

Dealing with coal mine waters in the North East – Taking a long term view



- Dr Ian Watson
- 22 November, 2018
- Presentation to: North of England Institute of Mining and Mechanical Engineers

The Coal Authority - Background

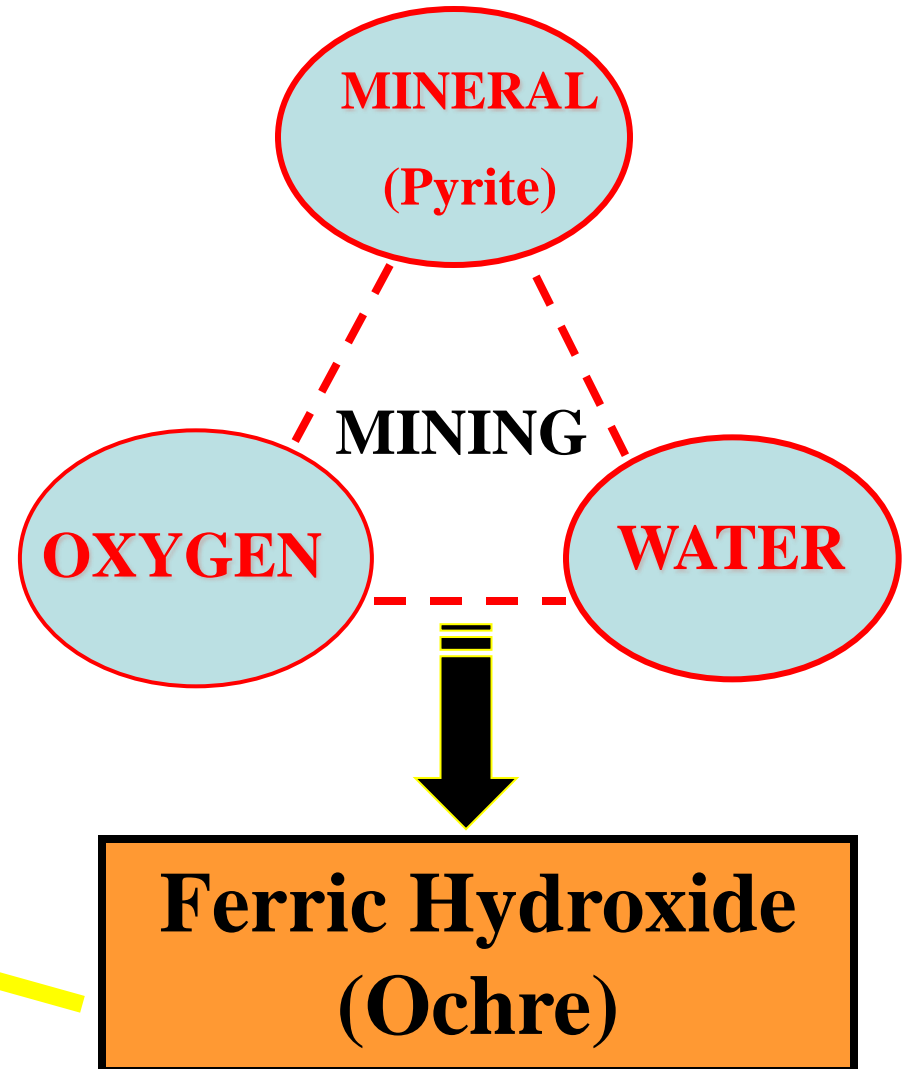
- Government Body
 - Established upon privatisation of the Coal Industry in 1994
 - Funded by BEIS, Dept. Bus., Energy & Ind. Strat.
- Environment programmes
 - Coal mine waters:
 - Remediation Schemes
 - Preventative Schemes
 - Non-Coal Mine Waters:
 - Remediation of mine waters from metal mines



What is Coal Mine Water?



Kibblesworth – approx 300l/s



Remediation of Coal Mine Waters

- No legal liability for mine water
- Memorandum of Understanding with EA
- Prioritisation agreed with EA
- Phased approach agreed with regulators and sponsors (BEIS)
- All schemes subject to
 - satisfactory business case
 - cost/benefit (over 25 years) assessment.

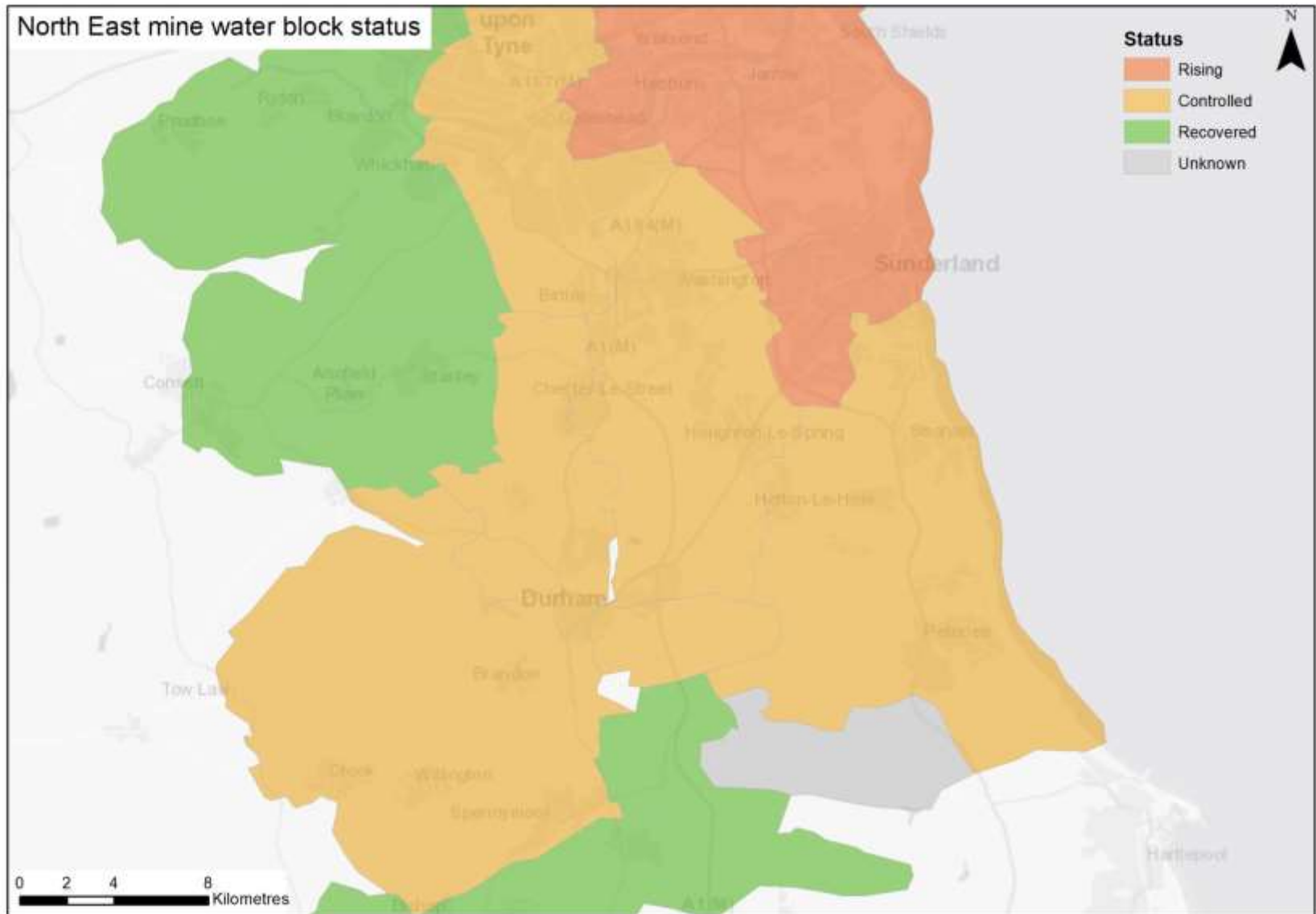


Preventative Programme

- Rising mine water
- No Deterioration
 - Principle from Water Framework Directive
- No legal liability for mine water
- All schemes subject to
 - satisfactory business case
 - cost/benefit (over 25 years) assessment.

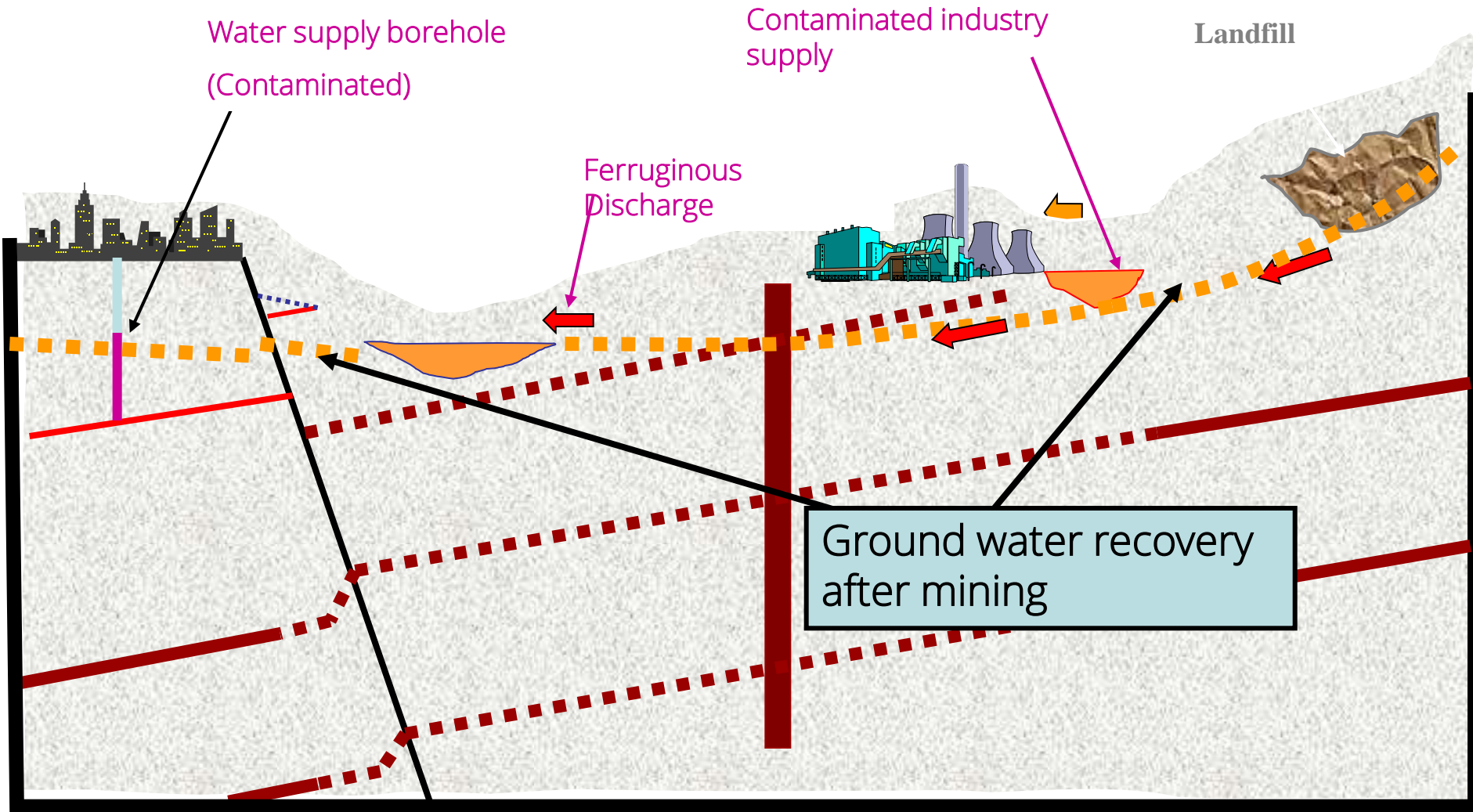


Current Mine Water Status Map



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Why is Mine Water a Problem?



