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Managing rising mine water to prevent aquifer pollution

Dr Ian Watson

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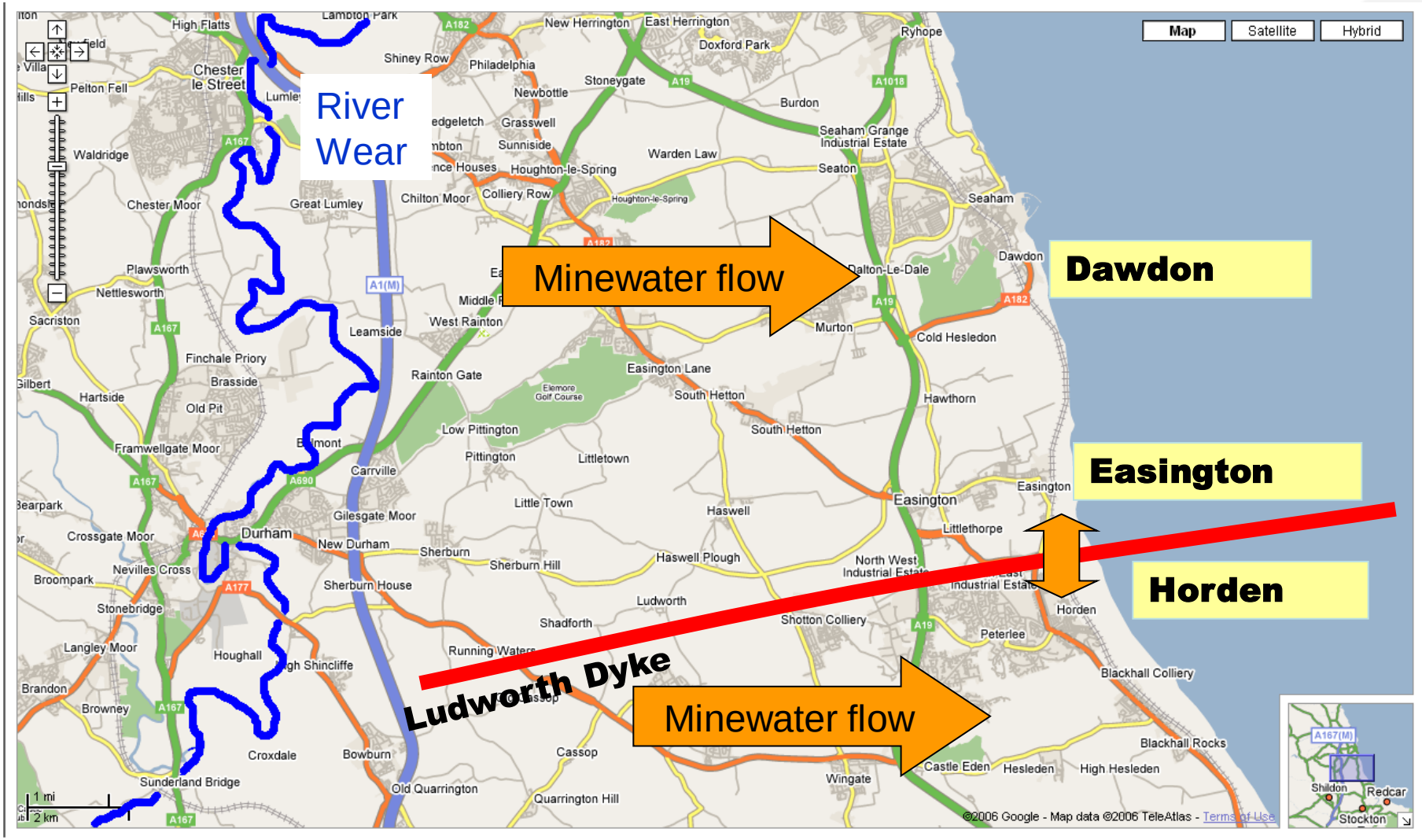
East of Wear Mining Block



