Groundwater Governance - A Global Framework for Action (2011-2014) is a joint project supported by the Global Environment Facility (GEF) and implemented by the Food and Agriculture Organisation of the United Nations (FAO), jointly with UNESCO's International Hydrological Programme (UNESCO-IHP), the International Association of Hydrologists (IAH) and the World Bank.

The project is designed to raise awareness of the importance of groundwater resources for many regions of the world, and identify and promote best practices in groundwater governance as a way to achieve the sustainable management of groundwater resources.

The first phase of the project consists of a review of the global situation of groundwater governance and aims to develop of a Global Groundwater Diagnostic that integrates regional and country experiences with prospects for the future. This first phase builds on a series of case studies, thematic papers and five regional consultations.

Twelve thematic papers have thus been prepared to synthesize the current knowledge and experience concerning key economic, policy, institutional, environmental and technical aspects of groundwater management, and address emerging issues and innovative approaches. The 12 thematic papers are listed below and are available on the project website along with a Synthesis Report on Groundwater Governance that compiles the results of the case studies and the thematic papers.

The second phase of the project will develop the main project outcome, a Global Framework for Action consisting of a set of policy and institutional guidelines, recommendations and best practices designed to improve groundwater management at country/local level, and groundwater governance at local, national and transboundary levels.

Thematic Papers

No.1 - Trends in groundwater pollution; trends in loss of groundwater quality and related aquifers services
No.2 - Conjunctive use and management of groundwater and surface water
No.3 - Urban-rural tensions; opportunities for co-management
No.4 - Management of recharge / discharge processes and aquifer equilibrium states
No.5 - Groundwater policy and governance
No.6 - Legal framework for sustainable groundwater governance
No.7 - Trends in local groundwater management institutions / user partnerships
No.8 - Social adoption of groundwater pumping technology and the development of groundwater cultures: governance at the point of abstraction
No.9 - Macro-economic trends that influence demand for groundwater and related aquifer services
No.10 - Governance of the subsurface and groundwater frontier
No.11 - Political economy of groundwater governance
No.12 - Groundwater and climate change adaptation

www.groundwatergovernance.org
GLOBAL ENVIRONMENTAL FACILITY PROJECT
Groundwater Governance:
A Global Framework for Country Action

UNECE REGION
REGIONAL CONSULTATION
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DIAGNOSTIC REPORT UNECE REGION - DRAFT

November 2013

John Chilton and Ebel Smidt

REGIONAL DIAGNOSTIC REPORT – UNECE REGION
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1. Background

“Groundwater Governance: A Global Framework for Action” is a Global Environment Facility (GEF) project being undertaken from 2011 to 2014 by international partners FAO, UNESCO, IAH and the World Bank, in co-operation with relevant regional and national organizations. The project focuses on addressing concerns over the depletion and degradation of groundwater resources and the main objective is to raise awareness of the importance of sound management of groundwater resources and to accelerate the adoption of improved groundwater resource governance and promote best practices in groundwater governance.

The project is being carried out in phases. The first phase reviewed the global situation of groundwater governance through a series of case studies, thematic papers and a synthesis report. The second phase built on this through five regional consultations and the final phase will see the production of a Global Groundwater Diagnostic drawn from these regional and country experiences. The final phase will also produce a Vision for Groundwater Governance and a Global Framework for Action which will consist of a set of policy and institutional guidelines, recommendations and best practices designed to improve governance at local, national and international levels. Outputs related to these phases of work can be found on the project website1.

The five regional consultations were:

- Latin America and the Caribbean, 18-20 April 2012 Montevideo, Uruguay
- Sub-Saharan Africa, 29-31 May 2012 Nairobi, Kenya
- Arab states, 8-10 October 2012 Amman, Jordan
- Asia and Pacific Region, 3-5 December 2012 Shijiazhuang, China

The specific objectives of the regional consultations were to:

- seek first-hand knowledge about the main features of groundwater resources, governance and management in the region;
- discuss the different issues that arise from the specific characteristics, challenges and priorities of the region, based on case studies presented by national experts;
- build partnerships between agencies, stakeholders, decision-makers and specialists.

The Fifth Regional Consultation covered the UNECE member states and includes Europe, Canada and the USA, Israel, Turkey and the countries of Central Asia. It was organized by UNESCO-IHP in cooperation with UNECE and with the support of the International Groundwater Resources Assessment Centre (IGRAC) and held at The Hague Institute for Global Justice. Altogether, 114 participants attended the meeting or part of it: 42 from The Netherlands, 47 from other European countries, 17 from North America and 8 from other countries, including the eastern Mediterranean and Central Asia.

This report broadly follows the outline provided. Contributions to the regional consultation in the form of presentations, workshop interventions and reports and responses to the questionnaires have been attributed in the text and boxes. Published material used in the report is referenced in the conventional manner and some additional on-line sources are indicated as footnotes. Overall, more emphasis has been given to the material and views from the consultation itself, as the questionnaire responses have been well analysed by the general rapporteur Jac van der Gun (2013). His report also covers the private sector round table session in some detail and these discussions are briefly drawn on here to illustrate specific points.

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1 See www.groundwatergovernance.org.

2. Current Status of Groundwater Governance in the Region

2.1. Regional drivers from an overall groundwater perspective

The UNECE region is huge (Figure 1), covering a great range of physical, economic and social settings. Physically, it includes some of the major national and international river basins of the world, many of which (such as the Rhine, Danube, Don and Mississippi,) are highly developed and densely populated.

![Figure 1. Areas covered by the regional consultations](http://www.groundwatergovernance.org)

The range of climatic conditions within Europe, broadly from the generally colder and wetter north and west to the warmer and drier south and east means that surface and groundwater resources have varying importance across the region and even within countries. Moreover, in such a vast region, every major geological type is represented and provides important and extensive aquifers, many of which have been drawn on for domestic and agricultural use for centuries and more recently for industry. These include such globally important groundwater resources as the Ogalla of the High Plains and the Californian Central Valley sediments in the USA, the Dinaric Karst of the Balkan region and thick sequences of alluvial sediments in the larger river basins, including those mentioned above. Although not on the same geographic scale, more localized but vitally important groundwater resources occur in, for example, the volcanics of the Spanish islands, the Chalk of the United Kingdom and the Paris Basin and the large numbers of small glacial sand and gravel aquifers of the Scandinavian Shield. This range of type and scale of climatic and hydrogeological settings inevitably has governance and management implications, some of which came out in the presentations.

The UNECE region is also politically, socially and economically diverse. Political and economic settings range from the long established and ‘mature’ democracies of western and northern Europe and North America to the new nations of eastern Europe, the Balkan Region and The Caucasus and Central Asia experiencing social and economic transition. With some exceptions, overall national water supply and sanitation service levels are high and the social and economic drivers for increased agricultural, industrial and urban groundwater use were at their strongest several decades ago or even earlier, at least in the north and west of the UNECE region. These drivers are not currently putting water resources under the same development pressures as in the other regions. Indeed, in the east of the UNECE region, the profound political and economic changes after 1989 resulted in sharp declines in water usage which are only now beginning to rise again (UNECE, 2011). Nevertheless, populations and associated water requirements continue to increase, and countries in the region have often struggled to balance greater awareness of the need to protect groundwater
resources from depletion and quality deterioration with the need to respond to and meet growing water demand.

Whilst the heaviest groundwater abstraction for agricultural irrigation is in the warmer and drier parts of the UNECE region, groundwater has long been important for domestic water supply more broadly throughout the region. This is illustrated by Figure 2, which shows the proportion of groundwater in drinking water supply in Europe, based on information from EUREAU and from the Synthesis report on the quality of drinking water in EU Member States in the period 2005–2007, with some additional information from national presentations at the Fifth Regional Consultation.

![Figure 2. Groundwater dependence in drinking water supply in Europe (modified from EC, 2012a)](image)

This perhaps surprising and somewhat ‘hidden’ reliance on groundwater even in some of the countries in Figure 2 with abundant surface water resources is a tribute to groundwater’s intrinsic advantages as a source of supply. These include its availability close to where it is required, relatively modest cost of development which can be undertaken progressively to meet demand, generally excellent natural quality so that it is suitable for potable supply without treatment, and protective cover provided by the soil and unsaturated zone. Large numbers of people are, therefore, dependent on groundwater drawn from all of the major aquifer types mentioned above. When this dependence is fully appreciated it translates into an important regional driver for good governance of groundwater. Quoting directly from the discussions in Working Group 3 - “even the northern European countries cannot afford to be relaxed about groundwater availability” – they need to protect their valuable groundwater resources from pollution.

