

Exeter Link Main

3,700 properties in Topsham and Exminster benefit from a secure and higher quality water supply

by Dave Raw

The Exeter Link Main is a 3km water mains installation scheme, running from Pearce's Hill, Exminster, to Exeter Road, Topsham, in Devon. This scheme crossed beneath the M5 motorway, Exminster bypass, River Exe, Exeter Shipping Canal and a Site of Special Scientific Interest, Special Protection Area and Ramsar site (wetlands of international importance). This required close liaison with both archaeological and ecological agencies and various other stakeholders in the area. The construction work undertaken was comparable in a sense to keyhole surgery, with the team able to carry out the required work without causing major disruption. This paper examines the many challenges the design and construction team overcame to provide a sustainable and environmentally friendly approach to the operational plans.



The project need and options

The object of this project was to provide circa 3,700 properties in Topsham and Exminster with a secure and higher quality water supply.

One option was to rehabilitate the existing water mains, which would have required working along major commuter routes and through the recently reconstructed city centre. Such a project would have caused major traffic congestion, heavily disrupting motorists, and CO₂ emission levels would undoubtedly have increased around sites. In addition, the numerous highway excavations required on such an undertaking would have meant the use of landfill for waste and quarried materials for reinstatement, which would be non-sustainable, costly and open to public criticism.

The chosen option was to run a new 3km pipeline starting at Pearce's Hill, Exminster, and finishing on Exeter Road, Topsham.

Route selection

The design and construction team overcame many challenges to provide a sustainable and environmentally friendly approach to the operational plans, such as negotiating restricted working areas and finding routes around complex natural hazards, including the Exminster floodplain. Several routes were investigated in the first instance and disregarded due to the level of risk or insurmountable issues. When the final route was settled on it was not without its own difficulties that were to prove challenging to overcome:

- 3km of 355mm diameter SDR 11 polyethylene pipe.
- 2 (No.) 740m horizontal directional drills using recycled gas steel mains as the host pipe for the 355mm diameter SDR11 polyethylene pipe.
- Guided auger bore under railway.
- Chain trenching (Exminster bypass).
- Open cut.

Preparation

Balfour Beatty Utility Solutions (BBUS), who were working in partnership with South West Water to deliver the company's distribution activities throughout Devon and Cornwall from 2005 to 2010, were appointed main contractors for the project. Before the scheme commenced, BBUS held lengthy consultations with the following stakeholders:

Royal Society for the Protection of Birds (RSPB), National Grid, Network Rail, Devon County Council, Environment Agency, Devon Wildlife Trust, Exeter Archaeology, Ambios Ecology, Natural England, Marine and Fisheries Agency, Exeter City Council Rivers and Canals, private landowners, environmental health officers and the Secretary of State for Transport.

As these works involved major river and canal crossings under the River Exe and Exeter Shipping Canal, consultation with The Crown Estate was also essential.

The working corridor

After consultation with stakeholders, all ecologically sensitive land had boundary fences set up around the exclusion areas, providing teams with a working corridor on private land that gave operatives little space for storage and dictated that care must be taken. To ensure that everything was accounted for, an in-depth ecology survey was carried out by Ambios Ecology and a data search was commissioned with Devon Biodiversity Records Centre.

The information obtained from the field survey and data search allowed an assessment of the likely impacts of the work on the following:

- Ecologically important habitats.
- Specially protected animal species.
- Badgers.
- Invasive species.
- Hedgerows of biological value.
- Plant species of significant nature conservation value.
- Nesting birds including curlew and wintering waterfowl.
- Water features with ecological value.
- Bats and dormice.

This highlighted several areas needing attention, recommendations or mitigation:

Species-rich un-grazed, unimproved grassland: Topsoil stripped and stored separately to excavated materials. Replaced in-situ on completion of the works.

Slow-worm habitat: Re-routed pipeline to the carriageway (Exminster bypass), therefore avoiding entry into habitat area.

Numerous open draining ditches: 7m buffer zone adjacent to the ditch, in which no work, including the tracking of machinery or the storage of materials, would take place.

Exe Estuary - Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA): Mitigations and recommendations included:

- Horizontal directional drilling (HDD) trenchless technique chosen to reduce impact.
- HDD machinery set up in Newport Park outside the SSSI, exit location in grazed marsh within SSSI.
- Formal notice served with Natural England and consent granted.
- Advice sought from the Environment Agency with regard to accidental impacts arising from the storage and handling of solid and liquid materials during the course of works.



M5 viaduct - Courtesy of BBUS



Sound baffling fence erected to deaden sound for residents in Newport Caravan Park - Courtesy of BBUS



Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA) - Courtesy of BBUS



Grey Heron & Little Egret on Exminster Marsh SSSI - Courtesy of BBUS



Semi Mature Moribund Oak Protected from works activities
Courtesy of BBUS



Ground guard system used to protect Newport Park, an environmentally sensitive area - Courtesy of BBUS



Chain trencher - Courtesy of BBUS

Semi-mature moribund oak dominated semi-natural broadleaved woodland: Mitigations and recommendations included:

- Bat survey commissioned.
- Any excavations required under the tree canopy would be dug by hand, preventing damage to roots and avoiding soil compaction by heavy machinery.

