

# Horden Passive Mine Water Treatment Scheme

## a collaborative partnership delivering a sustainable solution to the legacy of mine closures on the North East coastline

by Tracey Davies, Peter Long and Rob Dunn

The Horden passive Mine Water Treatment Scheme (MWTS) replaces an existing active MWTS originally built in 2004 to address an urgent need to control rising mine waters and provide valuable information for the development of a long term mine water control strategy in East Durham. Completed in June 2011, the £1.4m passive scheme now offers a sustainable solution to the legacy of mine closures on the North East coastline. It eliminates the need for the existing active plant – where chemicals are added to the mine water – and instead uses a passive system whereby ochre is allowed to settle out from the mine water without the need for such chemicals. The scheme has also enhanced the existing landscape with the provision of water features and reed beds that are open to the public to walk around – offering an aesthetically-pleasing foreground to the North Sea.



Final trimming of earthworks to reed beds (photograph taken by an enthusiastic local hang-glider) - Courtesy of JN Bentley

### Background

The mass closure of collieries in the area in the early 1980s resulted in the cessation of pumping of mine water from the underground workings. As a result, mine water in the abandoned workings recovered, posing a threat of contamination to the overlying aquifer – a significant asset for potable water abstraction supplying the Sunderland area.

The original active mine water treatment works was constructed in 2004 and is located to the west of the new passive treatment works, on Horden's former colliery site. At the time of its construction, the active works served to both address an urgent need to control rising mine waters whilst a permanent solution was developed, and provide valuable information key to the development of a long-term strategy to control rising mine water in East Durham.

### Engineering success: a sustainable solution

The new scheme continues to prevent irreversible pollution of the East Durham magnesian limestone aquifer – and adjacent coast – by iron and chloride rich mine water.

Additionally, the passive MWTS, which involved the construction of two settlement ponds and two wetland areas, together with an associated supply pipeline, inlet and outlet structures and landscaping works, provides Horden with a long-term natural treatment process that avoids the use of chemicals to treat the mine water.

The water is intercepted below the critical input to the aquifer and diverted through the passive treatment scheme before being discharged to sea. The aquifer provides 36 million litres/day of drinking water to Sunderland and surrounding communities.

The passive treatment scheme eliminates the need for the existing active plant and the use of chemicals to treat the mine water - the ochre is allowed to settle out from the mine water naturally.

The new scheme is also designed to allow increased quantities of mine water to be treated, ensuring that the level of water within the old mine workings is maintained, thereby preventing any future outbreaks of ochreous water from the network of mine workings.

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Horden Passive Minewater Treatment Scheme, County Durham



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In addition to the positive environmental impact, there is a large operational cost saving for the user in eliminating the need for chemicals and minimising the maintenance input for the site.

### Improving the landscape

The location of the new passive scheme is on the site of the old colliery and its associated spoil heaps – these had been moulded in to the landscape and covered in sparse grass and scrub. The new passive scheme has enhanced this landscape with the provision of ponds and reed beds sculptured into the relief of the spoil heaps. Marginal planting has been introduced to the reed beds, offering a wider habitat for flora and fauna, as well as being more visually attractive.

Most of the site is now open to visitors and walkers and the active plant has been decommissioned, partially demolished and reinstated to open grassland. Public access to the area has also been further improved to the lower lying reed bed areas by linking the paths around the reed beds to the existing coastal footpath.

### Environmental benefits

A key driver for the project itself was to improve a number of environmental issues associated with the treatment of mine water. Now complete, the operation of the passive mine water treatment scheme has a number of key environmental benefits:

- It maintains mine water levels below critical levels within the mine workings, preventing pollution of the drinking water aquifer and preventing further outfalls of mine water within the local environment.
- It removes 150 tonnes/year of ochre.
- It has eliminated the need to add chemicals to treat the mine water (the previous active plant required the use of sodium hydroxide to increase the alkalinity of the mine water), saving £100,000 per year. There is also a

huge reduction in water and power usage following the decommissioning of the active plant, which is helping to save £25,000 per year.

