ReBALAN:CE : What we need to know and potential risks

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- Water Framework Directive
- Main regulatory driver for reducing nutrients in waterbodies
- Achieve Good Ecological Status and “no deterioration”
- Publication of River Basin Management plans every 6 years (next due 2015)
  - Ecological Status/Potential for each WB
  - Progamme of measures to get to GES/P
- Cost Effectiveness

- Ecological status assessments according to WFD Normative Definitions
  - Plants (macrophytes, phytobenthos and phytoplankton)
  - Invertebrates
  - Fish
- Supporting elements (including P) set by Member States
- Monitor to assess baseline and progress towards GES
- EA do most of the monitoring for England (and Wales), includes ~400 lakes

Extent of failure of WFD P standards in England and Wales

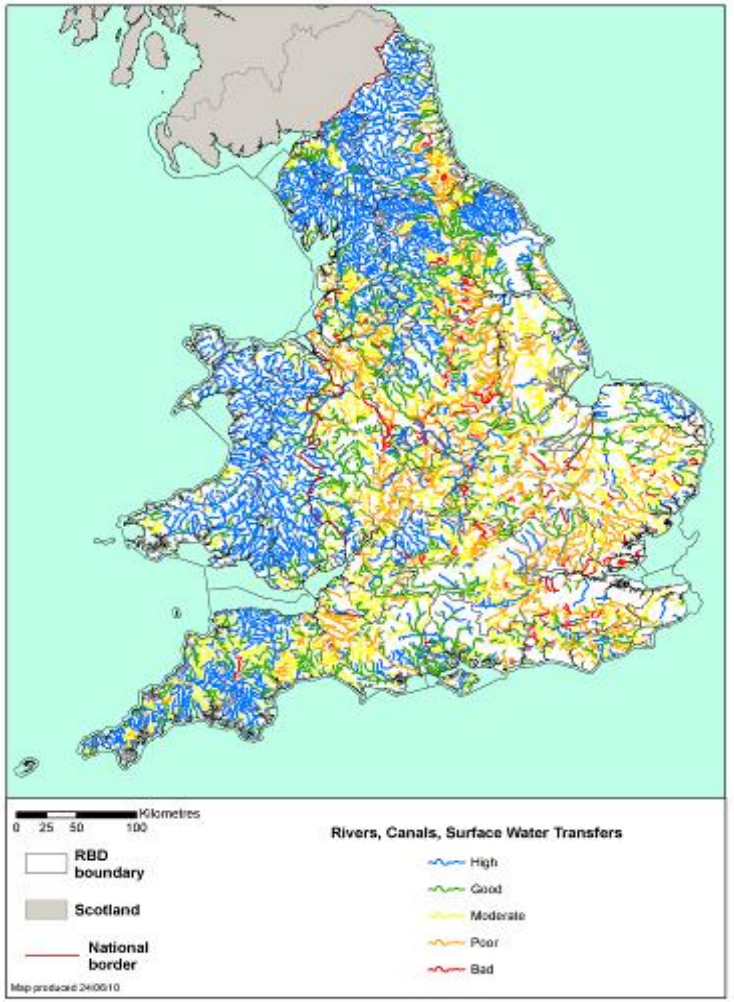
- River waterbodies
  - Approx 45% in England and 7% in Wales fails on P

  (2012 river classification data for P)

- Half the failing river points exceed the phosphorus standard by 2.5 times and a quarter exceed it by 5 times or more.

