Inventory of existing guidelines and protocols for groundwater assessment and monitoring

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1 General Approach of the Inventory Introduction

1.1 Context

The inventory of guidelines and protocols in the fields of groundwater assessment and monitoring constitutes one of the initial activities of the International Groundwater Resources Assessment Centre (IGRAC).

IGRAC focuses on three fields of activities (see also http://www.igrac.nl/):
a) Establishing a Global Groundwater Information Centre;
b) Promoting and producing guidelines and/or protocols for improved assessment and monitoring of groundwater resources;
c) Contributing to global projects with a significant groundwater component.

The inventory of Guidelines and Protocols (G&P), presented in this report, is part of the second field of activities.
The rationale behind this field of activities is that groundwater data and information - in a world-wide sense - are still very scarce, not always of good quality and less uniform than desirable. G&P are believed to have a positive impact on completeness, uniformity and quality of data collection and analysis programmes, which in turn, will improve the level and quality of groundwater assessment. Indirectly this will promote safe and sustainable use of groundwater resources. Information on internationally available G&P can be used in countries where national developments of G&P are absent or less advanced. It can also be used to update existing G&P.

The primary goal of the inventory is to improve access of the international groundwater community to guidelines and protocols that might be useful to them. Secondly, the inventory is meant to be a first step for identification of the needs for guidelines and protocols in fields of groundwater assessment and monitoring that are inadequately covered.

1.2 Objectives and scope of the inventory

The objectives of the inventory of guidelines and protocols are the following:
- To obtain a broad overview of existing G&P in the fields of groundwater resources assessment and monitoring, available either in the form of hard copies or as digital documents on internet;
- To gain insight into the subjects, scope, status, and availability of G&P;
- To find out how accessible these published G&P are;
- To identify fields of groundwater resources assessment and monitoring that are not or inadequately covered by G&P.

The inventory of guidelines and protocols focused on procedures, methods and techniques, relevant to groundwater resources assessment and monitoring. This encompasses fields such as geophysical surveys, drilling, well logging, well installation and development, pumping tests, sampling and analysis of groundwater data, etc. as well as more complex issues, such as groundwater assessment and monitoring.
Selection of G&P has been limited to methods and techniques of investigation, analysis and presentation, aimed at investigating the physical, chemical and biological properties of subsoil and groundwater. More general techniques, such as management and processing of data, with no particular impact on assessment of groundwater resources, have been omitted.

For practical reasons, the first search has been confined to documents in the English language. This is not a principal choice, but a purely pragmatic one. G&P written in other languages may be added in a later stage, if the need is there.
Analysis of available G&P, as presented in this report, has been mainly based on the titles of guidelines and protocols, as only from a small percentage (10 – 15 %) complete documents were available. IGRAC intends to gradually perform a more in-depth analysis of the documents, with priority for subject-fields that are poorly covered with G&P.

1.3 Outline of the Inventory Report

Chapter 2 of the report describes the general approach followed during the inventory of Guidelines and Protocols (G&P). The role of various organisations in production, promotion, prescription and use of G&P is discussed in Chapter 3. An overview of the identified G&P, classified according to different categories, is presented in Chapter 4. Chapter 5 contains a summary and evaluation of the results of the inventory. Chapter 6 lists the conclusions and recommendations.

The appendices of the report provide the categories of inventoried documents, listed on the basis of subjects. Also the type of document has been indicated. An overview of the appendices and their subject-categories is given below:

A: Category 'Drilling and well construction'
B: Category 'Surveys and field tests'
C: Category 'Field measurements and sampling'
D: Category 'Soil Quality'
E: Category 'Water Quality'
F: Category 'Data analysis and mapping'
F: Category 'Monitoring networks'
G: Categories 'Groundwater Modelling and Miscellaneous'

The codes in the columns of the tables (A1, A2, etc.) are only used for the purpose of sorting and have no other meaning.

1.4 Internet version

The *Inventory report* has been put on the IGRAC-site of internet (http://www.igrac.nl/) after a first round of corrections. Appendices of this report provide a "dated" overview of the documents inventoried. For practical reasons the tables in the appendices have been confined to title, type of document and category (or categories) of subjects covered.

An *extended version of the database of documents* that includes details on authors, subjects covered, scope, reference codes, links to the documents, etc. will be put on the IGRAC-internet site. This internet version of the documents will be regularly updated.

General Approach of the Inventory

In order to find a sufficient number of G&P for the fields of groundwater assessment and monitoring, the inventory has been set up as broad as possible, although limited by the amount of time available. The approach consisted of 3 steps, viz.:

- A search of G&P on internet,
- A search of G&P by using personal (international) contacts
- A search of G&P by consulting the catalogues of selected libraries.

1.5 Internet search

The internet search for G&P has been performed both on the basis of selected topics and through organisations.

Search on the basis of selected topics

G&P or references to them can in principle be found on the internet, by searching directly for specific topics. For that purpose, the Google search engine was used, mainly because of its fastness, flexibility and fertility. It allows performing an advanced search by using word combinations.

It depends on the search instruction how many results the engine will yield. A search list with combined words in a certain order will restrict the number of results. Next table gives examples of the huge numbers of items found in a search by selected topics.

Table 1.1 Example of search result

	Search instruction in Google	Number of hits found
1	Ground water assessment	433,000
	Groundwater assessment	351,000
	"ground water assessment"	1,330
2	Ground water monitoring	473,000
	Groundwater monitoring	375,000
	"ground water monitoring"	20,300
3	"ground water monitoring" guideline	4,600
	"ground water monitoring" assessment	312

The table shows the difficulties faced when searching by topics. The search engine comes up with too many hits. The given Uniform Resource Locators (URL) refer to text on Internet sites, titles of documents or even text within WORD or PDF documents. It is clear that the majority of these URL does not refer to proper material for the inventory. Based on the titles or the brief description of the URL, one has to decide which URL to trace and which not. Even after carefully choosing the word combinations and putting them in a fixed order, the search may result into some hundreds of items, not all of them very useful. This process also demonstrates the need for a more structured set-up of a search system on G&P by IGRAC.

Although the given URL just sporadically refer to useful material, they indirectly refer to organisations in the field of groundwater (assessment). The next step is to focus the inventory on these organisations. One of the results of this Internet inventory has been the discovery of importance of the American Society for Testing and Materials (ASTM).

Search through organisations

During the search through organisations, Internet sites of a number of selected organisations were visited. The selected organisations are listed below in alphabetic order (name and Hyperlink).

- EPA Environmental Protection Agency (http://www.epa.gov/)
- IAH International Association of Hydrogeologists (http://www.iah.org/)
- ISO International Organisation for Standardization (http://www.iso.ch/iso/en)
- UNECE United Nations Economic Commission for Europe (http://www.unece.org/)
- UNESCO United Nations Educational, Scientific and Cultural Organization (http://www.unesco.org/)
- USGS United States Geological Survey (http://water.usgs.gov/)
- WMO World Meteorological Organization (http://www.wmo.ch/)
- ASTM American Society for Testing and Materials (http://www.astm.org/)

Detailed information about the organisations can be found on their internet sites.

Most organisations provide on their homepages a site-specific search tool with various entries. The IGRAC search focused on the records presented on the Internet site itself or on separate digital libraries or catalogues made accessible via Internet by the owner organisation. The results are an indispensable supplement to the 'Google search'.

On many of these Internet sites useful titles were found. For instance, the International Organisation for Standardization (ISO) publishes large collections of standard guides for determining Soil Quality and Water Quality and continues to update and develop them. Another interesting series is found on the site of the United States Geological Survey (USGS). This organisation started publishing a series called: *Techniques of Water-Resources Investigations of the United States*, which now consists of 9 Chapters with a total of more than 50 different topics.

Internet pages of these organisations often contain a list of links to other organisations in the same field. These links have also been screened and searched when considered useful for the inventory.

1.6 Consultation of international experts

One of the main sources of information for G&P consists of experts active in the field of groundwater assessment and monitoring. IGRAC staff members consulted experts not only from their own organisation and The Netherlands, but from several other countries as well. These contacts were established either by mail or by telephone.

The results of this part of the inventory are not yet optimal. Because of time constraints, only a limited number of persons could be questioned about the development and use of guidelines in their country. From these persons only a few were able to provide new material, but many came up with new and useful references. They shall be invited to come up with comments and needs.

IGRAC is committed to play a major role in sharing groundwater information within the international field of groundwater assessment and monitoring. Therefore, IGRAC intends to actively interact with the international community of groundwater experts. This inventory of G&P may be considered a step in that direction.

1.7 Library searches

Apart from the Internet, also libraries provide access to information about Groundwater Assessment. Most libraries can be visited through Internet, though some of them require a paid subscription. Well-known international databases are:

- Georef: http://georef.cos.com/
- Geography: http://www.lib.uwaterloo.ca/discipline/geog/
- Geosource: http://www.library.uu.nl/geosource/
- Web of science: http://library.caltech.edu/scisearch/default.htm

Searches in libraries can be done through their extensive databases. A useful search system for science-oriented searches is Scirus (http://www.scirus.com/), launched by Elsevier Science, international publisher of scientific information. Scirus can be used to search free sources and journal sources as well as peer-reviewed articles.

The library search by IGRAC has added just a few titles to the total list of G&P. Similarly to the Internet search by selected topics, a library search produces an extensive list of titles. However, most books or articles do not contain the information IGRAC needs, as many of them deal with detailed scientific research. Another disadvantage of library searches is the lack of direct links to the internet sites of publishing organisations that might be useful for further searches.
Based on this experience it was concluded that libraries do not provide quick access to information about G&P, but may be consulted for a book or its summary, once the title is known.

1.8 Limitations of the inventory

The inventory of G&P has been limited by a number of factors:

Time was a limiting factor. IGRAC has opted for producing within limited time an inventory report that can be used to trigger world-wide response, rather than postponing such interaction until the first draft would be more comprehensive.

IGRAC's network of contacts is still in an early phase of development. As a consequence, direct contacts with professionals have not yet produced as much information as they potentially might have done. Therefore, searches were mainly confined to internet-searches and some library consultations.

Internet and digital library searches have some limitations as well. Internet-searches are limited to material made available on the internet. It is not possible to find documents only available in the form of printed matter, unless they have a reference on the Internet sites. It also takes more time and effort to trace those documents and get a hard copy. Furthermore, complete databases of organisations and libraries are automatically excluded from being searched, if they have not been made accessible through Internet.

Because of staff and language limitations, the first inventory had to be restricted to documents in the English language. This means that documents in other languages have not been included so far. IGRAC will decide later whether and how to collect information on relevant documents in other languages.

1.9 Definitions used in this report

A great variety of terms is used to characterise the books, reports and other documents that deal with theory, procedures, methods and practices in the fields of groundwater assessment, development, monitoring and management. On top of that the organisations for standardisation (e.g ISO, ASTM) have their own preferential terminology to classify their standardised documents.

In order to enable classification of documents collected from different sources (organisations, institutions, and individuals) in a consistent manner, a set of IGRAC-definitions have been formulated. The definitions, given in the table below, are meant to be unambiguous with respect to significance. In order to make sure that they cover important groups of documents inventoried, the definitions have been formulated in a way compatible with the definitions of organisations for standardisation.

Table 2.2: IGRAC-definitions used in the report

Category	Type of document	Definitions and Explanation
Guidelines	Handbook	A book that primarily focuses on giving information about a subject. Example: *Application of drilling, coring and sampling techniques to testholes and wells (USGS)*
	Guide	A compendium of information or series of options, that focuses on providing methodological guidance. Example: *"Analysis and Evaluation of Pumping Test Data", by Kruseman and De Ridder.*
	Manual	A book that provides instructions for use of a tool or program, or for performing a specific operation. Example: *"Manual on Groundwater Data Collection, Processing and Storage" (Hydrology Project, India)*
Protocols	Standard Guide	A standard compendium of information or series of options, that focuses on providing methodological guidance, rather than specifying a course of action.
	Standard Test Method	A standard procedure for determining or testing the properties of a system, or the relation between them, aimed at producing a test result.
	Standard Practice	A standard definite set of instructions for performing one or more specific operations, not aimed at producing a test result

Comments with respect to the definitions:

- The IGRAC-category "**Guidelines**" covers a variety of documents that provide guidance to the user with respect to methods, practices or tools in the field of groundwater. Guidelines often relate to a broader field of subjects than protocols do.
- The IGRAC-category "**Protocols**" covers a set of standard documents on procedures, methods or tests in the field of groundwater, that have been subjected to a quality assurance procedure, for instance by organisations for standardisation.
- In groundwater practice there is no sharp difference between the terms "handbook" and "guide". Both terms are used at taste.
- ASTM documents inventoried are covered by the ASTM definitions of "Standard Guides", "Standard Test Methods" and "Standard Practices", which can be found on the ASTM web site. The IGRAC definitions for these standards, provided in the table, are slightly different but still compatible with the ASTM-definitions.

