







The Lower Tees and its Coast – The Risks that Industry, Dredging and Development Pose to Crabs and Seals

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Acknowledgements

- **North East Fishing Collective**
 - Hartlepool
 - Redcar
 - Whitby
- **Multi-Council - Crustacean Deaths Collaborative Working Group**
 - Redcar & Cleveland, Middlesbrough, Stockton, Hartlepool, North Yorkshire
- **Reclaim Our Sea**
- **Tees Estuary Seal Study (TESS)**
- **North East Marine Research Group**
 - Universities of Durham, Hull, Newcastle, York
 - Fishmongers' Company
 - Reclaim Our Sea
- **Tees Pollution Group 2022 -2024**
 - Sally Bunce / Dawn Love / Richard Randle / Robin Yardly / Simon Gibbon

What I Hope To Get Across

- A partial picture of the Lower River Tees and its History
- River Tees sediment is contaminated
- Much of the contamination is on silt (small particles)
- Contaminated silt is released into the river during dredging
- The release of contaminated silt is damaging to the River Tees Estuary's ecology
- Dredging methods need to be changed to protect the estuary's ecology

Plan

- River Tees then and now
- 2021 Crab die-off
- 2024 Seals
- Maintenance Dredging
- Sediment Contamination
- Teesworks Development
- UKD Orca
- Dredge Contamination Spread
- Concluding Remarks

Water Pollution – Source / Monitoring

- Sewage
- Agricultural run-off
- Industrial effluents
- **Contaminated sediments**
- Road Run-off
- Monitoring primary aim is human health risks
- All sources are stresses on marine flora and fauna
- Dominant stress may change over time
- Need to test water for nature

The River Tees

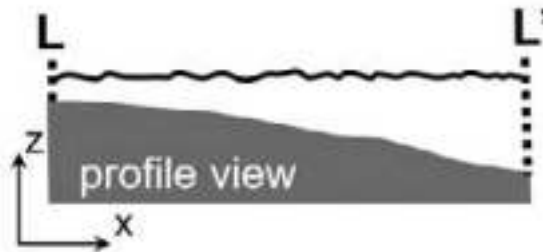
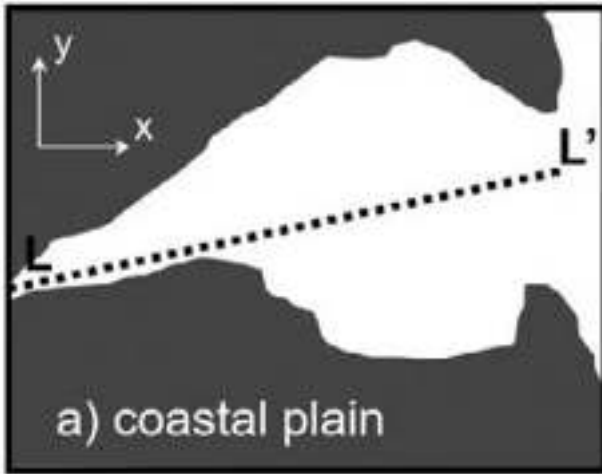
The North Sea

- River Tees discharges into the North Sea
- Currents flow north – south past Teesmouth
- What happens in the wider sea?
- Disposal sites on continental shelf

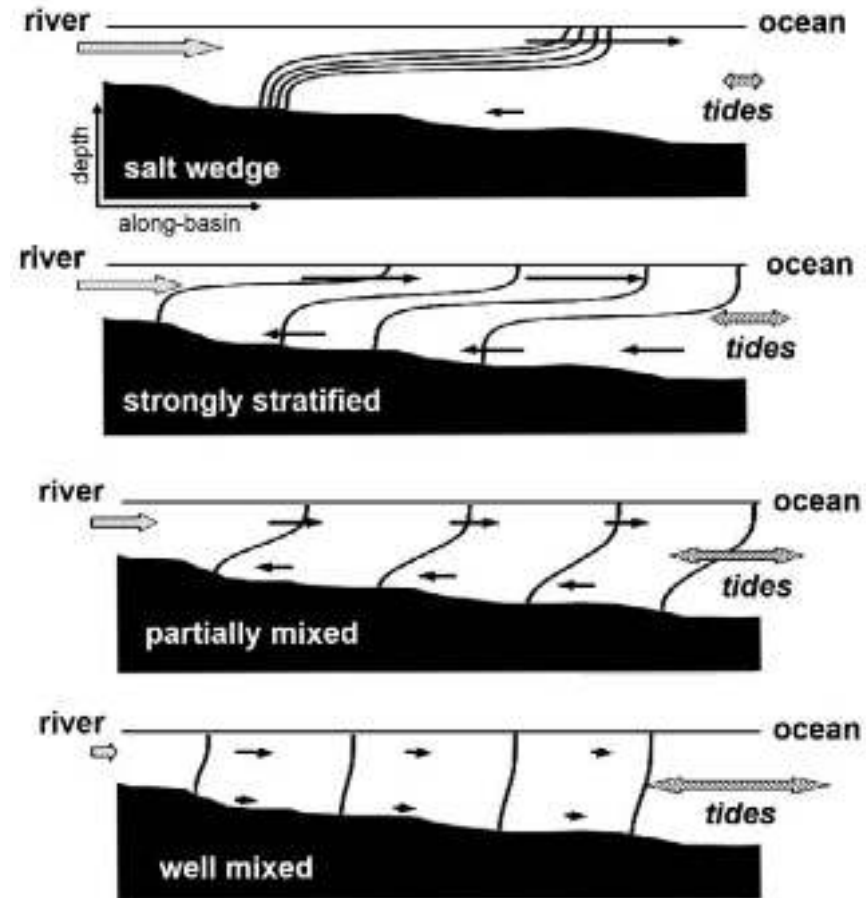
River Tees



River Tees – Intertidal Estuary



It's complex
It's biologically diverse



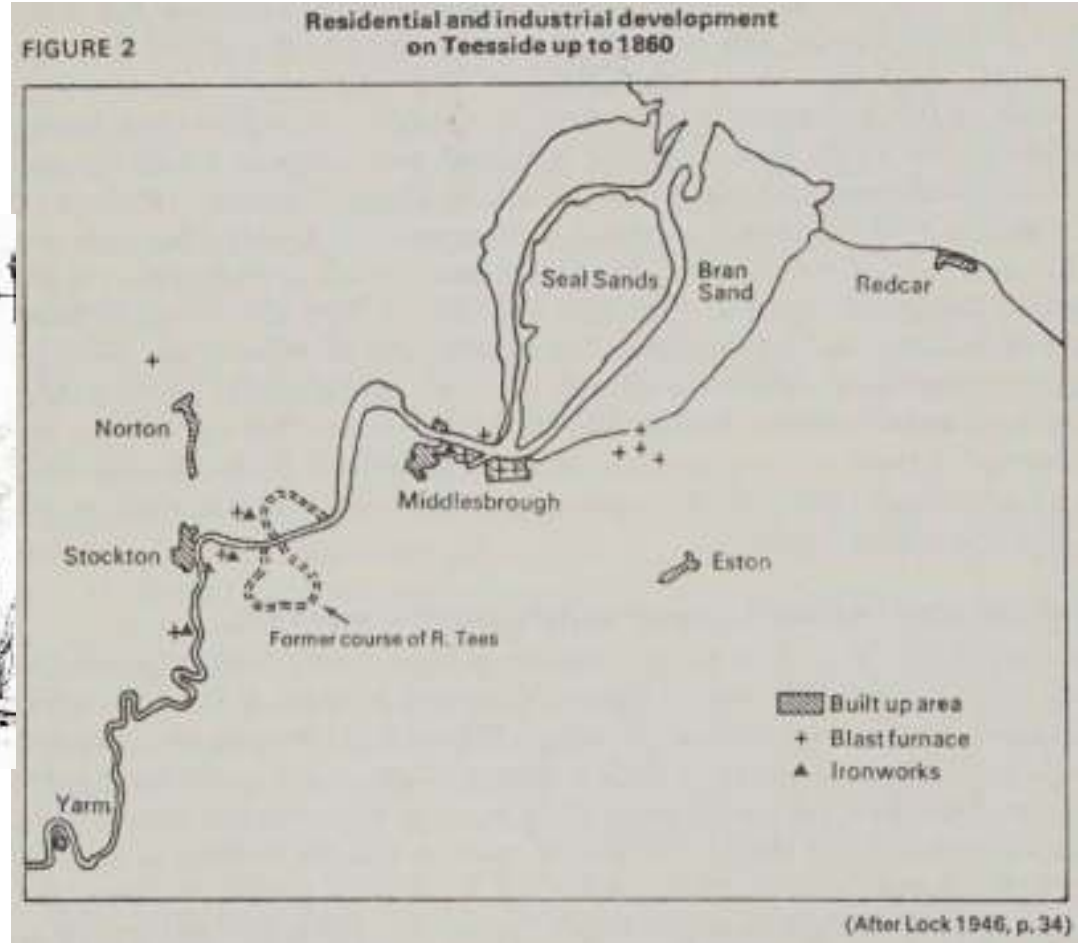
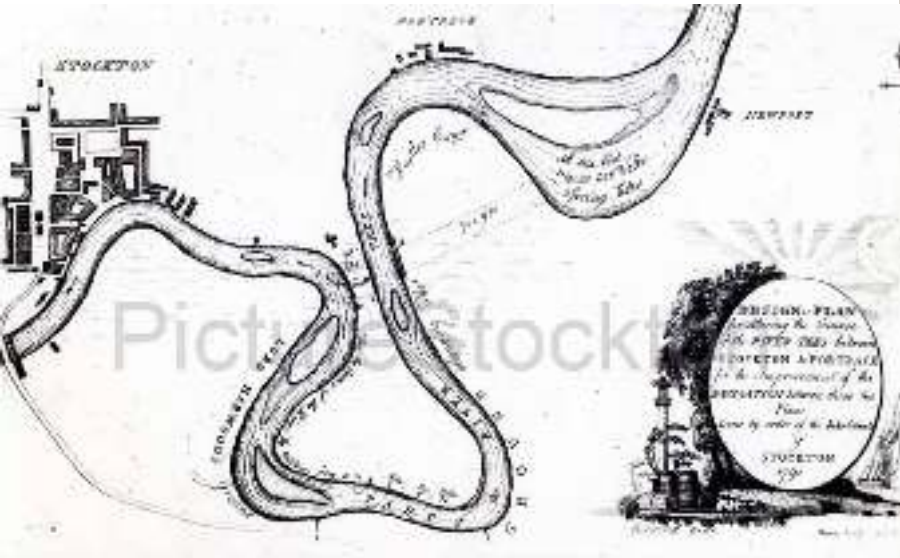


