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# Counting the cost of groundwater quality degradation

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# Drivers

- More stringent regulation

1980 Drinking Water Directive

1989 Water Act

Water Supply (Water Quality) Regulations

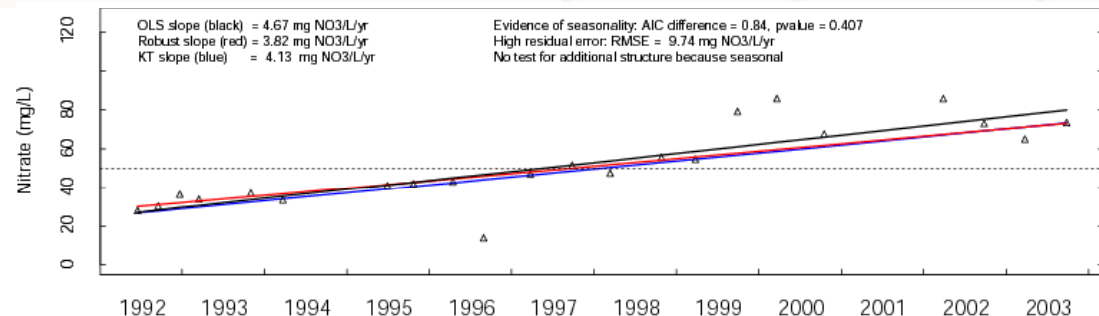
1989 Nitrate, pesticides

1999 Cryptosporidium

2000 Arsenic, solvents, hydrocarbons

2003 The Water Environment (Water Framework Directive) Regulations

- Decrease in groundwater quality



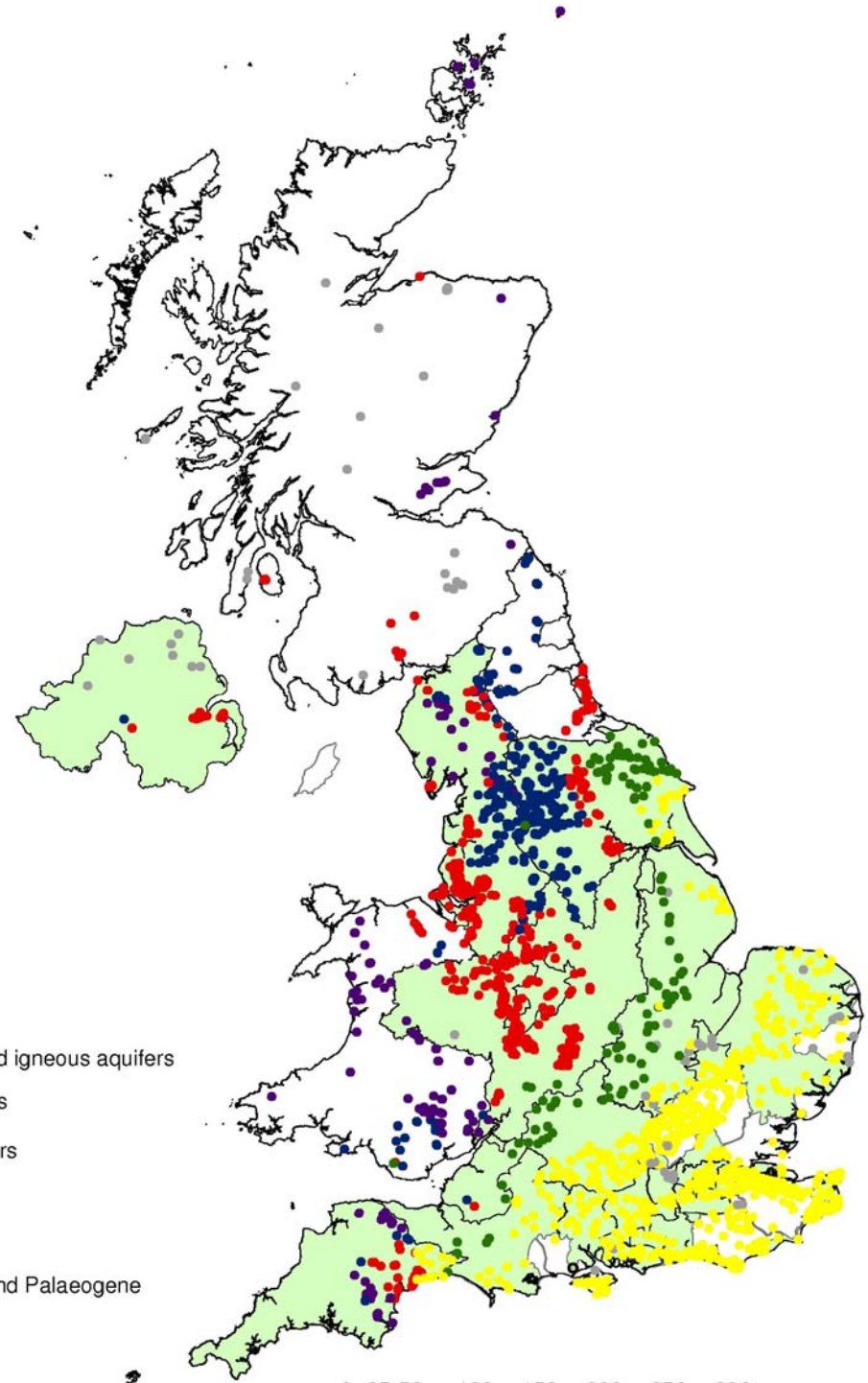
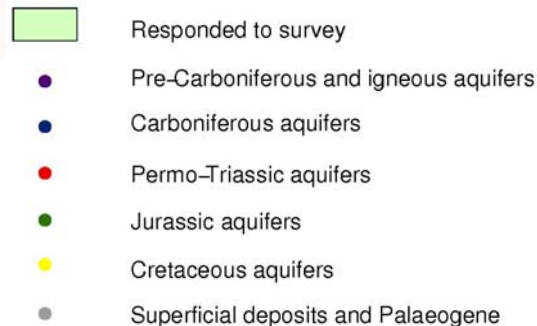


