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Case studies on aquifer protection in rising mine water areas.

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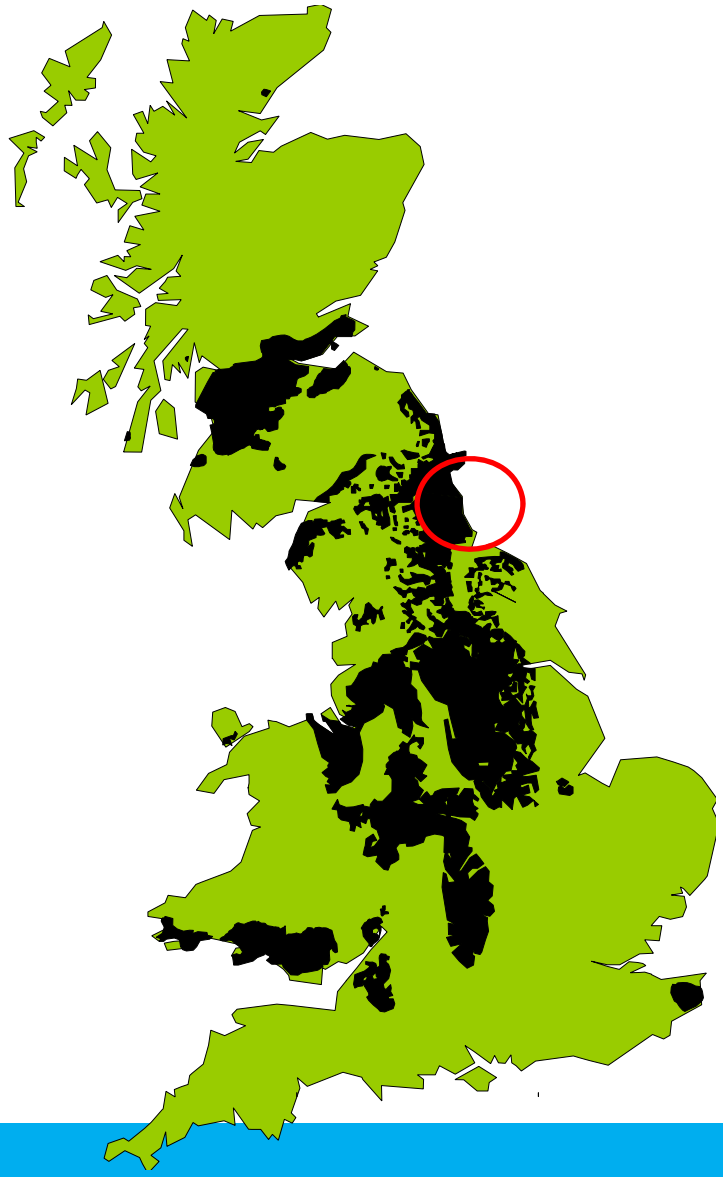
Contents

- Preventative Case Study
- Durham Aquifer Protection
- Active and Passive treatment schemes



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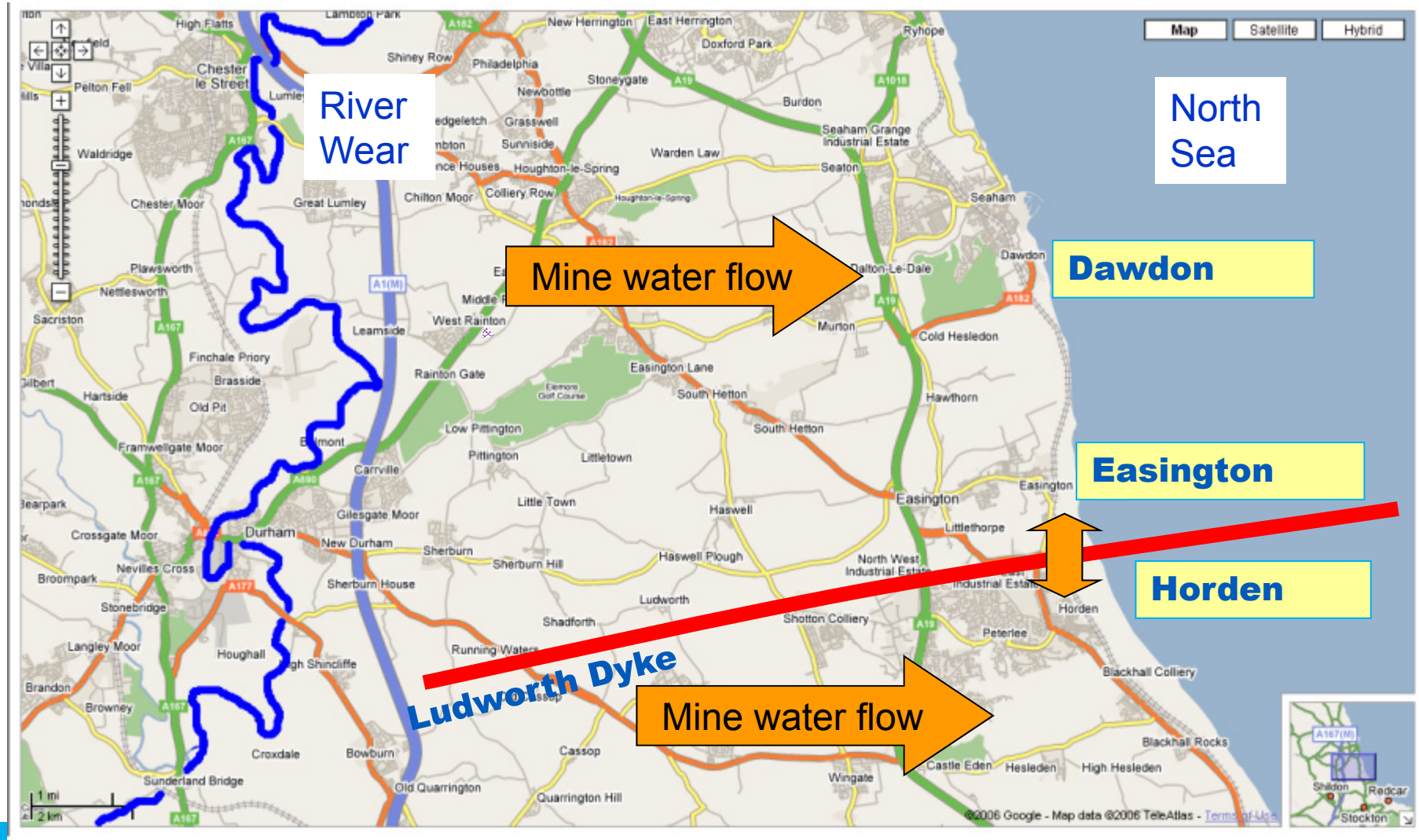
East of Wear Mining Block