A further distinguishing feature more prevalent in this region than others is the widespread and serious groundwater quality impairment from the legacy of industrial pollution caused in the main by poor practices in the storage, use and disposal of chemicals, and the equally lengthy historical legacy of pollution from mining activities. In many such instances, the polluter no longer exists or does not have the technical capacity or financial resources to deal with pollution by persistent and toxic chemicals originating decades ago but still present in the aquifer. Within the last thirty years, realization of the extent and seriousness of this pollution and the high cost and great technical
difficulty of remediation of groundwater and restoration of aquifers affected by industrial and mining pollution has been an important driver for improved governance in both Europe and North America.

Two other hydrogeological characteristics of this region are worthy of note. Firstly, while not completely absent, the exploitation of non-renewable groundwater resources is less important than some of the other regions. On the other hand, use of the subsurface resources of aquifers and other geological formations for purposes other than water supply (van der Gun et al, 2012) is already quite widely seen and is becoming more important in the region. The legacy of deep mining has been mentioned above, but shallow extraction of sand and gravel for building materials can have major environmental impacts. Existing governance provisions in the form of land use planning, public consultation and obligations for restoration are not always adequate. Direct use of shallow aquifers for heating and cooling was mentioned in the presentation from The Netherlands and is becoming widely developed elsewhere in the region. Deeper geothermal energy development, including the need for transboundary management of such resources was featured in the presentation from Hungary. While other functions and activities such as storage of radio-active waste, hydraulic fracturing to enhance the recovery of shale gas and carbon capture and storage are normally targeted much deeper in the subsurface, nevertheless their impacts can be felt in overlying aquifers. All of these activities are going on and likely to grow in importance in the UNECE Region.

Partly as a result of the features outlined above, regional drivers are by no means all translated into negative pressures on groundwater quantity and quality. The long-established, multi-party democracies with electoral processes embracing varying forms of proportional voting facilitate the representation of smaller political parties. Thus, Green Party politicians have become prominent first in parliament and then in government in some countries, and even more widely at local government and municipal levels. This has obliged established political parties to become more environmentally sensitive in their own policies and commitments. Higher standards of living, increased leisure time and the desire for outdoor activities have contributed to greater public environmental awareness and strengthened NGOs working in nature and conservation.

2.2. Regional perceptions of and drivers for groundwater governance

Perceptions of groundwater governance vary considerably across the region. This is partly because the presentations and the questionnaire responses to the more open questions reflect not only differences between countries but perhaps even more the differences in perspectives of individual respondents and the institutions they represent. Notions of ‘governance’ and ‘management’ of water resources are clearly intertwined in the region, to the extent that many of the national presentations in The Hague (and at the other regional consultations) actually focused as much on management of groundwater as on governance. A useful, but not region-specific, distinction between governance and management made by Bob Varady in the first plenary session has been adapted in Box 1.

Box 1. Governance or management?

- **Groundwater governance** is the often complex framework that establishes who formulates policies and strategies and is responsible for their execution and how different stakeholders interact. This framework determines the management of groundwater resources and the use of aquifers;

- **Groundwater policies** are the decisions made by stakeholders regarding what to do in the context of the governance framework. These usually define why activities are needed and when they should be undertaken or completed;

- **Groundwater management** is what these stakeholders do within the governance framework; activities related to the development and protection of groundwater to achieve the policies which have been established. The hydrogeological conditions and distribution of human activities will determine where these management activities are required.

*Modified from Varady presentation, 2013*
Historically, governance of groundwater in some countries of the UNECE Region goes back centuries to the water boards of The Netherlands (Ebel Smidt), the Baillages of the twelfth century in France (Didier Pennequin) and the eighth century Water Court of Valencia in Spain (Emilio Custodio). While these have stood the test of time, they were essentially local and probably narrowly focused on protecting the rights of important water users.

Nowadays, perceptions of groundwater governance in the region are intimately bound up with the more recent concept of integrated water management (IWRM). Thus, if IWRM is adopted as a desirable goal, what different governance is needed in terms of new legal instruments, institutional arrangements and financial provisions to help this happen? Certainly, river basin oriented IWRM is likely to need at the very least some degree of regulatory re-configuration towards basin-defined institutions, as has been seen in many EU Member States in response to the WFD. This is probably reinforced by a general feeling that sustainable groundwater abstraction and sound management and protection practices need suitable enabling governance frameworks. As an example, some of the groundwater policy and management aspirations set out in the UK presentation;

- taking a risk based approach;
- applying the precautionary principle when uncertainty is high;
- adopting the ‘polluter pays’ response wherever possible, and
- improving consultation and stakeholder participation;

have governance implications.

It may also be that the emergence of perceptions of groundwater governance reflects growing awareness that water management is part of the wider societal processes bound up in the energy-food-water nexus. Water governance and management cannot be separated from the political and socio-economic processes within that nexus; for example, it must be fully integrated with land management and urban planning. This was the clear message from the presentation by Stephen Foster. The emergence of groundwater governance can therefore also be regarded as a response to increased awareness in the water community of the importance of political and economic drivers.

In addition to the adoption of IWRM, other drivers for increased focus on groundwater governance that appeared in the presentations can probably be summarized as:

- pressures resulting from the integration of local into regional economies and regional economies into global economies;
- greater awareness of the importance of understanding stakeholder processes and social interactions;
- the increased use of aquifers other than for water supply, as mentioned above;
- growing awareness that population increase, economic development and climate change together put increasing stress on water systems and specifically on the buffering capacities of groundwater storage in aquifers;
- following from this, groundwater is still often missing in water governance as it is inadequately appreciated, poorly understood and incompletely assessed. However, awareness is growing amongst water professionals that this knowledge gap needs bridging.

Within the region, some differences in perception of and drivers for governance were apparent. As already mentioned, the WFD plays a dominant role in groundwater governance for the EU Member States. In Eastern Europe and Central Asia, priorities are different and governance is more directed towards improving technical infrastructure in water supply and wastewater collection and treatment. In addition, in this part of the UNECE region the changing political setting and the emergence of new countries increases the focus on transboundary waters. In contrast, the perception of governance in North America generally envisages a continuing strong reliance on market forces backed up by ‘light
touch’ regulation, although it is also true that a ‘market forces’ approach results in much greater use of the courts and litigation in North American than in Europe.

A very different and not strictly regional perspective on governance was given by David Zetland of Wageningen University. He listed several causes of governance failure related specifically to groundwater (Box 2) and suggested how each of these might be tackled by improved governance.

<table>
<thead>
<tr>
<th>Box 2. Causes of failure of governance of groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theft</strong></td>
</tr>
<tr>
<td><strong>Myopia</strong></td>
</tr>
<tr>
<td><strong>Subsidies</strong></td>
</tr>
<tr>
<td><strong>Rescue</strong></td>
</tr>
</tbody>
</table>

Institutions with formal rules and informal norms will not emerge if these ‘cheaper’ (politically as well as financially) and easier approaches are adopted. Local institutions can manage groundwater on a sustainable basis, but national authorities need to improve governance by establishing property and water rights to prevent theft, reducing myopia by encouraging sustainable investments and food markets favourable to poorer communities, phasing out subsidies and setting environmental flows so that surface water rescues are no longer possible.

*Zetland presentation (2013)*

### 2.3 Legal Frameworks and Institutional Settings

The variation within the UNECE region in legal frameworks and institutional settings for governance of groundwater and management of groundwater resources is, as would be expected, rather large. This range reflects current and historical political ideologies, economic frameworks and cultural settings, and came out strongly in some of the presentations. At one end of the spectrum, private ownership and development of resources, including groundwater, is protected and encouraged and the state has a minimal role in regulating processes between stakeholders (US and Canada). At the other end, groundwater is considered a common pool resource, mainly controlled and managed by public authorities, eg Israel and Turkey (see Box 4) and the countries of Central Asia, (Table 1). In the case of Turkey, recent changes to bring groundwater protection legislation closer to that of the EU will see broader stakeholder involvement. In some countries, the situation is more complex; in Spain the Water Act of 1866 put groundwater into the public domain, but was too advanced for its time and groundwater was returned to the private ownership by the 1879 Water Act, where it stayed for more than 100 years until the Water Act of 1985 (see Box 8).

