Groundwater Asset Plans

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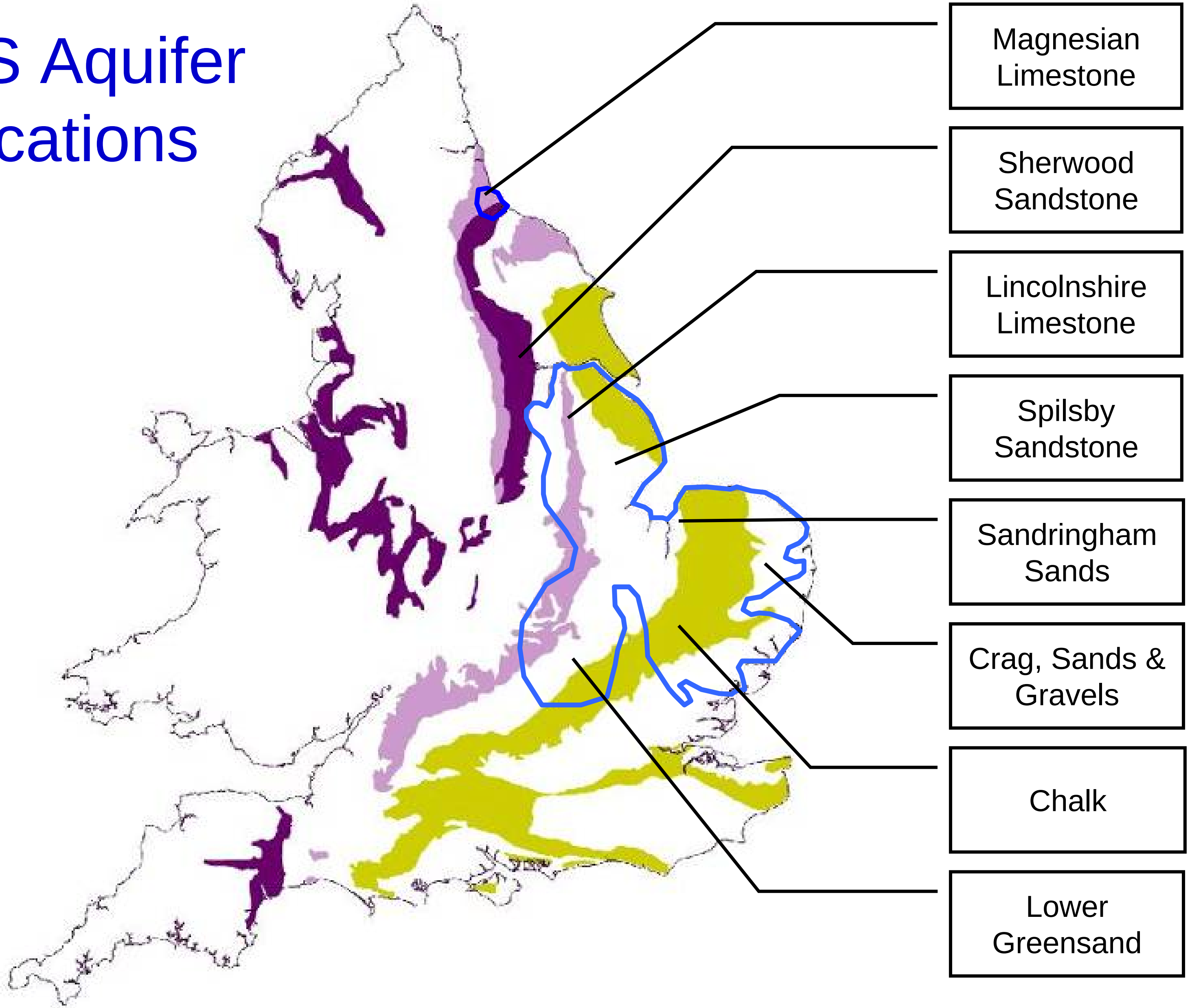
Groundwater resources

- 50% of total demand (1400 Ml / Day) supplied by groundwater abstracted from approx. 480 boreholes in 9 aquifers:

    - Chalk (Lincolnshire, Norfolk, Suffolk and Essex)
    - Lincolnshire Limestone
    - Lower Greensand, Spilsby Sandstone, Sandringham Sands
    - Crag and Sands and Gravels
    - Sherwood Sandstone
    - Magnesian Limestone