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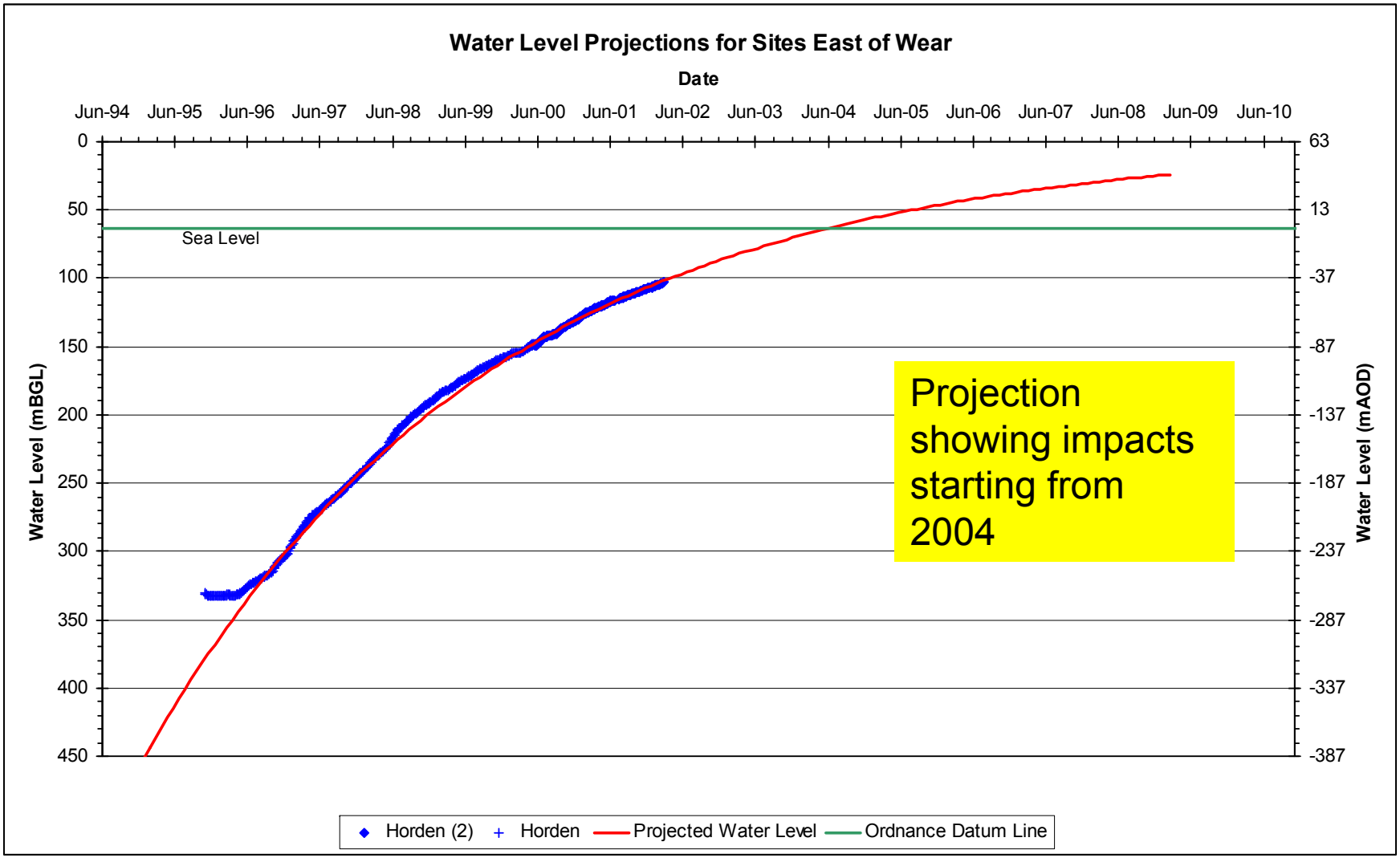
2002: Rising Mine Water Levels