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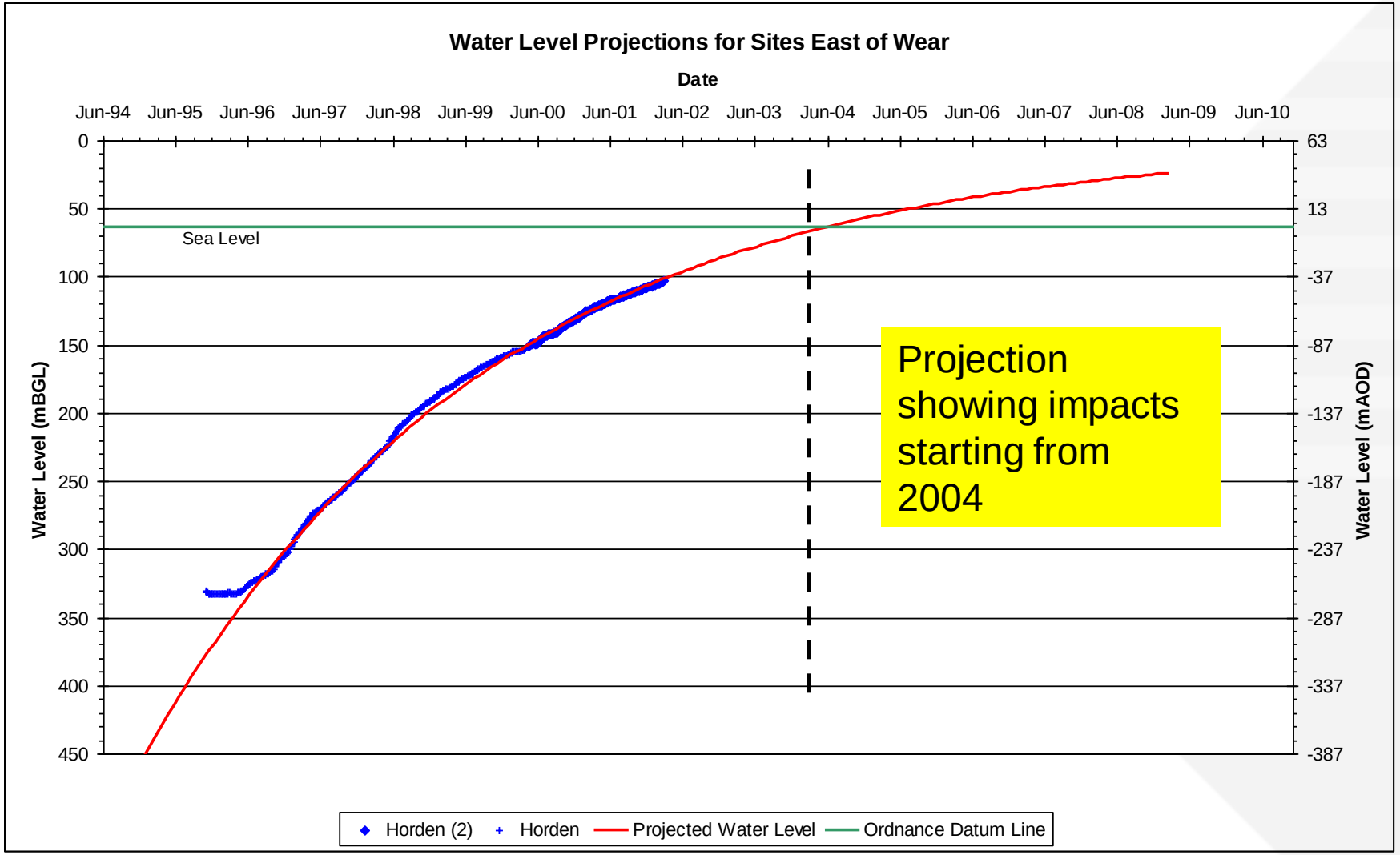
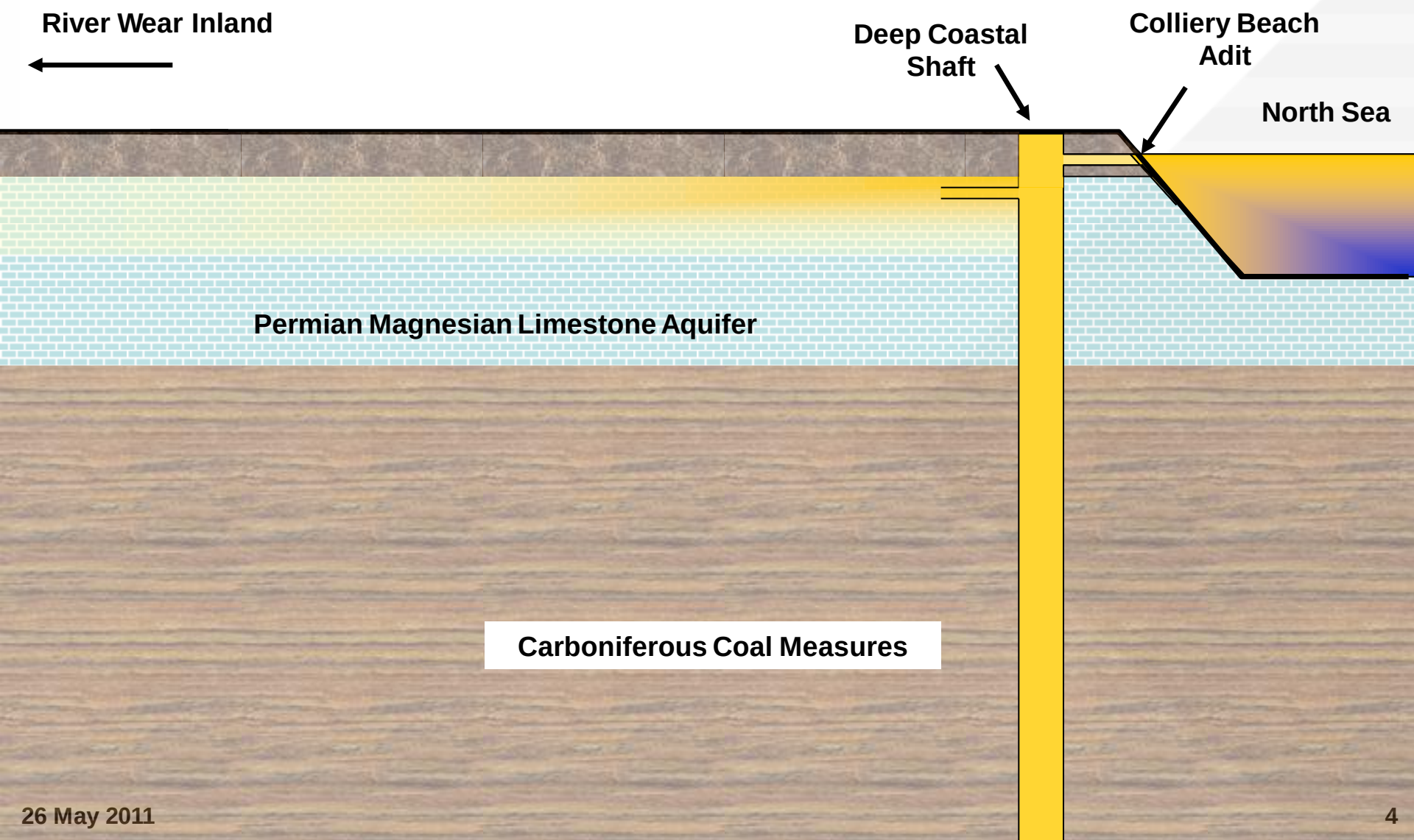
2002: Rising Minewater Levels