- Borehole depths from 6 to 500 m
- Yield between 2 and 180 l/s
- Borehole asset lives range from 10 to 100+ years

AWS Aquifer Locations



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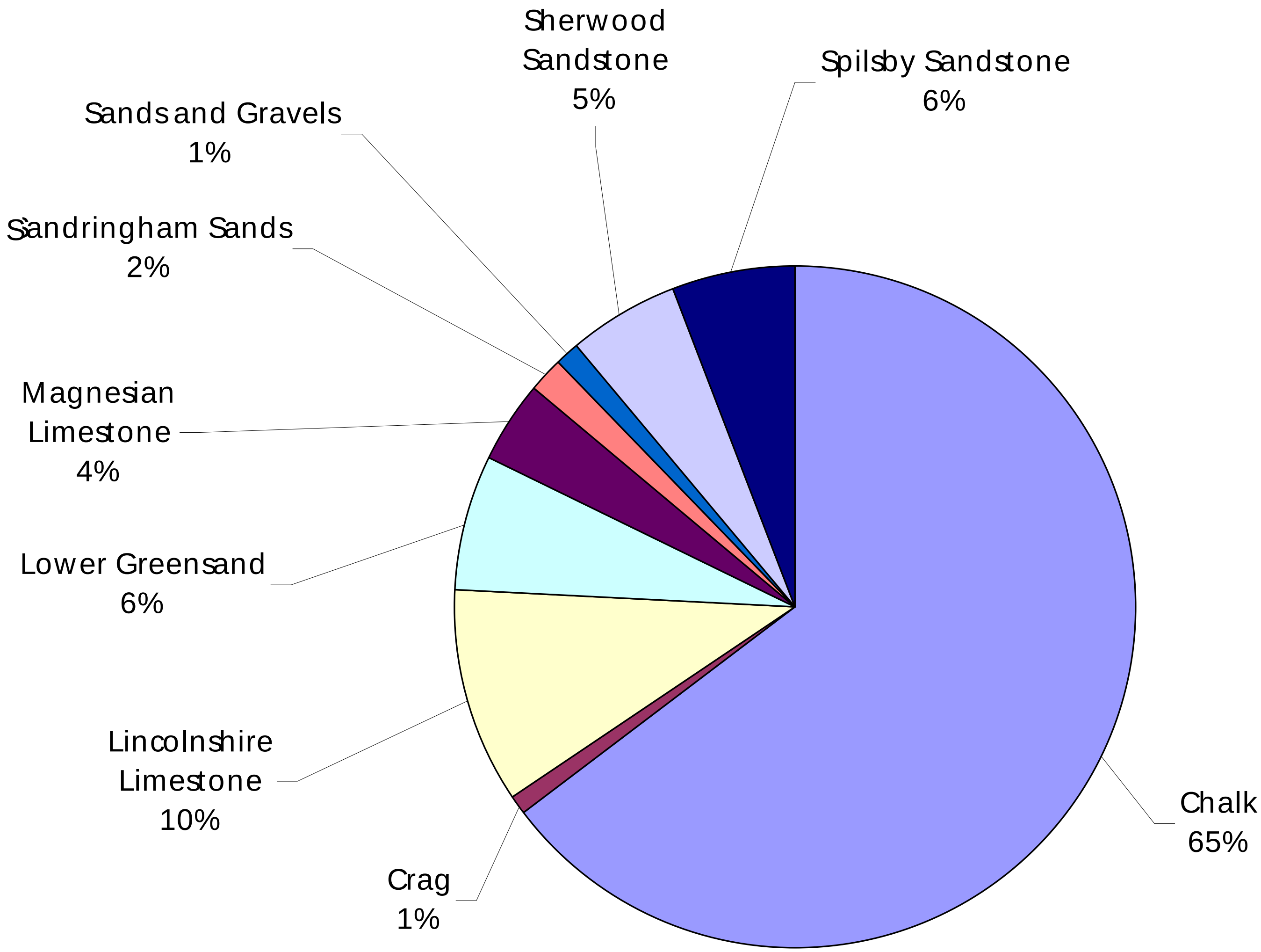
Abstraction by Aquifer