1.10 Remarks concerning classification of documents

Classifying the documents in a consistent way proved to be difficult, as may be demonstrated by the following examples:

- The type, subject and scope of many documents had to be deduced from their title, no other information being available. However, the title does not always provide enough information. Therefore, the classification may have to be reviewed after analysing the documents in more detail.
- Some documents named “guidelines” or “guides” or “manuals” consist of thick volumes, each chapter containing an introduction followed by a list of references, ranging from handbooks to international standards. Such volumes have been classified as “guides”.

For the classification of the type of documents in this report, the definitions given by ISO and ASTM have been used with minor adjustments. However, as far as ISO and ASTM documents are concerned, the terminology used by these Organisations should be consulted, whenever there are questions or doubts about the significance of formulation in these documents.
Both ISO- and ASTM-documents have been assigned the status of “standard” (standard guides, methods or practices), because of comparable production and quality assurance procedures. No other documents inventoried have been given yet this status.

2 Production and use of G&P

2.1 Introduction

With respect to guidelines and protocols (G&P) in the field of groundwater, it is useful to distinguish between "production", "promotion", "prescription" and "use" of these documents.

- *Production.* Many documented "standard guides", "standard methods" and "standard practices" are produced by so-called organisations for standardisation, national as well as international. Before being awarded the status of standards they have to pass extensive screening procedures. Other producers of G&P are universities, research organisations (e.g. geological institutes), consultants or private persons (many handbooks).

- *Promotion.* A variety of international and national organisations and associations stimulate safe and sustainable use of the world's water resources through exchange of knowledge. They facilitate exchange of knowledge through congresses and publications, and pay much attention to solid and safe approaches in water resources assessment and monitoring. Examples of such organisations are UNESCO, WMO, and IAH.

- *Prescription.* Use of G&P may be prescribed by governments or their agencies (e.g. Environmental Protection Agencies), or by supra-national bodies (e.g. the European Union). Governmental organisations may make use of the available G&P, by prescribing them in their regulations. They may have special committees to screen the standards, such as CEN (European Union). Prescription may also form part of, for instance, contracts or certification processes.

- *Use.* Users (e.g. manufacturers, consultants, etc.) follow the G&P to test products, to conduct surveys or to carry out operations. The G&P may be used on a voluntary basis or on a compulsory basis, if they are prescribed or referred to in orders, commitments, terms of reference, etc.

In the following paragraphs some major producers of G&P and their procedures are briefly introduced.

2.2 Organisations for standardisation

The International Organisation for Standardization (ISO)

"ISO is the world's largest developer of standards. Although ISO's principal activity is the development of technical standards, ISO standards also have important economic and social repercussions. ISO standards make a positive difference, not just to engineers and manufacturers for whom they solve basic problems in production and distribution, but to society as a whole".

Relevant ISO-categories for IGRAC are "Soil-Quality" and "Water-Quality". There are various sub-fields, each with its own Standard Committee (SC) as shown in the following table for the category Soil Quality.

Table 3.1: Standard Committees and subjects in the Category Soil Quality

Standard Committee	Subject field
SC1	Soil Quality – Vocabulary
SC2	Soil Quality – Sampling methods
SC3	Soil Quality – Chemical methods and Soil characteristics
SC4	Soil Quality – Biological methods
SC5	Soil Quality – Physical methods
SC7	Soil Quality – Soil and site assessment

Similar standard-committees exist in the field of Water Quality.

Apart from the long list of available international standards in the field of soil quality, roughly 50 new ISO-standards are in the process of development for this area.
New standards have to pass five phases of a design and screening procedure, before being awarded the status of "International Standard (ISO)". These phases are New Work Item (NWI), Working group Draft (WD), Committee Draft (CD), Draft International Standard (DIS), Final Draft International Standard (FDIS) and International Standard (ISO).

American Society for Testing and Materials (ASTM International)

"ASTM, established in 1898, is one of the largest voluntary standards development organisations in the world. ASTM International is a not-for-profit organisation that provides a forum for the development and publication of voluntary consensus standards for materials, products, systems, and services. More than 20,000 members representing producers, users, ultimate consumers, and representatives of government and academia develop documents that serve as a basis for manufacturing, procurement, and regulatory activities".

Concerning the subjects of groundwater assessment and monitoring, the ASTM standards cover a broad field of activities. The following sub-fields can be distinguished:

Table 3.2: Fields covered by ASTM standards

Fields covered
• Site selection • Geophysical methods • Drilling • Water well installation, development, maintenance, rehabilitation, abandonment • Well tests and aquifer tests • Characterisation of groundwater bodies • Measuring groundwater levels • Sampling and analysis of groundwater quality • Groundwater assessment and presentation • Design of groundwater monitoring networks

ASTM standards are updated every five years. The standards have to pass a committee that can accept them for a new period or reject them.

Although ASTM is originally a national society, its standards are of international importance, as demonstrated by the fact that many of them have been included in the EPA "Guidelines for Groundwater Protection in Australia", for instance.

Other National Organisations for Standardisation

Many countries have their own national organisation for standardisation, such as the Dutch NEN and the German DIN organisations. Many of these organisations have links to ISO and take part in its activities. It is quite possible that these national organisations have come up with internationally interesting guidelines and standards. However, because of time constraints it was not considered practical to try and get an overview of the work of these organisations in this stage of the IGRAC activities. It will take more time to map these organisations and analyse their scope of activities.

Quality assurance procedures

Organisations for standardisation have well defined quality assurance procedures in place for design of the standards (standard guides, standard methods and standard practices). ISO and ASTM provide "a standard preparation manual" which describes the aspects to be covered, limitations to be specified, terminology to be used, quality demands to be met, minimum number of tests to be done, level of uncertainty to be expressed, comments from international experts and references to be included. The manual also specifies the layout of the document to be provided. The standard documents have to pass a number of phases, ranging from initiation to the level of final documents (see ISO).

2.3 Governmental organisations

Some governmental institutions, such as national geological surveys or environmental organisations, produce guidelines for groundwater resources assessment and environmental protection as well. The guidelines may consist of publications on groundwater and groundwater related subjects. In the table below the publications by the United States Geological Survey (USGS) are given as an example of a series of guideline documents.

Table 3.3: Guidelines produced by the United States Geological Survey (USGS)

Subjects of USGS guidelines
• Guidelines for collection and field analysis of GW samples for selected unstable constituents
• Application of surface geophysics to groundwater investigations
• Application of seismic-refraction techniques to hydrologic studies
• Borehole geophysics applied to groundwater investigations
• Aquifer-test design, observation, and data analysis
• Application of drilling, coring and sampling techniques to testholes and wells
• Type curves for selected problems of flow to wells in confined aquifers
• Regression modelling of groundwater flow
• Methods for determination of radioactive substances in water and fluvial sediments
• Quality assurance practices for the chemical and biological analyses of water and fluvial sediments
• Application of borehole geophysics to water-resources investigations.
• General Field and Office Procedures for Indirect Discharge Measurements
• Some Statistical Tools in Hydrology

These documents were produced between 1975 and 2000.

Another type of guideline identified consists of a comprehensive volume of selected groundwater subjects and groundwater related subjects, as published by the EPA of Australia, New Zealand and the USA. Each subject is presented by an introduction, followed by a recommended list of references to handbooks, guides, standards and articles. The Technical Guidance Manual from the United States Environmental Agency (US-EPA) is given as an example:

Table 3.4: "Technical Guidance Manual for Hydrogeologic Investigations and Ground Water Monitoring" (only technical fields mentioned)

Chapter	Title
3	Characterisation of Site Hydrogeology
4	Slug and Pumping Tests
5	Monitoring Well Placement
6	Drilling and Subsurface Sampling
7	Monitoring Well Design and Installation
8	Monitoring Well Development
9	Monitoring Well and Borehole Abandonment
10	Ground Water Sampling and Analysis
11	Supplemental Methods
12	Groundwater quality Data Organisation and Interpretation
13	Statistics for Groundwater Quality Comparison

On a national level or a project level there may be many more. An example is the guidelines and protocols produced by the *Hydrology Project in India*, of which not yet a full overview was available.

2.4 International organisations and associations

A number of international organisations or associations, active in groundwater or related fields, are also publishing G&P. They promote the use of standard procedures through congresses and workshops. UNESCO, WMO and IAH may be taken as examples:

Table 3.5: Examples of international publications

Organisation	Publications (or series)
UNESCO	Studies and reports in Hydrology
	Example: "Guideline for conducting water resources assessment"
WMO	Guide to hydrological practices
IAH	International Contributions to Hydrogeology
	Example: "Guidebook on Mapping Groundwater Vulnerability"

2.5 Other producers

Many handbooks, guides, or manuals produced by others, such as universities, research institutes, consultants or private persons can also be considered "guidelines", as long as they assist the user in understanding his problems or select the right procedure or tool for his particular problem situation. Many of these documents are referred to in the guidelines published by governmental agencies, showing their importance for the water sector.

2.6 Remarks about implementation

The production and prescription of G&P are distinct steps. Many producers of G&P, such as organisations for standardisation (e.g. ISO and ASTM) and other non-governmental organisations or persons have no regulative power. Implementation of the standards is thus free. Only if these G&P are prescribed in the directives of authorities or in contracts between parties, their use becomes compulsory.

3 Categories of Guidelines and Protocols

3.1 Introduction

By the end of June 2003, the inventory of guidelines and protocols (G&P) yielded over 400 titles. For practical reasons this first phase of inventory had to be limited to rapidly available information, mainly from Internet, and to documents available in the English language. The searches on G&P were directed on those, expected to be of international importance, thus leaving untouched the information from many national committees. For these reasons, the results of the inventory, presented in this report, are only the beginning of the IGRAC files on G&P. However, our expectations are that the first results will provide a sound basis for future work. The exercise will also serve to categorise the information and trigger response. The information will certainly have to be updated in a continuous activity, on the basis of the response and a further analysis of data.

A limiting factor in categorising the available information is that the contents and scope of the documents inventoried had to be deduced from their titles. In the lists provided by the organisations for standardisation, such as ISO and ASTM, the titles have been carefully chosen and are often quite clear. For many other titles there is a larger risk of misinterpretation, which can only be reduced by taking a closer look at the contents in the near future.

A third aspect that needs attention is the lack of a clear distinction between the terms guides, guidebooks, handbooks and even manuals. The organisations for standardisation are using their own specifications in a consequent way (e.g. standard guides, standard method and standard practice). As far as guides, handbooks and manuals are concerned, these terms have been used in a very free fashion, which makes it difficult to categorise them in a consequent way. It may be necessary to renew this characterisation, as soon as the real scope of these books becomes clear.

In the next paragraphs the identified documents have been classified according to a number of sub-fields of groundwater assessment and monitoring. These distinct fields are:

- Drilling and well construction
- Surveys and field tests
- Field measurements and sampling
- Laboratory tests – soil quality and water quality
- Data analysis and mapping
- Monitoring networks
- Groundwater Modelling and Miscellaneous

3.2 Drilling and well construction

All in all 36 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Well site selection	6
• Drilling methods	13
• Well construction and development	15
• Well operation and maintenance	4
• Abandoning of sites	3

A complete list has been attached as Appendix A

Comments

The guidelines and standards inventoried so far originate from the United States, except for one from India. The larger part of guidelines and standards is from ASTM, some handbooks are also available.

- The standard guides on "*Site selection"* deal with descriptors of "Ground Water Sites" (descriptors for identification, physical characterisation and usage) and Environmental site characterisation.
- Standard guides for "*Drilling"* cover most drilling methods, from cable tool and casing advanced methods to rotary drilling (direct and reverse circulation, air lift as well as fluid systems).
- Standards on "*Well construction"* cover production wells as well as monitoring wells and a broad range of subjects, from selection of materials for casing, screens and grouting to installation and development of both production wells and observation wells, including installation of piezometres.
- In the sector of "*Well operation and maintenance"* there are standard guides for maintenance and rehabilitation.
- In the sub-category of "*Abandoning of sites"*, guidelines are found for decommissioning of various types of wells.

It can be concluded that the field of drilling and well construction has been covered extensively by guiding material.

3.3 Surveys and field tests

All in all 46 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Remote sensing methods	1
• Geophysical surface methods	4
• Borehole and well logging	7
• Pumping tests	31
• Geotechnical tests	6

A complete list is attached as Appendix B

Comments

Besides documents from the USA, there are documents from The Netherlands and South Africa.

