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# GROUNDWATER – QUALITY ISSUES OF A TECHNICAL AND REGULATORY NATURE

NON POINT SOURCE POLLUTION

JOHANNES GRATH

# FACTS & FIGURES

- **founded in 1985** under the Environmental Control Act
- since **1999** under the legal status of a **Limited Liability Company**
- more than **500 employees**
- more than **49 Mio.€ turnover**
- experience in more than **60 countries**
- partner in numerous **networks**



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# SERVICES

- providing the basis for decision making and implementation of sustainable strategies and measures
- recommendations for decision-makers in politics, administration and business in Austria, the EU and international
- development of scenarios
- providing quality assured data incl. monitoring, management and assessment

[www.umweltbundesamt.at/en/services/](http://www.umweltbundesamt.at/en/services/)

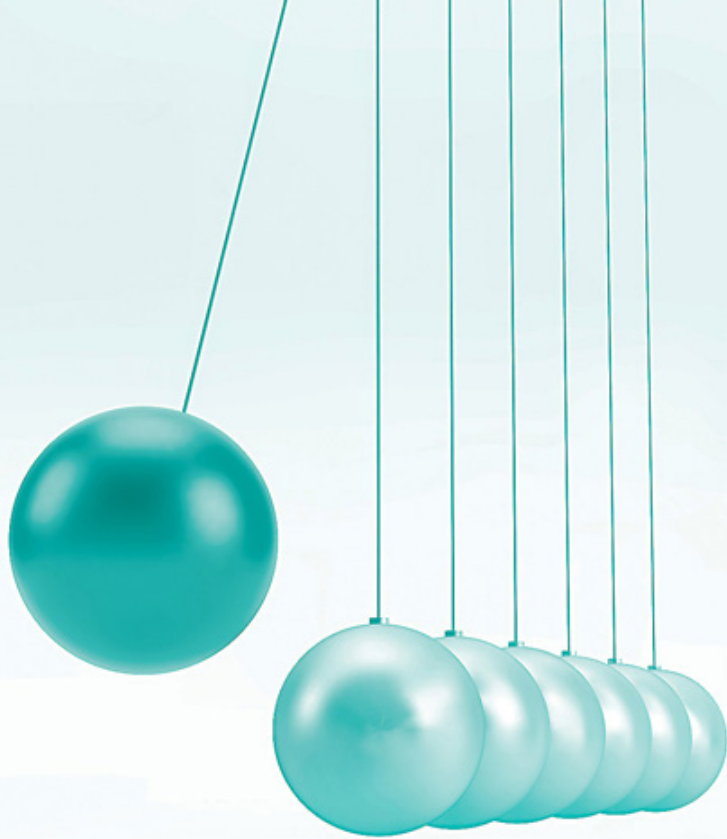


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# CONTENT

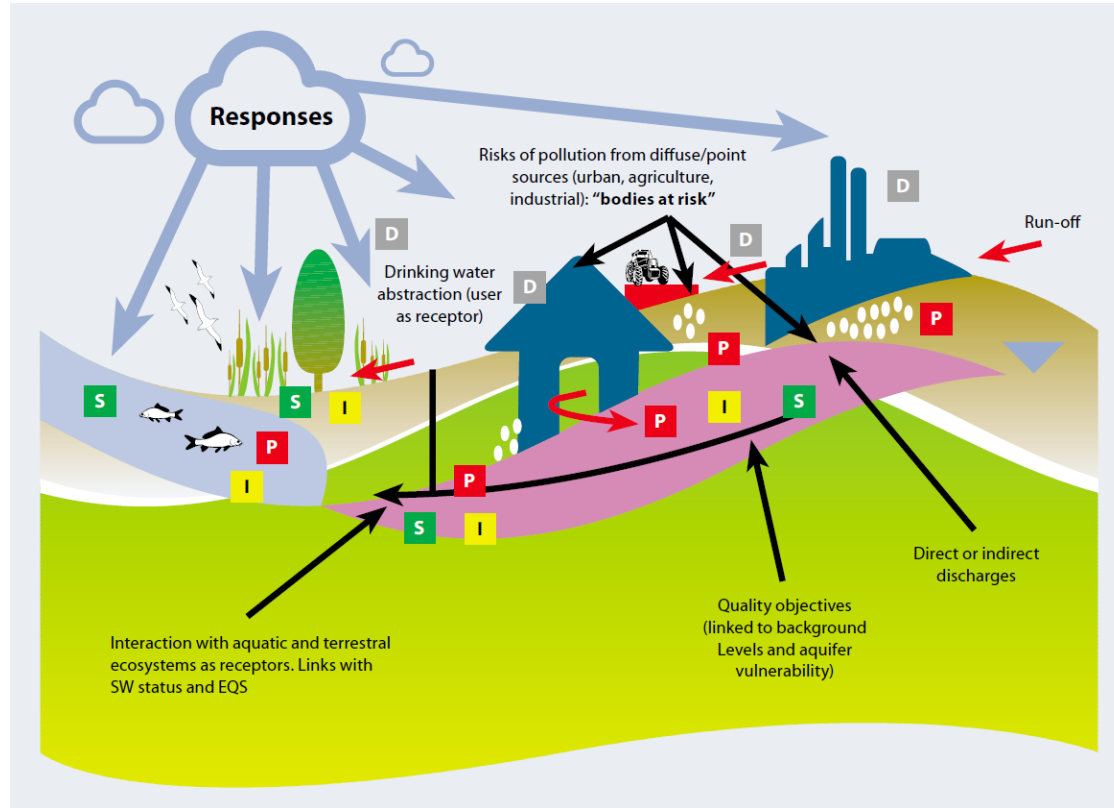
- EU (Ground)Water Policy – brief overview
  - Environmental objectives for groundwater
- Groundwater Bodies – Characterisation and Assessment at European level
- Groundwater Monitoring – requirements and implementation
- Chemical Groundwater Monitoring in Austria
- River Basin Management Plan

# EUROPEAN (GROUND)WATER POLICY



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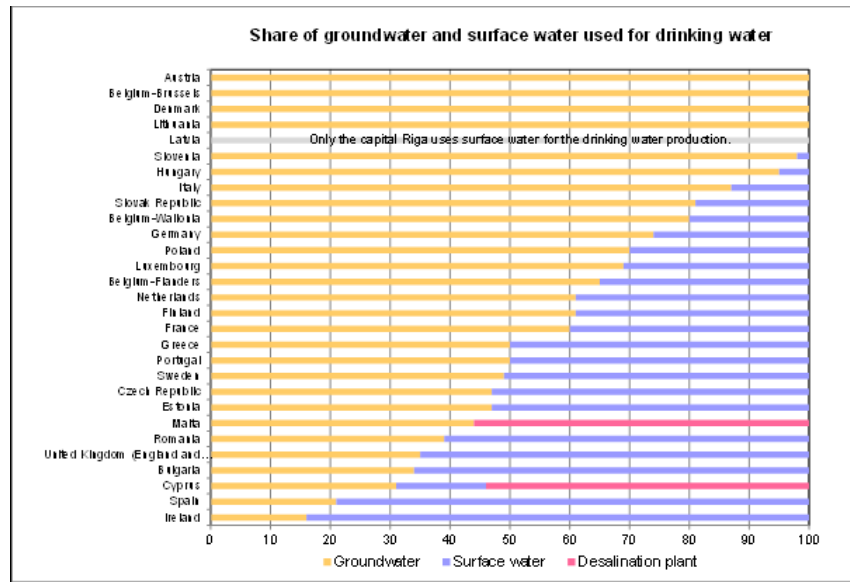
# DIVERSITY OF USES, PRESSURES AND IMPACTS



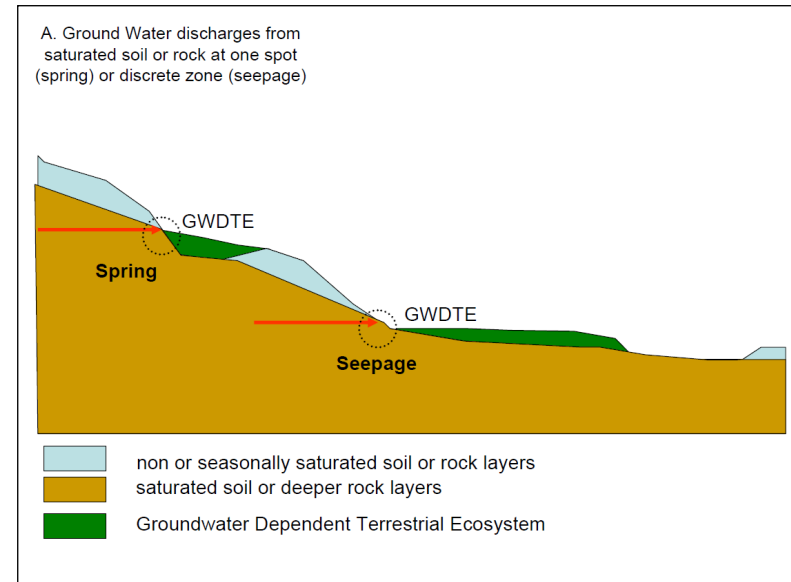
Source: European Commission 2008: Groundwater Protection in Europe

