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Standard Guide for Set of Data Elements to Describe a Ground-Water Site; Part Two—Physical Descriptors[1]

This standard is issued under the fixed designation D 5409; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide is Part Two of three guides to be used in conjunction with Practice D 5254 that delineates the data desirable to describe a ground-water data collection or sampling site. This guide identifies physical descriptors, such as construction and geologic elements, for a site. Part One (Guide D 5408) describes additional information beyond the minimum set of data elements that may be specified to identify any individual ground-water site, while Part Three identifies usage descriptors, such as monitoring, for an individual ground-water site.

NOTE 1—A ground-water site is defined as any source, location, or sampling station capable of producing water or hydrologic data from a natural stratum from below the surface of the earth. A source or facility can include a well, spring or seep, and drain or tunnel (nearly horizontal in orientation). Other sources, such as excavations, driven devices, bore holes, ponds, lakes, and sinkholes, that can be shown to be hydraulically connected to the ground water, are appropriate for the use intended.

NOTE 2—Part One (Guide D 5408) includes data confidence classification descriptor (one element), geographic location descriptors (four elements), political regime descriptor (one element), source identifier descriptors (four elements), legal descriptors (nine elements), owner descriptors (two elements), site visit descriptors (three elements), other identification descriptors (two elements), other data descriptors (three elements), and remarks descriptors (three elements). Part Three (Guide D 5410) includes monitoring descriptors (77 data elements), irrigation descriptors (four data elements), waste site descriptors (nine data elements), and decommissioning descriptors (eight data elements). For a list of descriptors in this guide, see Section 3.

1.2 These data elements are described in terms used by ground-water hydrologists. Standard references, such as the Glossary of Geology **(1)**[2] and various hydrogeologic professional publications, are used to determine these definitions. Many of the suggested elements and their representative codes are those established by the Water Resources Division of the U.S. Geological Survey and used in the National Water Information Systems computerized data base **(1-19)**.[2]

NOTE 3—The purpose of this guide is to suggest data elements that can be collected for ground-water sites. This does not uniquely imply a computer data base, but rather data elements for entry into any type of permanent file.

NOTE 4—Component and code lists given with some of the data elements, for example" Type of Spring," are only suggestions. These lists can be modified, expanded, or reduced for the purpose intended by the company or agency maintaining the ground-water data file.

NOTE 5—Use of trade names in this guide is for identification purposes only and does not constitute endorsement by ASTM.

1.3 This guide includes the data elements desirable to document a ground-water site beyond those given in the "Minimum Set of Data Elements." Some examples of the data elements are well depth, contributing aquifer, and permanence of spring. No single site will need every data element, for example, springs do not need well depth and well casing data. Each record (group of related data elements) for a site has mandatory data elements, such as the type of lift for the lift record. However, these elements are considered necessary only when that specific record is gathered for the site.

1.4 The values given in either inch-pound units or SI units are to be regarded separately as the standard. The values given in parentheses are for information only.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.6 *This guide offers an organized collection of information or a series of options and does not recommend a specific course of action. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this guide may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*

[1] This guide is under the jurisdiction of ASTM Committee D-18 on Soil and Rockand is the direct responsibility of Subcommittee D18.21 on Ground Water and Vadose Zone Investigations.

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[2] The **boldface** numbers in parentheses refer to a list of references at the end of the text.

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[3]
D 2488 Practice for Description and Identification of Soils (Visual—Manual Procedure)[3]
D 5254 Practice for the Minimum Set of Data Elements to Identify a Ground-Water Site[4]
D 5408 Guide for Set of Data Elements to Describe a Ground-Water Site; Part One—Additional Identification Descriptors[4]
D 5410 Guide for Set of Data Elements to Describe a Ground-Water Site; Part Three—Usage Descriptors[4]

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms applicable to this guide, see Terminology D 653.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *code*—a suggested abbreviation for a component, for example, ″G" is the code suggested for the galvanized iron component of data element casing material.

