Managing rising mine water to prevent aquifer pollution

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2002: Rising Minewater Levels

Water Level Projections for Sites East of Wear

Projection showing impacts starting from 2004
The Pollution Threat in East Durham

River Wear Inland

Permian Magnesian Limestone Aquifer

Deep Coastal Shaft

Colliery Beach Adit

Carboniferous Coal Measures

North Sea
Key Contaminants

- Predictions made from:
  - Water quality during mining
  - Samples from shafts during rebound

- Iron - up to 200 mg/l
- Salinity - Hypersaline
- Chlorides - 20,000 to 30,000 mg/l
- Sulphate – 3,000 to 5,000 mg/l
Source Protection Zones

Permian Magnesian Limestone Aquifer

c. 36 Million Litres / day abstracted by Northumbrian Water Ltd:

150,000 people rely on this major aquifer for drinking water
Possible Impacts

Aquifer Pollution

Coastal Pollution

River Pollution
Pumping commenced August 2004
Salinity and Iron increase with Depth

Salinity and Iron increase with pumping
Salinity and Iron increase as pumping increase from c50 l/s to c100 l/s.
Hydraulic Control Risks

- Single Roadway Connection
  - Recorded as dammed
  - Currently flowing freely
  - Could become restricted or blocked
  - Horden would not be able to control the whole area.
Proposed Two Site Strategy

◆ Main pump/treat site at Dawdon
  ◆ For hydraulic control North of Ludworth Dyke
  ◆ Dawdon shaft is deeper than Horden
    ◆ Expect worse quality mine water
    ◆ Higher chlorides, iron etc.
  ◆ Active treatment technology to remove Iron
    ◆ 150 l/s capacity

◆ Secondary pump/treat site at Horden
  ◆ Existing 100 to 150 l/s capacity temporary active plant
    ◆ Chlorides high due to high pumping rate
  ◆ Reduce to 50 l/s when Dawdon on stream
  ◆ If chlorides reduce replace with passive plant
    ◆ Settling lagoons and reed beds
Twin Sea Outfall Transfer Pipelines

TREATMENT PLANT

EXISTING SHAFT (PUMPS & CONTROLS)

TWIN SEA OUTFALLS

Cross section of sea outfall
Treatment Layout

1. De-Gassing Tank
2. Stage 1 Reactor
3. Stage 2 Reactor
   - Clarifier

Blower Room

Transformers, Panels and Control Room

Workshop/lab

Polymer Make-up Area

Lime Silo

Lime Mixing Tanks

Sludge Thickening and Disposal (Filter-press)

Outlet Tank

Process water stock
Process Construction

Multi disciplinary project

Over 30 different sub-contractors

Complex programming
Coastal Modelling:

Dispersion Modelling and Sea Bed Survey

Directional Drilling - from cliff top to sea bed
Pumping at Dawdon

Dawdon Starts pumping

Control throughout coalfield confirmed
Preventing Aquifer Pollution by:

2 Active Pump & Treat schemes:
- Horden Temporary
- Dawdon

Final Phase:
Replace Horden active with Passive
- New Lagoons and reedbeds
- Reedbeds depend on decreased Chloride
Salinity and Iron peaked and decreased, as pumping decreased from c100 l/s to c50 l/s.
Reedbeds
Shaft & Cascade
Outlet Point
Settlement Lagoons
Horden/Dawdon Timetable

June 2004  Horden active plant operational

Nov 2008  Dawdon active plant operational 150 l/s
          Reduce Horden rate to ~50 l/s

2010  Commence construction of Horden passive plant

2011  Horden passive plant operational
      Dismantle Horden active plant
Horden Passive forming of lagoon cells
Horden Passive - Lining the cells
Morrains, South Wales at commissioning
Summary

♦ Pumping at 2 sites
♦ Dawdon Active treatment for:
  ♦ High flows of poor quality water
♦ Horden Passive treatment for:
  ♦ Smaller flows of better quality water

♦ Drinking Water Aquifer protected