- The sub-category *"Remote sensing methods"* covers air-borne an satellite methods. The only document found so far, is from EPA. This document, entitled "subsurface characterization and monitoring techniques" provides, amongst other, an overview of remote sensing methods for selection of the best method in a particular case.
- Four documents deal with "*Surface geophysical methods"*. One of them exclusively deals with seismic-refraction.
- Seven titles are found on *"Borehole and well logging*" mainly as handbooks or guides. The exact scope of these documents is not clear from their titles and has to be further investigated.
- In the field of "*Pumping tests"* the majority of the documents originates from ASTM. Most of these are standard test methods. Apart from those the international guide by Kruseman and De Ridder (1990) on pumping tests deserves mentioning.
  With 31 documents the field of pumping tests has been extensively covered, mainly by "standard testing methods". No obvious gaps have been identified so far, but it may be verified whether hard-rock tests are dealt with well enough.
- Six items are found in the field of "*Geotechnical tests"*. Their significance for hydrogeological surveys and groundwater-related compaction, has not yet been evaluated.

In conclusion the field of pumping tests has been covered extensively. A more detailed analysis will be necessary to evaluate the coverage of the other fields.

3.4 Field measurements and sampling

All in all 90 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Soil and rock sampling	24
• Measuring soil moisture content and fluxes	14
• Measuring groundwater levels	9
• Groundwater quality sensors	7
• Sampling groundwater quality (incl. preservation, etc.)	47

A complete list is attached as Appendix C

Comments

A relatively large number of guides and standards was inventoried in the category of "field measurements and sampling methods". Many of them stem from the organisations for standardisation.

- The sub-category of "*Soil and rock sampling"* counts 24 documents, mainly Standard Guides, Standard Practices from ISO and ASTM. They include sampling, preservation and transport.
- In the sub-category of *"Measuring soil moisture content and fluxes"* the standards cover in situ determination of infiltration and soil moisture contents and fluxes by various techniques, such as tensiometers and nuclear techniques. One document deals with soil-gas sampling.
- In the sub-category *"Measuring groundwater levels"* most documents have relatively vague titles suggesting that they deal with groundwater level measurements as well. This field needs more attention in order to conclude about gaps and further needs.
- In the sub-category of *"Groundwater quality sensors"* a number of standard guides are found that combine different drilling methods with installation of groundwater quality sensors. All of them are from ASTM and focus on Geo-environmental Exploration.
- The sub-category of *"Sampling groundwater quality"* is covered by a large number (47) of standard guides and standard practices, aimed at one of the many aspects of sampling, handling, preservation, packaging, shipping, etc. The majority of these documents originate from ISO and ASTM. Others are from USGS and Hydrology Project India. They are included in the guides from the EPA's of USA and Australia.

In conclusion the fields of sampling "soil and rocks", soil moisture and (ground)water quality seem to be well covered. The field of measuring groundwater levels needs to be evaluated in more detail, and may need more attention.

3.5 Laboratory tests - Soil and water quality

Laboratory tests - Soil quality

All in all 41 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Criteria, terminology and codification	6
• Physical methods	6
• Chemical methods and soil characteristics	23
• Biological methods	6
• Soil & site assessment	0

A complete list is attached as Appendix D

Laboratory tests - Water quality

All in all 113 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Terminology	9
• Physical methods	4
• Chemical methods	83
• Bio-chemical methods	17
• Micro-biological methods	0
• Biological methods	14

A complete list is attached as Appendix E

Comments

Health and environmental concerns have world-wide led to extensive developments of norms for water quality as well as for standard sampling and determination methods. This has led to a large number of standards for sampling and determination of quality parameters, especially in the sector of chemical and biochemical methods. In addition an extensive programme of new developments is going on. These developments will result in new standards within a period of 5 years (see for instance the ISO programme on soil quality).
Large collections of *international standards* on laboratory tests for soil quality and water quality have been produced by the International ISO. There may be more collections of standards from national organisations (such as DIN and NEN), but the information has not yet been fully explored.
It has not been possible to evaluate these fields of soil-quality and water-quality standards with respect to completeness and possible gaps. Moreover, considering the advanced state of development in this sector, it is likely that IGRAC will focus on less well developed sectors.

3.6 Data analysis and mapping

All in all 41 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Survey, assessment and mapping	19
• Analysis and presentation of groundwater level data	7
• Analysis and presentation of groundwater quality data	21
• Analysis and presentation of aquifer vulnerability	4
• Analysis and presentation of land subsidence	2

A complete list is attached as Appendix F

Comments

This field has been subdivided into a general survey and several more specific fields for further analysis of categories of data. All together they cover a qualitative description of groundwater system. Quantitative calculations with the help of groundwater models have been excluded from this category as a separate item.

A mixed international group, including UNESCO, IAH, ASTM, EPA, USGS and Hydrology Project India has published the documents inventoried. Some handbooks have also been selected.

- The titles in the sub-category "*Survey and assessment"* are very diverse. The documents (mainly guides) deal with survey and assessment methods as well as groundwater systems analysis and reporting. They also include field measurements, data collection protocols, processing and storage, methods of analysis, etc. The documents will have to be studied in more detail to be able to categorise their subjects in a proper way and evaluate completeness.
- Of 7 titles that probably include "*Groundwater level analysis"*, only one standard method from ASTM deals with this subject for sure.
- The sub-category of "*Analysis and presentation of groundwater quality data*" covers methods of analysis and presentation of water quality data in diagrams and maps as well as statistical techniques. The components range from major ions to trace elements and pesticides.
- Two guides were identified that deal with *"Aquifer vulnerability"*.
- Only one guidebook deals with studying *"Landsubsidence"* caused by groundwater withdrawal.

The documents of this category will have to be analysed in more detail to identify possible gaps. However, a first impression of the types of documents in the subcategory of assessment (mainly guides and handbooks) is that this subcategory, in combination with sampling and monitoring, may need more attention.

3.7 Monitoring networks

All in all 23 titles have been found in this category. Some of them may belong to more than one sub-category. They are distributed in the following way:

Sub-category	Number of titles found
• Setting standards/criteria for monitoring	10
• Design of monitoring networks – Groundwater levels	10
• Design of monitoring networks – Groundwater discharge	1
• Design of monitoring networks – Groundwater quality	13
• Design of monitoring networks – Landsubsidence	1

A complete list is attached as Appendix G

Comments

Quite a number of the inventoried documents deal with monitoring in one way or the other.

- In the sub-category *"Setting standards and criteria"* the documents discuss requirements for data sampling and sampling sites, as well as effective sampling in relation to detection and quantification limits.
- In the sub-category *"Design of monitoring networks – Groundwater levels"* 10 documents have been found. However, for some of them it is not exactly clear from their titles what they cover. A special one is the European Water Framework Directive (WFD) that specifies the needs for monitoring in relation to water management and regulations in the European Union, covering both groundwater quantity and quality. Another EU guideline specifies the needs of monitoring and assessment of transboundary groundwater. Other areas covered are design and installation of monitoring wells in aquifers (two documents from ASTM) and monitoring in Karst Terrains.
- In the sub-category *"Design of monitoring networks – Groundwater discharge"* only one document on groundwater monitoring in Karst Terrains suggests that discharge measurements are involved. A new inventory on surface water discharge measurements and monitoring should yield more titles.
- In the sub-category *"Design of monitoring networks – Groundwater quality"* many titles suggest that both, water levels and water quality, may be dealt with. However a few works from the USGS and EPA deal exclusively with water quality monitoring. In the European WFD both groundwater quantity and quality are dealt with and the same is true for the guidelines on monitoring and assessment of transboundary groundwaters.
- In the sub-category *"Design of monitoring networks – Landsubsidence"* no documents were found so far. Land subsidence is an important effect of dropping groundwater levels in areas with soft soils.

It seems that the fields of design and evaluation of monitoring networks are not yet very well covered by guidelines and standards. This is especially true for groundwater level monitoring. With respect to design of groundwater discharge monitoring networks no documents have been found, but a search on surface water monitoring may yield more results. Furthermore, groundwater quality monitoring is covered in a limited way. In conclusion, the various fields of monitoring may need more IGRAC attention.

3.8 Groundwater modelling and Miscellaneous

The numbers of inventoried documents of the categories of Groundwater Modelling and Miscellaneous are shown in the following table:

Sub-category	Number of titles found
• Groundwater modelling	9
• Miscellaneous	43

Complete lists are attached as Appendix H.

Comments

The category of *"Groundwater modelling"* documents consists mainly of ASTM guides. Only documents with a clear relation to groundwater data have been included in the list. The subjects covered includes definition of model boundaries and initial conditions on the basis of data, model calibration and sensitivity analysis. A more detailed analysis will have to show whether indeed the relation between modelling and groundwater data is emphasised in these documents.

The category of "*Miscellaneous*" contains items from the periphery of the other categories, however with a clear relation to the subjects. Many of these subjects may have been addressed in standard guides and handbooks, which may be of interest to the persons who consult the websites for information. The subjects include terminology lists, quality assurance and control procedures, criteria for assessment of testing laboratories, guidelines for reporting, statistical tools, etc. This category is needed and will have to be restructured and completed. Some documents may have to be shifted to a category of background documents.

4 Summary and Evaluation

The inventory of guidelines and protocols in the field of groundwater yielded a large number of international and national documents, ranging from recommendable handbooks to quality assured standard guides and methods. With respect to the documents, it is useful to distinguish between the roles of producers, promoters, enforcers and users. For practical reasons, the inventory has mainly been directed at the production side and has been limited to documents in the English language.

- *Protocols.* Large collections of "standards" (standard guides, methods and practices) in groundwater and related fields are produced by Organisations for standardisation, both international (for instance ISO) and national (for instance ASTM, DIN, etc). These documents have passed a number of screening phases, before they reach the level of international or national standard. Many of these standards deal with single processes or applications, such as determination of a particular parameter in a laboratory.

- *Guidelines.* A variety of guidelines ranging from handbooks to guides and manuals has been produced by governmental organisations, scientific institutes, universities and private organisations or persons. Most guidelines provide their information subjectwise. They may also cover broad processes or activities, such as surveys, assessment and monitoring. Guideline documents have many different forms, ranging from single documents to a series of publications (e.g. by the USGS) or thick volumes with introductions and extensive lists of references (e.g. some EPA documents).

- *Promotion.* A variety of international and national organisations and associations, amongst other activities, stimulate safe and sustainable use of the world's water resources through exchange of knowledge. They disseminate the knowledge through their networks or through meetings and workshops organised by them. Examples are UNESCO, WMO, and IAH.

Legislation and enforcement. Use of available G&P is free till the point of enforcement. Most producers of G&P (e.g. organisations for standardisation) have no legislative or enforcing power. However, use G&P may be made compulsory by national and supra-national authorities, through prescription in their directives. Prescription can also form part of a contract between parties (often provoked indirectly by regulations) or of a process of certification.
It is not yet clear what the status of available G&P is in that respect. For instance, some extensive guideline volumes, produced by governmental organisations such as EPA, do not seem to lend themselves very well for prescription. The matter of the status of G&P-documents in relation to enforcement needs further attention.

- *Potential Gaps.* It was not yet possible to get a clear picture of the gaps in the fields covered by G&P, since, in this stage of the inventory, of most documents too little information was available. However the following indications can be given. Very few G&P were found on systematic, practical and stepwise approaches for assessing and monitoring groundwater quantities. Relatively few G&P were also found on assessment and monitoring of groundwater in hard rock areas and on determining the relation between groundwater levels and land subsidence.

The inventory is still rather incomplete. Therefore, the inventory report is also meant to provoke reactions from experts of the groundwater community, regarding incompleteness or failures in the report, or views of the experts. IGRAC intends to put this inventory report on its internet-site, together with more details of the information inventoried. After receiving response (comments or additional material) from the readers, IGRAC will make the necessary adjustments.

Some items will need further attention. For instance the relative arrears in a number of technical fields. Also the question of the status of the G&P in relation to their use (free or compulsory) needs to be further investigated.
Finally the need for expansion of G&P will have to be evaluated on the basis of this report, the response from experts, and further investigation.

5 Conclusions and Recommendations

5.1 Conclusions

1. The inventory of Guidelines and Protocols (G&P), conducted in the fields of groundwater assessment and monitoring yielded over 420 available documents and about 50 titles in preparation. This is a considerable amount of documents, if taking into account the limitation of the inventory to searches in the English language and to internet based information. However, because of these limitations, the results presented here are probably still far from complete.

2. With respect to access to the information on G&P, the overall conclusion must be that the accessibility is rather poor. Searches on internet on the basis of selected topics lead to large amounts of hits, the majority of these not very useful. If one does not know the organisations involved, it is very hard to get to the right type of documents. Searches through known organisations are more successful.