The beneficial consequences of being somewhere between these two extremes are best reflected in the development over the past thirty years of environmental legislation by the European Union. From a groundwater quality management standpoint, this probably dates back to the original Groundwater Directive (1980), the Nitrates Directive (1991) and Drinking Water Directive (1998). The establishment of legally binding groundwater quality standards and introduction of measures to prevent or limit inputs of pollutants into groundwater dates from the original Groundwater Directive. However, from the broader governance perspective of this discussion it is the Water Framework Directive (WFD) which has been the real ‘game-changer’. It is no exaggeration to state that, since its adoption in 2000, the sound, basin-oriented technical basis and practical provisions and obligations
and clear implementation timetable of the WFD have completely dominated water management within the European Union.

However, while most of the national presentations from EU Member States confirmed the present dominance of the WFD in governing and managing groundwater, it would be wrong to think there was nothing of note before that. Particular mention of existing national legislation in the presentations from the Czech Republic and the United Kingdom related to authorising and controlling abstraction and establishing groundwater protection and from France on the well established structure of basin agencies and institutions demonstrate this. What was new, as Hana Prchalova from the Czech Republic explained, was the definition of new groundwater management units (bodies), much more systematic data collection and inventory of pressures, public participation and the clear link between status, trends and measures (see Box 5).

Even in the favourable situation created by EU environmental legislation, European policy and legislation does not always move consistently in the same direction. For many years the overall objectives of the EU Common Agricultural Policy (CAP) in encouraging and financially supporting intensive farming have been at odds with the EU’s environmental policy objectives. More recently the Renewable Energy Directive encourages the cultivation of biofuel crops, with possible negative impacts on both groundwater resources by decreasing recharge and groundwater quality from the increased use of agrochemicals.

The presentations from the US and Canada illustrate a contrasting governance situation in which legislation enacted at federal and at state or provincial level may not always be coordinated, and indeed may sometimes work against each other. A recent survey of governance and management experience at State level in the US was presented by Sharon Megdal. As highlighted by Gabriel Eckstein (Box 3), much of the emphasis of environmental legislation in the US over the last thirty years has been on addressing the legacy of industrial pollution mentioned in section 2.1. However, unrealistic goals and attempts to restore contaminated aquifers to pristine conditions resulted in extreme costs ($5 billion was mentioned in the presentation of Daniel Ronen) with limited beneficial impact at some sites. This was followed (he felt) by an over-reaction and the promotion of natural attenuation to resolve contamination, which could be interpreted as “do nothing”. Even if this is not entirely fair, the time frames for effective natural attenuation are long in relation to the objectives of the legislation and some processes of natural attenuation can result in more hazardous decay products and different environmental risks from volatile substances.

**Box 3. US federal legislation targets water quality**

Noting the great diversity of geology and climate in the US, where 90% of freshwater is groundwater and 46% of drinking water comes from groundwater, Gabriel Eckstein explained that there is no single federal law governing groundwater resources. Groundwater quality is a federal issue and quantity is a state issue. Thus the federal government regulates drinking water quality through the Safe Drinking Water Act and the quality of discharges through the Clean Water Act. Existing pollution is targeted by the Resource Conservation Recovery Act (RCRA), the Toxic Substance Control Act (TSCA) and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) which imposes strict liability for the cleanup of hazardous sites.

Partly in recognition that “the polluter pays” principle cannot be easily imposed on individual polluters with limited resources and technical capacity, or who are no longer in business, a substantial federal budget known as the “Superfund” was established by taxes on the chemical and petroleum industries. The fund was also built up by cost recovery from legal actions against those responsible for the pollution where these were possible. Superfund Trust funds were exhausted ten years ago and funding now depends on annual federal budgeting. Under CERCLA, a national priority list and hazard ranking of sites in terms of the pollutant source, pathway receptor conceptual model was established. Measures should be taken to return groundwater to its original beneficial use “within a reasonable time frame taking account of site characteristics”. Where this was not possible, the pollution should be contained by engineered barriers or pumping and treatment, backed up by suitable monitoring programmes.

*Eckstein presentation, 2013*
While the sums of money involved mean that a “Superfund” approach is not likely to be easily adopted in other regions, some of the results derived from the boom in US and Canadian research into groundwater quality and contaminant behaviour stimulated by the Superfund certainly do have broader usefulness. This applies in particular to the investigation tools, modelling approaches, sampling protocols and monitoring techniques derived from studies at some of the Superfund sites.

Canada is also a huge country with great variations in geology and climate and very uneven population distribution. Legislation is also is characterized by a high degree of diversity (presentation by Alfonso Rivera). Water is primarily regulated at provincial level but there is inter-jurisdictional fragmentation between federal and provincial governments. Horizontally, there is fragmentation across the provinces and territories and both cross- and inter-departmentally within provincial and territorial governments. The consequent tensions were illustrated for the Alberta tar sands, for which federal responsibility is primarily directed towards economic development whereas provincial responsibility is dominantly related to environmental protection.

Where national and local political systems have undergone the dramatic recent changes characterising Eastern Europe and Central Asia, legislation and institutions often still largely reflect a dominant and inflexible public sector whose ability to respond to rapid changes is greatly constrained by lack of technical capacity and financial resources. The legal setting for the Central Asian countries was well illustrated in the presentation of Akmal Karimov (Table 1).

Table 1. Water legislation in Central Asia (presentation by Akmal Karimov, 2013)

<table>
<thead>
<tr>
<th>Ownership</th>
<th>Kazakhstan</th>
<th>Kyrgyzstan</th>
<th>Tajikistan</th>
<th>Turkmenistan</th>
<th>Uzbekistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basis of water administration</td>
<td>Basin/territorial</td>
<td>Basin</td>
<td>Basin/territorial</td>
<td>Territorial (basin)</td>
<td>Basin/territorial</td>
</tr>
<tr>
<td>Water use based on</td>
<td>Permits</td>
<td>Rights/Permits</td>
<td>Permits</td>
<td>Permits</td>
<td>Permits</td>
</tr>
<tr>
<td>Permission for water use issued by</td>
<td>State Committee of Geology and Mineral Resources</td>
<td>State hydrogeology body</td>
<td>Nature Protection Committee</td>
<td>Local authorities</td>
<td>Nature Protection Committee</td>
</tr>
<tr>
<td>Duration</td>
<td>Permanent/ temporary</td>
<td>Temporary</td>
<td>Permanent/ temporary</td>
<td>Permanent/ temporary</td>
<td>Permanent/ temporary</td>
</tr>
<tr>
<td>short term (yrs)</td>
<td>3</td>
<td>15</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>long term (yrs)</td>
<td>25</td>
<td>50</td>
<td>25</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Payment for water use</td>
<td>Payment for services-full cost, subsidized water saving</td>
<td>Payment for services</td>
<td>Payment for use of water and services</td>
<td>Payment for water use</td>
<td>State taxes, payment for water services by WUAs</td>
</tr>
<tr>
<td>Use of groundwater of drinking quality for other uses</td>
<td>Not allowed, except some cases</td>
<td>-</td>
<td>Prohibited except some cases</td>
<td>Not allowed, except some cases</td>
<td>May not be used, except some cases</td>
</tr>
<tr>
<td>Transboundary Waters</td>
<td>Recognised</td>
<td>Not recognised</td>
<td>Not recognised</td>
<td>Recognised</td>
<td>Recognised</td>
</tr>
<tr>
<td>Convention on transboundary watercourses signed?</td>
<td>Yes (January 1996 )</td>
<td>No</td>
<td>No</td>
<td>Yes, in process, not yet declared officially</td>
<td>Yes (September 2007 )</td>
</tr>
</tbody>
</table>

In summary, the legal and institutional situation in the UNECE Region illustrates the generic challenges at the domestic level identified in Thematic Paper 6 (Mechlem, 2012):

- status of groundwater, whether a public or private resource;
• coherence of the legal framework for groundwater; (3)
• dealing with small scale or de minimis uses;
• reconciling formal legislation with customary law, avoiding disenfranchisement of customary right holders;
• managing the land-water management interface, which is often neglected;
• strengthening stakeholder participation in groundwater user groups and in formulating legislation;
• improving implementation and enforcement and addressing fragmented institutional structures;
• aligning water law, macro-level policies, and tariffs with agricultural and energy policies.