# SOME GROUNDWATER USES & RECEPTORS

- In many EU Member States > 50% groundwater used for drinking water



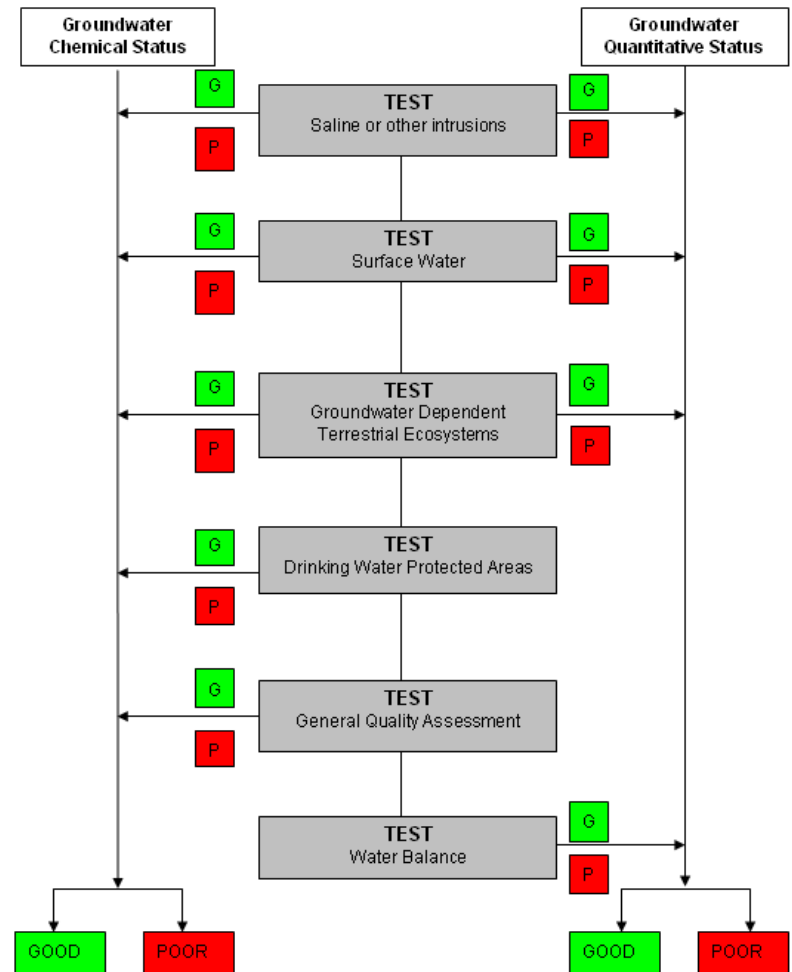
- Groundwater dependent terrestrial ecosystems



Source: 'Pressures and Measures study' - taken from EC SWD (2012) 379 final; CIS Technical Report No. 6 on Groundwater Dependent Terrestrial Ecosystems

# STATUS ASSESSMENT ENVIRONMENTAL OBJECTIVES

- All **relevant** test must be completed
- **Quantity**
  - Balance between natural recharge and abstractions
- **Chemistry**
  - No saline or other intrusion
  - Compliance with numerical quality standards (EU-wide and national)
  - No diminution of associated aquatic ecosystems
  - No deterioration of dependent terrestrial ecosystems





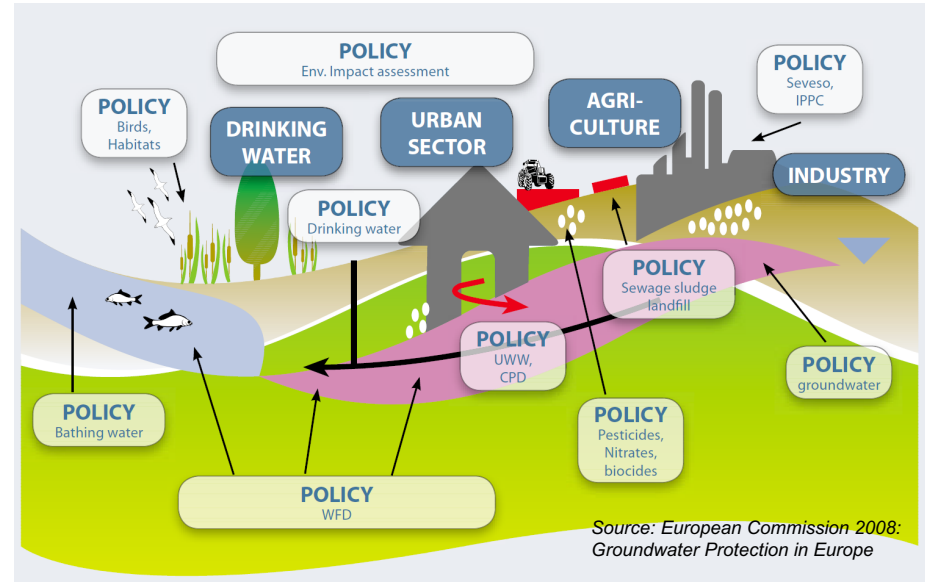


# WATER FRAMEWORK DIRECTIVE - MAIN GOAL

**2015: Good status for all waters**

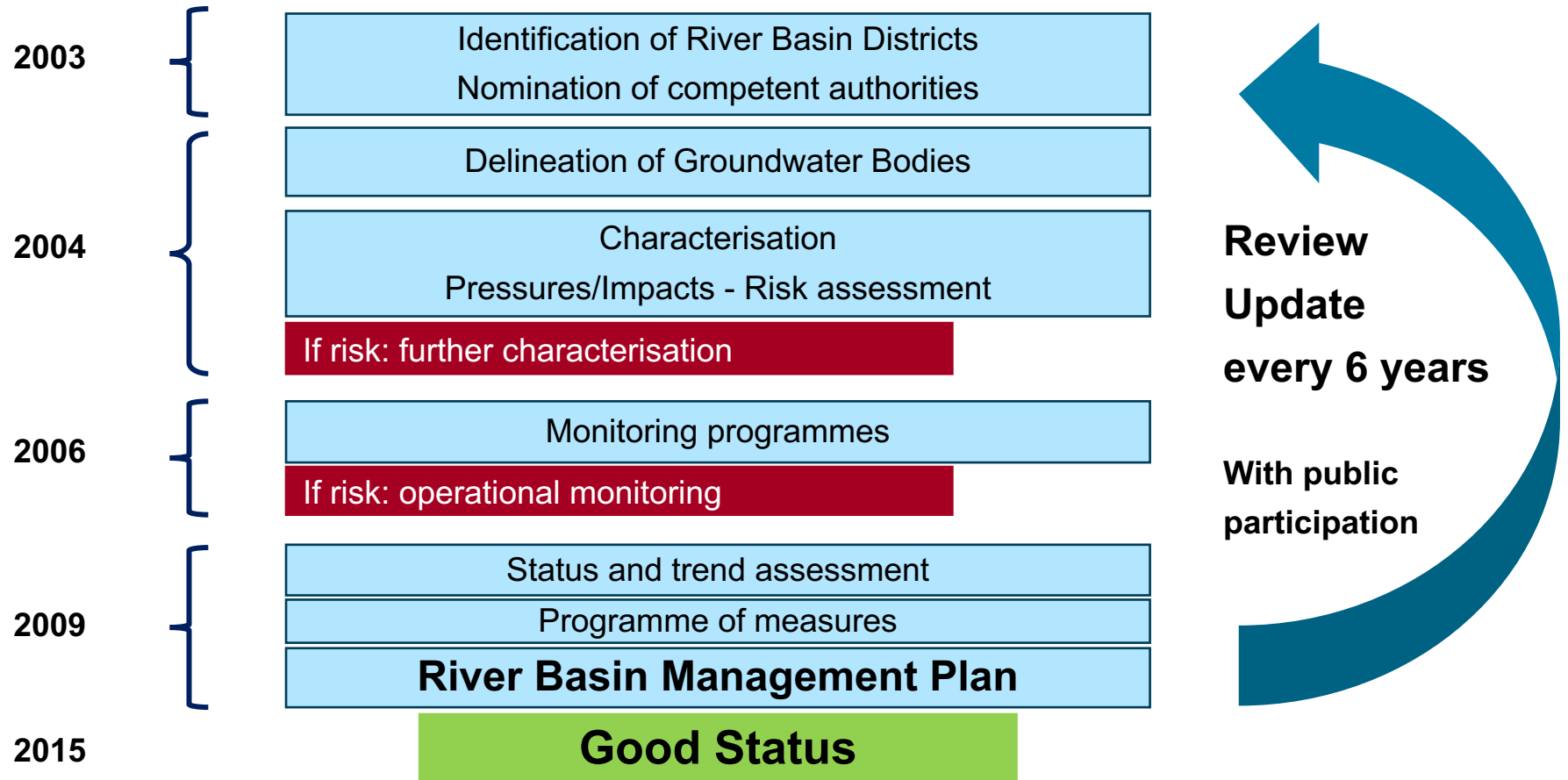
## Groundwater

- chemical status
- quantitative status
- no significant upward trend & trend reversal

