

# **WATER FRAMEWORK DIRECTIVE**

## **Groundwater Monitoring Requirements**

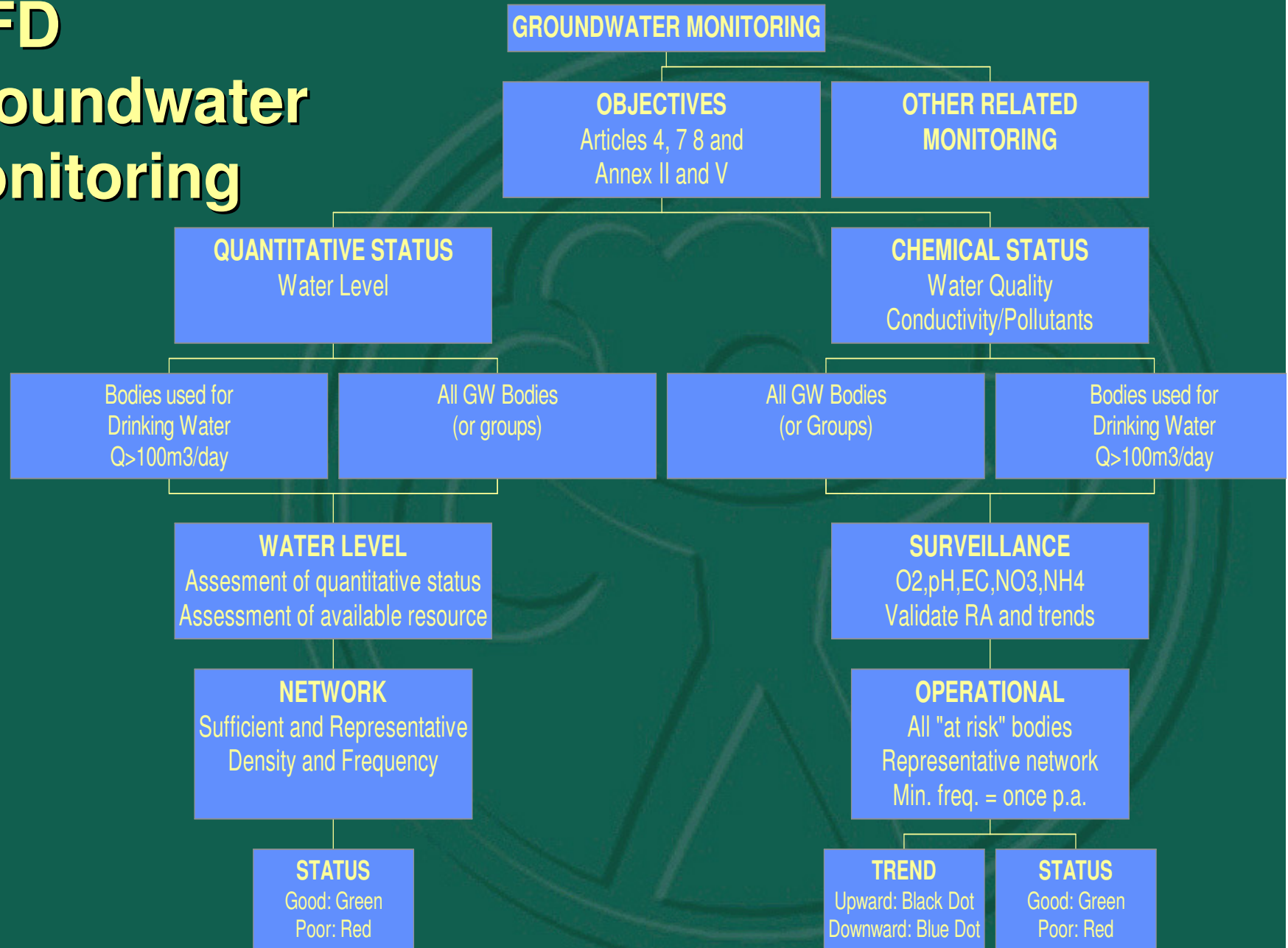
**Rob Ward**

**National Groundwater & Contaminated Land Centre  
Environment Agency**

# OVERARCHING OBJECTIVES

- Coherent and comprehensive overview of water status in each River Basin District
- For Groundwater, programmes shall cover both monitoring and assessment of chemical and quantitative status
- Monitoring programmes shall be operational by Dec 2006
- Monitoring will be in accordance with Annex V