Mine Water Program National Summary

- Completed >70 treatment schemes
- Improved over 120km of watercourses
- Over 200km of watercourses protected
- Prevents 4000 tonnes / year of Iron from entering watercourses
- Major drinking water aquifers protected in Durham, Northumberland and Cannock
- Very successful sewage/mine water co-treatment to remove phosphates at Lamesley (NWL Birtley)
- Many schemes provide local amenity





WE OPERATE
75
MINE WATER
TREATMENT
SCHEMES

WE PROTECT
OVER **350** km



OF RIVERS FROM MINE
WATER POLLUTION

WE PREVENT
4,000
TONNES_{pa}

OF IRON SOLIDS
ENTERING NATION'S
WATER COURSES



PROTECTED
AQUIFERS FOR 
0.5 MILLION
PEOPLE
VALUED AT: £30.5 MILLION_{pa}

£**23**
MILLION
ENVIRONMENTAL
BENEFITS DELIVERED
SINCE 2011

Types of Scheme

- Scheme type affects long term costs
- Pumping vs gravity flow
 - ££ Pumped from Depth (controls water levels)
 - £ Pumped overland (to treatment area)
 - Gravity fed
- Treatment
 - ££ Fully active (industrial type plant)
 - ££ Active (chemical addition only)
 - £ Passive (natural processes only)
 - None (quality OK for dilution only)

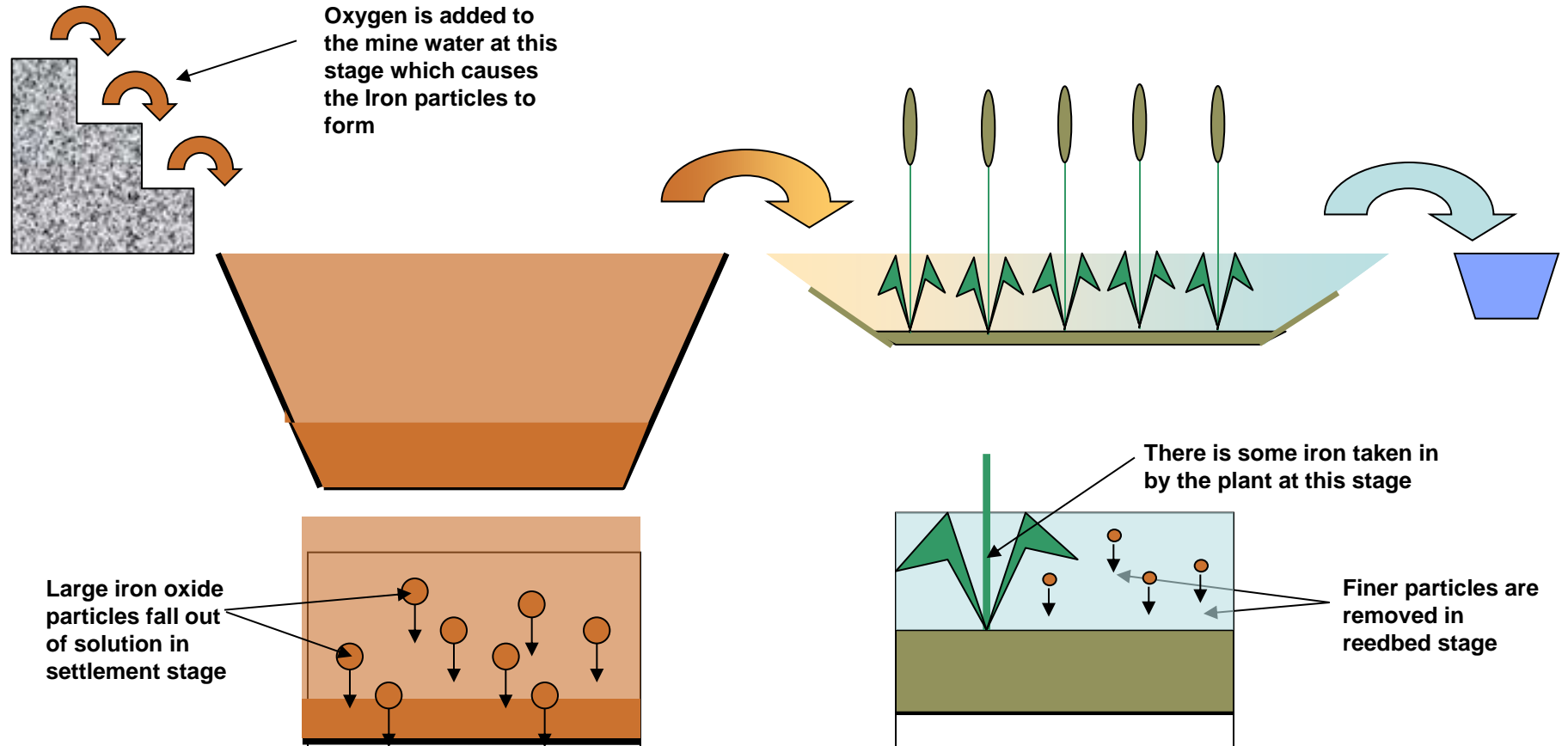
How a coal mine water scheme works

**Aeration
Cascade**

Settlement

Reedbed

River/Stream



North East Schemes

including preventative, controlling rising water

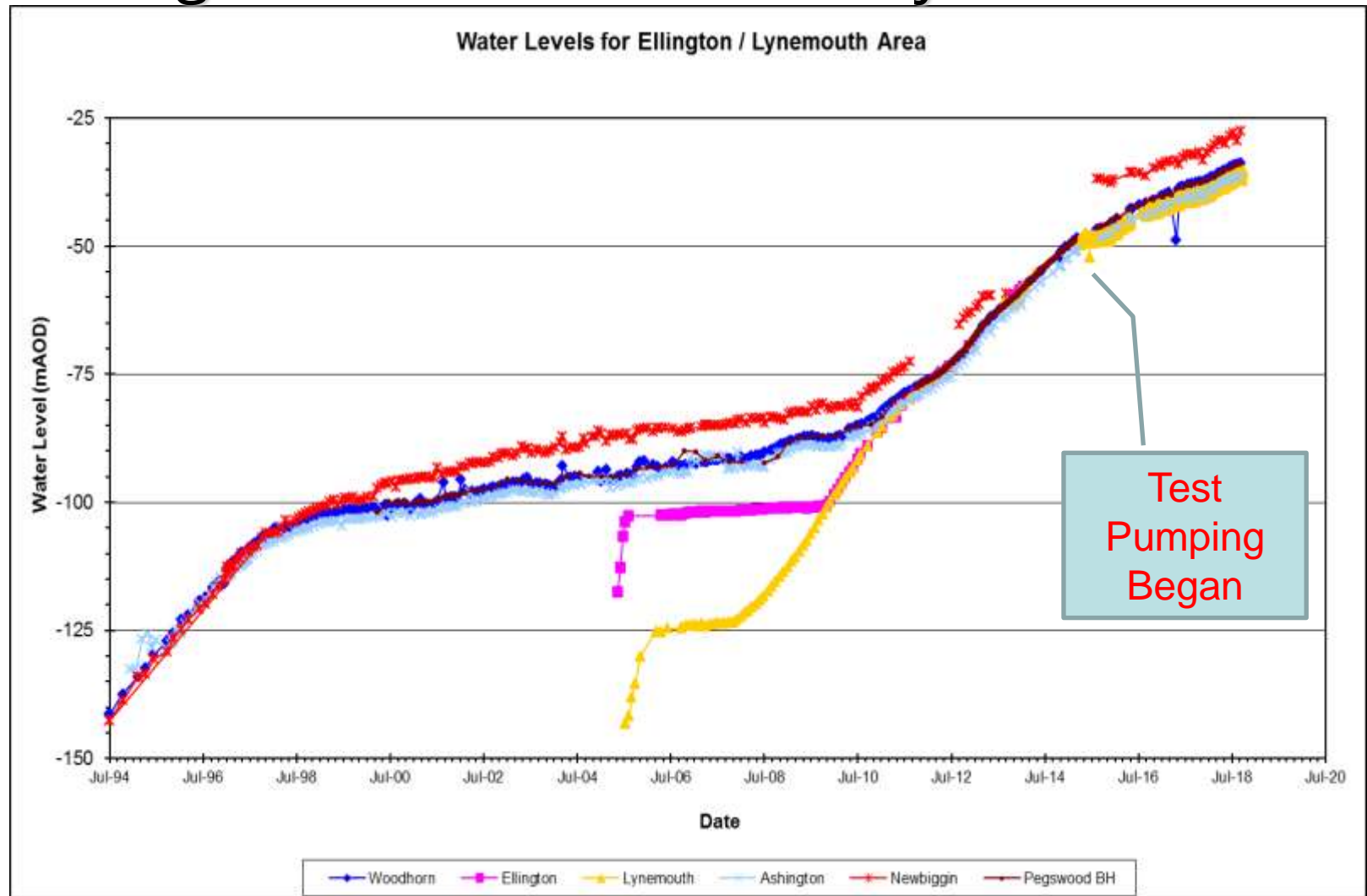
- **Fully Active**
 - Dawdon
- **Pumped and Active Dosed**
 - Acomb
 - Blenkinsopp
- **Pumped Passive**
 - Allerdean Mill
 - Whittle
 - Bates
 - Lambley
 - Lamesley
 - Horden
 - Edmondsley
 - Lynemouth
- **Fully Passive**
 - Stony Heap
 - Kimblesworth passive
- **Pumping Stations**
 - Chester Moor
 - Kibblesworth
 - Kimblesworth
 - Whitburn
- **Engineered Gravity Flows**
 - Chatershaugh
 - Page Bank
 - Vinovium
- **Non-Coal**
 - Saltburn (Ironstone)

Current preventative focus

- Lynemouth
- Aims to provide protection for:
 - Aquifer around Morpeth
 - Surface waters
- Scheme location
 - Former Ellington Combine Colliery