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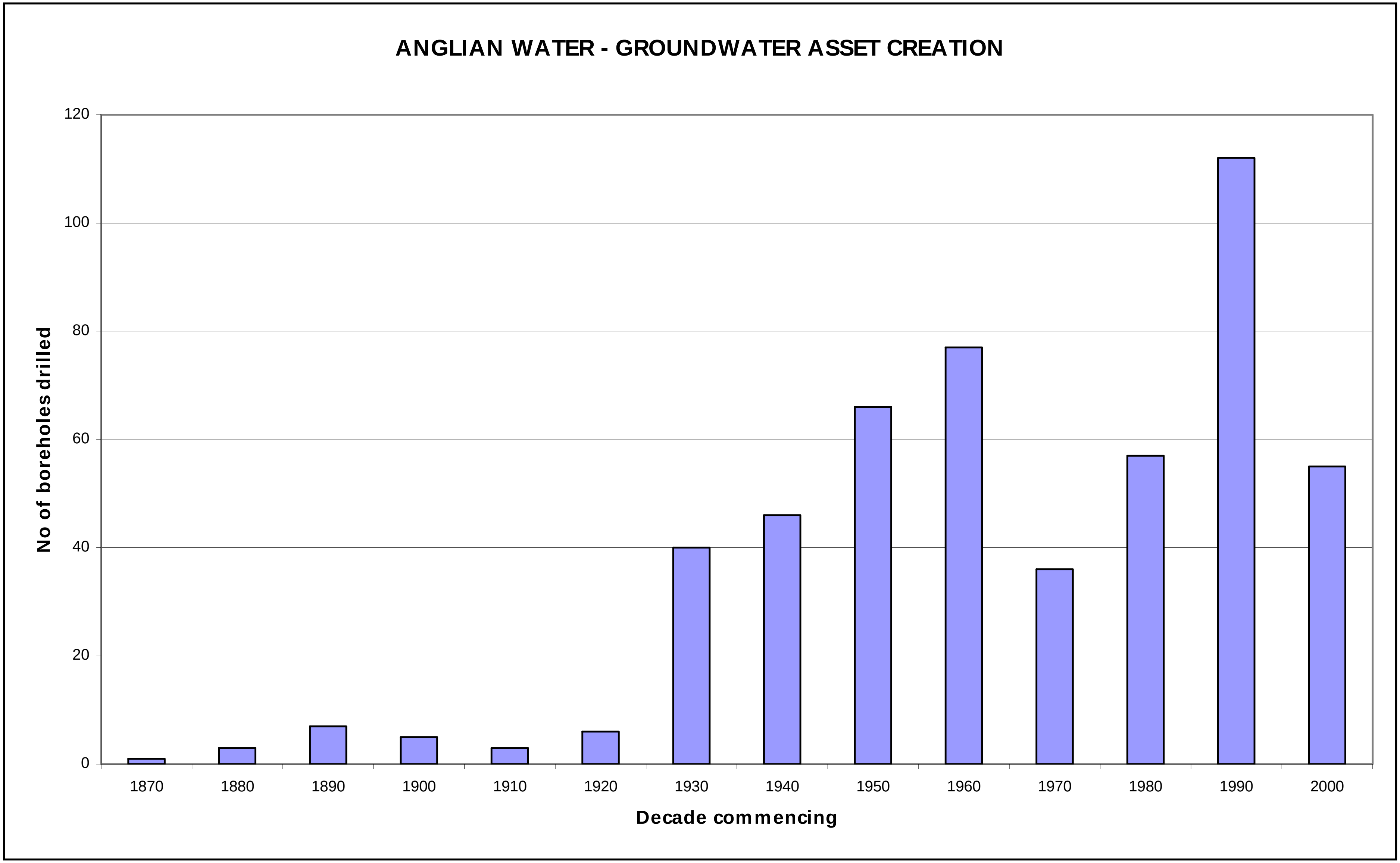
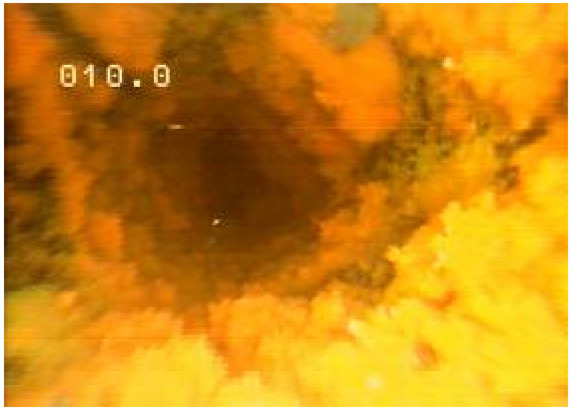
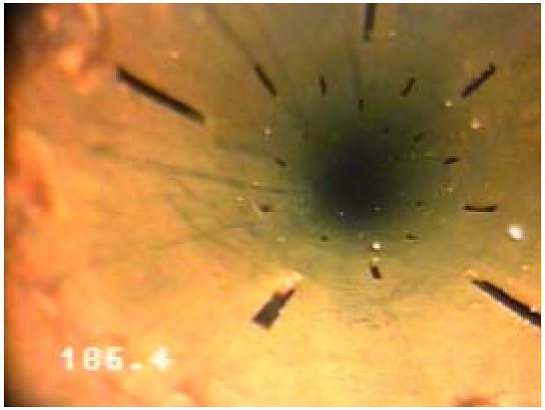

