BRITISH STANDARD

BS EN
14968:2006

Semantics for groundwater data interchange

The European Standard EN 14968:2006 has the status of a British Standard

ICS 13.060.10; 35.240.99

BSI
British Standards

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 14968:2006.

The UK participation in its preparation was entrusted to Technical Committee CPI/113, Hydrometry.

A list of organizations represented on CPI/113 can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 29 September 2006

ISBN 0 580 49297 4

Amendments issued since publication

Amd. No.	Date	Comments

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 14968

August 2006

ICS 13.060.10; 35.240.99

English Version

Semantics for groundwater data interchange

Sémantique pour l'échange de données concernant les eaux souterraines

Semantik für den Austausch von Grundwasserdaten

This European Standard was approved by CEN on 1 August 2006.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: rue de Stassart, 36 B-1050 Brussels

Ref. No. EN 14968:2006: E

Contents

Page

Foreword

This document (EN 14968:2006) has been prepared by Technical Committee CEN/TC 318 “Hydrometry”, the secretariat of which is held by BSI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2007, and conflicting national standards shall be withdrawn at the latest by February 2007.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

Introduction

Piezometric data, e.g groundwater level, pressure, groundwater flow, represent a valuable resource and their value is likely to increase in the context of today at the European, national and local levels.

Indeed, the environment is one of the main concerns of the European Union, and it is reflected in the new EU Directives such as the "*EU Water Framework Directive"* requesting that knowledge regarding environment be shared at the national or international levels.

Equally, groundwater quantitative data also represent a source of wealth for local actors (cities, local authorities, private companies, etc.) in undertaking their present activity. For example, a town that uses groundwater for drinking water needs groundwater data to define its drinking water policy, and run its drinking water plant. Towns can directly provide the data that they need or, if data are not available; they have to collect them from various producers that are sometimes located in different countries. In this latter case, this standard provides for a unique data exchange interface which will help towns to collect data more easily and producers to disseminate them quicker.

The aim of this standard is to describe data necessary to produce "initial" groundwater quantitative data. The description of aggregate data for groundwater lies outside the scope of this standard. For example, the depth measurement can be carried out in accordance with this standard, but not the altitude measurement. This standard is designed to meet producers' needs and not to define data that are required for exchange between national or European organizations.

This standard gives the complete semantic basis necessary to store and exchange groundwater quantitative data. To perform such exchanges, the producer may use a XML file such as recommended by European organizations but these semantics can be used with other file formats (text file, HTML).

1 Scope

This standard covers the semantics (meaning) of data exchanged between data producers, users and databanks, independently from the software device and the formats used to exchange the files.

It provides a consistent set of terms defining selected objects and their related attributes.

The standard is not applicable to:

— data describing domestic uses (drinking water, waste water) or qualitative aspects ;

— real time data or data calculated from models;

— all the various characteristics on the organizations exchanging data concerned;

— debimetric measures.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
aquifer system
hydrogeological entity within which all components are in hydraulic continuity and that is bound by limits representing an obstacle for the dissemination of any perceptible effect outside the system

2.2
archive data
data stored to keep knowledge about an object for a given period of time

2.3
attribute
characteristic of an object or entity [ISO/IEC 11179-1]

2.4
calculated data
data established from calculations carried out to reach different goals: forecast, simulation, design, etc.

2.5
concept
unit of thought constituted through abstraction on the basis of characteristics common to a set of objects

2.6
data
representation of facts, concepts, or instructions in a formalized manner, suitable for communication, interpretation, or processing by humans or by automatic means

2.7
data element
unit of data for which the definition, identification, representation, and permissible values are specified by means of a set of attributes [ISO/IEC 11179-1]

2.8
data element dictionary
information resource that lists and defines all relevant data elements

2.9
data interchange
process of sending and receiving data in such a manner that the information content or meaning assigned to the data is not altered during the transmission

2.10
data length
maximum size given in a number of characters

2.11
data producer
private or public entity in charge of data production and responsible for the validity of these data when they are published

2.12
data model
description of the organization of data in a manner that reflects an information structure

NOTE See Annex A.

2.13
data type
format used for the collection of letters, digits, and/or symbols, to depict values of a data element, determined by the operations that may be performed on the data element

2.14
definition
statement that expresses the essential nature of a data element and permits its differentiation from all other data elements

2.15
entity
any concrete or abstract thing of interest, including associations among things

2.16
information
(in information processing): knowledge concerning objects, such as facts, events, things, processes, or ideas, including concepts, that within a certain context has a particular meaning

2.17
metadata
data that defines and describes other data [ISO/IEC 11179-1]

2.18
object
any part of the conceivable or perceivable world

2.19
real time data
data generally taken from devices for the immediate knowledge of a phenomenon state

3 File structure for data interchange

The data included in the directories presented in Clauses 6 and 7 can be used with any method for data interchange. Any file format can be used to exchange data according to this standard provided that it has no impact on the data structure and the semantics described in the following clauses.

4 Piezometric concepts

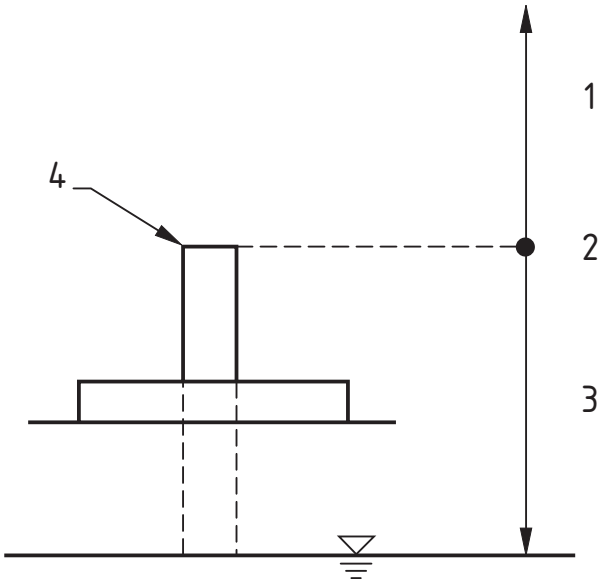
4.1 Piezometric time series

4.1.1 General

Piezometric time series are a record of the groundwater level over time. They associate a date to the groundwater level at a given moment.

Depending on the variability of the groundwater level, measurements will be more or less frequent over a period of time.

The groundwater level measurements shall be positive or negative according to the measurement point (see Figure 1). Measurements are negative when the groundwater level rises above the measurement point (as with an artesian well), and positive in all the other cases.



Key

1 height (-)
2 level zero
3 depth to groundwater level (+)
4 measurement point

Figure 1 — Qualification of the groundwater level measurements

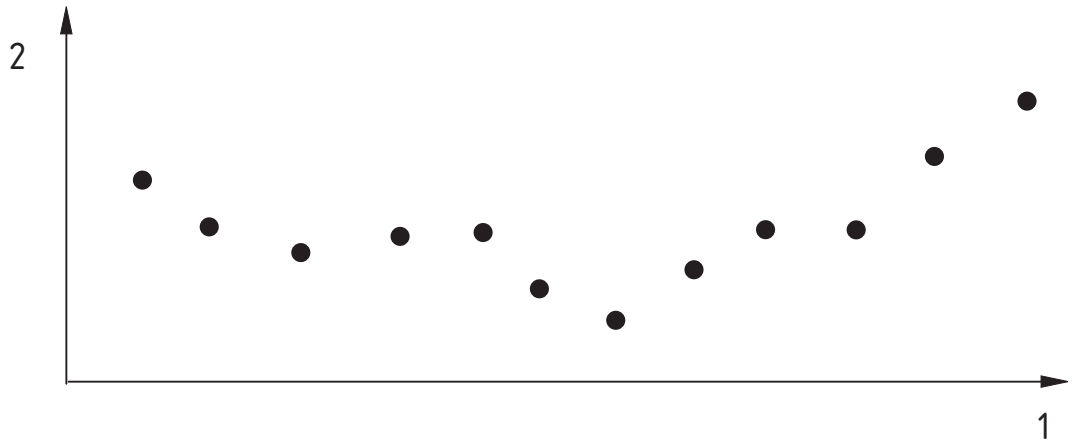
4.1.2 Type of time series

4.1.2.1 General

The groundwater level is measured with discontinuous or continuous time series.

4.1.2.2 Discontinuous time series

Discontinuous time series are sets of level measures observed with or without any specific frequency (see Figure 2).



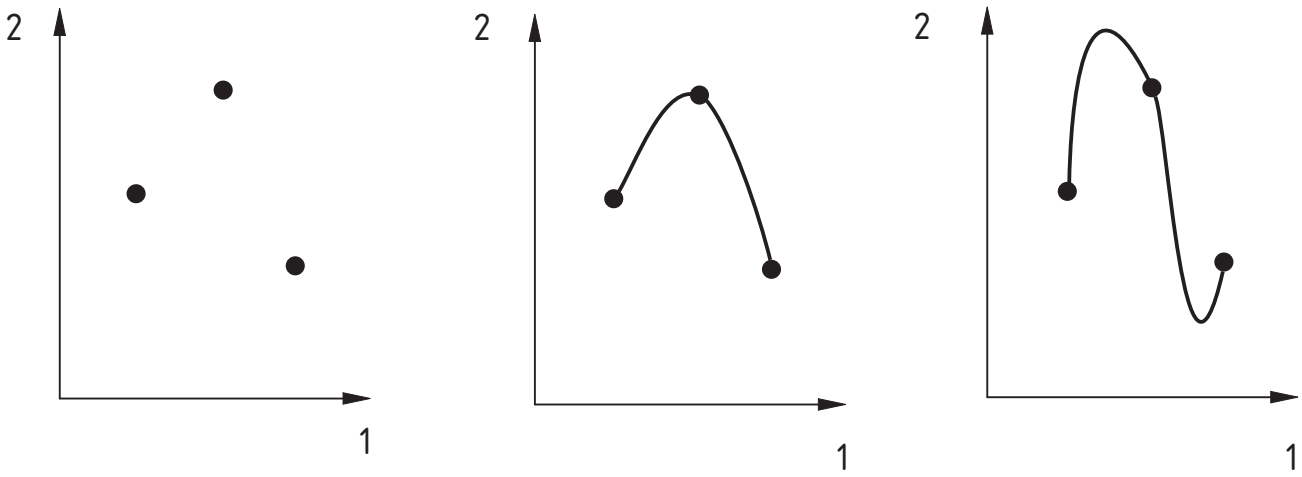
Key

1 time
2 depth to groundwater level

Figure 2 — Discontinuous time series

With this kind of time series, the evolution of the groundwater level between two measures is unknown.

