the volume and pressure of water, as does the material used. Steel pipes with diameters between 700mm and 900mm are being installed between Elsham and Peterborough, while the rest of the network will have 430mm to 710mm diameter high performance polyethylene pipes.

Ground conditions vary along the pipeline route, affecting the depth at which the pipes are laid. The underlying geology of the Fens – at the north end of the Anglian Water region – is a combination of post glacial alluvium and freshwater clays and post Roman marine clays. Moving south the ground transitions to Chalk and further down, Lowestoft Formation, which forms a sheet of chalky till, alongside outwash sand gravels, silts and clays.

“We generally aim for a minimum of 900mm cover, but through the Fens due to the way the ground erodes on an annual basis we are aiming for a minimum of 1.8m cover,” says Farrans programme area manager for SPA's south infrastructure assets Ryan Rogan.

Wilkinson says another characteristic of the ground in the Fens is that “it does not hold up well to water, any amount of rain just sits there” which meant that pipe laying activities for the Grantham to Peterborough section and the Etton to Bexwell sections had to pause last winter.

Rogan says the rainy winter weather meant that pipe laying activities in the southern sections also paused during certain periods but that the team was still able to make progress at some sites.

“The Bexwell to Isleham section is now 50% complete, Isleham to Gazeley about 70%, Rede to Little Whelnetham 50% and Raydon to Gazeley and Horkesley about 30% complete,” he says. The team is aiming to complete pipe laying in these sections by October.

Beyond the main pipeline, MMB programme area manager for non-infrastructure elements Jamie Crosby says good progress on a number of pumping stations is being achieved.

He says that the heavy civil works are being carried out at Etton pumping station, located around the middle of the network as the project moves towards superstructure construction. Superstructure work has already begun at the Bexwell and Kentford pumping stations.



Anglian Water decided to implement Project 13 principles for the delivery of SPA

Efficiency

When the team was looking to find the best route for the network it wanted to keep it as short as possible and took into account the best existing assets. Crosby says the objective was to reduce capital expenditure and operational costs.

Mott MacDonald's Moata digital platform, a common data environment incorporating a geographic information system platform, was used by the Strategic Pipeline Alliance and the supply chain. The platform played an instrumental role in the route optimisation process.

The software enabled the team to analyse layers of data from various parties, revealing opportunities to reuse tens of kilometres of existing pipework and identifying where shorter routes were practical.

Moata's route optimiser tool was valuable for refining the pipeline network's vertical profile, navigating hills to minimise total height gain and gradient. This has enabled substantial reductions in anticipated pumping demand and associated energy use.

According to MMB, the software contributed to a 22% reduction in total pipeline length and to the repurposing of 67km of existing pipe.

It also reduced total pumping energy demand by 26% and cut the need for new water storage capacity by 65%. These efficiencies contributed to carbon reductions of 200,000tCO₂e compared to the original estimate.

"Reduction of carbon footprint was a massive challenge put to the alliance from Anglian Water," says Rogan. As examples of carbon reduction efforts, he cites the use of hydrotreated vegetable oil fuel, solar powered welfare units and CCTV system and maximising the length of trench sections.

"Instead of welding standard 12m or 14m lengths, we are welding up to 18m lengths. This means less transport and fewer welds, further reducing carbon," he explains.

Reprocessing material from trench excavations is another way the team reduced the carbon footprint and cost. When the ground material is suitable – like the Lowestoft Formation – an onsite crusher processes it into smaller aggregate that meets the specification for pipe bedding, removing the need to import material.

The alliance also tested efficiency gains that could be achieved through the use of the pipe plough method.

Laying large diameter pipe usually involves excavating a trench, placing bedding material then the pipe, and finally backfilling. Pipe ploughing uses a blade to cut a slit in the ground and the pipe is laid in the cut as the plough advances, with the ground closing up immediately behind.

A pipe plough was trialled when the team laid polyethylene pipes up to 500mm in diameter at a depth of 2.5m at the Norwich to Wymondley section. Crosby says this “pushed the boundaries in terms of its use” as in the past it was only used for smaller diameter pipes.

“It is quicker, it requires less equipment and by default is far more cost effective,” says Wilkinson. Tests proved that the plough could run in a straight line and level, while it saved an estimated 200tCO₂ compared with traditional methods.

“In the right conditions, we can lay up to 2km of pipeline a day using the pipe plough,” says Mott MacDonald Bentley SPA operations manager Andy Holt. “This compares with around 1km a day using a pipe trencher and 150m to 200m a day with open excavation”.

Although the trial was successful, Crosby says it is not a “silver bullet”.

“You have to apply engineering judgment as to whether it can be effective and efficient,” he adds, explaining that ground conditions and the type of pipe material used are parameters to be considered.

Wilkinson says there are no plans to use this technology again in the SPA project but that it will be an option for future projects when the conditions are right.

The SPA project is expected to be completed in 2027, according to Slade, who emphasises that there are more large projects in the pipeline as water transfer schemes and reservoirs.

He says lessons about planning and the use of digital solutions from this project will help the company in the delivery of these major future projects.