- Lake waterbodies
  - Approx 83% (England) and 44% (Wales) of monitored lakes fail on P

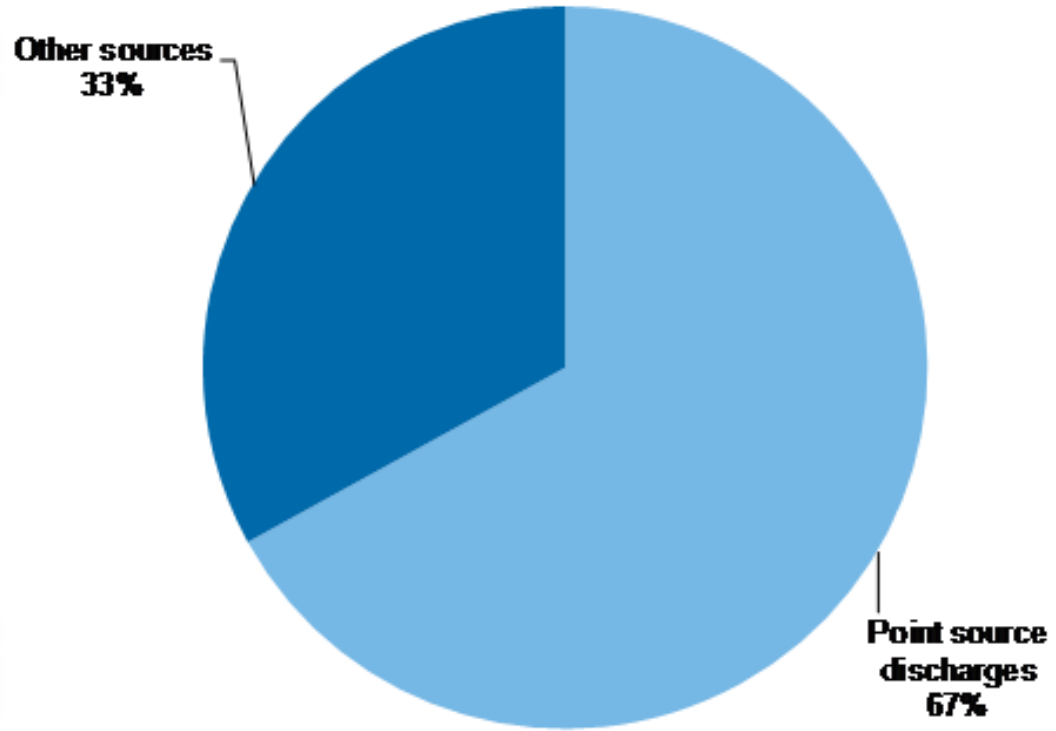
  (2011 WFD lake classification for P)



Geographical bias towards south and east

P standards for rivers will be tightened, number of failing waterbodies will increase!

Sewage treatment works and agriculture are main sources of phosphorus entering the water environment (England and Wales)



The phosphorus load for England and Wales is approx 27,000 – 53,000 tonnes per year