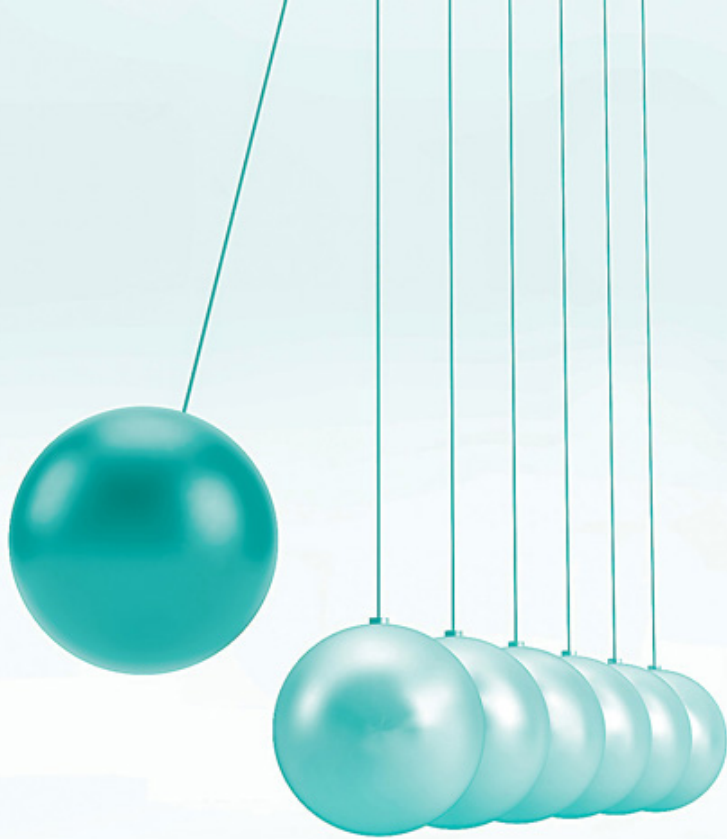


**Innovation: integrated management for surface and groundwater at the EU level & policy integration**

# WFD IMPLEMENTATION STEPS



# GROUNDWATER BODIES – CHARACTERISATION AND ASSESSMENT AT EUROPEAN LEVEL



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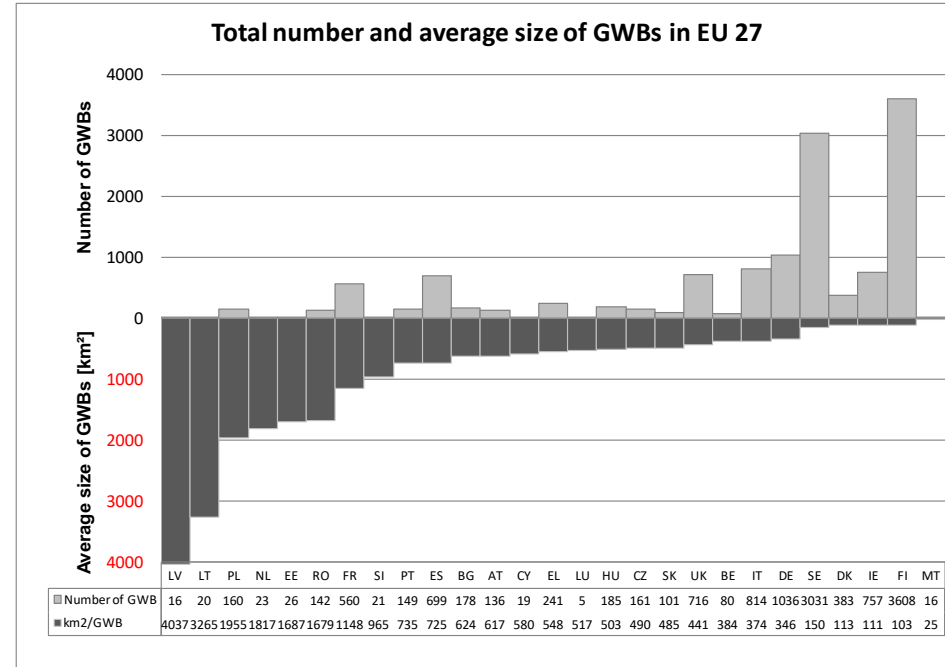
# DELINEATION - WHAT IS A GROUNDWATER BODY

## Background

- a **groundwater body** (GWB) is a coherent **management unit** which has to meet the environmental objectives
- a GWB is a distinct volume of groundwater within an aquifer or aquifers
- the identification of GWBs is a tool and not an objective in itself

## Main purpose of groundwater bodies

- to enable accurate **description of status** (quantitative and chemical) and comparison to environmental objectives
- to **implement the measures** necessary for achieving the objectives