# WFD Groundwater Monitoring

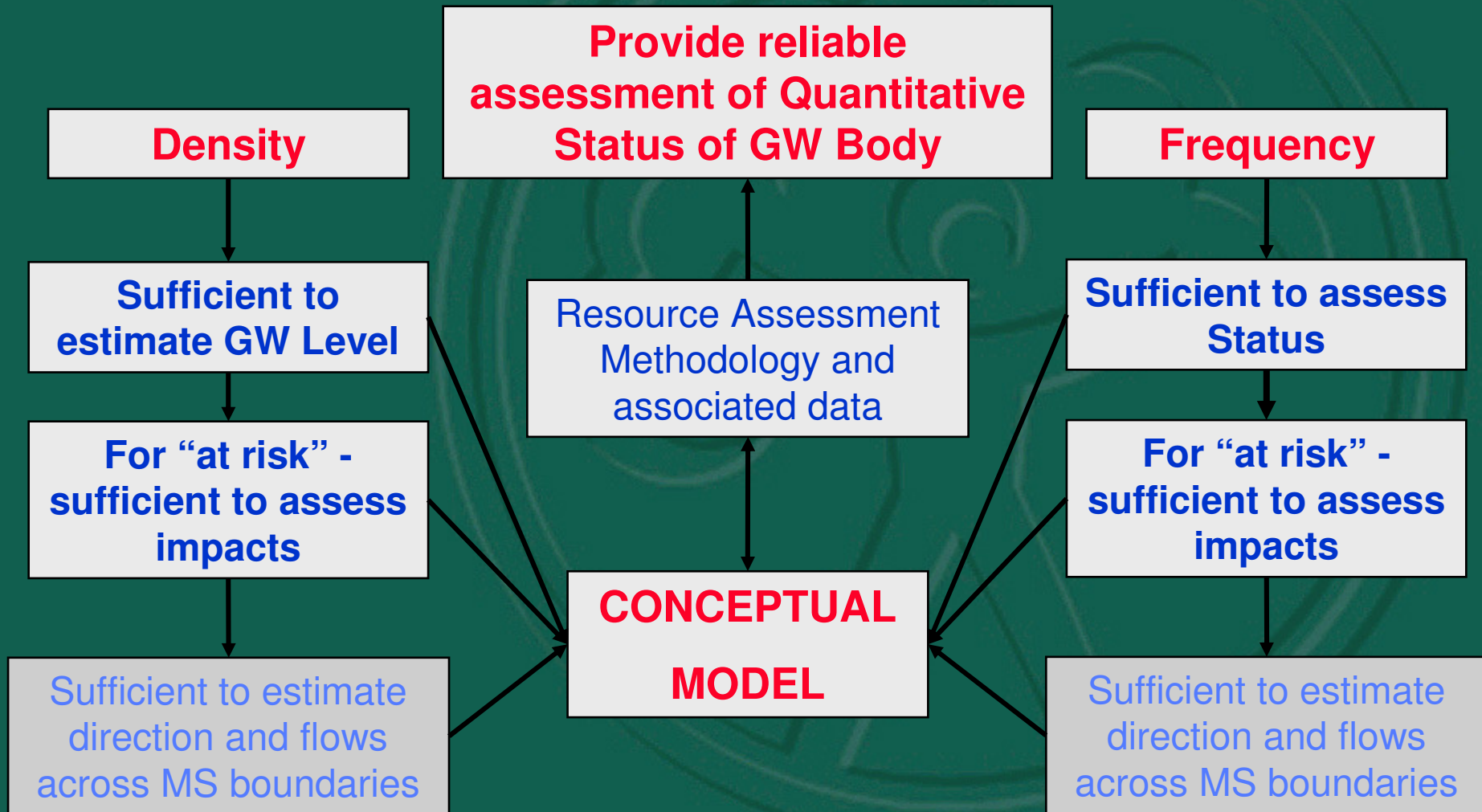


# Quantitative Status

- Status refers to level as the key parameter
- Water levels to be used to demonstrate that available groundwater resource is not exceeded by long-term annual average rate of abstraction
- Reliable Assessment for all bodies (or groups) including assessment of available resource
- Network and monitoring to support this - however can't achieve it on its own. It is only one of the parameters that is required