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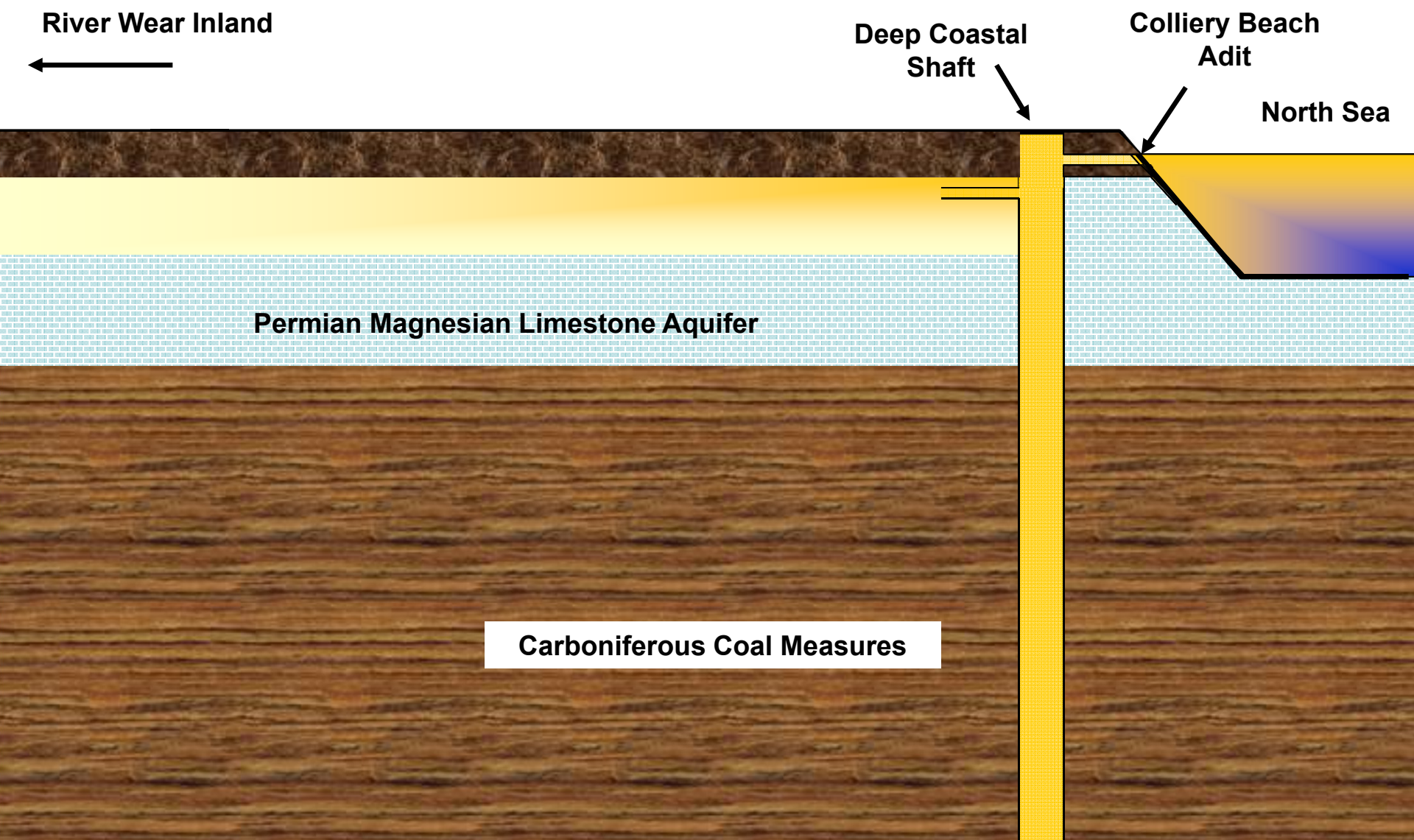
The Pollution Threat in East Durham



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Key Contaminants

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

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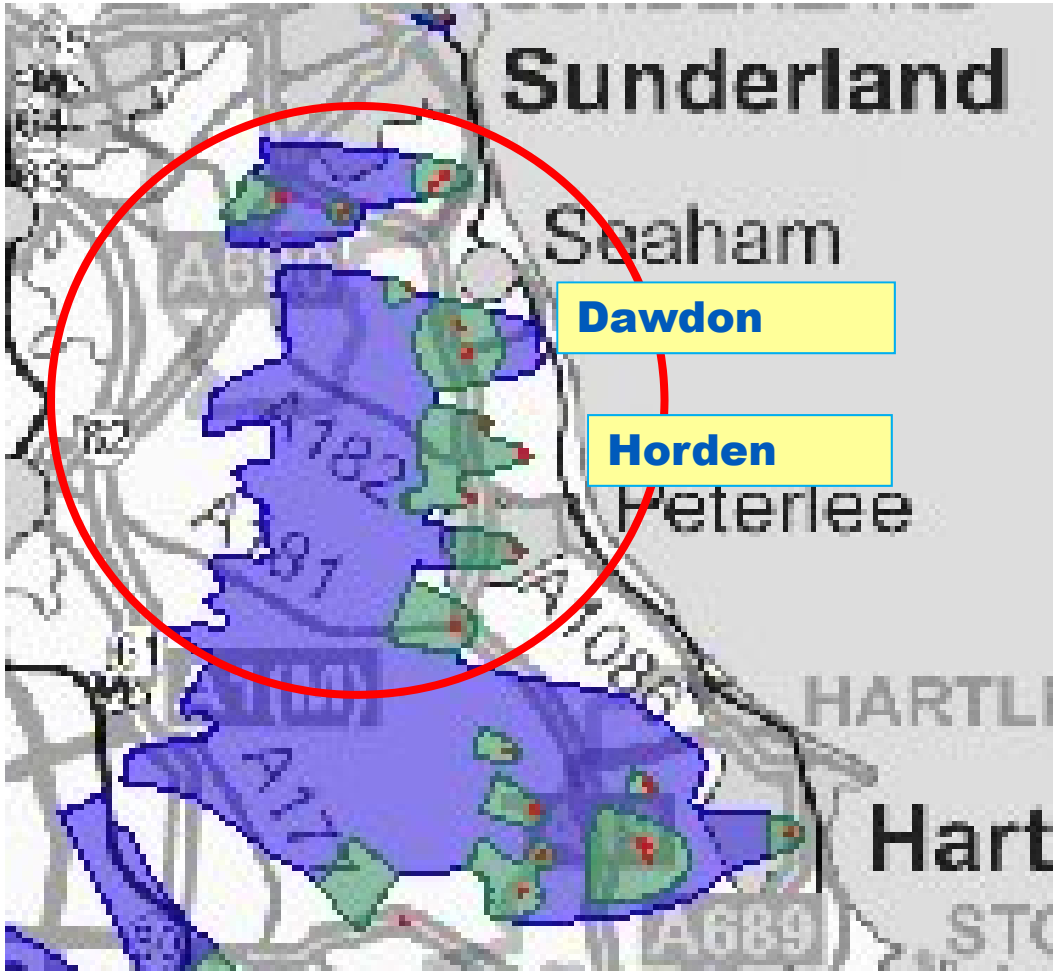
Source Protection Zones



