GWPD 3—Establishing a permanent measuring point and other reference marks

VERSION: 2010.1

PURPOSE: To establish a permanent measuring point at a well from which water levels are measured, to establish a permanent land-surface datum, and to establish nearby reference marks.

Materials and Instruments

1. Groundwater Site Inventory (GWSI) System Groundwater Site Schedule, Form 9-1904-A
2. Measuring tape graduated in feet, tenths and hundredths of feet
3. Field notebook
4. Topographic map or Global Positioning System (GPS) receiver
5. Pencil or pen, blue or black ink. Strikethrough, date, and initial errors; no erasures
6. Spray paint, bright color or permanent marker
7. Metal file for marking well casing; hammer and cold steel chisel, survey monument (nail, spike, tablet)
8. Two wrenches with adjustable jaws or other tools for removing well cap
9. Key for well access
10. Camera
11. Protractor, calculator, or other tools to calculate angles and lengths
12. Rod, leveling instrument, and leveling notes sheets

Data Accuracy and Limitations

The "stickup" of a well is the length of well casing above the plane of the land-surface datum (LSD).

Altitude Accuracy: Vertical Stickup

The accuracy of the measuring point (MP) or LSD altitude depends on the measurement method used. When topographic maps are used, the accuracy typically is about one-half the contour interval of the topographic map. When geodetic differential GPS methods are used, the accuracy can be on the order of a couple of centimeters. When spirit leveling is used the accuracy is dependent on the order (1st, 2nd, 3rd) of surveying and the length of the survey line and typically can vary from tens of centimeters to a millimeter or less. Limitations: A high level of altitude accuracy is not critical when measurements obtained from a single well are compared to one another. Measurement accuracy is important, but altitude accuracy is not. If water-levels are to be compared *among wells*, however, a higher altitude accuracy (such as from spirit leveling) may be needed.

MP Correction Length Accuracy: Vertical Stickup

The MP correction length is the distance the measuring tape travels from the MP to the plane of the LSD (fig. 1). The accuracy of the MP correction length depends on the configuration of the MP with respect to the LSD. In the simplest example of a well with a vertical stickup and the LSD as a monument in the well pad or a file mark on the casing, the MP correction length can be measured directly with a measuring tape. In that instance, the accuracy of the measurement is 0.01 foot. In the case when the vertical distance between LSD and the MP cannot be directly measured with a tape, such as when a protective casing prevents direct measurement, the accuracy is a function of the measurement method used. A visual estimate using a measuring tape likely will have an accuracy slightly greater than 0.01 foot. When spirit leveling is used, the accuracy can vary from tens of centimeters to a millimeter or less. MP correction length accuracy is critical because a well may have more than one MP, all of which should be referenced to a single LSD. Limitations: Special considerations must be made

for a well with a non-vertical stickup, when the configuration of the MP at the well does not allow the measuring tape to hang vertically directly from the MP through the plane of the LSD (fig. 2).

Altitude Accuracy: Non-Vertical Stickup

The altitude of the MP of a non-vertical stickup is not used directly, but may be measured for use in combination with the LSD altitude and the MP correction length. In the case of a non-vertical stickup, the accuracy of the LSD altitude is identical to that described in the vertical case. The accuracy of a water-level altitude calculated from the MP altitude and the MP correction length (option in Instruction no. 4) is equivalent to the least accurate measurement.

MP Correction Length Accuracy: Non-vertical Stickup

When the measurement tape does not hang vertically from the MP to the plane of the LSD, the MP correction length must be computed on the basis of the measurement path length and angles of deviation from vertical (fig. 2). The accuracy of this MP correction length is a function of the configuration of the well and the ability of the hydrographer to determine the tape path, but likely is greater than 0.01 foot.

Reference Mark Accuracy

A reference mark (RM) is used to determine whether the MP has moved with reference to LSD and, in extreme cases, to re-establish the LSD or MP at a well, thus the accuracy of the RM should be at least equivalent to that of the water-level measurement. In most instances, this is 0.01 foot. Limitation: comparability of water-level measurements made before and after re-establishment of the LSD or MP is limited by the accuracy of the RM.

Assumptions

1. For comparability to the water level measured in other wells, water-level measurements will be referenced consistently to the same vertical geodetic datum.
2. LSD is a specific type of RM. Once established, the LSD is not changed unless it is destroyed. If a new LSD must be established, the date of this change must be recorded, as well as the vertical distance between the destroyed LSD and the new LSD.
3. Measuring points change from time to time, especially on private wells. If a new MP must be established, the date of this change must be recorded, as well as the distance between the new MP and LSD (MP correction length).
4. Some wells have multiple measuring points or access points, especially production wells. Care must be taken in tracking these multiple MPs.
5. The operator can run leveling equipment in order to establish one or more RMs.