Rising water levels across the Lynemouth Area





The Coal
Authority



2005:
Closure of
Ellington
Combine
Colliery



Water levels
begin to
rebound



2013: Phase
1 build
begins at on
former
Lynemouth
Colliery site



Feb. 2015:
Test
pumping
commences
from
Lynemouth
Shaft



October
2018: Phase
2 build works
begin



June 2019:
Partial start
up of Phase
2



October
2019:
Completion
of Phase 2
build

Blenkinsopp – case study

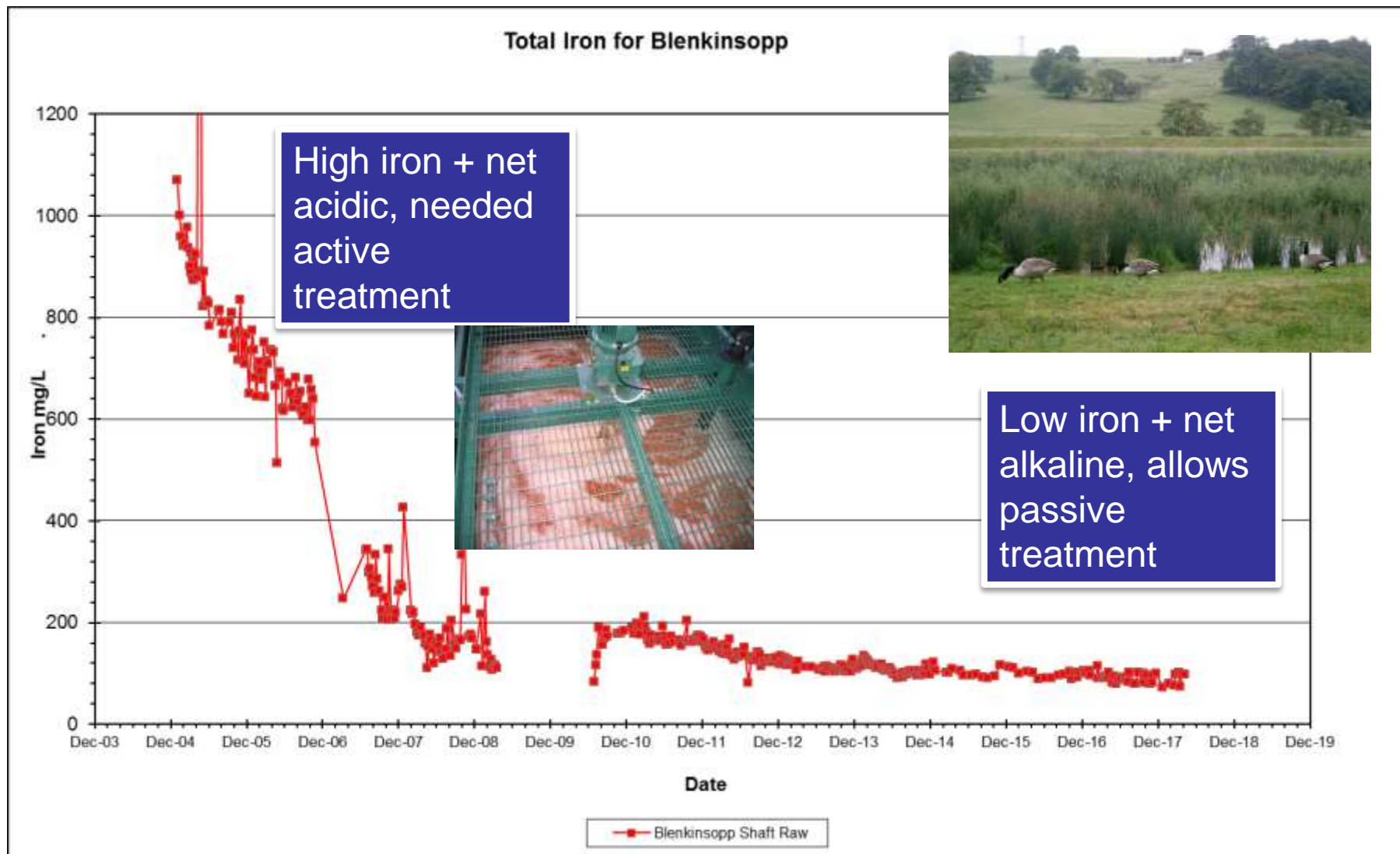
- Evolution of a preventative scheme



Blenkinsopp (Haltwhistle) First Flush Pumping commenced Jan 2005



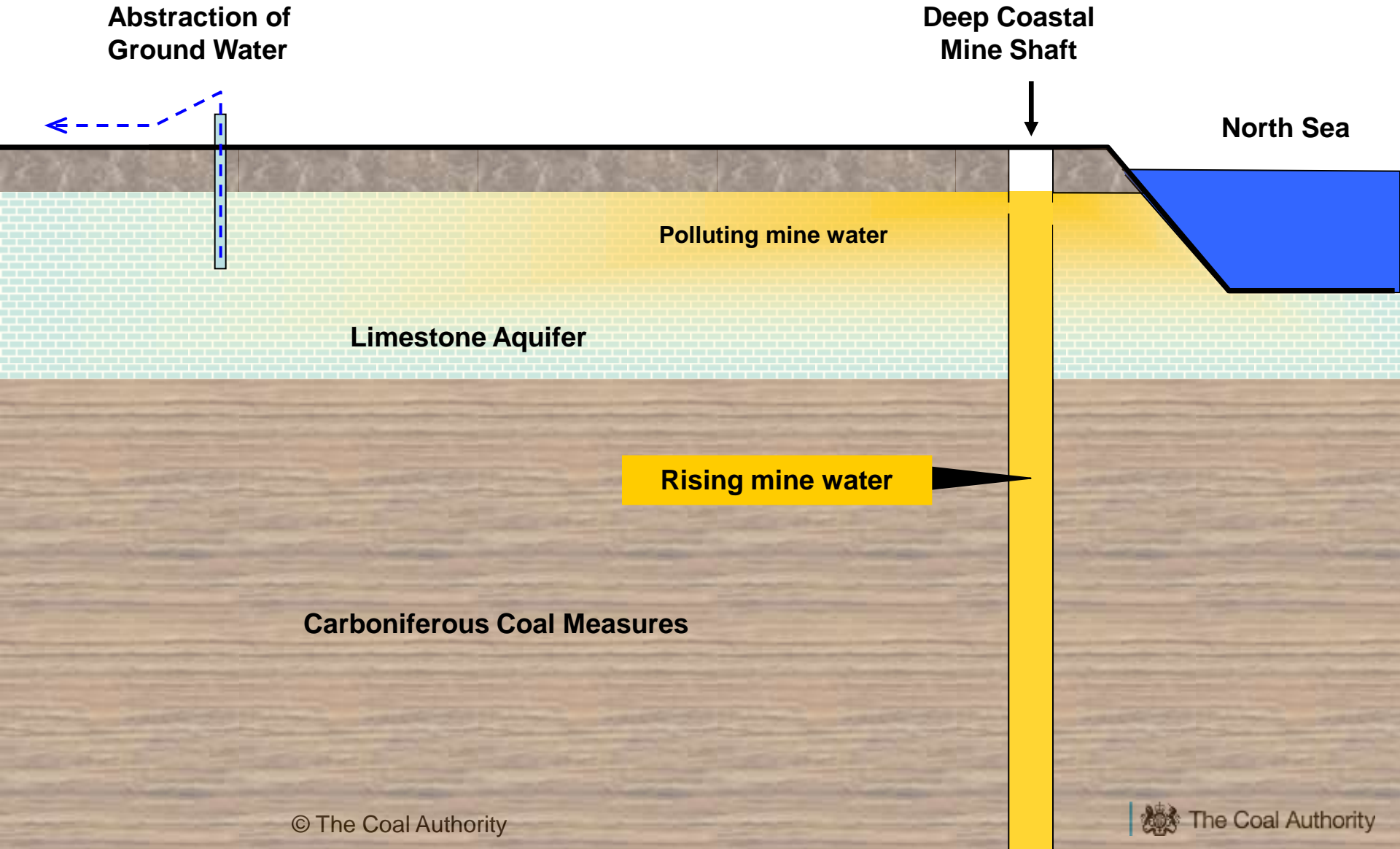
Blenkinsopp improvement over time



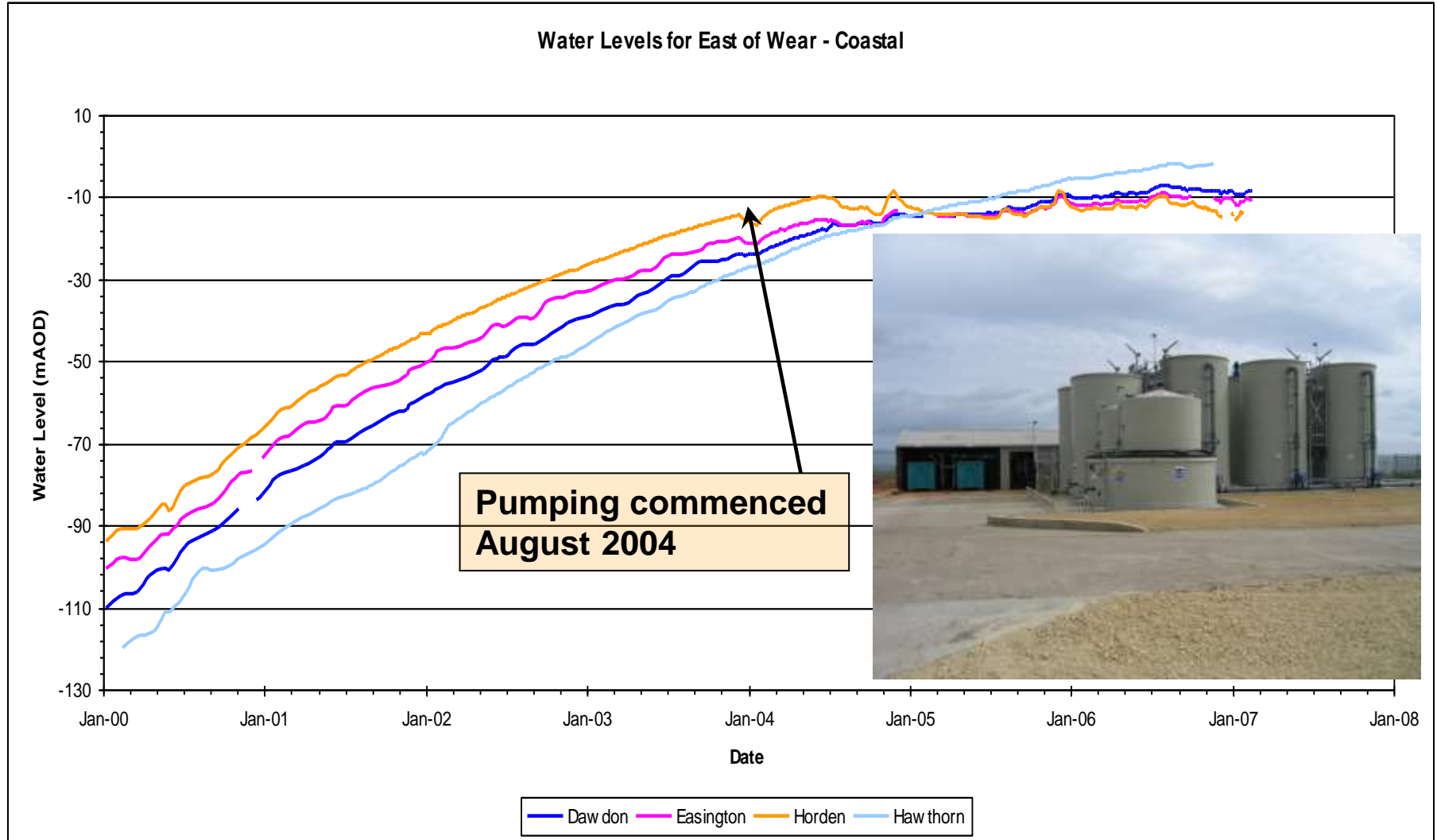
Case Study - East of the River Wear



Rising Mine Water Possible Impact on Aquifer



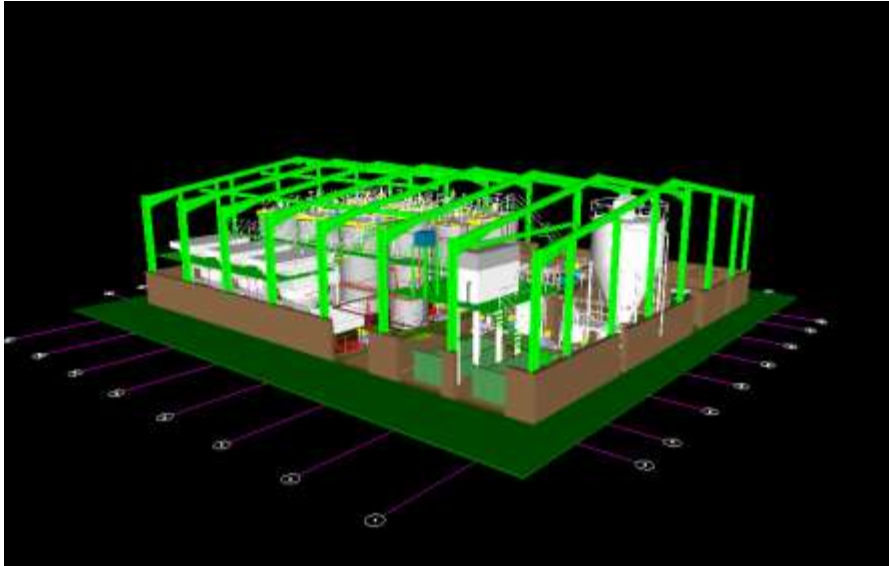
Horden (Peterlee) Control of Water Levels



Finding a more sustainable approach

- Aquifer protection – for the long term