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# Survey response

- 14 utilities
- 75.6% of supplied groundwater
- Unrepresented settings in Scotland & Wales 3% of total volume





# Main quality issues

## Diffuse pollution

- Nitrate
- Pesticides
- Hydrocarbons & solvents
- Other point sources

## Point source pollution

## Regulatory changes

- Cryptosporidium
- Arsenic

## 'Natural quality problems'

- Iron & manganese
- Salinity



# Calculated mean unit costs

	Blending		Treatment	
	Capex (£/MI/d)	Opex (£/MI)	Capex (£/MI/d)	Opex (£/MI)
Nitrate	261,500	7.2	476,100	68.1
Pesticides	111,300	2.9	263,000	19.5
Cryptosporidium	-	-	359,000	16.6
Hydrocarbons	220,000		723,200	8.1

- All costs at 2003 equivalent
- Very large data ranges particularly for capex (95% CL=  $\pm 60\%$ )



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# Estimates

- Missing abstraction volumes
- Missing treatment and blending costs, particularly opex
- Cost of replacement sources
- Scaling-up to 100% response





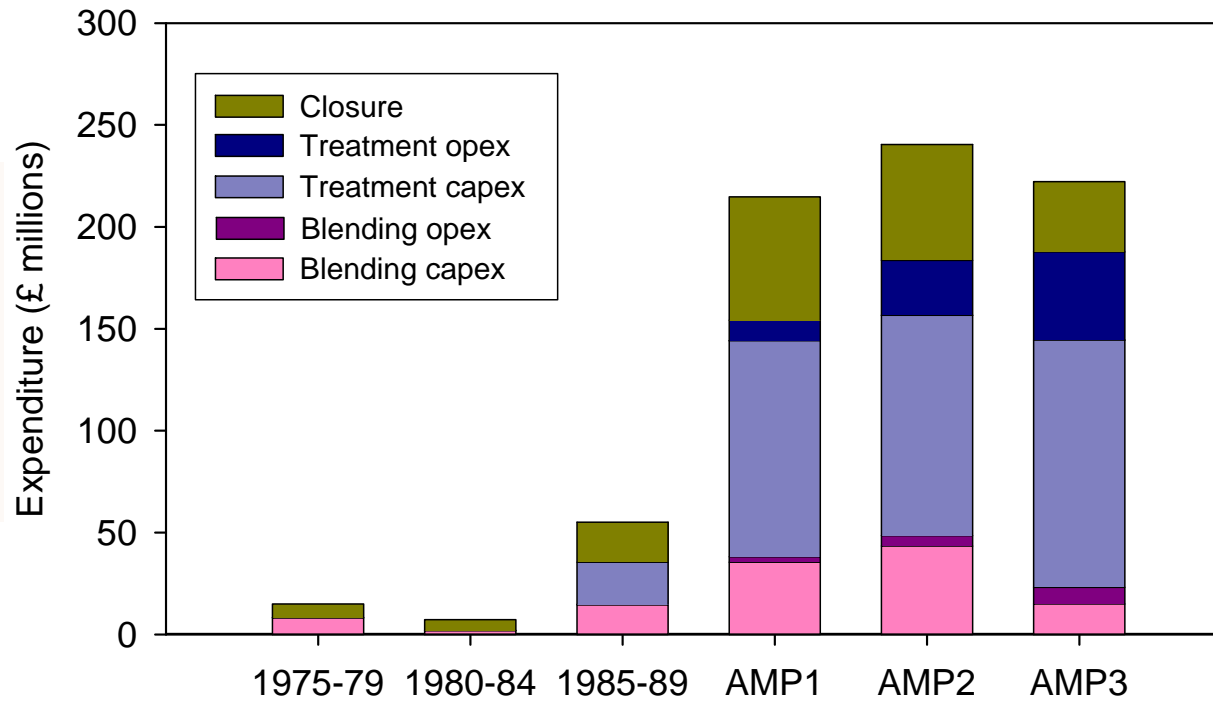
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# Industry costs to 2004, opex & capex