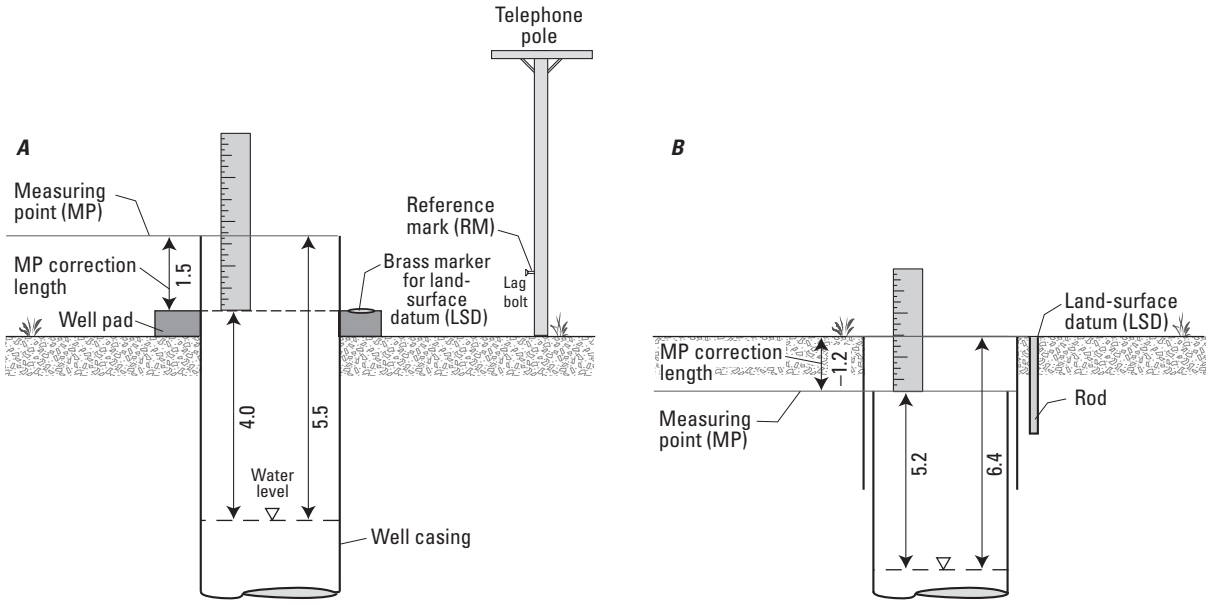

Figure 1. Relations among land-surface (LSD), measuring-point (MP), and reference-mark datums for measuring points above and below land surface. *A*, If the MP is above the LSD, subtract MP correction length to correct the water level to LSD (5.5 – 1.5 = 4.0). *B*, If the MP is below the LSD, subtract MP correction length to correct the water level to LSD (5.2 – (–1.2) = 6.4).