 - Pumping timescale is indefinite
 - Treatment – opportunity to manipulate
- Long term strategic plan
- Dawdon – 2/3 of water – active plant
- Horden - 1/3 of water – passive scheme

Dawdon; Seaham



- Pumping Prevents pollution to Magnesian Limestone aquifer
- HDS plant 150l/s

Horden: active (2004) to passive (2009)



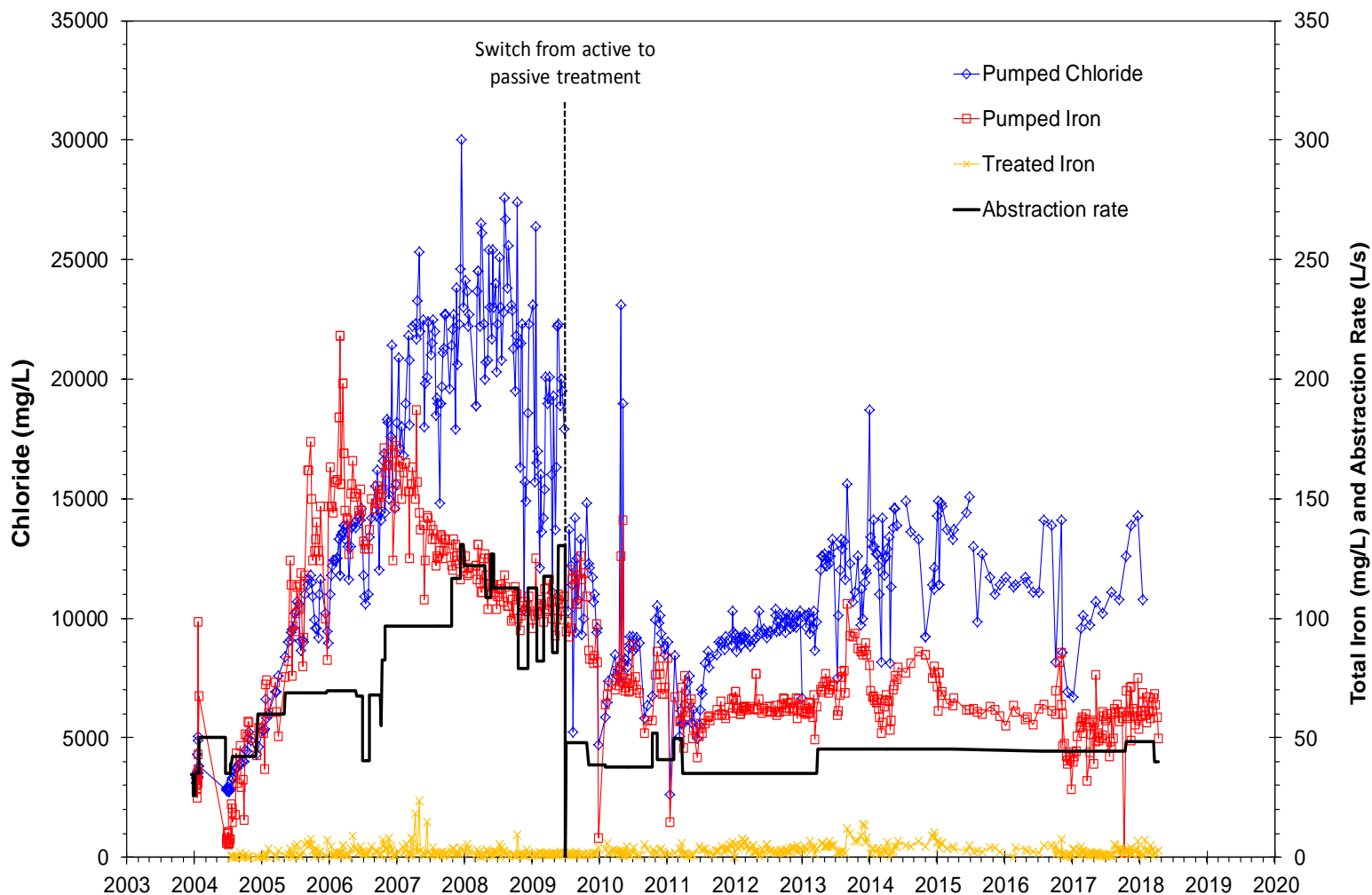
Horden temporary active to passive



Active Treatment Area = 0.1 ha

Passive Treatment Area = 1.7 ha

Horden: chemistry changes – iron and chloride



Changing pumped to gravity fed

- Pumping sites
- Converted to engineered gravity discharges
- Allow recovery to surface decant point
- E.g. Page Bank, Vinovium, Chatershaugh
- Kimblesworth MWTs
 - NEW

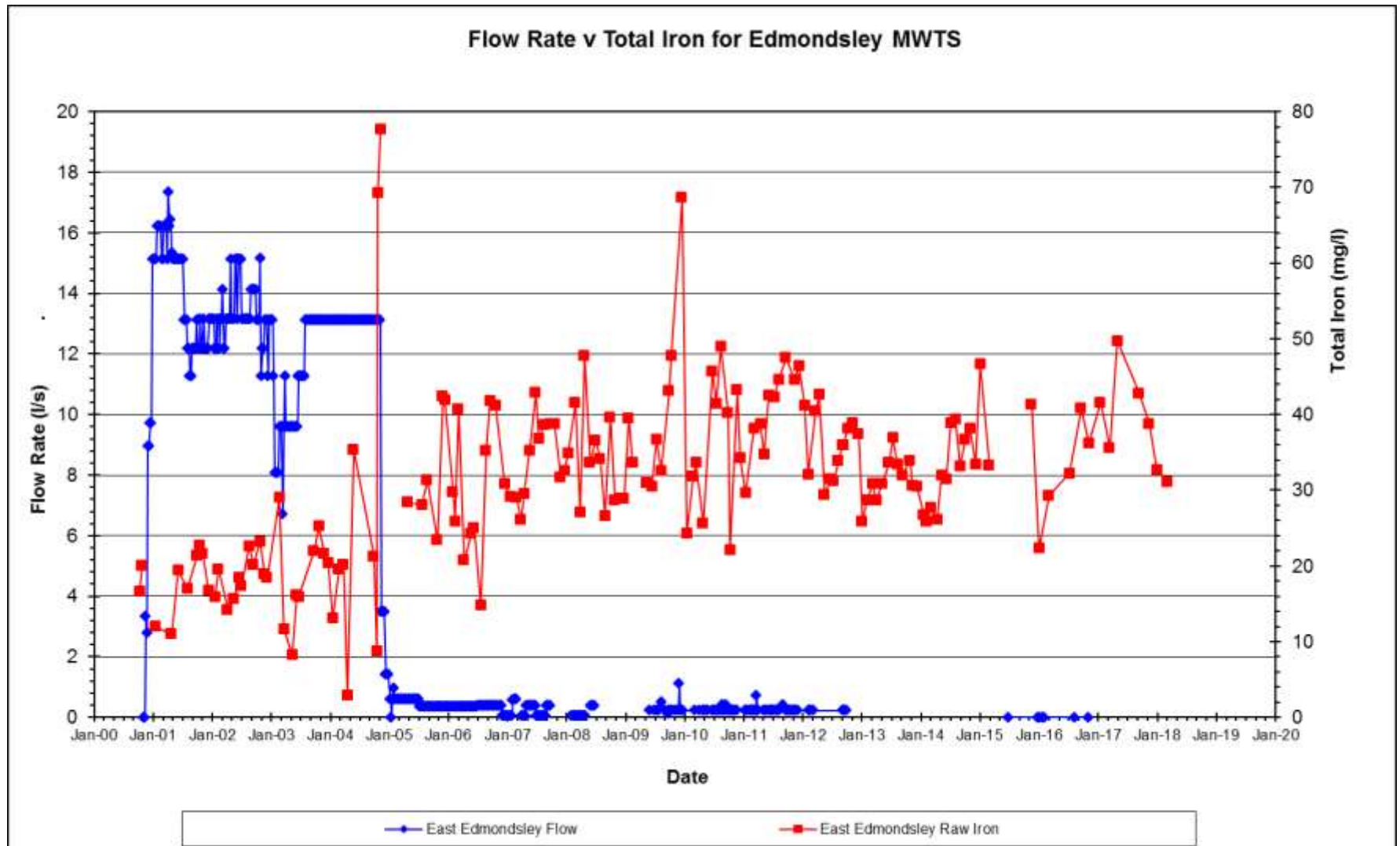


Unexpected changes

- Underground collapses/ blockages
- Temporary / permanent changes to flows
- Blow outs possible
- Edmondsley MWTS
- Adit collapsed
- Flow reduced