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

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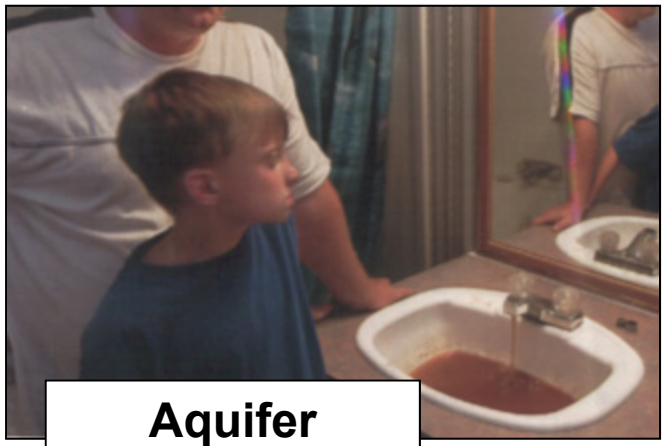
Possible Impacts



Aquifer Pollution

River Pollution

Coastal Pollution

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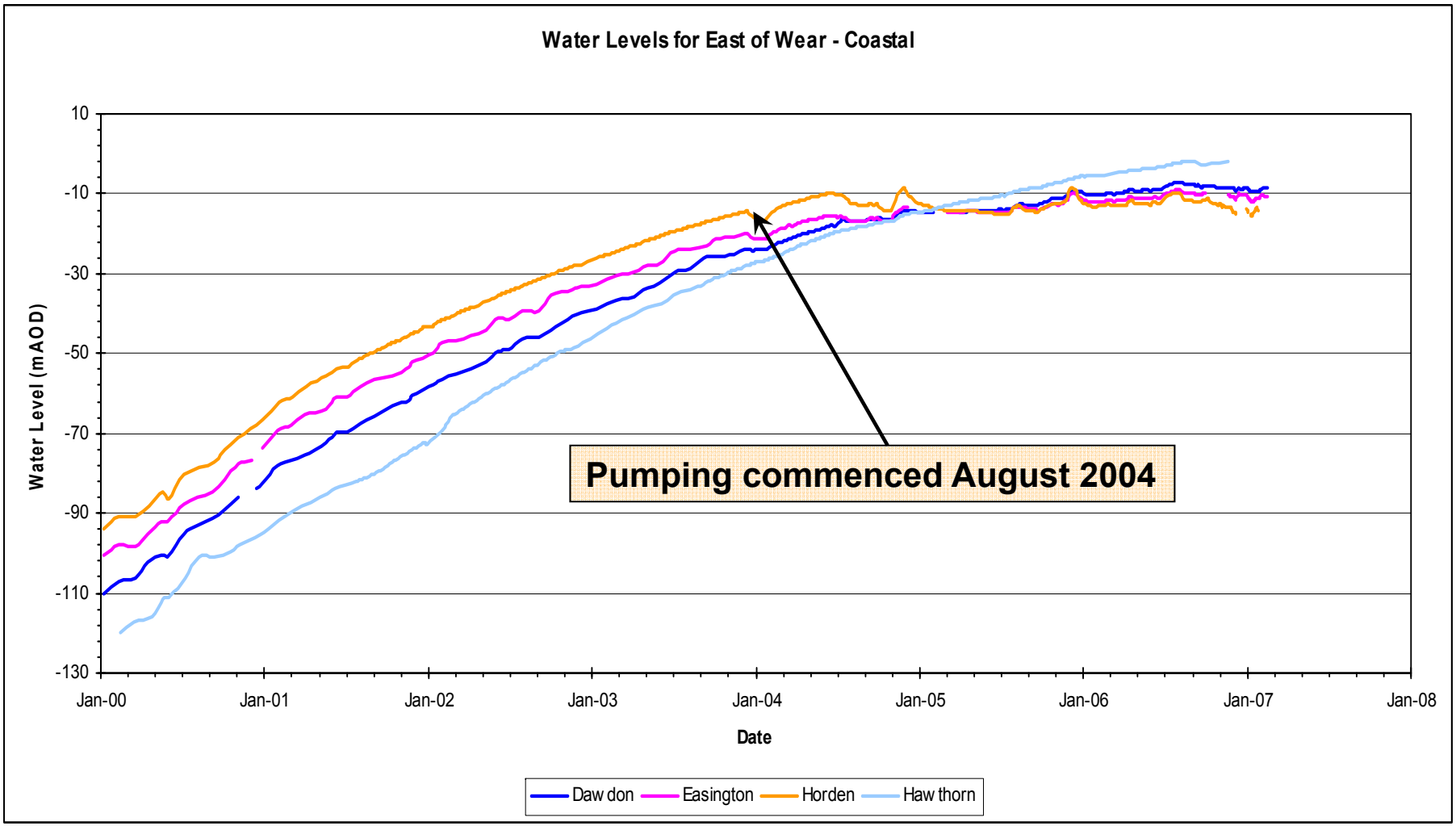
Horden Control of Water Levels