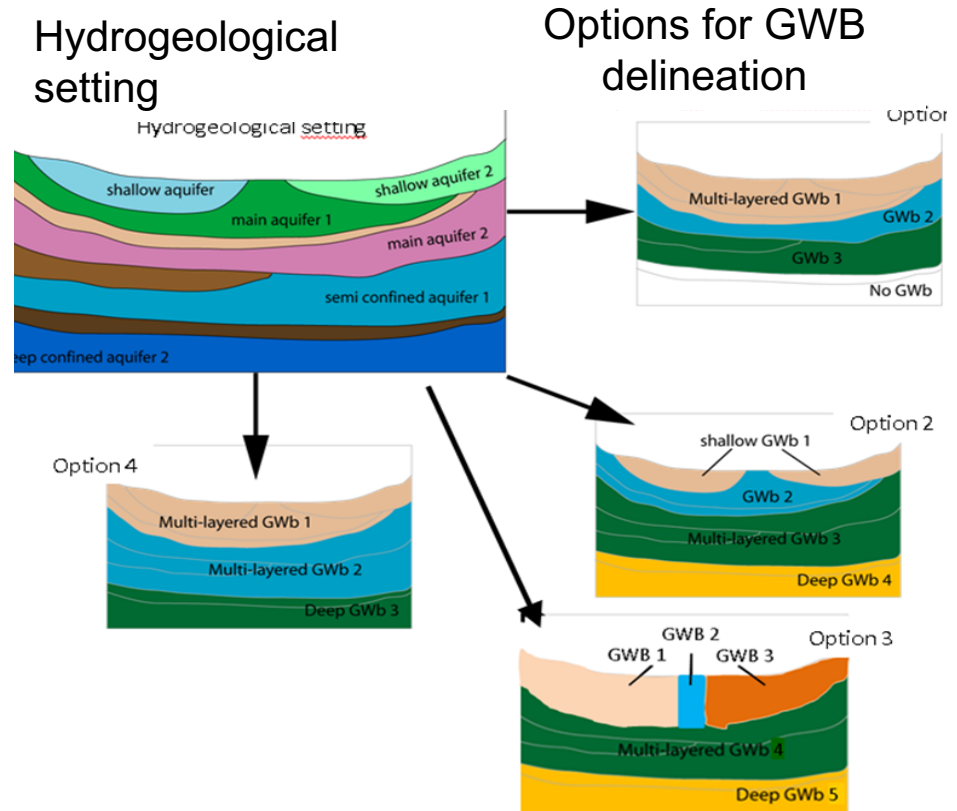


**13,261 GWB in the EU 27, > 80% in the 1<sup>st</sup> horizon**

# GW-BODY DELINEATION

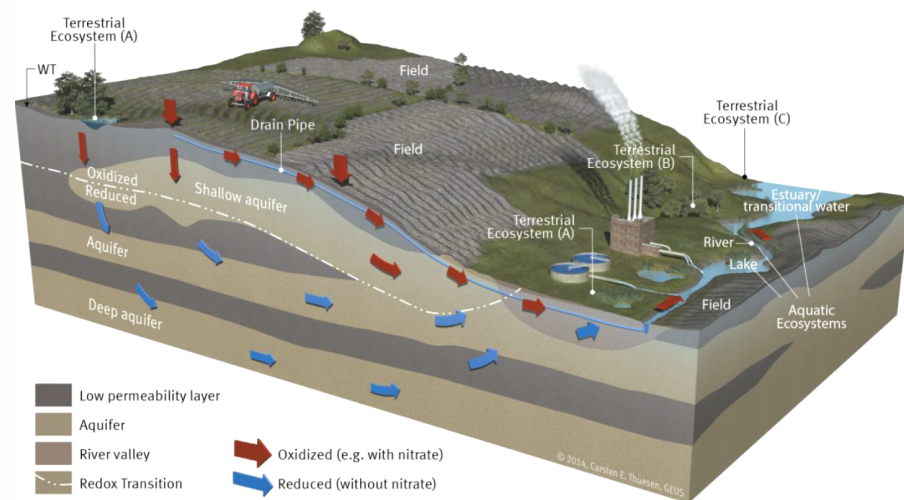
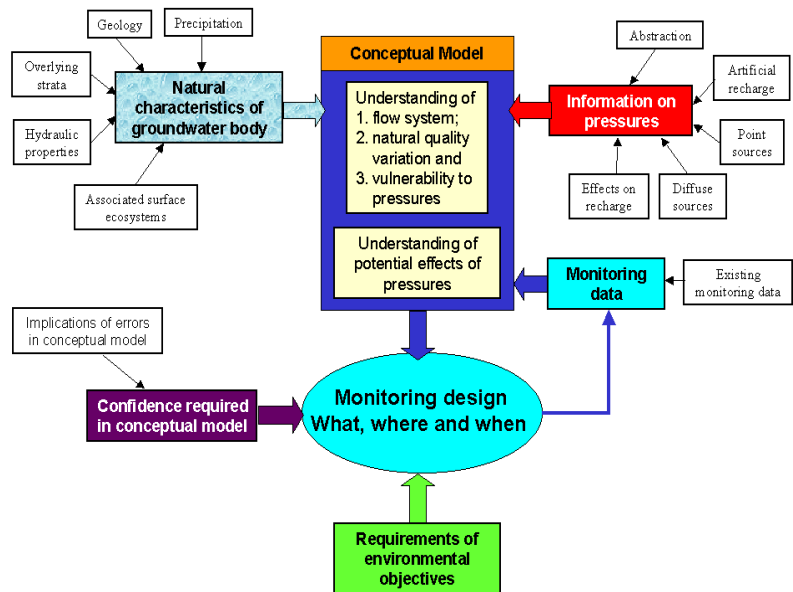
## Challenges for delineation

- GWB is a 3-D body → delineation comprises both, the horizontal and vertical dimension
- Efficient and practical management units
- Variation of characteristics and pressures
- Appropriate administrative burden.
- Grouping of bodies can support efficiency



Source: WFD Reporting Guidance 2016

# CONCEPTUAL MODEL / UNDERSTANDING



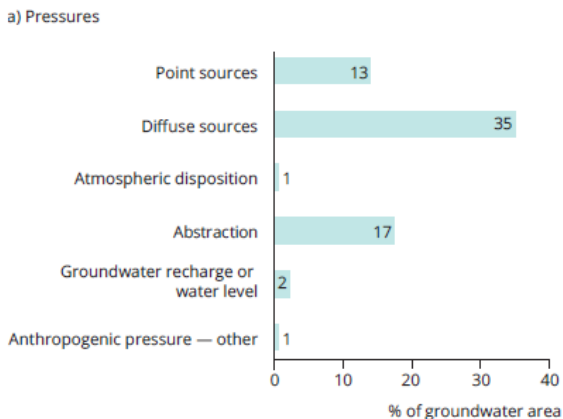
Source: CIS Guidance Document No. 7 on monitoring under the Water Framework Directive

Source: CIS Technical Report No. 9 on groundwater associated aquatic ecosystems, modified Hinsby et al., 2008, 2012

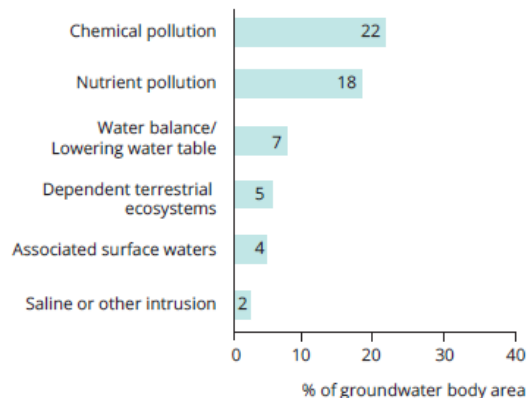
# CHALLENGES IN THE EUROPEAN UNION

- Main pressures and impacts (% of total groundwater area of 4.3 million km<sup>2</sup>)

**Figure 6.4** Overview of the proportion of the area of groundwater bodies in the second RBMPs with a) main significant pressures and b) main significant impacts



b) Impacts



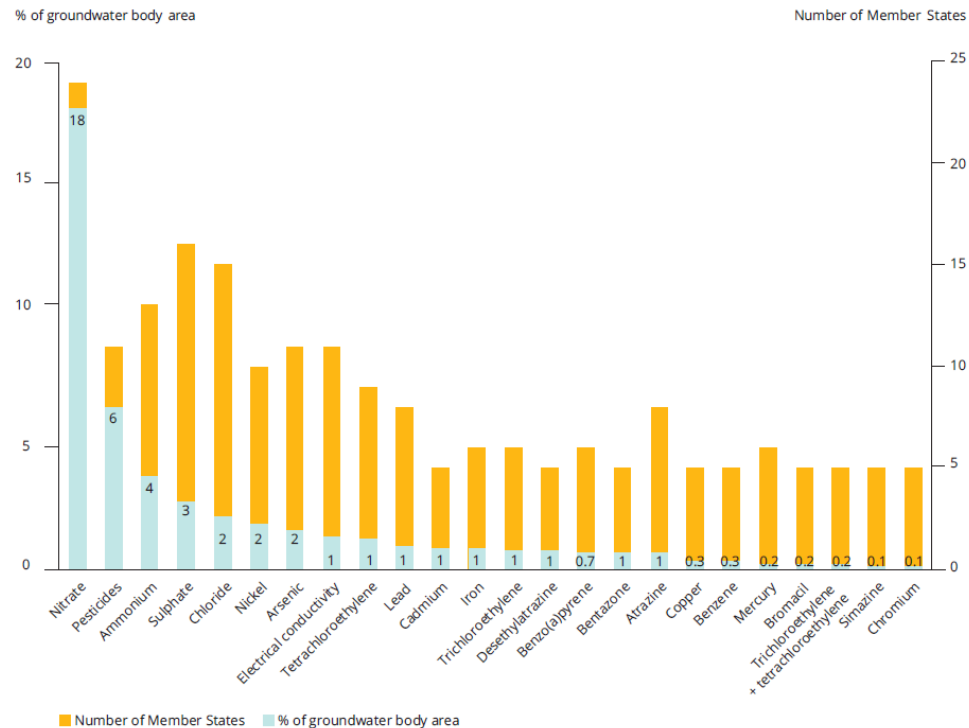
**Notes:** Pressures from diffuse sources do not include atmospheric deposition. The diagrams show the proportion (%) of groundwater body area affected by each main pressure and impact for the second RBMPs (4.2 million km<sup>2</sup>).

**Source:** Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). [Groundwater bodies: Significant pressures](#) and [Groundwater bodies: Significant impacts](#).

Source: European Environment Agency, 2018: *European waters – Assessment of status and pressures 2018*.

# CHALLENGES IN THE EU CHEMISTRY

- A few pollutants cause poor chemical status in many groundwater bodies
- E.g. nitrate, pesticides, ammonium, sulphate



**Notes:** Pollutants causing failure shown by proportion of total groundwater body area. The substances shown have caused failure in groundwater in at least five Member States.

**Source:** Results based on the WISE-SoW database including data from 25 Member States (EU-28 except Greece, Ireland and Lithuania). [Groundwater bodies: Pollutants — overview](#) and [Groundwater bodies: Pollutants](#).

Source: European Environment Agency, 2018: *European waters – Assessment of status and pressures 2018*.



