Groundwater Resources Assessment Workshop

GGRETA Project - Pretashkent Aquifer Case Study

Almaty, Kazakhstan, 6-7 Nov 2014

Agenda

Objectives:

- **To present and discuss the results on collection and processing of hydrogeological, socio-economic and environmental data relevant for the Pretashkent Aquifer;**
- **To present and discuss available data on legal and institutional aspect of groundwater management in Kazakhstan;**
- **To present the Information Management System for the the Pretashkent Aquifer and discuss input requirements and functionality of the system;**
- **To start in depth assessment of the Pretashkent Aquifer and make related agreements.**

DAY 1 • Thursday, 6 Nov 2014

9:00 - 9:30 Welcome addresses
- Mr Lazarev, Director UNESCO Cluster Office in Almaty
- Mr Seversky, Chair of the National Committee of UNESCO-IHP in Kazakhstan
- Mr Isaev (State Committee of Geology of Kazakhstan) (tbc)

9:30 - 10:00 GGRETA project (recap), objectives and agenda of the meeting
- Presentation: Mr N. Kukuric
- Questions + Discussion

10:00 - 10:30 Overview of GGRETA activities in Kazakhstan (carried out and planned)
- Presentation: Mr O. Podolny
- Questions + Discussion

10:30 - 10:45 Coffee break

10:45 - 13:00 Reporting on data collection and processing
- Hydrogeology (Mr N. Baizakov and Ms V. Salybekova)
- Socioeconomic and environmental data (Ms V. Salybekova and Ms I. Skorintseva)

13:00 - 14:00 Lunch

14:00 - 15:00 Reporting on data collection and processing, cont.
- Hydrogeology (Mr N. Baizakov and Ms V. Salybekova)
- Socioeconomic and environmental data (Ms V. Salybekova and Ms I. Skorintseva)
- Questions + Discussion

15:00 - 15:30 Gender issue and PCCP
- Presentations: Mr Gevinian
- Questions + Discussion

15:30 - 16:00 Legal and institutional aspects
- Presentation: Mr Petrakov
- Questions + Discussion

16:00 - 16:15 Coffee break

16:15 - 16:45 Information Management System (IMS)
- Presentation: Mr. Kukuric
- Questions + Discussion

16:45- 17:30 Plenary discussion, day recap, second day planning

15:30 End of the Day 1

DAY 2 • Friday, 7 Nov 2014

9:00 - 10:30 Remaining data collection and processing
- Data gaps
- Processing
- Harmonisation
- Visualisation

10:30 - 10:45 Coffee break

10:45 - 13:00 Assessment of the Pretashkent Aquifer
- General assessment
- Indicator based assessment

13:00 - 14:00 Lunch

14:00 - 15:30 Conclusions and agreements

15:30 End of the meeting

Groundwater Resources Assessment Workshop

Project: GGRETA Project - Pretashkent Aquifer

Report

Members present:

Mr. Lazarev, Director UNESCO Cluster Office in Almaty
Mr Seversky, Chair of the National Committee of UNESCO-IHP in Kazakhstan
Mr A. Isayev, State Committee of Geology of Kazakhstan
Ms. K. Tovmassyan, UNESCO Cluster Office in Almaty
Mr N. Kukuric, IGRAC
Mr S. Gevinian, UNESCO
Mr O. Podolny, National Coordinator
Mr T.Mavlyanov , State Committee of Geology of Uzbekistan
Ms I. Skorintseva, Technical Specialist Socioeconomic and Environmental Issues
Ms V. Salybekova, Technical Specialist Hydrogeology and GIS
Ms. T. Borisova Specialist Socioeconomic and Environmental Issues

Guests
Mr. S. Karpov, UNESCO Cluster Office in Almaty
Ms. E. Conkevich, Head UN Women for Central Asia
Ms. M. Korovina, PhD Student

Meeting called to order at 9:30 by meeting chair Kristine Tovmasyan.