3. A variety of "guidelines" have been found from governmental and other organisations in various parts of the world. These publications range from handbooks to guides and manuals. Some guidelines are published as a series of publications, such as those from UNESCO and the USGS. Others consist of comprehensive volumes with introductions of respective subjects, accompanied by extensive lists of references to standards, books and articles. The guidelines may also cover broad subjects, such as groundwater survey, assessment and monitoring.

4. Organisations for standardisation are the main producers of quality controlled "protocols" in the field of groundwater. Large collections of these international important standards are found from organisations such as ISO and ASTM. These documents have passed a number of screening phases, before they reach the level of international or national standard. Many of these standards deal with single processes or applications, such as determination of a particular parameter in a laboratory.

It was not yet possible to get a complete and clear picture of the gaps in the technical fields covered by G&P, since, in this stage of the inventory, too little information was available on most of the G&P. However, the following indications may be given. Very few G&P were found on systematic and practical approaches for assessing and monitoring groundwater situations. Relatively few G&P were found on assessment and monitoring of groundwater in hard rock aquifers and on determining the relation between groundwater levels and land subsidence.

5. The status of many P&G with respect to regulation and enforcement is not very clear. There are various forms in which the use of G&P can be made compulsory. National or supra-national authorities may prescribe the use of standards in their directives concerning groundwater legislation and regulation. The use of G&P may also be prescribed in contracts between parties or be part of a process of certification. As the status of G&P with respect to their use in regulation is supposed to be of interest to potential users, this issue requires more attention.

5.2 Recommendations

1. In order to improve access to available Guidelines and Protocols (G&P), it is recommended to put the available information on them on IGRAC's internet site (http://www.igrac.nl/). The information should be completed with fact sheets on these G&P.

2. It is recommended to investigate the need for further development of G&P in the fields where they are missing. From the inventory of G&P it appears that subjects poorly covered are systematic set-up of groundwater assessment and groundwater monitoring, as well as assessment and monitoring of hard rock aquifers and land subsidence.

3. In order to benefit from the expertise and available information on groundwater in various countries, the possibilities to intensify the contacts between IGRAC and the groundwater community should be further investigated.

Appendices: Lists of inventoried documents

A: Category 'Drilling and well construction'
B: Category 'Surveys and field tests'
C: Category 'Field measurements and sampling'
D: Category 'Soil Quality'
E: Category 'Water Quality'
F: Category 'Data analysis and mapping'
G: Category 'Monitoring networks'
H: Categories 'Groundwater Modelling and Miscellaneous'

Appendix A: List of inventoried documents - category 'Drilling and well construction'

		Type								Drilling & Well constr.				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Well-site selection***	***Drilling methods***	***Well construction & development***	***Well operation & maintenance***	***Well abandonment***
		S1	S2	S3	S4	S5	S6	S7	S8	A1	A2	A3	A4	A5
Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells	US-EPA	S1								A1	A2	A3	A4	A5
Standard Guide for Selection and Documentation of Existing Wells for Use in Environmental Site Characterization and Monitoring	ASTM				S4					A1				
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part One-Additional Identification Descriptors	ASTM				S4					A1				
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Three-Usage Descriptors	ASTM				S4					A1				
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Two-Physical Descriptors	ASTM				S4					A1				
Standard Practice for Minimum Set of Data Elements to Identify a Ground-Water Site	ASTM						S6			A1				
Practice for Sonic Drilling in Geoenvironmental Exploration and Installation of Su Bsurface Monitoring Devices	ASTM						S6				A2			
Standard Guide for Selection of Drilling Methods for Environmental Site Characterization	ASTM				S4						A2			
Standard Guide for Use of Cable-Tool Drilling and Sampling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Dual-Wall Reverse-Circulation Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Standard Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4						A2			
Subsurface Characterization and Monitoring Techniques	EPA		S2								A2			
Practical Handbook of Ground Water Monitoring [Groundwater monitoring System Design; Design and Installation of Groundwater Monitoring Wells].	Lewis	S1									A2			
Application of drilling, coring and sampling techniques to testholes and wells	USGS	S1									A2			
Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.09, pp. 162-173.	ASTM						S6					A3		

Appendix A: List of inventoried documents - category 'Drilling and well construction'

		Type								Drilling & Well constr.				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Well-site selection***	***Drilling methods***	***Well construction & development***	***Well operation & maintenance***	***Well abandonment***
		S1	S2	S3	S4	S5	S6	S7	S8	A1	A2	A3	A4	A5
Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers	ASTM				S4							A3		
Standard Guide for Installation of Direct Push Ground Water Monitoring Wells	ASTM				S4							A3		
Standard Practice for Direct Push Installation of Prepacked Screen Monitoring Wells in Unconsolidated Aquifers	ASTM						S6					A3		
Standard Specifications for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR) SCH40 and SCH80. Annual Book of American Society for Testing Material Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 792-805.	ASTM							S7				A3		
Guidelines for implementation of piezometers	HP-India		S2									A3		
Groundwater and Wells, 2nd ed.	Johnson Division	S1										A3		
Manual on the Selection and Installation of Thermoplastic Water Well Casing.	NWWA			S3								A3		
Ground-Water Data-Collection Protocols and Procedures for the National Water-Quality Assessment Program: Selection, Installation, and Documentation of Wells, and Collection of Related Data	USGS							S7				A3		
A Guide to the Selection of Materials for Monitoring Well Construction and Ground Water Sampling.	US-Illinois SWS		S2									A3		
Michigan Water Well Grouting Manual.	US-Michigan			S3								A3		
Design and Construction of Water Wells.	Van Nostrand	S1										A3		
Groundwater Resource Evaluation	McCraw-Hill	S1										A3		
Groundwater and Wells (Second ed.).	Johnson Division	S1										A3	A4	
Standard Guide for Maintenance and Rehabilitation of Ground-Water Monitoring Wells	ASTM				S4								A4	
Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations	ASTM				S4								A4	
Standard Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities	ASTM				S4									A5
Guidelines for Plugging Abandoned Water Wells.	Iowa		S2											A5

Appendix B: List of inventoried documents - category 'Surveys and field tests'

		Type								Surveys & field tests				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Remote sensing methods***	***Geophysical surface methods***	***Borehole and well logging***	***Pumping tests***	***Geotechnical tests***
		S1	S2	S3	S4	S5	S6	S7	S8	B1	B2	B3	B4	B5
Subsurface Characterization and Monitoring Techniques	EPA		S2							B1	B2	B3	B4	
Application of seismic-refraction techniques to hydrologic studies	USGS	S1									B2			
Application of surface geophysics to groundwater investigations	USGS	S1									B2			
Application of Surface Geophysics to Groundwater Investigations.	USGS	S1									B2			
Evaluation of Selected Borehole Geophysical Methods for Hazardous Waste Site Investigations and Monitoring.	EPA							S7				B3		
Well Logging in Groundwater Development.	IAH	S1										B3		
Practical Handbook of Ground Water Monitoring [Groundwater monitoring System Design; Design and Installation of Groundwater Monitoring Wells].	Lewis	S1										B3		
Standard Descriptors for Boreholes	NORAD		S2									B3		
Application of borehole geophysics to water-resources investigations.	USGS	S1										B3		
Borehole geophysics applied to groundwater investigations	USGS	S1										B3		
Standard Guide for Methods for Measuring Well Discharge	ASTM				S4								B4	
Standard Guide for Selection of Aquifer-Test Method in Determining of Hydraulic Properties by Well Techniques	ASTM				S4								B4	
Standard Practice for (Field Procedure) for Constant Drawdown Tests in Flowing Wells for Determining Hydraulic Properties of Aquifer Systems	ASTM						S6						B4	
Standard Test Method (Analytical Procedure) for Determining Hydraulic Properties of a Confined Aquifer and a Leaky Confining Bed with Negligible Storage by the Hantush-Jacob Method	ASTM					S5							B4	
Standard Test Method (Analytical Procedure) for Determining Hydraulic Properties of a Confined Aquifer Taking into Consideration Storage of Water in Leaky Confining Beds by Modified Hantush Method	ASTM					S5							B4	
Standard Test Method (Analytical Procedure) for Determining the Efficiency of a Production Well in a Confined Aquifer from a Constant Rate Pumping Test	ASTM					S5							B4	
Standard Test Method (Analytical Procedure) for Determining Transmissivity and Storage Coefficient of Nonleaky Confined Aquifers by the Modified Theis Nonequilibrium Method	ASTM					S5							B4	
Standard Test Method (Analytical Procedure) for Determining Transmissivity and Storage Coefficient of Nonleaky Confined Aquifers by the Theis Nonequilibrium Method	ASTM					S5							B4	
Standard Test Method (Analytical Procedure) for Determining Transmissivity of Nonleaky Confined Aquifers by Overdamped Well Response to Instantaneous Change in Head (Slug Tests)	ASTM					S5							B4	
Standard Test Method (Field Procedure) for Withdrawal and Injection Well Tests for Determining Hydraulic Properties of Aquifer Systems	ASTM					S5							B4	
Standard Test Method [Analytical Procedure] for Tests of Anisotropic Unconfined Aquifers by Neuman Method	ASTM					S5							B4	
Standard Test Method for (Analytical Procedure for) Analyzing the Effects of Partial Penetration of Control Well and Determining the Horizontal and Vertical Hydraulic Conductivity in a Nonleaky Confined Aquifer	ASTM					S5							B4	
Standard Test Method for (Analytical Procedure) Determining Hydraulic Conductivity of an Unconfined Aquifer by Overdamped Well Response to Instantaneous Change in Head (Slug)	ASTM					S5							B4	

Appendix B: List of inventoried documents - category 'Surveys and field tests'

		Type								Surveys & field tests				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Remote sensing methods***	***Geophysical surface methods***	***Borehole and well logging***	***Pumping tests***	***Geotechnical tests***
		S1	S2	S3	S4	S5	S6	S7	S8	B1	B2	B3	B4	B5
Standard Test Method for (Analytical Procedure) Determining Transmissivity of Confined Nonleaky Aquifers by Critically Damped Well Response to Instantaneous Change in Head (Slug)	ASTM					S5							B4	
Standard Test Method for (Analytical Procedure) Determining Transmissivity, Storage Coefficient, and Anisotropy Ratio from a Network of Partially Penetrating Wells	ASTM					S5							B4	
Standard Test Method for (Analytical Procedure) for Determining Transmissivity of Confined Nonleaky Aquifers by Underdamped Well Response to Instantaneous Change in Head (Slug Test)	ASTM					S5							B4	
Standard Test Method for (Field Procedure) for Instantaneous Change in Head (Slug) Tests for Determining Hydraulic Properties of Aquifiers	ASTM					S5							B4	
Standard Test Method for Determining Specific Capacity and Estimating Transmissivity at the Control Well	ASTM					S5							B4	
Standard Test Method for Determining Transmissivity and Storage Coefficient of Bounded, Nonleaky, Confined Aquifers	ASTM					S5							B4	
Standard Test Method for Determining Transmissivity and Storage Coefficient of Low-Permeability Rocks by In Situ Measurements Using the Constant Head Injection Test	ASTM					S5							B4	
Standard Test Method for Determining Transmissivity and Storativity of Low Permeability Rocks by In Situ Measurements Using Pressure Pulse Technique	ASTM					S5							B4	
Standard Test Method for Determining Transmissivity of Nonleaky Confined Aquifers by the Theis Recovery Method	ASTM					S5							B4	
Standard Test Method for Measuring the Rate of Well Discharge by Circular Orifice Weir	ASTM					S5							B4	
Determination of Aquifer Parameters From Step Tests and Intermittent Pumping Data.	Groundwater	S1											B4	
Analysis and evaluation of pumping test data.	ILRI, Wageningen		S2										B4	
Aquifer Testing, Design and Analysis of Pumping and Slug Tests.	Lewis	S1											B4	
Aquifer-test design, observation, and data analysis	USGS	S1											B4	
Type curves for selected problems of flow to wells in confined aquifers	USGS	S1											B4	
Groundwater Resource Evaluation	McCraw-Hill	S1											B4	
A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells.	WRR							S7					B4	
Deep, Quasi-Static, Cone and Friction-Cone Penetration Tests of Soil. D3441-86, 1989 Annual Book of ASTM Standards, Philadelphia, pp. 414-419.	ASTM		S2											B5
Standard Guide for Using the Electronic Cone Penetrometer for Environmental Site Characterization	ASTM				S4									B5
Standard Method For Deep Quasi-state, Cone and Frictioncone Penetration Tests of Soils. Annual Book of American Society of Testing Material Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 338-343.	ASTM					S5								B5
Standard Method for Penetration Test and Split-Barrel Sampling of Soils. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 129-133.	ASTM					S5								B5
Standard Practice for Cone Penetrometer Technology Characterization of Petroleum Contaminated Sites with Nitrogen Laser-Induced Fluorescence	ASTM						S6							B5
Guidelines for Cone Penetration Test Performance and Design.	FHWA		S2											B5