Duddon Estuary, Cumbria

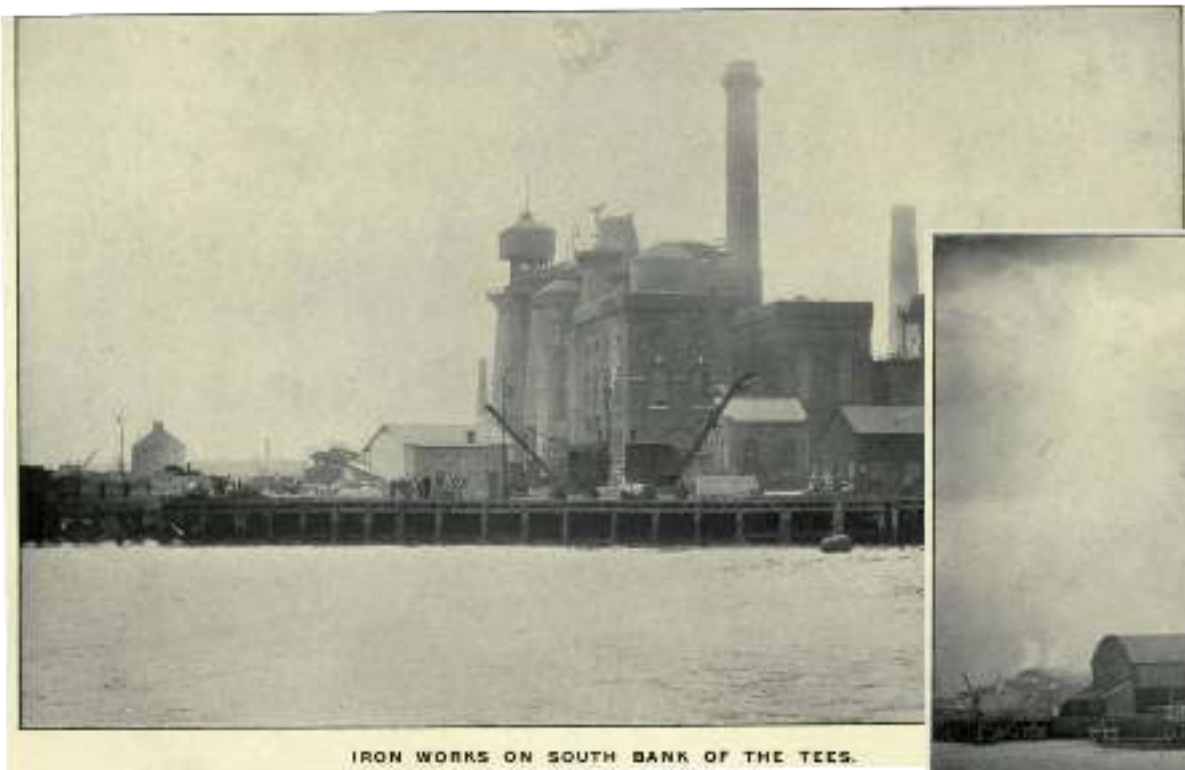


The Lower River Tees – 1791, 1860

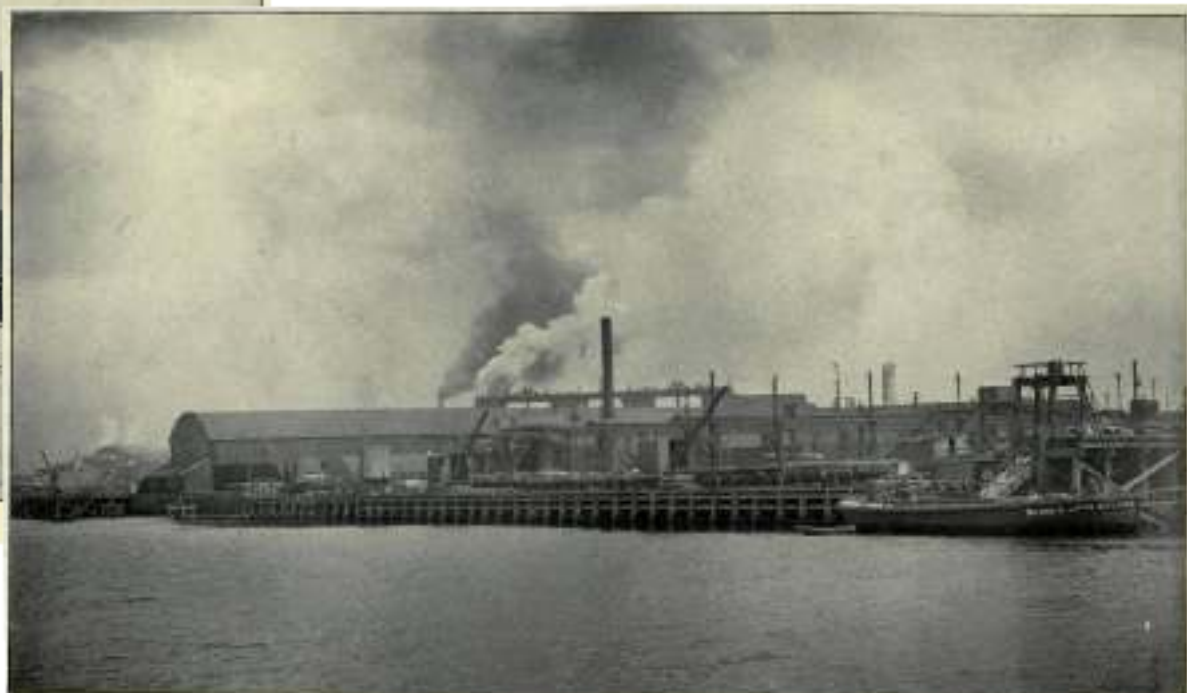
1791 – 1810 & 31



1906

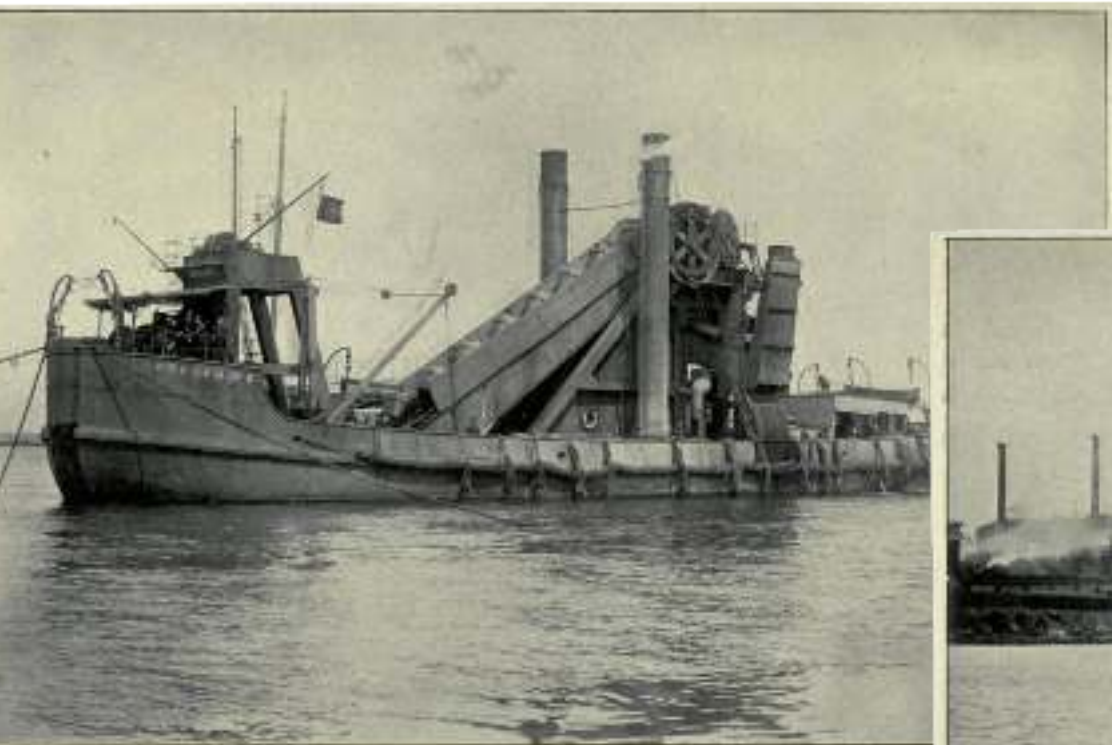


IRON WORKS ON SOUTH BANK OF THE TEES.

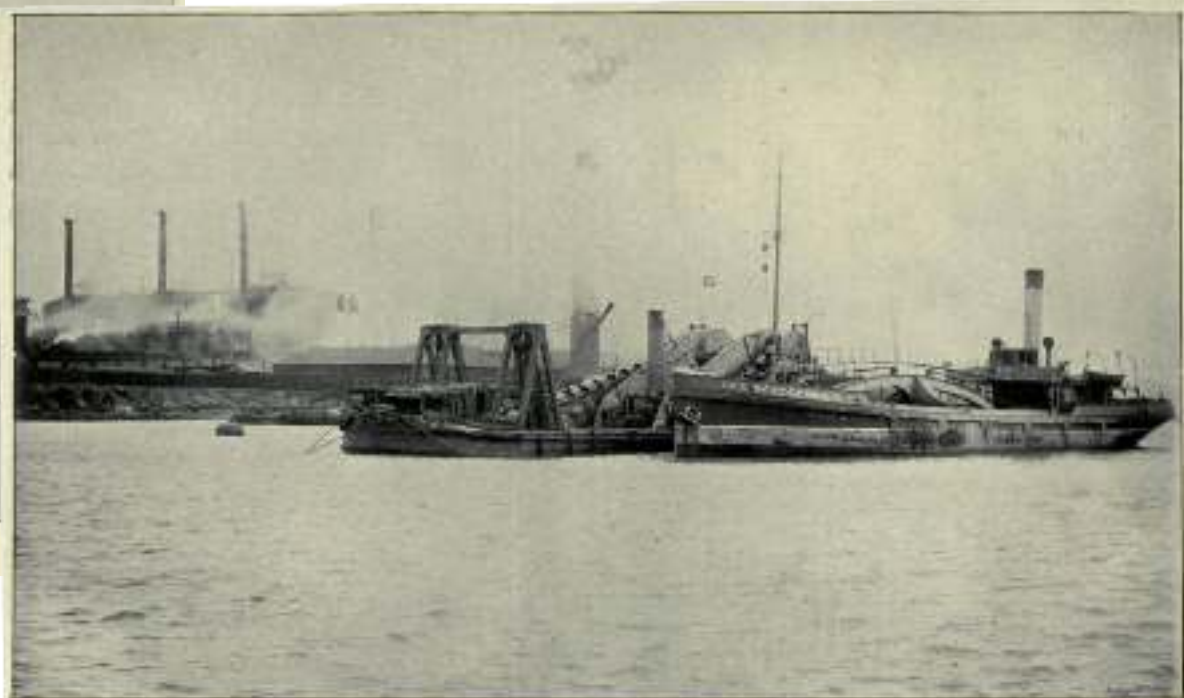


STEEL WORKS ON SOUTH BANK OF THE TEES.

1906

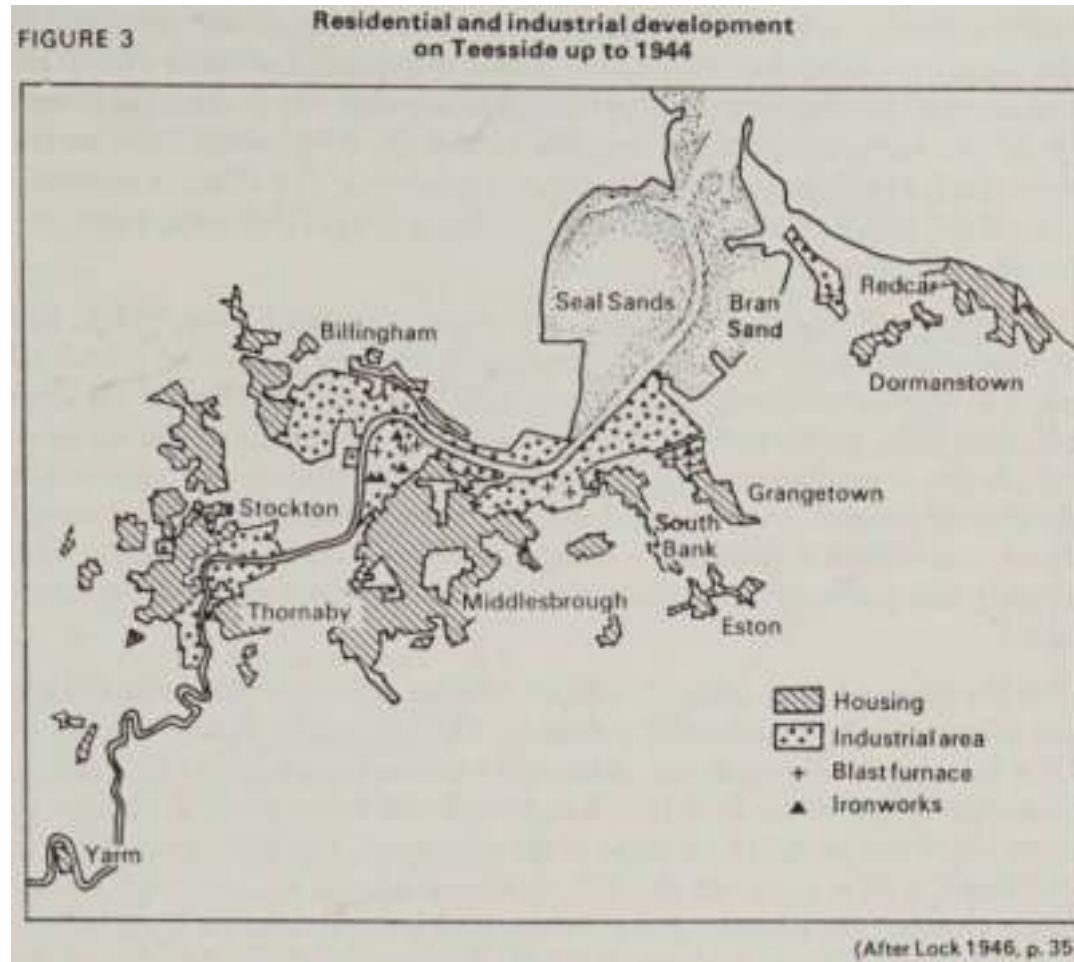


TEES COMMISSIONERS' NEW DREDGER, NO. 6.