3.2.2 *component*—a subdivision of a data element, for example, galvanized iron is one of 30 components suggested for data element casing material.

3.2.3 *data element*—an individual segment of information about a ground-water site, for example, casing material. The data element is in the casing record record.

3.2.4 *record*—a set of related data elements that may need to be repeated to fully describe a ground-water site. For example, a well that consists of several diameters of casing from the top end to the bottom will need more than one Casing Record record (the record includes data elements depth to top, depth to bottom, diameter, casing material, and casing thickness) to fully describe the construction of the well. However, if only a single size of casing is used in the well, the record is utilized once.

3.2.5 *record group*—a set of related records. For example, the lift record group includes the lift record, power record, and standby record. Some record groups consist of only one record, for example, the spring record group includes only the spring record.

4. Summary of Guide

4.1 This guide includes the following physical descriptor data elements to describe a ground-water site. Single elements usually need one entry for a site, while repeated elements commonly require several records to fully describe the conditions and history of the site.

Single Elements:
  Individual Site Characteristics:
    Land Use (in vicinity of site)
    Drainage Basin/Watershed
    Relationship to Surface Stream/Lake, etc.
    Hole Depth
    Well Depth
    Source of Depth Data
    Primary Aquifer
Repeated Elements:
Construction Record Group:
  Construction Record:
    Date Construction Began
    Date Construction Ended
    Name of Contractor
    Source of Construction Data
    Method of Construction
    Type of Drilling Fluid
    Volume of Drilling Fluid
    Type of Finish
    Type of Seal
    Depth to Bottom of Seal
    Method of Development
    Length of Time of Development
    Volume of Liquid Removed During Development
    Special Treatment
  Hole Record:
    Depth to Top of the Hole Interval
    Depth to Bottom of the Hole Interval
    Diameter of the Hole Interval
  Casing Record:
    Depth to Top of the Cased Interval
    Depth to Bottom of the Cased Interval
    Diameter of the Cased Interval
    Casing Material
    Casing Thickness
  Opening or Screen Record:
    Depth to Top of the Open Interval
    Depth to Bottom of the Open Interval
    Diameter of the Open Interval
    Type of Material in the Open/Screened Interval
    Type of Openings in the Open Interval
    Length of Openings
    Width of Openings
    Mesh of Screen
    Packing Material
    Size of Packing Material
    Thickness of Packing Material
    Depth to Top and Bottom of Packing Material
  Repairs Record:
    Date of Repairs
    Nature of Repairs
    Name of Contractor Who Made Repairs
    Percent Change in Performance After Repairs
Special Cases Record:
  Well Clusters:
    Number of Wells in Cluster
    Depth of Deepest Well in Cluster
    Depth of Shallowest Well in Cluster
    Diameter of Well Cluster
  Collector Well/Laterals:
    Number of Laterals in Collector Well
    Depth of Laterals in Collector Well
    Length of Laterals in Collector Well
    Diameter of Laterals in Collector Well
    Mesh of Screen in Laterals
  Ponds:
    Length of Pond
    Width of Pond
    Depth of Pond
    Volume of Pond
  Tunnel or Drain:
    Length of Tunnel or Drain
    Width of Tunnel or Drain
    Depth of Tunnel or Drain
    Bearing (Azimuth) Tunnel or Drain
    Dip of Tunnel or Drain
Lift Record Group:
  Lift Record:
    Type of Lift
    Date Permanent Lift was Installed
    Depth of Intake
    Manufacturer of Lift Device
    Serial Number
    Pump Rating
  Power Record:
    Type of Power

[3] *Annual Book of ASTM Standards*, Vol 04.08.
[4] *Annual Book of ASTM Standards*, Vol 04.09.