The Old Sludge Beds - Devon Wildlife Trust Nature Reserve: As the main must pass through this area, installation took place using trenchless directional drilling technology.

Mosaic of reed bed, semi-natural broadleaved woodland, scrub and dense bramble all immediately adjacent to the boundary of Exe Estuary SSSI/SPA: As main must pass through this area, installation took place using trenchless directional drilling technology.

Badger sett (Newport Park): 30m fenced exclusion zone around sett.

Implementation

All of the previous special requirements, along with the tailored mitigations/requirements, were delivered to all personnel and subcontractors during their site induction and subsequent tool box talks.

The BBUS and South West Water teams working on this project were dedicated to minimising disruption to customers and the environment. Due to the sensitive nature of the project, BBUS utilised specific construction methods adapted to suit the environmental challenges, including horizontal directional drilling and guided auger bore, bog matting, chain trencher and track way systems, all with the aim of protecting marsh fields and environmentally sensitive areas. Furthermore, the impact of the works on local residents was considered. For instance, a fence was erected to lower the decibel rating for residents living in the adjacent Newport Caravan Park. Additional sound baffling was also erected around the drilling rigs generator.

Engineering difficulties

BBUS engineers faced two particularly problematic issues on this scheme:

- Crossing the Penzance to Exeter mainline railway (specialist auger bore beneath two tracks).
- Directional drill 2 (No.) 740m of welded steel recycled gas pipes beneath the M5 motorway bridge, River Exe and Exeter Canal, which is believed to be one of the oldest shipping canals in England.

Chain trencher

BBUS chose to use a chain trencher in the carriageway along the Exminster bypass. Although it was more expensive, it was a much quicker technique when compared to the conventional open-cut.

This avoided the identified slow-worm habitat in the wide verge and, secondly, enabled waste from the trenching operation to be recycled locally and reused to form the temporary roadway base at Newport Park. This temporary roadway was constructed with the topsoil being stripped and stored for final reinstatement. Terram was used to cover the subsoil, and the layer of Terram was then covered in recycled, cleaned stone from the trenching operation in order to form the base of the roadway. This was then covered with another layer of Terram and topped off with the ground guard system. This process was completed to enable 40-tonne lorries to access the site safely. The roadway was removed and the stone sent for recycling prior to final reinstatement of the land.

As part of this process, arrangements were made to reduce travelling miles and to improve logistics. As such, the location of the fusion tent was carefully planned and pipes were delivered direct to site.

All pipes were butt fusion welded, reducing the risk of future leaks often associated with using conventional type mechanical fittings.

Innovation

Allen Watson was our chosen specialist for the HDD operation, and they were able to supply a mud recycling unit to accompany their drilling rig. This unit is used to recycle the bentonite clay and mud from the drilling bore, and by recycling these materials the quantity of waste earmarked for landfill (plus associated transportation) was reduced. This unit also helps to reduce the expense and use of new bentonite clay, adding a more sustainable dimension.

Archaeology

As with all schemes undertaken, Devon County Council archaeologists were consulted at the very early stages of design. It was agreed that, due to the location of this scheme, an archaeological watching brief would be required for all excavations. The watching briefs were undertaken by Exeter Archaeology. The flood plain area is geologically made up from river and marine alluviums. In the past this area has revealed preserved ancient leather and wooden artefacts. None of these items were found, although an old brick-built kiln was discovered in Newport Park whilst soil stripping. The kiln location was recorded and photographed and covered with sand and Terram for future preservation.

Conclusion

All phases of these works were completed according to plan, in spite of the complex environmental issues. The water mains were constructed efficiently and economically, with minimal disruption to the environment, wildlife and customers. This was achieved through great efforts by the site teams, sub-contractors, suppliers and the close working relationship with South West Water and relevant stakeholders.

Comprehensive planning and an innovative approach to issues across this ecologically sensitive area ensured that sustainability and environmental issues were embedded into the design of the scheme at every stage of planning. The timing and duration of the scheme also met with the RSPB's request not to affect the nesting pattern of the wildfowl on the reserve adjacent to the project.

The installation method choice of horizontal directional drilling ensured that the pipeline was installed without destructive excavations/trenches being dug through the SSSI, Ramsar site, nature reserve, River Exe and canal, thereby ensuring that the scheme met the high-quality environmental criteria that were established at the outset.

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Horizontal directional drilling rig - Courtesy of BBUS



Mud recycling plant - Courtesy of BBUS



Milbury Lane prior to excavation - Courtesy of BBUS



An example of final reinstatement: Milbury Lane after pipe installation
Courtesy of BBUS