Figure 3 shows that measures (example A) conceal two radically different evolutions (examples B and C) of the groundwater level.



Example A Example B Example C

Key

1 time
2 depth to groundwater level

Figure 3 — Elevation of the groundwater level between measurements

Piezometric measurements shall be made with a sensor. If the sensor does not operate for a shorttime, e.g. sensor breakdown, or if the result has no meaning, at least one piezometric measurement will be missing. In such a case, the missing data shall be identified because there is no continuous series for the measure preceding this missing data and the measure coming after.

4.1.2.3 Continuous time series

The groundwater level is known at any moment during the period covered by the continuous time series. Indeed, continuous time series are curves resulting from a permanent measurement of the groundwater level.

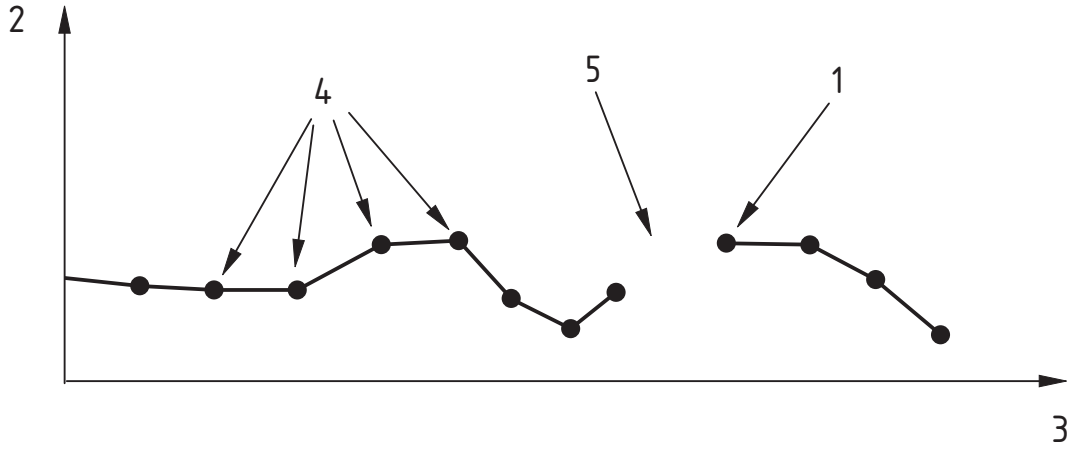
Time series shall be obtained by using graphical or electronic devices.

4.1.3 Time series presentation

Each time series is represented by a set of points in succession over time. Each point represents the groundwater level at a given moment.

Points represent the measures of discontinuous time series or the curve inflection point of the continuous time series.

To indicate the continuity between two points as shown in Figure 4, each point may be linked to the preceding point. If a point is not linked, it is the first point of a new sequence in the time series. The presence of an initial point therefore indicates that data were not available for the preceding period.



Key

1 initial points
2 depth
3 time
4 current points
5 discontinuity

Figure 4 — Continuous time series presentation

4.1.4 Validation of the measurements

The validity of each measurement is described according to the type of measurement method used. Four scenarios are possible:

a) Impossible to validate;

b) Valid;

c) Suspect ;

d) Not valid ;

By default, all values are specified as 'Not validated yet'. The operator shall then assign one of the above-mentioned qualifications after examination.

A measurement is validated when the producer believes that the data and all the different procedures used to produce them comply with the monitoring protocol.

A measurement is not valid when the producer believes that the data or the procedures used to produce them do not comply with the measurement protocol.

A measurement is "Impossible to validate" when the operator does not have the information available to determine the validity of the data production according to the measurement protocol (e.g. historical data from archives).

4.2 Piezometer station

4.2.1 General

A piezometer is one method of measuring the piezometric height at a point within an aquifer system. It indicates the pressure at this point, enabling the observer to record the phreatic level or pressure. In the data interchange, only the depths to groundwater level of a piezometer are exchanged.

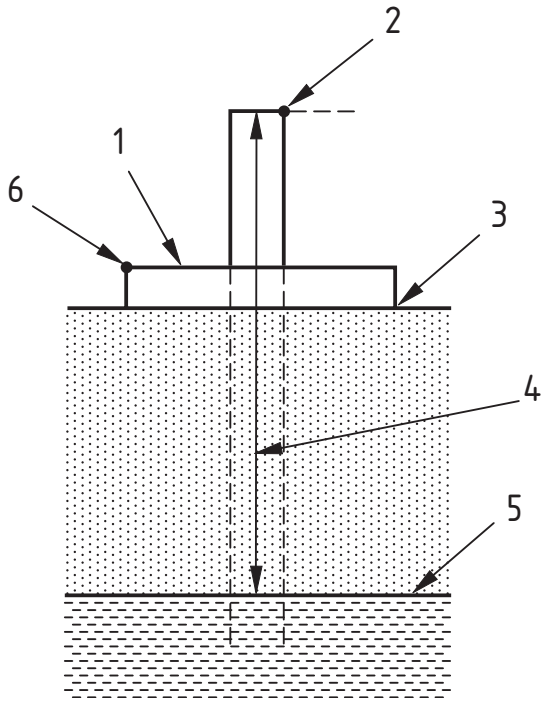
According to the scope of this standard, the concept of "piezometer" is extended to all artificial structures (well, borehole, gravel-pit) or natural structures (swallow, hole, grottos) which enables the groundwater level to be measured.

Each piezometer shall have a unique code given by the country where it is located.

4.2.2 Key features of a piezometer

4.2.2.1 General

Each piezometer has two key features: the level measurement point and the altitude benchmark measurement point as shown in Figure 5.



Key

1 plinth
2 level measurement point
3 altitude of surface in relation to the national altitude reference system
4 depth to groundwater level
5 groundwater level
6 altitude benchmark point

Figure 5 — Key features of a piezometer

4.2.2.2 Level measurement point

The level measurement point is the location on the piezometer used as a marker to measure the depth of the groundwater level (for example: the side of the tube of the borehole, the edge of the well, the reference ground level on a gravel-pit, etc.).

The level measurement point is 0, which is the basis for all depth measures. It applies to all measurement points. The real height is defined by using benchmark points.

4.2.2.3 Altitude benchmarks

Altitude benchmark points are used to compare data from all the piezometers in an aquifer system in order to determine the groundwater level of the system.

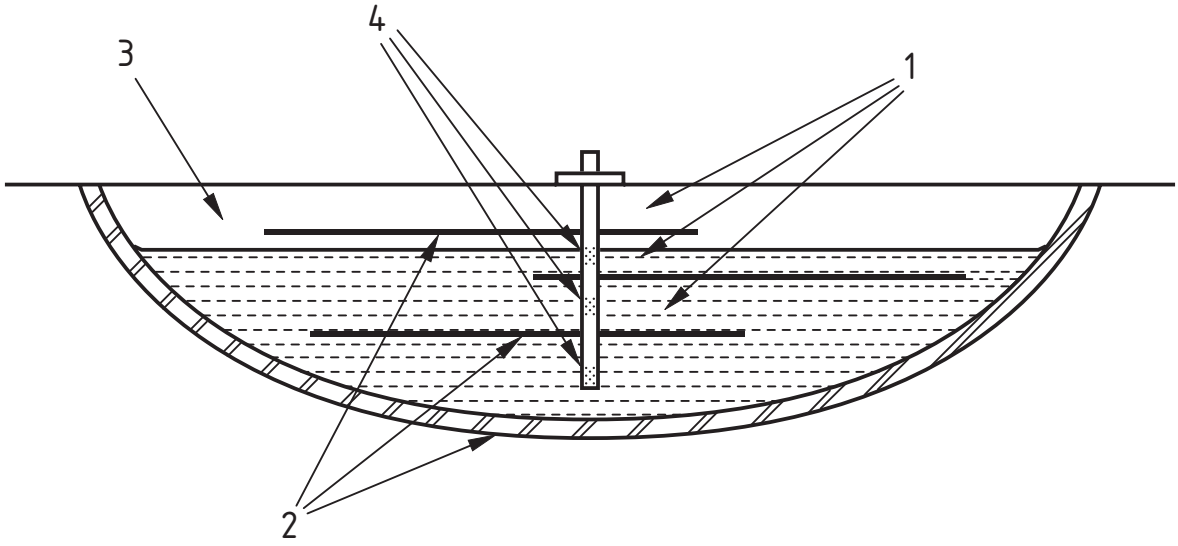
Three main locations are generally used to establish an altitude benchmark point: the level measurement point itself (when it is a permanent fixture), the altitude of the surface level or the plinth altitude.

The altitude of the benchmark altitude point can be determined by several means such as maps, GPS, topographic surveying, etc. and it is valid only for a given period of time. The altitude shall be based on the national altitude reference system.

The definition of the altitude benchmark point shall ensure the continuity within the time series when the piezometer has been damaged (a chipped tube has been broken), or modified (a new collar has been built).

4.2.3 Monitored aquifer systems

A piezometer should be used to monitor the depth of groundwater level of only one aquifer system as shown in Figure 6, even if it has to go through numerous aquifer horizons.

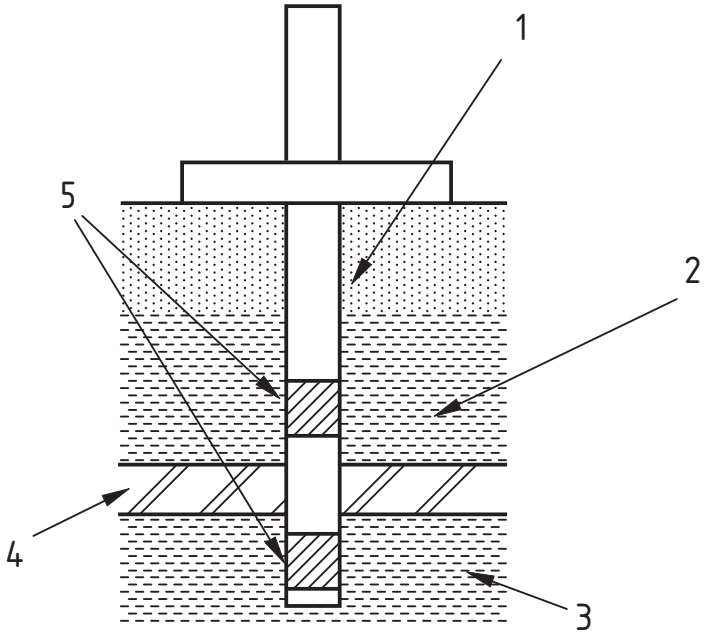


Key

1 aquifer horizons
2 impermeable layers (aquiclude)
3 aquifer system
4 strainers

Figure 6 — Aquifer horizons

Nevertheless, boreholes going through several aquifer systems may sometimes be also used as piezometers, especially in areas where the number of piezometers is limited (see Figure 7). This situation should be avoided as far as possible, but if such boreholes are used, data related to them shall be identified as coming from multi-aquifer boreholes, so that they can be carefully interpreted.