- Horsepower Rating
- Name of Power Company
- Power-Company Account Number
- Power-Meter Number
- Standby Lift Record:
  - Additional Lift
  - Name of Company that Maintains Lift
  - Rated Pump Capacity
  - Type of Standby Power
  - Horsepower of Standby Power Source
- Geologic Record Group:
  - Geophysical Log Record:
    - Date of Log
    - Type of Log
    - Depth to Top of Logged Interval
    - Depth to Bottom of Logged Interval
    - Source of Log Data
  - Geohydrologic Unit Record:
    - Aquifer Unit(s)
    - Contributing Unit
    - Depth to Top of Interval
    - Depth to Bottom of Interval
    - Lithology
    - Description of Material
  - Sample/Unconsolidated Material Record:
    - Sample Weight
    - Sample Interval
    - Particle Size
    - Percent of Total Sample
    - Particle Shape
    - Mineralogy
  - Sample/Consolidated Material Record:
    - Drill Cuttings or Core
    - Sample Size (Weight)
    - Sample Interval
    - Mineralogy
    - Core Length
    - Core Diameter
    - Core Recovery-Percent
    - Bedding
    - Structure
    - Porosity
- Hydraulic Record Group:
  - Hydraulics Record:
    - Hydraulic/Aquifer Unit
    - Hydraulic/Aquifer Unit Type
    - Depth to Top of Unit
    - Depth to Bottom of Unit
    - Static Water Level
    - Measurement Date and Time
    - Unit Contribution
  - Aquifer Parameters Record:
    - Transmissivity
    - Horizontal Hydraulic Conductivity
    - Vertical Hydraulic Conductivity
    - Coefficient of Storage
    - Leakance
    - Diffusivity
    - Specific Storage
    - Specific Yield
    - Barometric or Tidal Efficiency
    - Porosity
    - Specific Capacity
    - Method Used to Determine Aquifer Characteristics
    - Availability of File of Detailed Results
- Spring Record Group:
  - Spring Record:
    - Name of Spring
    - Type of Spring
    - Permanence of Spring
    - Sphere of Discharge
    - Discharge
    - Date of Discharge
    - Improvements
    - Number of Spring Openings
    - Flow Variability
    - Accuracy of Flow Variability
    - Magnitude of Spring

5. Significance and Use

5.1 Data at ground-water sites are gathered for many purposes. Each of these purposes generally requires a specific set of data elements. For example, when the ground-water quality is of concern not only are the 'minimum set of data elements' required for the site, but information concerning the sample collection depth interval, method of collection, and date and time of collection are needed to fully qualify the data. Another group of elements are recommended for each use of the data, such as aquifer characteristics or water-level records. Normally the more information that is gathered about a site by field personnel, the easier it is to understand the ground-water conditions and to reach valid conclusions and interpretations regarding the site.

5.2 The data elements listed in this guide and Guides D 5408 and D 5410 should assist in planning what information can be gathered for a ground-water site and how to document these data.

NOTE 6—Some important data elements may change during the existence of a site. For example, the elevation of the measuring point used for the measurement of water levels may be modified because of repair or replacement of equipment. This frequently occurs when the measuring point is an opening in the pump and the pump is modified or replaced. Because changes cannot always be anticipated, it is preferable to reference the height of the measuring point to a permanent nearby altitude datum. The measuring point is referenced by being the same altitude (zero correction) or above (negative correction) or below (plus correction) the altitude datum. All appropriate measurements should be corrected in reference to the altitude datum before entry into the permanent record. Care must be exercised to keep the relationship of these data elements consistent throughout the duration of the site.

5.3 Some data elements have an extensive list of components or possible entries. For example, the aquifer identification list described in 6.1.8 has over 5000 entries. Lengthy lists of possible entries are not included in this guide, however, information on where to obtain these components is included with the specific data element.

NOTE 7—This guide identifies other sources, lists, etc. of information required to completely document information about any ground-water site.