Note - Regional apportionment varies

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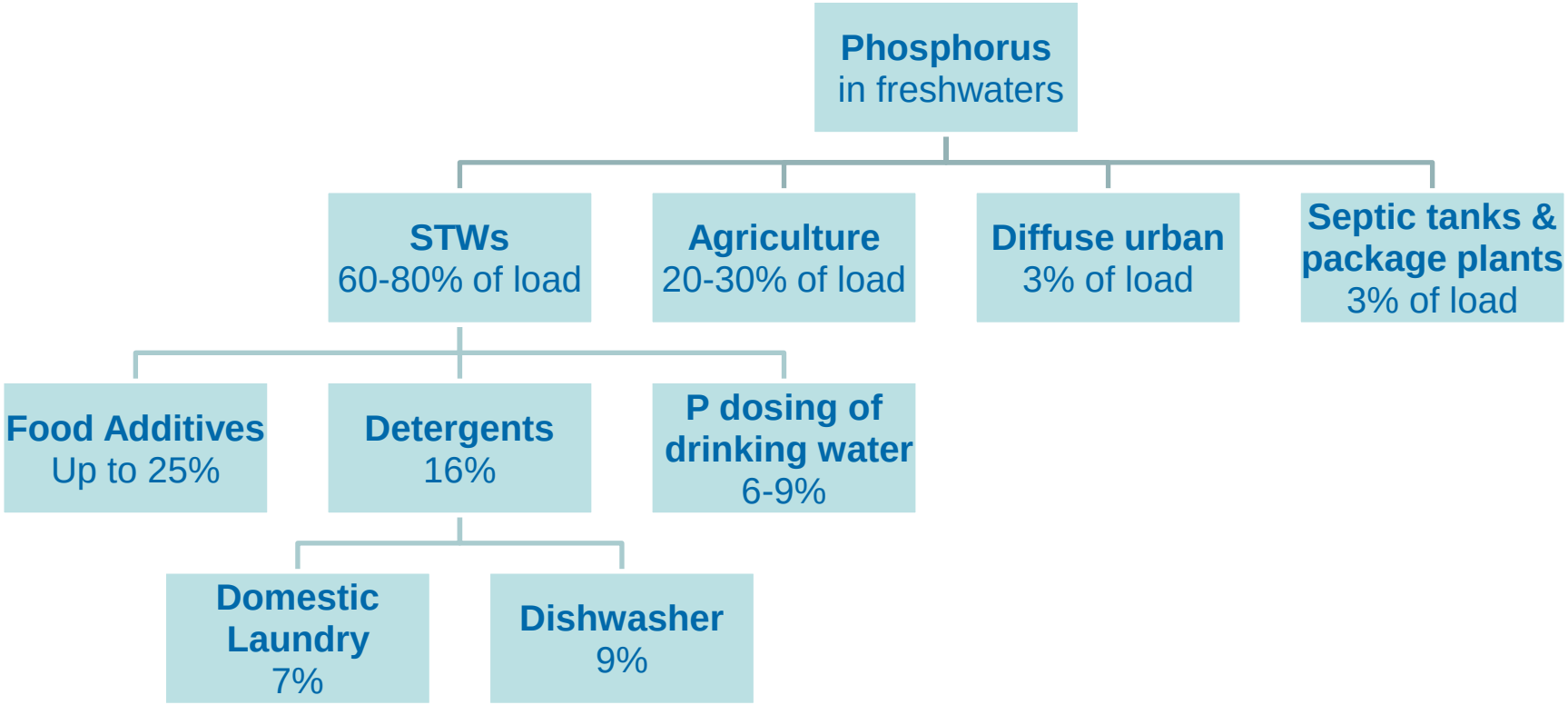
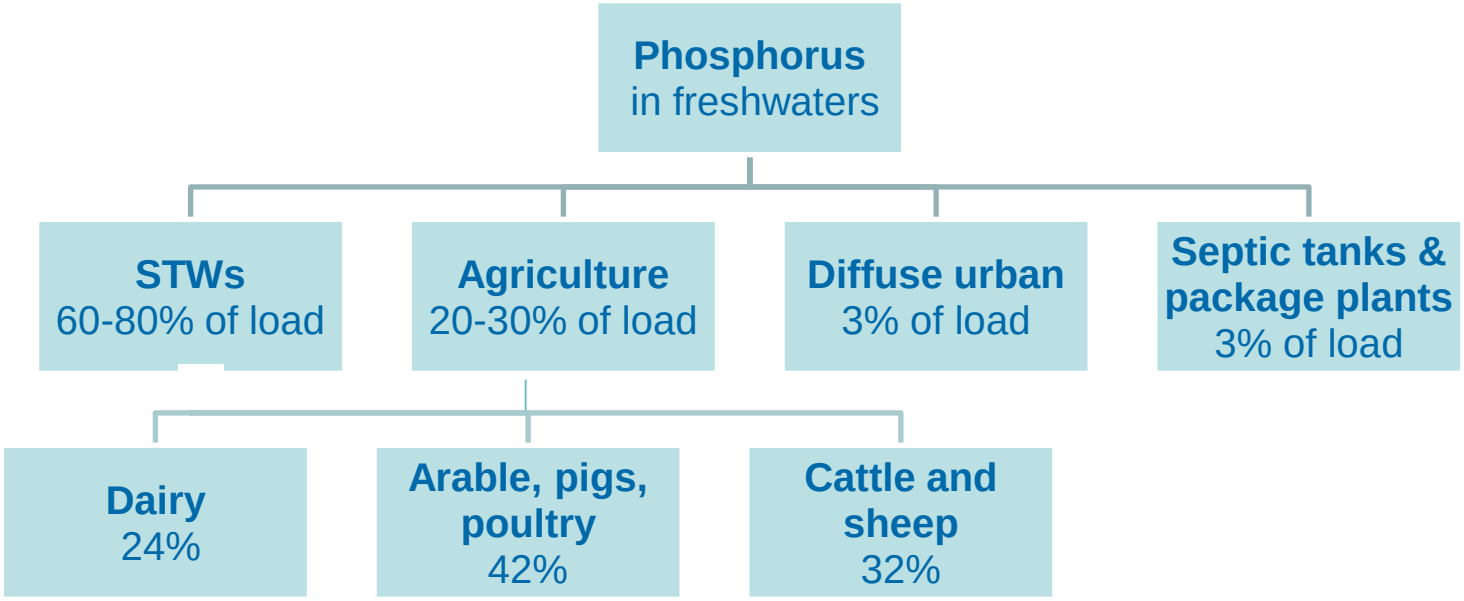
Source apportionment – P sources to STWs