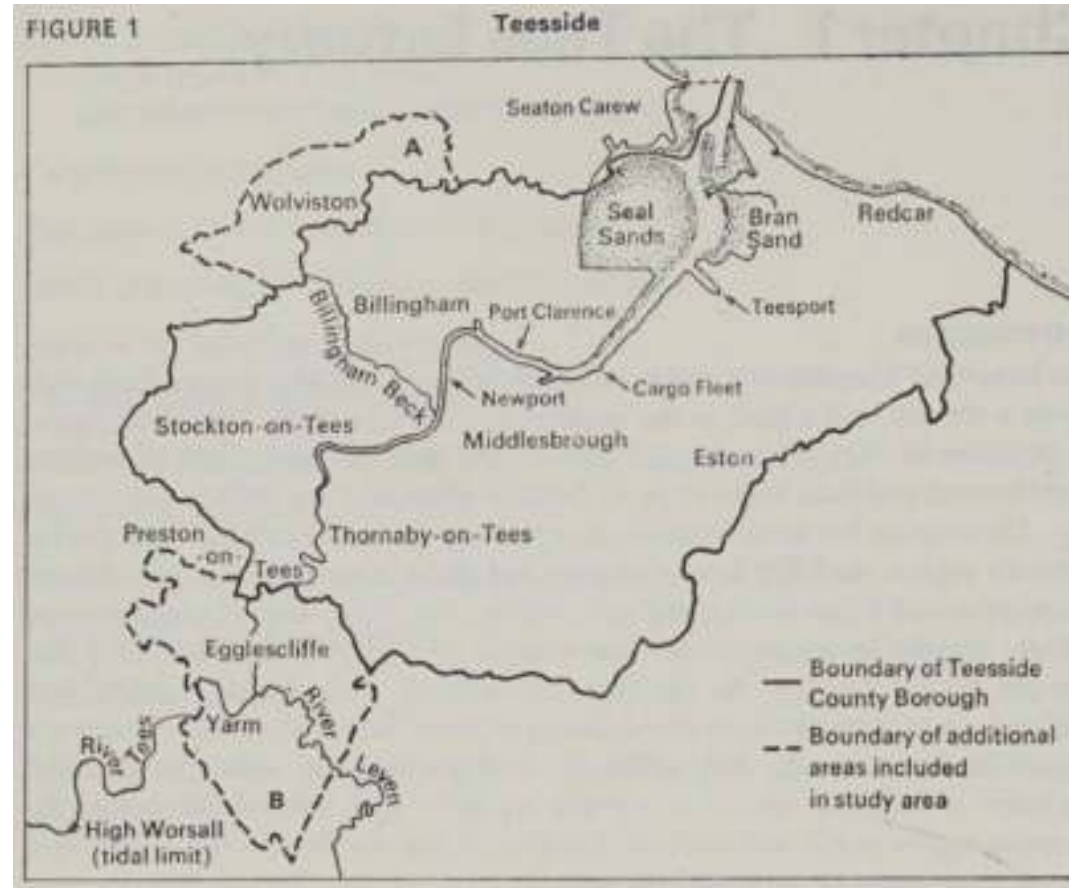


MIDDLESBROUGH REACH.
(T.C.C. DREDGER AND TWIN SCREW STEAM HOPPER)

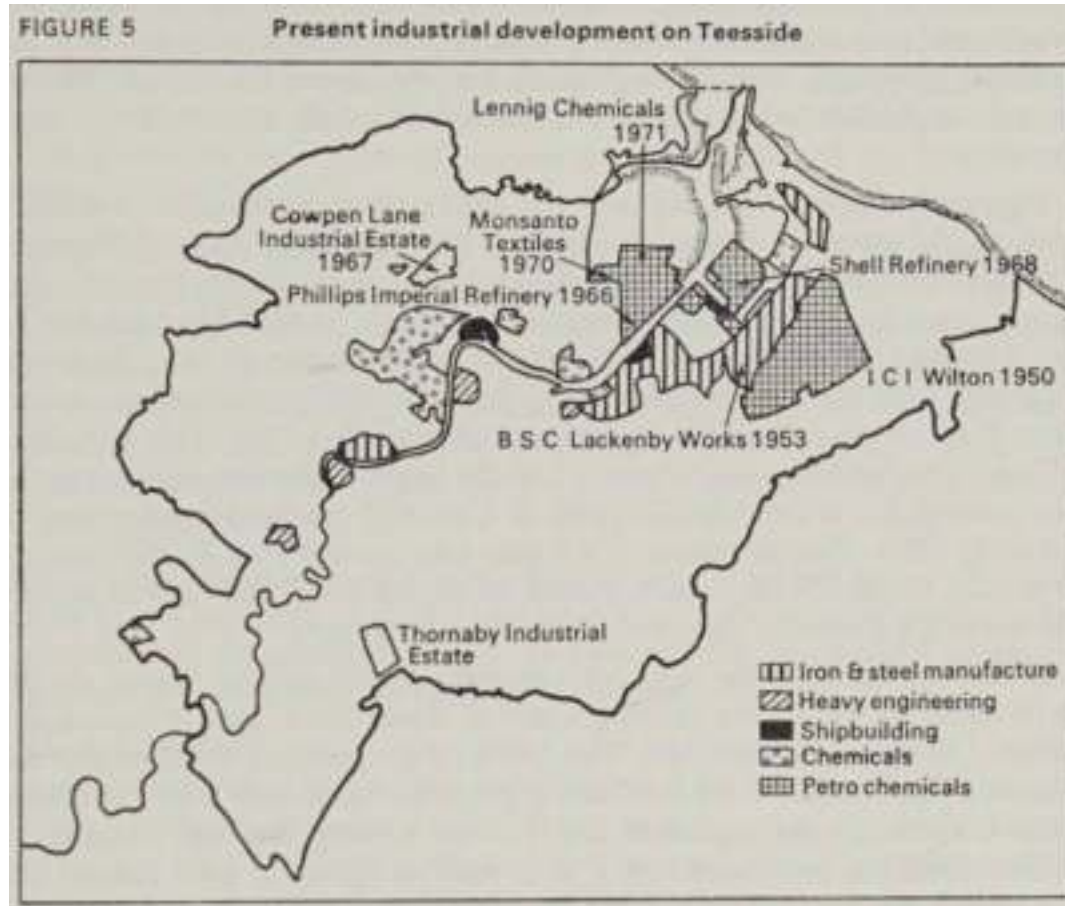
The Lower River Tees – 1944



The Lower River Tees - 1971



The Lower River Tees - 1971



History of Land Reclamation

- 90% intertidal area lost (reclaimed)
- Straightening of river
- Hard boundaries between river and land
- Loss of land for nature / natural systems
- The reclaimed land was used for heavy industry
- Pollution made the river unviable for nature
- Pollution left behind the legacy
 - highly contaminated land (treat carefully)
 - highly contaminated river sediments (remove or leave alone)



Figure 1. The pattern and sequence of land claim in the Tees Estuary

Bran Sands



Saltmarsh Formation – North Gare



Greatham South managed realignment

- Remove sea wall
- Letting sea back in
- Flood resilience
- Nature too

- *Tees Tideland*



Crab Die-off 2021

Crab Die-off – 2021

- 25/9 – 5/10 huge crab die-off
- 4/11 – Hartlepool
- 2021 – present many reported die-offs
 - EA – natural
 - storm related
 - unbalanced ecosystem
- 2021 – present
 - Decreased near inshore catches
 - Hartlepool to Whitby
 - Drastically reduced inshore fishing livelihoods



Links / embedded videos

<https://www.northeastfc.uk/doku.php?id=start>

Channel 4 – What's killing marine life in North East England? 30th September 2022

<https://youtu.be/HZdXyrTLjhh>

Gary Caldwell – Mass Marine Die-off: Searching for Cause of These Events in Northeast England - 27th July 2023

<https://youtu.be/9ZW6B9t-XPw>

Chronology of Marine Die-offs

https://www.northeastfc.uk/doku.php?id=chronology_of_marine_die-offs



Map of 2021 Die-off

- Localised to inshore waters
- Not all species impacted
- Crabs are born north as far as Lindisfarne
- No large crabs but few small crabs
- Migratory lobsters largely unaffected

Fig 1: Location map for the coastline from which unusual crab wash ups were reported between October and November 2021, adapted from the Environment Agency's incident investigation summary. Locations with washups shown in Figures 2 to 5. Key industrial facilities considered as possible point source pollution are marked with black dots, and the extent of dredging in the Tees and dredging disposal site are outlined in black. (22_1BH_NEIFCA wash up incidents and logs record October 2021 to September 2022; 23_1BH_Wash Up Reports September to December 2022).

Crab Die-off – Theories

- Algal Bloom – 2021
 - simultaneous die-off / nutrient enrichment
 - wrong time of year
- Pyridine – 2022 detected in dead crabs
 - volatile / would require large amount
 - simultaneous die-off / detected at disposal site 1 year later
 - 2024 - new DEFRA test suggests no pyridine in crabs
- Novel pathogen – 2023
 - ruled out by Centre Environment Fisheries and Aquaculture Science (CEFAS) in 2021
 - wouldn't expect simultaneous die-off c.f. bird flu / Covid etc.
 - 100% mortality
- Multiple causes – 2025
 - no die-off without human action i.e. pollution, run-off,

Seals 2024

Seals



Dredgers and Seals



Grecko Indie Media - The dredger Causeway in Seaton aka Able UK channel at Teesmouth Part 1.
<https://www.youtube.com/watch?v=4iTnjh5rvys>
Grecko Indie Media - The dredgers Causeway and Magnor in Seaton channel Teesmouth Part 2
<https://www.youtube.com/watch?v=nBBuZalbbmc>
NorthEastFC - Magnor dredging Seaton Channel - 1st June 2024
<https://www.youtube.com/watch?v=AjcaNnUkbZw>

Harbour Seals

- Tees colony pups are born late June to Early July
- Maximum pup count - 10th July 2024 – 22 pups
- Next breeding colony over 100miles North or South
- August to October 2024 - 23 harbour seal pup strandings between Northumberland and North Yorkshire



23 Stranded Pups

- 16 had mouth rot
- All underweight many below birth
- Different bacteria so not common source
- Mainly weaned / some unweaned
- All had high levels of the industrial chemicals (PCBs) in their tissues



TESS Conclusions

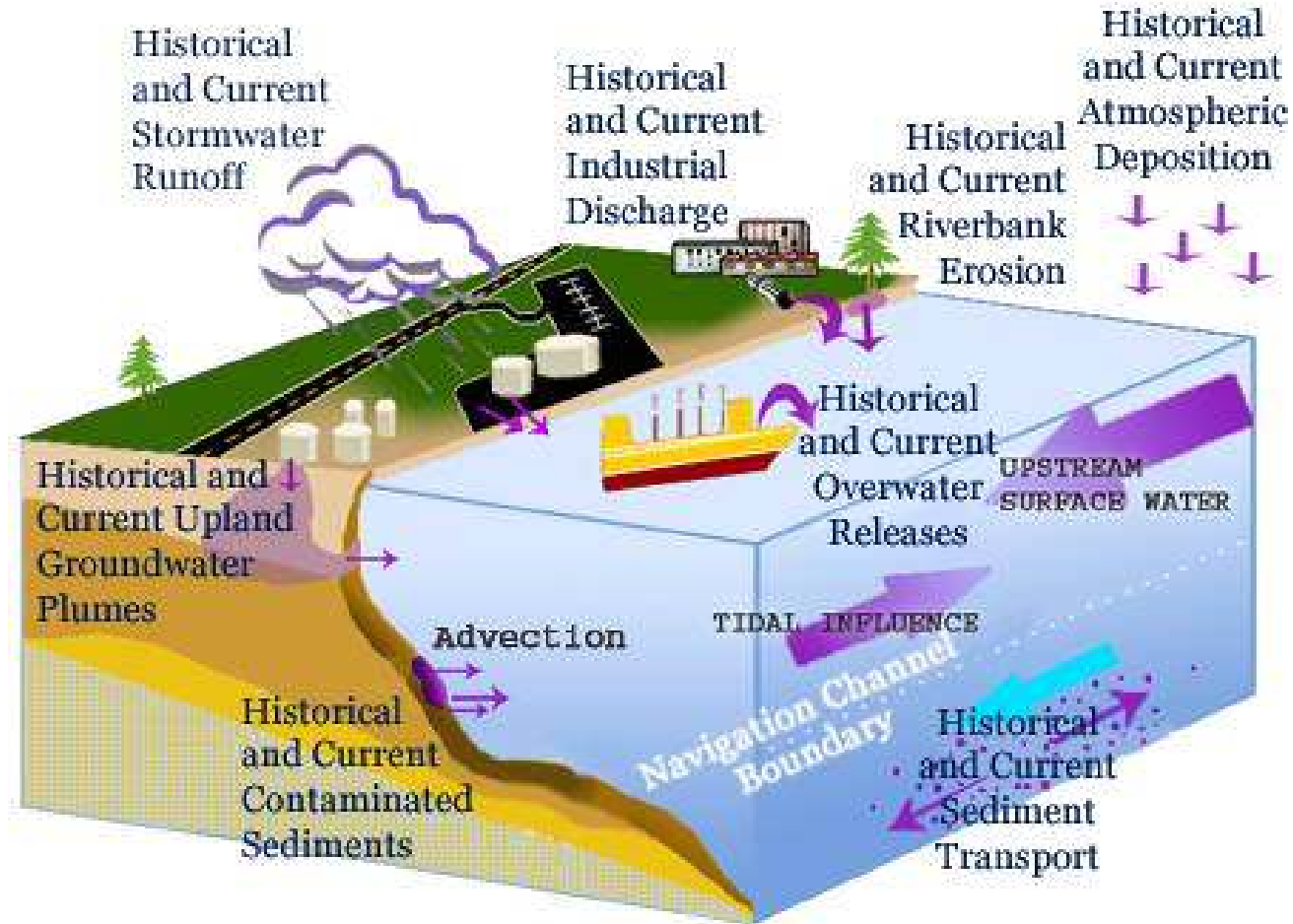
- Pups dying mainly in the immediate postweaning period.
- Pups dying because of:
 - their low body weight and hence physical weakness
 - and their mouth-rot bacterial infection.
- Both of these principal factors are likely to be caused by:
 - the relatively high PCB contamination of their body tissues,
 - indicated by the blubber analyses for PCBs.
- PCBs are known to cause:
 - poor prenatal and postnatal growth of the newborn seal pup
 - immunosuppression in harbour seals and other marine mammals.
- The PCB findings do not rule out contributions from other pollutants but may be enough on their own to account for the extraordinarily high Tees pup postweaning mortality of close to 100%.