6. Documentation of Individual Site Characteristics

6.1 *Introduction*:

6.1.1 A vast number of data elements can be documented about a ground-water site to thoroughly describe its location, physical features, relationship to other features on the earth's surface, and to designate what information is gathered at the site. These data elements typically are transcribed once for a site, in contrast to data elements that may be repetitive, such as water levels. Many of these data are extremely valuable in the characterization of sites that fall into certain categories, for example wells, for which the primary aquifer is an essential element to assist in the identification of the source of water at the site **(2–5, 7, 8, 10–17, 19)**.

6.1.2 *Land Use (in Vicinity of Site)*— Document the use of the land in the area surrounding the ground-water site. This data element is important if there is a possibility of the use

affecting the availability or quality of the water. If more than one significant land use is nearby, such as industrial and farming, document each purpose **(5, 16)**.

6.1.3 *Drainage Basin/Watershed*—Document the name or other identification of the watershed and drainage basin where the site is located. Maps with watersheds delineated are available from the State Conservationists, U.S. Department of Agriculture, Soil Conservation Service located in each of the states, possessions, and associated areas. Information about river basins is available on maps in "Atlas of River Basins of the United States" published by the U.S. Department of Agriculture, Soil Conservation Service **(20)**.[5]

6.1.4 *Relationship to Surface Stream/Lake, etc.*—Document information concerning the influence of any nearby surface-water source upon the ground-water site. For example, the ground-water source for the site could be directly connected to a surface-water body (recharging the aquifer or discharging to the surface-water body) or have no connection and be influenced by a seasonal variation in loading of the surface water body upon the aquifer **(4, 7, 8, 16)**.

NOTE 8—This information is more useful if a quantitative estimate of the amount of connection is given rather than a yes, there is a connection, or no, there is no connection notation. For example, a ground-water body that is only influenced by seasonal loading of a surface-water body would have 0 % connection. While a stream or lake that is partially or completely linked to the ground-water body could have from 1 to 100 % connection, however, a quantitative value seldom can be determined. Usually, the range of thickness of the aquifer penetrated by the surface water body or thickness and lithology of the material between the aquifer and surface water body is all that is known about the connection.

6.1.5 *Hole Depth*—If applicable, document the total depth that the hole was drilled, in feet or metres below a datum at or near land surface. Many times the hole is drilled deeper in order to explore stratum below the completed depth of the final well. This number is always equal to or greater than the well depth. The hole depth is important because the information concerning the stratum below the final well can be critical in understanding ground-water conditions at the site. Document the accuracy or confidence classification for this data element **(4, 5, 7, 8, 13, 14, 16)**. If applicable, note orientation and angle of hole if not vertical.

6.1.6 *Well Depth*—If applicable, document the depth of the finished well, in feet or metres below a datum at or near land surface. This depth is important as a means to delineate the maximum depth at which water is entering the well bore. Document the accuracy or confidence classification for this data element **(4, 5, 7, 8, 13, 14, 16)**.

6.1.7 *Source of Depth Data*—If applicable, document the source of the hole and well depth information. Suggested source of depth data components and representative codes are as follows **(13)**:

A —Reported by a government agency
D —From driller's log or report
G —Private geologist-consultant or university associate
L —Depth interpreted from geophysical logs by personnel of source agency
M —Memory (owner, operator, driller)
O —Reported from records by owner of well
R —Reported by person other than owner, driller, or another government agency
S —Measured by personnel of reporting agency
Z —Other source (describe)

6.1.8 *Primary Aquifer*—Document the identification of the primary aquifer unit from which the water is withdrawn or monitoring data are collected. A convenient and systematic method of coding geologic units was described by Cohee **(6)** in the American Association of Petroleum Geologists Bulletin. This method is used by the U.S. Geological Survey to code aquifer and geologic unit names in a National file (Catalog of Aquifer Names and Geologic Unit Codes used by the Water Resources Division) (for example, Edwards Limestone of Texas is coded 218EDRD). Information needed to obtain an ordered list of aquifers and related codes is available from the following **(6, 13)**:[6]

NOTE 9—An example of a form (see Fig. 1) for documenting the data elements as described under "Individual Site Characteristics" is illustrated here to show a method of design for this tool. The forms are commonly known as field forms or as coding forms (for computer entry). This type of form is routinely used for transcribing field data while at the ground-water site and entering non-field information at the agency's or company's office. It should be noted that each form has the site identification (primary identification as used by the agency or company), date of field visit, and person that recorded the data as the first entries. These three data items are mandatory to ensure correct filing of the information, either in cabinets or in a computer data base, and for quality control.