The Pollution Threat in East Durham

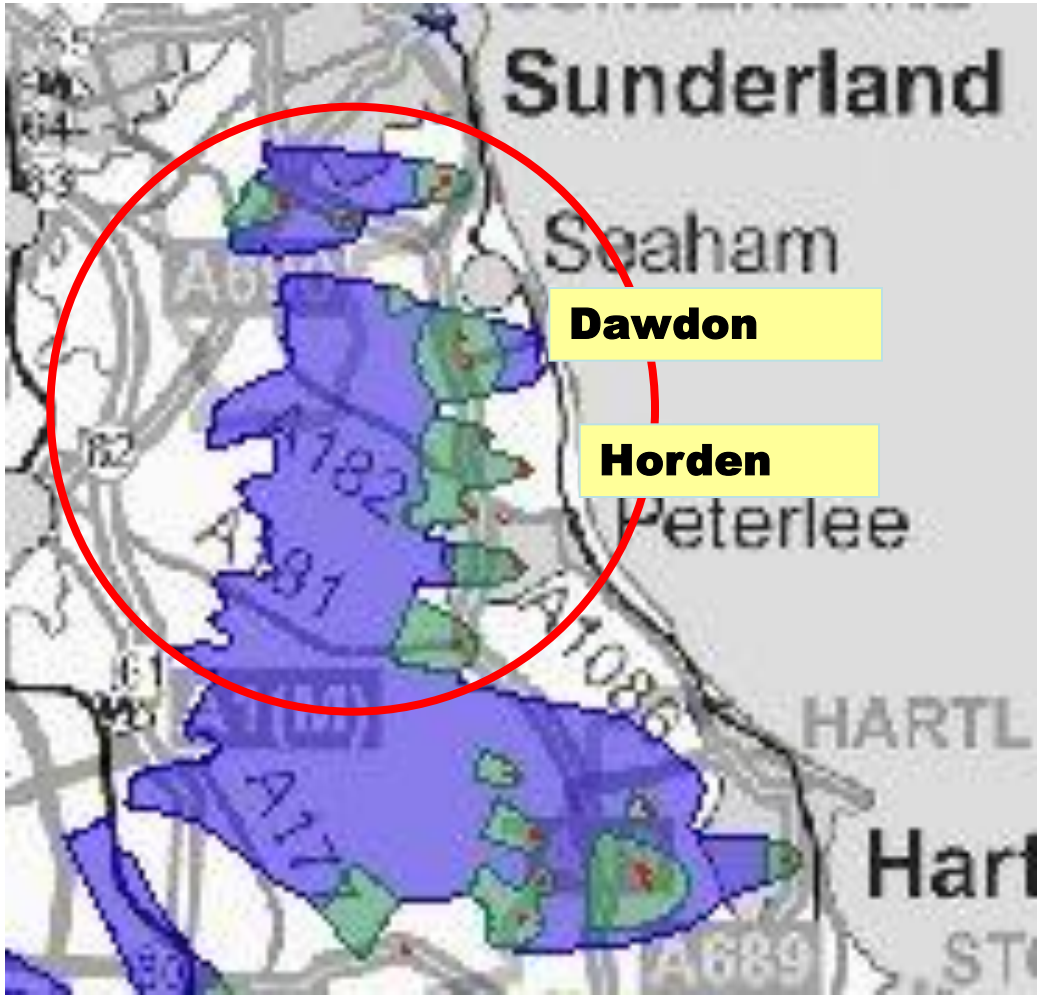


Key Contaminants

- 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

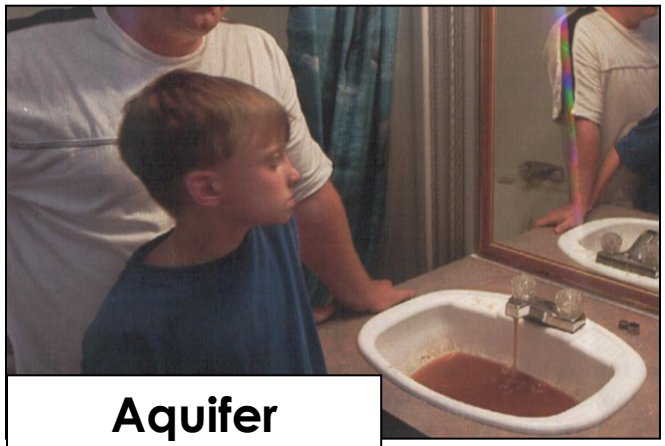


Permian Magnesian Limestone Aquifer

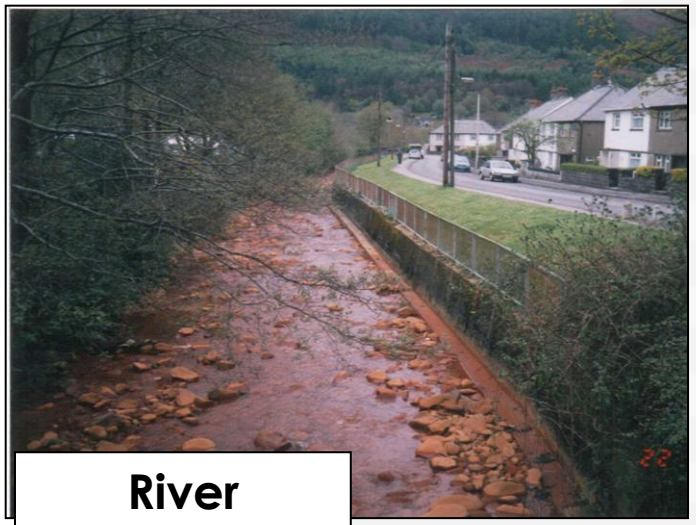
c. 36 Million Litres / day abstracted by Northumbrian Water Ltd:

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

Possible Impacts



Aquifer Pollution



River Pollution

Coastal Pollution

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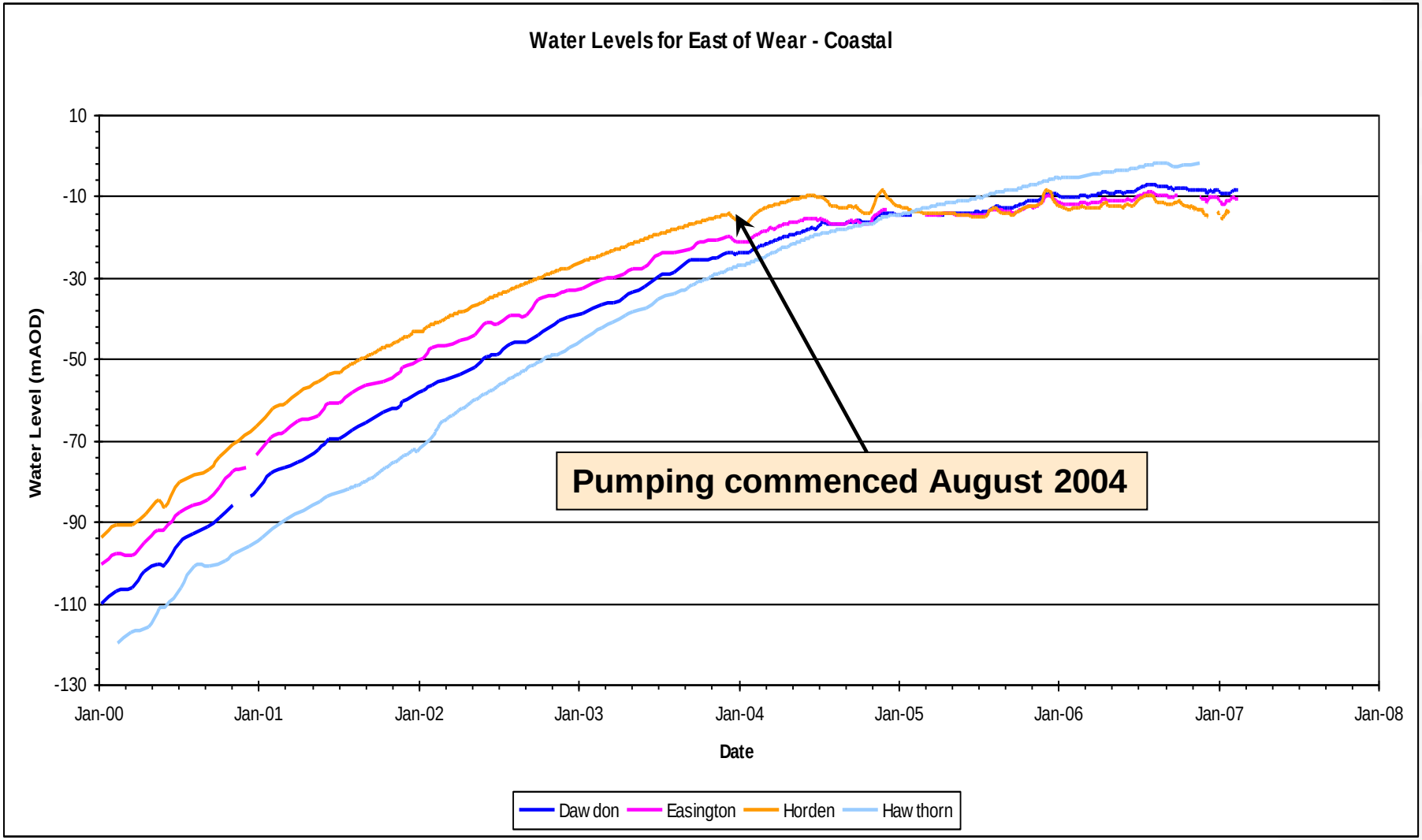
Horden Control of Water Levels