# Water Level Monitoring



# Chemical Status

- Parameters: Conductivity and Pollutants
- Concentrations of pollutants:
  - do not exhibit effects of intrusions
  - do not exceed quality standards
  - will not result in failure to achieve Art. 4 objectives for surface waters, diminution of ecological or chemical quality or in significant damage to terrestrial ecosystems.
- Additional criterion for quality is that of anthropogenically induced trend assessment
- Network(s) need to be capable of determining status and trends: two types of monitoring identified - *Operational* and *Surveillance*

# Surveillance Monitoring

- To supplement RA (characterisation etc)
- Data for trend assessment (natural and anthropogenic)
- Parameters: Core set plus indicative pollutants from risk assessment
- Inform additional (Operational) monitoring requirement

# Operational Monitoring

- Only in groundwater bodies (or groups) identified as being “at risk” following impact assessment and surveillance monitoring
- To establish chemical status of all “at risk” bodies
- To establish presence of any long term anthropogenically induced trends in pollutant concentrations
- Network to provide data representative of whole body (or group)
- Frequency: sufficient to detect impacts but at least once per year



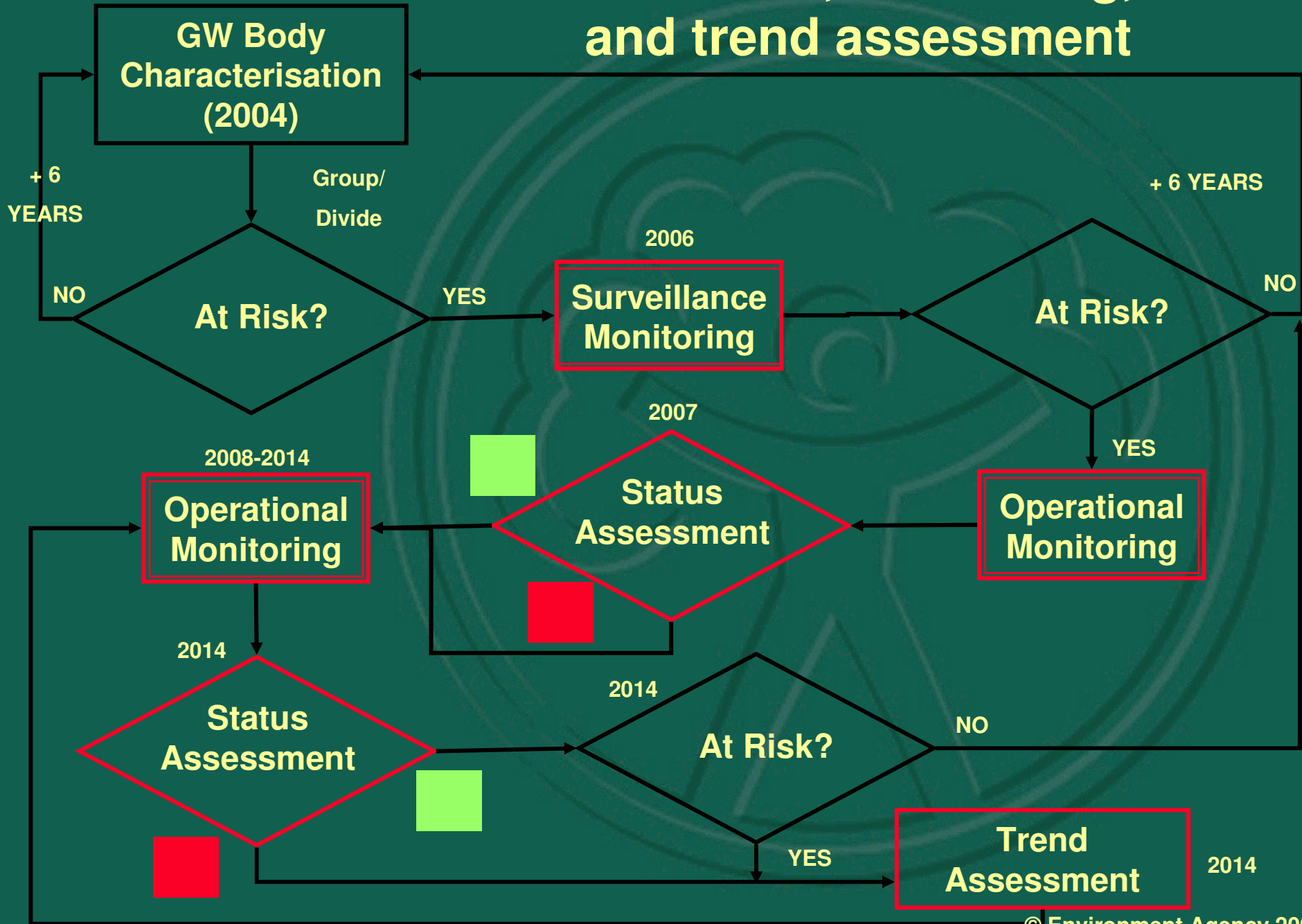
# Pollutant Trends

- Data from both surveillance and operational monitoring to be used
- Objective: to identify any long term anthropogenically induced upward trends and their reversal
- Trends calculations shall be done for the body as a whole (or group)
- Statistical significance and confidence must also be determined

# Interpretation of Status

- Chemical status for a groundwater body will be determined by aggregating data for the body as a whole
- Where standards have been set (or are relevant), the mean value of the results will be used to demonstrate compliance
- Results of both quantitative and chemical status along with pollutant trends are to be presented on a colour-coded map

# Characterisation, monitoring, status and trend assessment





## Current situation

- In England and Wales: Quantitative monitoring reasonably well established and a strategy for quality monitoring being implemented
- In Scotland: limited monitoring currently undertaken but a strategy being developed
- Main areas of concern are the poorly permeable aquifers that will be defined as groundwater bodies but have very little monitoring
- Resource Assessment and Management (RAM) Framework and CAMS process will support quantitative aspects



# Other WFD groundwater monitoring requirements

- For “at risk” bodies....where relevant.....
  - Location of abstractions (>10 m<sup>3</sup>/day or serving >50 people) and annual average abstraction rates
  - Chemical composition of water abstracted from body
  - Discharges to groundwater bodies - location, rate and composition
  - Land use