7. Documenting of Miscellaneous Repetitive Data Elements

7.1 *Introduction*:

7.1.1 Many of the ground-water data elements require multiple records or entries to completely describe a site.

[5] Regional contacts for obtaining information are as follows: Northeastern United States contact Director, Northeastern National Technical Center, USDA, SCS, 160 East 7th Street, Chester, PA 19013. Southern United States contact Director, Southern National Technical Center, USDA, SCS, Fort Worth Federal Center, Bldg. 23, Room 60, Felix and Hemphill Streets, PO Box 6567, Fort Worth, TX 76115. Midwestern United States contact Director, Midwest National Technical Center, USDA, SCS, Federal Bldg., Room 345, 100 Centennial Mall North, Lincoln, NB 68508-3866. Western United States contact Director, Western National Technical Center, USDA, SCS, Federal Bldg., Room 248, 511 N.W. Broadway, Portland, OR 97209-3489.

[6] Geologic Names Unit, U.S. Geological Survey, 439 National Center, Reston, VA 22092.

GROUND-WATER SITE
INDIVIDUAL SITE CHARACTERISTICS

Site Identification _____ Date Prepared _____
Prepared by _____ (Name)

Individual Site Characteristics:
Land Use (In Vicinity of Site) _____ (Describe)
Drainage Basin/Watershed _____ (Name)
Relationship to Surface Stream/Lake _____ (Describe)
Hole Depth _____ (Feet/Meters) Accuracy _____
Well Depth _____ (Feet/Meters) Accuracy _____
Source of Depth Data _____ (Name)
Primary Aquifer _____ (Name)

FIG. 1 Example Form

Time-related elements, such as water levels, discharge measurements, and water chemistry, may present hundreds or thousands of records over a period of many years that answer a specific question about a single site. These time-related data help to determine historical trends and serve to establish bench-mark conditions for the site **(4, 5, 13, 14)**.

7.1.2 Other data elements that are not time related, such as casing lengths, spring openings, and some geophysical logs, require a sequence of records to thoroughly describe the site. These data are extremely valuable in site characterization, for example, wells for which the construction components are required to understand the source of the water **(4, 5, 13, 14)** .

7.2 *Construction Record Group*—The construction record group includes records for documenting data elements relating to any type of structure built for withdrawal of water or monitoring at a ground-water site, including construction, hole, casing, openings or screen, repairs, and special cases, such as well clusters, collector wells, ponds, tunnels, and drains **(2, 3, 5, 7, 8, 13–17)**. If applicable, any construction that may have modified the ambient ground water conditions should be documented. Examples include grouting, blasting, hydrofracturing, and local disruption such as tunnels, underground chambers, or excavations.

7.2.1 *Construction Record*—The construction record includes data elements relating to the date of construction, contractor, construction method, drilling fluids, finish, and development. Data elements that are included in the construction record are the following:

7.2.1.1 *Date Construction Began*—If applicable, document the date (year, month, day in YYYYMMDD format) on which the construction work was initiated at the ground-water site.

NOTE 10—Although this guide is written to be used with any type of data file, date information should be arranged in year, month, day, and time (24-h clock) format (for example, 19910822094158 for 1991, August 22nd, 9 h, 41 min, and 58 s AM), especially for ease of interchanging information among data systems (computerized files). This is the format recommended by the American National Standard for Information Systems (ANSI) and adopted as a Federal Information Processing Standards (FIPS) system **(21, 22)**.