2.4 Water sector characteristics: public, private and partnerships

Political and economic history largely determines the roles of the public or private sectors in the countries of the UNECE region. In all countries cooperation between public and private sectors exists in one way or another, and the way a specific model develops depends on the unique combination of climate and consequent water resource availability, groundwater settings and political and institutional frameworks. From a governance perspective, understanding the way these models have developed is equally as important as knowledge of their current form.

A key governance factor in this respect is the mode of ownership and method of financing of public water supply and sanitation. As discussed during the working groups, while it is clearly not an objective of this project to re-visit the private/public debate for water utilities, nevertheless it is important to appreciate how their ownership and financing can influence approaches to water management. In the United Kingdom, for example, the 1989 Water Act (UK presentation) established completely privatised, shareholder-owned water and sewage companies as part of a comprehensive selling-off of national public utilities. Since privatisation, the UK water industry’s financing and cost recovery arrangements and regulatory provisions have strongly favoured capital investment over recurrent. While this was probably an unintended consequence of privatisation, it has had profound impact. From a water quantity viewpoint, this has meant building new infrastructure (supply side intervention) in preference, for example, to greater efforts to reduce leakage in the distribution system or to extend water metering (demand side measures). Similarly from a quality point of view, it has resulted in a preference for capital investment in water treatment (“end-of-pipe” solutions) over efforts to apply or encourage measures to reduce pollutant loads in the capture zones of major groundwater supplies (a catchment protection approach).

The contrast between this and other Member States, particularly in northern Europe was illustrated by the presentation from Denmark, where water supplies are operated by private but not-for-profit limited companies owned by the municipalities. This approach applies equally to Copenhagen and to smaller towns, and nationally there are about 2500 such companies. Incentives for these companies were described as being that they are small and locally established and locally answerable. Many or even most of the consumers live in the catchments from which the groundwater is drawn, so they have a strong stakeholder interest in participating in protective measures and in holding their local water company accountable.

This contrast has been further illustrated in the specific case of nitrate pollution by a major EU research project entitled “Water4all” (EU, 2005), whose primary objective was to develop approaches at a local scale for use by ‘catchment managers’ to control agricultural impacts on groundwater quality. Many of the local approaches proposed or already being implemented in project areas in Denmark, Germany and The Netherlands were feasible because of the local ownership and accountability of the water supply companies and consequent active stakeholder participation. These would be much more difficult to implement where supplies are operated by a fully-privatised, shareholder-owned water company. More recently the greater presumption against water treatment envisaged in the WFD and embraced in much of Europe is beginning to be felt in the UK. For diffuse pollution, the UK companies are now looking towards longer term catchment
management to postpone or even remove the expected need for treatment and to enable existing treatment plants to be decommissioned or placed on standby.

A more strongly public sector focus on governance and management is apparent in Turkey, where the main issues are related to groundwater overexploitation and unregistered wells, producing water shortages, falling groundwater levels, land subsidence and salt water intrusion coastal aquifers. The responses are outlined in Box 4 below.

**Box 4. Management of groundwater abstraction in Turkey**

Legal provision through Government Orders, Articles and Circulars has triggered the implementation of a large number of regulatory measures. Four critical river basins out of 25 have been closed to groundwater exploitation (no new wells or increased abstraction) by cabinet decision. Based on the Groundwater Law, wells in the four critical and 10 semi-critical basins must be equipped with flow meters and control cards to prevent abstraction exceeding allocations. Groundwater action plans have been prepared to define realistic groundwater allocations. Additional measures are being taken to transfer surface water to some drought-prone areas. The efficiency of irrigation systems is being improved to decrease water losses and measures are enforced by linking them to abstraction licenses. Capacity building projects have included awareness campaigns on TV and posters, education, information meetings for local governments and stakeholders and the development of a groundwater database, meetings to increase transparency. Agriculture is by far the largest groundwater user in these basins and a component of the measures encourages low-consumption crops and to improve the situation agricultural policies.

*Doğdu presentation, 2013*

### 2.5 Stakeholders and roles

Institutions, communities and individuals have distinctive roles to play in groundwater use, management and governance (Table 2). Sometimes these roles are not the same in the perceptions either of each individual stakeholder or of the other stakeholders and groups, and they may not be the same in practice as in perception. Both perception and reality will depend on the local situation and it is likely to be an important governance challenge to firstly identify the actual and desired roles of each stakeholder and then enable them to take on these roles. Several of the most important stakeholders are both users and actual or potential polluters of groundwater (Table 2).

### 2.6 Technical knowledge, scientific methods and tools

While a lengthy discussion of recent advances in hydrogeological science is beyond the scope of this short report, it is worth mentioning some innovations which have had a direct bearing on the management of groundwater:

- improvement in resolution of remote sensing techniques and introduction of new remote sensing technologies such as GRACE, enables the quantification of large mass changes from space. Although these developments do not replace field measurements, they do permit better analysis of water availability at various time scales from space;

- improvement of sensor technology and wireless data transmission partly counterbalances a general trend of declining financial support for data collection programmes;

- integrated numerical modelling of groundwater systems in terms of both flow and quality has become easier, and the use of such models to support groundwater management has become more widespread.
These are reinforced in a number of ways in which steady development rather than brand-new approaches have proved significant:

Table 2. Stakeholders and roles in groundwater and aquifer use, management and governance

<table>
<thead>
<tr>
<th>Stakeholder</th>
<th>Roles in Groundwater use</th>
<th>Roles in Groundwater management</th>
<th>Roles in Groundwater governance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Households</td>
<td>Garden watering, heating and cooling, private domestic, small quantities</td>
<td>Pressure group: strength dependent on issue</td>
<td>Important for public support and image building</td>
</tr>
<tr>
<td>Farmers</td>
<td>Irrigation: full dependency or as supplementary resource. Abstractions are small to extremely large and often seasonal</td>
<td>Both cultivation and livestock cause pollution</td>
<td>Pressure group: in many UNECE countries farmers and farmer associations are well organized and politically strong</td>
</tr>
<tr>
<td>Industries and mines</td>
<td>Small to intermediate use for primary processes, large abstractions for cooling purposes or mine dewatering</td>
<td>Major polluters</td>
<td>Highly important and influencing pressure groups</td>
</tr>
<tr>
<td>Water companies</td>
<td>Medium to large abstractions</td>
<td>Often lead in developing good groundwater management for their own interests, but if they are dual water and sewage utilities can be polluters</td>
<td>Privatisation on one hand and developments into regional land and water managers on the other show diversity in governance roles</td>
</tr>
<tr>
<td>Municipalities</td>
<td>Limited, unless owners of water companies</td>
<td>Mostly strongly involved due to a variety of water and waste disposal tasks. Urban land use planning</td>
<td>Key players in transmitting needs and opinions to other stakeholders and as decision making on practical policy</td>
</tr>
<tr>
<td>Local authorities</td>
<td>No role</td>
<td>Implementation of management plans</td>
<td>Policy making and decision making</td>
</tr>
<tr>
<td>National authorities</td>
<td>No role</td>
<td>Policy making and setting of standards. Provision of funding</td>
<td>Legislation and decision making, setting the scene</td>
</tr>
<tr>
<td>International authorities</td>
<td>No role</td>
<td>Increasing role in policy development especially transboundary issues</td>
<td>International coordination, setting the scene, legislation, comparative studies</td>
</tr>
<tr>
<td>NGO interest groups</td>
<td>No role</td>
<td>Can act as pressure groups, monitoring of effectiveness of management</td>
<td>Crucial when well linked to media</td>
</tr>
<tr>
<td>Scientific organizations</td>
<td>No role</td>
<td>Knowledge and innovation providers from research, including researching effectiveness of measures</td>
<td>Understanding and innovation providers (not yet very well). Research and comparative studies</td>
</tr>
<tr>
<td>Media</td>
<td>No role</td>
<td>Holding to account. Making management effective or not</td>
<td>Holding to account. Making governance effective or not</td>
</tr>
</tbody>
</table>

- better and cheaper laboratory equipment and the development of analytical methods mean that many micro-pollutants can now be measured at the detection levels required in relation to environmental standards;
• much greater understanding of the subsurface transport and behaviour of a whole range of contaminants;

• the use of isotope techniques to help characterise groundwater systems;

• the greater use of conceptual models, in particular the source pathway receptor approach;

• greater understanding of the links between groundwaters, surface waters and ecosystems.