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Horden Temporary Active Treatment Scheme

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Horden Temporary Active Treatment Scheme

Hydraulic Control Risks

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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 commissioned
- If chlorides reduce replace with passive plant
  - Settling lagoons and reed beds

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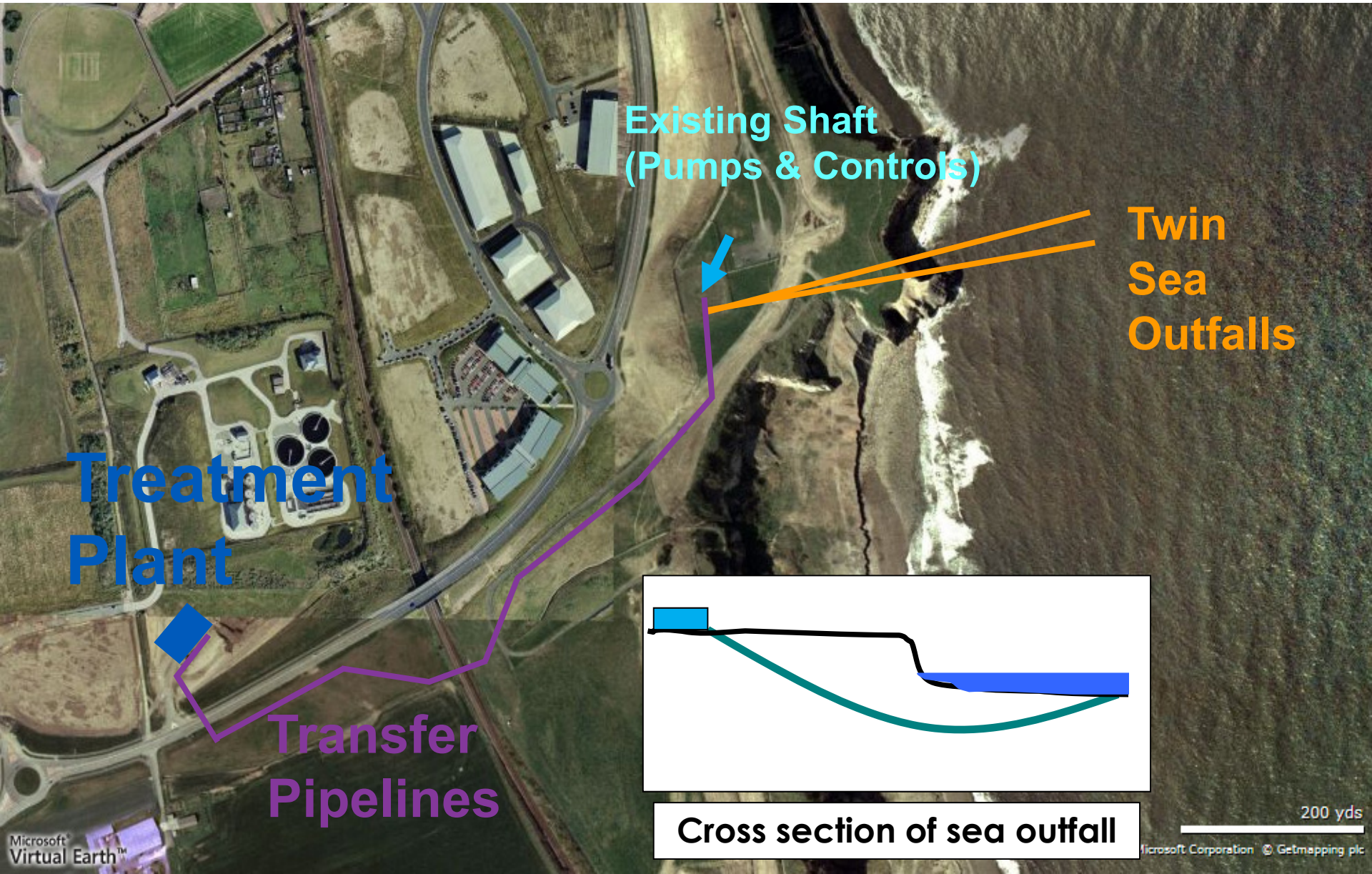

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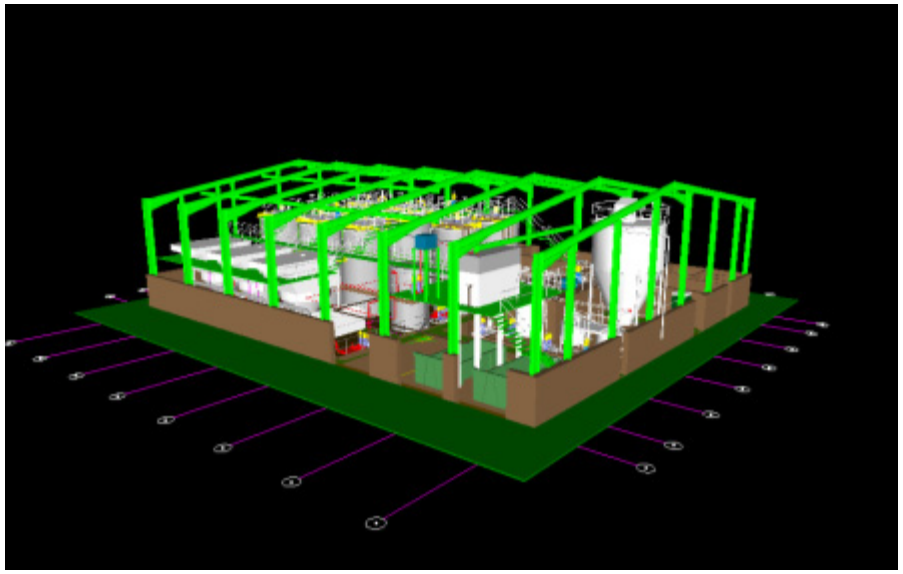
Process Construction