- It has used the most sustainable option for mine water treatment – purely natural reed beds that act as a valuable habitat for birds and insects.
- It has been designed to complement the Durham heritage coastline, following extensive discussions with Durham County Council and the Durham Heritage Coast Team.
- It uses all native species (e.g. juniper bushes have been reintroduced to the coastline).

In addition, following the discovery of large amounts of clay, which were not suitable for use as material to line the reed beds, the material was laid on site – a decision county ecologists welcomed as it incorporated an area of poor nutrient soil within the scheme, offering an environment for wild flowers.

Another particularly important feature key to the success of the scheme was the balance of the earthworks cut and fill that was achieved. A careful design of the settlement ponds and reed bed lagoons within the existing ground profiles yielded economic, environmental and aesthetic benefits, primarily because no earthworks materials had to be imported to or exported from site.

### An excellent Health and Safety record

Health and Safety performance at Horden remained exceptional throughout this eight month scheme, with no reportable or lost-time injuries on site. JN Bentley internal audits identified four areas in particular of outstanding best practice: site induction; standard and maintenance of welfare facilities; materials storage; and management of site deliveries.

The team was not afraid to 'challenge' each other if a potentially unsafe condition arose either: they challenged the Design Team



Twin cascades used to aerate the mine water prior to entry into the settlement ponds - Courtesy of JN Bentley



Newly constructed reed beds with landscape islands. This area of the scheme is left open to the public and linked by a footpath to the coast - Courtesy of JN Bentley

to resolve an issue which left a potential trip/fall hazard on long sections of open channel. The design was subsequently amended – taking up suggestions made by the team – and the unsafe condition rectified.

The Coal Authority uses a series of Key Performance Indicators (KPIs) to measure the performance of its contractors – one of which is safety. Their health and safety audits were carried out at monthly intervals, and the team not only met all requirements throughout the eight month scheme, they achieved a 100% score on two separate occasions – something not matched on any other Coal Authority site (average score: 97%). The team's approach to health and safety was recognised by JN Bentley when they selected Horden MWTS as 'Team of the Year'.

#### Minimal disruption

The site at Horden was bounded by a public footpath, so it was vital to inform and update local stakeholders about the works. Scheme information boards were erected and maintained to advise the community of reasons for the works undertaken, how they were progressing, and of the benefits of the finished scheme. The main such benefit is that the new natural treatment process provided by the passive works has improved the landscape at Horden. The areas around the wetlands and reed beds are open for public access, and provide a gateway to the Durham coastline.

The Coal Authority and JN Bentley worked with the Horden Regeneration Group (comprising local councillors and residents), and the scheme was 'highly commended' in a 'Horden in Bloom' submission. There have also been a number of enquiries from local schools who are interested in projects associated with the scheme. The site foreman's excellent work in building relationships with local stakeholders even contributed to him winning JN Bentley's equivalent to 'Employee of the Year'.

#### On target and budget, despite the weather...

Key to achieving the works ahead of programme and below the target cost was the team's approach to working around the weather conditions on this section of coastline. Bulk earthworks were completed prior to the onset of winter and when the weather turned severe, a decision was taken to reduce labour and plant resources on site and focus on isolated works that were able to continue despite the conditions. This significantly reduced costs during this period. Once weather conditions allowed, resources were returned to elevated levels to retrieve the time.

Careful ground preparation, including compaction and trimming, eliminated the need for a sand binding later to protect the pond liner, resulting in time and cost savings. On-site construction time was also significantly reduced by using precast concrete for the cascade and weir plate structures and once at Horden, they just had to be assembled.

#### Summary

The scheme is one of a number of mine water treatment projects being delivered collaboratively by JN Bentley and the Coal Authority. Providing a sustainable solution to the legacy of mine closures on the North East coastline, the partnership has also resulted in numerous additional benefits for the local community and environment.

JN Bentley's work as contractor on the Horden Passive Mine Water Treatment Scheme was also commended for sustainability and environmental issues in the recent ICE NE Robert Stephenson Awards.

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Site overview - Courtesy of JN Bentley