ANGLIAN WATER - GROUNDWATER ASSET CREATION
No of boreholes drilled
0
20
40
60
80
100
120
1870
1880
1890
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Decade commencing

Why Spend?





- Investment is required to maintain the serviceability of assets.
- Well maintained assets reduce unit costs.
- Asset Plans reduce the cost of asset management by highlighting areas where investment will be required, allowing timely intervention to be focused on those assets which require it most.

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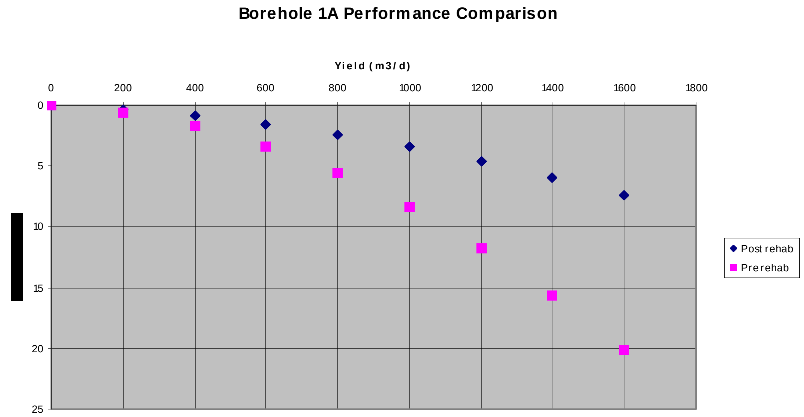
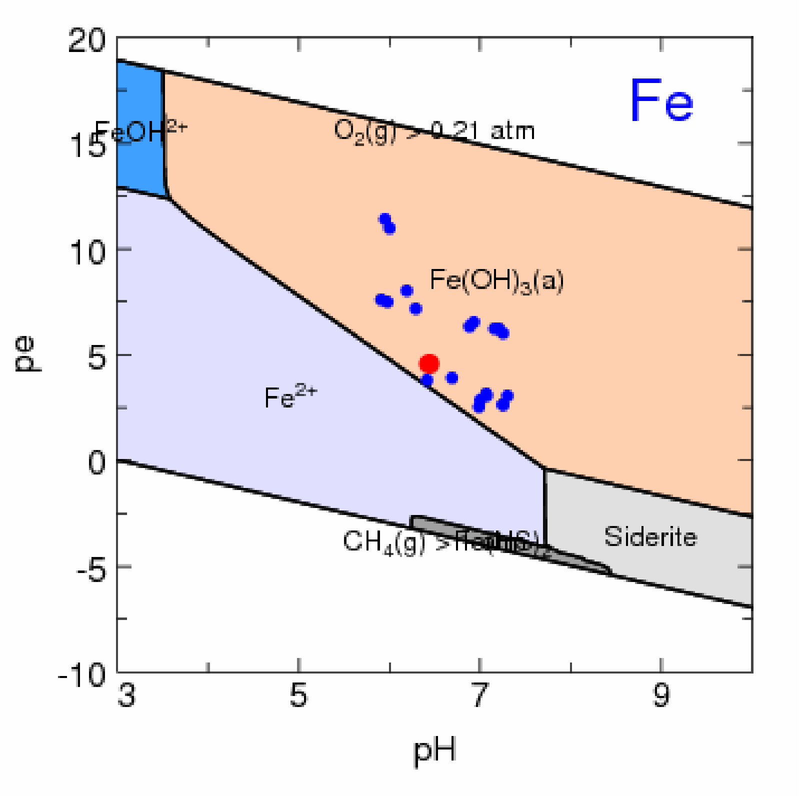
Rehabilitation Case Study: Lower Greensand BH