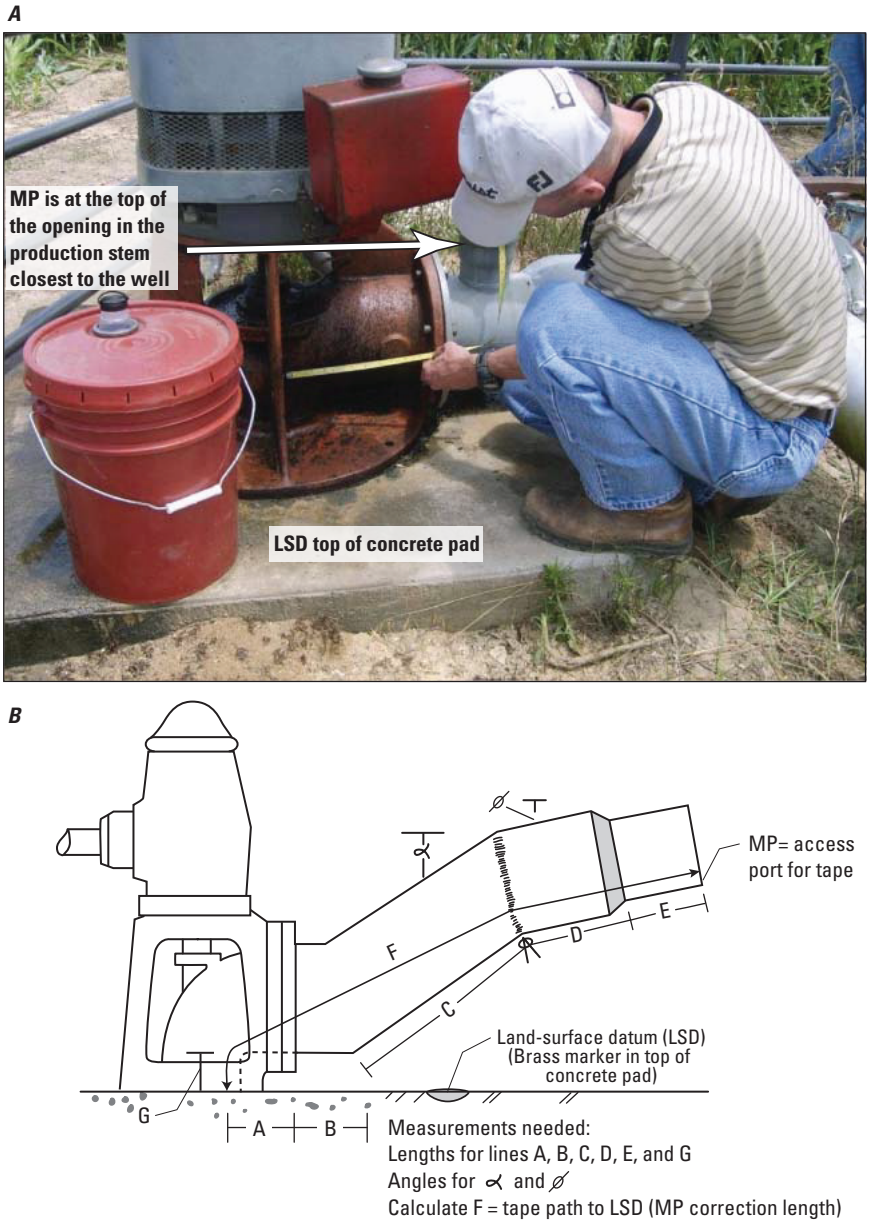

Figure 2. Examples of (*A*) determining a measuring point (MP) correction length when the configuration of the MP at the well does not allow the measuring tape to hang vertically directly from the MP through the plane of the land-surface datum (LSD) and (*B*) the measurements needed to calculate the MP correction length on the basis of the distance a tape would travel from the MP to the plane of the LSD in an irrigation well. (Photograph by E.L. Kuniansky, U.S. Geological Survey.)

Instructions

1. **Establish land-surface datum following these definitions and procedures:**

   a. The LSD at a well is a fixed RM at the well, at or near land surface, that can be used to measure the absolute vertical position (altitude) of the LSD and the distance from the LSD to the MP (the MP correction length).

   b. The LSD must be stable, as permanent as possible, clearly defined, clearly marked, and easily located.

   c. The LSD should be established to facilitate measuring from it to the MP.

   d. The LSD should be established to facilitate setting a survey rod or GPS antenna on the mark.

   e. Mark the LSD. For example, the LSD is noted by an ‘X’ etched into the well casing or is marked with a brass marker or chiseled “+” in the concrete pad at the base of the surface casing. If the landowner does not allow marking of the well, then describe the LSD as accurately as possible.

   f. Take a photograph of the LSD.

2. **Determine the altitude of the land-surface datum.**

   a. The altitude of the LSD must be determined for every site. At a minimum, it can be estimated from a topographic map. Locate the well using GWPD 5. Determine the altitude of the LSD from the topographic map.

   b. Optional: Depending on the use of the measurements from the well, the altitude of the LSD may be surveyed from a geodetic benchmark using spirit leveling or differential GPS techniques.

3. **Establish the measuring point following these definitions and procedures:**

   a. The MP is the most convenient place to measure the water level in a well. It is often at the top of the casing of an observation well, at the top of an access standpipe installed at a production well, or at an access point at the stem of a production well (see figs. 1 and 2).

   b. The MP must be stable, as permanent as possible, clearly defined, clearly marked, and easily located. For example, the MP is noted by a file mark on the well casing. The MP on a casing that does not have a horizontal rim commonly is established on the high or low side of the rim.

   c. If possible, position the MP at a particular point on the casing where a leveling rod could be set directly on it and the measuring tape can hang freely into the well when it is in contact with the MP.

   d. Using a file, lightly mark the MP on the well casing. Optionally, mark the MP by an arrow sprayed with a bright colored paint or permanent marker. If the MP cannot be marked, it must be clearly defined.

   e. Take a photograph of the MP.

   f. If more than one MP exists for a well, all MPs must be documented, and clearly differentiated.

   g. Optional: Depending on the use and storage of measurements from the well, the altitude of the MP of a well with a vertical stickup may be surveyed from a geodetic benchmark using spirit leveling or differential GPS techniques. MP altitude may be determined in two ways, depending on the calculation of the MP correction length described below.