Welcome addresses

- Mr Lazarev, Director UNESCO Cluster Office in Almaty
- Mr Seversky, Chair of the National Committee of UNESCO-IHP in Kazakhstan
- Mr A.Isayev (State Committee of Geology of Kazakhstan)

Reading of Agenda
Motion: To approve the agenda for 06 Nov 2014
Vote: Motion carried
Resolved: Agenda for the meeting approved without modification

1. GGRETA project (recap), objectives and agenda of the meeting

- Presentation: Mr N. Kukuric
Objectives and agenda of the meeting.
About: GGRETA project complex review , phase 1 and 2.
About work completed by the Kazakhstan technical team.
Next phase – harmonization in 2015.

Questions:

Main parameters and indicators to be discussed during the meeting

2. Overview of GGRETA activities in Kazakhstan (carried out and planned)
Mr O. Podolny.
Presentation 1. Prepared indicators and parameters.
Presentation 2. Groundwater balance. Sources of recharge and discharge.

Questions discussed:

Sources of discharge (border on Syr Darya river)

Sources of recharge (is it only outcrops of Cenomanian aquifer)

By the isotopic survey it is studied that groundwater age is about 1.6-2.6 bil. years. Therefore can we take into account studied recharge zones.

3. Reporting on data collection and processing.
Salybekova V. Hydrogeological and environmental aspects on Pretashkent TBA.

Questions discussed:

- About graph on average groundwater abstraction;
- Drawdown during abstraction.

4. Socioeconomic and environmental data
Ms I. Skorintseva. Presentation.

Questions discussed:

- data series on average annual temperature and precipitations (no data on 2009, for some data series there is no data) ;
- animal mortuaries (spontaneous burial fields), pesticide warehouses and poultry farms water
- water abstraction on each site (to be collected, not finished yet)

5. Legal and institutional aspects Mr I. Petrakov. Presentation.
- Main legal documents on water resources in Kazakhstan

Questions discussed:

- Control mechanisms;
- The legal assessment methodology

6. Gender issues.
S.Gevinian Presentation.

Questions discussed:

The questioner prepared by WWAP

Applicability and availability of the data on gender issues.

Skorintseva – some of the questions are hard to apply for Kazakhstan. Not enough data. Field work is required

Petrakov suggested:

First phase – to correct list of questions;

Second phase – field works

Decision: Petrakov to review the list of questions.

E. Conkievich – its an important issue for the region. The list of questions is very inserting. UN women to get back to UNESCO with suggestions on a possible cooperation

T. Mavlyanov – why is gender assessment conducted in this study?

7. PccP. Presentation

S.Gevinian

Questions discussed:

Usefulness of the course for the region

V.Salybekova shared her experiences on the course taken at IHE

8. Discussion on indicators and parameters

A. Physiography and climate

A.1. Temperature	
	Format
Description of temperature in the aquifer area, including an overview of the temporal and spatial variation. Data from 4 State and 5 Private meteorological stations in the aquifer area. • **Prepared data table on temperature (mean minimum, mean maximum), graphs of monthly mean values, Map of spatial distribution of mean temperature in aquifer area.** • **Need translation in English**	**Text:** Mean values **Table + graphs:** Time series with monthly averages **Map:** raster and isolines in ArcGIS 10.2
	Unit
	[Degrees Celsius]

A.2. Precipitation	
Description	**Format**
Description of precipitation in the aquifer area, including an overview of the temporal and spatial variation. • **Prepared database on mean annual precipitation (mean minimum, mean maximum), Map and graps on spatial distribution of mean precipitation in the aquifer area.** • **No data on 2009, some values on other data series missed**	**Text:** Mean values **Table + graphs:** Time series with monthly averages **Map:** raster and isolines in ArcGIS 10.2
	Unit
	[mm/yr], [mm/day], [mm/month]

A.3. Evapo-transpiration	
Description	**Format**
• No data • No influence	

A.4. Land use / land cover	
Description	**Format**
Prepared map, graphs and tables on: • Agricultural land, differentiating between non-irrigated (rainwater fed or groundwater-fed) and irrigated (irrigated by groundwater or irrigated by surface water) • Groundwater supported wetlands and ecosystems • Need translation	**Map:** raster and isolines in ArcGIS 10.2

A.5. Topography and elevation	
Description	**Format**
• Prepared topographical map	**Map:** raster and isolines in ArcGIS 10.2
	Unit
	Meters above mean sea level