Tees Estuary Seal Study (TESS)

Comment. There is no other breeding colony of harbour seals for 100 miles to the south of the Tees Estuary or for more than a hundred miles to the north. Therefore it seems likely that most of the pups stranding in the summer between north Yorkshire and Northumberland were born in the Tees. Since the total number of reported strandings in this area was approximately equal to the number of live pups counted with their mothers in the Tees breeding colony, it seems that the Tees pup post-weaning mortality in 2024 was close to 100%.”

Sediment Contamination

Sediment Contamination



Where is the Organic Contamination?

- Absorbed inside organic material
- Adsorbed on the surface of mineral particles
- Great Volume more contamination
- Greater Area more contamination
- Natural & Human
- Human



Hartlepool

11

Mainly sand
Large particles
Small area

10

9

8

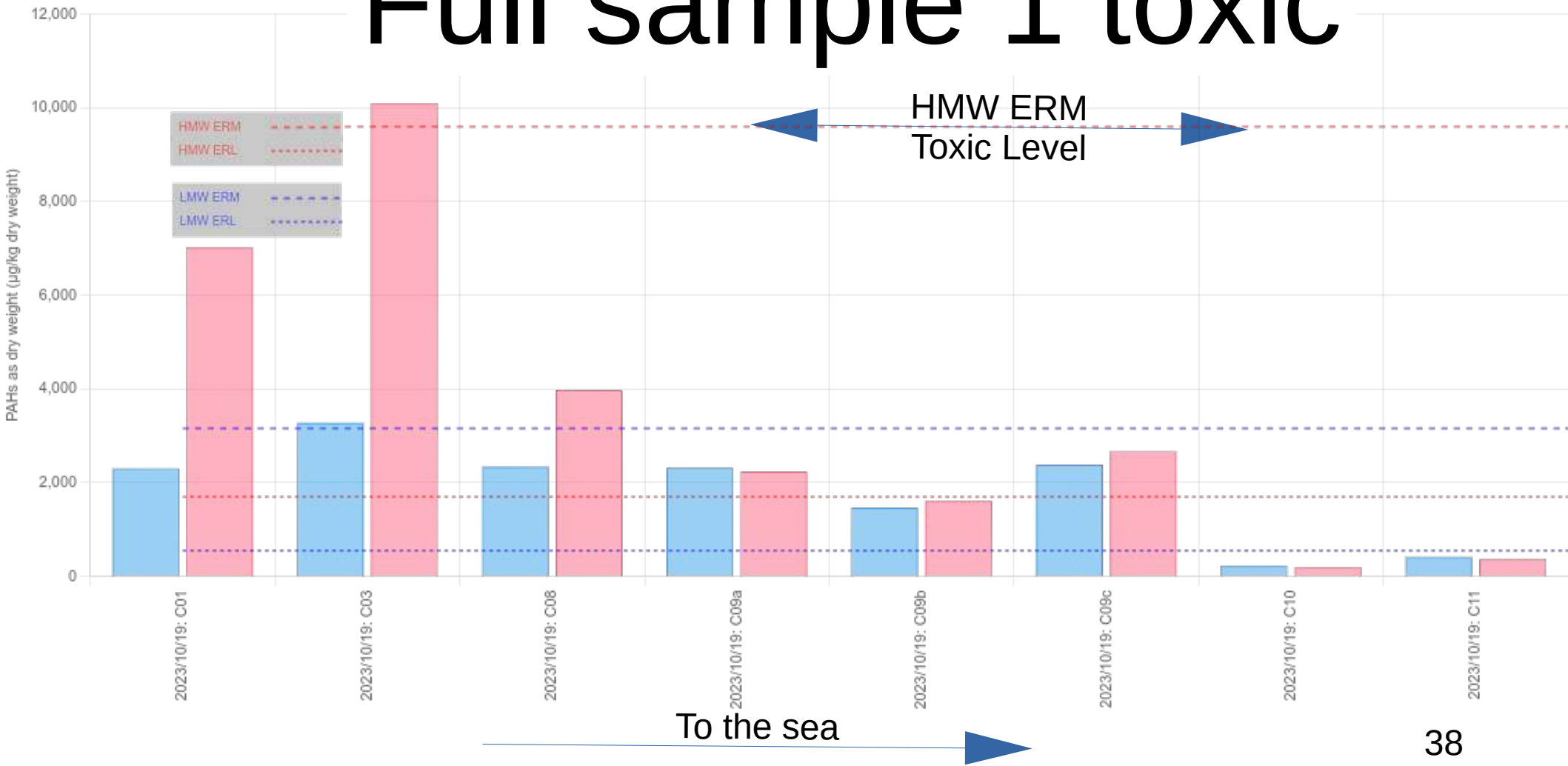
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Mainly silt
Small particles
Large area