# CHALLENGES IN THE EU CHEMISTRY

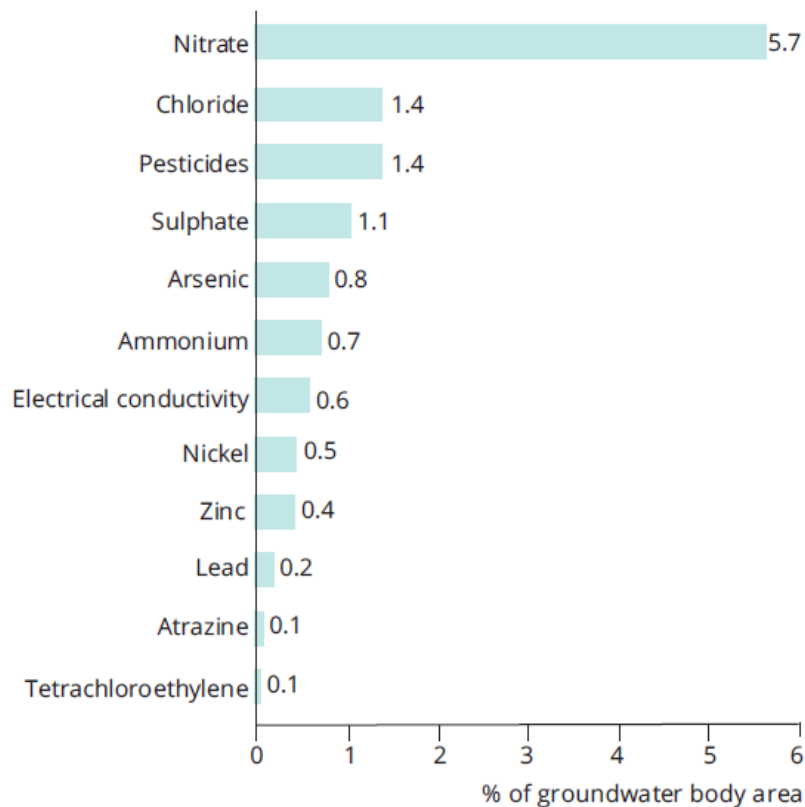
- Upward trends for some pollutants

**Note** Substances shown are causing failure in at least four Member States.

**Source:** Results based on WISE-SoW database including data from 25 Member States (EU28 except Greece, Ireland and Lithuania). [Groundwater bodies: Pollutants — Upward trend](#)

Source: European Environment Agency, 2018: *European waters – Assessment of status and pressures 2018*.

**Figure 4.4** Pollutants with an upward trend by area of groundwater bodies



# POLY INTEGRATION WITH AGRICULTURE: CROSS-COMPLIANCE

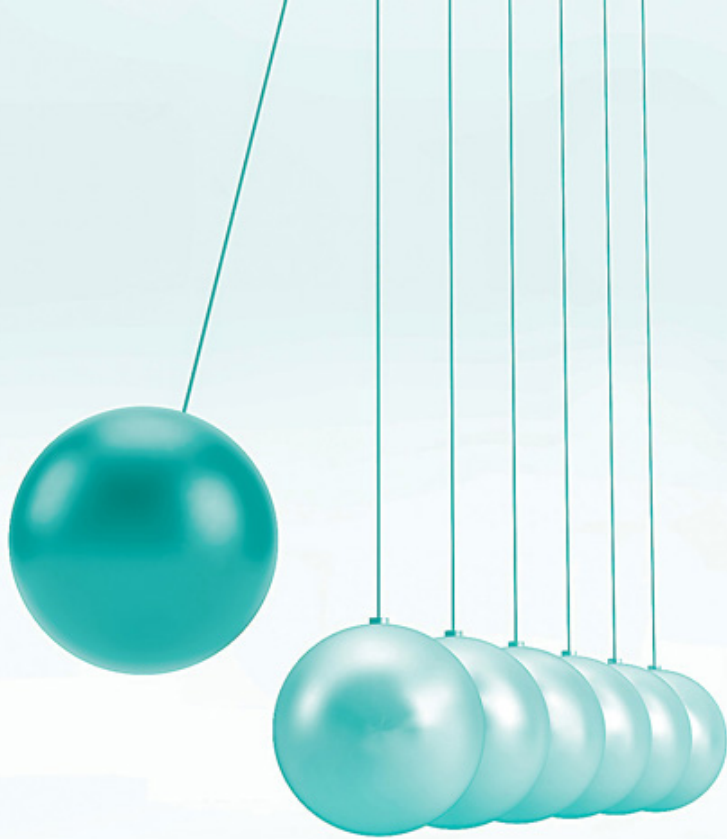
Establishing a link between:

1. The granting of income support (direct payments) and
2. Compliance by beneficiary with specified requirements of public interest

Objectives of Cross-Compliance:

- Improve sustainability of European agriculture and rural areas
- Make the EU Common Agriculture Policy (CAP) compatible with the expectations of modern society and of consumers
- Strengthen the CAP's legitimacy and public acceptance

# GROUNDWATER CHEMICAL MONITORING

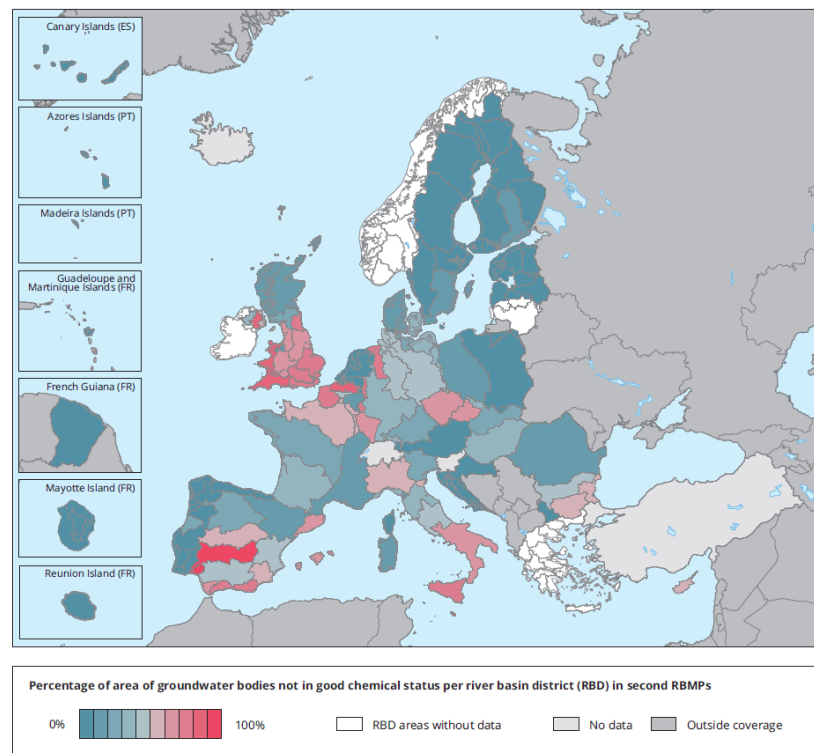


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# CHALLENGES IN THE EU: CHEMISTRY

- Groundwater chemical status
  - Percentage of the area of groundwater bodies not in good chemical status in the second RBMPs

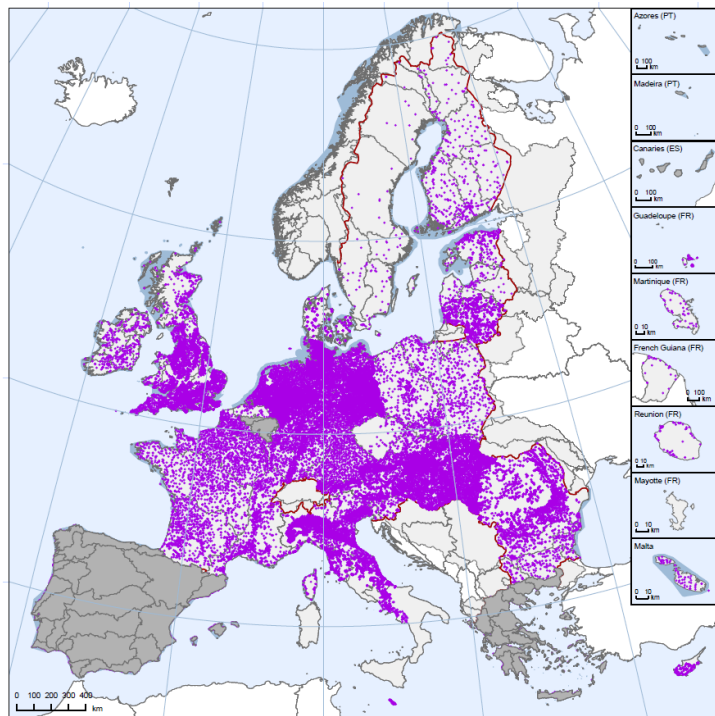
Map 4.1 River basin groundwater chemical status



Source: Results are based on the WISE-SoW database including data from 24 Member States (EU-28 except Greece, Ireland, Lithuania and Slovenia). [Groundwater bodies failing to achieve good status, by RBD.](#)

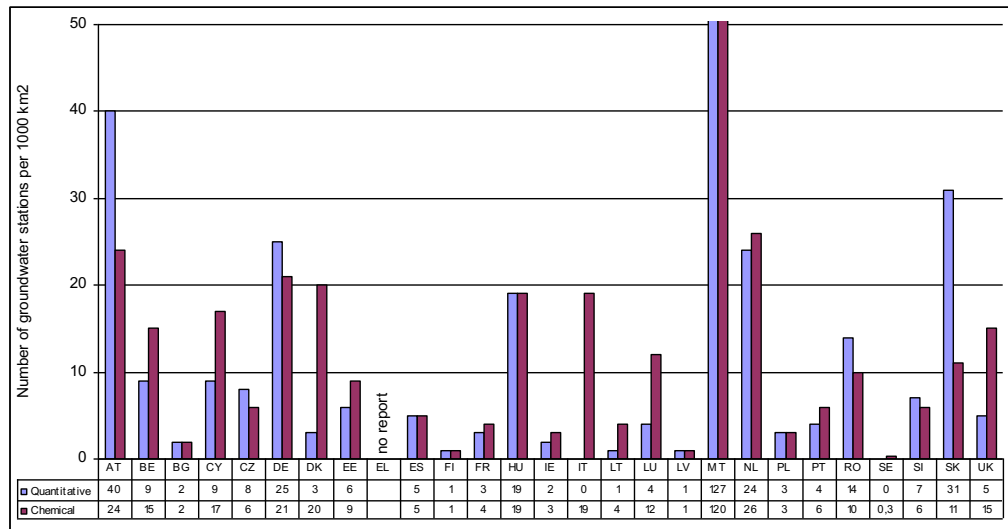
Source: European Environment Agency, 2018: *European waters – Assessment of status and pressures 2018*.