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Horden Temporary Active Treatment Scheme

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Horden Temporary Active Treatment Scheme

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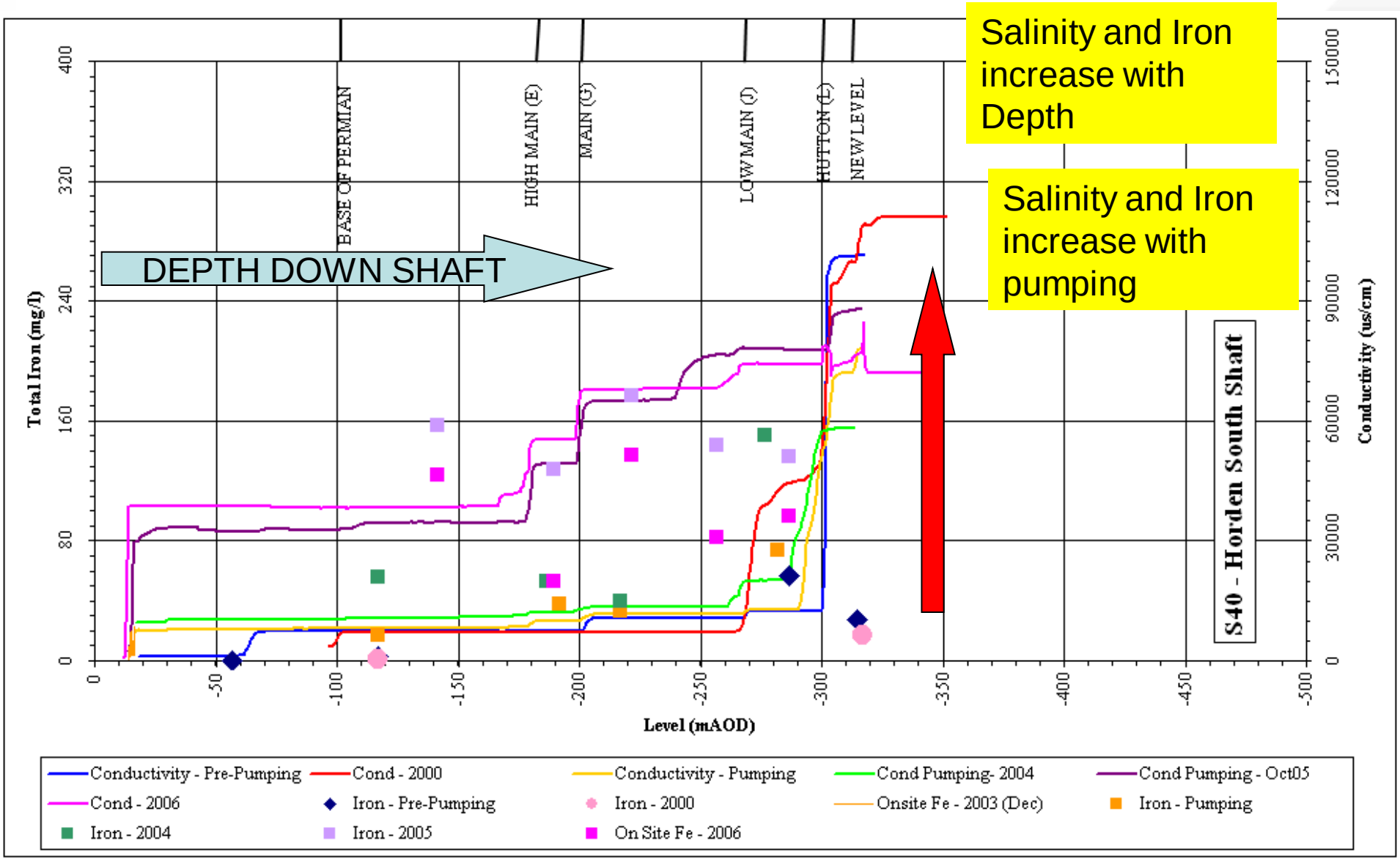
Horden Shaft Water Profile



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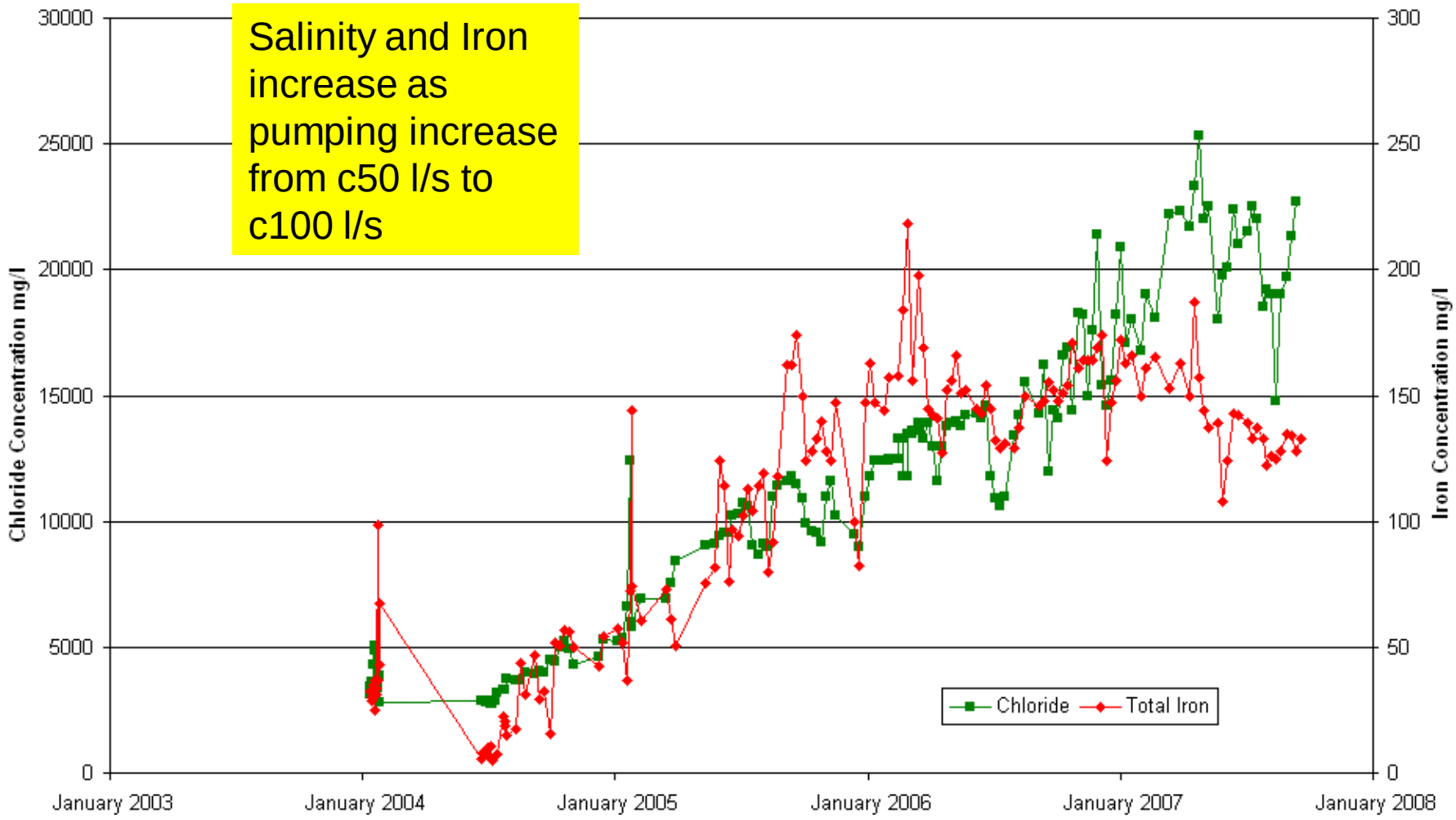
Horden Pumped Water Quality