4. **Determine the measuring point correction length following these definitions and procedures:**

   a. The MP correction length is the distance the measuring tape travels from the MP to the plane of the LSD. This is a vertical distance (also known as MP height) for a simple, vertical well. If the well stickup is not vertical, the MP correction length is not a true height above the LSD, but still represents the distance the tape must travel to reach the plane of the LSD.

   b. Measure the MP correction length in feet above or below the LSD (fig. 1). Values for MP correction lengths above LSD (fig. 1*A*) are positive numbers. Values for MP correction lengths below LSD (fig. 1*B*) are negative numbers and should be preceded by a minus sign (–).

      (1) For a well with a vertical stickup, where a water-level tape can hang vertically from the MP through the plane of the LSD (fig. 1), this distance can be measured directly with a steel tape or by leveling. Optional: if the objectives of the measurement require a precise altitude, the altitude of the MP for these wells can be surveyed from a geodetic benchmark using spirit leveling or differential GPS techniques.

      (2) For a well with a non-vertical stickup, where a water-level tape does not hang vertically from the MP through the plane of the LSD (fig. 2), the MP correction length cannot be measured directly. It is the distance between the MP and the plane of the LSD. The length along the measurement path between the MP and LSD must be computed on the basis of the measurement path length and angles of deviation from vertical (fig. 2). The geometry of this measurement path varies widely among this type of well. This will result in an MP correction length greater than the vertical distance between the LSD and the MP. Optional: If the objectives of the measurement require a precise water-level altitude, the altitude of the MP for wells with a non-vertical stickup should not be measured directly.

         (i) Water-level altitude can be referenced to the LSD, in which case the MP altitude is not needed.

         (ii) Water-level altitude can be referenced to the MP, in which case the MP altitude must be calculated by adding the MP correction length to the altitude of the LSD. Note that the MP altitude in this case is not a true altitude, but subtracting a depth to water measurement from this MP altitude will result in a true water-level altitude.

5. **Establish additional reference marks following these definitions and procedures:**

   a. An RM is a nearby datum established by permanent marks and is used to check the MP and (or) LSD or to re-establish the MP and (or) LSD should the original MP or LSD be destroyed or changed.

   b. Check the condition of the rod and leveling instrument.

   c. Establish the vertical relation between the MP and RMs by use of leveling (Kenney, 2010, for example). Establish at least one clearly marked RM near the well; more than one RM is preferable. For example, a benchmark, a lag bolt set in a telephone pole (fig. 1*A*), a spike in a mature tree, a mark on a permanent structure, or a poured concrete post. The RM should be located a suitable distance from the well to assure that a circumstance that damages a well does not also damage the RM.

   d. Take photographs of the RMs and include the photographs in the site field folder.

   e. A visual inspection of the MP, LSD, and RMs should be made at each site visit. Dates of any damage to the MP, LSD, or RMs must be documented. The vertical relation between the MP and RMs should be checked whenever there is evidence of damage to the MP, LSD, or RM. If no damage is apparent, the vertical relation between the MP and RMs should be confirmed at 3–5 year intervals.

Data Recording

Record data by use of appropriate field notebooks, level note sheets, and the GWSI Groundwater Site Schedule (fig. 3, Form 9-1904-A).

1. LSD: Record a description of the LSD in the field notebook, including the altitude, altitude accuracy, and geodetic datum. Final measurements should be documented in figure 3 as follows: (C16) Altitude of land surface, (C17) Method altitude determined, (C18) Altitude accuracy, and (C22) Altitude datum.

2. MP and MP correction length: Record a description of the MP in the field notebook, including the date of MP establishment, MP correction length or altitude, and a detailed description of the MP. Final data should be documented in figure 3 as follows: (C321) Beginning date, (C323) MP height (correction length), and (C324) MP remarks (description of the MP). If the altitude of the MP is determined, also record (C325) Measuring point altitude, (C326) Method altitude determined, (C327) Measuring point altitude accuracy, and (C328) Measuring point altitude datum. If an MP is destroyed or no longer in service, record the date of the destruction in (C322) Ending date.