# WFD GROUNDWATER MONITORING



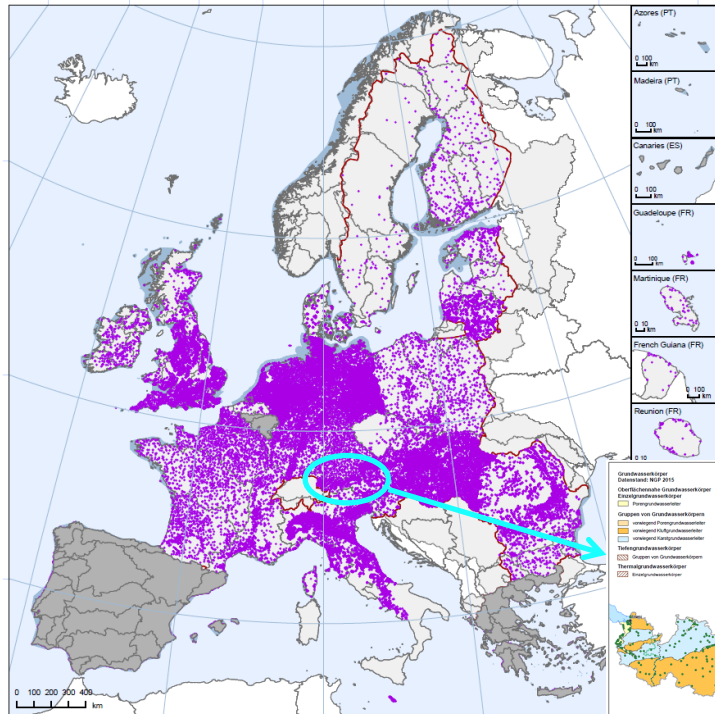
Source: European Commission map of groundwater monitoring stations in River Basin Districts, Version of 29 October 2012

GW monitoring density in Europe – sites per 1000 km<sup>2</sup>



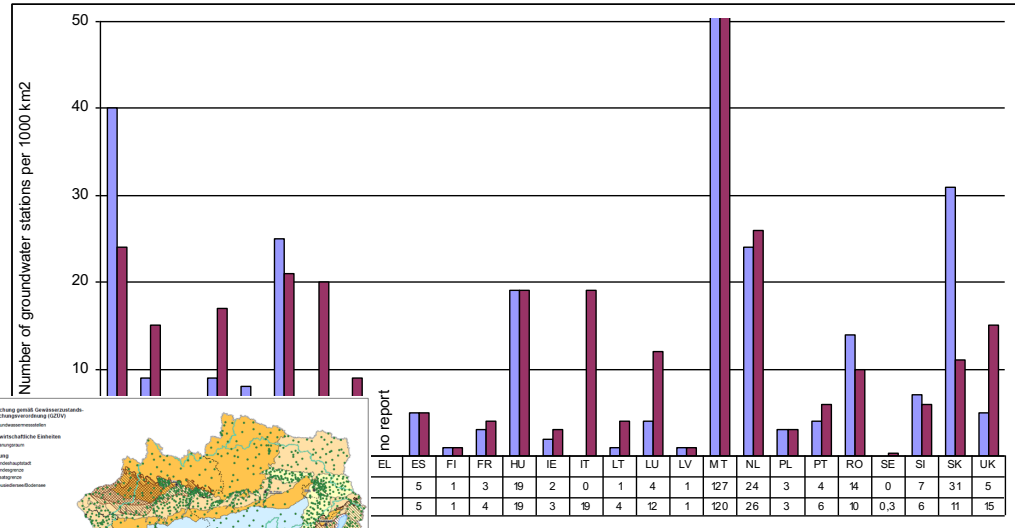
Data source: WISE

# WFD GROUNDWATER MONITORING



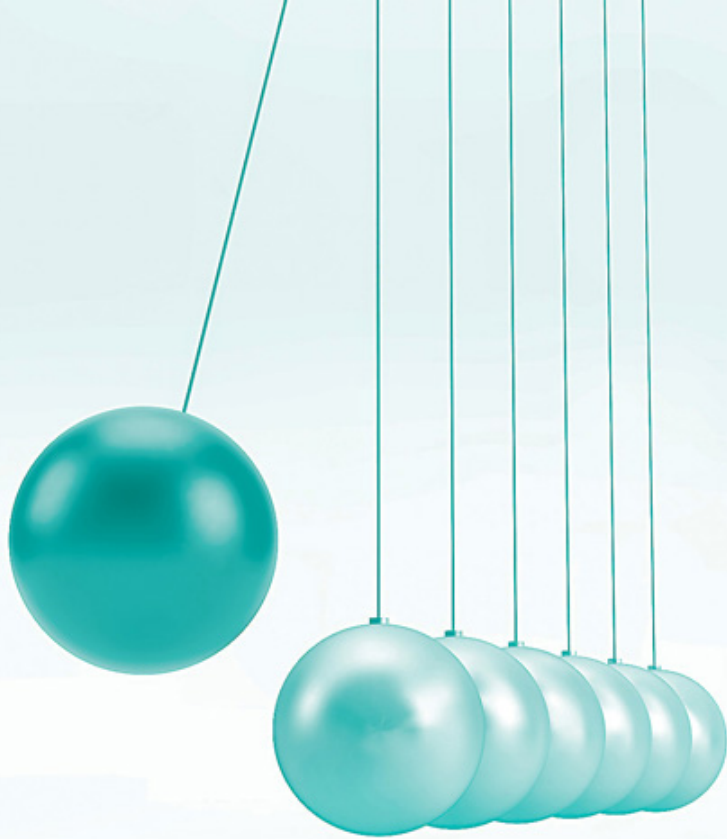
Source: European Commission map of groundwater monitoring station. River Basin Districts, Verison of 29 October 2012

GW monitoring density in Europe – sites per 1000 km<sup>2</sup>



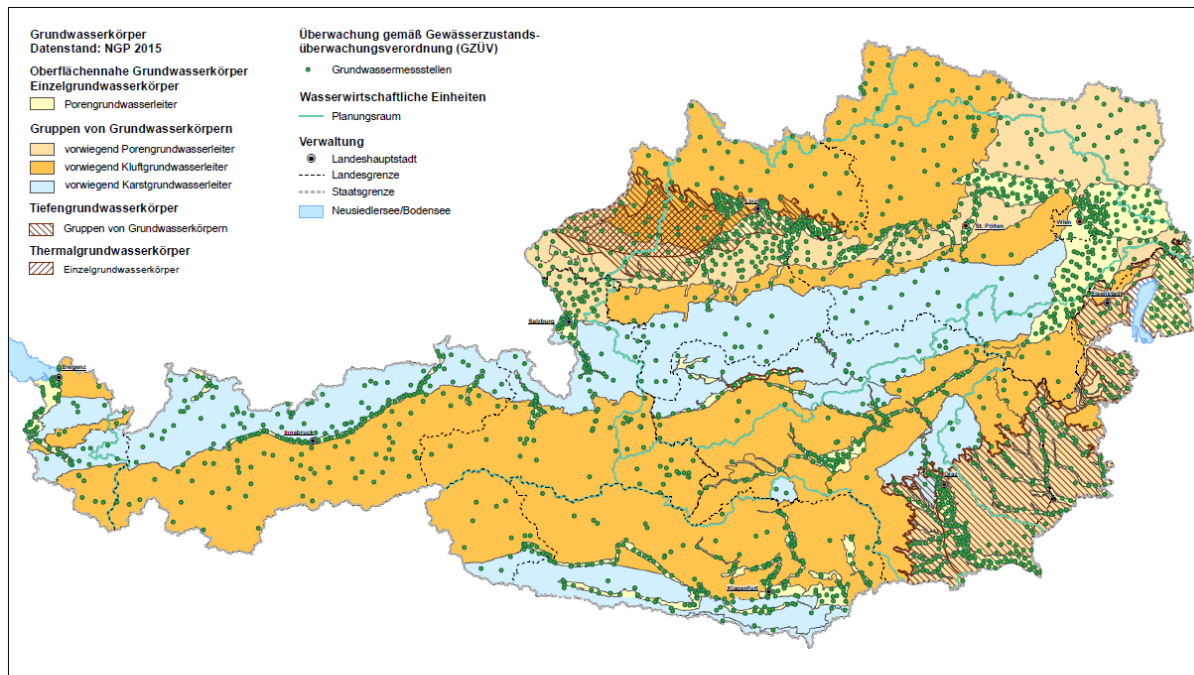
Data source: WISE

# GROUNDWATER MONITORING AND ASSESSMENT IN AUSTRIA



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# GROUNDWATER QUALITY MONITORING NETWORK