- After chemical jetting and airlifting the borehole performance increased
- For a yield of 16 l/s hydraulic performance improved by 165%
- Slots clean and 100% open
- Reduction of 60% in the unit cost of water
- Extended borehole and pump asset life



Water Quality

- Different aquifer environments produce many hydrogeological conditions.
- These conditions effect asset performance and life.
- Characterising the processes that effect water quality is a key step in developing a portfolio of evidence.
- Evidence of asset deterioration and failure can be used in conjunction with water quality information to drive investment.



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Background to Asset Plans

- In 2003 generic asset lives for the different aquifer units were generated to predict the remaining asset lives for each AWS borehole
- Evidence was drawn from existing observations on each aquifer unit to ascertain a generic asset life.
- The remaining asset life for each borehole was used to support the intervention / replacement programme for the AMP4 period.

Aquifer unit	Generic Asset Life
Unconfined Chalk	80
Confined Chalk	50
Lincolnshire Limestone	60
Great Oolite	60
Sherwood Sandstone	80
Lower Greensand	40
Spilsby Sandstone	40
Sandringham Sands	40
Crag	40
Sands and Gravels	30

Background to Asset Plans

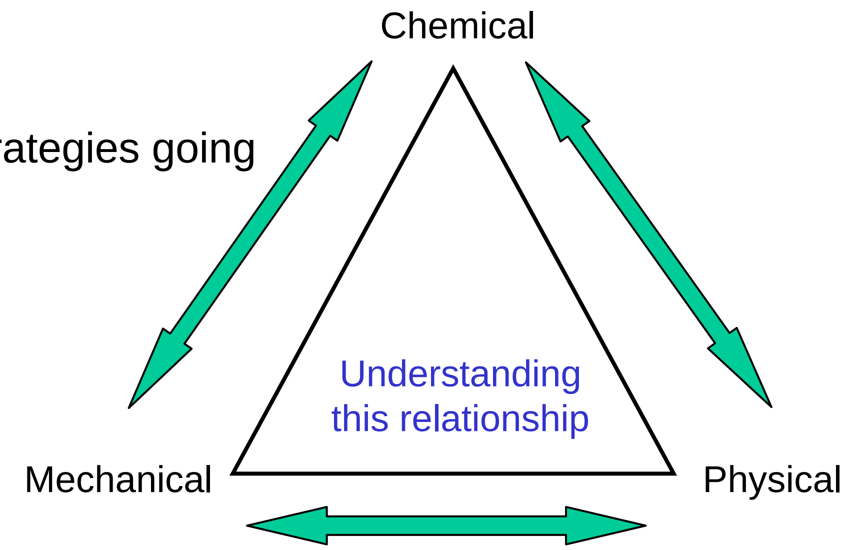
- A problem with this method of asset life prediction was that many boreholes were still in operation after their predicted life.
- Some boreholes outperformed their predictions by up to 40 years.
- Each borehole is unique, both in terms of the groundwater environment in which it is situated, as well as in its construction and operation.
- Therefore a value across each aquifer may not suit every borehole and so each asset has to be considered individually.

Approach

- Characterising processes which affect asset performance, decline and failure

- Water Quality: Chemical, bacteriological
- Construction
- Operation

- Developing asset management strategies going forward



Asset Plan

- The asset plans comprise several sections:
  - Asset Summary
  - Borehole information
  - Supporting evidence
  - Water quality

	Encrusting 1	Encrusting 2	Encrusting 3
Corrosive 1	0	2	3
Corrosive 2	2	4	6
Corrosive 3	3	6	9

Groundwater Asset Plan: Bardfield BH Nos. 1, 3

Organisational Unit	Colchester		
Sourceworks	Petches Bridge	Asset Code	PETCWW
Source	Great Bardfield	Asset Code	GTBWBS