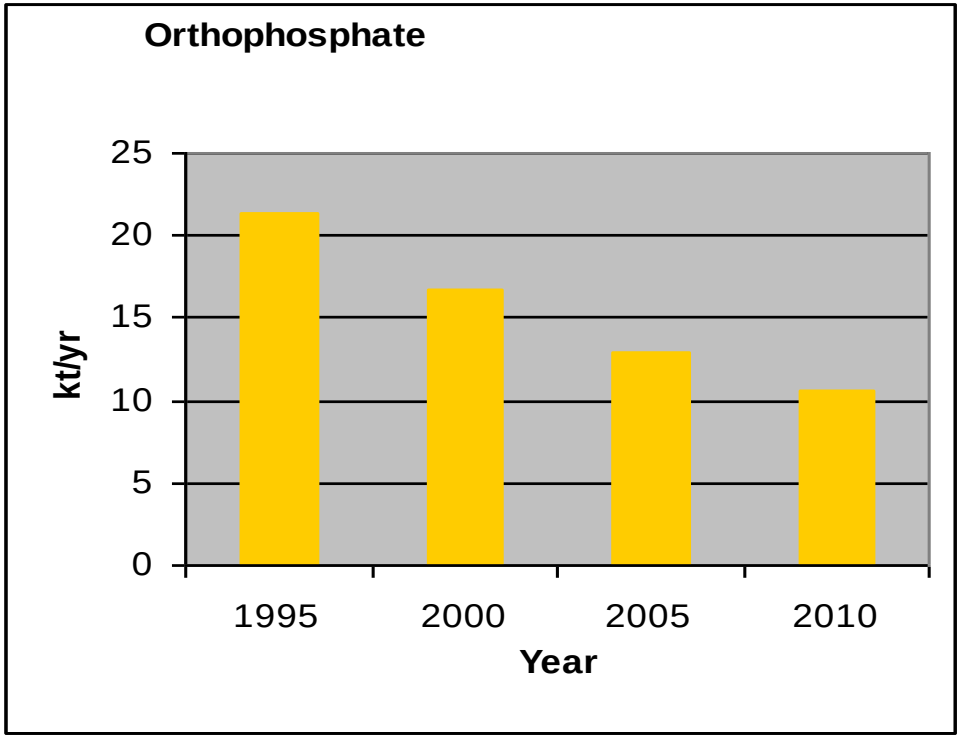


Source apportionment – P sources from agriculture



P released from agriculture is rainfall-driven, occurs in different forms (soluble, insoluble and particulate) and greater losses occur in biologically inactive periods (winter)