Multi disciplinary project

Over 30 different sub-contractors

Complex programming

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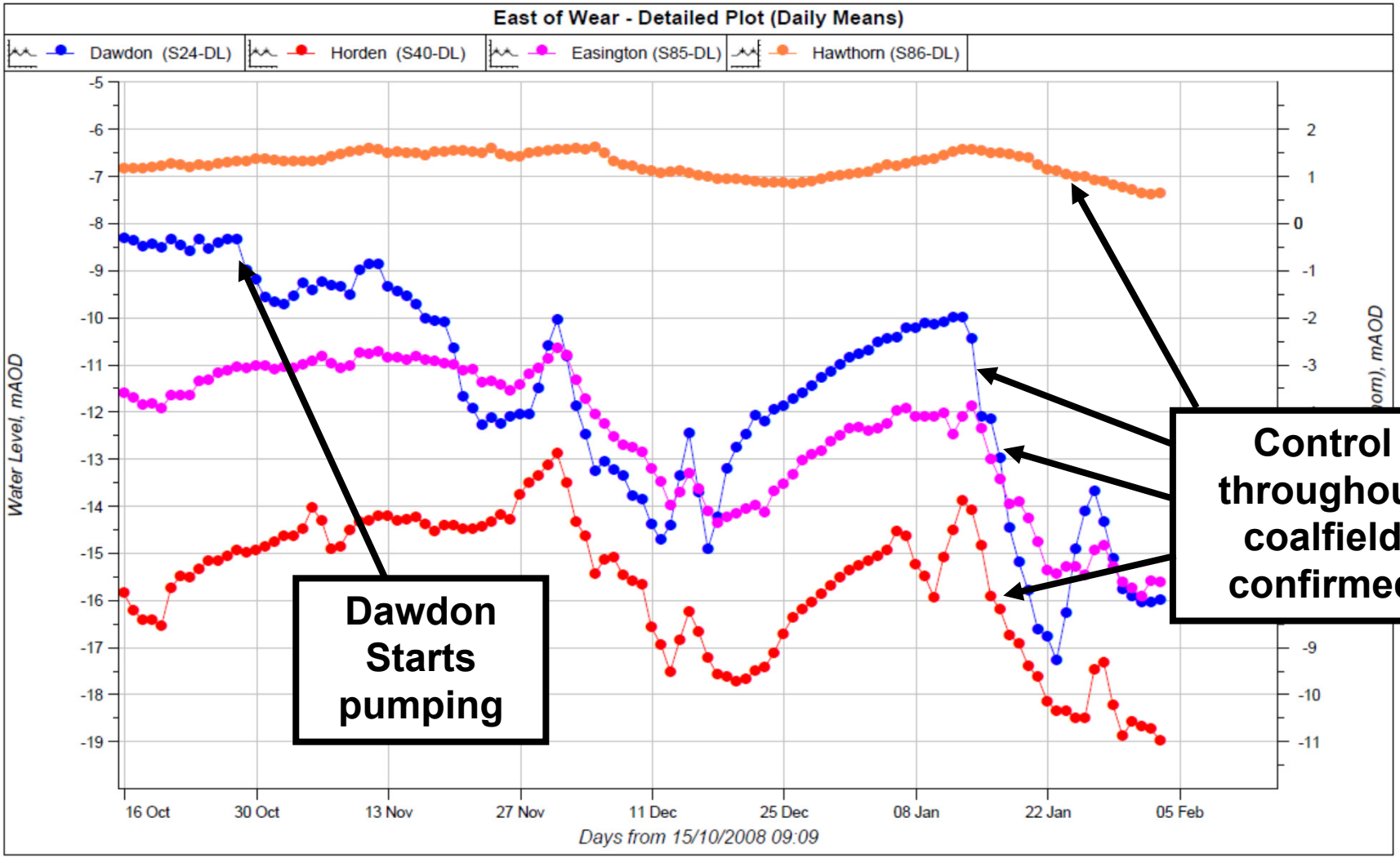
Pumping at Dawdon



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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