Quelle: Gewässerzustandsüberwachungsverordnung (GZUV) BGBl. Nr. 470/2006 i.d.F.  
BMNT, Sektion IV, Abteilung 3 Nationale und internationale Wasserwirtschaft; Ämter der Landesregierungen;  
Auswertung/Graphik: Umweltbundesamt GmbH, 2018

0 20 40 80 km

Bundesministerium  
Nachhaltigkeit und Tourismus  
umweltbundesamt

- **Monitoring:**
  - 138 groundwater bodies
  - ~ 2000 chemical monitoring sites (1 site / 40 km<sup>2</sup>)
- **Monitoring frequency:**
  - 1-4 samples/year
- **Monitoring scope:**
  - 183 chemical parameters
    - 11 field parameters
    - 17 chemical analytical parameters
    - 12 dissolved metals
    - 13 volatile halogenated hydrocarbons
    - 126 pesticides and their metabolites



# AUSTRIA – KEY FIGURES

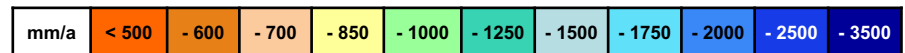
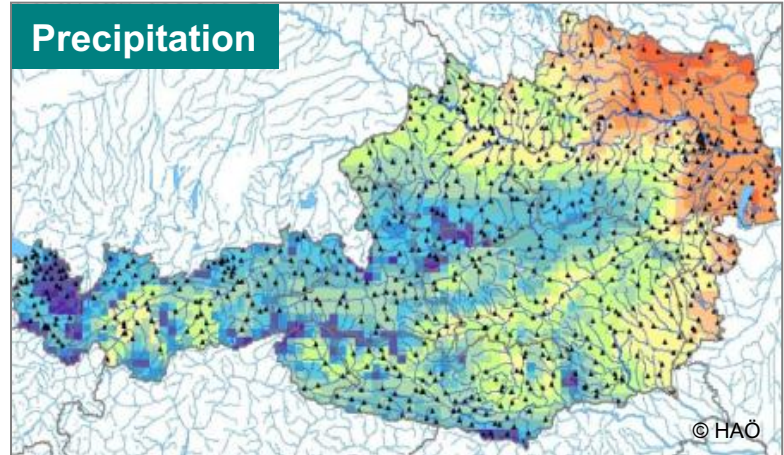
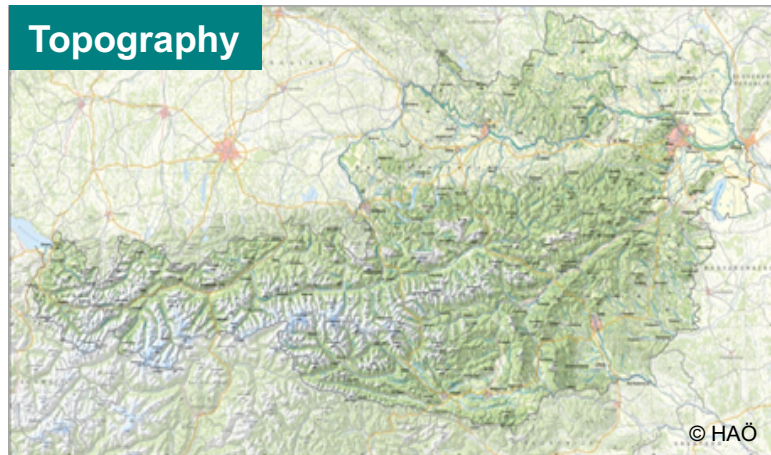
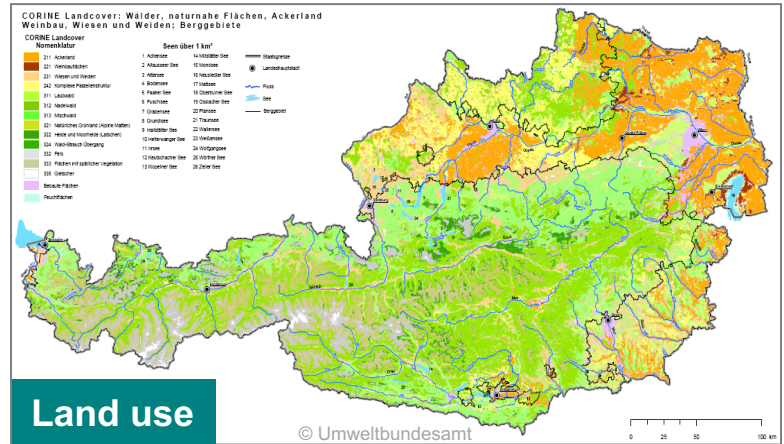
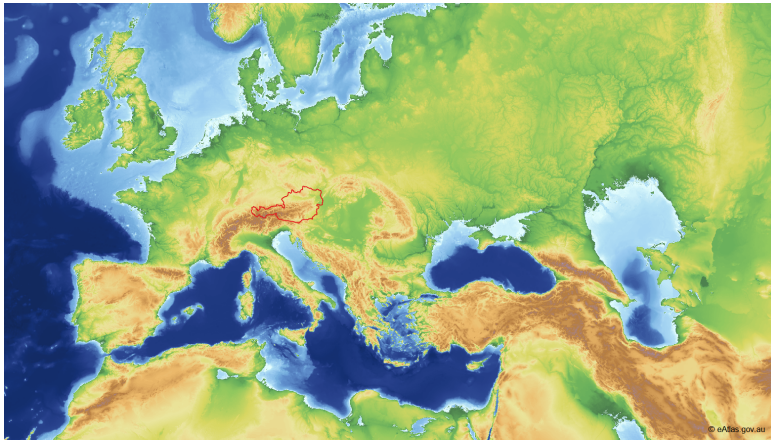
- Federal State with 9 “Bundesländer” (Provinces)
- 8.3 mio. inhabitants on ~84,000 km<sup>2</sup>
- 62 % mountainous terrain
- 46 % forested area
- 96 % of territory in Danube, 3 % in Rhine, 1 % in Elbe Basin
- 1,170 mm precipitation (average annual), 596 mm run-off
- **100 %** drinking water from groundwater, ~ 135 l/person.day
- 95 % linked to waste water treatment plants

# LEGAL PROVISIONS

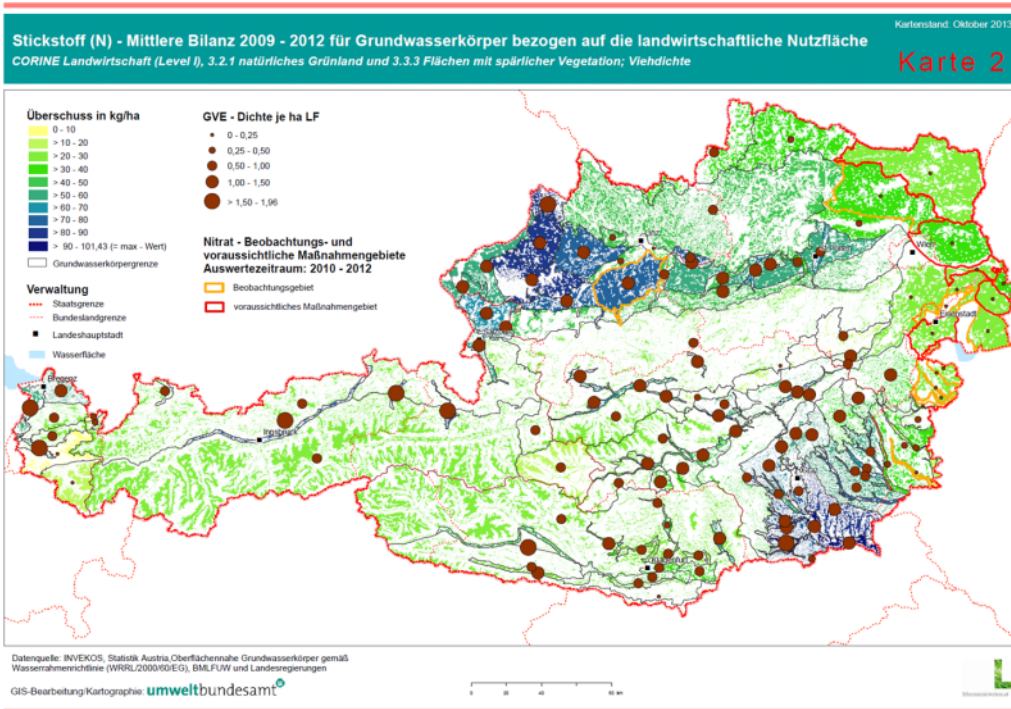
- Austrian Federal Water Act (Wasserrechtsgesetz 1959 – WRG 1959 i.d.g.F)
  - General Provisions concerning monitoring of both groundwater and surface water
  - Provisions concerning financing/covering of costs
- Austrian Ordinance on the Monitoring of the Status of Water Bodies (Gewässerzustandsüberwachungsverordnung – GZÜV)
- Complemented by Ordinances e.g. concerning chemical status assessment for groundwater, .....
- legal implementation of the European Water Framework Directive in the year 2003