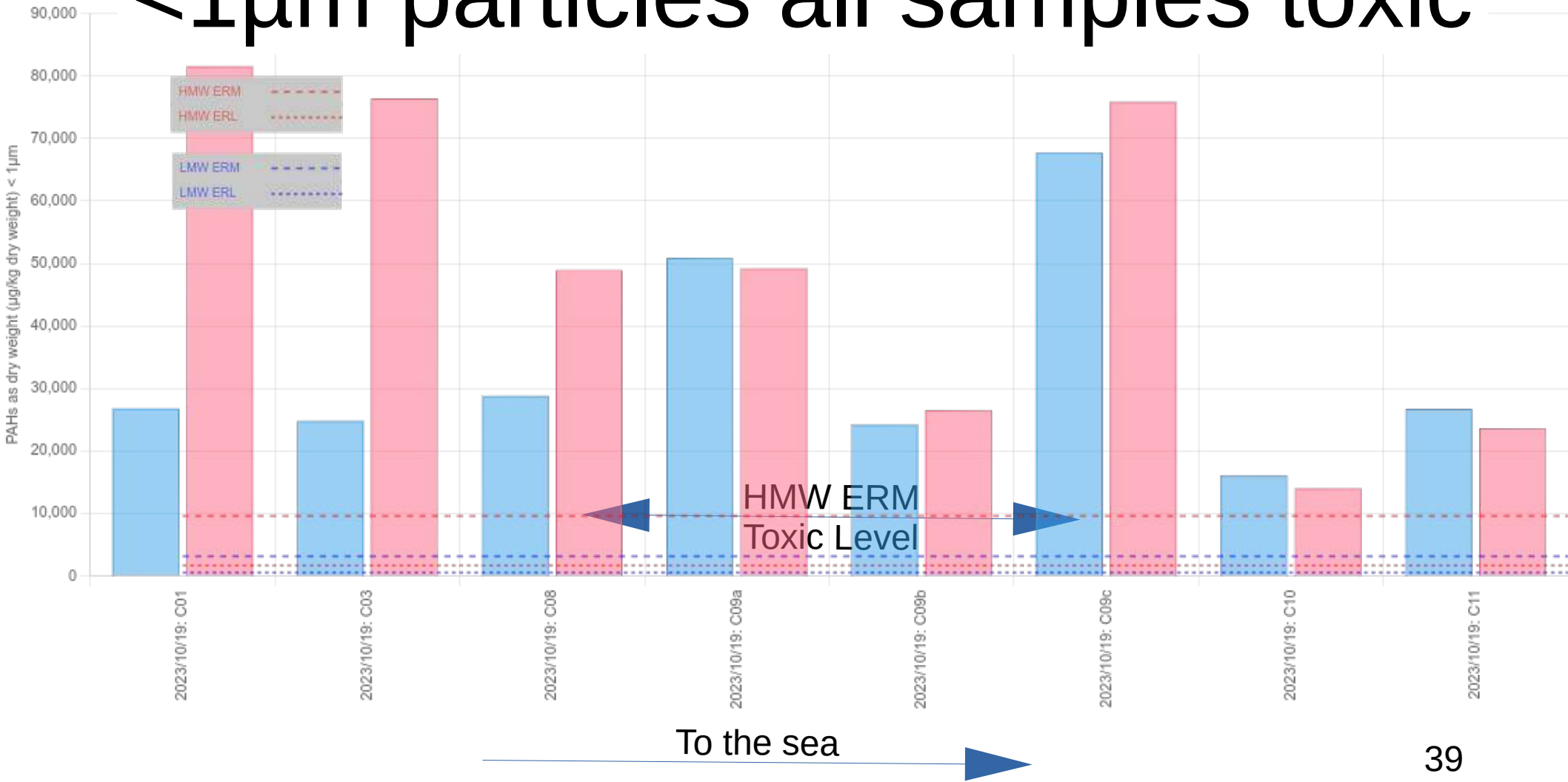
1

3

Full sample 1 toxic



<1 μ m particles all samples toxic



Maintenance Dredging

Maintenance Dredging

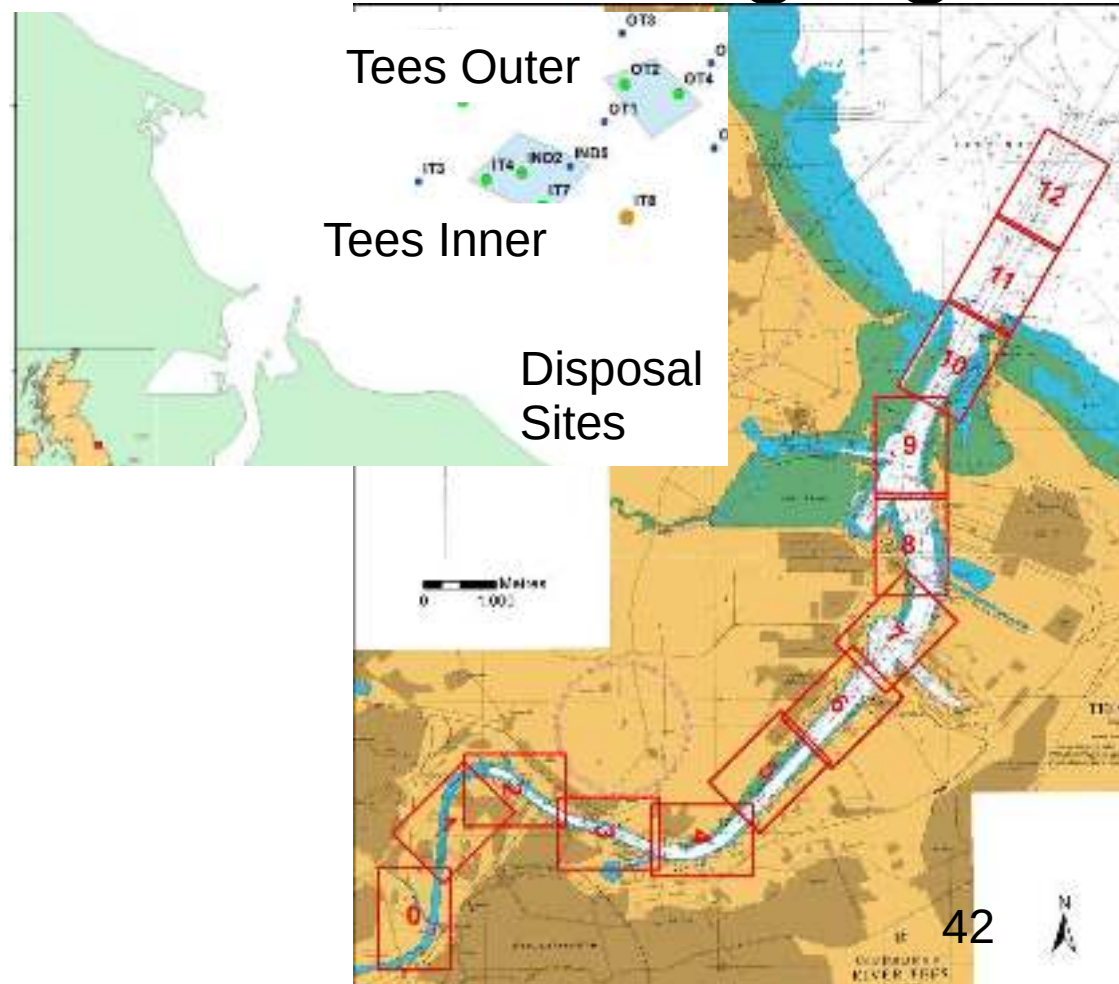


- Sand washes up
- Silt washes down



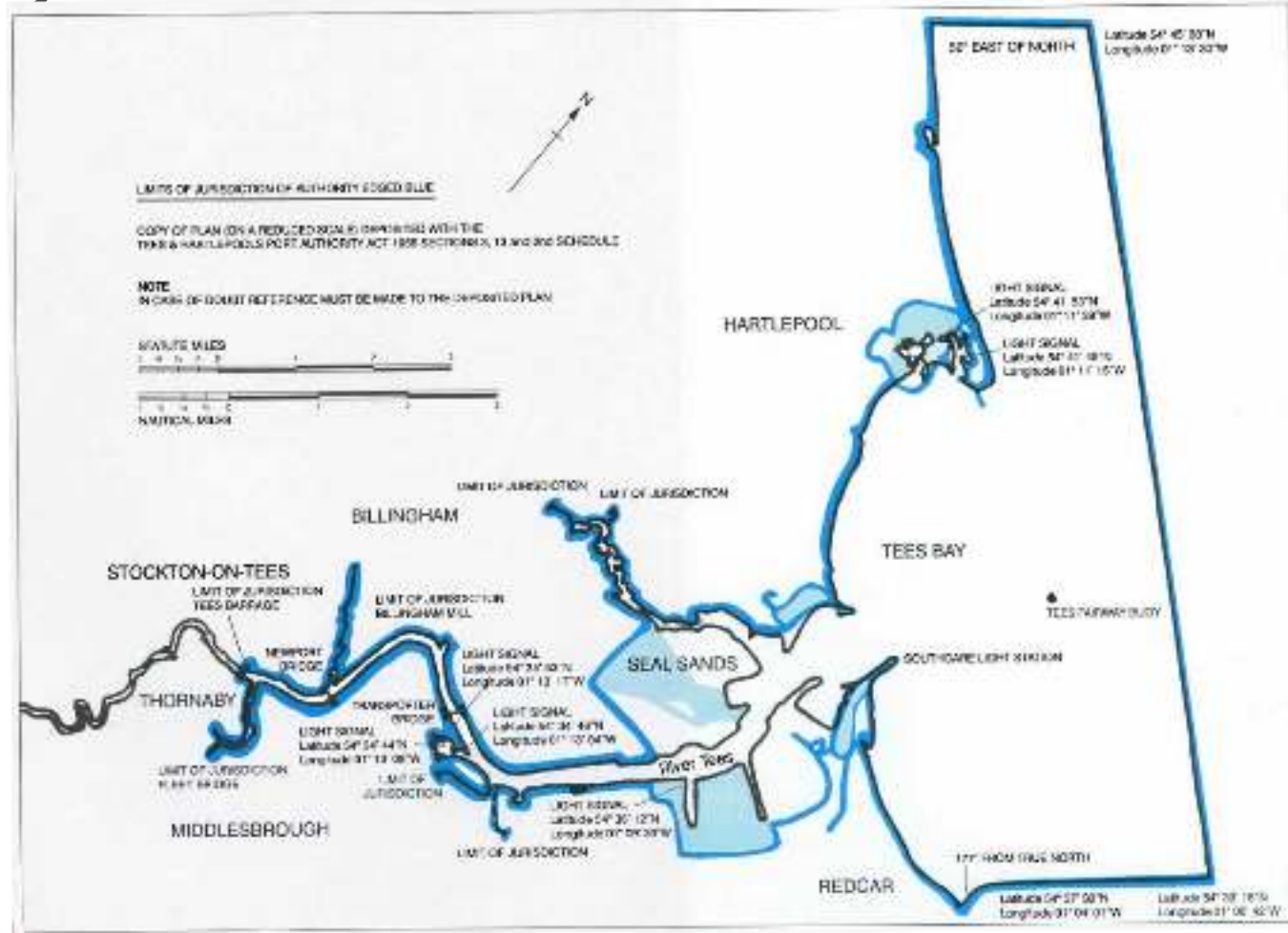
River Tees Maintenance Dredging

- River Tees has been dredged for over 100 years
- 10 year maintenance dredging disposal licence – annual amounts:
 - River Tees – <2.5million tonnes wet
 - Hartlepool – <0.5million tonnes wet
 - Total volume less than 2million cubic metres (2 hectare cubes) 9 x 30 storey buildings
- Dispose at Tees Bay A (inner) – 3 miles from shore
- Granted based on 25 riverbed surface samples
- Selective extra sampling every 3 years

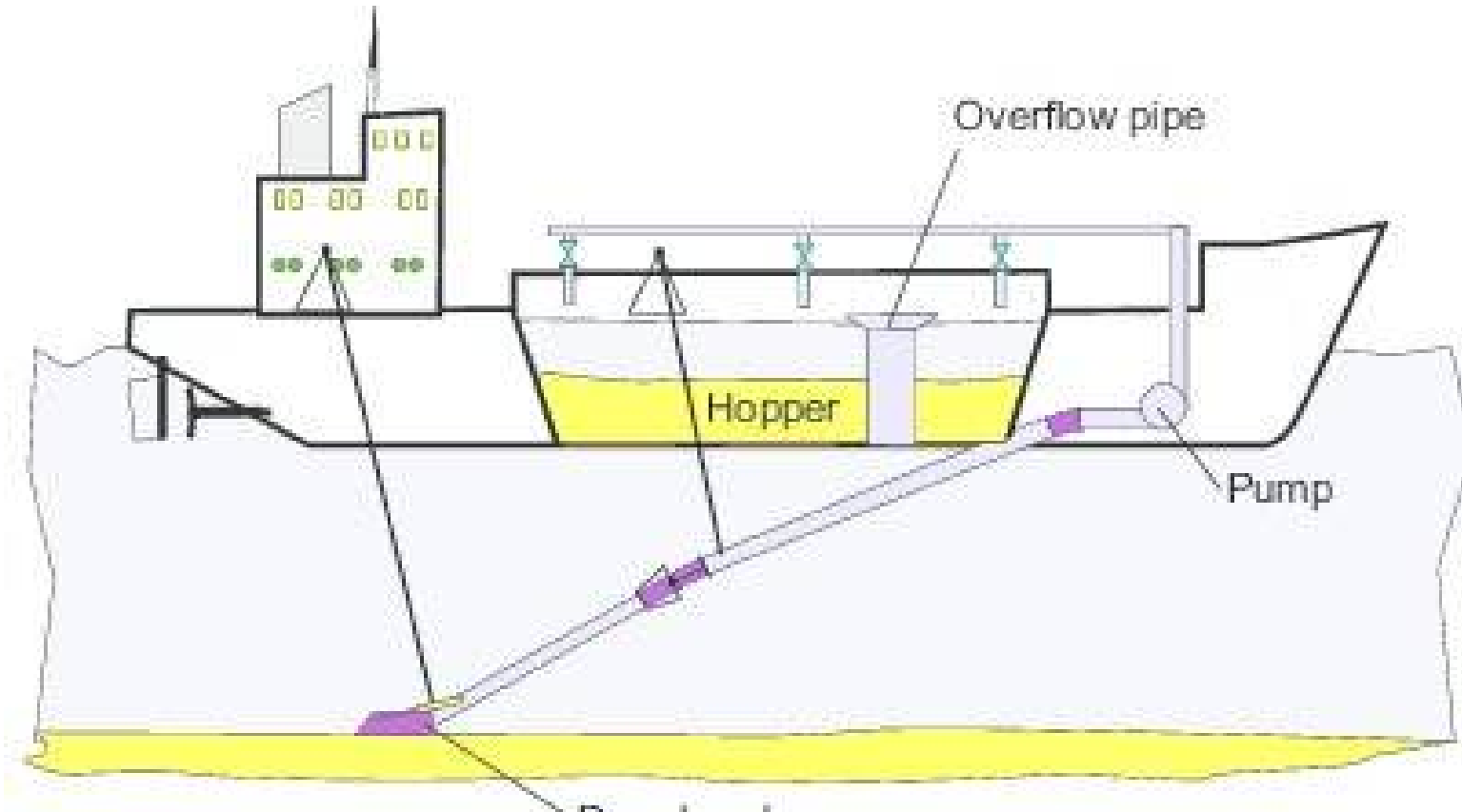


Statutory Harbour Authority

- PD Ports
- Must enable navigation
- Maintenance dredging
- No disposal without Marine License



Trailing Suction Hopper Dredger



Dredging Material Destination



- Local (>10%)
 - Resuspension
 - Turbidity
 - Release of contaminants
- Disposal site (<90%)
 - Resuspension
 - Turbidity
 - Release of contaminants
 - Seabed loss