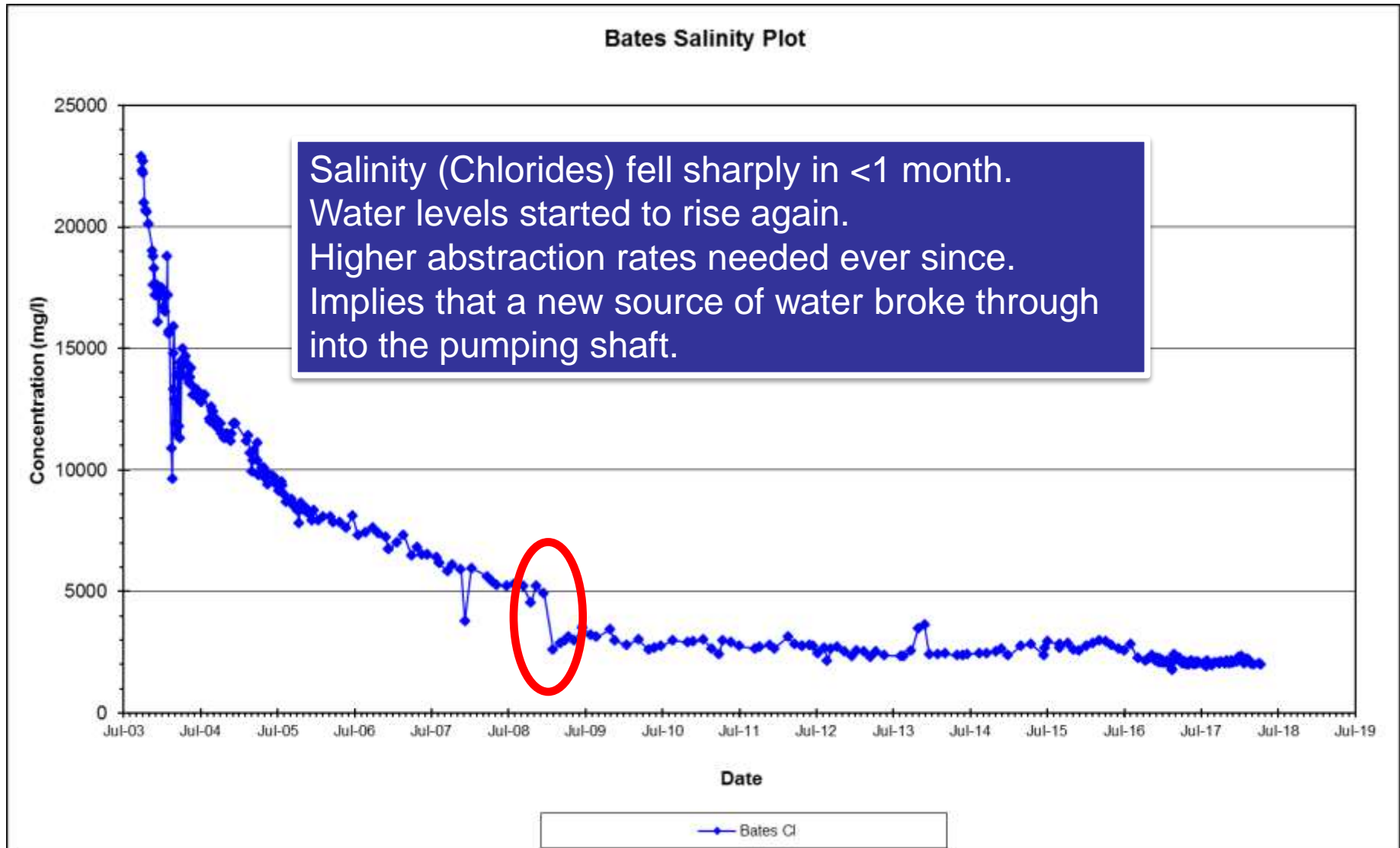
Edmondsley change over time



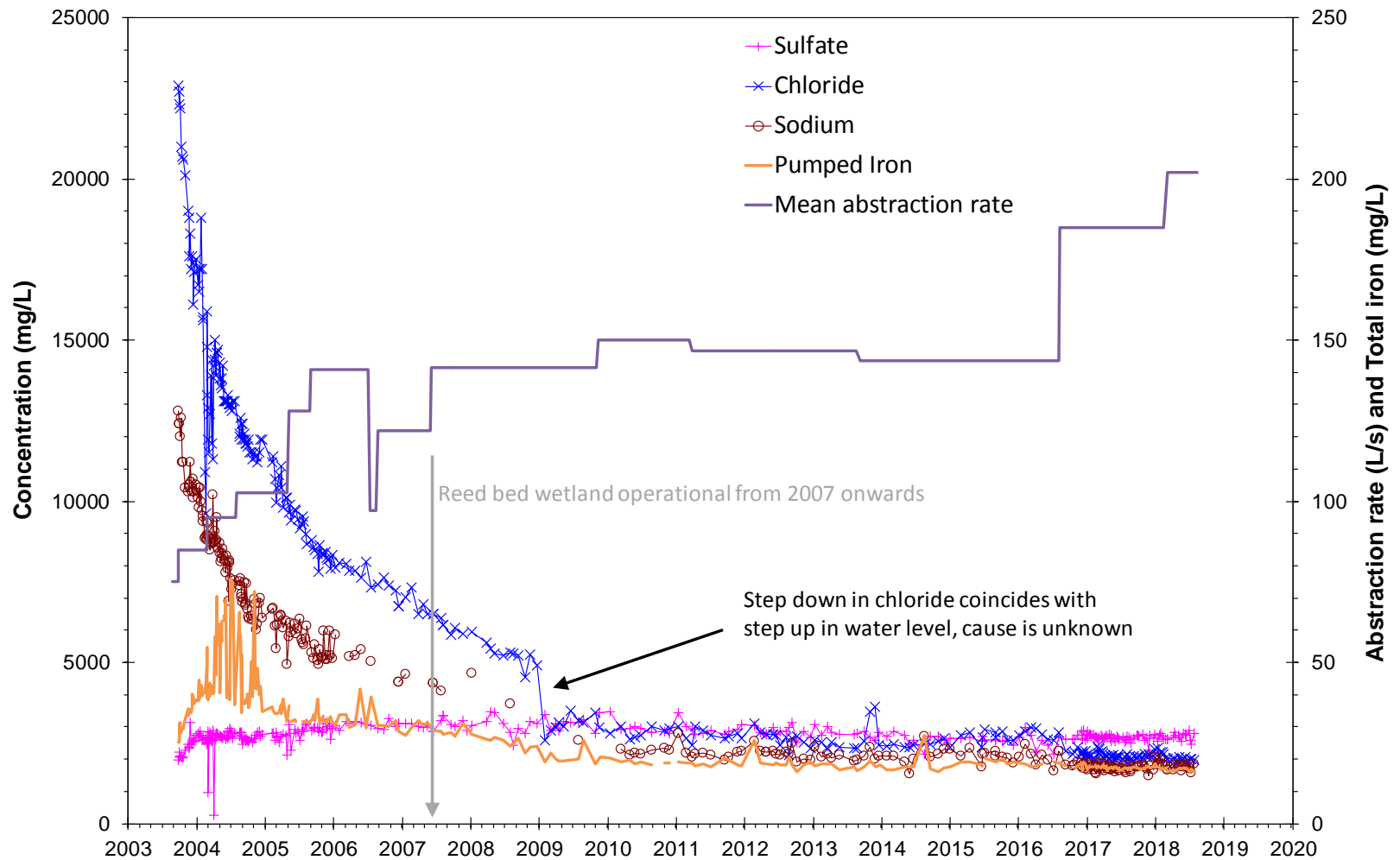
Bates preventative scheme, Blyth



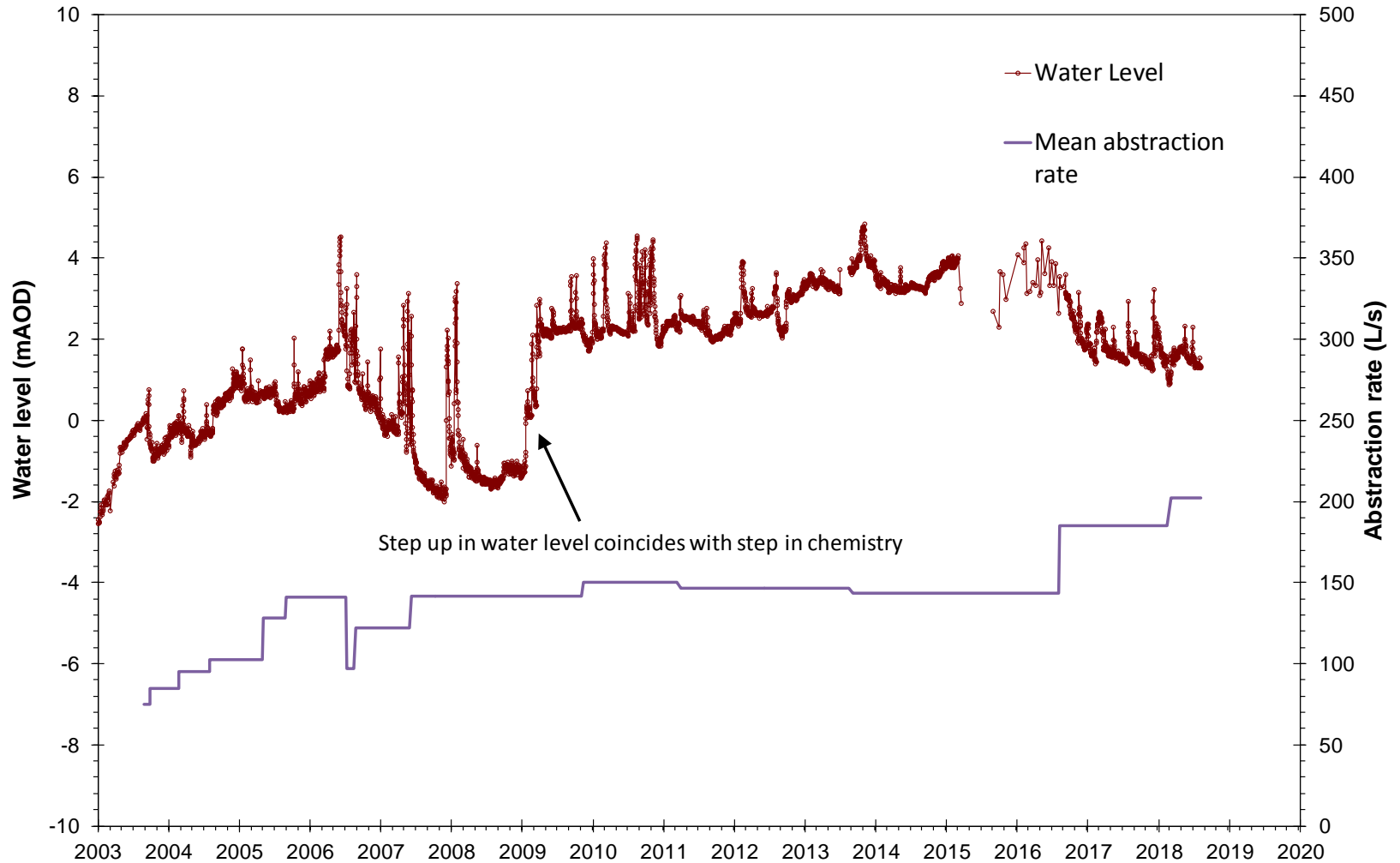
Bates (Blyth) sudden change in flows



Bates – chemistry detail



Bates – water level trend



Summary – adapting to change

- Rising Mine Water areas
 - Plan new schemes where needed
- After Recovery
 - Look for opportunities
 - Active to passive
 - Pumped to gravity-fed
 - New remedial schemes
 - if cost-beneficial
 - Adapt to unexpected changes
 - May need more / less pumping / treatment