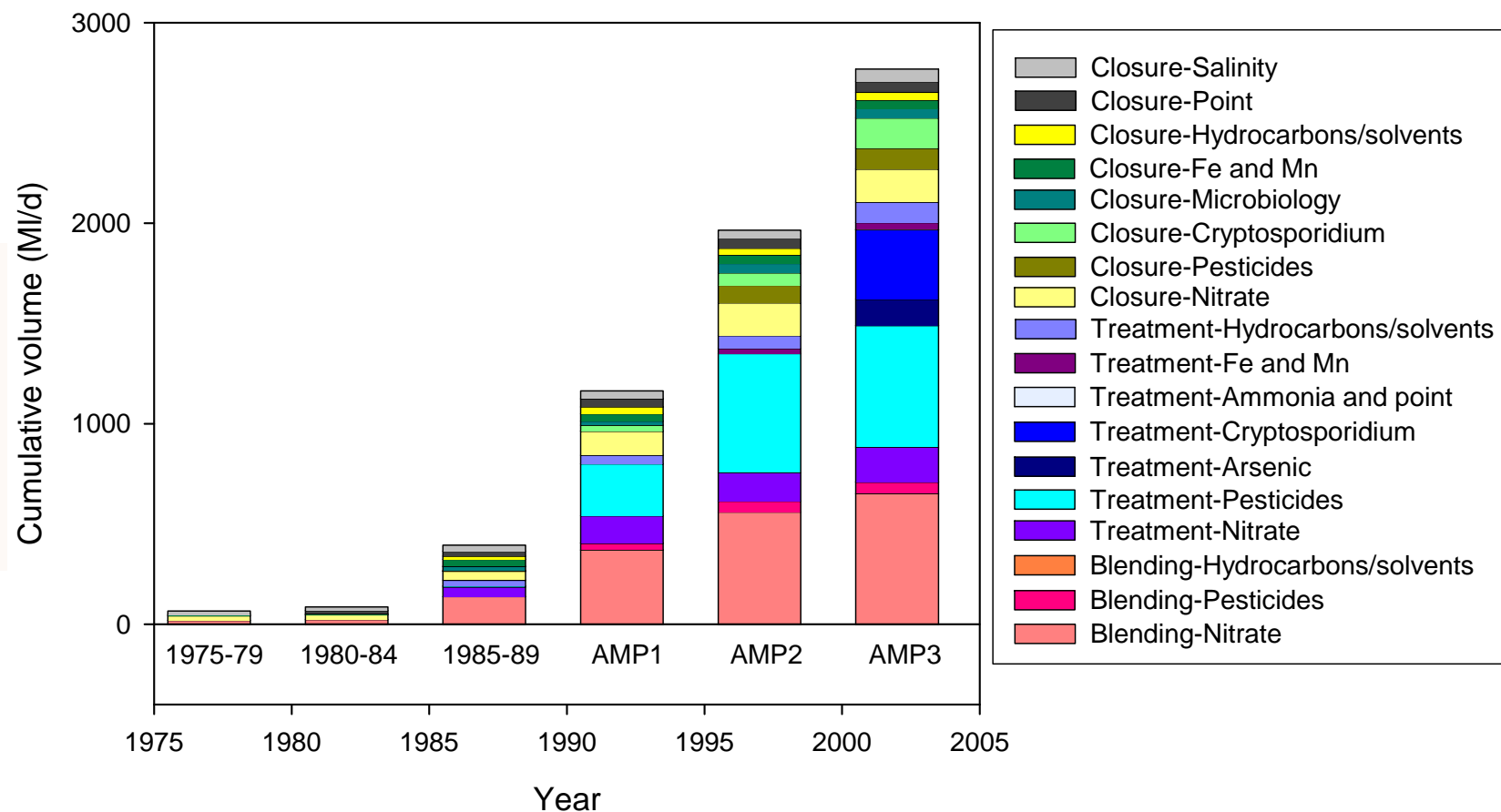
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# Amount of water affected





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## Future scenarios tested

- A. **Best case:** linear extrapolation based on past trends for nitrate only
- B. **Likely case:** linear extrapolation based on past trends for all contaminants except *Cryptosporidium* and As
- C. **Worst case:** as B but with no new blending/treatment after AMP4 – curtailment after 2010

### Assumptions:

- Demand remains at current level - no account of demographic or climate changes
- No quality improvements from protection measures
- No further regulatory changes or 'new pollutants'