A.6. Surface water network	
Description	**Format**
• Prepared map of irrigated lands • Need translation	**Map:** ArcGIS, raster

B. Aquifer Geometry

B.1. Hydrogeological map	
Description	**Format**
• Hydrogeological map	**Map Info, raster**

B.2. Geo-referenced boundary of Transboundary Aquifer / Aquifer System	
Description	**Format**
• Prepared schematic map of boundaries of TBA	**Map Info, raster**

B.3. Depth of water table / piezometric surface and groundwater flow direction	
Description	**Format**
• Prepared map of piezometric surface of TBA	**Map Info, raster**

B.4. Depth to top of aquifer formation [m]	
Description	**Format**
Prepared map of top surface of TBA	**Map Info, raster**

B.5. Vertical thickness of the aquifer (system) including aquitards / aquicludes	
Description	**Format**
Prepared map of vertical thickness of TBA	**Map Info, raster**

B.6. Degree of confinement	
Description	**Format**

Prepared map of sites of Pretashkent TBA on the Earth's surface	**Map Info, raster**

B.7. Representative cross-sections	
Description	**Format**
Prepared 6 cross-section lines	Raster, CRD

C. Hydrogeological characteristics

C.1. Aquifer recharge	
Description	**Format**
Prepared map of natural recharge zones	**Map Info, raster**

C.2. Aquifer lithology	
Description	**Format**
Prepared text report	Text describing lithology, including lateral and vertical variations

C.3. Soil types	
Description	**Format**
Prepared map on type of soils Sort text report need translation	**Map:** raster and isolines in ArcGIS 10.2

C.4. Porosity	
Description	**Format**
Mentioned in a text report with lithology	Text

C.5. Transmissivity and vertical connectivity	
Description	**Format**
Prepared transmissivity map	**Map Info, raster**

C.6. Total groundwater volume	
Description	**Format**
Text report	Text

C.7. Groundwater depletion	
Description	**Format**
Prepared text report, graphs and tables	Text, based on tabular information or maps

C.8. Natural discharge mechanisms	
Description	**Format**
For Pretashkent TBA discharge is equal to abstraction. Estimations shown in a text report	Text

C.9. Discharge by springs	
Description	**Format**
No data	

D. Environmental aspects

D.1. Natural groundwater quality / suitability for human consumption	
Description	**Format**
Prepared map of groundwater mineralization Text report *Need to simplify map	Text **Map Info, raster**

D.2. Groundwater pollution	
Description	**Format**
No pollution	**Text**

D.3. Solid waste and waste water control	
Description	**Format**
Prepared map of landfills Text report	**Map:** ArcGIS, raster **Text**

D.4. Shallow groundwater table and groundwater dependent ecosystems	
Description	**Format**
No data	

E. Socio-economic aspects

E.1. Population Density and total population per municipality	
Description	**Format**
Prepared text, maps and graphs Need translation	**Map:** ArcGIS, raster **Text**

E.2. Groundwater use	
Description	**Format**
Prepared: - text report on GW use * Data will be modified	**Text** **Table** **Map**

E.3. Surface water use	
Description	**Format**
Prepared text, maps and graphs Need translation	**Map:** ArcGIS, raster **Text**

E.4. Dependence of industry and agriculture on groundwater	
Description	**Format**
Text report	**Text** **Tables and graphs**

E.5. Percentage of population covered by public water supply	
Description	**Format**
Text report	**Text** **Table**

E.6. Percentage of population covered by sanitation	
Description	**Format**
Text report	**Text** **Tables**

F. Legal and institutional aspect

Not finished by the expert

Methodology to be discussed and explained to expert

07 Nov 2014

Members present:
Mr. Seversky, Chair of the National Committee of UNESCO-IHP in Kazakhstan
Mr A. Isayev , State Committee of Geology of Kazakhstan
Ms. K. Tovmassyan, UNESCO Cluster Office in Almaty
Mr N. Kukuric, IGRAC
Mr S. Gevinian , UNESCO
Mr O. Podolny, National Coordinator
Mr T.Mavlyanov, State Committee of Geology of Uzbekistan
Mr. N. Baizakov, Technical Specialist Hydrogeology
Ms I. Skorintseva, Technical Specialist Socioeconomic and Environmental Issues
Ms V. Salybekova, Technical Specialist Hydrogeology and GIS
Ms. T. Borisova Specialist Socioeconomic and Environmental Issues

Reading of Agenda
Motion: To approve the agenda for 07 Nov 2014
Vote: Motion carried
Resolved: Agenda for the meeting approved without modification

1. Presentation: Mr N. Kukuric

Presentation on IMS.
About GGIS 2.0.
Information for public and private use.