7.2.1.2 *Date Constructed Ended*—If applicable, document the date (year, month, day in YYYYMMDD format) on which the construction work was completed at the ground-water site.

7.2.1.3 *Name of Contractor*—If applicable, document the name and address of the principal individual or company that did the construction work at the ground-water site (for example, drilled the well).

7.2.1.4 *Source of Construction Data*—If applicable, document the source of the information concerning the construction at the ground-water site (for example, driller's log or geologist's log). Suggested source of construction data components and representative code are as follows:

A —Reported by a government agency
D —From driller's log or report
G —Private geologist-consultant or university associate
L —Depth interpreted from geophysical logs by personnel of source agency
M —Memory (owner, operator, driller)
O —Reported from records by owner of well
R —Reported by person other than owner, driller, or another government agency
S —Measured by personnel of reporting agency
Z —Other source (describe)

7.2.1.5 *Method of Construction*—If applicable, document the method by which the ground-water site was constructed. Suggested method of construction components and representative codes are as follows:

B —Bored or augered, generalized
L —Wash boring
M —Hollow stem auger
N —Solid stem auger
E —Bucket auger
A —Direct air-rotary method, with bit
K —Direct air-rotary method, with downhole hammer
H —Direct mud rotary
R —Reverse circulation rotary (no casing)
F —Dual-wall reverse circulation, generalized
G —Dual-wall reverse rotary
I —Dual-wall reverse percussion
C —Cable-tool
P —Air-percussion drill
Q —Hydraulic percussion
S —Jet percussion
J —Jetted by water
D —Dug or excavated
T —Trenching, dammed pond, or drain
V —Driven pipe
U —Cone penetration
W —Combined driven and jetting
Z —Other (describe)

NOTE 11—Several of the method of construction components are the same or similar methods (jetted by water and wash boring), but with different name identifications. In addition, several of the components that have generalized names, for example, bored or augered also have the specific methods (hollow stem auger, solid stem auger, etc.) included in the list.

7.2.1.6 *Type of Drilling Fluid*—If applicable, document the type and amount of additives (in pounds or kilograms) used in the drilling fluid (water) for the construction of the ground-water site. Suggested additive components and representative codes are as follows:

A —Acrylic polymers
D —Attapulgite
E —Baking soda
B —Barites
F —Biodegradable material
G —Caustic soda
C —Cellulosic polymers
H —Chromelignosulfonates
I —Chrysotile asbestos
J —Complex phosphates
K —Lignitic materials
L —Lime
Q —Lubricants
M —Modified guar gum products
R —Modified polysaccharide
N —Native clay
O —Organic polymers
P —Peptized bentonite
U —Pregelatinized starch
V —Soda ash
W —Sodium carboxymethylcellulose
S —Standard bentonite
X —Surfactants
T —Tannins
Z —Other (describe)

7.2.1.7 *Volume of Drilling Fluid*—If applicable, document the volume (in gallons or litres) of drilling fluid lost in the drilled hole. Specify the unit of measurement. Document the accuracy or confidence classification for this data element. It may be difficult to quantify losses in air drilling. Estimates may be made by comparing output versus compressor capacity.

7.2.1.8 *Type of Finish*—If applicable, document the method of finish or the nature of the openings that allow water to enter the well. Suggested type of finish components and representative codes are as follows:

C —Porous concrete
G —Gravel-packed screen
H —Horizontal gallery or collector
O —Open-ended casing
P —Perforated or slotted casing
S —Screen, commercial
T —Sand point, driven screen
W —Walled or shored
X —Open-hole in aquifer
Z —Other (describe)

7.2.1.9 *Type of Seal*—If applicable, document the type and amount (in pounds or kilograms) of material used to seal the well against the entry of surface water and the leakage of water between aquifers having different hydraulic pressures. Suggested type of seal components and representative codes are as follows:

B —Bentonite
C —Clay or cuttings
G —Cement grout
N —None
Z —Other (describe)

7.2.1.10 *Depth to Bottom of Seal*—If applicable, document the depth to the bottom of the seal in feet or metres below a datum at or near land surface. Document the accuracy or confidence classification for this data element.