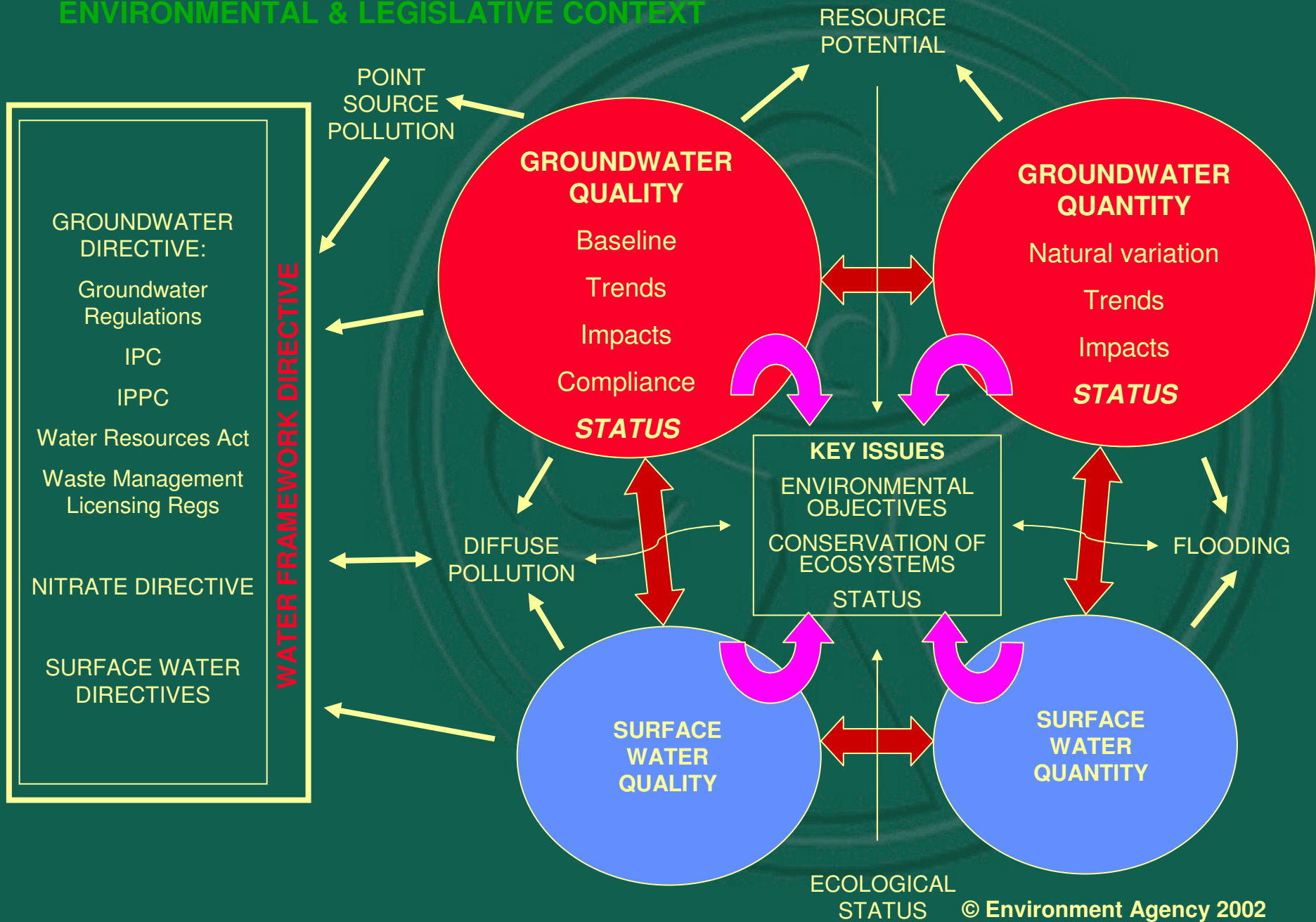
# Supporting Initiatives

- Europe: Common Implementation Strategy
  - Work Packages to support implementation
    - Monitoring: guidance on requirements
    - Data aggregation and trend assessment
- Environment Agency Groundwater Monitoring Strategy
  - Framework for Quality Monitoring
    - Guidance on network design
    - Risk-based monitoring

# Quality monitoring strategy

- Development of a strategic framework for monitoring:
  - Strategic Drivers and Objectives
    - Water Framework and Daughter Directives
  - Strategy planning and prioritisation of needs
    - Business Planning
    - National/Regional needs and priorities
  - Implementation
    - Conceptual model development/network design
    - Monitoring, interpretation and reporting