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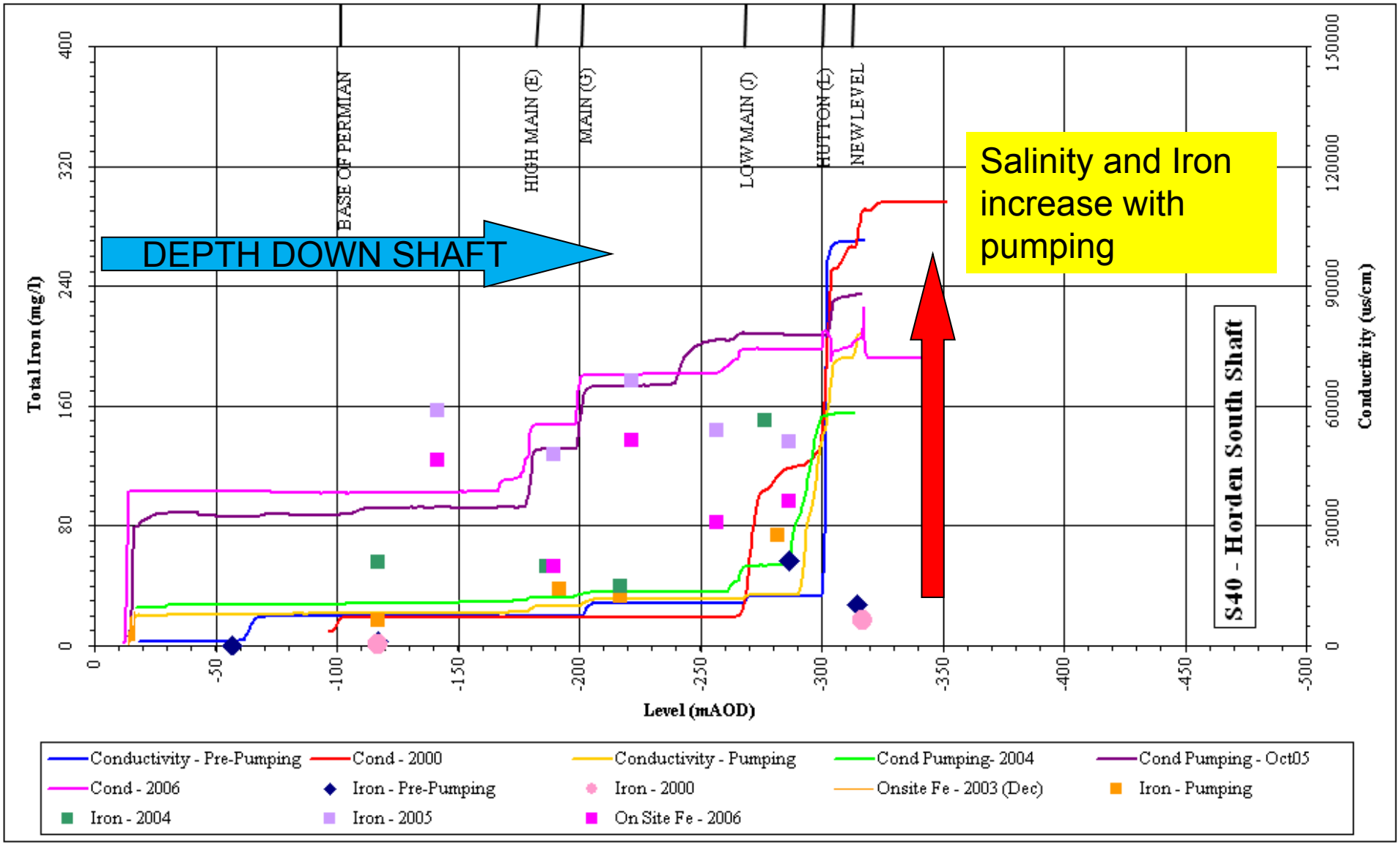
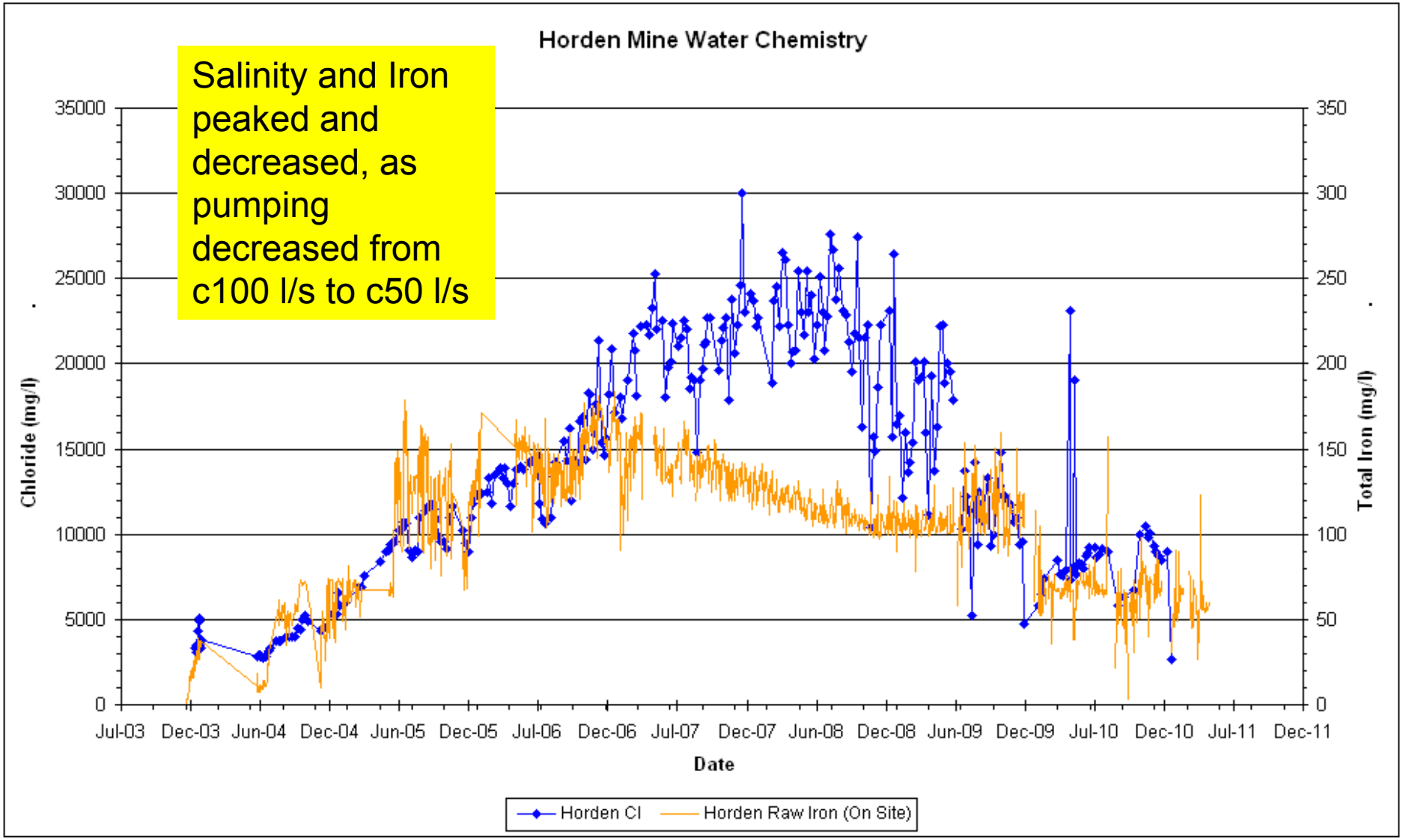
Horden Shaft Water Profile