An Overview of the R & D / Innovation Programme

- Low footprint coal / metal mine water treatment options
- Review of treatment performance of lagoon systems
- Re-use of ochre sludge
 - Contaminated land remediation
 - Waste water coagulant
 - Pigments (paint, bricks ...)
 - etc



An Overview of the R & D / Innovation Programme

- Recovery of heat from mine water
 - Typical 11 – 19C
- Some large scale >1MW schemes exist
 - Eg heating of warehouses



- Standard Renewables
- Solar PV at several sites now



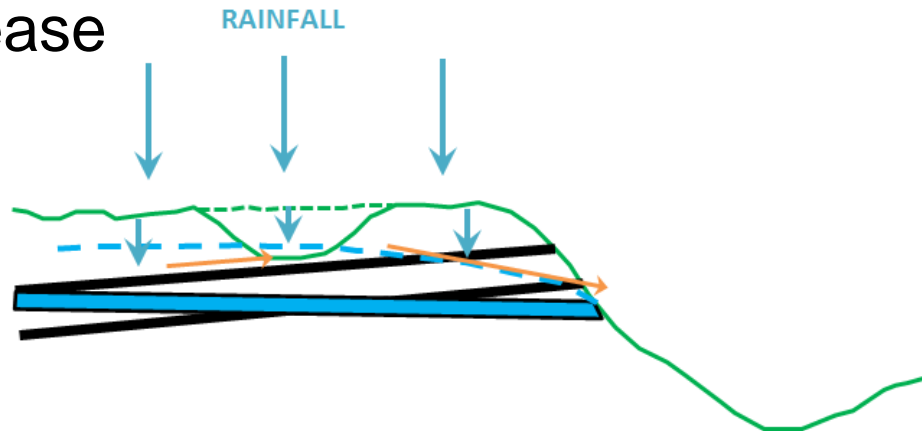
A new project

- Discussions with EA
 - Opportunity to raise awareness
 - Mine Water
 - What is happening ?
 - What could happen ?
- Could it be a constraint for new developments ?
 - Sustainable Drainage Systems, SuDS
- A new partnership project
 - began in 2017



SuDS can be great, but...

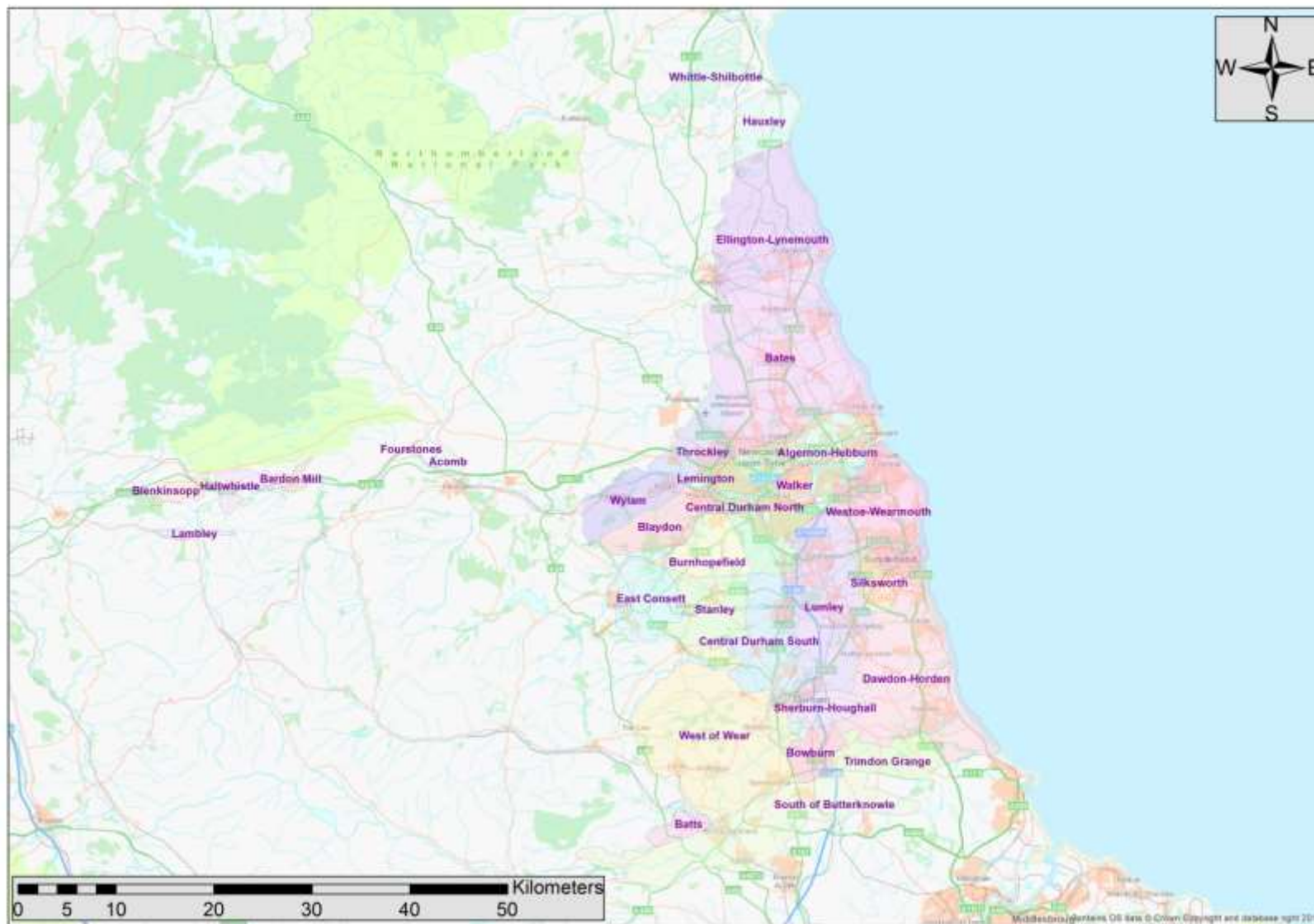
- **Infiltration** type SuDS in mining areas
 - May cease to work if rising mine water approaches surface
 - May give rise to problems elsewhere
 - New discharges may occur
 - Discharges may change (quantity &/ quality)
 - Coal Authority schemes will incur extra cost if flows / concentrations increase



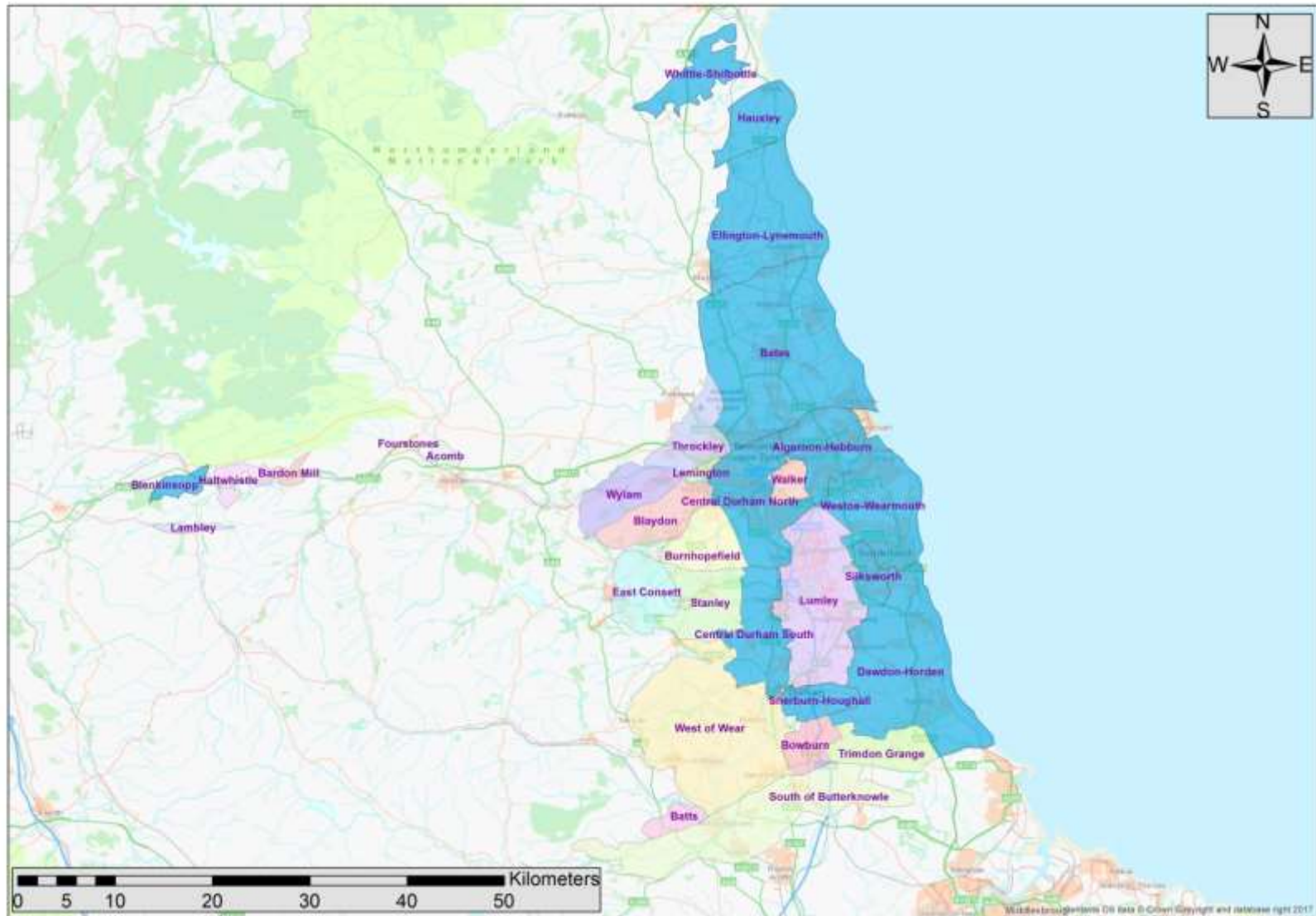
Progress to date

- Mining and Groundwater Constraints for Development
 - North East England coalfield coverage
- Toolkit produced:
 - Mine water constraints mapped and categorised
 - Guidance
- Midway through pilot year with Local Authorities