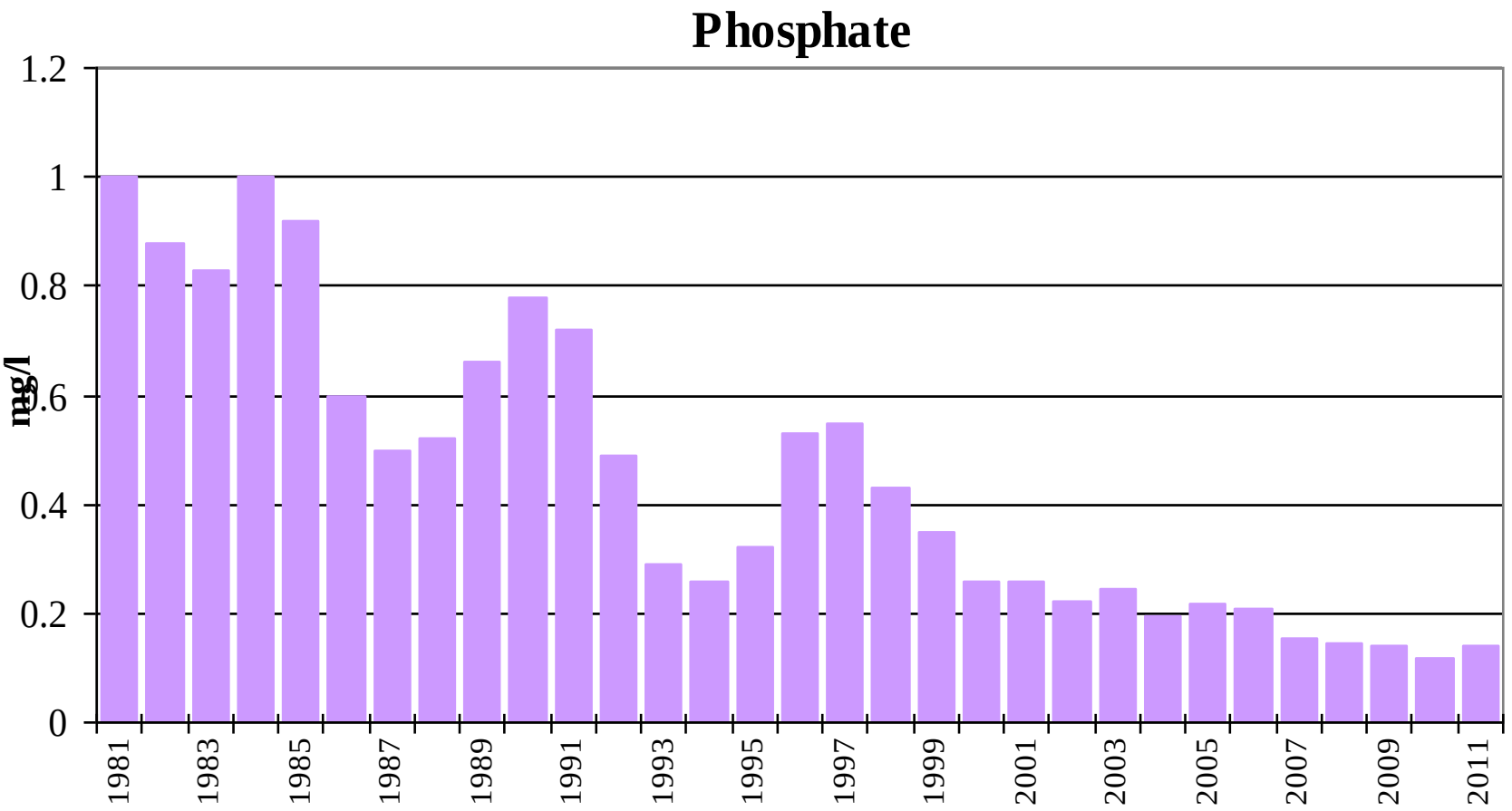
P load to rivers from sewage treatment works (England & Wales)



Reduction through Water company Price Review process, Urban Waste Water Treatment Directive driver, now WFD. Effluent P consents of 1 or 2 mg/L