Appendix C: List of inventoried documents - category 'Field measurements and Sampling'

		Type								Field measurem. & sampling				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Soil and rock sampling***	***Measuring soil moisture content and fluxes***	***Measuring GW-levels***	***GW-quality sensors***	***Sampling of GW-quality (incl. preservation)***
		S1	S2	S3	S4	S5	S6	S7	S8	C1	C2	C3	C4	C5
Subsurface Characterization and Monitoring Techniques	EPA		S2							C1	C2	C3		C5
Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone	ASTM				S4					C1	C2			
Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells	US-EPA	S1								C1		C3		C5
Standard Guide for Selection of the Minimum Set of Data Elements Required to Identify Locations Chosen for the Field Collection of Information to Describe Soil, Rock, and Their Contained Fluids	ASTM				S4					C1				
Standard Practice for Minimum Set of Data Elements to Identify a Soil Sampling Site	ASTM						S6			C1				
Ground-Water Contamination: Field Methods.	ASTM	S1								C1				C5
Standard Guide for Direct Push Soil Sampling for Environmental Site Characterizations	ASTM				S4					C1				
Standard Guide for Selection of Soil and Rock Sampling Devices Used With Drill Rigs for Environmental Investigations	ASTM				S4					C1				
Standard Method for Density and Unit Weight of Soil in Place by Rubber Balloon Method. Annual Book of American Society of Testing Materials Standards (reapproved 1990). Philadelphia, Pennsylvania. Vol. 04.08, pp. 168-171.	ASTM					S5				C1				
Standard Method For Density of Soil in Place by Drive Cylinder Method. Annual Book of American Society of Testing Materials Standards (reapproved 1990). Philadelphia, Pennsylvania. Vol. 04.08, pp. 265-269.	ASTM					S5				C1				
Standard Method for Density of Soils in Place by Sand Cone Method. Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 112-117.	ASTM					S5				C1				
Standard Method For Description and Identification of Soils (Visual Manual Procedure). Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 214-224.	ASTM					S5				C1				
Standard Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.09, pp. 159-161.	ASTM						S6			C1				
Standard Practice for Thin-Wall Tube Sampling of Soils: AnnualBook of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 134-136.	ASTM						S6			C1				
Standard Practices for Preserving and Transporting Soil Samples. Annual Book of American Society for Testing and Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 513-522.	ASTM						S6			C1				
Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index for Soils. Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 551-561.	ASTM					S5				C1				
Standard Tests Method for pH in Soils. Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 1125-1127.	ASTM					S5				C1				
Standard Guide for Soil Sampling from the Vadose Zone	ASTM				S4					C1				
Soil quality -- Sampling -- Part 3: Guidance on safety	ISO				S4					C1				
Soil Quality – Sampling – Part 1: Guidance on the design of sampling programmes	ISO				S4					C1				

Appendix C: List of inventoried documents - category 'Field measurements and Sampling'

		Type								Field measurem. & sampling				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Soil and rock sampling***	***Measuring soil moisture content and fluxes***	***Measuring GW-levels***	***GW-quality sensors***	***Sampling of GW-quality (incl. preservation)***
		S1	S2	S3	S4	S5	S6	S7	S8	C1	C2	C3	C4	C5
Soil Quality – Sampling – Part 2: Guidance on sampling techniques	ISO				S4					C1				
Soil quality -- Vocabulary -- Part 2: Terms and definitions relating to sampling	ISO				S4					C1				
Practical Handbook of Ground Water Monitoring [Groundwater monitoring System Design; Design and Installation of Groundwater Monitoring Wells].	Lewis	S1								C1				C5
Application of drilling, coring and sampling techniques to testholes and wells	USGS	S1								C1				
Standard Guide for Comparison of Techniques to Quantify the Soil-Water (Moisture) Flux	ASTM				S4						C2			
Standard Guide for Measuring Matric Potential in the Vadose Zone Using Tensiometers	ASTM				S4						C2			
Standard Guide for Pore-Liquid Sampling from the Vadose Zone	ASTM				S4						C2			C5
Standard Guide for Soil Gas Monitoring in the Vadose Zone	ASTM				S4						C2			
Standard Method For Infiltration Rate of Soils in Field Using Double-Ring Infiltrometers. Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 321-327.	ASTM					S5					C2			
Standard Method For Moisture Content of Soil and Soil- Aggregate in Place by Nuclear Method (Shallow Depth). Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 285-289.	ASTM					S5					C2			
Standard Methods for Moisture-Density Relationships of Soils and Soil Aggregating Mixtures Using 10 lb. (4.54 Kg) Hammer and 18 in. (457-mm) Drop. Annual Book of American Society of Testing Materials Standards. Philadelphia, Pennsylvania. Vol. 04.08, pp. 118-125.	ASTM							S7			C2			
Standard Test Method for Logging In Situ Moisture Content and Density of Soil and Rock by the Nuclear Method in Horizontal, Slanted, and Vertical Access Tubes	ASTM					S5					C2			
Monitoring in the Vadose Zone: A Review of Technical Elements and Methods.	EPA	S1									C2			
Soil quality -- Determination of pore water pressure – Tensiometer method	ISO					S5					C2			
Soil quality -- Determination of water content in the unsaturated zone -- Neutron depth probe method	ISO					S5					C2			
Practical Handbook of Soil, Vadose Zone, and Ground-Water Contamination; Assessment, Prevention and Remediation.	Lewis-Publishers	S1									C2			
Standard Guide for Design of Ground-Water Monitoring Systems in Karst and Fractured-Rock Aquifers	ASTM				S4							C3		
Standard Test Method for Determining Subsurface Liquid Levels in a Borehole or Monitoring Well (Observation Well)	ASTM					S5						C3		
Manuals for Groundwater Data Collection, Processing and Storage	HP-India			S3								C3		C5
Groundwater Monitoring Guidelines, Santa Clara County, California, 58 pp.	US-California		S2									C3		
A Guide to Ground Water Sampling and Monitoring.	US-Idaho		S2									C3		C5
A Guide to the Selection of Materials for Monitoring Well Construction and Ground Water Sampling.	US-Illinois SWS		S2									C3		
Ground-Water-Level Monitoring and the Importance of Long-Term Water-Level Data	USGS							S7				C3		

Appendix C: List of inventoried documents - category 'Field measurements and Sampling'

		Type								Field measurem. & sampling				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Soil and rock sampling***	***Measuring soil moisture content and fluxes***	***Measuring GW-levels***	***GW-quality sensors***	***Sampling of GW-quality (incl. preservation)***
		S1	S2	S3	S4	S5	S6	S7	S8	C1	C2	C3	C4	C5
Standard Guide for Use of Cable-Tool Drilling and Sampling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Direct Rotary Wireline Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Dual-Wall Reverse-Circulation Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Standard Guide for Use of Hollow-Stem Augers for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices	ASTM				S4								C4	
Development of Effective Ground-Water Sampling Protocols, in A.G. Collins and A.I. Johnson, eds., Ground-Water Contamination: Field Methods, ASTM STP 963, ASTM, Philadelphia, pp. 17-26.	ASTM		S2											C5
Chemical Stability Prior to Ground-Water Sampling: A Review of Current Well Purging Methods. In: A. J Collins and A. I. Johnson (editors), Ground-Water Contamination Field Methods. ASTM Publications. Baltimore, Maryland. pp. 232-239.	ASTM		S2											C5
Guide for Packaging and Shipping Environmental Samples for Laboratory Analysis	ASTM		S2											C5
Standard Guide for Direct-Push Water Sampling for Geoenvironmental Investigations	ASTM				S4									C5
Standard Guide for Documenting a Ground-Water Sampling Event	ASTM				S4									C5
Standard Guide for Field Filtration of Ground-Water Samples	ASTM				S4									C5
Standard Guide for Field Preservation of Ground-Water Samples	ASTM				S4									C5
Standard Guide for Purging Methods for Wells Used for Ground-Water Quality Investigations	ASTM				S4									C5
Standard Guide for Sampling Groundwater Monitoring Wells. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 11.04. pp. 91-103.	ASTM				S4									C5
Standard Guide for the Selection of Purging and Sampling Devices for Ground-Water Monitoring Wells	ASTM				S4									C5
Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations	ASTM						S6							C5

Appendix C: List of inventoried documents - category 'Field measurements and Sampling'

		Type								Field measurem. & sampling				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Soil and rock sampling***	***Measuring soil moisture content and fluxes***	***Measuring GW-levels***	***GW-quality sensors***	***Sampling of GW-quality (incl. preservation)***
		S1	S2	S3	S4	S5	S6	S7	S8	C1	C2	C3	C4	C5
Verification of Sampling Methods and Selection of Materials for Ground-Water Contamination Studies, in A.G. Collins and A.I. Johnson, eds., Ground-Water Contamination: Field Methods. ASTM STP 963, American Society for Testing and Materials, Philadelphia, PA, pp. 221-231.	ASTM		S2											C5
Field Comparison of Ground-Water Sampling Methods -- Interim Report.	EPA							S7						C5
Handbook for Sampling and Sample Preservation of Water and Wastewater	EPA			S3										C5
Permit Guidance Manual on Unsaturated Zone Monitoring for Hazardous Waste Land Treatment Units.	EPA			S3										C5
Practical Guide for Ground-Water Sampling	EPA		S2											C5
Manual of Ground Water Sampling Procedures.	EPA/NWWA			S3										C5
Sampling Guidelines for Ground Water Quality.	EPRI			S3										C5
Groundwater Quality Sampling, Field Manual	HP-India			S3										C5
Protocol for Water Quality Monitoring, Hydrology Project,	HP-India							S7						C5
Water quality -- Sampling -- Part 1: Guidance on the design of sampling programmes	ISO				S4									C5
Water quality -- Sampling -- Part 11: Guidance on sampling of groundwaters	ISO				S4									C5
Water quality -- Sampling -- Part 14: Guidance on quality assurance of environmental water sampling and handling	ISO				S4									C5
Water quality -- Sampling -- Part 15: Guidance on preservation and handling of sludge and sediment samples	ISO				S4									C5
Water quality -- Sampling -- Part 16: Guidance on biotesting of samples	ISO				S4									C5
Water quality -- Sampling -- Part 18: Guidance on sampling of groundwater at contaminated sites	ISO				S4									C5
Water quality -- Sampling -- Part 2: Guidance on sampling techniques	ISO				S4									C5
Water quality -- Sampling -- Part 3: Guidance on the preservation and handling of samples	ISO				S4									C5
Water quality -- Sampling -- Part 5: Guidance on sampling of drinking water and water used for food and beverage processing	ISO				S4									C5
RCRA Sampling Procedures Handbook.	RCRA	S1												C5
Practical guide for ground-water sampling	USA-ISWS		S2											C5
Procedures for Conducting a Comprehensive Ground Water Monitoring Evaluation of Hazardous Waste Disposal Facilities.	US-California	S1												C5
Ground-water data-collection protocols and procedures for the national water-quality assessment program: collection and documentation of water-quality samples and related data	USGS			S3				S7						C5
Guidelines for collection and field analysis of GW samples for selected unstable constituents	USGS		S2											C5
National Field Manual for the Collection of Water-Quality Data, Techniques of Water-Resources Investigations, Book 9. Handbooks for Water-Resources Investigations	USGS	S1												C5

Appendix C: List of inventoried documents - category 'Field measurements and Sampling'

		Type								Field measurem. & sampling				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Soil and rock sampling***	***Measuring soil moisture content and fluxes***	***Measuring GW-levels***	***GW-quality sensors***	***Sampling of GW-quality (incl. preservation)***
		S1	S2	S3	S4	S5	S6	S7	S8	C1	C2	C3	C4	C5
Practical Guide for Ground- Water Sampling.	US-Illinois SWS		S2											C5
Guidelines for Sampling Ground Water.	Water Polution													C5
Murray-Darling Basin Groundwater Quality Sampling Guidelines			S2											C5
Groundwater Sampling: A Comprehensive Guide.	WRC-SA		S2											C5
Groundwater Sampling Procedures Guidelines.			S2											C5

Appendix D: List of inventoried documents - category 'Soil quality'