Key

1 casing
2 unconfined aquifer
3 confined aquifer
4 impermeable layer
5 screens

Figure 7 — A borehole linked to two aquifers

The lithology at the piezometer location should also be described, so that information on local variations in the general lithology defined for the whole aquifer can also be provided.

4.2.4 Piezometer history

Many events can happen during the lifetime of the piezometer. This kind of information shall be stored with the date since it can be very useful to understand the time series described. These events might be:

— a new topographic survey;

— the building of a new collar/plinth;

— a new measuring equipment;

— the destruction of the piezometer head by works; etc.

4.3 Groundwater level producer

At a given date, a piezometer is always the responsibility of a producer. The producer might change during the life cycle of the piezometer because the responsibility can move from one producer to another. It is therefore important to keep track of such changes.

4.4 Measurement methods

A description of the method used to obtain measurements and the measurement frequency may accompany measurement data.

Different methods of measurement may be used such as:

— a manual method (manual dipper, scale reading);

— a curve plotter (strip chart recording, float recorder, analogical plotter);

— a digital recorder (time step fixed or variable).

Measurement frequencies shall also be mentioned. These frequencies indicate, for example, that an important variation of the groundwater level is likely to be observed between two measures. The lower the frequency is, the bigger is the probability for this variation.

4.5 Monitoring network of the piezometer

Usually, a piezometer is operated within one monitoring network during a given period of time. In some cases, a piezometer can belong to several networks during the same period of time.

5 Interchange prerequisites

This standard is intended to facilitate interchange of groundwater data. For efficiency reasons, the following should be carried out before any interchange of groundwater data.

— Define the prerequisites for the interchange, in particular, the list of data to be exchanged;

— Identify data already defined in this standard;

— Specify with partners exchanging data, those data which are not defined in this standard;

— Determine the codification systems required to identify the organizations and the aquifer systems involved in the data interchanges, piezometers;

— Select a file format to decide the way to organise data in the files to be exchanged;

— Describe the organization involved in the interchanges: who is sending what to whom, when, and by what means ?

— Prepare a formal document such as a contract agreed by the partners involved in the interchanges and containing all these aspects and any additional relevant elements that may prove necessary.

6 Object dictionary

6.1 General

This directory contains a list of basic objects used in the field of groundwater.

Each identified object is given:

a) a name which appears as the title of the article;

b) a description of the concept to explain the agreed meaning;

c) the organization(s) responsible for the specific information related to the object and likely be transmitted;

d) a list of attributes pertaining to each object.

6.2 Aquifer system

An aquifer system is an hydrogeological entity within which all components are in hydraulic continuity and that is bound by limits representing an obstacle for the dissemination of any perceptible effect outside the system (see 2.1).

Data to be exchanged about the list of hydrogeological entities shall be defined by the partners involved in the interchange.

This object includes the following information:

- Aquifer system code (object identifier);
- Aquifer system name;
- Aquifer system state;
- Aquifer system nature;
- General information on the aquifer system;
- Comments on the aquifer system.

6.3 Measurement method used with the piezometer

The measurement method used with a piezometer represents the history of the various methods which have been used with the frequency of the measurements carried out with the piezometer.

Information on the piezometer is the responsibility of the organization(s) providing the data and that uses the piezometer.

This object includes the following information:

- Starting date of use of the measurement method (object identifier);
- Closing date of use of the measurement method;
- Measurement method;
- Measurement frequency;
- Comments on the measurement method used on the piezometer.

6.4 Monitoring network

A monitoring network is a set of piezometers used for a specific purpose.

A piezometer can be operated within several measurement networks, which may vary over a period of time. In this case, all the periods of association of a piezometer to a given network may be specified.

The description of the networks to which the piezometer is associated is the responsibility of the organization(s) providing the data and that uses the piezometer.

This object includes the following information:

- Code of the monitoring network (object identifier);
- Name of the monitoring network;
- Purpose of the monitoring network.

6.5 Organization

Organizations are private or public entities identified for the functions that they play (data producer, operator, etc.) in data exchanges.

The list of organizations shall be defined by the partners involved in the data interchange.

This object includes the following information:

- Organization code (object identifier);
- Organization name;
- Organization address 1;
- Organization address 2;
- Organization address 3;
- Organization address 4;
- Organization address 5;
- Organization address 6;
- Comments on the organization.

6.6 Operating period of a piezometer by an organization

A piezometer is usually operated by a single organization, known as the manager of the piezometer. However, a piezometer may be managed by two or more organizations. In this latter case, only one organization is responsible for validating data produced.

The piezometer manager(s) can change in the course of time. The period during which an organization has been responsible for the piezometer shall also be specified.

The establishment of the management periods of the piezometer is placed under the responsibility of the organization(s) providing the data and that uses the piezometer.

This object includes the following information:

— Starting date of the operating period of the piezometer (object identifier);

— Closing date of the operating period of the piezometer;

— Operator's internal code of the piezometer.

6.7 Period of association of a piezometer to a network

Typically, a piezometer is operated within one monitoring network during a given period of time. In some cases, a piezometer may belong to several networks during the same period of time.

This information is the responsibility of the organization(s) providing the data and that uses the piezometer.

This object includes the following information:

— Starting date of the association period of a piezometer to a monitoring network (object identifier);

— Closing date of the association period of a piezometer to a monitoring network;

— Operator's internal code of the piezometer.

6.8 Piezometer

Basically, a piezometer is a device to measure the piezometric height at a given point within an aquifer system. It indicates the pressure at this point, enabling the phreatic level or pressure to be observed and recorded. [Source: G. Castany, J. Margat (1977) French dictionary of hydrogeology, Editions du BRGM, Orléans, France].

However, for practical reasons, and in keeping with common practice, in this standard the piezometer concept is extended to all artificial structures (well, borehole, gravel-pit etc.) or natural structures (spring, swallow hole, grottoes etc.) which permit access to the groundwater to measure it.

Theoretically, a piezometer is a device used to measure only one groundwater level. As a matter of fact, a piezometer can be used to measure several groundwater levels if it is linked to several layers separately.

Information on the piezometer is the responsibility of the organization(s) providing the data and that uses the piezometer.

This object includes the following information:

— Piezometer code (object identifier);

— Piezometer name;

— Name of the piezometer location;

— Type of piezometer;

— Creation date of piezometer;

— Closing date of piezometer;

— Coordinate X of piezometer;

— Coordinate Y of piezometer;

- Precision on the piezometer coordinates;
- Coordinate reference system of the piezometer;
- Piezometer altitude;
- Expression of the piezometer time series;
- Confinement condition;
- Name of the town;
- Piezometer lithology name;
- Piezometer lithology type name;
- Comments on the piezometer.

6.9 Piezometer altitude benchmark point

The altitude benchmark point of the piezometer is a physical point located on the piezometer. Its altitude is measured (more or less precisely) to establish the elevation (z level) of the groundwater piezometric height.

For a conventionally built piezometer (a tube rising above the ground level protected by a base or a plinth), three positions can be used as a piezometer altitude benchmark point:

- The measurement reference mark (tube rim);
- The upper rim of the base or plinth;
- The ground at the foot of the piezometer.

The altitude of these points can be obtained using two methods: either from the measurement carried out by a land surveyor or, directly from a map scaled at 1:25 000 or over (if it is the only source of information available).

The altitude of the altitude benchmark point may be expressed using different reference systems.

Several altitude benchmark points of different types (mark, rim or ground) may be used for the piezometer at any given time.

Information on the piezometer is placed under the responsibility of the organization(s) collecting data and processing them.

This object includes the following information:

- Type of the altitude benchmark point of the piezometer (object identifier);
- Starting date of the validity of the altitude benchmark point (object identifier);
- Closing date of the validity of the altitude benchmark point;
- Altitude of the altitude benchmark point of the piezometer;
- Altitude reference system;
- Method for the altitude measurement;

— Comments on the altitude benchmark point of the piezometer.

6.10 Piezometer event

Events may occur on a piezometer. They include facts that the data producer using the piezometer may wish to record as they are considered as being significant to understand the lifecycle of a piezometer and interpret the data that are measured by the piezometer.

EXAMPLES:

— Rebuilding plinths;

— Redefining the altitude benchmark point;

— Installing a measurement device.

Information on the piezometer is the responsibility of the organization(s) producing data and processing them.

This object includes the following information:

— Date of the piezometer event (object identifier);

— Description of the piezometer event.

6.11 Level measurement point

The level measurement point is the physical point located on the piezometer housing, from which the groundwater level is measured.

The difference of level between the level measurement point and the altitude benchmark point shall be known so that the surface altitude of the aquifer system may be determined. With a conventionally built piezometer (with a tube rising above ground level, and protected by a base or a plinth), the height is negative when the altitude benchmark point corresponds to the ground at the foot of the piezometer or the upper rim of the base or plinth. It is equal to zero if the altitude benchmark point corresponds to the measurement point. The description of the marker indicates to which altitude benchmark point the mark refers.

The information on the piezometer is the responsibility of the organization(s) acquiring data acquisition or managing them.

This object includes the following information:

— Starting date of the validity of the level measurement point (object identifier);

— Closing date of the validity of the level measurement point;

— Distance between the level measurement point and the altitude benchmark point;

— Altitude benchmark point taken as reference;

— Comments on the level measurement point;

6.12 Piezometric time series

The piezometric time series is measured as a function of time and water levels observed at a given piezometer in an aquifer system.

Variations of heights are discretized to obtain a depth/time representation in the shape of a series of poly-lines.

Data are discretized using a fixed or variable time sampling rate (when traced over the inflexion points of the curve representing the time series).

Each depth is validated by one and only one of the organizations designated as the operator of the piezometer.

This information is placed under the responsibility of the organization(s) collecting data and the measurements on the piezometer.

This object includes the following information**:**

- Date of the point (object identifier);
- Time of the point (object identifier);
- Point value;
- Continuity code of the point;
- Mode to obtain the point;
- Point precision;
- Point validity.

7 Attribute dictionary

7.1 General

This directory names and defines a list of attributes specifying the objects that are listed in Clause 6.

Each attribute is given:

a) A name which appears as the title of the article;

b) The object related name;

c) A definition;

d) Specifications including:

- Data type and its length;
- The data producer who is the organization(s) responsible for the attribute described and likely be transmitted;
- A list of values, if relevant;
- A written rule for clarification when necessary.

7.2 Altitude benchmark point taken as reference

Definition: point used to measure the difference of the elevation level of the piezometer from the measurement point. It is described using one of the codes in Table 1.