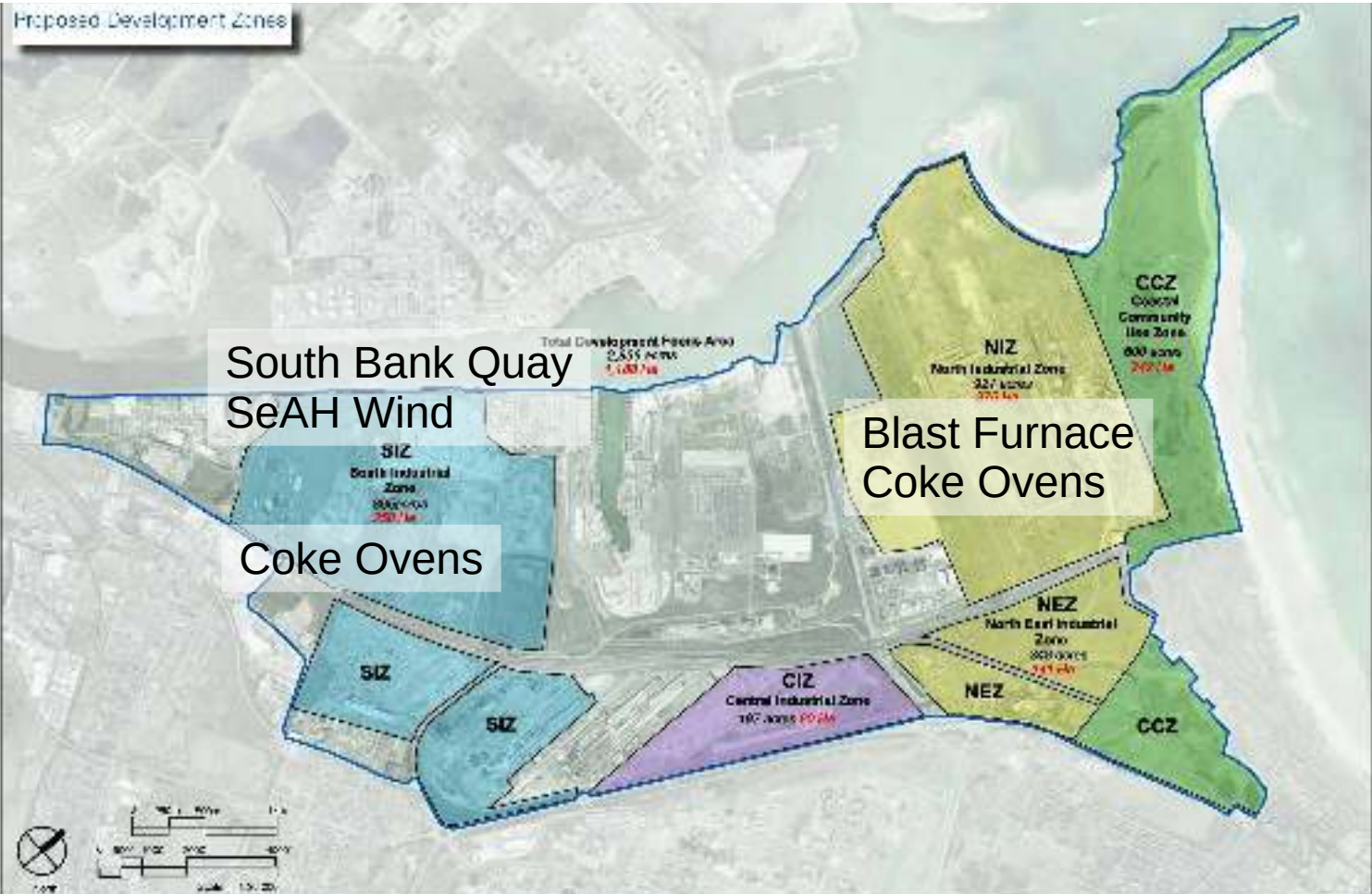


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Teesworks Development

Teesworks / South Tees Site



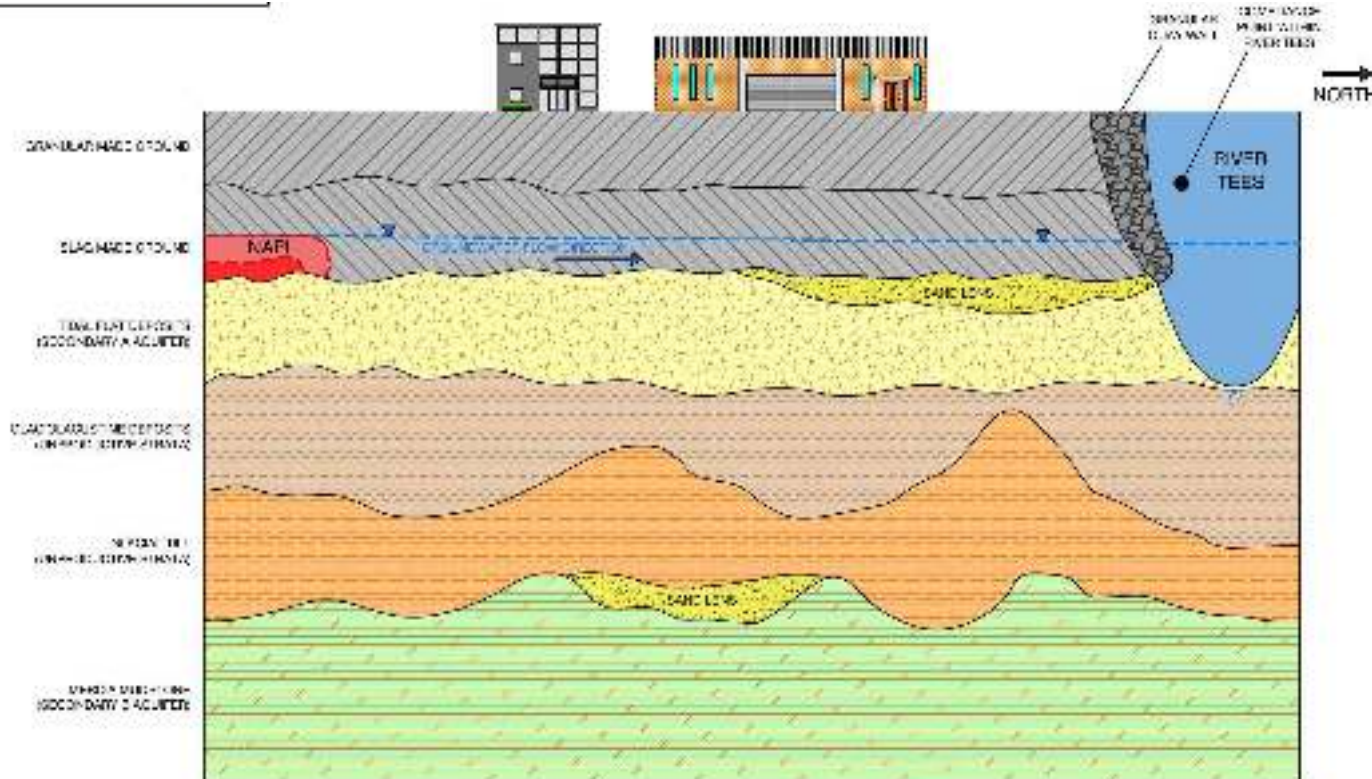
- Reclaimed land
- Historical site of:
 - Steel works
 - Coke ovens
 - Metal recovery
 - Landfills

Teesworks

- It will be ok approach ignoring hazards (providential not precautionary)
- Teesworks redevelopment (not remediation)
 - High contamination areas unremediated
 - Redeveloped areas will already be being recontaminated
 - Therefore most development monies used inefficiently
- Teesworks pollution into ground then river then sea
 - Groundwater into river
 - Dense non-aqueous phase liquids (DNAPL) on river bed
 - Coal tar is a DNAPL
 - Not if but when

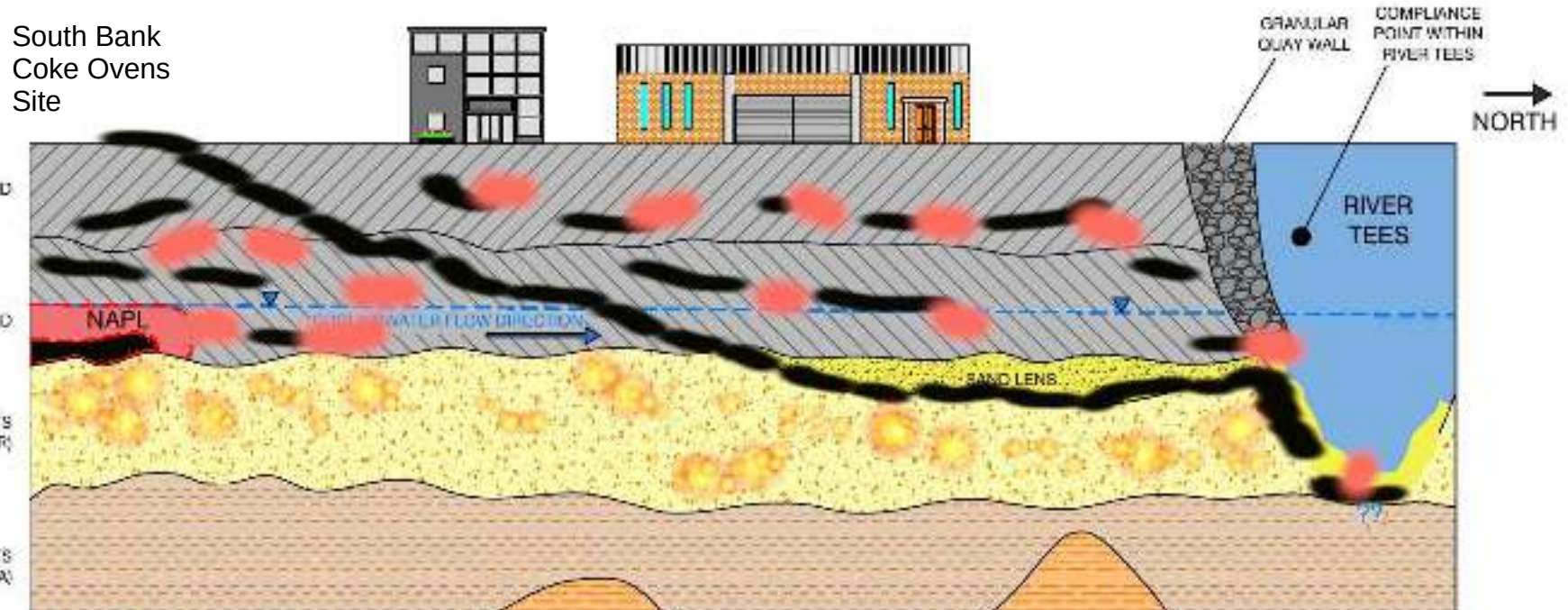


Site Conceptual Map



- Simplified
- End state
- Not construction
- Incorrect isolation of NAPLs

EA DNAPL + Arcadis South Bank



Groundworks underway Autumn 21

- Including:
 - Excavation of hinterland South Bank Quay
 - Excavation of South Bank to 7.5m
 - Decanting of heavy fuel oil deposits
 - Demolition of buildings
 - CoMAH product removal from vessels/pipes
 - Explosive blowdown of coke ovens / related plant



September 2021

Dorman Long Tower listed in September 2021
Listing revoked 19th September 2021
Demolished night of 19th September 2021



Steve DJI Mavic Pilot – South Bank Coke Overs - 15th September 2021

<https://www.youtube.com/watch?v=yfCqeg02aiQ>

Tees Valley Combined Authority – Dorman Long Tower Demolition - 19th September 2021

<https://www.youtube.com/watch?v=LJ1-aFIRIzg>

UKD Orca – 25/9/21 – 4/10/21

UKD Orca

- Tees dredgers Cleveland County & Heortnesse low availably autumn 2021
- UK Dredging Ltd's THSD Orca commissioned to dredge outer Tees estuary channel 25/9 to 4/10
- Potential differences:
 - 24 / 7 operation
 - what was being dredged



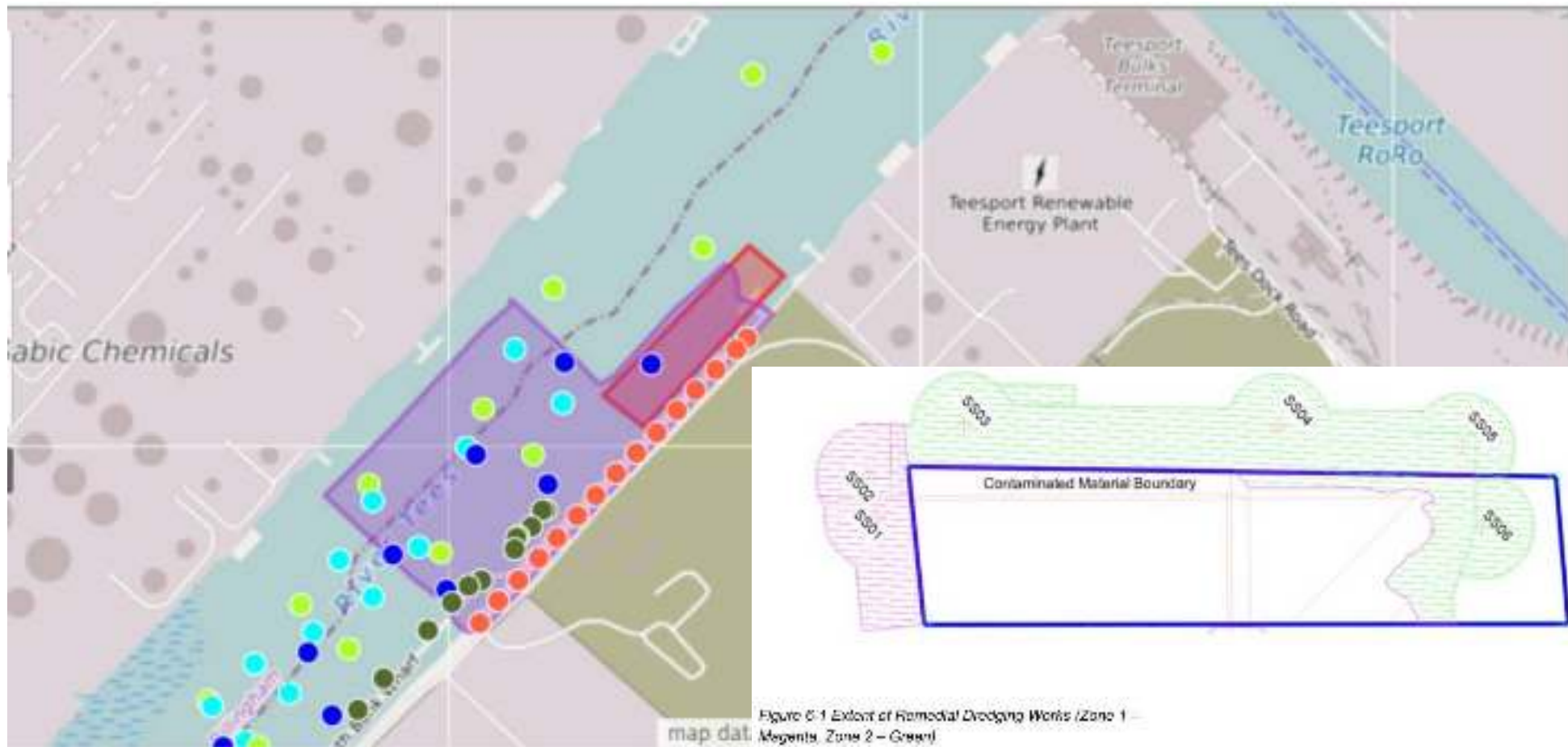
Fig 9: Compilation of the positions of the dredger over the period 25 September to 4 October every few minutes based on transmissions of its position using the AIS system. Dredging activity in the south-west and deposition site in the north-east.

Documented Dredge Contamination

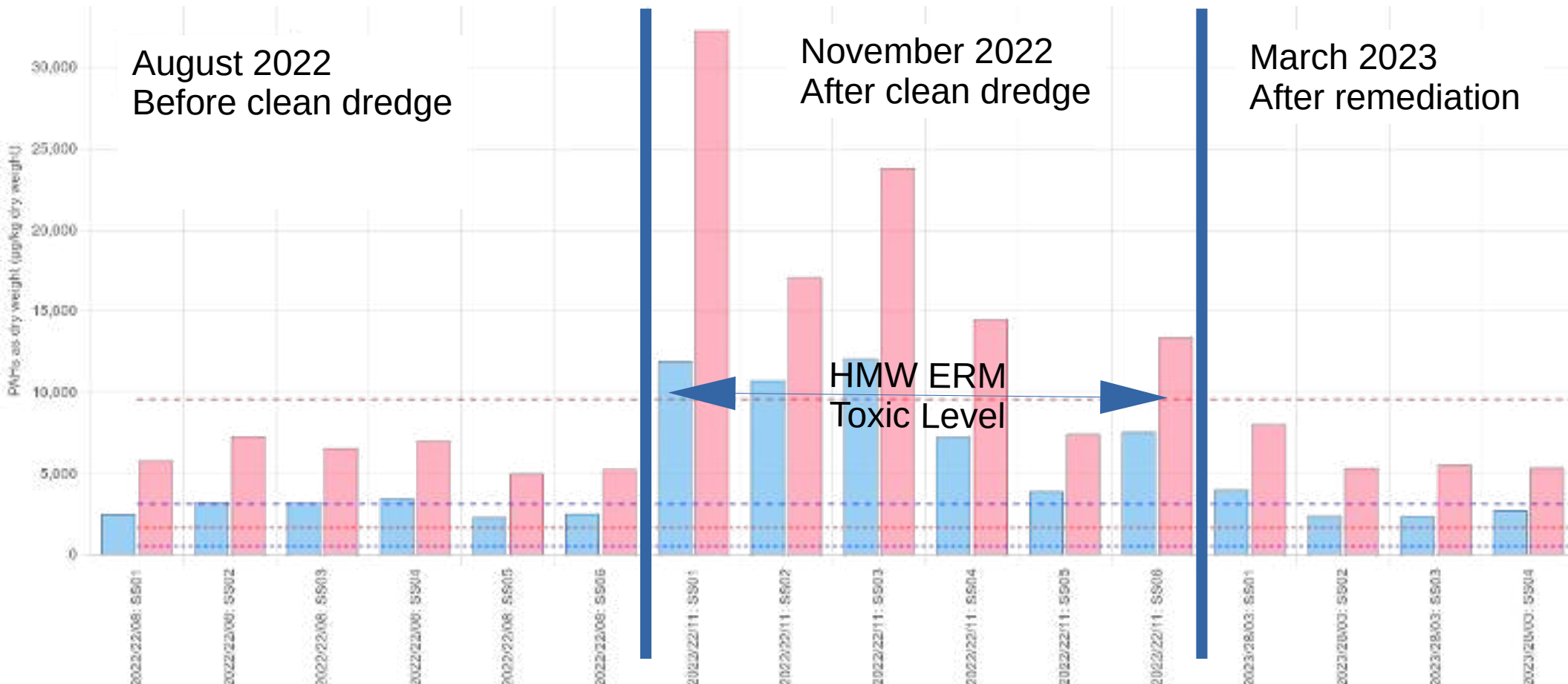
Documented Dredge Contamination

- South Bank Quay required dredging of highly contaminated area (Borehole 34)
- Excluded from disposal at sea
- Material had to be taken to land
- Dredge had to avoid any spillage into the river
- Marine Management Organisation (MMO) license required before and after sediment sampling

Exclusion Zone



Surface Sampling Around Exclusion Zone



Is There Undocumented Dredge Contamination?