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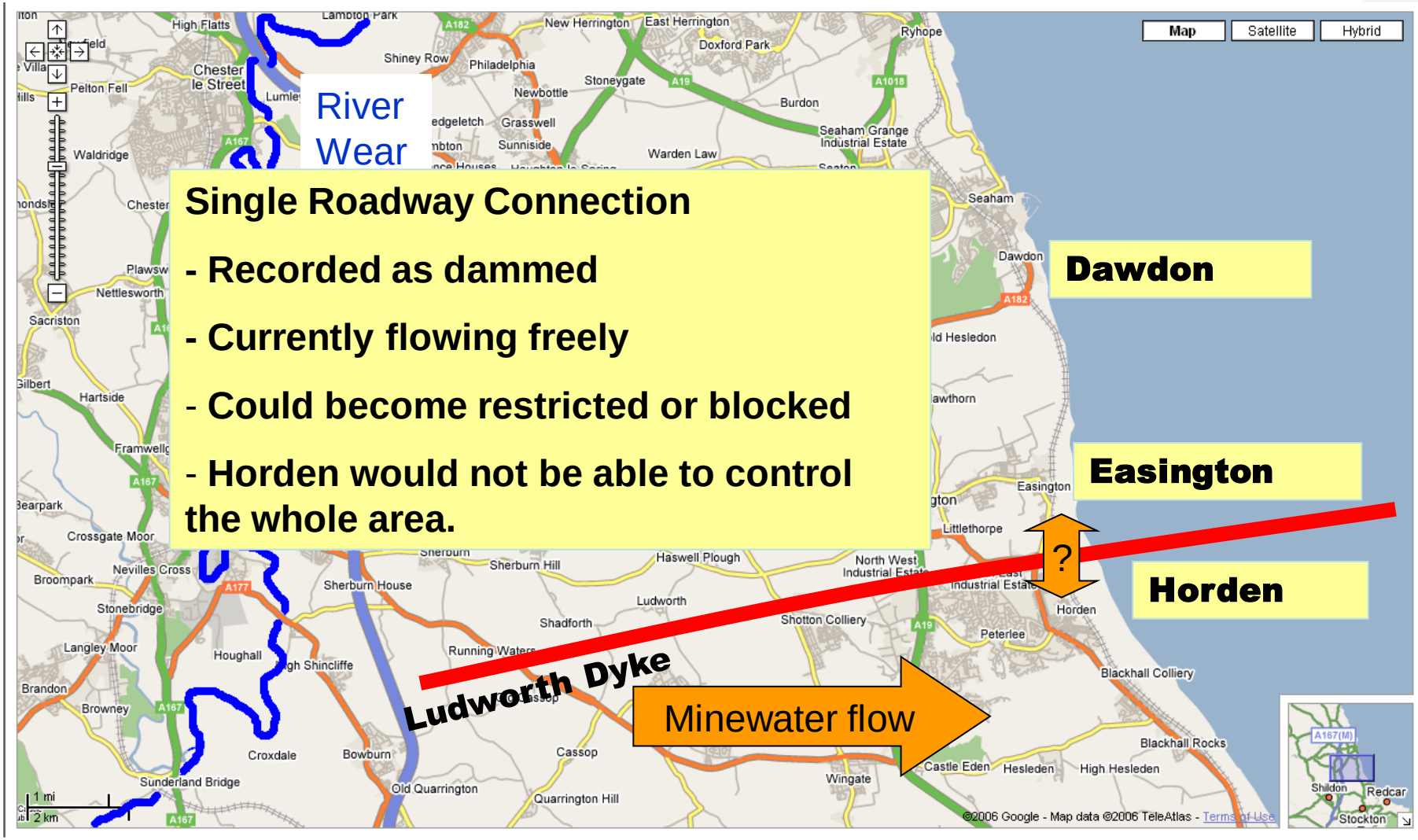
Hydraulic Control Risks