Questions:

- List of main points of assessment
- List of information for public use
- N. Kukuric - Proposal and review of a training course on IMS
- T. Mavlyanov – can the data base stay locked on a national level?
-

2. Discussion on indicators (table below)

3. Discussion on Data gaps and timing
   To be completed by the end of December

Findings and Achievement

4. The exact recharge of the aquifer is not well known. Water is reaching the aquifer form 3 small areas of recharge (mountains, river bed, and fault)

Participants learned that the aquifer is renewability is considered to be 6000 years.

1. Gas storage – Messrs Isaev and Podolny stressed that gas storage is located at the depth of approximately 700 m compared to the 1500 of the depth of Pretashkent aquifer and is not connected or affect the waters of Pretahkent. There is no noticeable pollution.,
2. Field works completed by Mr. Baizakov. The hard copies of the water level measurements were brought to the workshop.
3. Uzbekistan and Kazakhstan classify the aquifer differently
   Its considered as mineral water in Uzbekistan and fresh in Kazakhstan
4. PCCP presentation generated some interest mainly due to an input of one the IHE preventive diplomacy courses participants, Valentina Salybekova
5. Two of the participant already have taken part in a similar training conducted by the local NGOs in Kazakhstan
6. Preliminary calculation of the indicators (parties agreed that indicators 1.2 1.4 21. 2.2 2.3 2.4 2.5 will be 0
7. Socio-economic and Environmental assessment methodology does not work per region (3 in Kazakhstan) but had to be divided into 43 communes to get the right representation
8. Thanks to the exercise national experts produced a new unique map dividing the region per agricultural communities
9. Abstraction did not change much from 89 however still much higher than recharge – Same situation in Uzbekistan
10. Number of agricultural farms has risen however the output of the farms has reduced (agedly due to shortages of water)
11. Parts of the assessment methodology would be misleading as Kazakhstan is agricultural in the area with 500K population whereas Uzbekistan urban and industrial with 6 mln.
12. Groundwater is a state property where as well are private
    Up to 50 m3 is free to use
    50m3-2000m3 require a licence/ permit
    over 2000m3 a special contract

5. Conclusions and agreements

1. National experts will fill the data gaps by the end of 2014
   Mr. Boizakov for instance will provide the information on water consumers by the end of November
2. Neno Kukuric is to send a short list of questions to be addressed in a midterm report by the national experts
3. National experts are to write a short description incorporating the below
   a. which data is collected

b. quality of data
c. scope of data
d. experts opinion on the results of compiled data
e. what can we learn from the data collection and processing exercise

4. Neno Kukuric proposed a capacity building session to be held at IGRAC in Delft in early-mid February
   National experts will be shown and trained on uploading into and using the data in the systems, its utility and functionality inc. right map projections etc.
   The purpose of the meeting is to use national technical experts' expertise and vision for improving the information database
   National experts are expected to finalise the indicator based assessment at the Deft meeting
5. Uzbekistan committed to providing the hydrogeological data by the beginning of February (provide the permissions from MFA to participate in the project)
   Socio-economic and environmental assessment might prove to be more problematic
6. All parties agreed on a first preliminary report to be produced at the end of December 2014 – beginning of January 2015
7. Uzbekistan promised to use the same classification and legends in order to save time on Harmonisation
8. Its been agreed to hold a training on international law, PCCP and finalise the legal assessment in April 2015
9. Its been mentioned that Pretashkent should be translated into Russian as Pr-I-Tashkent (with И instead of E) for both countries

Note:
National experts stated that due to some of the requested data being classified they will require an official request form UNESCO to the Kazakh MFA to grant the permission to access the data (for instance for temperature which costs 200 Euros per figure)

Indicators

Core indicators are marked in grey. Additional indicators are unmarked (white)