- This contamination was only discovered because the license required sediment sampling immediately after the completion of the dredging
- The River Tees is dredging over 250 days a year for 10 hours a day by 2 dredgers plus any capital dredging occurring
- Around 40 samples are taken once every 3 years
- So unless sampling occurs before an area is redredged then that event will be unknown / undocumented / unrecorded
- More than 1500 dredger days occur between each sampling

To Sum Up

Ideal Next Steps

- Far more regular and extensive measurement of sediment / dredged materials
- Adopt precautionary dredger operation
 - No overflow
 - Unless overflow regularly measured to be clean
 - Dredging operations to take greater account of river / tide / weather state

Recap

- River Tees sediment is contaminated
- Much of the contamination is on silt (small particles)
- Contaminated silt is released into the river during dredging
- The release of contaminated silt is damaging the River Tees Estuary's ecology
- Dredging methods need to be changed to protect the estuary's ecology

NEMRG Ongoing

- Sampling sediment around Tees (18/2 North Gare)
- Reanalysing sediment sampling data from Marine Management Organisation (MMO) applications
- Publishing new scientific understanding around environmental threats to marine life
- Increase engagement with agencies / government

Vision

- Contamination from small particles eliminated from River Tees estuary
- Contamination of River Tees by dredging significantly reduced
- Contaminated small particles largely deposited at Tees Bay A
- Small particle contamination will be dispersed over a wider area from Tees Bay A than is the case when the release happens in river
- Environment significantly improved for seals / other marine animal
- Accidental dredging of contaminated areas of River Tees will no longer create extensive contamination

Acknowledgements

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 - Hartlepool
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 - Whitby
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 - Sally Bunce / Dawn Love / Richard Randle / Robin Yardly / Simon Gibbon

Where to read around

- NorthEast File Collection – <https://northeastfc.uk> - this talk plus supporting articles / information
- Tees Valley Monitor – <https://www.teesvalleymonitor.com/>
- Teesside Lead – <https://thelead.uk/teesside>
- North East Bylines – <https://northeastbylines.co.uk/> - Ray Casey, Julia Mazza, Simon Gibbon, ...
- Tees Tidelines – <https://engageenvironmentagency.uk.engagementhq.com/sto021-tees-tidelands>
- River Tees Trust – <https://www.teesriverstrust.org/>
- Tees Valley Wildlife Trust – <https://www.teeswildlife.org/>
- Industry Nature Conservation Association (INCA) – <http://www.inca.uk.com/>

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<https://northeastfc.uk>

Small Particles and Contamination

- Small particles contain most contamination
- Lots of small particles are dispersed in the river
- Most of small particles won't get to the disposal site

Small Particles and Contamination

- **Organic hydrophobic contamination** is adsorbed on **particle surfaces**
- Per unit mass **small particles** have **larger surface areas**
- $<1 \mu\text{m}$ particles **ratio** of surface area fraction to mass fraction
- Contamination of small particles is average contamination multiplied by **ratio**
- Currently small particles lost during overflowing while dredging
- Currently small particles lost at dredge head
- **Majority of hydrophobic contamination is released in river** not at disposal site

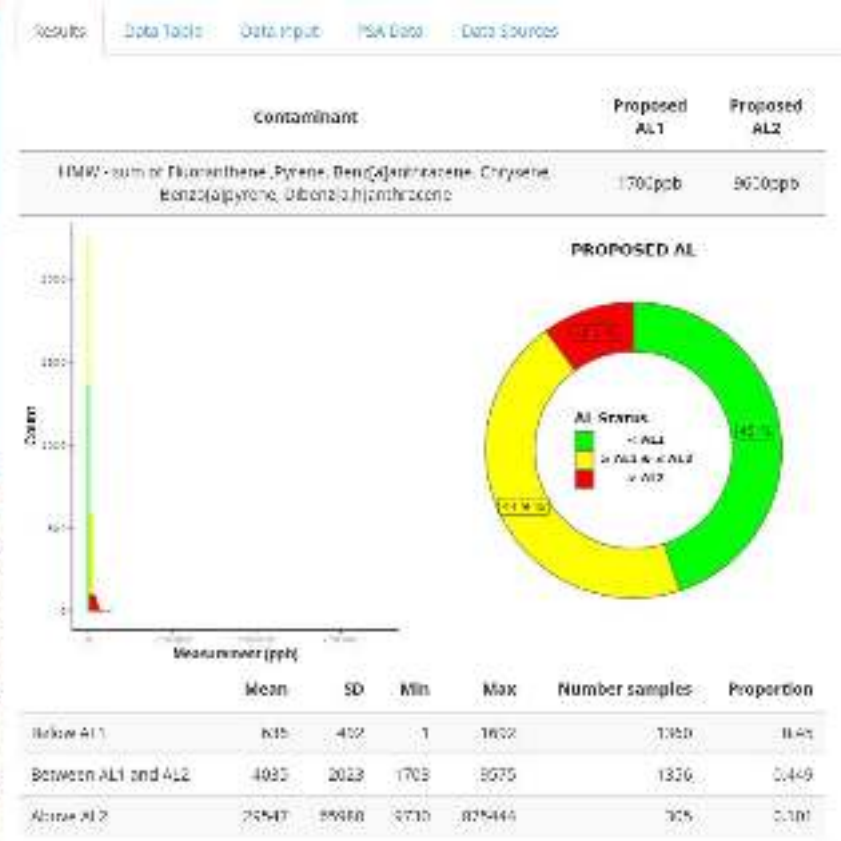
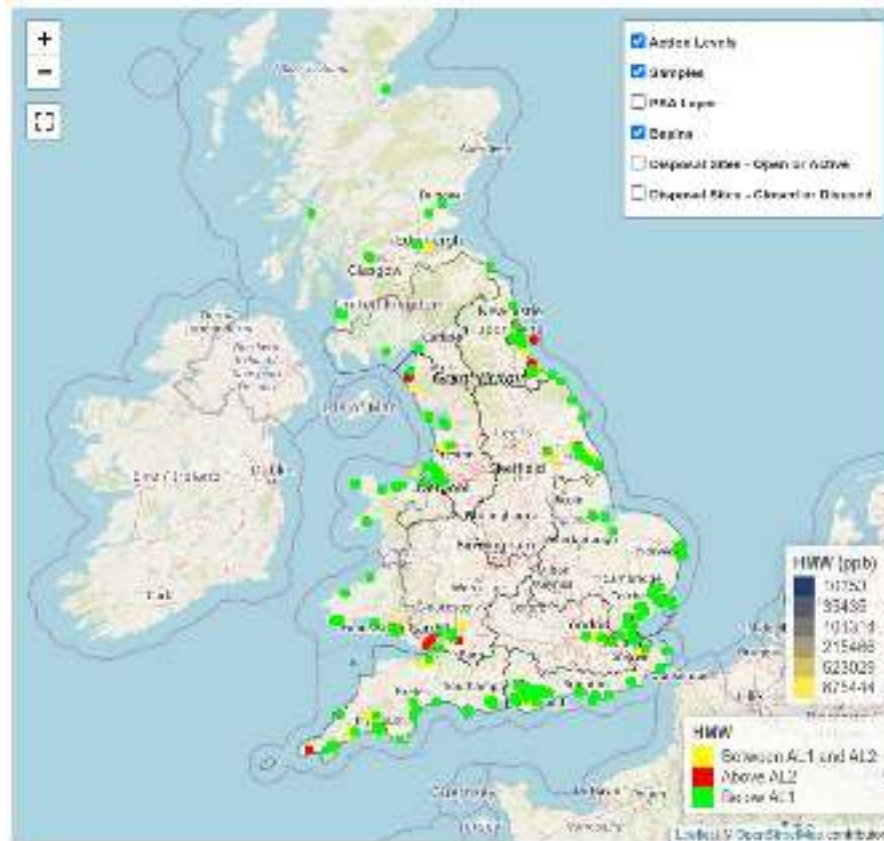
Changes to Dredging the Tees

- All dredging must be carried out with zero overflow from hoppers / barges
- Hoppers will only be filled to $\ll 100\%$ (40%?)
- Implications
 - Improvements to River Tees marine environment
 - Double number of dredger trips to disposal site?
 - Halve dredging capacity?

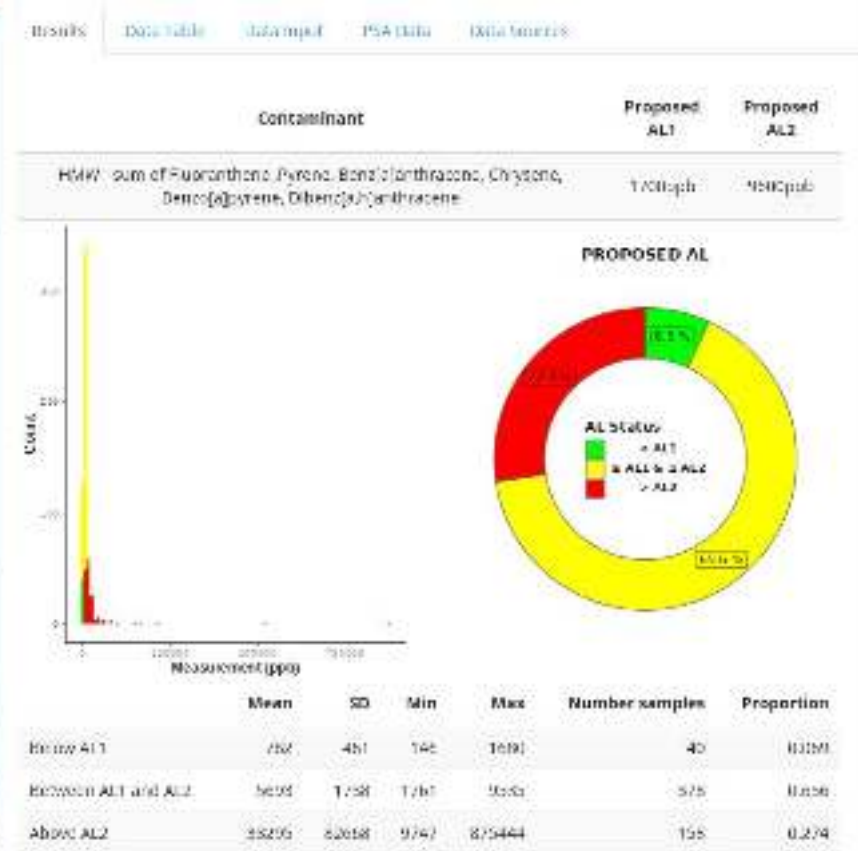
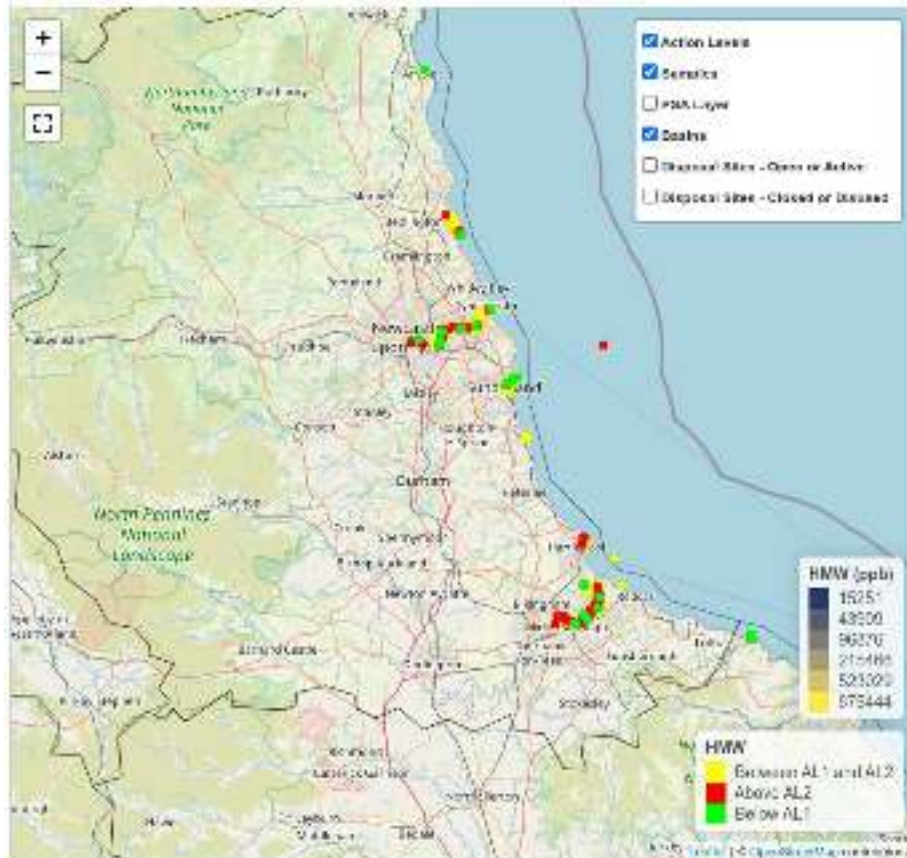
UK Wide - MMO Licensing