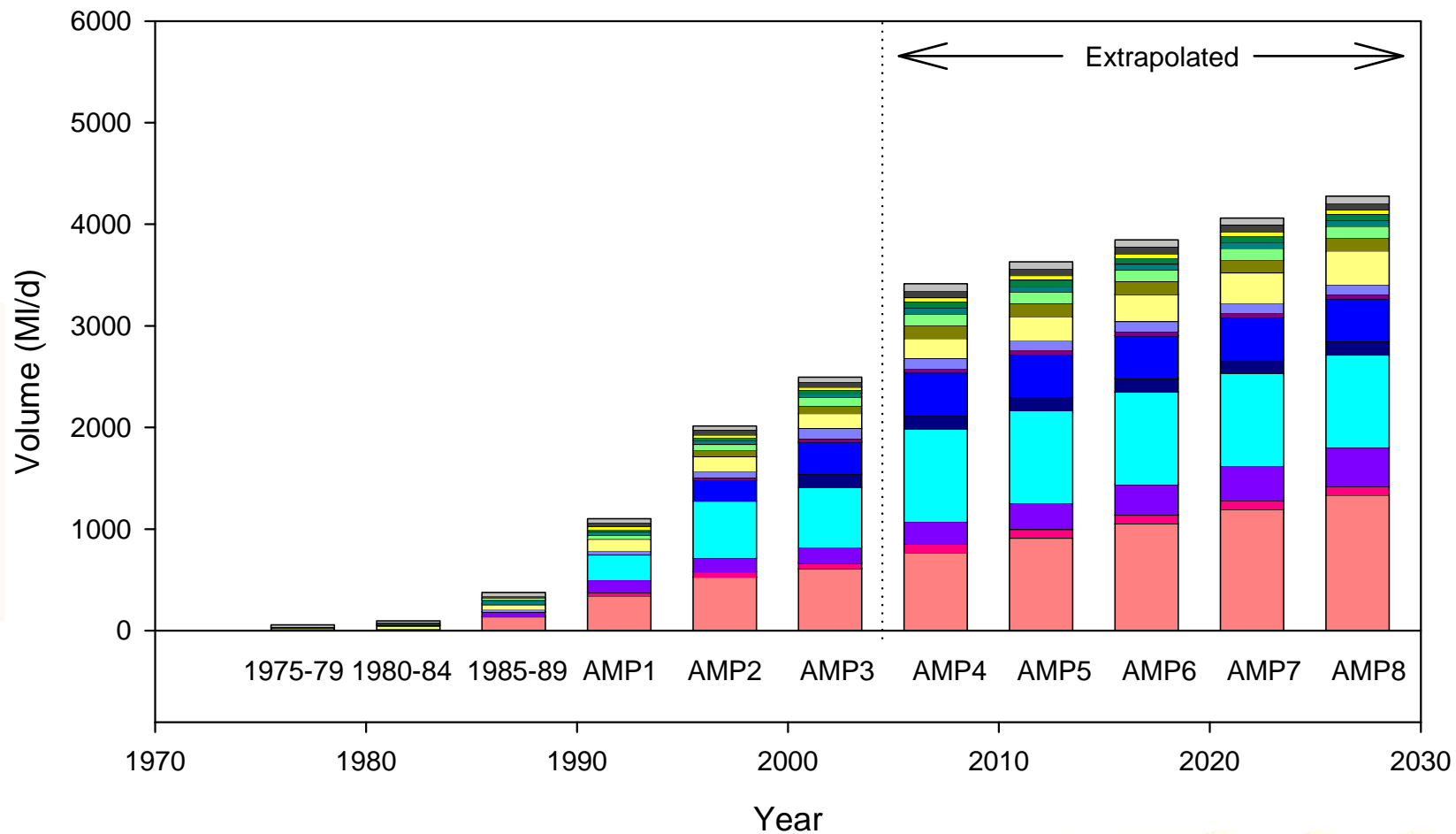
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# Scenario A - volumes