1 - Defining or constraining the value of aquifers and their potential functions					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring***	**Remarks**
1.1	Mean annual groundwater recharge depth (mean annual recharge volume per unit of area)	Long-term mean groundwater recharge, including man-made components (return-flows, induced recharge, artificial recharge), divided by area	mm/year	1. Very low: < 2 mm/yr 2. Low: 2 -20 mm/yr 3. Medium: 20-100 mm/yr 4. High: 100-300 mm/yr 5. Very high: > 300 mm/yr	Weakly time-dependent, but margin of uncertainty is greater than possible variations over time.
1.2	Annual amount of renewable groundwater resources per capita	Long-term mean groundwater recharge, including man-made components, divided by the number of inhabitants of the area occupied by the aquifer	m^3/yr/capita	1. Low: < 1000 2. Medium: 1000 - 5000 3. High: > 5000	Time-dependency mainly related to the number of inhabitants
1.3	Natural background groundwater quality	Percentage of the area occupied by the aquifer where groundwater is found of which natural quality satisfies local drinking water standards	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80%	Suitability for drinking water used as criterion. It is accepted that local drinking water standards may vary.
1.4	Aquifer buffering capacity	Ratio between volume stored and long-term mean groundwater recharge (equivalent to mean residence time)	year	No data, to be specified	Mainly meant as a simple proxy for the aquifer's resilience to climatic variability
1.5	Aquifer vulnerability to climate change	Extent of expected groundwater budget regime change in response to change in climatic conditions	ordinal score	1. *Low*: confined aquifers containing only fossil water or receiving negligible recent recharge. 2. *Medium*: weakly recharged aquifers with limited interaction with other components of the hydrological cycle, due to location at considerable depth and/or hydraulic	Class 1 corresponds to 'non-renewable groundwater'.

				confinement. *3. High*: aquifers actively interacting with streams, atmosphere and/or sea (e.g. coastal aquifers, SIDS, shallow water-table aquifers, karst aquifers)	
1.6	Aquifer vulnerability to pollution	Percentage of its horizontal area where the aquifer is considered moderately to highly vulnerable to pollution	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80% NO	Approximate criteria for "Moderately to highly vulnerable: " > 100 in DRASTIC method (if data availability is limited make use of GOD method where > 0.3 would be the threshold
2 - Role and importance of groundwater for humans and the environment					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring**	**Remarks**
2.1	Human dependency on groundwater	Percentage of groundwater in total water abstraction for all human water uses.	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80% To be specified	Abstraction of water includes the quantity used and all losses.
2.2	Human dependency on groundwater for domestic water supply	Percentage of groundwater in water abstraction for domestic water use.	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80% To be specified for KZ UZB use only for balneology	Abstraction of water includes the quantity used and all losses.

2.3	Human dependency on groundwater for agricultural water supply	Percentage of groundwater in water abstraction for agricultural water use (mainly irrigation).	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80% NO	Abstraction of water includes the quantity used and all losses.
2.4	Human dependency on groundwater for industrial water supply	Percentage of groundwater in total water abstraction for domestic water use.	%	1. Very low: < 20% 2. Low: 20 -40% 3. Medium: 40-60% 4. High: 60-80% 5. Very high: > 80% NO for KZ To be specified UZB	Abstraction of water includes the quantity used and all losses.
2.5	Ecosystem dependency on groundwater	Percentage of the aquifer's area where the aquifer has a phreatic water level shallower than 5 m below surface	%	1. Very low: < 5% 2. Low: 5 – 10% 3. Medium: 10-25% 4. High: 25-50% 5. Very high: > 50% NO	Phreatic water level taken as a proxy
2.6	Prevalence of springs	Total annual groundwater discharge by springs, divided by mean annual groundwater recharge	%	1. Very low: < 5% 2. Low: 5 – 10% 3. Medium: 10-25% 4. High: 25-50% 5. Very high: > 50%	Springs are very sensitive for changes in groundwater budget. Therefore a meaningful indicator of change.
3 – Changes in groundwater state					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring**	**Remarks**
3.1	Groundwater depletion	Observed current rate of long-term progressive decrease of groundwater storage (accompanied by steadily declining ground-water levels), expressed as an equivalent depth of water averaged over the aquifer.	mm/year	1. Absent to very low: < 2 mm/yr 2. Low: 2 -20 mm/yr 3. Medium: 20-50 mm/yr 4. High: 50-100 mm/yr 5. Very high: > 100 mm/yr Equal to abstraction,	Depletion should target a long-year trend; short-term variations due to climatic variability should be discarded.