7.2.1.11 *Method of Development*—If applicable, document the primary method used to develop the well. Suggested method of development components and representative codes are as follows:

A —Pumped with air lift
B —Bailed
D —Chemical, for example, dry ice
C —Surged, compressed air
J —Jetted, air or water
N —None
P —Overpumped
S —Surge block
Z —Other (describe)

7.2.1.12 *Length of Time of Development*— If applicable, document the number of hours and minutes that the well was bailed, pumped, or surged for development. Document the accuracy or confidence classification for this data element.

7.2.1.13 *Volume of Liquid Removed During Development*—If applicable, document the volume of liquid (in gallons or litres) removed from well during development. Specify the unit of measurement. Document the accuracy or confidence classification for this data element.

7.2.1.14 *Special Treatment*—If applicable, document any special treatment that was applied during development of the well. Suggested special treatment components and representative codes are as follows:

C —Chemical (acid, and so forth)
D —Dry ice
E —Explosives
F —Deflocculent
H —Hydrofracturing
M —Mechanical abrasion
Z —Other (describe)

7.2.2 *Hole Record*—The hole record includes data elements that relate to the description of the opening constructed for emplacement of hardware into the ground for the development of a monitoring or production well at a ground-water site. For many sites, several distinct hole length and size intervals are required for the completion of the well. Data elements that are included in the hole record are the following:

7.2.2.1 *Depth to Top of the Hole Interval*— If applicable, document the depth to the top of the hole interval, in feet or metres below a datum at or near land surface. The first or uppermost section of the hole starts at or near the datum. Document the accuracy or confidence classification for this data element.

7.2.2.2 *Depth to Bottom of the Hole Interval*—If applicable, document the depth to the bottom of the hole interval, in feet or metres below the datum. Document the accuracy or confidence classification for this data element.

7.2.2.3 *Diameter of the Hole Interval*— If applicable, document the nominal diameter of that interval of the hole, in inches or millimetres. Document the accuracy or confidence classification for this data element. Caliper logs may be very useful as documentation.

7.2.3 *Casing Record*—The casing record includes all information that relates to the description of the casing material placed into the ground for the construction of a monitoring or production well at a ground-water site. For many sites, several distinct length and size intervals are required for the completion of the well. Data elements that are included in the casing record are the following:

7.2.3.1 *Depth to Top of the Cased Interval*— If applicable, document the depth to the top of the cased interval, in feet or metres below a datum at or near land surface. The first or uppermost section of the casing starts at or near the datum. Document the accuracy or confidence classification for this data element.

7.2.3.2 *Depth to Bottom of the Cased Interval*—If applicable, document the depth to the bottom of the cased interval, in feet or metres below the datum. Document the accuracy or confidence classification for this data element.

7.2.3.3 *Diameter of the Cased Interval*— If applicable, document the inside diameter of that interval of the casing, in inches or centimetres. Document the accuracy or confidence classification for this data element.

7.2.3.4 *Casing Material*—If applicable, document the type of casing material used for the construction of the well. Note if casing joint or other components are different than casing material. Suggested casing material components and representative codes are as follows:

E —Acrylonitrile butadiene styrene (ABS)
A —Aluminum
H —Asbestos cement
B —Brick
J —Carbon structural steel
L —Chlorotrifluoroethylene (CTFE)
N —Coal tar epoxy coated steel
U —Coated steel
C —Concrete
D —Copper
O —Cupro-nickel
F —Fiberglass-reinforced epoxy
Q —Fluorinated ethylene propylene (FEP)
G —Galvanized iron
K —Kai-well
V —Perfluoroalkoxy (PFA)