		Type								Soil Quality-subdivision					
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Criteria, termin. & codification*	*Sampling*	*Physical methods*	*Chemical methods & Soil characteristics*	*Biological methods*	*Soil & site assessment*
		S1	S2	S3	S4	S5	S6	S7	S8	D1.1	D1.2	D1.3	D1.4	D1.5	D1.6
ISO standards handbook 16.	**ISO**			S3						D1.1					
Soil quality -- Vocabulary -- Part 1: Terms and definitions relating to the protection and pollution of the soil	ISO				S4					D1.1					
Soil quality - Vocabulary -- Part 4: Terms and definitions related to rehabilitation of soils and sites	ISO				S4					D1.1					
Soil quality -- Vocabulary -- Part 2: Terms and definitions relating to sampling	ISO				S4					D1.1					
Soil quality – Format for recording soil and site information	ISO				S4					D1.1					
Soil quality -- Simplified soil description	ISO				S4					D1.1					
Soil quality -- Sampling -- Part 3: Guidance on safety	ISO				S4						D1.2				
Soil Quality – Sampling – Part 1: Guidance on the design of sampling programmes	ISO				S4						D1.2				
Soil Quality – Sampling – Part 2: Guidance on sampling techniques	ISO				S4						D1.2				
Soil quality -- Pretreatment of samples for physico-chemical analyses	ISO						S6				D1.2				
Soil quality -- Determination of dry bulk density	ISO					S5						D1.3			
Soil quality -- Determination of dry matter and water content on a mass basis -- Gravimetric method Technical Corrigendum 1	ISO					S5						D1.3			
Soil quality -- Determination of particle density	ISO					S5						D1.3			
Soil quality -- Determination of particle size distribution in mineral soil material -- Method by sieving and sedimentation Technical Corrigendum 1	ISO					S5						D1.3			
Soil quality -- Determination of soil water content as a volume fraction using coring sleeves -- Gravimetric method	ISO					S5						D1.3			
Soil quality -- Determination of the water-retention characteristic -- Laboratory methods	ISO				S4							D1.3			
Soil quality -- Determination of cadmium, chromium, cobalt, copper, lead, manganese, nickel and zinc -- Flame and electrothermal atomic absorption spectrometric methods	ISO					S5							D1.4		
Soil quality -- Determination of carbonate content – Volumetric method	ISO					S5							D1.4		
Soil quality -- Determination of effective cation exchange capacity and base saturation level using barium chloride solution Technical Corrigendum 1	ISO					S5							D1.4		
Soil quality -- Determination of exchangeable acidity in barium chloride extracts	ISO					S5							D1.4		
Soil quality -- Determination of mineral oil content -- Method by infrared spectrometry and gas chromatographic method	ISO					S5							D1.4		
Soil quality -- Determination of nitrate nitrogen, ammonium nitrogen and total soluble nitrogen in air-dry soils using calcium chloride solution as extractant	ISO					S5							D1.4		
Soil quality -- Determination of nitrate, nitrite and ammonium in field moist soils using potassium chloride solution as extractant- Part 1: Manual method	ISO					S5							D1.4		
Soil quality -- Determination of organic and total carbon after dry combustion (elementary analysis)	ISO					S5							D1.4		
Soil quality -- Determination of organic carbon by sulfochromic oxidation	ISO					S5							D1.4		
Soil quality -- Determination of organochlorine pesticides and polychlorinated biphenyls – Gas chromatographic method with electron capture detection	ISO					S5							D1.4		

Appendix D: List of inventoried documents - category 'Soil quality'

		Type								Soil Quality-subdivision					
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Criteria, termin. & codification*	*Sampling*	*Physical methods*	*Chemical methods & Soil characteristics*	*Biological methods*	*Soil & site assessment*
		S1	S2	S3	S4	S5	S6	S7	S8	D1.1	D1.2	D1.3	D1.4	D1.5	D1.6
Soil quality -- Determination of phosphorus – Spectrometric determination of phosphorus soluble in sodium hydrogen carbonate solution	ISO					S5							D1.4		
Soil quality -- Determination of polynuclear aromatic hydrocarbons -- Method using high -performance liquid chromatography	ISO					S5							D1.4		
Soil quality -- Determination of redox potential – Field method	ISO					S5							D1.4		
Soil quality -- Determination of the potential cation exchange capacity and exchangeable cations using barium chloride solution buffered at pH = 8,1	ISO					S5							D1.4		
Soil quality -- Determination of the specific electrical conductivity Technical Corrigendum 1	ISO					S5							D1.4		
Soil quality -- Determination of total nitrogen -- Modified Kjeldahl method	ISO					S5							D1.4		
Soil quality -- Determination of total nitrogen content by dry combustion ("elemental analysis")	ISO					S5							D1.4		
Soil quality -- Determination of total sulfur by dry combustion	ISO					S5							D1.4		
Soil quality -- Determination of water-soluble and acid-soluble sulfate	ISO					S5							D1.4		
Soil quality -- Dissolution for the determination of total element content -- Part 1: Dissolution with hydrofluoric and perchloric acids	ISO						S6						D1.4		
Soil quality -- Extraction of trace elements by buffered DTPA solution	ISO						S6						D1.4		
Soil quality -- Extraction of trace elements soluble in aqua regia	ISO						S6						D1.4		
Soil quality -- Gas-chromatographic determination of the content of volatile aromatic hydrocarbons, naphthalene and volatile halogenated hydrocarbons -- Purge and trap method with thermal desorption	ISO					S5							D1.4		
Soil quality -- Biological methods -- Determination of nitrogen mineralization and nitrification in soils and the influence of chemicals on these processes	ISO					S5								D1.5	
Soil quality – Determination of abundance and activity of soil microflora using respiration curves	ISO					S5								D1.5	
Soil quality -- Guidance on laboratory testing for biodegradation of organic chemicals in soil under aerobic conditions	ISO				S4									D1.5	
Soil quality -- Guidance on laboratory testing for biodegradation of organic chemicals in soil under anaerobic conditions	ISO				S4									D1.5	
Soil quality -- Laboratory incubation systems for measuring the mineralization of organic chemicals in soil under aerobic conditions	ISO				S4									D1.5	
Soil quality – Laboratory methods for determination for microbial soil respiration	ISO					S5								D1.5	

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	Published by	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary	ISO				S4					D2.1						
Water quality -- Vocabulary -- Part 9: Alphabetical list and subject index	ISO				S4					D2.1						
Water quality -- Sampling -- Part 1: Guidance on the design of sampling programmes	ISO				S4						D2.2					
Water quality -- Sampling -- Part 11: Guidance on sampling of groundwaters	ISO				S4						D2.2					
Water quality -- Sampling -- Part 14: Guidance on quality assurance of environmental water sampling and handling	ISO				S4						D2.2					
Water quality -- Sampling -- Part 15: Guidance on preservation and handling of sludge and sediment samples	ISO				S4						D2.2					
Water quality -- Sampling -- Part 16: Guidance on biotesting of samples	ISO				S4						D2.2					
Water quality -- Sampling -- Part 18: Guidance on sampling of groundwater at contaminated sites	ISO				S4						D2.2					
Water quality -- Sampling -- Part 2: Guidance on sampling techniques	ISO				S4						D2.2					
Water quality -- Sampling -- Part 3: Guidance on the preservation and handling of samples	ISO				S4						D2.2					
Water quality -- Sampling -- Part 5: Guidance on sampling of drinking water and water used for food and beverage processing	ISO				S4						D2.2					
Water quality -- Determination of the activity concentration of radionuclides by high resolution gamma-ray spectrometry	ISO					S5						D2.3				
Water quality -- Determination of tritium activity concentration -- Liquid scintillation counting method	ISO					S5						D2.3				
Water quality -- Measurement of gross alpha activity in non-saline water -- Thick source method	ISO						S6					D2.3				
Water quality -- Measurement of gross beta activity in non-saline water	ISO						S6					D2.3				
Water quality -- Calibration and evaluation of analytical methods and estimation of performance characteristics -- Part 1: Statistical evaluation of the linear calibration function	ISO				S4								D2.4			
Water quality -- Calibration and evaluation of analytical methods and estimation of performance characteristics -- Part 2: Calibration strategy for non-linear second-order calibration functions	ISO				S4								D2.4			

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Guide to analytical quality control for water analysis	ISO				S4								D2.4			
Water quality -- Determination of 15 polycyclic aromatic hydrocarbons (PAH) in water by HPLC with fluorescence detection after liquid-liquid extraction	ISO					S5							D2.4			
Water quality -- Determination of 33 elements by inductively coupled plasma atomic emission spectroscopy	ISO					S5							D2.4			
Water quality -- Determination of adsorbable organically bound halogens (AOX)	ISO					S5							D2.4			
Water quality -- Determination of alkalinity -- Part 1: Determination of total and composite alkalinity	ISO					S5							D2.4			
Water quality -- Determination of alkalinity -- Part 2: Determination of carbonate alkalinity	ISO					S5							D2.4			
Water quality -- Determination of aluminium -- Atomic absorption spectrometric methods	ISO					S5							D2.4			
Water quality -- Determination of aluminium -- Spectrometric method using pyrocatechol violet	ISO					S5							D2.4			
Water quality -- Determination of ammonium -- Distillation and titration method	ISO					S5							D2.4			
Water quality -- Determination of ammonium -- Part 1: Manual spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of ammonium -- Part 2: Automated spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of ammonium -- Potentiometric method	ISO					S5							D2.4			
Water quality -- Determination of ammonium nitrogen by flow analysis (CFA and FIA) and spectrometric detection	ISO					S5							D2.4			
Water quality -- Determination of arsenic -- Atomic absorption spectrometric method (hydride technique)	ISO					S5							D2.4			
Water quality -- Determination of benzene and some derivatives -- Part 1: Head-space gas chromatographic method	ISO					S5							D2.4			
Water quality -- Determination of benzene and some derivatives -- Part 2: Method using extraction and gas chromatography	ISO					S5							D2.4			
Water quality -- Determination of biochemical oxygen demand after n days (BODn) -- Part 1: Dilution and seeding method with allylthiourea addition	ISO					S5							D2.4			
Water quality -- Determination of biochemical oxygen demand after n days (BODn) -- Part 2: Method for undiluted samples	ISO					S5							D2.4			
Water quality -- Determination of borate -- Spectrometric method using azomethine-H	ISO					S5							D2.4			
Water quality -- Determination of cadmium by atomic absorption spectrometry	ISO					S5							D2.4			
Water quality -- Determination of calcium and magnesium -- Atomic absorption spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of calcium content -- EDTA titrimetric method	ISO					S5							D2.4			

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Determination of certain organochlorine insecticides, polychlorinated biphenyls and chlorobenzenes -- Gas chromatographic method after liquid-liquid extraction	ISO					S5							D2.4			
Water quality -- Determination of chloride -- Silver nitrate titration with chromate indicator (Mohr's method)	ISO					S5							D2.4			
Water quality -- Determination of chloride by flow analysis (CFA and FIA) and photometric or potentiometric detection	ISO					S5							D2.4			
Water quality -- Determination of chromium -- Atomic absorption spectrometric methods	ISO					S5							D2.4			
Water quality -- Determination of chromium(VI) -- Spectrometric method using 1,5-diphenylcarbazide	ISO					S5							D2.4			
Water quality -- Determination of cobalt, nickel, copper, zinc, cadmium and lead -- Flame atomic absorption spectrometric methods	ISO					S5							D2.4			
Water quality -- Determination of cyanide -- Part 1: Determination of total cyanide	ISO					S5							D2.4			
Water quality -- Determination of cyanide -- Part 3: Determination of cyanogen chloride	ISO					S5							D2.4			
Water quality -- Determination of dissolved anions by liquid chromatography of ions -- Part 3: Determination of chromate, iodide, sulfite, thiocyanate and thiosulfate	ISO					S5							D2.4			
Water quality -- Determination of dissolved anions by liquid chromatography of ions -- Part 4: Determination of chlorate, chloride and chlorite in water with low contamination	ISO					S5							D2.4			
Water quality -- Determination of dissolved bromate -- Method by liquid chromatography of ions	ISO					S5							D2.4			
Water quality -- Determination of dissolved fluoride, chloride, nitrite, orthophosphate, bromide, nitrate and sulfate ions, using liquid chromatography of ions -- Part 1: Method for water with low contamination	ISO					S5							D2.4			
Water quality -- Determination of dissolved Li+, Na+, NH4+, K+, Mn2+, Ca2+, Mg2+, Sr2+ and Ba2+ using ion chromatography -- Method for water and waste water	ISO					S5							D2.4			
Water quality -- Determination of dissolved oxygen -- Electrochemical probe method	ISO					S5							D2.4			
Water quality -- Determination of dissolved oxygen -- Iodometric method	ISO					S5							D2.4			
Water quality -- Determination of dissolved sulfide - - Photometric method using methylene blue	ISO					S5							D2.4			
Water quality -- Determination of electrical conductivity	ISO					S5							D2.4			
Water quality -- Determination of fluoride -- Part 1: Electrochemical probe method for potable and lightly polluted water	ISO					S5							D2.4			
Water quality -- Determination of free chlorine and total chlorine -- Part 1: Titrimetric method using N,N-diethyl-1,4-phenylenediamine	ISO					S5							D2.4			