				To be specified	
3.2	Groundwater pollution	Observed polluted zones as a percentage of total aquifer area (due to pollution caused water quality to exceed drinking water quality standards)	%	1. Very low: < 5% 2. Low: 5 – 10% 3. Medium: 10-25% 4. High: 25-50% 5. Very high: > 50% NO	Local drinking water quality standards as a criterion.
4 - Drivers of change and pressures					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring**	**Remarks**
4.1	Population density	Number of people per unit of area on top of the aquifer	Persons/ km^2	1. Very low: < 1 p/km^2 2. Low: 1-10 p/km^2 3. Medium: 10-100 p/km^2 4. High: 100-1000 p/km^2 5. Very high: > 1000 p/km^2 To be specified by Skorintseva	
4.2	Groundwater development stress	Total annual groundwater abstraction divided by long-term mean annual groundwater recharge	%	1. Very low: < 2% 2. Low: 2-20% 3. Medium: 20-50% 4. High: 50-100% 5. Very high: > 100% To be specified by Skorintseva	Measure for the degree of modification of the groundwater budget (repercussions for outflow and storage)
INDICATORS BELOW RELATE TO LEGAL AND INSTITUTIONAL. THIS SECTION IS STILL UNDER DEVELOPMENT					
5 – Enabling environment for transboundary aquifer resources management					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring**	**Remarks**
5.1	Transboundary legal framework/SIDS groundwater management legal framework	Existence, status and comprehensiveness of a binding agreement on the transboundary aquifer or SIDS groundwater under consideration	Scores	1. No agreement in existence, nor under preparation 2. Agreement under preparation or available as an unsigned draft	

				3. Agreement with limited scope signed by all parties (e.g. agreement to co-operate or exchange information) 4. Agreement with full scope for TBA management or SIDS groundwater management signed by all parties. To be specified by Petrakov	
5.2	Transboundary institutional framework/SIDS groundwater management institutional framework	Existence, mandate and capabilities of institutions or institutional arrangements for managing the transboundary aquifer or SIDS groundwater under consideration (all types of interventions)	Scores	1. No institutions in existence that have the mandate and capability for TBA management or SIDS groundwater management 2. Such institutions do exist, but with limitations in mandate and/or capability for TBA management or SIDS groundwater management 3. Domestic agencies do exist that have full mandate and adequate capabilities for TBA management or SIDS groundwater management 4. A special bi- or multi-national transboundary institution has been established with full mandate and adequate capabilities for joint management of the specific TBA. (in case of SIDS: an institution has been established with full mandate and adequate capabilities for SIDS	The institutions are not only in charge of the implementation of legal measures, but also of other aspects of TBA management or SIDS groundwater management (plan development, economic measures and incentives, monitoring, etc.) Note: Capabilities here interpreted in terms of staffing and budget (compared to needs)

				groundwater management) To be specified by Petrakov	
6 – Implementation of groundwater resources management measures (In TBA or SIDS)					
No	**Categories and indicator names**	**Indicator definitions**	**Units**	**Classification/ scoring**	**Remarks**
6.1	Control of groundwater abstraction	Current practices on the implementation of measures to control groundwater abstraction	Scores	1. No measures for control applied 2. Indirect methods applied (incentives, disincentives) 3. Direct measures applied (licensing with strictly adhered criteria for granting or refusal) 4. Combination of indirect and direct methods applied. To be specified by Skorintseva	Note: licensing systems that only require a licence fee to be paid after which a license always is granted should be rated as "no measures implemented".
6.2	Groundwater quality protection	Current practices on the implementation of groundwater quality protection	Scores	1. No protective measures applied 2. Land use planning used as a tool for groundwater quality protection 3. Prohibition of the use or disposal of certain chemicals or waste 4. 'Polluter pays' principle applied 5. Combination of two or more categories of protective measures. To be specified by Skorintseva	

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