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

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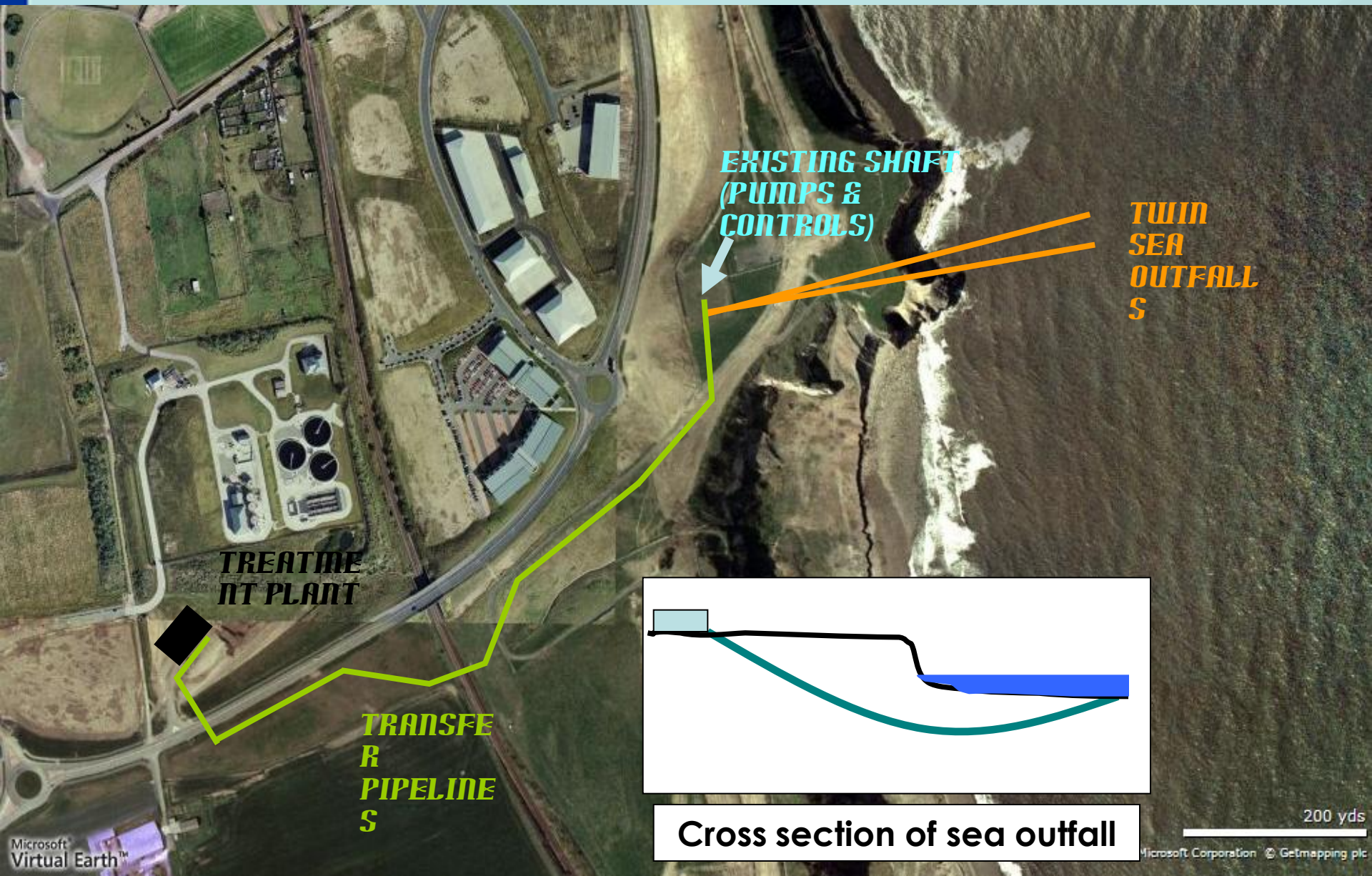
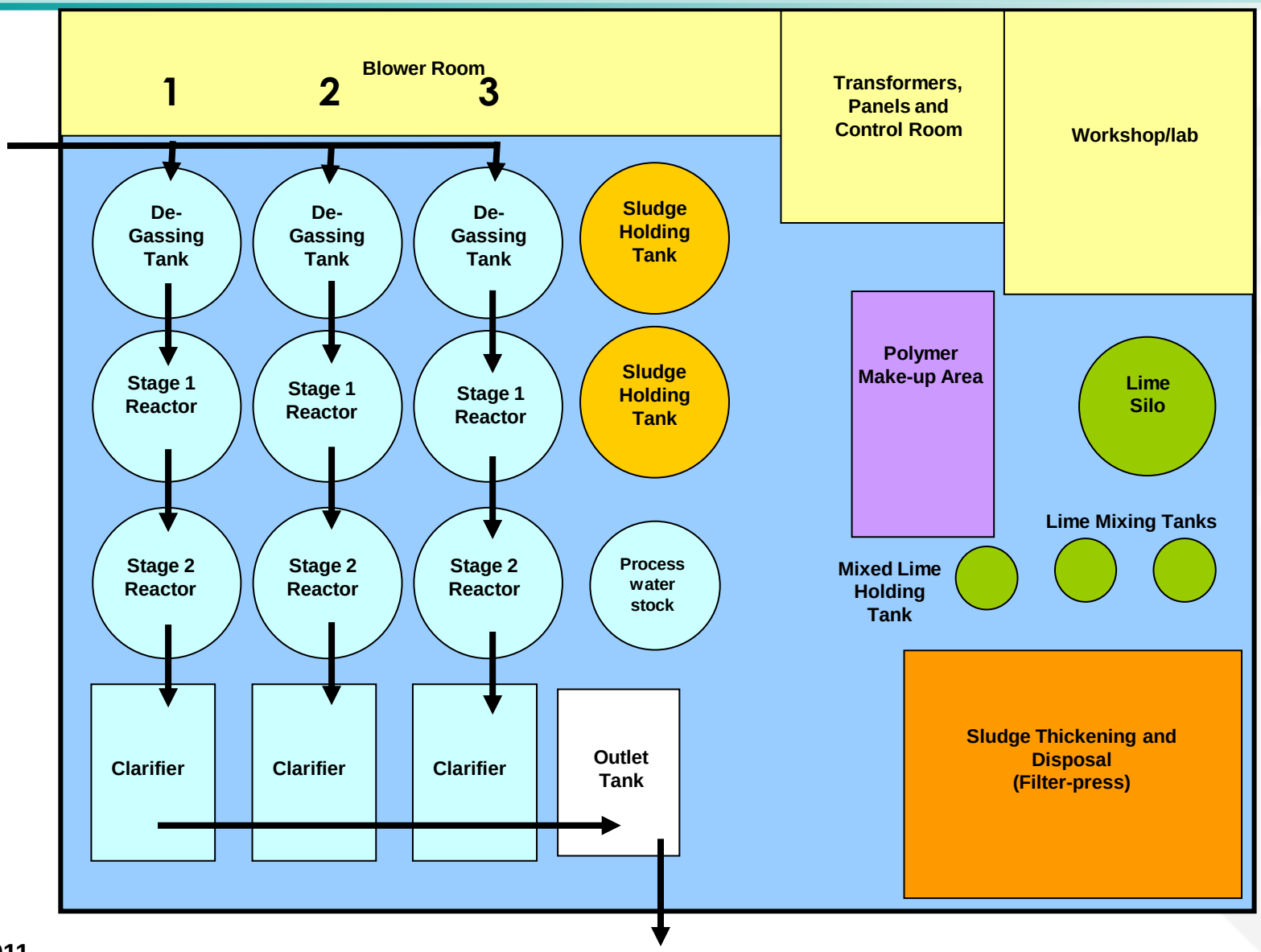
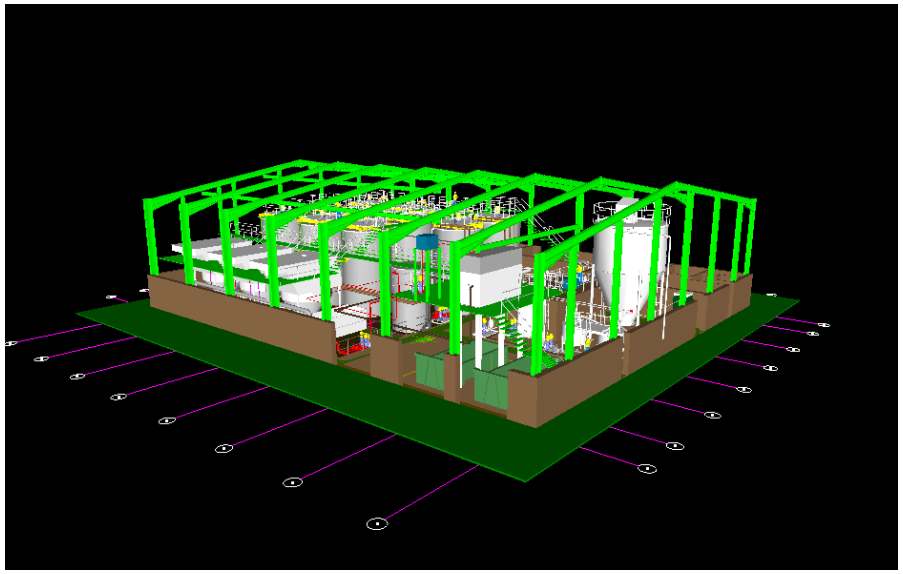