North East Coalfield mine water blocks



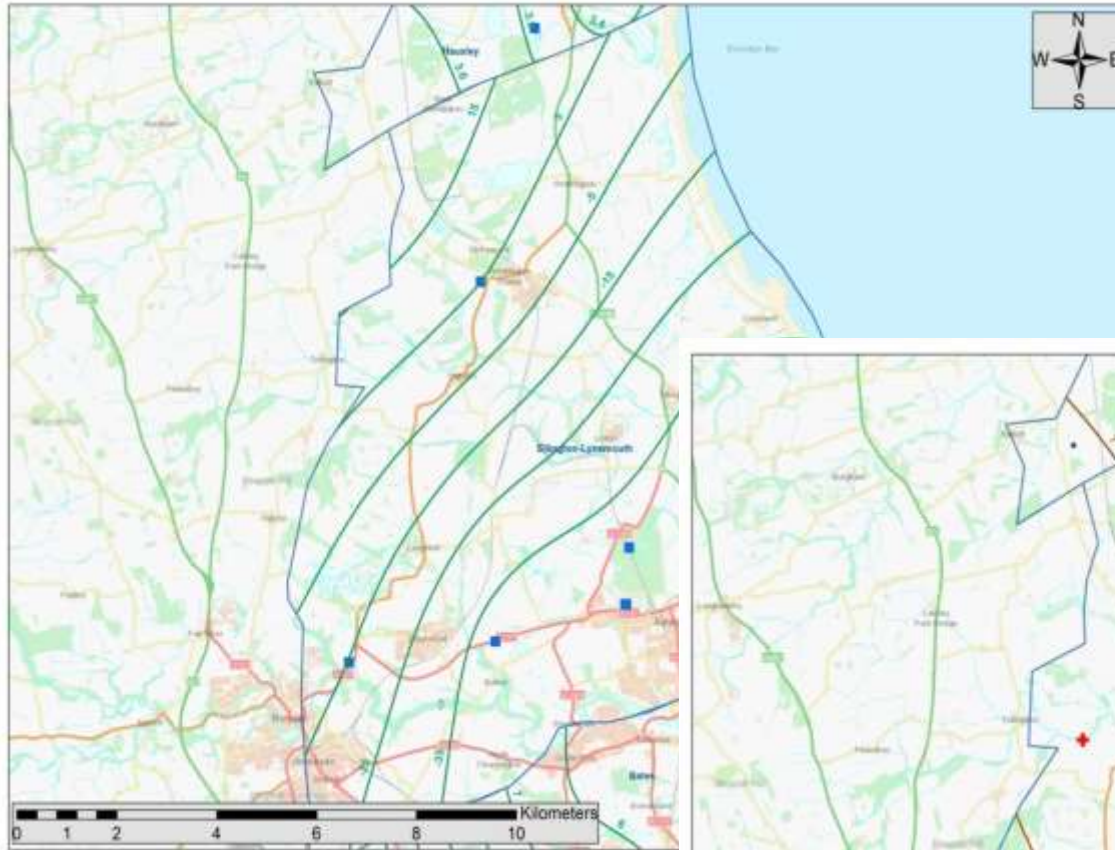
Potential for mine water level to change



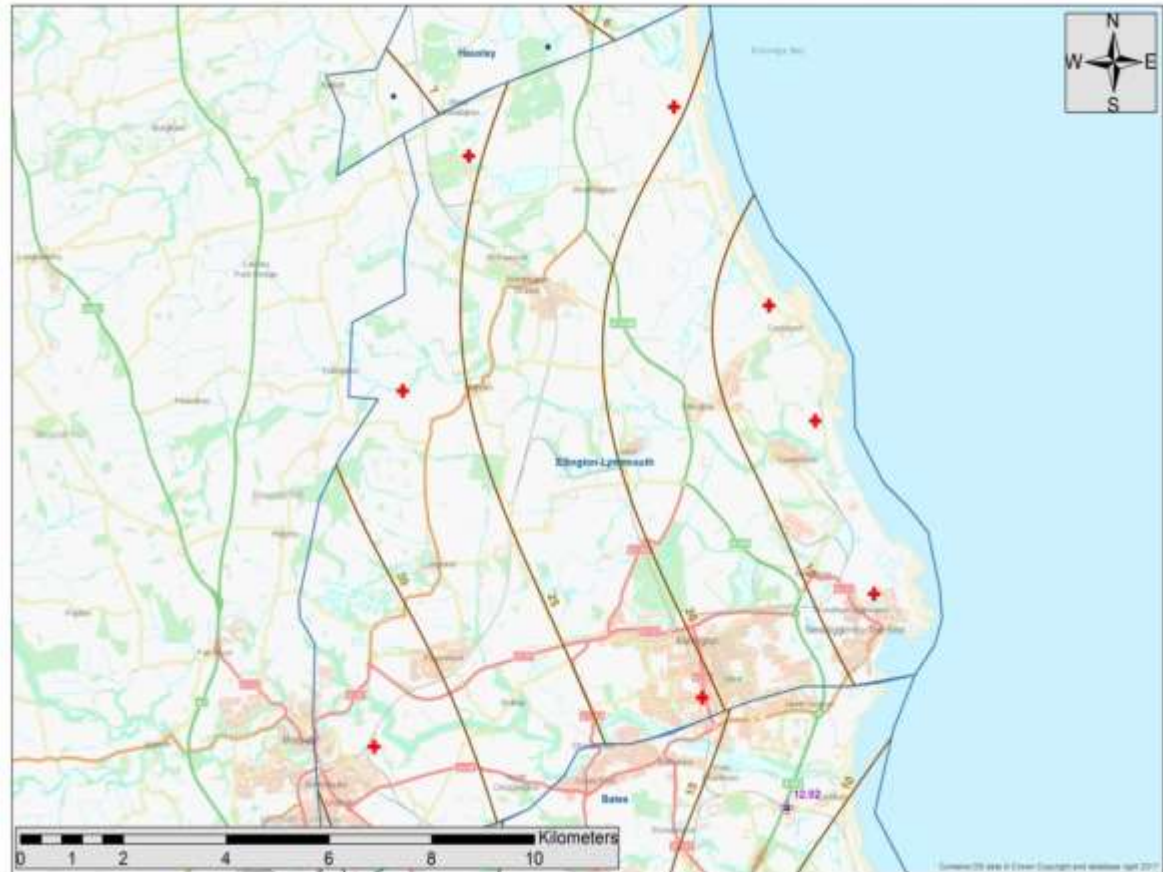
Seeing the Future

- Aim to future proof mapping
 - 100 year design life for some developments
 - Consider potential mine water changes ahead
- “Future” is our view of what could happen if areas are allowed to rise without ongoing control by pumping
 - relatively conservative approach taken

New datasets - contours



Current



Future

- Contour datasets could have other uses
- E.g. assessing heat extraction from mine water
- Coal Authority data is available on request
- datasolutions@coal.gov.uk
 - Subject to licence, may be chargeable

Producing the constraints map

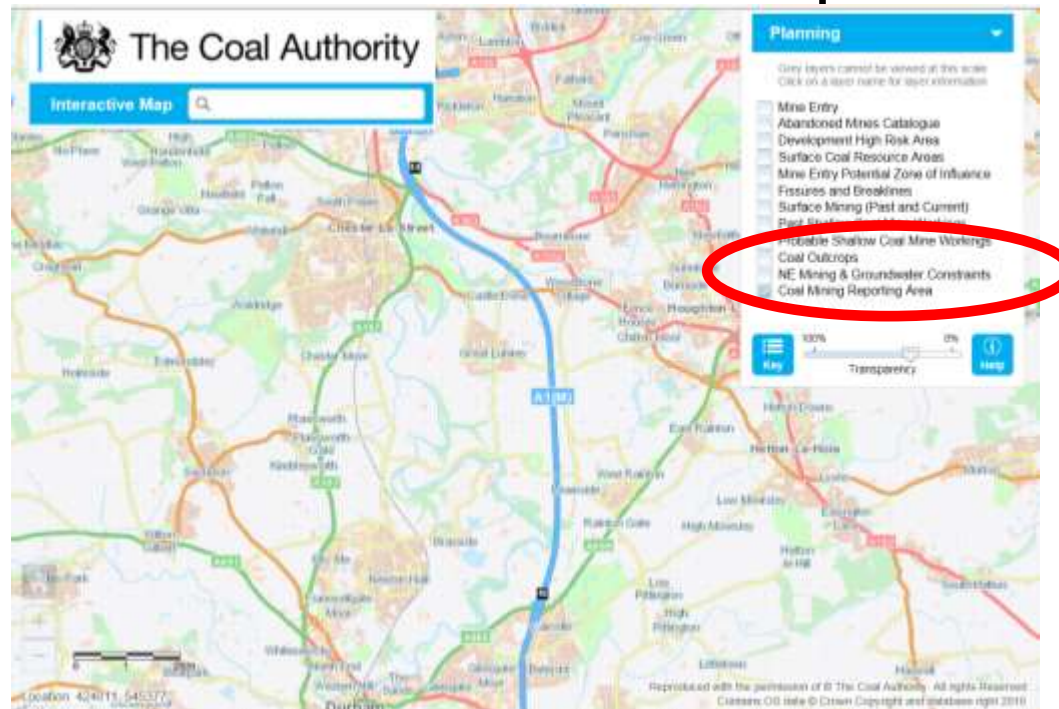
- Defined Mine Water Blocks
- Predicted depth to mine water
 - Shallow mine water <10m depth / artesian
- Assumes no future pumping
- Proximity to current controlling outflow
- Proximity to future controlling outflow
- Shallow mine workings (<30m depth)
- Uses criteria to determine a category

Mapping categories

Category	Criteria description
A	Off the coalfield
B	On the coalfield area
C1	On the coalfield area with one, or both of: shallow mine workings, and nearby controlling outflow
C2	On the coalfield area with shallow mine water
D	On the coalfield area with shallow mine water, and one, or both of: shallow mine workings, and nearby controlling outflow

Finding out a sites category

- Search the Coal Authority's interactive map viewer
 - <http://mapapps2.bgs.ac.uk/coalauthority/home.html>
- Zoom in, then activate the 'NE Mining and Groundwater Constraints' option