It is also worth remarking that many of these advances come at least in part from the substantial and sustained investment by the European Commission in environmental research programmes intended to provide the technical knowledge needed to support European legislation. The results of some of this recent research are described by Quevauviller et al (2008, 2009). Major innovations also result from research funded and directed by the US Environmental Protection Agency which, as mentioned in section 2.3, plays a similar role with respect to the legislation set out in Box 3.

3. Gaps in relation to the state of groundwater governance

3.1 Gap analysis

Even in the highly developed and well-regulated countries of the UNECE Region, gaps remain to be addressed in the governance process and were picked out in the presentations and discussions. For example, much of the work of the OECD is directed towards developing analytical frameworks and tools for policymakers to help them identify gaps in governance in their own sector. Table 3, based on the presentation prepared by Aziza Akhmouch and shown by Alice Aureli on her behalf, lists some of these generic governance gaps and identifies how they manifest themselves in relation to groundwater. While it could be argued that the first of these, the ‘objective’, represents the realities of the world which in governance of groundwater must be developed rather than a ‘gap’ to be closed, nevertheless analysing them in this way focuses on the issues that need to be addressed. Moreover, dealing with divergent objectives is a task of governance in any sphere.

Table 3. Governance gaps and groundwater (adapted from OECD presentation, 2013)

<table>
<thead>
<tr>
<th>Gap</th>
<th>Specific examples relevant to the governance of groundwater</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective</td>
<td>Widely dispersed sets of stakeholders with conflicting interests and aims, competing demands that change with time, shifting priorities – development vs conservation</td>
</tr>
<tr>
<td>Policy</td>
<td>Weak linkages across sectors – lack of consideration of groundwater in spatial planning and land management, short-term and narrow political horizons</td>
</tr>
<tr>
<td>Administrative and Institutional</td>
<td>Basins, aquifers and groundwater flow don’t recognise political boundaries, river basins and aquifers don’t coincide, surface and groundwater and quality and quantity in different institutions,</td>
</tr>
<tr>
<td>Accountability</td>
<td>Difficult transparency (eg in water and property rights) limited monitoring of practices which is needed for institutional quality, awareness and public trust, uncertain where responsibilities lie between national, sub-national and local</td>
</tr>
<tr>
<td>Capacity</td>
<td>important capacity and educational needs for groundwater; both hard (technical) and soft (policy expertise rather than technical)</td>
</tr>
<tr>
<td>Information</td>
<td>Lack of information on groundwater use, state and trends, and lack of sharing of information</td>
</tr>
<tr>
<td>Funding</td>
<td>Limited appreciation of the instrumental value of water, limited use of economic instruments to foster rationale use (abstraction charges), inadequate funding of research to evaluate success stories</td>
</tr>
</tbody>
</table>

Many of the gaps and shortcomings shown in Table 3 are common to a greater or lesser extent and were brought up at all of the regional consultations. To avoid duplication and to keep this discussion...
reasonably short, only some of those highlighted in the presentations and workshop discussions and particularly relevant to the UNECE Region are mentioned in the following sections.

3.2 Policy gaps

Based mainly on the presentations and working group discussions, the main gaps identified from a policy viewpoint can be expressed as:

a) the short-term (4 to 5 year) vision of political decision makers – often seen as the next election – compared to the time needed to establish good groundwater governance;

The time needed to plan, consult, legislate, set up institutions and put finance in place is probably more like ten to twenty years. In this respect, therefore, the general advantages of established parliamentary democracy can become a disadvantage; when clear long-term vision and stability of policy is needed, governments frequently change political colour and policy direction. (This is, incidentally, an even greater problem for the energy sector with its very long lead-in times for new power generating plants). The vision behind the WFD had much to do with addressing this policy concern by committing Member States to a clear timescale and common and implementation strategy. The time mismatch between the political cycle and the hydrological cycle can also be a common policy gap; politicians find it hard to appreciate the time scales of groundwater systems and the time required for measures to have a beneficial impact, and the need to be “in for the long run”.

b) the narrow horizons of many politicians mean there is still inadequate policy response to the existing and obvious linkages between water, energy and food and the additional emerging links to ecosystems, climate change, globalisation of the economy and political power shifts.

A consequence of this already outlined in section 2 is that policies remain sectoral and are often in direct conflict with each other. There was also agreement on the need for better understanding of the value of groundwater storage as a buffer against the challenges posed within the water-energy-food nexus and in climate change adaptation strategies.

c) there is still too much of a sectoral approach within water policy development;

Many participants at the consultation expressed satisfaction at the growing appreciation of groundwater issues at the political and decision making levels in comparison with the situation of only a few years ago. However, even in the highly developed nations of Europe and North America, groundwater is still not well understood and appreciated. This leads to priority being given to the ‘visible’; the surface water resources over groundwater. Targets set in sectorally-focused organizations tend to have priority over inter-sectoral objectives. Existing legislation often does not favour inter-sectoral coordination and creating new legal regimes with new sets of rules across sectors requires flexibility, political willingness and even courage from decision makers.

While it is still important to counteract this by demonstrating the importance of groundwater resources so they are fully incorporated into IWRM strategies, too much emphasis on the ‘special’ place of groundwater can be counter-productive. In policy terms, groundwater professionals cannot necessarily have it both ways, ‘fully integrated’ as well as ‘special’, and a balance is needed between the messages that are given in this respect.

d) although major progress was reported, policy instruments which enable and encourage transboundary groundwater management are still needed;

Advances in transboundary cooperation were described in the presentation from UNECE and particularly exemplified by the ICPDR and presentations from the Danube Basin countries (see also section 4). In the both the Caucasus and Central Asia (UNECE, 2011a) there are major, heavily used
shared aquifers which are not recognised within the sub-region (Table 1) and for which transboundary agreements are urgently needed.

### 3.3 Administrative and institutional gaps

Based on both the questionnaires and the presentations, there was broad regional consensus that legislation is adequate and itself rarely constitutes a major gap. Moreover, many of the questionnaire respondents believe that institutions in their country are adequate to address groundwater and even perform well. The most optimistic judgements came from Western and Central Europe, with probably the most positive from Hungary. Perhaps surprisingly, the lowest questionnaire ratings in this respect came from North America, but the division of responsibilities between Federal and State and Provincial levels mentioned in the presentations and referred to in Box 3 are probably the cause of this. If there had been a presentation from the regulatory sector in Germany, similar divisions between Federal and Lander would probably have been mentioned.

This overall optimistic regional view should not be taken as an indication that there are no administrative gaps nor institutional barriers to the achievement of better governance of groundwater. Many countries reported that:

- a large numbers of institutions at national, sub-national and local level are involved in groundwater governance;
- equally importantly, other institutions and organisations at all three levels have a stake in governance of groundwater but are not at present involved;
- not only in the federal countries mentioned above but in general, the mandate for decision making in groundwater management rests at the highest sub-national level. From the questionnaire responses, only in Israel and perhaps Azerbaijan is this mandate at the national level.

Historically, water institutions have derived part of their mandate and their reason for existence from handling of problems or even calamities – too much or too little water – floods and droughts, mostly related to surface water events. Building storage and distribution systems for large volumes of water is a second major institutional function. ‘Top down’ engineering approaches towards such issues are common and usually accepted because of the need to take rapid actions and major investments, and the operational style in many water institutions has been more top down than bottom up. Because of the more diffuse nature of its use, groundwater management and governance needs more bottom up approaches. Many of the gaps in accountability, capacity and funding mentioned below follow from these historical institutional settings.

### 3.4 Accountability gaps

In some countries in the UNECE Region either institutional responsibility for groundwater governance is not clearly assigned or there are many institutions and legal instruments involved. Lack of clear identification of responsibilities at all levels of interaction between users on the one hand and policy making and managing institutions on the other was reported as an obstacle to good governance of groundwater. With lack of responsibility come gaps in accountability and transparency and lack of motivation and commitment from stakeholders who are not adequately involved.