Horden Quality 2004-2010



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Horden Passive forming of lagoon cells

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Horden Passive – Lining the cells

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Horden Passive – finishing reedbeds

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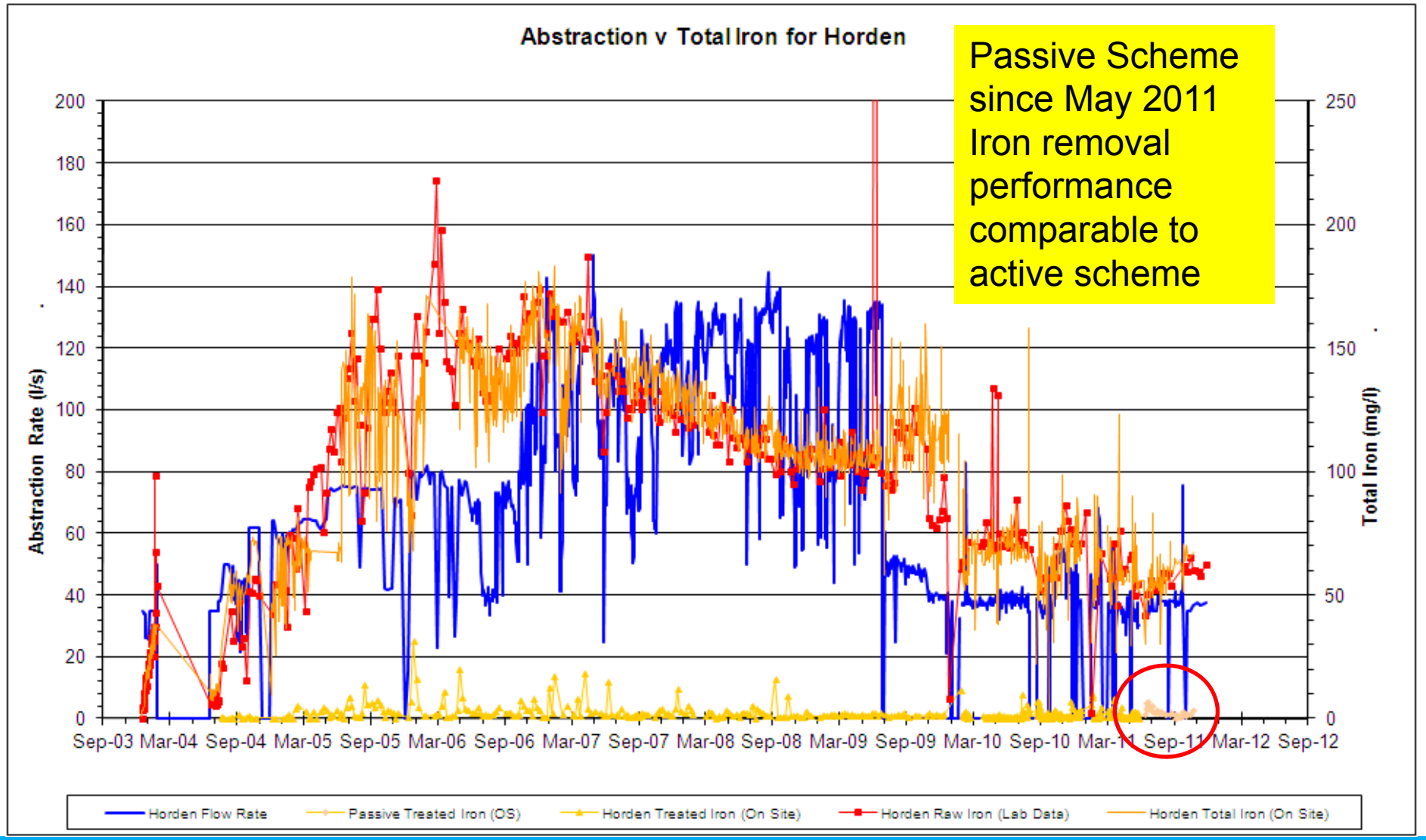
Horden Passive – Water testing of Lagoon Liner

Horden Passive shortly after commissioning

Active Treatment Area = 0.1 ha

Passive Treatment Area = 1.7 ha

Horden trend chart Flow v Iron (Raw & Treated)



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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

- Future – other areas of UK at risk
  - E.g. Nottinghamshire