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# NITROGEN BALANCE IN AUSTRIA



## Nitrogen balance for groundwater bodies

- High surpluses in some regions with high numbers of cattle
- Surpluses in areas of concern mostly below Austrian average but:
  - High percentages of agricultural area
  - High variability of surpluses in the east due to variability of yields
  - Frequently negative average climatic water balance
  - Low groundwater renewal rate

→ **Low surpluses can lead to high nitrogen concentrations in infiltrating water!**

Report: <https://www.bmnt.gv.at/wasser/wasserqualitaet/grundwasser/Stickstoffbilanzen.html>

# NITRATE IN GROUNDWATER (Austria)

Ausweisung von Beobachtungs- und voraussichtlichen Maßnahmegebieten sowie von gefährdeten Messstellen in oberflächennahen Grundwasserkörpern gemäß Qualitätszielverordnung (QZV) Chemie Grundwasser im Beurteilungszeitraum 1.1.2014 bis 31.12.2016

- Beobachtungsgebiet (B)
- voraussichtliches Maßnahmegebiet (vM)
- Grenze der Grundwasserkörper  
Datenstand: NGP 2015
- 150 Kennziffer Oberflächennahe Grundwasserkörper<sup>1</sup>

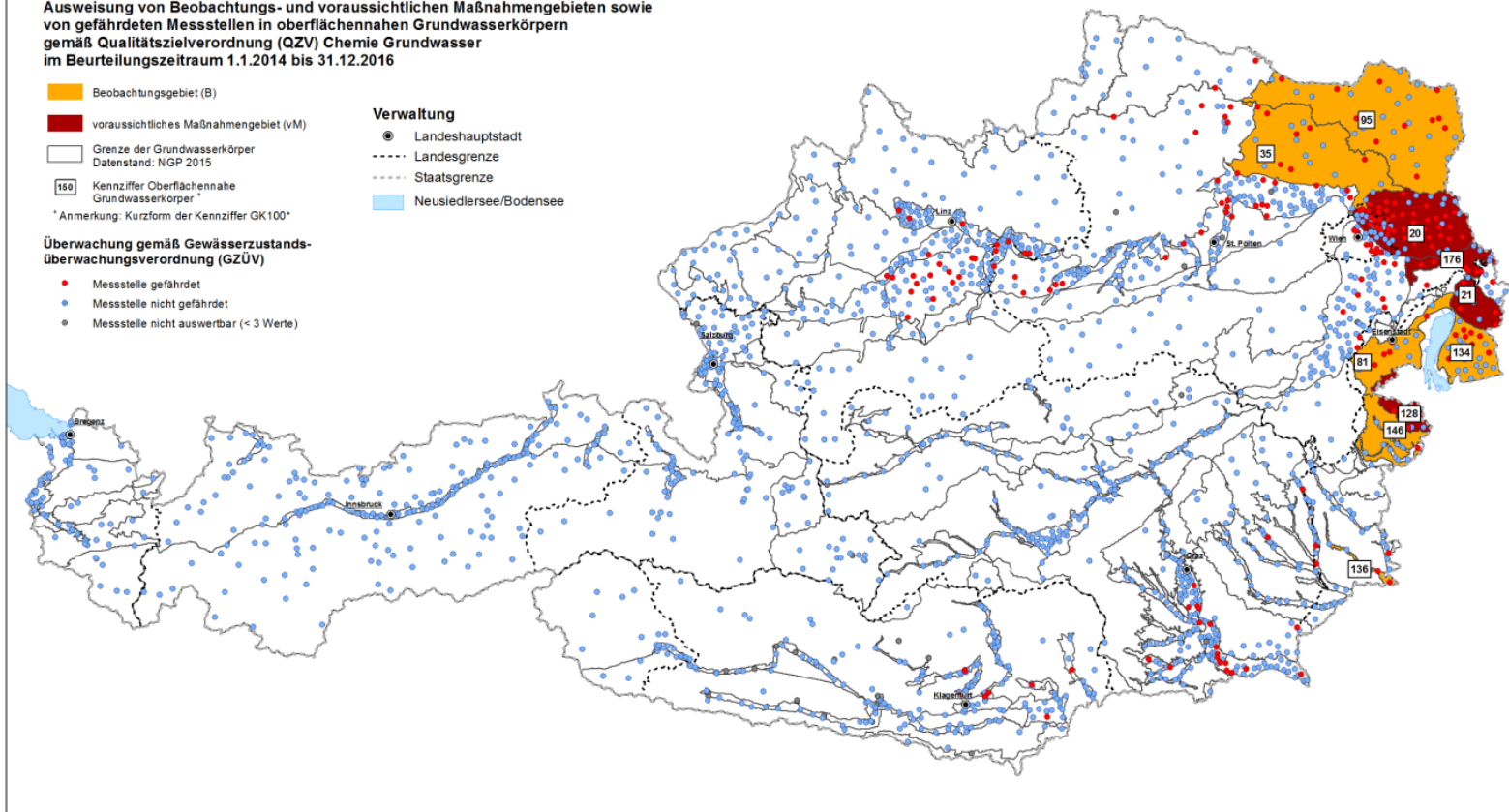
<sup>1</sup> Anmerkung: Kurzform der Kennziffer GK100\*

Überwachung gemäß Gewässerzustandsüberwachungsverordnung (GZÜV)

- Messstelle gefährdet
- Messstelle nicht gefährdet
- Messstelle nicht auswertbar (< 3 Werte)

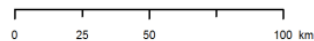
Verwaltung

- Landeshauptstadt
- Landesgrenze
- Staatsgrenze
- Neusiedlersee/Bodensee



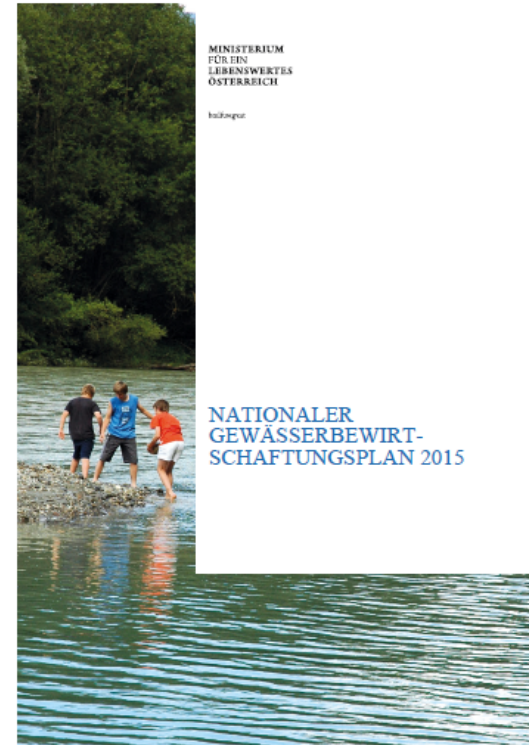
Quelle: Gewässerzustandsüberwachungsverordnung (GZÜV) BGBl. Nr. 479/2006 i.d.F.; BMNT, Sektion I, Abteilung 3 Nationale und internationale Wasserwirtschaft; Ämter der Landesregierungen;

Auswertung/Graphik: Umweltbundesamt GmbH, 2018



# RIVER BASIN MANAGEMENT PLAN (RBMP)

- RBMP is a framework planning and includes:
  - General characterisation of river basin districts and protected areas
  - Significant pressures and anthropogenic impacts on the status of surface water and groundwater
  - Economic analysis
  - Monitoring network
  - Environmental objectives
  - Programme of measures
  - Public participation
  - Competent authorities and contact points for background material and underlying documents
  - Climate Change
- RBMP is based on objectives and underlying principles as laid down in the Federal Water Act



# CONTACT & INFORMATION

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