Perceptions of accountability take on additional dimensions when the private sector is extensively engaged in commercial activities such as intensive agricultural cultivation, industrial uses or mining which draw heavily on groundwater resources or which can significantly impact groundwater quality. One of the key messages coming from the discussions during the private sector round table (van der Gun, 2013) was that improved water accounting in the form of comprehensive and readily-available information on water use could greatly improve public understanding and help to close this accountability gap. Private sector and NGO contributions at a recent transboundary groundwater
conference convened by the University of Strathclyde confirmed this, highlighting recent efforts to improve water accounting.

Although less important in the UNECE Region than others, exploitation of non-replenished groundwater resources is likely to require governance frameworks which take account of the different approach to sustainability such exploitation requires and the extra efforts to demonstrate accountability that are needed.

3.5 Capacity gaps

Many of the capacity gaps identified by participants are, in reality, more associated with management than governance; the most common being shortage of technical capacity. The widely cited constraints in terms of technical capacity are often made worse by institutional fragmentation; the most able people are not at the right governance level or in the most appropriate organisation.

There is also a capacity gap in relation to the overall availability of adequately trained staff. While this is partly a consequence of the sometimes rapidly widening gap between the ever increasing environmental task list of the regulatory agencies and the finances and resources provided to them, it may also be partly due to the changing nature of the professional skills required and the need for university courses to keep up with these changes.

At operational levels, sensitivity to broader governance issues is often weak while at higher political and policy levels understanding of practical issues is also weak. If there is no ‘meeting of the minds’ between the two, a significant capacity gap can persist.

Constraints can arise from differences in backgrounds and attitudes. Professionals in technical and scientific fields may use different languages and terminologies from other stakeholders – politicians, managers, media and communities. The communication gap resulting from this lack of common understanding was highlighted in the presentation of Jacques Ganoulis. He suggested that modern information and communication technologies can facilitate dialogue between stakeholders by combining spatially-distributed data and GIS applications with open source maps such as Google to create interactive web-based mapping applications. This presents opportunities to address both capacity and information gaps.

3.6 Information gaps

Although some of the national presentations mentioned information gaps, overall these are likely to be less significant than in some of the other regions. The monitoring and reporting obligations of the WFD have helped in this respect, and much more data and information about groundwater quantity and quality are publicly available. The Water Information System for Europe (WISE) was mentioned in the presentation of Johannes Grath. Nevertheless, even in the UNECE countries reliable and up to date information about groundwater abstraction is not always available.

One of the consequences of groundwater being in the public domain but abstraction being largely a private activity is the need, mentioned in several presentations, for effective licensing of abstraction and of the drilling of new boreholes. Both of these need adequate collection, archiving and access to operate effectively and to help close the information and accountability gaps. In this respect, while the importance of data is not in doubt, the often quoted ‘no data –no management’ is an easy maxim that cannot always be applied. Lack of data related to groundwater abstraction and groundwater levels or monitoring information about groundwater quality deterioration can be used by powerful stakeholders as an argument to prevent or slow down management initiatives that would impact on their operations and could affect profitability. In some circumstances, therefore, enabling

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3 The programme and presentations are available at [http://www.cifalscotland.org/index.php](http://www.cifalscotland.org/index.php)

governance provisions and funds (perhaps partly collected from these stakeholders by licensing charges) may be needed to establish monitoring and data collection where it is absent.

3.7 Funding gaps

Some participants indicated that it was not enough to rely on external donors support to increase the level of investment in groundwater governance. There is also a need to recover more costs from groundwater users and polluters, and to look for other mechanisms of financial involvement by stakeholders.

Raising awareness and improving the practical governance skills of water users, managers and politicians needs more investment. The same holds for curricula development on groundwater governance in water management courses at all levels.

The results of research aimed at a fundamental understanding of groundwater governance issues were presented at the consultation and are drawn on for the Thematic Papers. Such research is in its infancy and probably needs stronger financial support, particularly to enable better exchange of experiences and facilitate the long-term collection of data that is needed to assess the effectiveness of management actions.

Overall, participants at the Fifth Regional Consultation probably reported fewer gaps in groundwater governance than at the others. However, there were some very useful contributions of "lessons learnt" and examples of good practice in groundwater governance, some of which are highlighted in the next section.

4. Lessons learnt and opportunities to address the gaps

The UNECE Regional Consultation provided an opportunity to exchange experience, draw out lessons learnt from around the region and report good practices and success stories. Almost every national representative was able to report examples showing progress in the governance and management of groundwater in their country. Some of these are summarised in the next section of the report, highlighting features that can address some of the gaps set out in section 3 above.

4.1 Examples of good practice and success stories

At the European regional level, there can be no doubt that the Water Framework Directive (WFD) has proved to be the single major landmark in enabling and promoting better governance of groundwater. Its development up until its adoption in 2000 can be considered a good example of effective cooperation between policy makers, water managers and scientists, although ‘governance’ as a concept was probably hardly mentioned at the time! The process of implementing of the WFD is also an example of successful groundwater governance and management. Among other things implementation obliged national governments to look at whether their own institutional frameworks really encouraged IWRM and management at the river basin scale, or whether some degree of reorganisation might be required. The presentation of Johannes Grath nicely picked out the key words and main features of this process (Box 5)\(^5\).

The UNECE Water Convention (The International Water Convention on Transboundary Watercourses and Lakes, also known as the “Helsinki Convention”) can also be considered a success story of the region (Box 6). The convention was signed in 1992, entered into force in 1996 and has been ratified by 38 countries and the European Union, with several others in the process of ratification. The increased awareness from the WFD of the importance of bringing together the management of

rivers, lakes and groundwaters at a catchment scale has certainly helped raise perceptions of transboundary waters. The convention was amended in 2013 to allow inclusion of countries outside the UNECE region.

**Box 5. The Water Framework Directive**

Key features and steps in WFD implementation:

- nomination of competent authorities
- establishment of river basin districts
- delineation and characterisation of water bodies
- analysis of pressures and impacts
- classification of bodies at risk
- design of monitoring programmes
- development of river basin management plans (RBMPs)
- putting in place programmes of measures.

Using the distinctions from Box 1, the first two steps could be described as the essential governance provisions which enable the subsequent management activities to be undertaken. These are all aimed towards the achievement of good chemical and quantitative status by 2015. For groundwater quality, this requires the assessment of chemical status and the identification and reversal of significant and sustained upward trends in pollutant concentrations. The six year cycle for the development, implementation and review of RBMPs is an important strength of the WFD; the lessons learnt in the first cycle contribute to the refinement of the second cycle. Moreover, the WFD has shown itself to be robust but flexible enough to accommodate the expansion of the EU to 28 Member States with their widening physical, economic and political backgrounds. The principle of ‘subsidiarity’ provides sufficient flexibility to take account of these differences. Thus, quality criteria established under the WFD take account of local characteristics and allow for further improvements to be made based on monitoring data and new scientific knowledge.

Other important features of the WFD which help to address the gaps outlined in section 3 include the requirements for stakeholder involvement and public consultation emphasized in the UK presentation and the transparent provision of information. Development of the daughter Groundwater Directive and its adoption in 2006 have addressed weaknesses related to groundwater known to be present in the WFD.

*Grath presentation, 2013*
The long-term development of the water supply for Amsterdam was highlighted as a successful example of the evolution of governance in the presentation of Ebel Smidt (Box 7) and of conjunctive management of surface water and groundwater in that of Albert Tuinhof. The importance of

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Box 6. The UNECE Water Convention

The convention is based on three main principles:
- protection of transboundary waters to prevent, control and reduce of transboundary impacts;
- allow for reasonable and equitable use of transboundary groundwaters and;
- obligation to cooperate through agreements and joint institutions.

The major benefit for neighbouring countries sharing transboundary aquifers has been the facilitation for establishing joint bodies such as commissions to consult and exchange information, carry out joint monitoring and assessment and develop joint management objectives and action programmes. In the 1990s, these benefits were appreciated particularly by the countries of central Europe. As more of these have become members of the EU, the emphasis of the work of the convention has moved further eastwards, but still ensuring that guidance given is compatible with the WFD. This certainly helps countries on the eastern border of the EU to reach agreements with their neighbours. Technical groups set up by the UNECE have provided guidance to help achieve the convention’s objectives by, for example, undertaking an inventory of transboundary groundwaters in 1999, publishing guidelines for groundwater monitoring and assessment in 2000 and undertaking two major regional assessments in 2007 and 2011.