# GROUNDWATER MONITORING - ENVIRONMENTAL & LEGISLATIVE CONTEXT

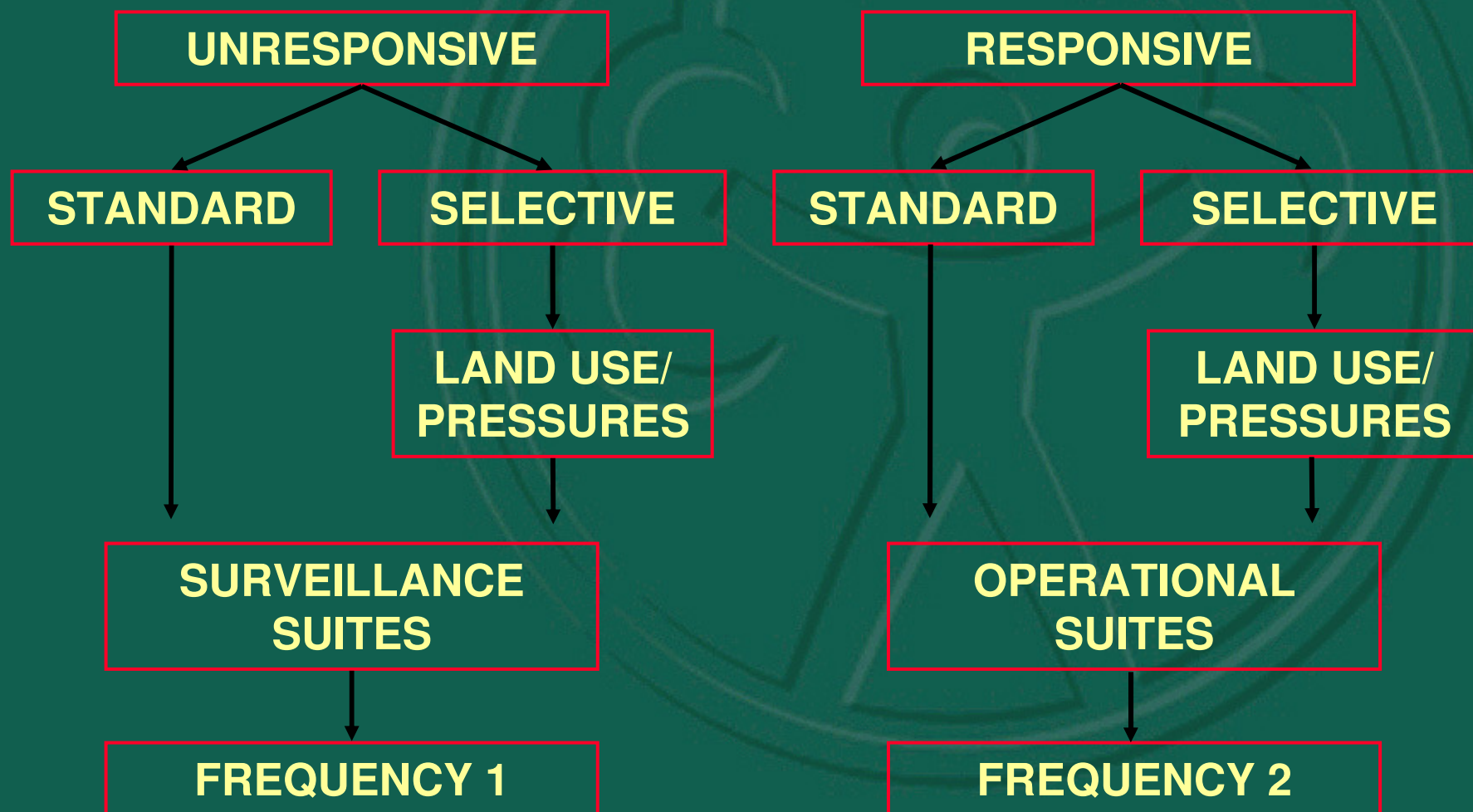




# Network Design Matrix

Priority Level	Principal Purpose/Criteria
1a	Recharge (Unconfined) Discharge
1b	Confined Aquifer
2	Land Use – Arable Land Use - Urban Land Use - Grassland Land Use – Semi-natural vegetation Land Use - Forestry
3	Land Use – Arable (deep/shallow)
4	Land Use – Urban sub-division (industrial/residential)
5	3-D monitoring
3 - 5	Local/Other criteria – specific Pressures/Impacts

# Determinand and Frequency Selection



# Sampling Frequency

			Hydrochemical Determinand	
			Unresponsive	Responsive
Hydrogeology	SLOW	Outcrop	3 years	6 monthly
		Confined	6 years	Annual
	FAST	Outcrop	Annual	Quarterly
		Confined	3 years	6 monthly
			Surveillance	Operational

# Guidance on Monitoring

- CIS Project will produce guidance on monitoring for each water body category
- The guidance will contain detailed technical information on requirements for:
  - monitoring each quality element
  - representative site selection
  - frequency and density to achieve adequate confidence
  - statistical testing
- Will draw on Member States experience and develop a “tool kit”



# Data Aggregation and Trend Assessment

Minimum number of sites, Network Criterion, Treatment of LOQ values

## Data Aggregation

Regularisation

Spatial aggregation

arithmetic mean and CL

weighted arithmetic  
mean and CL

optional

Kriging mean and CL

## Trend Assessment

Regularisation

Spatial aggregation

Trend assessment

Starting point

Min. length of time series

Max. length of time  
series

Frequency of trend  
testing

## Trend Reversal Assessment

Starting point

Min. length of time series

Max. length of time series

- Project focused on the development of particular algorithms for:
  - the identification of trends in pollutants (Annex V 2.4.4)
  - data aggregation method for chemical status assessment (Annex V 2.4.5)

# SUMMARY

- Specific monitoring requirements to support WFD
- Risk-based approach proposed
- Monitoring needs to be consistent with other needs - statutory and environmental
- Need to continue to contribute to EU developments
- Partnership approach needed to deliver effective monitoring and benefits