Number of Boreholes	2

Site Details

This is the only asset sheet for this source

Borehole No.	BH 1	BH 3
Asset Ref:	GBA1WA	GBA3WA
Datum elevation (mAOD)	Headplate - 63.0	Headplate - 65.4
Construction Year:	1977	1989
Total depth (m BGL):	90	125
Diameter (mm):	686 reducing to 610	711 reducing to 610 to 380
Plain casing (mbd):	0 - 19.5	0 - 25
Slotted casing (mbd):	18 - 90	22 - 90
Open section (mbd):	-	90 - 125
Aquifer:	Chalk	Chalk
Top of Aquifer (mbd):	3	3
Typical pwl (mbd):	35	25
Typical non-pwl (mbd):	20	18
DAPWL (mbd):	62	62

Asset Life Data

Construction Year	1977	1989
Generic asset life (Years)	70	70

Groundwater Environment Modifying Factors

GW Environment Corrosive	Category 2	Category 2
Corrosive category	2	2
GW Environment Encrusting	Category 2	Category 2
Encrusting category	2	2
GW Environment Severity (1)	4	4

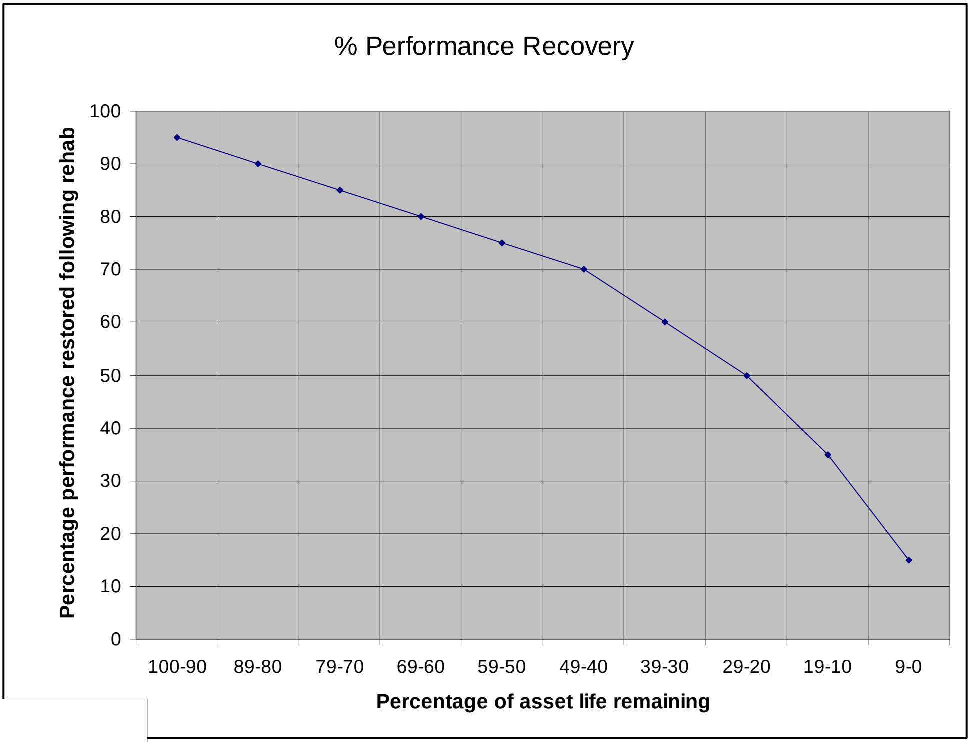
Locally Modifying Factors

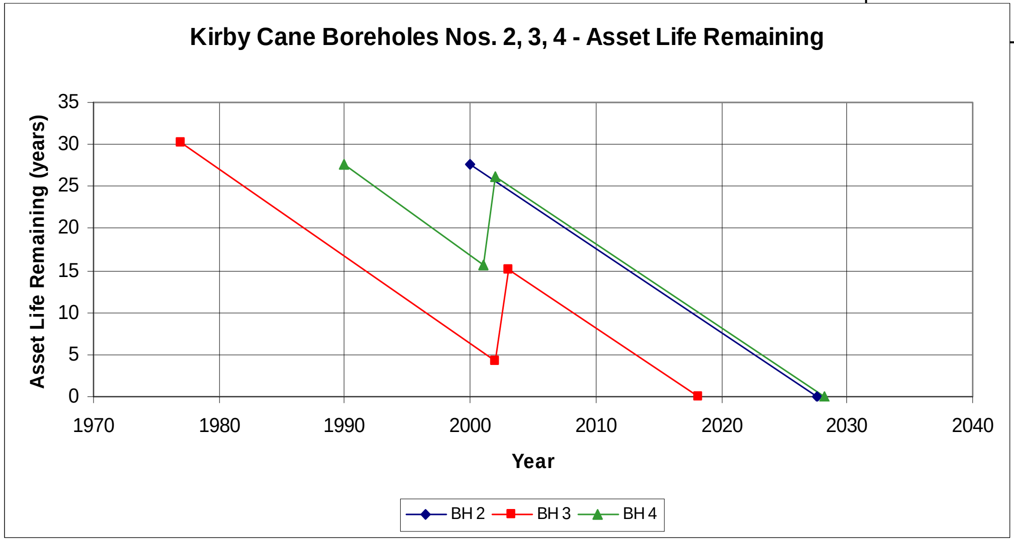