Total = 4300 MI/d by 2029

Groundwater supplied 2002 = 5178 MI/d



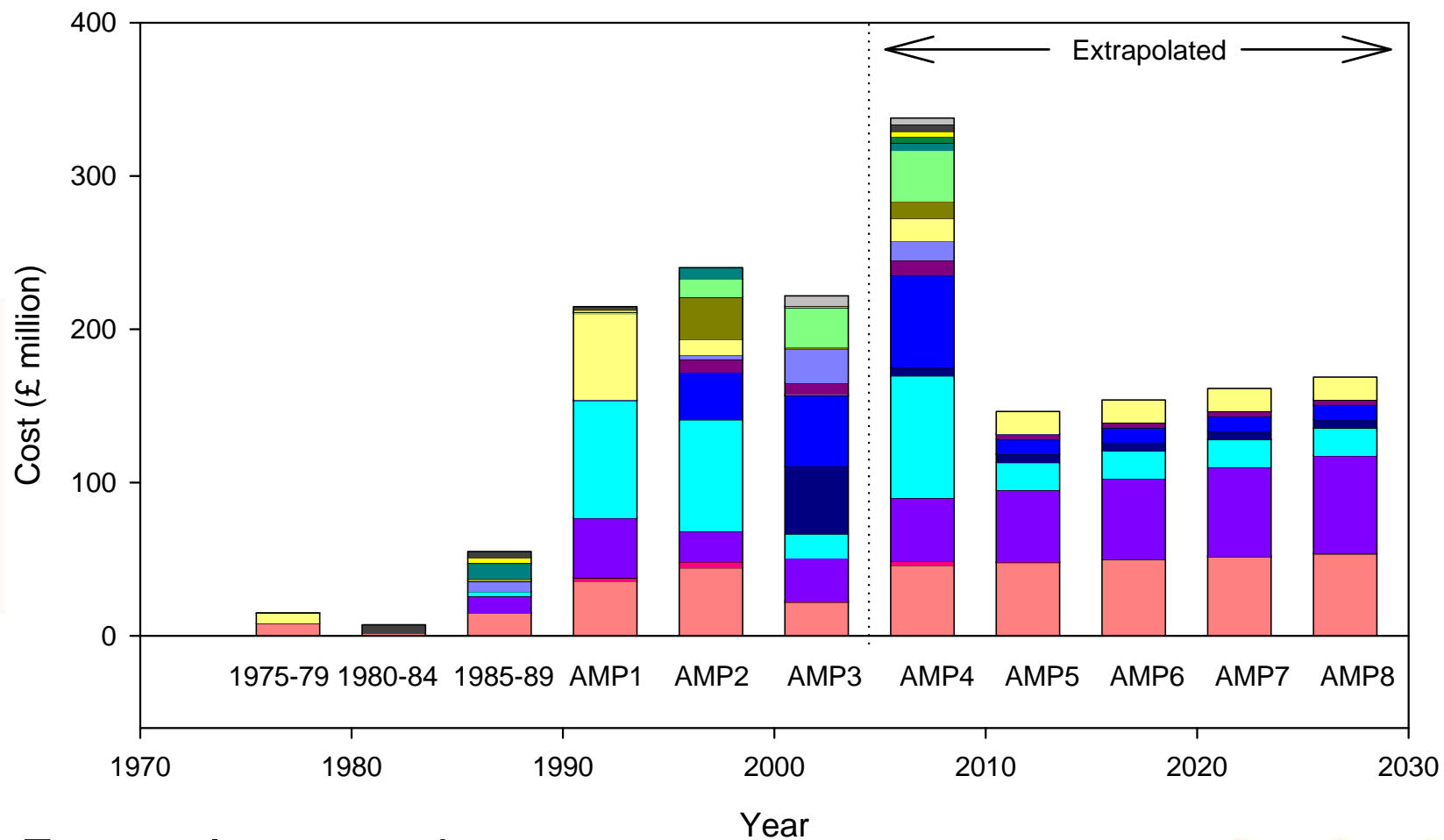
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# Scenario A - costs



From volume × unit costs



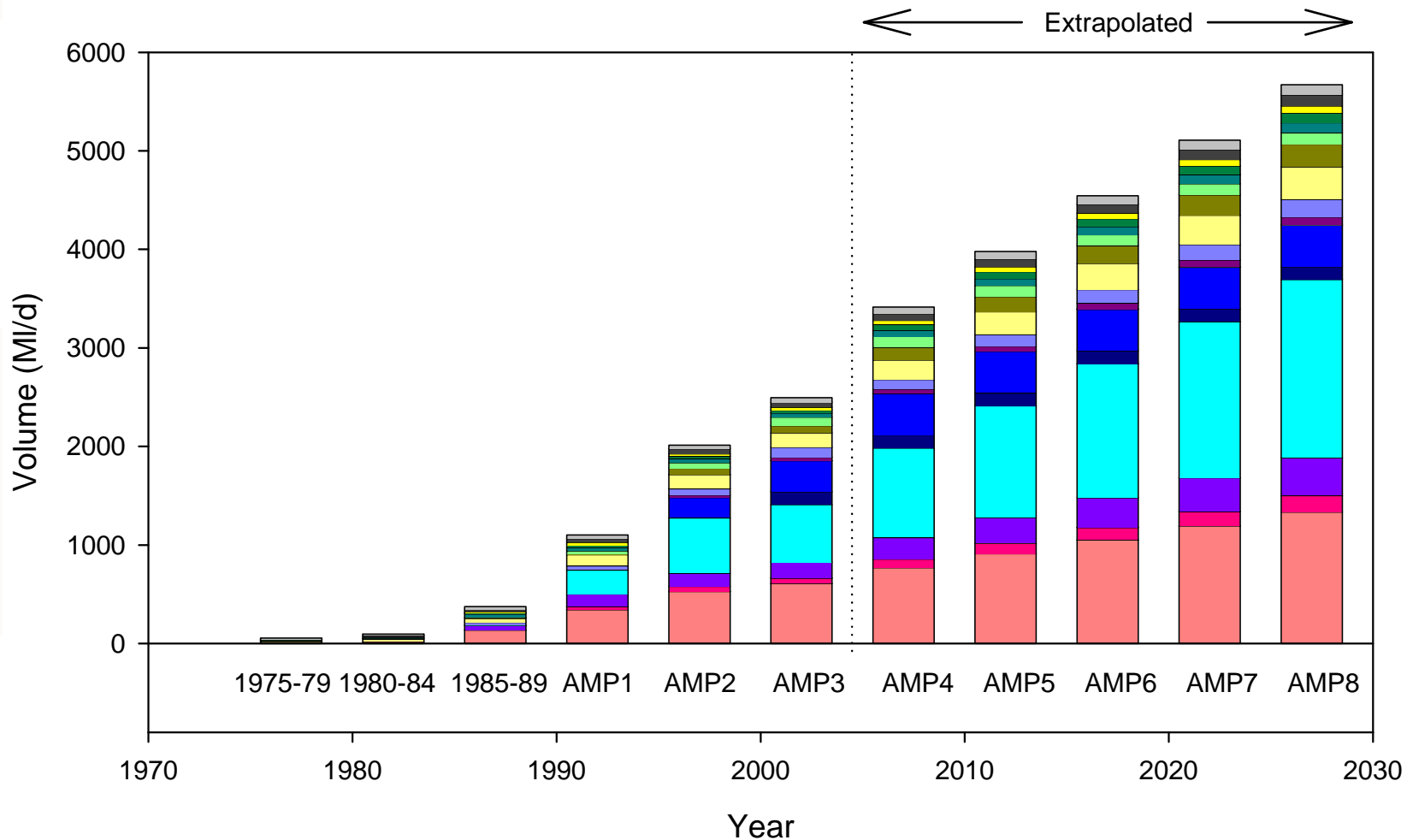
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# Scenario B - volumes