Treatment Layout



Process Construction



Multi disciplinary project

Over 30 different sub-contractors

Complex programming

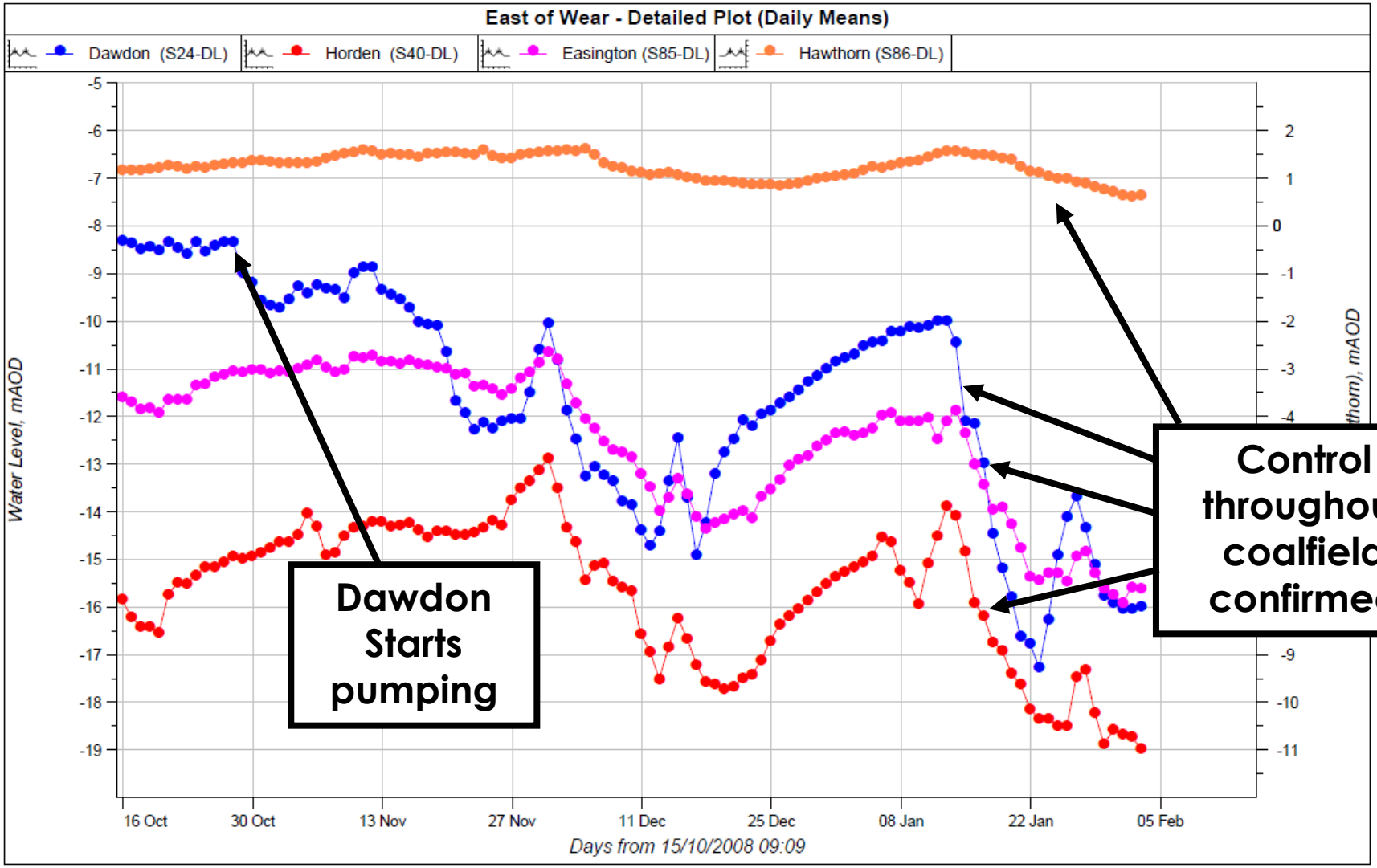
Short Sea Outfall

Coastal Modelling:

Dispersion Modelling and Sea Bed Survey

Directional Drilling - from cliff top to sea bed

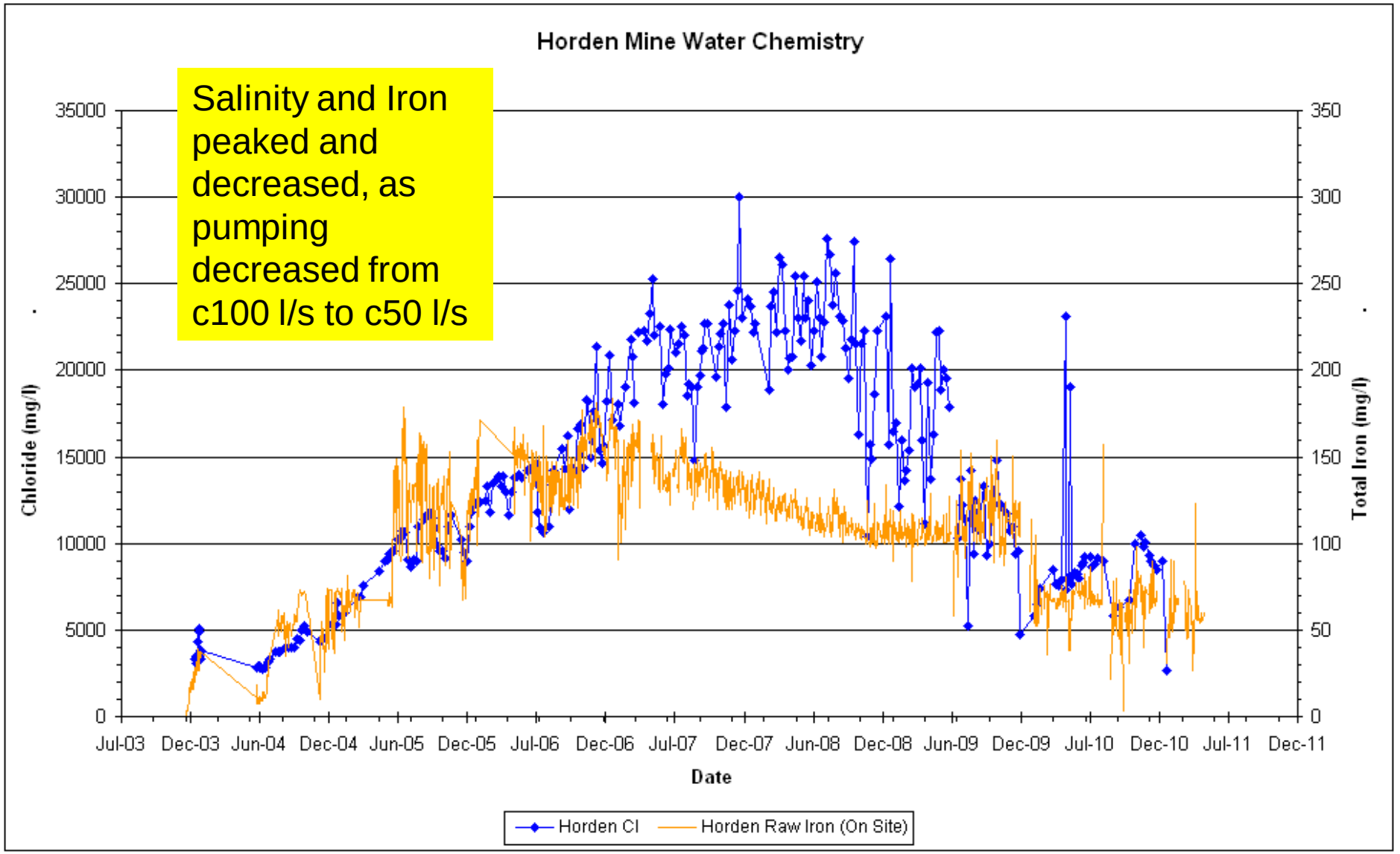
Pumping at Dawdon



Status in 2008

- 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

Horden Quality 2004-2010



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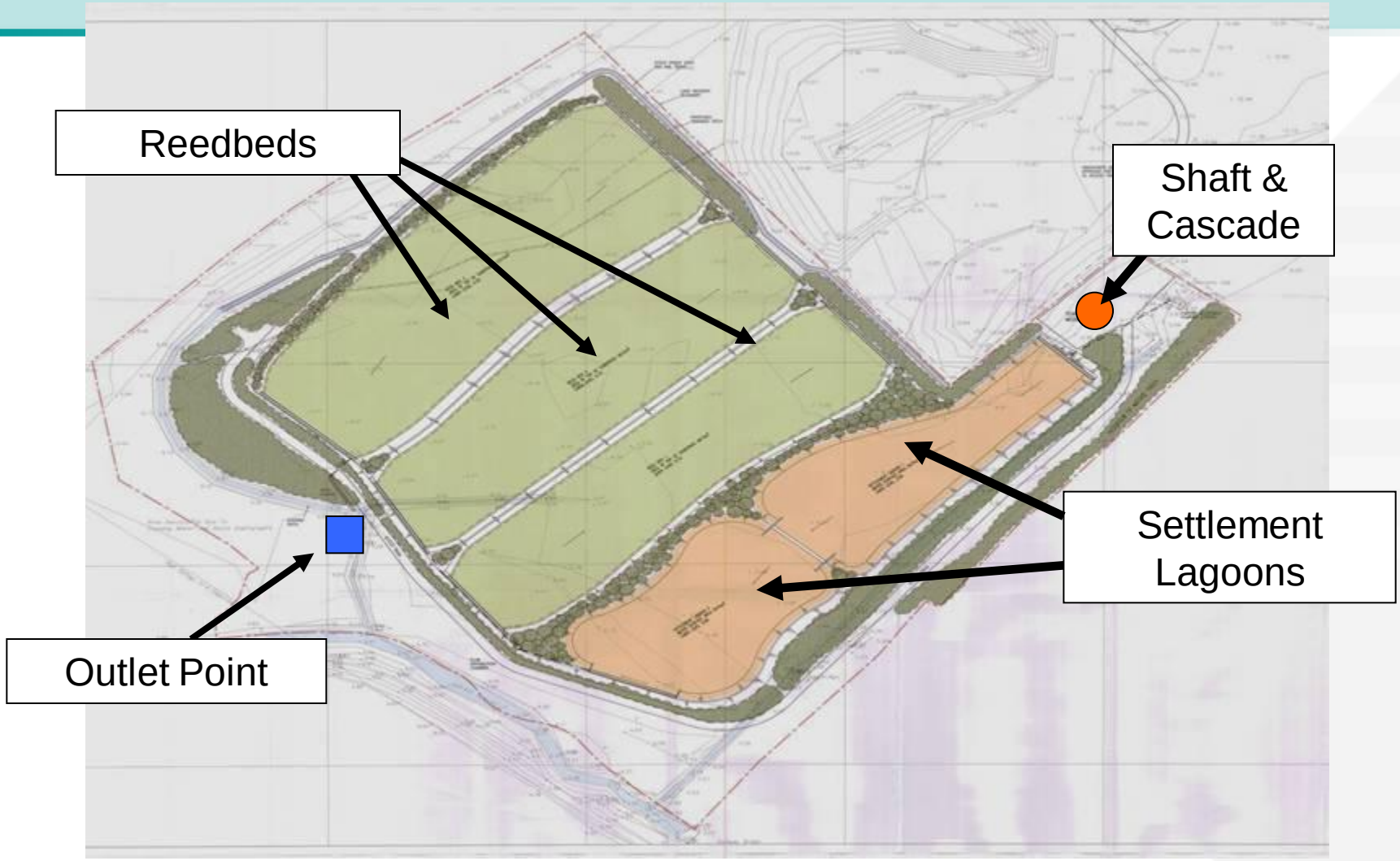

Horden/Dawdon Timetable

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

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Horden Passive forming of lagoon cells

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Horden Passive - Lining the cells

Aerial View May 2011

Treatment Area = 1.7 ha

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Morlais, 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