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Determination of free chlorine and total chlorine -- Part 2: Colorimetric method using N,N-diethyl-1,4-phenylenediamine, for routine control purposes	ISO					S5							D2.4			
Water quality -- Determination of free chlorine and total chlorine -- Part 3: Iodometric titration method for the determination of total chlorine	ISO					S5							D2.4			
Water quality -- Determination of highly volatile halogenated hydrocarbons -- Gas-chromatographic methods	ISO					S5							D2.4			
Water quality -- Determination of hydrocarbon oil index -- Part 2: Method using solvent extraction and gas chromatography	ISO					S5							D2.4			
Water quality -- Determination of iron -- Spectrometric method using 1,10-phenanthroline	ISO					S5							D2.4			
Water quality -- Determination of Kjeldahl nitrogen - - Method after mineralization with selenium	ISO					S5							D2.4			
Water quality -- Determination of manganese -- Formaldoxime spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of mercury	ISO					S5							D2.4			
Water quality -- Determination of mercury -- Methods involving enrichment by amalgamation	ISO					S5							D2.4			
Water quality -- Determination of nitrate -- Part 1: 2,6-Dimethylphenol spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of nitrate -- Part 2: 4-Fluorophenol spectrometric method after distillation	ISO					S5							D2.4			
Water quality -- Determination of nitrate -- Part 3: Spectrometric method using sulfosalicylic acid	ISO					S5							D2.4			
Water quality -- Determination of nitrite -- Molecular absorption spectrometric method	ISO					S5							D2.4			
Water quality -- Determination of nitrite nitrogen and nitrate nitrogen and the sum of both by flow analysis (CFA and FIA) and spectrometric detection	ISO					S5							D2.4			
Water quality -- Determination of nitrogen -- Part 1: Method using oxidative digestion with peroxodisulfate	ISO					S5							D2.4			
Water quality -- Determination of nitrogen -- Part 2: Determination of bound nitrogen, after combustion and oxidation to nitrogen dioxide, chemiluminescence detection	ISO					S5							D2.4			
Water quality -- Determination of permanganate index	ISO					S5							D2.4			
Water quality -- Determination of pH	ISO					S5							D2.4			
Water quality -- Determination of phenol index -- 4- Aminoantipyrine spectrometric methods after distillation	ISO					S5							D2.4			
Water quality -- Determination of phenol index by flow analysis (FIA and CFA)	ISO					S5							D2.4			
Water quality -- Determination of selected monovalent phenols -- Part 1: Gas-chromatographic method after enrichment by extraction	ISO					S5							D2.4			

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Terminology***	***Sampling***	***Physical methods***	***Chemical methods***	***Biochemical methods***	***Microbiological methods***	***Biological methods***
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Determination of selected monovalent phenols -- Part 2: Method by derivatization and gas chromatography	ISO					S5							D2.4			
Water quality -- Determination of selected nitrophenols -- Method by solid-phase extraction and gas chromatography with mass spectrometric detection	ISO					S5							D2.4			
Water quality -- Determination of selected organic nitrogen and phosphorus compounds -- Gas chromatographic methods	ISO					S5							D2.4			
Water quality -- Determination of selected phenoxyalkanoic herbicides, including bentazones and hydroxybenzonitriles by gas chromatography and mass spectrometry after solid phase extraction and derivatization	ISO					S5							D2.4			
Water quality -- Determination of selenium -- Atomic absorption spectrometric method (hydride technique)	ISO					S5							D2.4			
Water quality -- Determination of six complexing agents -- Gas-chromatographic method	ISO					S5							D2.4			
Water quality -- Determination of sodium and potassium -- Part 1: Determination of sodium by atomic absorption spectrometry	ISO					S5							D2.4			
Water quality -- Determination of sodium and potassium -- Part 2: Determination of potassium by atomic absorption spectrometry	ISO					S5							D2.4			
Water quality -- Determination of sodium and potassium -- Part 3: Determination of sodium and potassium by flame emission spectrometry	ISO					S5							D2.4			
Water quality -- Determination of surfactants -- Part 1: Determination of anionic surfactants by measurement of the methylene blue index (MBAS)	ISO					S5							D2.4			
Water quality -- Determination of surfactants -- Part 2: Determination of non-ionic surfactants using Dragendorff reagent	ISO					S5							D2.4			
Water quality -- Determination of the chemical oxygen demand	ISO					S5							D2.4			
Water quality -- Determination of the chemical oxygen demand index (ST-COD) -- Small-scale sealed-tube method	ISO					S5							D2.4			
Water quality -- Determination of the sum of calcium and magnesium -- EDTA titrimetric method	ISO					S5							D2.4			
Water quality -- Determination of total cyanide and free cyanide by continuous flow analysis	ISO					S5							D2.4			
Water quality -- Determination of turbidity	ISO					S5							D2.4			
Water quality -- Examination and determination of colour	ISO					S5							D2.4			
Water quality -- Guidelines for the determination of total organic carbon (TOC) and dissolved organic carbon (DOC)	ISO					S5							D2.4			
Water quality -- Spectrometric determination of phosphorus using ammonium molybdate	ISO					S5							D2.4			
Water quality -- Determination of inhibition of gas production of anaerobic bacteria -- Part 1: General test	ISO					S5								D2.5		

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Determination of inhibition of gas production of anaerobic bacteria -- Part 2: Test for low biomass concentrations	ISO					S5								D2.5		
Water quality -- Evaluation in an aqueous medium of the "ultimate" aerobic biodegradability of organic compounds -- Method by analysis of biochemical oxygen demand (closed bottle test)	ISO				S4									D2.5		
Water quality -- Evaluation in an aqueous medium of the "ultimate" aerobic biodegradability of organic compounds -- Method by analysis of dissolved organic carbon (DOC)	ISO					S5								D2.5		
Water quality -- Evaluation in an aqueous medium of the ultimate aerobic biodegradability of organic compounds -- Determination of biochemical oxygen demand in a two-phase closed bottle test	ISO					S5								D2.5		
Water quality -- Evaluation of the aerobic biodegradability of organic compounds at low concentrations -- Part 1: Shake-flask batch test with surface water or surface water/sediment suspensions	ISO						S6							D2.5		
Water quality -- Evaluation of the aerobic biodegradability of organic compounds at low concentrations -- Part 2: Continuous flow river model with attached biomass	ISO						S6							D2.5		
Water quality -- Evaluation of the aerobic biodegradability of organic compounds in an aqueous medium -- Semi-continuous activated sludge method (SCAS)	ISO					S5								D2.5		
Water quality -- Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium -- Carbon dioxide evolution test	ISO					S5								D2.5		
Water quality -- Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium -- Method by analysis of inorganic carbon in sealed vessels (CO2 headspace test)	ISO					S5								D2.5		
Water quality -- Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium -- Static test (Zahn-Wellens method)	ISO					S5								D2.5		
Water quality -- Evaluation of ultimate aerobic biodegradability of organic compounds in aqueous medium by determination of oxygen demand in a closed respirometer	ISO					S5								D2.5		
Water quality -- Guidance for the preparation and treatment of poorly water-soluble organic compounds for the subsequent evaluation of their biodegradability in an aqueous medium	ISO					S5								D2.5		
Water quality -- Guidelines for algal growth inhibition tests with poorly soluble materials, volatile compounds, metals and waste water	ISO				S4									D2.5		
Water quality -- Pseudomonas putida growth inhibition test (Pseudomonas cell multiplication inhibition test)	ISO					S5								D2.5		

Appendix E: List of inventoried documents - category 'Water quality'

		Type								Water Quality subdiv.						
Title	**Published by**	*Handbooks*	*Guides*	*Manuals*	*Standard guides (ASTM, ISO)*	*Standard test/determination methods (ASTM, ISO)*	*Standard practices (ASTM)*	*Other (reports, yearbooks, papers, etc.)*	*References*	*Terminology*	*Sampling*	*Physical methods*	*Chemical methods*	*Biochemical methods*	*Microbiological methods*	*Biological methods*
		S1	S2	S3	S4	S5	S6	S7	S8	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D2.7
Water quality -- Selection of tests for biodegradability	ISO				S4									D2.5		
Water quality -- Test for inhibition of oxygen consumption by activated sludge	ISO					S5								D2.5		
Water quality -- Detection and enumeration of bacteriophages -- Part 1: Enumeration of F-specific RNA bacteriophages	ISO					S5										D2.7
Water quality -- Detection and enumeration of bacteriophages -- Part 2: Enumeration of somatic coliphages	ISO					S5										D2.7
Water quality -- Detection and enumeration of bacteriophages -- Part 4: Enumeration of bacteriophages infecting Bacteroides fragilis	ISO				S4											D2.7
Water quality -- Detection and enumeration of coliform organisms, thermotolerant coliform organisms and presumptive Escherichia coli -- Part 2: Multiple tube (most probable number) method	ISO				S4											D2.7
Water quality -- Detection and enumeration of Escherichia coli and coliform bacteria -- Part 1: Membrane filtration method	ISO				S4											D2.7
Water quality -- Detection and enumeration of Escherichia coli and coliform bacteria in surface and waste water -- Part 3: Miniaturized method (Most Probable Number) by inoculation in liquid medium	ISO				S4											D2.7
Water quality -- Detection and enumeration of intestinal enterococci -- Part 2: Membrane filtration method	ISO				S4											D2.7
Water quality -- Detection and enumeration of intestinal enterococci in surface and waste water -- Part 1: Miniaturized method (Most Probable Number) by inoculation in liquid medium	ISO				S4											D2.7
Water quality -- Detection and enumeration of Legionella	ISO				S4											D2.7
Water quality -- Detection and enumeration of Salmonella	ISO				S4											D2.7
Water quality -- Enumeration of culturable micro- organisms -- Colony count by inoculation in a nutrient agar culture medium	ISO				S4											D2.7
Water quality -- General guide to the enumeration of micro-organisms by culture	ISO				S4											D2.7
Water quality -- Guidance on validation of microbiological methods	ISO				S4											D2.7
Water quality -- Practices for evaluating and controlling microbiological colony count media used in water quality tests	ISO						S6									D2.7

Appendix F: List of inventoried documents - category 'Analysis and Mapping'

		Type								Analysis & mapping				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Survey, assessment & mapping***	***Anal. & Present. of GW-level data***	***Anal. & present. of GW-quality data***	***Analysis of aquifer vulnerability***	***Analysis of landsubsidence***
		S1	S2	S3	S4	S5	S6	S7	S8	E1	E2	E3	E4	E5
Manual of Hydrological Field Measurement and Data Processing Practices, Vol. I and II - First Draft. (Now part of HIS Manual).	HP-India			S3						E1	E2	E3		
Practical Handbook of Ground Water Monitoring [Groundwater monitoring System Design; Design and Installation of Groundwater Monitoring Wells].	Lewis	S1								E1	E2	E3		
Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates:	EPA		S2							E1		E3		
Ground-water data-collection protocols and procedures for the national water-quality assessment program: collection and documentation of water-quality samples and related data	USGS			S3				S7		E1		E3		
Groundwater contamination inventory, A Methodological Guide [Contaminant source inventory; Map production]	UNESCO		S5							E1		E3	E4	
Groundwater resources, investigation and development	Academic Press	S1								E1				
"Quality Assurance Guidelines for Ground-Water Investigation: The Requirements", in A.G. Collins and A.I. Johnson, eds. Ground-Water Contamination: Field Methods, ASTM STP 963. ASTM, Philadelphia, pp. 27-34.	ASTM						S6			E1				
Standard Guide for Conceptualization and Characterization of Ground-Water Systems	ASTM				S4					E1				
Standard Guide for Establishing the Nomenclature of Ground-Water Aquifers	ASTM				S4					E1				
Hydrogeological Maps. A Guide and a Standard Legend.	IAH		S2							E1				
Groundwater Recharge. A Guide to Understanding Natural Recharge.	IAH		S2							E1				
Hydrogeology	John Wiley & sons	S1								E1				
Guidelines on Monitoring and Assessment of Transboundary Groundwaters	UN/ECE		S2							E1				
Hydrology and Water Resources of Small Islands (49) - A Practical Guide - Studies and Reports in Hydrology, 49	UNESCO		**S2**							**E1**				
Standard Legend for Hydrogeological Maps.	UNESCO							S7		E1				
Guidelines for conducting water resources assessment.	UNESCO/IHP		S2							E1				
Guidelines for groundwater investigation reports	USA-CA		S2							E1				
Hydrogeology.	John Wiley & Sons	S1								E1				
Applied Hydrogeology (Third ed.).	Macmillan	S1								E1				
Guidance Document on the Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities--Interim Final Guidance.	EPA		S2								E2	E3		