Total = 5700 MI/d by 2029

Groundwater supplied 2002 = 5178 MI/d



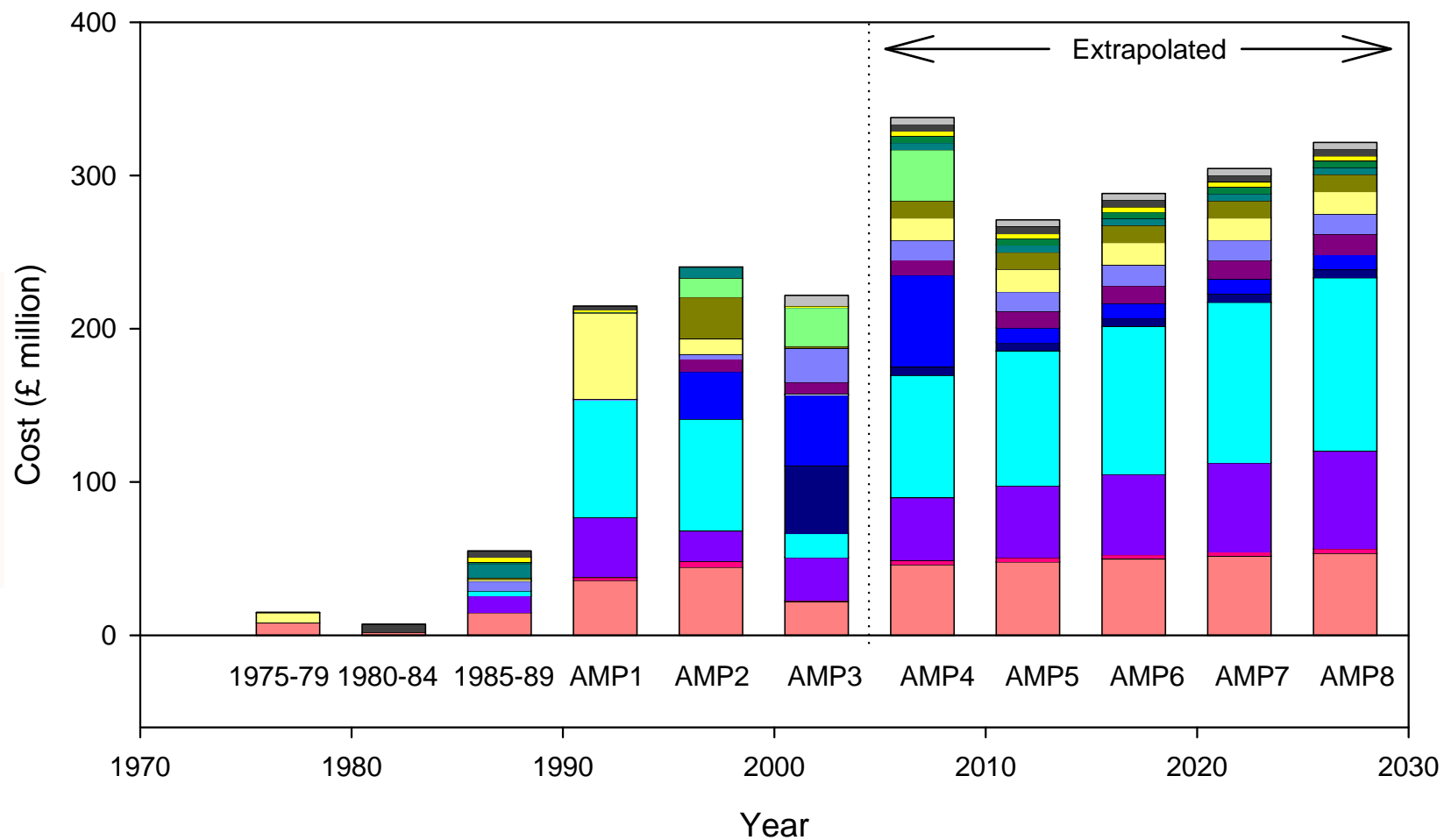
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# Scenario B - costs