Percentage of river length in England with v low and v high P concentration

Average phosphate in Anglian rivers



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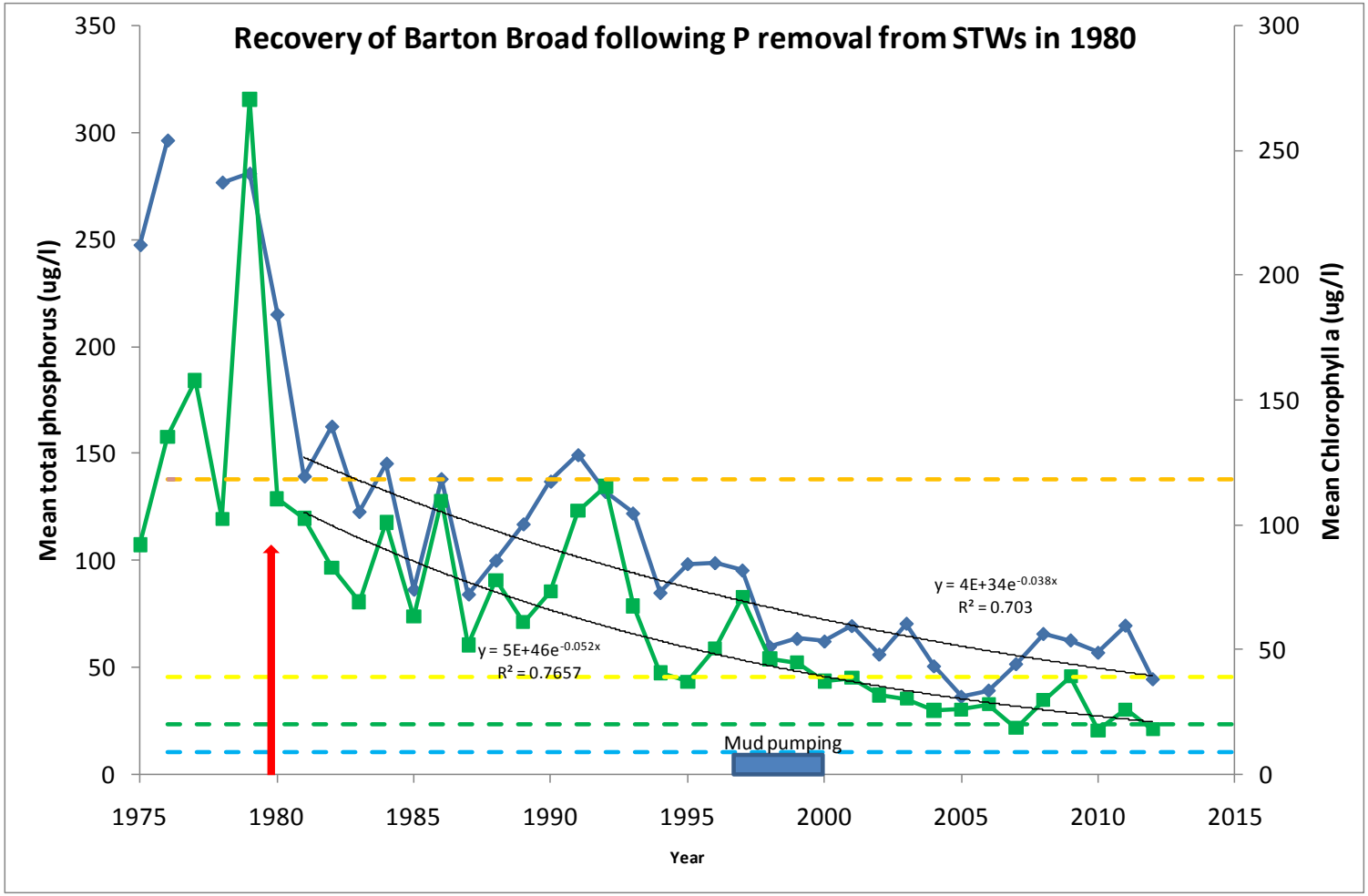

Reduction in total phosphorus (blue line) and chlorophyll a (green line) in Barton Broad following the introduction of phosphorus removal at sewage treatment works in the River Ant catchment in 1980. Dotted lines show WFD boundary values for chlorophyll a, solid lines are trend lines (exponential fit) (Data for 1975,1976 from UEA studies)

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Agricultural P reduction measures

- Agriculture, on average, needs to reduce P loss by 48% to achieve the WFD standards for its share of the pollution load.
- 24% reduction in P load 2000-2015 predicted through Business As Usual

- **England Catchment Sensitive Farming:** Farm loss reductions of 7-20% possible. Monitoring results v variable showing +/- 40% change in river P concentrations.