Appendix F: List of inventoried documents - category 'Analysis and Mapping'

		Type								Analysis & mapping				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Survey, assessment & mapping***	***Anal. & Present. of GW-level data***	***Anal. & present. of GW-quality data***	***Analysis of aquifer vulnerability***	***Analysis of landsubsidence***
		S1	S2	S3	S4	S5	S6	S7	S8	E1	E2	E3	E4	E5
Manuals for Groundwater Data Collection, Processing and Storage	HP-India			S3							E2	E3		
Groundwater Resource Evaluation	McCraw-Hill	S1									E2	E3		E5
Standard Guide for Presentation of Water-Level Information From Ground-Water Sites	ASTM				S4						E2			
Ground-Water-Level Monitoring and the Importance of Long-Term Water-Level Data	USGS							S7			E2			
Australian Guidelines for Water Quality Monitoring and Reporting	ARMC-AU&NZ		S2									E3		
Guide for Applying Statistical Methods for Assessment and Corrective Action Environmental Monitoring Programs	ASTM		S2									E3		
Standard Guide for Displaying Results of Chemical Analyses of Ground Water for Major Ions and Trace Elements-Diagrams Based on Data Analytical Calculations	ASTM				S4							E3		
Standard Guide for Displaying the Results of Chemical Analyses of Ground Water for Major Ions and Trace Elements-Diagrams for Single Analyses	ASTM				S4							E3		
Standard Guide for Displaying the Results of Chemical Analyses of Ground Water for Major Ions and Trace Elements-Trilinear Diagrams for Two or More Analyses	ASTM				S4							E3		
Standard Guide for Displaying the Results of Chemical Analyses of Ground Water for Major Ions and Trace Elements—Use of Maps	ASTM				S4							E3		
Guidelines on Standard Analytical Procedures for Water Analysis	HP-India		S2									E3		
Protocol for Water Quality Monitoring, Hydrology Project,	HP-India							S7				E3		
Workbook on Analysis of Heavy Metals in Environmental Samples by Atomic Absorption Spectrometry	HP-India							S7				E3		
Workbook on Analysis of Pesticides in Water Samples by Gas Chromatography,	HP-India							S7				E3		
Practical Handbook of Ground Water Quality [Organization and Analysis of Water Quality Data].	Lewis	S1										E3		
Standard Handbook for Solid and Hazardous Waste Facilities.	Lewis	S1										E3		
Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities, Interim Final Guidance.	RCRA	S1										E3		
Standard Guide for Selection of Methods for Assessing Ground Water or Aquifer Sensitivity and Vulnerability	ASTM				S4								E4	
Guidebook on Mapping Groundwater Vulnerability.	IAH		S2										E4	
Guidebook on Mapping Groundwater Vulnerability.	Verlag Heinz Heise		S2										E4	
Guidebook to studies of land subsidence due to ground-water withdrawal.	UNESCO		S2											E5

Appendix G: List of inventoried documents - category 'Monitoring networks'

		Type								Monitoring networks				
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***Setting standards/criteria for monitoring***	***Design of mon.networks - GW-levels***	***Design of mon.networks - GW-discharge***	***Design of mon.networks - GW-quality***	***Design of mon.networks - landsubsidence***
		S1	S2	S3	S4	S5	S6	S7	S8	F1	F2	F3	F4	F5
EU Water Framework Directive	EU							S7		F1	F2		F4	
Guidelines on Monitoring and Assessment of Transboundary Groundwaters	UN/ECE		S2							F1	F2		F4	
Management of Groundwater Observation Programmes	WMO							S7		F1	F2			
"Quality Assurance Guidelines for Ground-Water Investigation: The Requirements", in A.G. Collins and A.I. Johnson, eds. Ground-Water Contamination: Field Methods, ASTM STP 963. ASTM, Philadelphia, pp. 27-34.	ASTM						S6			F1				
Standard Guide for Selection of the Minimum Set of Data Elements Required to Identify Locations Chosen for the Field Collection of Information to Describe Soil, Rock, and Their Contained Fluids	ASTM				S4					F1				
Standard Practice for Minimum Set of Data Elements to Identify a Soil Sampling Site	ASTM						S6			F1				
Development of Effective Ground-Water Sampling Protocols, in A.G. Collins and A.I. Johnson, eds., Ground-Water Contamination: Field Methods, ASTM STP 963, ASTM, Philadelphia, pp. 17-26.	ASTM		S2							F1				
Guide for Developing and Applying Detection and Quantification Limits for Ground-Water Monitoring Systems	ASTM		S2							F1				
Standard Guide for Selection of Data Elements for Ground-Water Investigations	ASTM				S4					F1				
Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells	US-EPA	S1								F1				
Ground-Water Monitoring in Karst Terranes: Recommended Protocols and Implicit Assumptions.	EPA	S1									F2	F3		
Design and Installation of Ground Water Monitoring Wells in Aquifers. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.09, pp. 162-173.	ASTM		S2								F2		F4	
Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.09, pp. 162-173.	ASTM						S6				F2		F4	
Practical Handbook of Ground Water Monitoring [Groundwater monitoring System Design; Design and Installation of Groundwater Monitoring Wells].	Lewis	S1									F2		F4	
A groundwater monitoring network design algorithm	Princeton Univ.							S7			F2		F4	
Groundwater Monitoring Guidelines, Santa Clara County, California, 58 pp.	US-California		S2								F2		F4	
Ground-Water-Level Monitoring and the Importance of Long-Term Water-Level Data	USGS							S7			F2			
Australian Guidelines for Water Quality Monitoring and Reporting	ARMC-AU&NZ		S2										F4	
Guide for Optimization of Groundwater Monitoring Constituents for Detection Monitoring Programs for RCRA Waste Disposal Facilities	ASTM		S2										F4	
Evaluation of Selected Borehole Geophysical Methods for Hazardous Waste Site Investigations and Monitoring.	EPA							S7					F4	
Handbook of Suggested Practices for the Design and Installation of Ground Water Monitoring Wells.	EPA	S1											F4	
Procedures for Conducting a Comprehensive Ground Water Monitoring Evaluation of Hazardous Waste Disposal Facilities.	US-California	S1											F4	
Guidelines and standard procedures for studies of ground-water quality: selection and installation of wells, and supporting documentation	USGS		S2										F4	

Appendix H: List of inventoried documents - category 'Groundwater modelling and Miscellaneous'

		Type									Miscellaneous	
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***GW modeling***	***Miscellaneous***	***Not yet catagorized***
		S1	S2	S3	S4	S5	S6	S7	S8	G1	H1	X
Test Method for Ground Water Flow Modeling in Karst and Fractured - Rock Terraines	ASTM							S7		G1	H1	
Standard Guide for Calibrating a Ground-Water Flow Model Application	ASTM				S4					G1		
Standard Guide for Comparing Ground-Water Flow Model Simulations to Site-Specific Information	ASTM				S4					G1		
Standard Guide for Conducting a Sensitivity Analysis for a Ground-Water Flow Model Application	ASTM				S4					G1		
Standard Guide for Defining Boundary Conditions in Ground-Water Flow Modeling	ASTM				S4					G1		
Standard Guide for Defining Initial Conditions in Ground-Water Flow Modeling	ASTM				S4					G1		
Standard Guide for Documenting a Ground-Water Modeling Code	ASTM				S4					G1		
Standard Guide for Subsurface Flow and Transport Modeling	ASTM				S4					G1		
Regression modeling of groundwater flow	USGS	S1								G1		
Guidelines for Groundwater Protection in Australia	ARMC-AU&NZ		S2								H1	
"Quality Assurance Guidelines for Ground-Water Investigation: The Requirements", in A.G. Collins and A.I. Johnson, eds. Ground-Water Contamination: Field Methods, ASTM STP 963. ASTM, Philadelphia, pp. 27-34.	ASTM						S6				H1	
Guide for Applying Statistical Methods for Assessment and Corrective Action Environmental Monitoring Programs	ASTM		S2								H1	
Practice for Decontamination of Field Equipment Used at Nonradioactive Waste Sites. Annual Book of American Society for Testing and Material Standards. Philadelphia, Pennsylvania. Vol. 04.08. pp. 1169-1171.	ASTM							S7			H1	
Standard Guide for Developing Appropriate Statistical Approaches for Ground-Water Detection Monitoring Programs	ASTM				S4						H1	
Standard Guide for Locating Abandoned Wells	ASTM				S4						H1	
Standard Guide for Selection and Documentation of Existing Wells for Use in Environmental Site Characterization and Monitoring	ASTM				S4						H1	
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part One-Additional Identification Descriptors	ASTM				S4						H1	
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Three-Usage Descriptors	ASTM				S4						H1	
Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Two-Physical Descriptors	ASTM				S4						H1	
Standard Practice for Minimum Set of Data Elements to Identify a Ground-Water Site	ASTM						S6				H1	
Standard Practice for Monitoring Well Protection	ASTM						S6				H1	
Evaluation of Selected Borehole Geophysical Methods for Hazardous Waste Site Investigations and Monitoring.	EPA							S7			H1	
Guidance Document on the Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities--Interim Final Guidance.	EPA		S2								H1	
Handbook - Ground Water.	EPA	S1									H1	
List of terms of hydrogeology, geochemistry and geothermals of mineral and thermal waters	IAH							S7			H1	
Soil quality -- Sampling -- Part 3: Guidance on safety	ISO				S4						H1	

Appendix H: List of inventoried documents - category 'Groundwater modelling and Miscellaneous'

		Type									Miscellaneous	
Title	**Published by**	***Handbooks***	***Guides***	***Manuals***	***Standard guides (ASTM, ISO)***	***Standard test/determination methods (ASTM, ISO)***	***Standard practices (ASTM)***	***Other (reports, yearbooks, papers, etc.)***	***References***	***GW modeling***	***Miscellaneous***	***Not yet catagorized***
		S1	S2	S3	S4	S5	S6	S7	S8	G1	H1	X
ISO guide 9000 Quality management and quality assurance standards 1994. Part 1 : Guidelines for the selection and use; Part 2 General Guidelines for the application of ISO 9001, 9002 and 9003.	ISO				S4						H1	
ISO standards handbook 16.	**ISO**			S3							H1	
Soil quality -- Vocabulary -- Part 1: Terms and definitions relating to the protection and pollution of the soil	ISO				S4						H1	
Soil quality - Vocabulary -- Part 4: Terms and definitions related to rehabilitation of soils and sites	ISO				S4						H1	
Water quality -- Calibration and evaluation of analytical methods and estimation of performance characteristics -- Part 1: Statistical evaluation of the linear calibration function	ISO				S4						H1	
Water quality -- Calibration and evaluation of analytical methods and estimation of performance characteristics -- Part 2: Calibration strategy for non-linear second-order calibration functions	ISO				S4						H1	
Water quality -- Guide to analytical quality control for water analysis	ISO				S4						H1	
The Australian National Groundwater Data Transfer Standard	NGC-AU		S2								H1	
General criteria for the assessment of testing laboratories.	UN/ECE ?							S7			H1	
General criteria for the operation of testing laboratories.	UN/ECE ?							S7			H1	
Hydrological principles of groundwater protection.	UNESCO	S1									H1	
Hydrology and Water Resources of Small Islands (49) - A Practical Guide - Studies and Reports in Hydrology, 49	UNESCO		**S2**								**H1**	
Manual for estimation of probable maximum precipitation	UNESCO			S3							H1	
Monitoring for Groundwater Management in (Semi-) Arid Regions (57) - Studies and Reports in Hydrology, 57	UNESCO		**S2**								**H1**	
Water Resources of Hard Rock Aquifers in Arid and Semi-Arid Zones (58) - Studies and Reports in Hydrology, 58	UNESCO							S7			H1	
Guidelines for geophysical reports for environmental and engineering geology	USA-CA		S2								H1	
General Field and Office Procedures for Indirect Discharge Measurements	USGS	S1									H1	
Some Statistical Tools in Hydrology	USGS	S1									H1	
Guide to hydrological practices. Fifth edition.	WMO		S2								H1	
Guide to Hydrometeorological Practices. Second Edition. WMO- No. 168. TP. 82.	WMO		S2								H1	
Groundwater contamination inventory, A Methodological Guide [Contaminant source inventory; Map production]	UNESCO		S5								H1	
DRASTIC: A Standardized System for Evaluating Ground Water Pollution Potential Using Hydrogeologic Settings.	US-EPA							S7			H1	
Aquifer Contamination and Protection.	UNESCO	S1									H1	
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