_Bernardini presentation, 2013_
Box 7. Conjunctive use and artificial recharge for water supply in the coastal zone of the Netherlands

A water supply system for Amsterdam was established from 1853 by the construction of canals to draw water from the coastal dune systems. From 1903 these canals were replaced by wells, but the steadily increasing abstraction so close to the sea produced saline intrusion and the deteriorating quality of the pumped water began to threaten the operation of the systems after some thirty years.

The solution embarked on from 1953 was to pre-treat surface water from the Rhine near Utrecht, transport it 75 km (see map) and infiltrate it into the dunes. About 4 million people in the western part of The Netherlands are nowadays supplied with drinking water originating from a mixture of shallow and deep dune groundwater and infiltrated river water (see graph). Additional advantages of this approach were the creation of strategic water storage and recovery of groundwater levels to combat saline intrusion and to restore ecological and recreational functions.

![Diagram of water supply system](image)

An important governance provision which facilitated this development has been the merger between the water supply company, the regional water authority and the municipal water department. In the city of Amsterdam and surroundings one organization (Waternet) has been formed which manages both the natural water system and the water supply and sewerage systems. This has transformed the water companies into land AND water management companies.

Smidt presentation 2013

conjunctive management is also reinforced for the UNECE Region by the dependence some large cities along the Rhine and Danube on systems of bank filtration wells for urban water supply.

Over its 150 year history this can be seen as an example of successful groundwater governance which has evolved into land and water governance and which builds on the thousand year tradition of the water boards (Smidt and Satijn, 2013). Modern groundwater governance in The Netherlands reflects changes in society and in perceptions of the environment, with groundwater and aquifers being considered as multifunctional resources for energy, water and waste disposal.

As described in the presentation by Emilio Custodio, Spain has a long history of water user associations, with more than 7000 mostly for surface water. There was no legal basis for groundwater users associations until the 1985 Water Act, although there were informal activities such as the selling of rights to privately owned water and water markets in the Canary Islands. The increasing intensity of groundwater use, mostly for agriculture but also for urban supply and industry, was beginning to have serious quantity and quality impacts by the 1960s, bringing growing awareness that action was required. The Low Llobregat (Box 8) was one area where these impacts were beginning to appear.
Box 8. The Low Llobregat (Barcelona) Groundwater Users Association (CAUDLL)

This, the first such association, was formed in 1975 when water was still a private domain under the 1876 Water Act. Favourable local factors encouraging this particular association to get started included the availability of detailed studies of the groundwater situation and the consequent awareness of the essential role of groundwater in the local economy. Most importantly, there was already a good degree of trust between the Water Administration and the water users, who at the time were dominantly water suppliers and industries rather than agriculture.

CAUDLL was registered as a private body supported by the Water Administration and the municipal authorities. Its objectives were to protect private groundwater rights, secure water availability in periods of drought, and halt and reverse groundwater degradation. The association’s bye-laws allowed it to raise funds, punish wrong-doers and represent the water rights of its members.

The beneficial results included the control of new groundwater developments and reduction in groundwater abstraction, bringing an end to waste disposal in pits, and the establishment of monitoring programmes. Its success meant that most groundwater users in the Low Llobregat joined CAUDLL, and also new increased public investment came to the area which might not have done otherwise.

*Custodio presentation, 2013*

This success became well known in other areas with heavy groundwater usage and serious deterioration. Although this encouraged the development of other water user associations, therewere greater difficulties in dominantly agricultural areas with large numbers of users and right-holders, in areas with little existing groundwater knowledge or monitoring and, most importantly, where there was little interest or even resistance from the water authority. The arrival of the 1985 Water Act changed this. Groundwater became a public domain, water authorities had an obligation to manage it, and water user associations became recognised as public bodies. Although there were some initial failures of ‘top-down’ user associations in officially-declared ‘over-exploited’ areas, growing problems of deterioration combined with greater availability of information from groundwater investigations have led to the establishment of 15 groundwater associations.

Some aspects of good groundwater governance and management by users at a local level were reported for the Samgar Lift Irrigation Scheme in the Syrdarya River Basin in Tajikistan (Box 9). The effectiveness of this scheme illustrates that under-development of groundwater is one of the main factors contributing to the observed increases in salinity of river flows and irrigated soils. Surface and groundwater resources in the Aral Sea basin need to be managed jointly, and local farmer-managed schemes such as that at Samgar can contribute to this, provided the governance and institutional settings can enable conjunctive management. Managed aquifer recharge may provide greater long term sustainability of such systems.

4.2 Some lessons learnt from the success stories

A consequence of the hydrogeological variability across Europe outlined in section 2.1 is seen in the outcome of the process of defining groundwater bodies (Box 5). The number of such bodies varies from a few tens in the smaller countries with relatively simple geology to the thousands of small fluvio-glacial sand and gravel aquifers of the Scandinavian Shield in Finland, Norway and Sweden (EU 2012b). The WFD is able to provide a basis for the management and protection of everything from these on the one hand to the large multi-layered sedimentary aquifer systems of, for example, the Paris Basin and the Pannonian Basin in South Eastern Europe.

The influence of the WFD spreads well beyond the current borders of the EU to the potential accession countries and other neighbours. Andreas Scheidleder reported that in the ICPDPR the organisational structure to achieve good groundwater status is in place despite there being ten EU Member States and nine Non EU countries, 16 languages and 20 legislations. Through participation
Box 9 Farmer- managed Irrigation at Samgar, Tajikistan

In the Samgar scheme, wells are owned by the Farm Unions and farms have been established based on the command area of these wells; one well supplies water for the land belonging to one farmer. Farmers are responsible for the operation and maintenance of wells and water organizations provide maintenance services on a contractual basis. Farmers pay the utilities for electricity to operate the wells to cover maintenance costs. The cost of power to operate wells is significantly higher in the inter-season rather than in the main crop growing season; water is rotated in high water demand periods and farmers jointly cover the electricity cost.

Under such conditions groundwater irrigation (GWI) ensures higher water productivity compared to lift irrigation (LI) by pumping water from rivers at lower altitudes up to the foothills and highlands as shown above. Farmers understood the advantages of groundwater irrigation and investing their own funds in the installation of wells to secure their water supply, with the number of wells installed increasing in recent years, as shown in the figure. While there is non-uniform water supply under lift irrigation with over-irrigation in the lower parts and under-irrigation in the upper parts of the scheme, groundwater irrigation under effective permit regulation conditions ensures irrigation of crops evenly in high water-demand seasons.

*Presentation of Karimov, 2013*

in the ICPDR, river basin management plans (RBMPs) have been established for the Tisza and Sava Rivers and, by adoption of a new Water Act in 2010, Serbia has accepted the standards, definitions and goals of the WFD (presentation of Milanovic).

General lessons learnt from work of the UNECE include an appreciation that poor political recognition is a major hindrance to improving governance and that the challenges of transboundary cooperation are technical, legal, institutional and also political. Lessons learnt from the more specific experience gained in the pilot projects set up to demonstrate the application of the guidelines showed how important it was to tailor the approach to the settings and issues in the basins and the necessity of taking a careful, step by step approach to setting up improved monitoring and assessment. These steps often started with a sharing of information, then moving from:

- exchanging information on methodologies to agreeing on harmonized ones;
- general appraisal to more precise assessment;
- assessment of status to pressures, impacts or possible measures.

One of the key outcomes of introducing a strong IWRM basis into the work of the convention was that of the extending sampling geographically from a focus only on border stations to the whole basin or aquifer (UNECE 2011b).

The presentation by Emilio Custodio concluded with some lessons learnt from the experience of setting up groundwater user associations in Spain which are likely to have broad application in groundwater governance and provide useful insights for this project. Even with success, there can be big obstacles to overcome:

- as a result of the legislation, groundwater is in the public domain, but in practice remains privately owned or at least privately abstracted;
- with improving groundwater knowledge, existing water rights may exceed water availability;
• top-down government initiatives and actions have been largely ineffective. Lack of trust and transparency are major contributors to this;
• civil society (including water user associations) has become intruded and degraded by politicians and politicians gain excessive influence as a result.

In dealing with these, the Spanish experience shows that establishing effective groundwater user associations is a slow process as trust is built up. They need to be properly separated from politics and instead become part of civil society so they can play an effective role from that position. Some of the greatest efforts were needed to:
• raise awareness that aquifers are common assets that need to be protected;
• take account of large numbers of smaller groundwater users in agricultural areas;
• obtain agreements from different or competing interests;
• look for win-win solutions wherever possible.