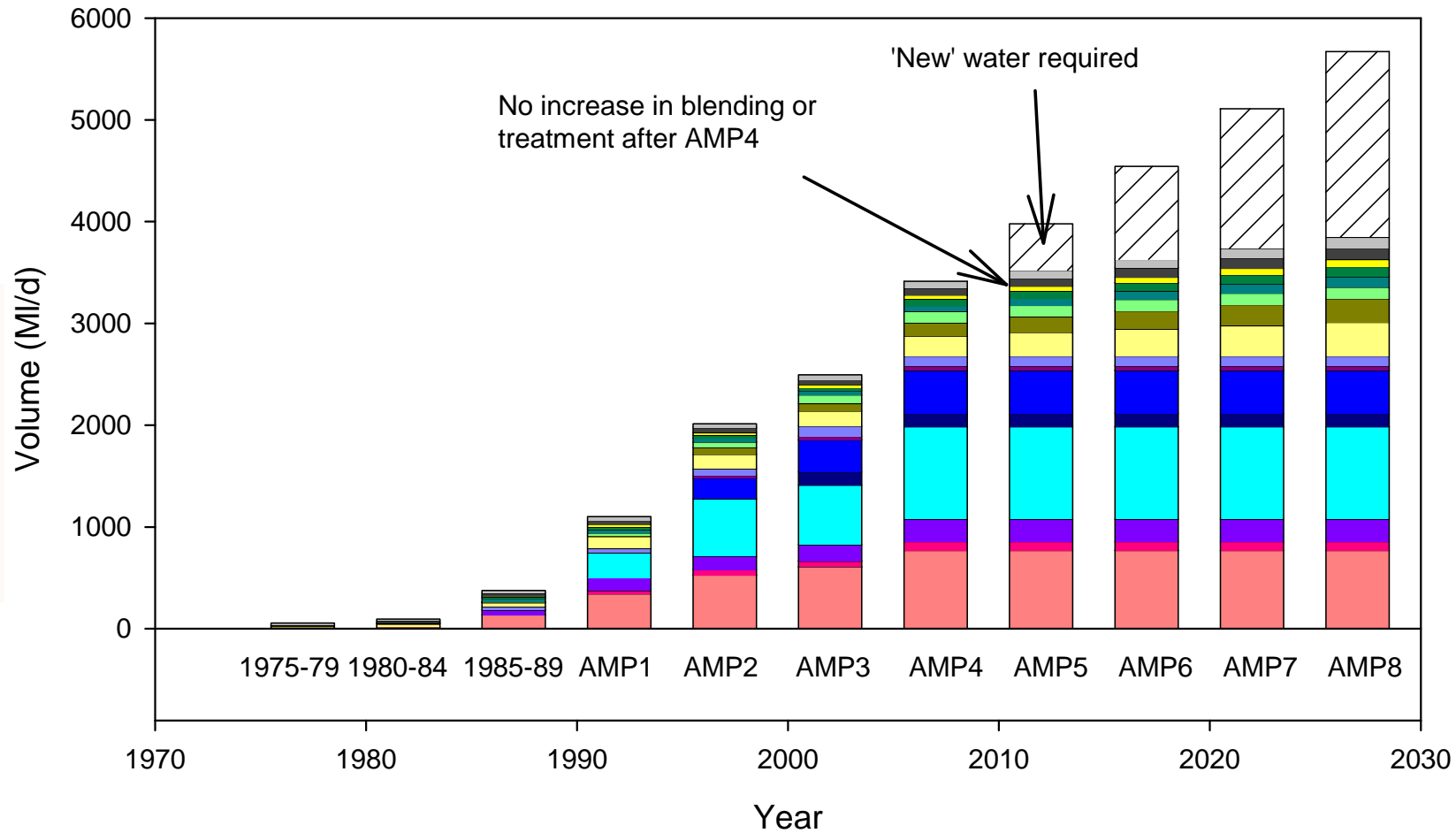
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# Scenario C - Groundwater shortfall