Table 1 — List of values allocated to altitude benchmark point taken

Code	Label
1	Rim of the tube
2	Upper edge of the base or plinth
3	Ground at the foot of the piezometer

Object related name: LEVEL MEASUREMENT POINT

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

7.3 Altitude of the altitude benchmark point

Definition: elevation of the measurement point of a piezometer, expressed in metres, according to the altitude reference system.

Object related name: ALTITUDE BENCHMARK POINT

Specifications:

Data type: Number

Data producer: Organization producing data and operating the piezometer

7.4 Altitude reference system

Definition: name of the altitude reference system in which the altitude of the altitude benchmark point of the piezometer is expressed.

Object related name: PIEZOMETER ALTITUDE BENCHMARK POINT

Specifications:

Data type: Character string

Length: 100

Data producer: Organization(s) producing data and operating the piezometer

7.5 Aquifer system code

Definition: identifier assigned to each aquifer system

It is recommended that this code be stable and unique in the course of time at a high geographical level: region, state or continent like Europe. The same code shall be used all the time to specify geographical level, such as area, region, state or continent e.g. Europe.

Object related name: AQUIFER SYSTEM

Specifications:

Data type: Character string

Length: 8

Data producer: Partners exchanging data

Value(s): Codes

Additional specifications: Identifier

The list of hydrogeological entities shall be specified by the partners involved in the interchange.

7.6 Aquifer system name

Definition: one word or a group of words specifying the common name of an aquifer system

The names of the hydrogeological entities are written in upper case except for indications specifying a subdivision that cannot be identified by a geographic name.

Examples of names:

Chalk aquifer (United-Kingdom)

Costal aquifer of Mar del Plata (Argentina)

Karasu karstic aquifer (Turkey)

The names of subdivisions of hydrogeological entities are composed of:

a) The name of the main aquifer system, separated from the name of the subdivision by a division slash '/';

b) Or the name of the main aquifer system complemented by the code for the subdivision.

Examples of names:

ILE CREMIEU / PLAINE D'OPTEVOZ (France)

Object related name:	AQUIFER SYSTEM
Specifications:	
Data type:	Character string
Length:	80
Data producer:	Organization producing data and operating the piezometer

7.7 Aquifer system nature

Definition: indication specifying whether it refers to an aquifer system or a hydrogeological domain. This is expressed by using one of the codes in Table 2:

Table 2 — List of values allocated to aquifer system nature

Code	Label
1	Aquifer system
2	Hydrogeological domain

A hydrogeological domain is a reference space area which are little aquifers (in comparison with an aquifer system). It is possible some aquifer entities but without a large extension and isolated in a impermeable entity.

The expression "Aquifer system" refers to an entity, all its parts being hydraulically connected and which is confined within limits preventing any noteworthy influence from spreading outside it.

Object related name: AQUIFER SYSTEM

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

7.8 Aquifer system state

Definition: confinement condition of an aquifer system. It is described using the codes in Table 3.

Table 3 — List of values allocated to aquifer system state

Code	Label	Definition
1	Confined aquifer system	An aquifer system is said to be confined when it is trapped between two totally impermeable layers of rock.
2	Unconfined aquifer system (or free)	An aquifer system is said to be unconfined when it is not covered with an impermeable layer.
3	Confined and unconfined aquifer	An aquifer system is said to be confined and unconfined when it is either globally one or the other, but includes unconfined or confined area, covering one or more places of its surface area.
4	Partly confined aquifer system	An aquifer system is said to be partly confined when it is overlain by a semi-permeable layer (e.g.: Saône aquifer system, which was originally unconfined but which has, with time, gradually become overlain by loam).
5	Artesian	
6	Partly artesian	

Object related name: AQUIFER SYSTEM

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

7.9 Closing date of the operating period of the piezometer

Definition: date, expressed to the nearest day, when the organization currently operating (or co-operating) the piezometer finishes filling its function.

Object related name : OPERATING PERIOD OF A PIEZOMETER BY AN ORGANIZATION

Specifications:

Data type: Date

Length: Length of the date in figures and words

Data producer: Organization producing data and operating the piezometer

Additional specifications: Identifier

7.10 Closing date of the validity of the level measurement point

Definition: date, expressed to the nearest day, when the measurement point of the piezometer is no longer used to measure the piezometric height of an aquifer system

Object related name:	PIEZOMETER LEVEL MEASUREMENT POINT
Specifications:	
Data type:	Date
Length:	Length of the date in figures and words
Data producer:	Organization producing data and operating the piezometer

7.11 Closing date of the association of a piezometer to a monitoring network

Definition: date, expressed to the nearest day, when the piezometer does no longer belong to the monitoring network

Object related name:	PERIOD OF ASSOCIATION OF A PIEZOMETER TO A NETWORK
Specifications:	
Data type:	Date
Length:	Length of the date in figures and words
Data producer:	Organization producing data and operating the piezometer
Additional specifications:	Identifier

7.12 Closing date of piezometer

Definition: date, expressed to the nearest day, when the piezometer is definitely shut down, i.e. the date when measurements can no longer be observed with this piezometer (the piezometer is damaged or destroyed, etc.)

The date of closure shall not be confused with the date when data are no more obtained by using the piezometer. As a matter of fact, a piezometer can be temporarily abandoned, and then put again into service after a given (more or less long) period.

Object related name:	PIEZOMETER
Specifications:	
Data type:	Date
Data producer:	Organization producing data and operating the piezometer

7.13 Closing date of the validity of the altitude benchmark point

Definition: date, expressed to the nearest day, when the altitude benchmark point can no longer be used to determine the piezometric height of the aquifer system.

Object related name:	PIEZOMETER ALTITUDE BENCHMARK POINT
Specifications:	
Data type:	Date
Data producer:	Organization producing data and operating the piezometer

7.14 Closing date of the use of the measurement method

Definition: date, expressed to the nearest day, when data are no longer measured using the method specified.

Object related name:	MEASUREMENT METHOD USED WITH THE PIEZOMETER
Specifications:	
Data type:	Date
Data producer:	Organization producing data and operating the piezometer

7.15 Code of the monitoring network

Definition: unique code that identifies a unique monitoring network of a given geographic scale within an interchange

The same code shall be used all the time to specify geographical level, such as area, region or state, continent e.g. Europe.

Object related name:	MONITORING NETWORK
Specifications:	
Data type:	Character string
Length:	10
Data producer:	Partners exchanging data
Additional specifications:	Identifier

7.16 Comments on the aquifer system

Definition: relevant additional information that cannot be recorded against its formalised specifications

Object related name:	AQUIFER SYSTEM
Specifications:	
Data type:	Character string
Length:	Unlimited
Data producer:	Partners exchanging data

7.17 Comments on the measurement method used on the piezometer

Definition: relevant additional information that cannot be recorded against its formalised specifications

Object related name:	MEASUREMENT METHOD USED WITH THE PIEZOMETER
Specifications:	
Data type:	Character string
Length:	Unlimited
Data producer:	Organization producing data and operating the piezometer

7.18 Comments on the organization

Definition: relevant additional information that cannot be recorded against its formalised specifications

Object related name: ORGANIZATION

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and operating the piezometer

The list of organizations shall be specified by the partners exchanging data.

7.19 Comments on the piezometer

Definition: relevant additional general information about the piezometer differing from information of “event” type or that recorded for the piezometer attributes

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and operating the piezometer

7.20 Comments on the altitude benchmark point

Definition: relevant additional information that cannot be recorded against the formalised specifications provided

Object related name: ALTITUDE BENCHMARK POINT

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and operating the piezometer

7.21 Comments on the level measurement point

Definition: relevant additional information that cannot be recorded against the formalised specifications provided

Object related name: LEVEL MEASUREMENT POINT

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and managing the piezometer

7.22 Coordinate reference system of the piezometer

Definition: identify coordinates such that those coordinates describe position unambiguously. An example of Coordinate reference system is proposed by the EPSG group: http://www.epsg.org/.

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and managing the piezometer

7.23 Confinement condition

Definition: description of any local variations of the water confinement within the aquifer system. It is defined by using one of the following codes given in Table 4.

Table 4 — List of values allocated to confinement condition

Code	Label
0	Type of aquifer system unknown
1	Unconfined
2	Confined
3	Unconfined and confined or semi-confined
4	Artesian

Specifications:

Object related name: PIEZOMETER

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

7.24 Continuity code of the point

Definition: time/depth time series curves are represented with points. By default, each point is linked to the previous point. However, a time series can sometimes be interrupted for various reasons and consequently the point marking the beginning of a time series is not related to the previous point.

Object related name: PIEZOMETRIC TIME SERIES

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

The point continuity code is used to manage the continuity between all the points. The default value is 2. It indicates that the point is a common point, i.e. it is related to the previous point. When the code designates the first point, i.e. a point starting a time series, its value is 1. A time series terminates with a common point.

7.25 Coordinate X of the piezometer

Definition: the coordinate X in the projection given under the attribute “Coordinate Reference system of the piezometer”. Conventionally, the projection is the European one: the European Terrestrial Reference System 1989 (ETRS89).

Coordinates shall be determined on a map with a scale greater or equal to 1:50 000.

Object related name: PIEZOMETER

Specifications:

Data type: Number

Data producer: Organization producing data and operating the piezometer

7.26 Coordinate Y of the piezometer

Definition: the coordinate Y in the projection given under the attribute “Coordinate Reference system of the piezometer”. Conventionally, the projection is the European one: the European Terrestrial Reference System 1989 (ETRS89)

Coordinates shall be determined on a map with a scale greater or equal to 1:50 000.

Object related name: PIEZOMETER

Specifications:

Data type: Number

Data producer: Organization producing data and operating the piezometer

7.27 Creation date of piezometer

Definition: date, (expressed to the nearest day) when the piezometer was created and installed. The creation date does not necessarily coincide with the date when measurements started.

Object related name: PIEZOMETER

Specifications:

Data type: Date

Data producer: Organization(s) producing data and operating the piezometer

7.28 Date of the piezometer event

Definition: date, expressed to the nearest day, at which the event about the piezometer occurred

Object related name: PIEZOMETER EVENT

Specifications:

Data type: Date

Data producer: Organization producing data and operating the piezometer

Additional specifications: Identifier

7.29 Date of the point

Definition: date, expressed to the nearest day, when the depth to groundwater level was observed on the piezometer.

Object related name: PIEZOMETRIC TIME SERIES

Specifications:

Data type: Date

Data producer: Organization producing data and operating the piezometer

Additional specifications: Identifier

7.30 Description of the piezometer event

Definition: concise description of the different facts related to an incident that occurred on the piezometer. The organization producing data and operating the piezometer may wish to record facts that are considered significant to understand the life-cycle of the piezometer and to interpret data measured with it.