Moreover, the importance of hydrogeological setting should not be forgotten; quantity aspects dominate over quality because at least half of Spain can be considered as semi-arid and groundwater-dependent. As better governance of groundwater develops, more attention will need to be given to quality.

4.3 Some general lessons from the region

There is no doubting the general statement that “governance and management of groundwater needs greater stakeholder involvement” but how does the wealth of experience from the UNECE region illustrate this? Overall, much of the evidence from presentations and discussions confirms the importance of combining global, regional or national frameworks with local actions to suit the spatial scale at which aquifers and groundwater use occur and need to be managed. This was exemplified by the success stories reported above, and additionally in the presentations such as GWP/GWEMATE and ICPDR and from the national experience of France, Denmark and the UK. In a way this is somewhat reassuring, as it precisely reflects the banner headline of this project!

Some more specific lessons follow from this, for example greater stakeholder involvement should mean “better” as well as “more”. ‘More’ clearly means all of the institutions, organisations, communities and individuals with a stake in governance of groundwater but ‘more’ should also imply taking part in more steps in the process. ‘Better’ means improving the quality and effectiveness of stakeholder involvement by closing some of the gaps with respect to accountability, information, capacity and funding outlined in section 3.

While essentially derived from experience in other regions, the lessons of the GW-MATE programme (Foster et al, 2010) are still broadly applicable to Europe and confirm many of the gaps of section 3 and the lessons set out here. Overall, the failure of groundwater management results more often from inadequate governance than from insufficient understanding of the hydrogeology, even though the latter is important. Confirming many of the views expressed in The Hague, most countries have adequate legal provisions but the institutional arrangements and operational capacity for implantation are lacking. There is a great need to address the gaps outlined in Table 3; lack of acceptance of responsibility, inadequate agencies with shortages of skilled staff and poor stakeholder engagement. Management of groundwater is essentially a local activity close to the users and potential polluters and it requires a sensitive blend of regulatory provision and stakeholder engagement. Management by users alone is rarely effective but management without user participation is impossible.

Accepting the need for more and better stakeholder involvement in governance and management by a mix of ‘top-down’ legal and institutional changes and ‘bottom-up’ community actions often means that progress is slow. In many (probably even most) of the hydrogeological environments mentioned in section 2.1, positive responses to measures taken are slow to appear, which can test the resolve and patience of some stakeholders more than others.
Apart from the Netherlands example, the need to properly consider groundwater and surface water resources together was widely acknowledged throughout the region. In the Aral Sea basin, for example, groundwater and surface water are both used for irrigation, but are not yet managed conjunctively. Under-development of groundwater leaving very high water levels was identified by Akmal Karimov as one of the main causes of water and soil salinisation.

### 4.4 Some opportunities identified in the region

Participants at the consultation identified a number of opportunities for activities aimed at improving the governance picture. Many were generic and often really only mirror image responses to the gaps and lessons outlined above; - more funding, better communication, more transparency and so on. While these are true and confirm generic recommendations from other regional consultations, they are not strictly “opportunities” and are not repeated here. A few useful and specific opportunities for enhancing groundwater governance were identified.

Communication, transparency and trust can all be enhanced by facilitating better common understanding of the basic facts about groundwater and aquifers. Digests that are not too technical are needed to provide balanced information which can be understood by a range of stakeholders. This is not easy. Much of the material in the excellent recent book by van der Gun and Margat (2013) contributes to this objective, but such material is also needed which fully reflects the spatial scales at which groundwater management must occur. Of the project partners, IAH and UNESCO are particularly well placed to do this.

From the experiences and lessons already summarised in this section, the importance of full involvement by local communities is clear. It is also apparent that this does not necessarily happen by itself, and there is often a need for champions of ‘bottom-up’ community processes who can help make things work. The Groundwater Governance Project needs to identify and report examples of this and to encourage partners to identify champions and facilitate the process after the project.

The opportunity to use experiences and instruments from the oil and gas industry, such as unitization was identified by Todd Jarvis. Experiences from other industries are relevant to the governance and management of aquifers for uses other than groundwater supply (van der Gun et al, 2012).

There are also some research and development opportunities arising from the discussions. Amongst these is the need for careful investigation of the specific reasons behind the more successful stories of groundwater governance and management. Others include the development of mechanisms to reduce the large transaction costs of public consultations and of models for abstraction management which include full recovery of the costs of monitoring. Applied research is needed to see whether theoretical solutions in groundwater management are really implementable. Another suggestion was that there was scope for investigating conflict resolution modalities over rights by, for example, creating groundwater mediation centres making use of local knowledge and experiences.

### 5. Conclusions and recommendations

Much of that which constitutes lessons and opportunities in the preceding section is also in practice the conclusions and recommendations respectively of the consultation. These are not, therefore, repeated here but there are some broad conclusions and recommendations for the project and the project partners.

Many of the presentations were from sophisticated institutions in highly developed countries. Any danger within the project of ‘writing off’ this experience as not relevant to the other regions should be resisted. Much of the detailed work to implement the legal instruments picked out here such as the WFD in Europe and the Superfund in the USA is expensive and requires huge technical capacity. This should not be allowed to hinder proper consideration of the broader value of the principles and
approaches underlying these legal instruments. Efforts to translate these experiences effectively to regions and countries with lower budgets for research and water management improvements and innovations may need special support.

Such broad agreement in the UNECE Region on many aspects of both the present situation of groundwater governance and what is needed by way of improvement should be acknowledged but also questioned. Some of the presentations and discussions in The Hague suggested an element of ‘preaching to the converted’. Why was this? It may partly be that this was the last of five consultations and ideas naturally tend to converge. It is also possible that, in some respects, the WFD has inadvertently become a victim of its own success and provides too much comfort. Both the legislation itself and the guidance to go with it are so comprehensive that there is a danger of narrowness of vision; “if it is not in the Directive then it can’t be right”. This is seen in a tendency towards diminished professional critique and questioning where Directive provisions and hydrogeological conceptual thinking do not match.

Experience to counterbalance such comfort was provided in the discussions during the private sector round table. When the governance of groundwater is set within the wider context of the food-energy-water nexus then many new challenges appear which need to be embraced somehow by the project in preparing the Vision and Framework.

The round table also taught us that ‘the private sector’ is a huge and highly varied group of stakeholders. Even though there were ten private sector panellists, still large parts of the private sector were not represented. These include the privatised water utilities, the agrochemical industry, arable and livestock farming, the supermarkets and the construction industry. Many of these are large-scale groundwater users and/or actual or potential polluters of groundwater who have much to contribute to the debate on groundwater governance. They are powerful economic and commercial players with substantial vested interests in how groundwater governance develops and how subsequent management approaches might affect their profits.

The round table discussion was explicitly focused on data sharing. This was appropriate in the immediate context of the International Year of Water Collaboration and World Water Day and produced many valuable insights for this project. There are, however, other aspects of the private sector’s role in the governance of groundwater which need to be explored, and which have different emphasis in the different regions. More opportunities are needed to facilitate private sector contribution to project objectives by, for example, a second consultation with wider participation and broader agenda. The World Business Council for Sustainable Development offered to participate in and help facilitate this. The project needs to practice what it preaches with regard to inclusive stakeholder involvement.

There is always a risk at such consultations that the essential insights from practioners who work in groundwater management are less well provided than those of the international academic community. It remains important for the project to draw on the operational and practical experience of the former and the view from the district or local office and the field. Realistically, this is difficult to do first hand within the scope and budget of the project, but the project consultation mechanism (PCM) may provide the best opportunity for this.

The regional consultations have shown that local groundwater governance success stories can be found almost everywhere. While probably beyond the immediate resources of the present project, an initiative to collect some of these together for the benefit of others and to underpin the Framework for Action would be well worthwhile.

One suggestion was that, following the example of the ‘Year of Chemistry’ it would be good to think of an experiment related to groundwater governance and management which, through the network of UNESCO schools, could be used to raise global awareness of groundwater issues.
References

Contributions to the regional consultation in the form of presentations, workshop interventions and summaries and the responses to the questionnaires have been attributed in the text and boxes of this report. Additional material used is referenced in the conventional manner and listed here.