- Must take account of sediment particle size distribution
- Must calculate or measure small particle contamination concentrations
- If small particle contamination concentrations exceed Action Levels / Gorham-Test / toxicity levels then:
 - Any dredging must operate with no overflow
 - Any dredging must actively contain all resuspended material close to dredge site and remediate following dredging

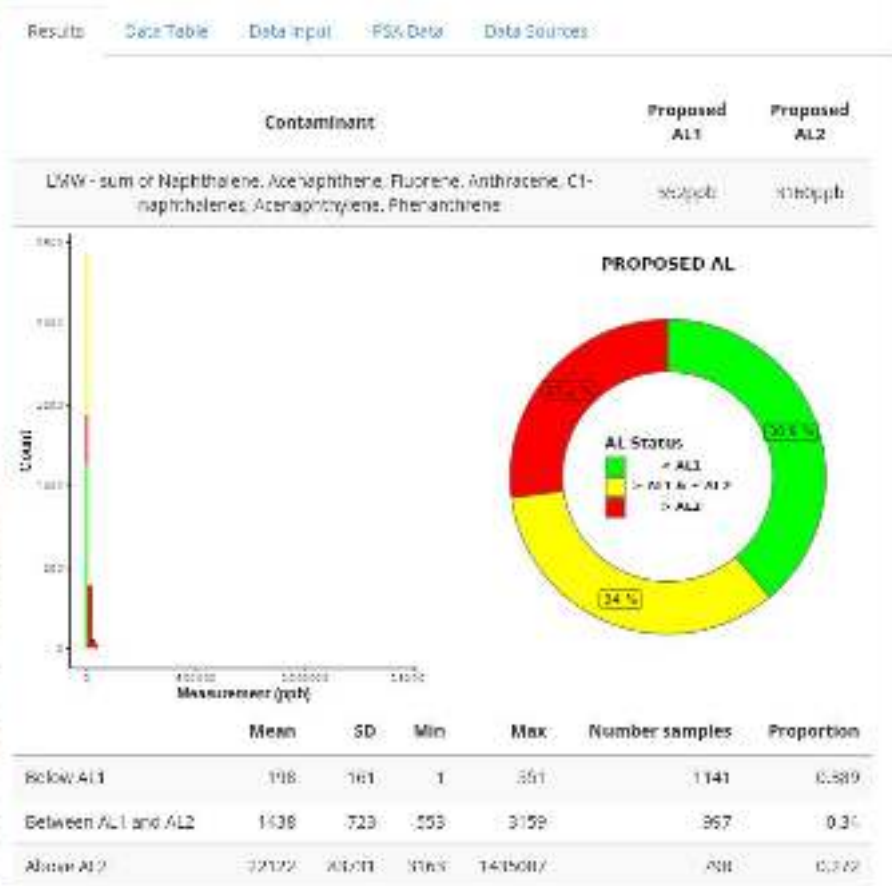
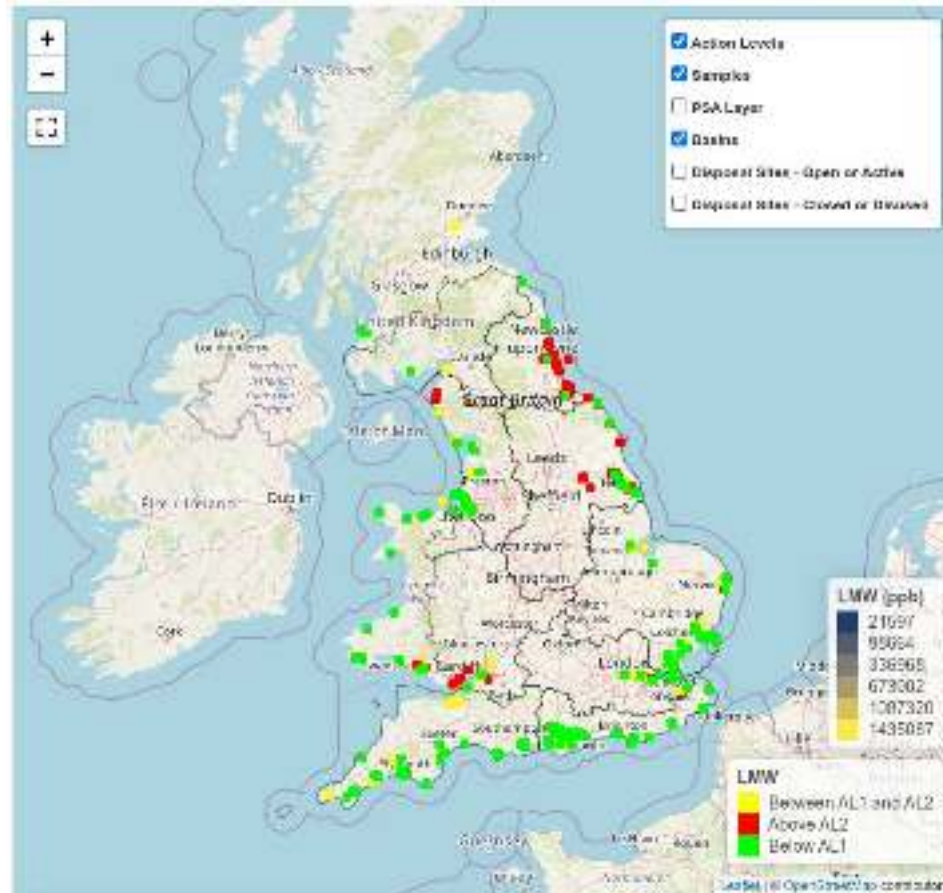
Proposed ALs Gorham-Test - HMW



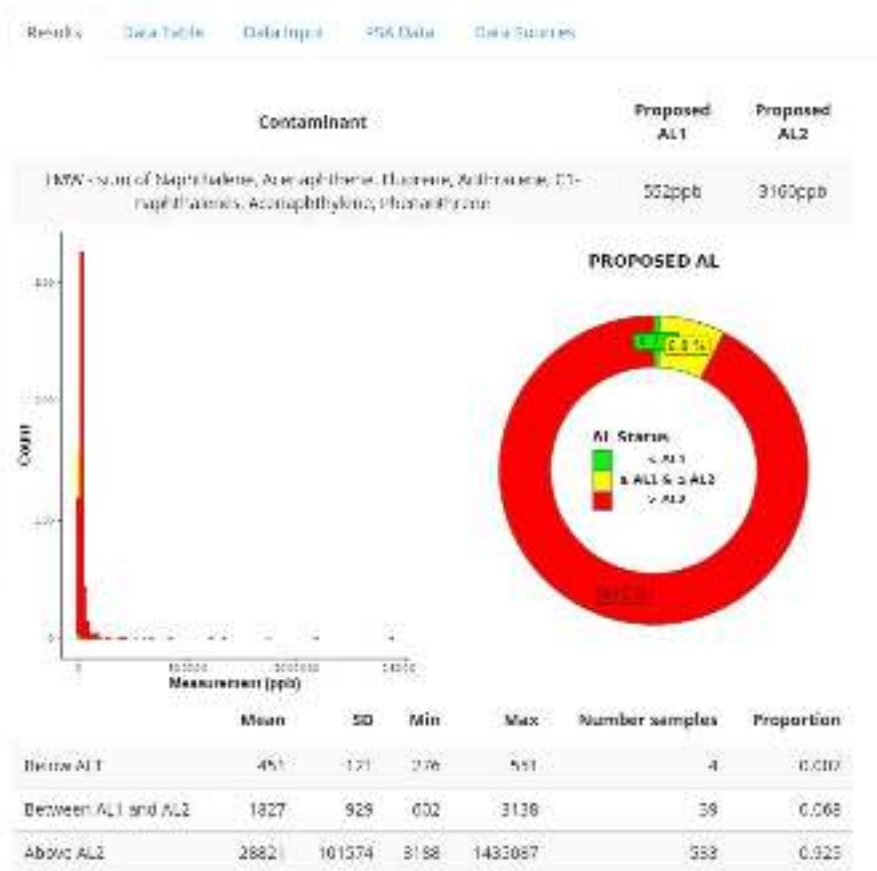
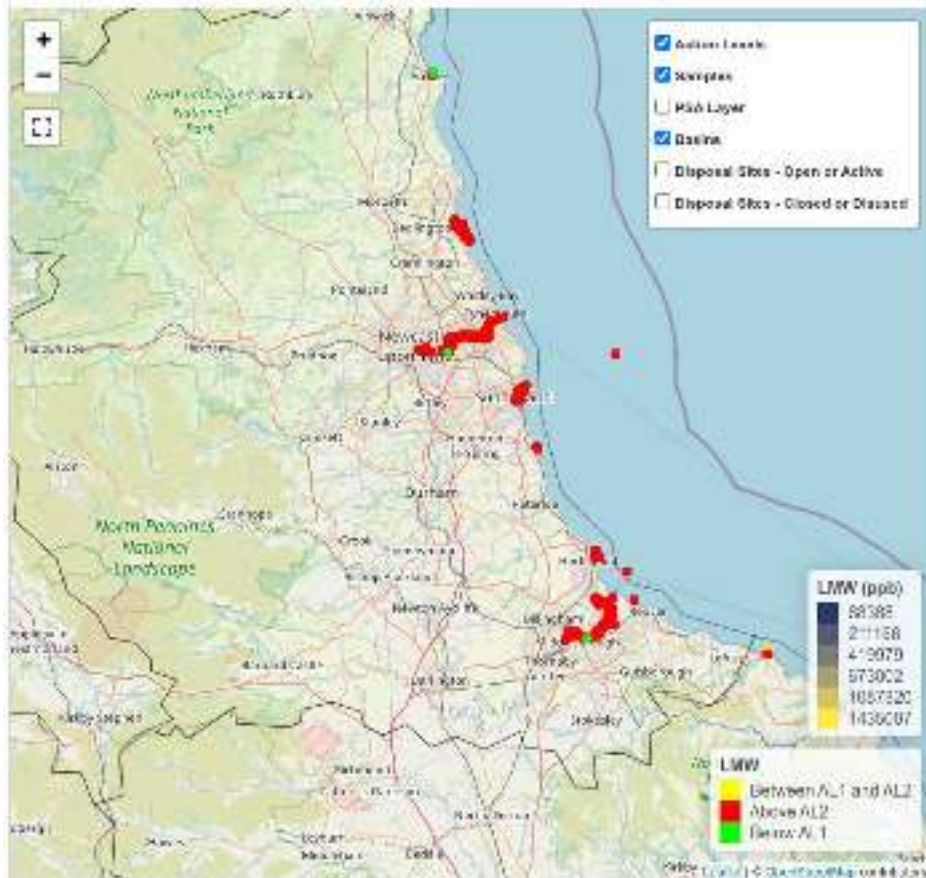
Proposed ALs Gorham-Test - HMW



Proposed ALs Gorham-Test - LMW



Proposed ALs Gorham-Test - LMW



North East and Planning

- Public information gives a picture of what is going into our marine environment
- The North East is poorly served by current dredging regulation:
 - Too little measuring
 - If its already bad it can stay bad
- Assumptions
 - Infinite dilution
 - Instant dilution
 - Single component toxicity
- Regulation both out of date and not fit for purpose
- Easy 1 step review of action levels
- New approach needed