EXAMPLES

- Reconstruction of the plinth;
- Redefinition of the altitude benchmark point;
- Installation of a measuring instrument...

Object related name : PIEZOMETER EVENT

Specifications:

Data type: Character string

Length: 100

Data producer: Organization producing data and operating the piezometer

7.31 Distance between the level measurement point and the altitude benchmark point

Definition: elevation difference between the measurement point and the altitude benchmark point. This distance is expressed in metres.

This value is zero when the altitude benchmark point and the piezometer measurement point are identical.

The value is positive when the piezometer measurement point is above the altitude benchmark point, and negative in the opposite case.

The organization(s) producing data and operating the piezometer is responsible for this information.

Object related name: LEVEL MEASUREMENT POINT

Specifications:

Data type: Date

Data producer: Organization producing data and operating the piezometer

7.32 Expression of the piezometer time series

Definition: time series values are given as a relative distance (depth/ height) or as an elevation based on the altitude reference system consistent with the altitude benchmark point selected for the piezometer at the time of measurement

NOTE See Table 5.

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

Table 5 — List of values allocated to expression of the time series

Code	Label
1	Altitude of groundwater level
2	Relative distance

The organization(s) producing data and operating the piezometer is responsible for this information.

7.33 General information on the aquifer system

Definition: general information relevant to the aquifer system including geographic or geological descriptions or other additional information pertaining to the aquifer system.

Object related name: AQUIFER SYSTEM

Specifications:

Data type: Character string

Length: Unlimited

Data producer: Organization producing data and operating the piezometer

7.34 Measurement frequency

Definition: frequency of acquisition of raw measurement data and not of measurements derived from data exchanged.

For graphic recorders, the period of the frequency of discretization shall be indicated.

Name of object: MEASUREMENT METHOD USED WITH THE PIEZOMETER

Specifications:

Data type: Date

Data producer: Organization producing data and operating the piezometer

7.35 Measurement method

Definition: method used to determine the water depth on the piezometer. The type of method used is described using one of the codes in Table 6.

Table 6 — List of values allocated to measurement method

Code	Label
0	Method unknown
1	Manual measurement (various manual probes, scale reading)
2	Graphic recorder (with floater, bubble to bubble – continuous graph on hydrograph)
3	Numeric recorder (pseudo-continuous – fixed or variable intervals)
4	Remote transmission digital recorder (as above, data transmitted by 'phone, radio, satellite...)

Object related name: MEASUREMENT METHOD USED WITH THE PIEZOMETER

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

7.36 Method for the altitude measurement

Definition: mode used to establish the elevation of the altitude benchmark point according to the altitude reference system. It is specified using one of the codes in Table 7.

Table 7 — List of values allocated to method for the altitude measurement

Code	Label
0	Acquisition method unknown
1	Elevation read on site (e.g. by a terrestrial surveyor)
2	Elevation measured on site (e.g. with GPS)
3	Elevation determined with a map (e.g. digitisation or On-screen digitisation, photogrammetric)
4	Elevation estimated (e.g. on the basis of assimilation from the known depth of another benchmark in the vicinity)

Object related name: ALTITUDE BENCHMARK POINT

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data and operating the piezometer

Value(s): Codes

7.37 Name of the monitoring network

Definition: name which explicitly identifies the monitoring network

EXAMPLES

a) Réseau National de Bassin (RNB) in France (*Permanent National Basin Network*);

b) Euro Water Net;

c) Franche-Comté network in France;

d) monitoring of water quality at water sampling points in the region near Paris;

etc.

Object related name: MONITORING NETWORK
Specifications:
Data type: Character string
Length: 110
Data producer: Organization producing data and operating the piezometer

7.38 Name of the piezometer location

Definition: name of the geographical site where the piezometer is located, usually for local use

EXAMPLES

— Rivarels farm ;

— Grou de Bane ;

— Cassa field...

Object related name: PIEZOMETER
Specifications:
Data type: Character string
Length: 50
Data producer: Organization producing data and operating the piezometer

7.39 Name of the piezometer town

Definition: name of the city on the territory where the piezometer is located

Object related name: PIEZOMETER
Specifications:
Data type: Character string
Length: 35
Data producer: Organization producing data and operating the piezometer

7.40 Operator's internal code of the piezometer

Definition: identification that the data producer assigns to the piezometer, in particular for internal management purposes

Object related name: PERIOD OF ASSOCIATION OF A PIEZOMETER TO A NETWORK
Specifications:
Data type: Character string
Length: 10
Data producer: Organization producing data and operating the piezometer

7.41 Organization address 1

Definition: first line of the organization address

Object related name:	ORGANIZATION
Specifications:	
Data type:	Character string
Length:	35
Data producer:	Organization producing data and operating the piezometer

7.42 Organization address 2

Definition: second line of the organization address

Object related name:	ORGANIZATION
Specifications:	
Data type:	Character string
Length:	35
Data producer:	Organization producing data and operating the piezometer

7.43 Organization address 3

Definition: third line of the organization address

Object related name:	ORGANIZATION
Specifications:	
Data type:	Character string
Length:	35
Data producer:	Organization producing data and operating the piezometer

7.44 Organization address 4

Definition: fourth line of the organization address

Object related name:	ORGANIZATION
Specifications:	
Data type:	Character string
Length:	35
Data producer:	Organization producing data and operating the piezometer

7.45 Organization address 5

Definition: fifth line of the organization address

Object related name:	ORGANIZATION
Specifications:	
Data type:	Character string
Length:	35
Data producer:	Organization producing data and operating the piezometer

7.46 Organization address 6

Definition: sixth line of the organization address

Object related name: ORGANIZATION

Specifications:

Data type: Character string

Length: 35

Data producer: Organization producing data and operating the piezometer

7.47 Organization code

Definition: unique code that identifies a unique organization within a data interchange

The same code shall be used all the time to specify geographical level, such as area, region, state or continent e.g. Europe.

Object related name: ORGANIZATION

Specifications:

Data type: Character string

Length: 17

Data producer: Partners involved in the interchange

Value(s): Codes

Additional specifications: Identifier

The list of organizations shall be specified by partners exchanging data.

7.48 Organization name

Definition: name under which an organization is commonly known or full name of a corporate. Abbreviations shall be avoided, and full names preferred

Object related name: ORGANIZATION

Specifications:

Data type: Character string

Length: 115

Data producer: Organization producing data and operating the piezometer

7.49 Piezometer code

Definition: identifier that designates a unique piezometer within a data interchange

It is recommended that this code be stable and unique over a period of time at a high geographical level: area, state or continent like Europe.

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 17

Data producer: Exchange partners

Other Characteristics: Identifier

The piezometer code shall be specified by partners exchanging data.

7.50 Piezometer altitude

Definition: altitude of the ground where the piezometer is located. Except in the case of geodetic levelling, the latter should be determined on a map with a scale greater than or equal to 1/50 000.

The altitude is specified within one meter at best. The altitude can exceed 1 000 m in mountainous areas but it can also be negative for piezometers located in areas where the elevation is lower than the sea level.

Object related name: PIEZOMETER

Specifications:

Data type: Number

Data producer: Organization producing data producer(s) and operating the piezometer

7.51 Piezometer lithology name

Definition: designation of the main lithology below the piezometer. Examples of lithology names used by France are given in Annex B.

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 25

Data producer: Organization(s) producing data and operating the piezometer

7.52 Piezometer lithology type name

Definition: designation of the main type of lithology below the piezometer. It is described according to the codes given in Table 8.

Table 8 — List of values allocated to piezometer lithology type name

Code	Label
0	Unknown lithological type
1	Porous and/ or fissured detrital rocks
2	Coherent porous and/ or fissured carbonate rocks
3	Porous volcanic rocks
4	Fissured or fractured carbonate rocks
5	Karstic carbonate rocks (sedimentary or metamorphic)
6	Fractured plutonic rocks
7	Fractured and coherent volcanic rocks
8	Fractured metamorphic rocks
9	Low permeability sedimentary formations
10	Very low permeability sedimentary rocks
11	Compact non fractured metamorphic rocks
12	Compact non fractured volcanic rocks

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 100

Data producer: Organization(s) producing data and operating the piezometer

7.53 Piezometer name

Definition: label with free text designating the piezometer

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 70

Data producer: Organization producing data and operating the piezometer

7.54 Mode to obtain a point

Definition: indication specifying whether the point value has been measured or obtained from a deduction

Object related name: PIEZOMETRIC TIME SERIES

Specifications:

Data type: Character string

Length: 1

Data producer: Organization producing data producer(s) and operating the piezometer

Value(s): Code

It is expressed by using one of the codes in Table 9.

Table 9 — List of values allocated to mode to obtain a point

Code	Label
0	Acquisition method unknown
1	Point value measured
2	Point value deduced

7.55 Point precision

Definition: optional data item giving the relative precision, in centimetres, of the depth of the water table level

Object related name: PIEZOMETRIC TIME SERIES

Specifications:

Data type: Number

Data producer: Organization(s) producing data and operating the piezometer

7.56 Point validity

Definition: status of the result of the measurement of the point. It indicates the level of conformity with the corresponding specifications and the level of reliability assigned to the analysis carried out by the data producer. It is indicated using one of the codes described in Table 10.

Table 10 — List of values allocated to point validity

Code	Label
0	Impossible to validate
1	Valid
2	Suspect
3	Not valid
4	Not yet validated

By default, the elements in the piezometric time series shall be assigned the status “Not yet validated”. After examination by the producer, the new element becomes one of the four values as described below.

A value shall be “Valid” when the producer considers that both the data and the whole process used to produce them are correct with regard to the target aimed at.

A value shall be “Suspect” if data, or the process to produce data, are tainted by malfunctions which rule out perfect adequacy between the data and the target aimed at.

A value shall be “Impossible to validate” when the producer is unable to obtain the information needed to validate the data item. This may be the case, for example, with historic data retrieved from archive sources for which no information on the way of how they were produced is available.

A value shall be “Not valid” when it is not usual and unexplained, despite the fact that checks on the data production chain have revealed no anomalies. This may be the case for example with data pertaining to exceptional phenomena, possibly even unknown for a state of knowledge.

Object related name: PIEZOMETRIC TIME SERIES
Specifications:
Data type: Character string
Length: 1
Data producer: Organization(s) producing data and operating the piezometer
Value(s): Codes

The organization(s) validating data is responsible for this information.

7.57 Point value

Definition: depth of the groundwater body head or its altitude at the date when the point was measured. It is expressed in metres according to the altitude reference system.