Constraints map example

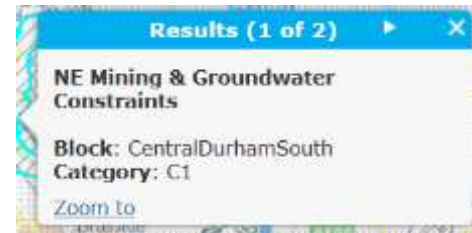


Constraints map example

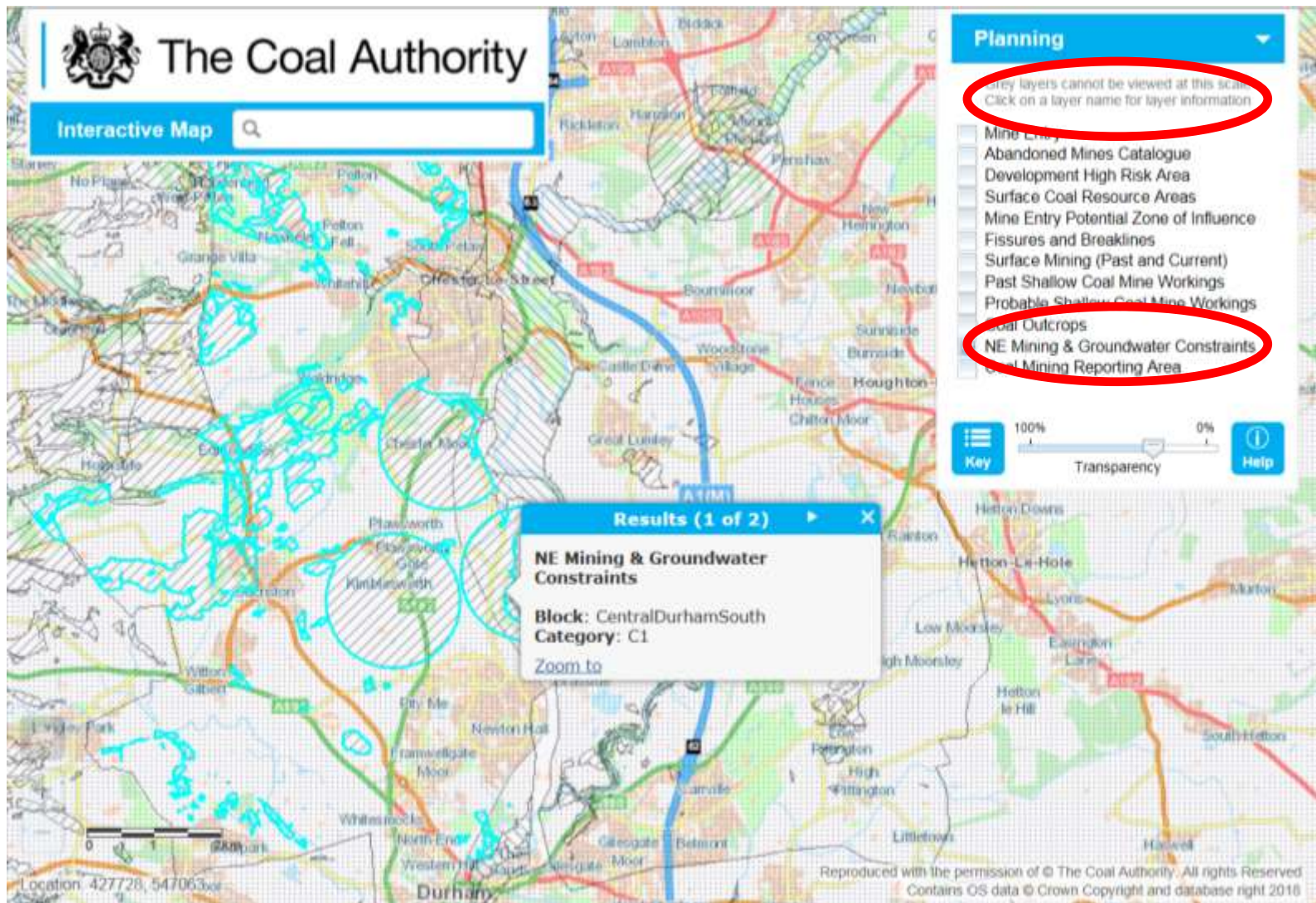


Next steps

- The viewer can be used to find out the :
 - Mapped category
 - Block name
- Guidance document is currently available via Local Authorities
 - 1st iteration now on gov.uk
 - <https://www.gov.uk/guidance/mining-and-groundwater-constraints-for-development>
- Each block has a summary fact sheet to provide additional information





Constraints map example



Guidance on gov.uk

<https://www.gov.uk/guidance/mining-and-groundwater-constraints-for-development>



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Guidance

Mining and groundwater constraints for development

If you are developing a site within a coalfield area you may need to give additional consideration to the proposed drainage and infiltration.

Published 14 November 2018
From: [Coal Authority](#)

Contents


- [Mining and groundwater constraints categories](#)
- [Check the constraint category of your development site](#)
- [Action to take after checking constraint category](#)
- [When category modifications are required](#)
- [Mine water block factsheets](#)

Related content

- [Environmental permits](#)
- [Environmental planning](#)
- [Land and development opportunities](#)
- [Planning system](#)


Mine Water Block Factsheets on gov.uk

<https://www.gov.uk/government/publications/mine-water-block-factsheets/north-east-england-mine-water-block-factsheets>



GOV.UK Search

Home > Mine water block factsheets


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Guidance
North East England mine water block factsheets
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2. Algernon-Hebburn mine water block factsheet
3. Allerdean Mill mine water block factsheet
4. Bardon Mill mine water block factsheet
5. Bates mine water block factsheet

1. Acomb mine water block factsheet

1.1 Description of mine water block

The Acomb mine water block is isolated from the main coalfield and is centralised around the village of Acomb, extending up to Barns Wood in the north to Target Wood in the east, Hexham in the south and Nether Warden in the west.

It is considered that the mine water levels in the Acomb mine water block are recovered.

Fact sheet example – Central Durham South

<https://www.gov.uk/government/publications/mine-water-block-factsheets/north-east-england-mine-water-block-factsheets>

12. Central Durham South mine water block factsheet

12.1 Description of mine water block

The Central Durham South mine water block extends from Ouston in the north to Durham in the south, Chester-le-Street in the east and Edmondsley in the west.

Currently the mine water levels are controlled by pumping at Kimblesworth shaft. Pumping at Kimblesworth shaft is due to be reduced overtime, and eventually will be switched off. This will result in development of artesian conditions and subsequently a controlled outflow of mine water at the Busty monitoring borehole. This will be the source of the mine water which will be treated at the newly built Kimblesworth mine water treatment scheme.

The south eastern extents of this block are fairly well defined, where there is a wide section, up to approximately 500m, of no recorded mine workings in some areas.

12.2 Contouring methodology

Within the mine water block, there are a total of 7 mine water level monitoring points. There are no current mine water discharges directly associated with the main mine water regime.

The contours were generated in ArcGIS and followed the agreed hierarchy contouring methods, in this block, the 95th percentile of maximum over a 5 year period from 2012 to 2017.

[↑ Contents](#)

Other mining features

- If there are other mining features on site
 - E.g. confirmed by ground investigation
 - Shafts etc
 - Shallow mine water, perched above general level
 - These could form additional pathways for water
- In such cases the mapped category can be modified



Mapped Categories can change

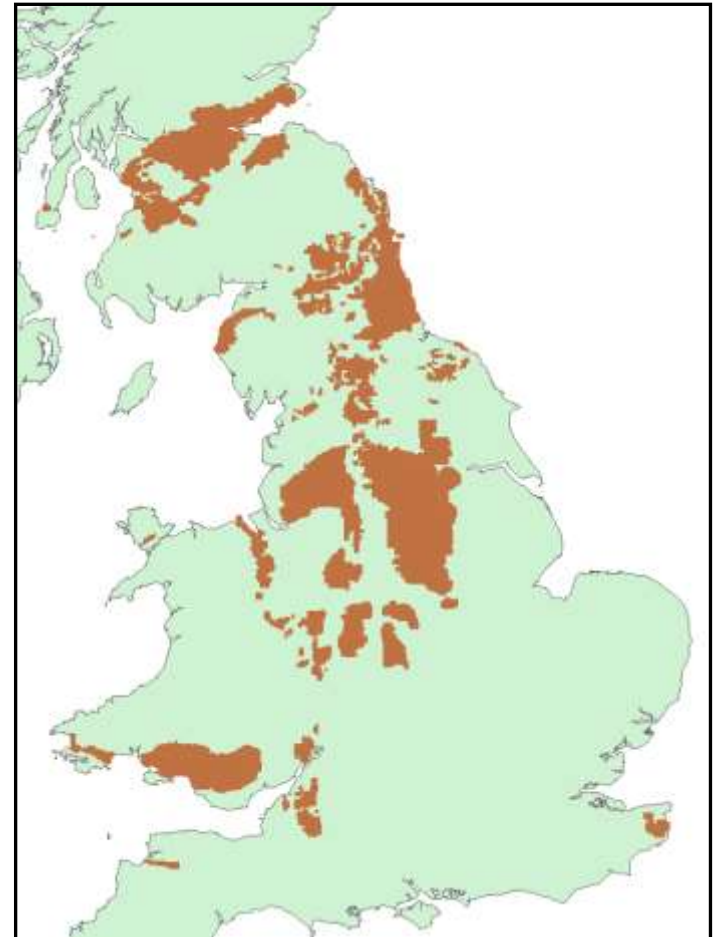
Mapped Category	Additional Mining Features found to be present on site	Modified, Effective Category
A	Within Coal Mining Reporting Area ¹	B
B	Any potential pathway including: Unrecorded Shallow Coal Mine Workings Mine Entry ¹ Coal Seam Outcrop ¹ Surface Mining ¹ (opencast backfill / high wall) Fissures / Breaklines ¹ Geological Fault	C1
B	Shallow Mine Water	C2
B	Minor discharge of mine water connected to workings underlying the site	C1
C1	Shallow Mine Water	D
C2	Any potential pathway including: Unrecorded Shallow Coal Mine Workings Mine Entry ¹ Coal Seam Outcrop ¹ Surface Mining ¹ (opencast backfill / high wall) Fissures / Breaklines ¹ Geological Fault	D
C2	Minor discharge of mine water connected to workings underlying the site	D

Action Summary

Category	Criteria description	Action summary
A	Off the coalfield	Available SuDS guidance and best practice for assessing pollution and flood risk should be followed. Groundwater should always be considered when designing drainage schemes.
B	On the coalfield area	Specific requirements for deep ground works or deep drainage boreholes.
C1	On the coalfield area with one, or both of: shallow mine workings, and nearby controlling outflow	Deep ground works or deep drainage boreholes require pre-application consultation with the Coal Authority (Permissions team).
C2	On the coalfield area with shallow mine water	SuDS may not work, developer must suggest alternative methodologies or undertake detailed hydrogeological risk assessment, or investigation, that require pre-application consultation with the Lead Local Flood Authority (LLFA).
D	On the coalfield area with shallow mine water, and one, or both of: shallow mine workings, and nearby controlling outflow	SuDS may not work, developer must suggest alternative methodologies or undertake detailed hydrogeological risk assessment, or investigation, that will require pre-application consultation with the Coal Authority (Permissions team) and the Lead Local Flood Authority (LLFA).

Next steps

- Complete pilot year
 - (to March 2019)
- Consider rolling out further:
- Method refinement?
- Other UK coalfields
- Non-Coal Mined areas



Conclusions

- To deal with mine water over the long term
- Expect changes to occur
 - Predictable AND
 - Unpredictable
- Understand the risks
 - SuDS designs allow for future water levels
- Seek out opportunities
 - Decrease pumping and treatment
 - Geothermal heat from flooded mines