Construction	Plain and slotted	Plain, slotted & open hole
Construction category	3	2
Operation	Steady	Steady
Operation category	1	1
Pumping Water Level	R&PWL in productive zone	RWL in PC, PWL below PC
PWL category	4	3
SEVERITY FACTOR (2)	4	2

Total asset life reduction (%) (3)	16	8
Evidence Alteration Factor (4)	0.6	0.6
Modified Asset Life	35	39

Previous Interventions

- Information on previous interventions
- Prediction on end of asset life based on new generic asset life
- Investment profile – based on intervention 1 AMP period prior to 'the-end', and replacement after 2 interventions





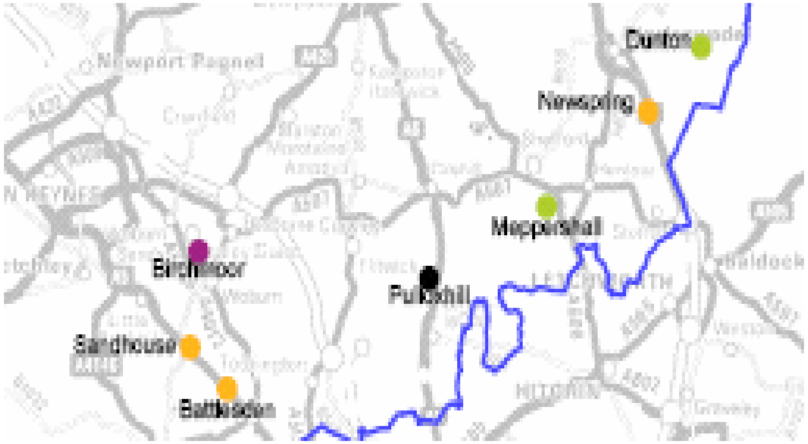
Pump Asset Plans

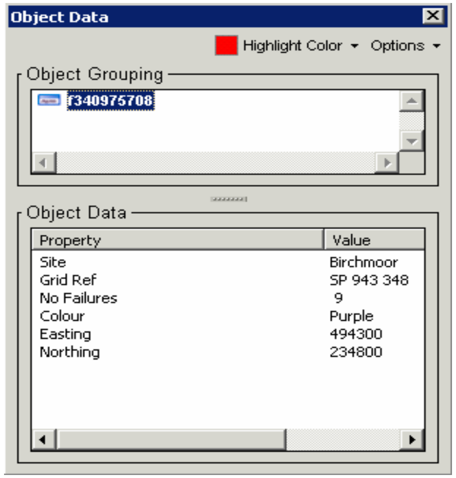
- Same approach as borehole asset plans
  - Water Quality
  - Construction
  - Operation

- Failure mode analysis provides evidence which informs the asset plans

- Pump Asset plans can be used to identify areas where PPM is cost effective.