- **Nitrates Directive action plans:** 8-10% modelled reduction in total P

- **Environmental Stewardship:** 4% modelled reduction in dissolved P (from Entry Level Scheme)

- River monitoring mainly phosphate, generally misses particulate and spate event sources

- Reductions in in-river phosphate concentrations,
  - mostly point-source reductions,
  - P standards still being failed
- Evidence of improvement in ecology limited
  - (probably insufficient reduction in P concentration to drive ecological improvement)
- Reduce effluent P concentrations further
  - Possible, to 0.1mg/L, increasingly energy intensive

Where might measures for P take us?

- Initial results from modelling....
  - Reduce STWs to 0.1 mgP/L and agricultural P by 50%
  - May still leave us with 15-20% river length failing on P
- Initial cost estimates for water industry STWs
  - Costs to prevent deterioration due to population growth = £73-619 million
  - Costs for good P status for water industry's share of P loadings = £1.9 billion capex +/-30% against the current standards and £2.45 billion +/-30% for revised (more stringent) P standards

- **Way forward** = targeted measures, traditional and innovative for sewage effluent and agricultural sources, **plus** national source control, plus anything else which works....
  - Water industry – address growth, more ambitious and innovative P removal, more recovery/recycling
  - Agriculture – issues around effectiveness, need improved control mechanisms for key diffuse water pollution pressures
  - Food & drink additives - firm up evidence, explore source control options
  - Tap water dosing – new lining technology?, optimisation?
  - Review risks and control options for small rural sewage sources

Algal and/or macrophyte harvesting – questions

- What is it intended to achieve?
  - Lake restoration?
  - Conversion of catchment nutrient sources into something which is reusable?
  - Treatment of effluent streams at sewage treatment works? – sustainable P-stripping??

Algal and/or macrophyte harvesting – questions

- Practicalities
  - Where – lakes? Rivers?
  - Lake depth, size, extent of shallow water areas
  - River macrophytes cut for navigation/flood defense already
  - Access, owner permissions
  - Seasonal nature of harvestable material
  - Harvesting equipment
  - Who pays?
  - Re-use as fertiliser – will it become diffuse P again?

Algal and/or macrophyte harvesting – questions

- Disruption caused by harvesting – especially macrophytes
  - Macrophyte communites (WFD status)
  - Sediment disturbance (P release)
  - Impacts on other aquatic organisms, e.g invertebrates, fish
  - Impacts on uses – e.g. fisheries
  - Change to phytoplankton dominated community?

Algal and/or macrophyte harvesting – questions

- Does it work?
  - How much P can realistically be removed?
  - > internal and external loads?
  - Can P concentrations be lowered sufficiently to become WFD compliant?
  - Do external loads need to be controlled?
  - One harvest per year for one year? 10years??

Algal and/or macrophyte harvesting – questions

- Costs and benefits
  - How much does it cost
    - to remove P from a waterbody?
    - to convert harvested material to something useable
  - – cheap/expensive, e.g. against tertiary treatment at STWs, against diffuse pollution mitigation, against use of other lake restoration measures (e.g. sediment capping, dredging)
  - Does the value of the benefit come from the product harvested or from the improvements to the aquatic environment? Or both?

Algal and/or macrophyte harvesting – questions

- Stakeholder engagement/public perception
  - “Water weed” already has a bad press – flooding, sailing
- Other things
  - EA – lake and river monitoring data
  - Experts in “waste”, regulation, management, application to land

Thanks for listening