Object related name: PIEZOMETRIC TIME SERIES
Specifications:
Data type: Number
Data producer: Organization(s) producing data and operating the piezometer

7.58 Precision on the piezometer coordinates

Definition: level of the coordinates accuracy using one of the codes in Table 11.

Table 11 — List of values allocated to precision on the coordinates

Code	Label
0	Coordinates precision unknown
1	Coordinates survey-read (accurate to within a millimetre)
2	Coordinates measured (accurate to within a metre)
3	Coordinates determined (accurate to within a decametre)
4	Coordinates estimated (accurate to within a kilometre)

Object related name: PIEZOMETER
Specifications:
Data type: Character string
Length: 1
Data producer: Organization(s) producing data and operating the piezometer
Value(s): Codes

7.59 Purpose of the monitoring network

Definition: objectives to be reached by the monitoring network

Object related name:	MONITORING NETWORK
Specifications:	
Data type:	Character string
Length:	Unlimited
Data producer:	Organization(s) producing data and operating the piezometer

7.60 Starting date of the association period of a piezometer to a monitoring network

Definition: date, expressed to the nearest day, when the piezometer is included in a monitoring network

Object related name:	PERIOD OF ASSOCIATION OF A PIEZOMETER TO A NETWORK
Specifications:	
Data type:	Date
Data producer:	Organization(s) producing data and operating the piezometer
Additional specifications:	Identifier

7.61 Starting date for the operating period of the piezometer

Definition: date when an organization is starting its mandate as a piezometer operator (or co-operator). It is expressed the nearest day.

Piezometer operating periods are established by the organization(s) producing data and operating the piezometer.

Object related name:	OPERATING PERIOD OF A PIEZOMETER BY AN ORGANIZATION
Specifications:	
Data type:	Date
Data producer:	Organization(s) producing data and operating the piezometer
Additional specifications:	Identifier

7.62 Starting date of the validity of the level measurement point

Definition: date, expressed to the nearest day, when the piezometer measurement point can be used to measure the depth of an aquifer system.

The organization(s) producing data and operating the piezometer is responsible for this attribute.

Object related name:	LEVEL MEASUREMENT POINT
Specifications:	
Data type:	Date
Data producer:	Organization(s) producing data and operating the piezometer
Additional specifications:	Identifier

7.63 Starting date of use of the measurement method

Definition: date, expressed to the nearest day, when the specified measurement method was first used to measure data.

Object related name: MEASUREMENT METHOD USED WITH THE PIEZOMETER

Specifications:

Data type: Date

Data producer: Organization(s) producing data and operating the piezometer

Additional specifications: Identifier

7.64 Starting date of the validity of the altitude benchmark point

Definition: date, expressed to the nearest day, when the altitude benchmark point can be used to determine the piezometric height of the aquifer system, based on depth measurements derived from the piezometer's measurement point.

The validity periods of a piezometer's altitude benchmark point are established by the organization(s) producing data producing organization(s) and operating the piezometer.

Object related name: ALTITUDE BENCHMARK POINT

Specifications:

Data type: Date

Data producer: Organization(s) producing data and operating the piezometer

Additional specifications: Identifier

7.65 Time of the point

Definition: hour, expressed to the nearest second, when the depth of the groundwater level pertaining to the point is observed.

Object related name: PIEZOMETRIC TIME SERIES

Specifications:

Data type: Time

Data producer: Organization(s) producing data and operating the piezometer

Additional specifications: Identifier

7.66 Type of piezometer

Definition: specification of the kind of piezometer enabling to indicate how the piezometer makes contact with the water table. It is coded according to the values given in Table 12.

Table 12 — List of values allocated to type of piezometer

Code	Label	Definition
0	Type unknown	
1	At water level	Lake, river, pond, river water intake, etc..
2	In a swallow hole	Direct opening in the ground in karstic soil, generally circular, resulting from ascending dissolution. A swallow hole offers communication between a karstic circuit and the surface. Very occasionally, it is possible to find or measure a karstic table level from a swallow hole.
4	At a drilled measurement point	Any non-watertight pipe, gravity subterranean water collector, to keep the water surface at a constant level, in which water flows with or without confined surface (trench, gallery, buried pipe, well or borehole). More particularly, a drain is a pipe for collecting and discharging excess water in an irrigation and sanitation perimeter (drainage network); facility used for maintaining piezometric levels, the free surface of a groundwater body below set depths, and to prevent under-pressure. Facility designed to evacuate water rather than hold it.
6	In a borehole	Structure implying the past, present or future extraction of a mineral substance, including water. Water injection borehole.
10	In a swallet	Location and phenomenon of total or partial disappearance of a permanent or temporary surface water course in the sub-soil, by infiltration or by swallowing, chiefly in karstic domains.
12	In a well	Any pit dug from the surface of the ground and penetrating an aquifer, used for drawing water or for taking local action on the hydraulic load in the aquifer, or more broadly for other uses (penetration in the sub-soil, extraction, etc.).
14	In a tapped spring	Spring from which the water is collected and channelled for one or more uses (drinking water, cattle water, etc.).

Object related name: PIEZOMETER

Specifications:

Data type: Character string

Length: 2

Data producer: Organization(s) producing data and operating the piezometer

Value(s): Codes

NOTE Some of the items formerly identified by codes 3, 5, 7 etc have been merged and reclassified in the codes appearing in the table.

The organization(s) producing data and operating the piezometer is responsible for this attribute.

7.67 Type of the altitude benchmark point

Definition: physical point on the piezometer used as altitude benchmark point in a conventional construction (tube coming up above the ground, protected by a base or round-the-rim plinth). It is described using one of the codes in Table 13.

Table 13 — List of values allocated to type of the altitude benchmark point

Code	Label
1	Rim of tube
2	Collar or plinth
3	Ground at the foot of the piezometer

Object related name: ALTIMETRIC BENCHMARK POINT

Specifications:

Data type: Character string

Length: 1

Data producer: Organization(s) producing data and operating the piezometer

Additional specifications: Identifier

Annex A
(informative)
Data model

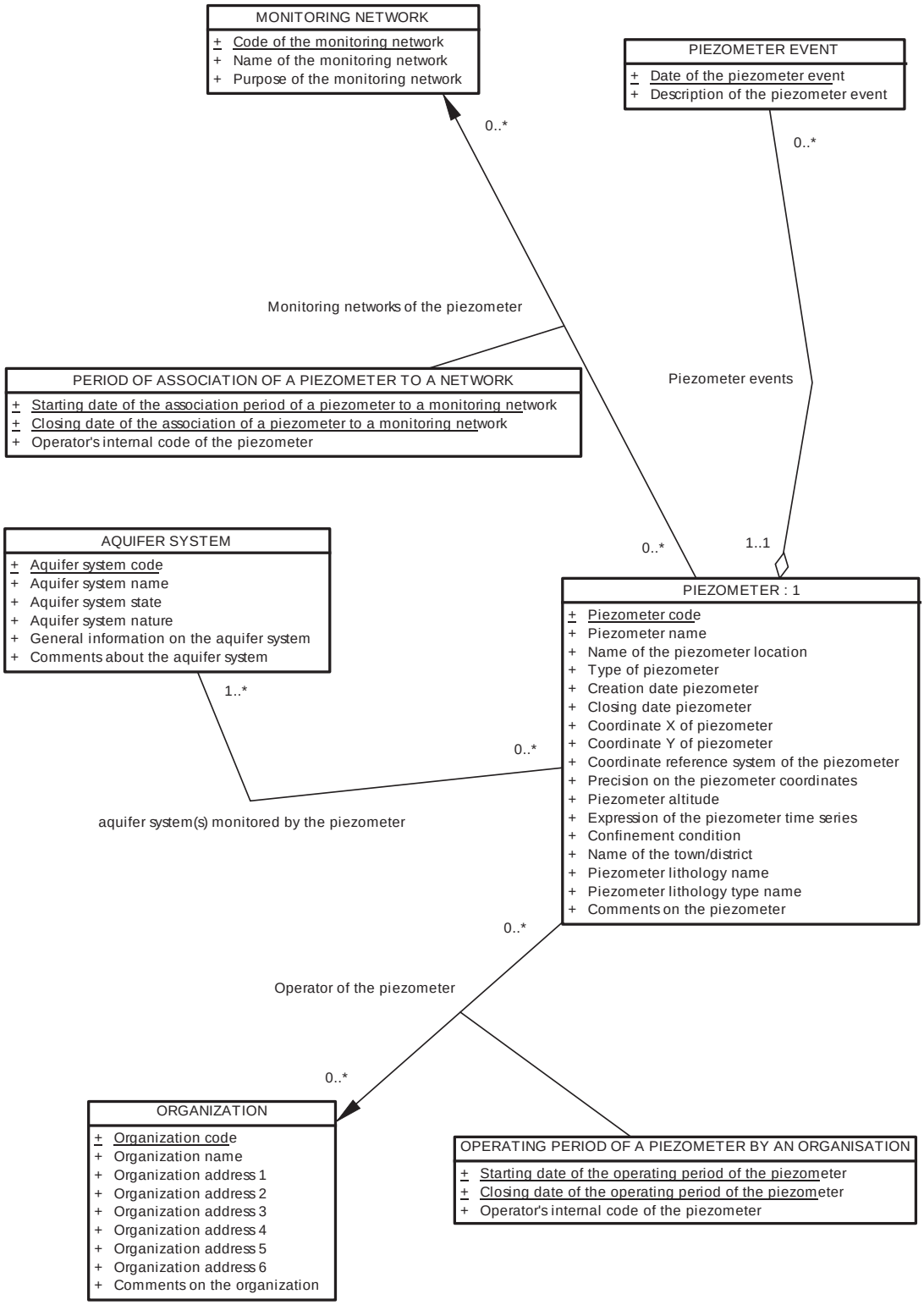


Figure A.1 — Sub-schema of the piezometer description

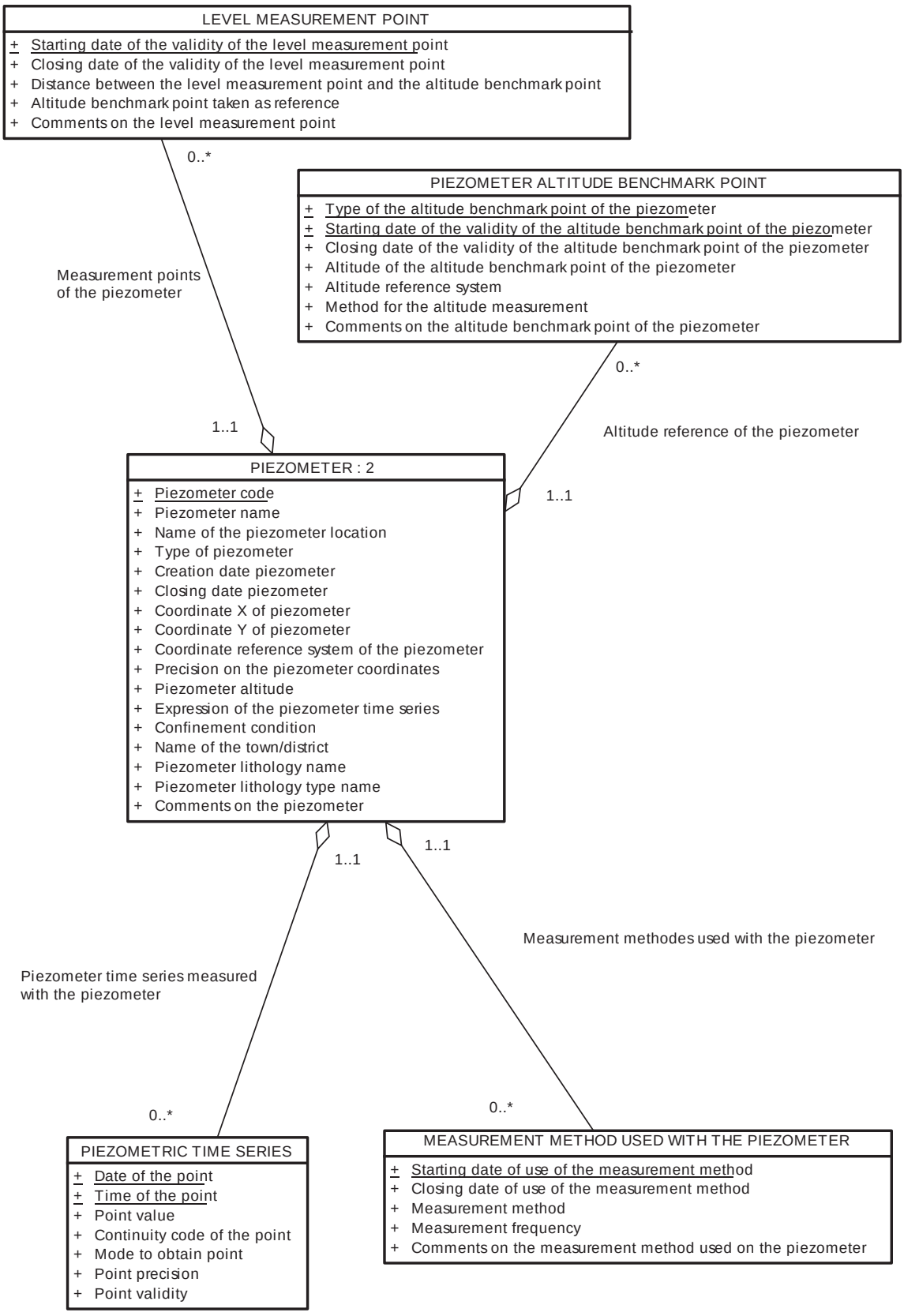


Figure A.1 — Sub-schema of the piezometer description *(continued)*

Annex B
(informative)
Lithology name

Code	Lithology	Definition
0	Unknown lithology	
1	Alluvial deposits	Sediments which are deposited by streams and lakes and composed of pebbles, gravels and sands, depending on the types of ground through which the stream flows and the force of the current. The deposits are often lens - shaped and the fine fraction corresponds to clays and loam deposits. Pebbly alluvial deposits are alluvial deposits containing pebbles.
2	Pebbly alluvial deposits (pebbles, gravels, sands)	
3	Gravelly alluvial deposits (gravels, sables)	
4	Alterite	Weathering products remaining in situ following alteration of the parent material by the action of chemical and/or physical weathering processes, without appreciable pedogenesis.
5	Andesite	Effusive igneous rock, usually exhibiting a purplish grey (leucocratic) colour, fluidal microlitic groundmass with rare glass fragments. Often exhibits a bubbly and finely scoriated aspect with vugs filled with cristobalite and trydimite or secondary white calcite. Basic andesites produce flow structures whereas more acidic andesites are less fluid and therefore produce needles and volcanic plugs (often leading to explosive volcanic activity).
6	Anhydrite	Calcium sulphate ($CaSO_4$) mineral in the orthorhombic system which produces tabular crystals with 3 orthogonal cleavage planes (resulting in an apparently cubic symmetry). Two of the cleavage planes have a glassy or pearly lustre with fine parallel striations whereas the third cleavage plane is not striated. Crystals are white, grey bluish or reddish in colour.
7	Arena (granitic or gneissic)	Coarse sand resulting from the in-situ alteration of quartz- and feldspar-rich igneous or metamorphic rocks (granite and gneiss in particular).
8	Shales	Clay designates a mineral with a sheet-like molecular structure. Shales are very fine-grained rocks formed by either sedimentary deposition of clay minerals or by the in-situ alteration of igneous or metamorphic rocks (saprolite). Shales are classified as lutites and contain at least 50 % clay minerals as well as a number of other highly diverse minerals which may or may not be detrital, accounting for their widely varied composition (calcareous shales, sandy shales, mica shales, etc.).
9	Arkoses	Detrital terrigenous sedimentary rock containing grains of quartz (up to around 60 %), feldspar (at least 25 %), and micas frequently.
10	Basalt	Very common effusive igneous rock. Along with pyroxene-bearing andesites, basalts constitute 95 % of continental and oceanic lavas.
11	Blocks	A lithic fragment of any origin, the size of which may range from several centimetres to more than a few meters. Depending on the grain-size classification used, the size of a block may exceed 100 mm, 200 mm or 256 mm (the coarsest fraction of the rudite class).

"to be continued"

Code	Lithology	Definition
12	Limestone	Carbonate sedimentary rock containing at least 50 % calcite ($CaCO_3$) and which may contain some dolomite, aragonite and siderite. Limestones are classified using a nomenclature based on the most distinctive compositional Characteristics: - Pure limestone: 100 % to 95 % calcite and 5 % maximum dolomite ; - Dolomitic limestone: 10 % to 50 % dolomite ; - Marly limestone: 5 % to 35 % clay - Shaly limestone: 35 % to 65 % clay
13	Shaly limestone	
14	Dolomitic limestone	
15	Marly limestone	
16	Calcareous schists	Schist generally resulting from low-grade metamorphism, containing a large percentage of limestone.
17	Cipolin	A metamorphic limestone with thin bands of serpentine which favours foliation in thin onion-skin like layers (whence the name). In the broad sense of the term, cipolin is a term used for metamorphosed calcareous rocks (crystalline limestones) formed of intertwined calcite crystals, with a saccharoid fracture (having the aspect of a piece of broken sugar). This rock often produces beautiful marbles.
18	Compact conglomerates	A detrital sedimentary rock containing at most 50 % lithic fragments larger than 2 mm (rudite class) bound by a cement matrix. If the rock contains elements ranging between 62,5 µm and 2 mm in size, it is called a microconglomerate. This term also includes sedimentary breccia (essentially angular fragments), puddingstone (rounded elements or pebbles or cobbles) and all rocks in-between.
19	Porous or fissured conglomerates	
20	Chalk	Sedimentary rock deposited in a marine environment composed essentially of limestone (≥ 90 % $CaCO_3$), very fine-grained, whitish, porous, very soft and friable. Leaves a mark on harder substances.
21	Dacite	Effusive igneous rock, usually light grey (leucocratic), with a microlitic texture with abundant glass and euhedral quartz phenocrysts, plagioclase (andesite, sometimes with orthoclase zoning) and ferromagnesian minerals: biotite, hornblende or pyroxene (hypersthene).
22	Diorite	Granular plutonic igneous rock with white (leucocratic) elements and greenish or blackish elements, essentially composed of whitish sub-euhedral plagioclase and green amphibole, with a little biotite.
23	Dolomite	Carbonate sedimentary rock containing 50 % or more carbonate, at least half of which is the mineral dolomite (Ca, Mg $(CO_3)_2$). Practically, the term includes dolomitic compositions ranging from pure dolomites (90 % to 100 % dolomite mineral) to calciferous or calcareous dolomite (50 % to 90 % dolomite mineral).
24	Flysch	Detrital sediments of terrigenous source deposited in a formation which is often thick, essentially composed of piled turbidites, typically conformable with the underlying layers, deposited in an orogenic zone which has been tectonised.
25	Gabbro	Granular igneous rock, generally greenish black, with more or less white speckles (meso- to melanocratic), composed essentially of sub-euhedral plagioclase and interstitial pyroxene, and secondarily of brown hornblende, olivine and biotite.
26	Pebbles	Large elements rounded by mechanical processes (wind, fluvial, marine).
27	Gneiss	Very common rock produced from regional metamorphism (usually mesozonal to catazonal), medium to coarse-grained (ranging from mm to cm scale), with foliation often characterised by dark bands rich in ferromagnetic minerals (mica, amphiboles, etc.) alternating with light-coloured bands (white, grey, pink) quartz and feldspar grains which are visible to the naked eye.

"to be continued"