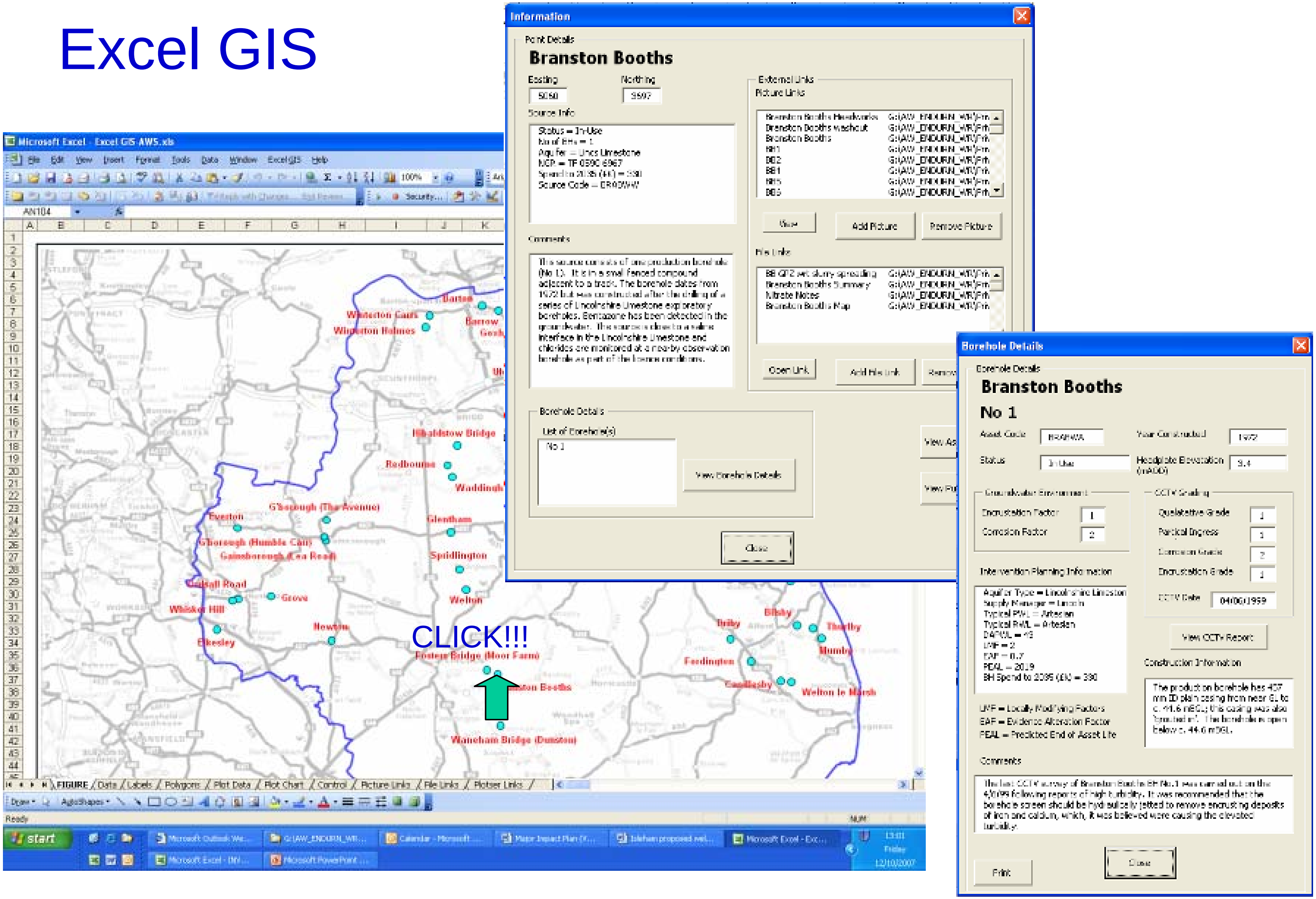
“Hot Spot Mapping”





- Portfolio of asset data used to develop intelligent asset maps with different layers
- Provides easy to use method of reviewing asset data down to site level
- Clearly shows areas of high asset failure and identifies key investment areas
- Potential for mapping chemical parameters to support investment profiles

Excel GIS



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Forward Planning

- Drawn up the AMP5 rehabilitation and replacement lists
- This approach to asset management allows for a more educated approach to maintaining and planning for assets in to the future
- Moves away from the lumped model of aquifer units and looks at site specific evidence to make informed judgements for each borehole

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Issues

- Continuous improvement ideas
- Matching theory to reality
- Quantifying performance deterioration due to scarcity of historic performance data
- Confidence in capturing all historic data