1800 MI/d by 2027



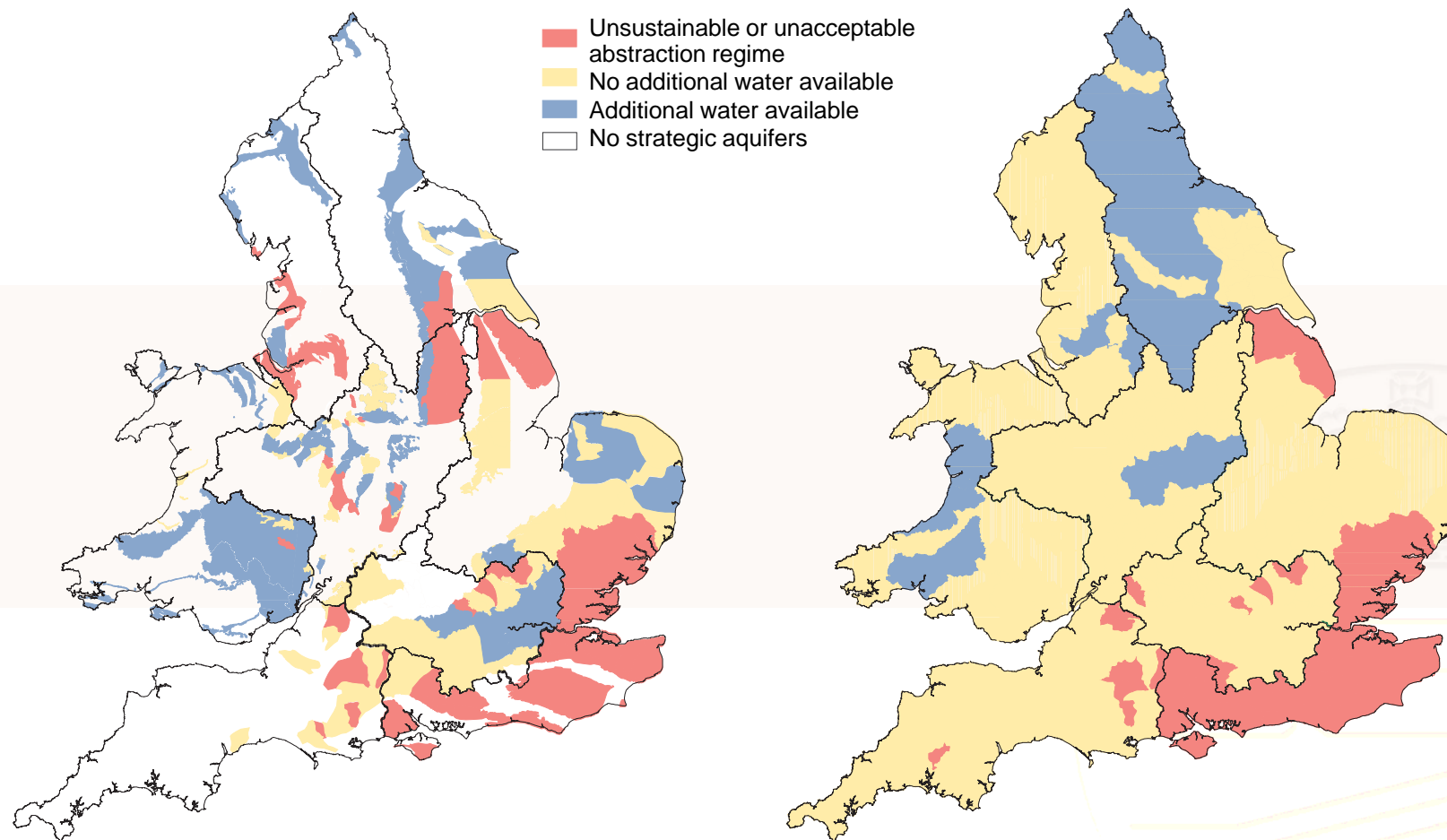
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# Water availability



Groundwater

Summer surface water (from EA, 2001)





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# Mean capital costs for replacement water

	Cost (£ million/MI/d)	Cost per AMP period (£ million)	Total AMP5 – AMP8 (£ million)
New groundwater source	1.3	580	2,300
Surface impoundment	2.75	1,240	4,950
Desalination	3.35	1,500	6,000



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# Conclusions

- 2450MI/d of supplied water is affected – **50%** of total
- Actions additional to disinfection have cost the water industry **>£750 million** from 1975 to 2004
- In 25 years time, groundwater quality deterioration could affect 4,300 – 5,700 MI/d (from **80% to all**)



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# Implications for water industry

- Changed economic balance of options - e.g. towards leakage reduction
- Limitation of groundwater treatment under the WFD could lead to a supply shortfall
- Alternatives, such as surface water impoundments or desalination, are very costly
- Emphasis back on managing and protecting resources