Code	Lithology	Definition
28	Granite	Very common plutonic igneous rock, with granular texture, light coloured (white, grey, pinkish, red and bluish: hololeucocratic to leucocratic) and containing the following basic minerals which form 80 % of the rock's composition: anhedral interstitial quartz, alkali feldspar (orthoclase and microcline) and sub-euhedral plagioclase feldspar (albite, oligoclase).
29	Gravels	Lithic fragments measuring several millimetres within detrital sedimentary rocks (rudite class) Depending on the classification used. The fragment size ranges from 1 mm or 2 mm to 15 mm or 30 mm, and sometimes more.
30	Sandstone	Terrigenous detrital sedimentary rock composed of at least 85 % more or less rounded quartz grains, ranging in size from $1/16^{th}$ mm (62,5µm) to 2 mm (arenite class).
31	Gypsum	Hydrated calcium sulphate ($CaSO4.2H_2O$), in the monoclinic crystal system, with perfect cleavage, exhibiting a vitreous translucent, pearly or silky lustre, depending on the cleavage face, forming tabular or lens-shaped crystals (for varieties with slightly curved faces containing impurities of Na, Cl, …). Gypsum often shows simple spearhead, swallow-tail or dovetail shaped twins. It is colourless, white, yellowish to amber or sometimes even red coloured. It is low on the hardness scale. It decrepitates when exposed to a flame, whitens and then starts to exfoliate. It is water soluble (forms selenitic water which is not suitable for drinking). It is a common mineral in sedimentary rocks and is one of the main terms of an evaporite sequence.
32	Soft coal	Bituminous coal : A form of coal which is a general term designating, in the broad sense of the word, a bedded sedimentary rock used for fuel, usually black in colour, of organic origin and essentially composed of plant debris. Coal (in its broad sense) is composed of 85 % carbon, is black in colour, with a matte or shiny lustre, tarnishes the fingers and (depending on the amount of volatile organic matter (distillation starts at 960 °C)) can contain: - Flaming bituminous coal: more than 33 % organic volatile matter, - Bituminous coal: 20 % to 33 %, - Semi-bituminous coal: 12 % to 20 % Strictly speaking, bituminous coal contains 5 % volatile organic matter and it is therefore (inappropriately) termed bituminous coal due to its high proportion of tars (which are not bitumen).
33	Lapilli	Fragments of lava (pyroclastic elements) projected by a volcano. The surface texture may be scoriated or not. Fragments range from 2 mm to 30 mm, or from 2 mm to 64 mm (depending on the grain-size classification used). An accumulation of such pyroclastic fragments (also termed lapilli, or pouzzolane) usually produces unconsolidated layers.
34	Latite	A variety of trachyandesite.
35	Lignite	A variety of coal.
36	Limburgite	A variety of basanite.
37	Loam	Unconsolidated deposit of detrital sediments, shaly and silty, very fine-grained (lutite class), of continental fluviatile, lagunal or aeolian origin (plateau deposits, loess).
38	Loess	Non stratified, unconsolidated detrital sedimentary deposit, argillaceous, calcareous and silty (grain size less than 62,5 µm (lutite class) of continental aeolian origin. These deposits are also termed "plateau loams" and are periglacial in nature.
39	Marble	Metamorphic rock formed by contact or regional metamorphism of limestone or dolomite. Also designates any rock which, when polished, has a beautiful sheen and can be used for decorative purposes. When used as such, the term has no particular petrographic meaning (therefore it should not be used).

"to be continued"

Code	Lithology	Definition
40	Marls	Sedimentary rock composed of a combination of limestone and clay (35 % to 65 % clay ratio), constituting a transition between shaly limestones (= marly limestones with 5 % to 35 % clay) and calcareous shales (= calcareous marls, containing 65 % to 95 % clay).
41	Mica-schists	Commonly found epi to mesozonal metamorphic rock, generally medium grained, with marked schistosity, containing abundant bands of mica visible to the naked eye, forming a lepidoblastic structure which produces platy foliation (several mm to several cm thick), shiny surface, light or dark coloured, depending on the colour of the mica. The main component minerals are very abundant quantities of mica (biotite and / or muscovite), quartz crystals (visible to the naked eye) scattered away or grouped together in thin discontinuous bands, little (<20 %) microscopic feldspar (contrary to gneisses). A wide variety of other minerals may be present (depending on the amounts of Al_2O_3, Ca, ...), and often form porphyroblasts (whence the "mineral name" placed before mica-schist) of: aluminium-silicates, staurotite, cordierite, garnet, humite, tremolite, etc.. Varieties of mica schist are designated on the basis of the minerals they contain: andalusite mica-schist, garnet mica-schist, calciferous mica schist when calcite is abundant (often in the form of inter-dented crystals forming thin light-coloured beds). Mica-schists are derived from sedimentary rocks such as shales and pelites (pelitic sequences) or calcareous pelites.
42	Molasse	Detrital sedimentary formation, thick, composed of turbiditic layers and of non-turbiditic terrigenous layers (sandstone, conglomerate) deposited in orogenic zones at the end of a period of tectonic activity. Molasses are typically in conflict with the subjacent layers.
43	Monzonite	Granular leucocratic igneous rock which, in terms of composition, is a calc-alkaline syenite containing as much orthoclase as plagioclase (essentially oligoclase, or andesite) as well as green hornblende, augite, biotite, sphene, apatite and zircon.
44	Moraines	An accumulation of non-stratified lithic fragments (blocks, cobbles, pebbles, sands including fine sands: "glacial or rock flour") deposited by a glacier.
45	Peridotite	Granular igneous rock, dark oily yellow or usually blackish green colour, holomelanocratic containing 90 % to 100 % ferromagnesian minerals (ultrabasic or ultramafic rock) with dominant olivine and pyroxene or spinel (picotite, chlorite) and sometimes brown hornblende, biotite and garnet.
46	Phonolite	Effusive igneous rock, greenish grey (leucocratic) with a fluidal microlitic structure, containing glass, sonorous cleavage, whitish patina with a greasy fracture plane. It contains feldspar (sanidine, anorthoclase) and feldspathoids: nepheline (small crystals only) that is sometimes blue hauinite, yellowish noseane or phenocrysts of leucite. Ferromagnesian minerals include aegirine or aegirinic augite, sometimes amphiboles (brown hornblende, red kataphorite). Sphene, apatite and zircon are frequent trace minerals.
47	Potash	Dry or anhydrous potassium hydroxide (KOH). Solid white deliquescent mineral, soluble in water and can form hydrates.
48	Quartzite	Siliceous rock, compact with a smooth conchoidal or splintered fracture, usually light coloured with a greasy lustre. Quartzite is composed of closely welded quartz crystals, often serrated or intermeshed. The fracture plane of the rock cuts through the crystals instead of around them.

"to be continued"

Code	Lithology	Definition
49	Rhyolite	Effusive igneous rock, with abundant glass fragments, light coloured (leucocratic) with a microlitic texture and rare phenocryts: quartz (often bipyramidal) and corroded (rhyolitic quartz), feldspar (e.g. sanidine), amphibole and biotite.
50	Shaly sands	Sand: In the common sense of the term, sands are any unconsolidated material composed of grains of quartz (sand grains) such as those found on beaches or dunes. More precisely, sand is unconsolidated detrital sediment with grain size ranging from 1/16 mm (62,5µm) and 2 mm (arenite class). The term sand includes the grain size, the nature of the dominant particles (quartz, limestone, etc.) and of other particles which may be present: feldspar sands, mica sands, gold-bearing sands, diamond-bearing sands, etc..
51	Fine-grained sands	
52	Coarse-grained sands	
53	Medium-grained sands	
54	Schists	In the broad sense of the term, schist is rock which exhibits schistose foliation, e.g.: bituminous schist that are often psammitic pelites. In the strict meaning of the word, schist is rock that has acquired schistosity under the effect of tectonic stress. Schist is characterised by platy cleavage either due to fracturing (fracture cleavage) or to a preferential orientation of certain rock minerals parallel to the cleavage planes (flow cleavage). Schist are metamorphic rocks.
55	Crystalline schist	This is an obsolete term that designates all rocks produced by regional metamorphism of a pelite sequence. It includes sericite and chlorite schist, mica schist and gneisses.
56	Rock salt	Synonym of halite: NaCl.
57	Syenite	Granular igneous rock, whitish, but more often pinkish to red (hololeucocratic to leucocratic) with, as the main mineral > 60 % alkali feldspar (orthoclase, anorthoclase, microcline – usually perthitic) and as secondary minerals some biotite (usually lepidomelane – iron mica) and hornblende.
58	Nepheline syenite	Granular igneous rock, whitish, grey, pink (hololeucocratic to leucocratic) containing alkali feldspar (often perthitic microcline) and feldspathoids, usually nepheline (euhedral if abundant, anhedral and interstitial if rare – and therefore difficult to identify), occasional presence of sodalite, analcite and hauine.
59	Tonalite	A variety of quartz diorite.
60	Peat	Light combustible deposit, brown, formed especially by accumulation of moss.
61	Trachyte	Effusive igneous rock, whitish, grey, greenish grey (leucocratic), microlitic and fluidal (trachytic texture), with little or no porphyry, often somewhat porous and therefore light, composed of sanidine (in microlites or limpid and crackled phenocrysts), anorthoclase, albite, with biotite and more rarely amphibole, with little glassy or cryptocrystalline mesostasis.
62	Travertine	Continental carbonate sedimentary rock, with a concretionary aspect, more or less vuggy, greyish to yellowish, roughly bedded. Travertine is deposited at the discharge point of certain springs and in shallow streams with minor waterfalls (carbonate precipitation activated by turbulence and release of CO_2).
63	Volcanic tuffs	Tuff : Term used to designate two types of rocks: a carbonate tuff (see travertine above) and volcanic tuff (see corresponding definition, hereafter). Volcanic Tuff: Rock formed by accumulation of volcanic projections of fragments of several millimetres in size (pyroclastic rock with dominant lapilli). Tuffs can contain blocks or ash and consolidate by the action of water.
The elements in the list above are extracted from [2]		

Bibliography

[1] G. Castany, J. Margat (1977) - French dictionary of hydrogeology, Editions du BRGM, Orléans, France.

[2] Foucault, A., Raoult, J.F. (1995): Dictionary of Geology, 4th edition, MASSON, Paris.

[3] BRGM (1990) - The glossaries of key words for use in establishing the documentation file on the subsoil, 88SGN 856 DIG, Editions du BRGM, Orléans, France.

[4] ISO 1087 (all parts), *Terminology work – Vocabulary*.

[5] ISO/IEC 2382-4:1999, *Information technology – Vocabulary - Part 4: Organization of data.*

[6] ISO/IEC 11179-1:2004, *Information technology - Metadata registries (MDR) - Part 1: Framework.*

[7] ISO/IEC 2022, 1994*, Information technology - Character code structure and extension techniques.*

[8] ISO/IEC 8859-9: 1999, *Information technology - 8-bit single-byte coded graphic character sets - Part 9: Latin alphabet No. 5.*

[9] EN ISO 19111: 2005 *Geographic information - Spatial referencing by coordinates (ISO 19111:2003)*

blank

BSI — British Standards Institution

BSI is the independent national body responsible for preparing British Standards. It presents the UK view on standards in Europe and at the international level. It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover. Tel: +44 (0)20 8996 9000. Fax: +44 (0)20 8996 7400.

BSI offers members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Buying standards

Orders for all BSI, international and foreign standards publications should be addressed to Customer Services. Tel: +44 (0)20 8996 9001. Fax: +44 (0)20 8996 7001. Email: orders@bsi-global.com. Standards are also available from the BSI website at http://www.bsi-global.com.

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Library and its Technical Help to Exporters Service. Various BSI electronic information services are also available which give details on all its products and services. Contact the Information Centre. Tel: +44 (0)20 8996 7111. Fax: +44 (0)20 8996 7048. Email: info@bsi-global.com.

Subscribing members of BSI are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration. Tel: +44 (0)20 8996 7002. Fax: +44 (0)20 8996 7001. Email: membership@bsi-global.com.

Information regarding online access to British Standards via British Standards Online can be found at http://www.bsi-global.com/bsonline.

Further information about BSI is available on the BSI website at http://www.bsi-global.com.

Copyright

BSI
389 Chiswick High Road
London
W4 4AL