3. RMs: Record a description of the site RMs in the field notebook, including the date of RM establishment. Document the vertical relation between the MP and RMs. Include the RM level notes in the site folder. Mark the MP and the RMs on the photographs and draw arrows to identify them. Store a copy of the photographs in the site folder.

References

Cunningham, W.L., and Schalk, C.W., comps., 2011a, Groundwater technical procedures of the U.S. Geological Survey, GWPD 1—Measuring water levels by use of a graduated steel tape: U.S. Geological Survey Techniques and Methods 1–A1, 4 p.

Cunningham, W.L., and Schalk, C.W., comps., 2011b, Groundwater technical procedures of the U.S. Geological Survey, GWPD 5—Documenting the location of a well: U.S. Geological Survey Techniques and Methods 1–A1, 10 p.

Hoopes, B.C., ed., 2004, User's manual for the National Water Information System of the U.S. Geological Survey, Ground-Water Site-Inventory System (version 4.4): U.S. Geological Survey Open-File Report 2005–1251, 274 p.

Kenney, T.A., 2010, Levels at gaging stations: U.S. Geological Survey Techniques and Methods 3–A19, 60 p.

U.S. Geological Survey, Office of Water Data Coordination, 1977, National handbook of recommended methods for water-data acquisition: Office of Water Data Coordination, Geological Survey, U.S. Department of the Interior, chap. 2, 149 p.

FORM NO. 9-1904-A
Revised Sept 2009, NWIS 4.9

File Code _____
Date _____

Coded by _____
Checked by _____
Entered by _____

U.S DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY

GROUNDWATER SITE SCHEDULE
General Site Data

AGENCY CODE (C4) USGS | SITE ID (C1) | PROJECT (C5)

STATION NAME (C12/900)

1 SITE TYPE (C802) - Primary Secondary | DISTRICT (C6) | COUNTRY (C41) | STATE (C7) | County code

COUNTY or TOWN (C8)

LATITUDE (C9) . | LONGITUDE (C10) . | LAT/LONG ACCURACY (C11) H 1 5 S R F T M U
Hndrth sec. | tenth sec. | half sec. | sec. | 3 sec. | 5 sec. | 10 sec. | min. | Unknown

LAT/LONG METHOD (C35) C D G L M N R S U
land net | DGPS | GPS | LORAN | map | interpolated digital map | reported | survey | unknown

LAT/LONG DATUM (C36) NAD27 NAD83
North American Datum of 1927 | North American Datum of 1983

ALTITUDE (C16) .

ALTITUDE ACCURACY (C18)

ALTITUDE METHOD (C17) A D G I J L M N R U
altimeter | DGPS | GPS | IfSAR | LiDAR | Level | map | DEM | reported | unknown

ALTITUDE DATUM (C22) NGVD29 NAVD88
National Geodetic Vertical Datum of 1929 | North American Vertical Datum of 1988

LAND NET (C13) ¼ ¼ ¼ S section T township range merid

TOPOGRAPHIC SETTING (C19) A B C D E F G H K L M O P S T U V W
alluvial fan | playa | stream channel | depression | dunes | flat | flood-plain | hill-top | sink-hole | lake or swamp | mangrove swamp | off-shore | pedi-ment | hill-side | ter-race | undu-lating | valley flat | upland draw

HYDROLOGIC UNIT CODE (C20) | DRAINAGE BASIN CODE (C801) | STANDARD TIME ZONE (C813) | DAYLIGHT SAVINGS TIME FLAG (C814) **Y** OR **N**

MAP NAME (C14) | MAP SCALE (C15)

AGENCY USE (C803) A D I L M O R
active no/na | discontinued | inactive site | active written | active oral | inventory site | remediated

2 NATIONAL WATER-USE (C39)

DATA TYPE (C804)
Place an 'A' (active), an 'I' (inactive), or an 'O' (inventory) in the appropriate box
WL cont | WL int | QW cont | QW int | PR cont | PR int | EV cont | EV int | wind vel. | tide cont | tide int | sed. con | sed. ps | peak flow | low flow | state water use

INSTRUMENTS (C805)
(Place a "Y" in the appropriate box):
digital recorder | graphic recorder | telemetry land line | telemetry radio | telemetry satellite | AHDAS | crest-stage gage | tide gage | deflection meter | bubble gage | stilling well | CR type recorder | weighing rain gage | tipping bucket rain gage | acoustic velocity meter | electromagnetic flowmeter | pressure transducer

DATE INVENTORIED (C711) month – day – year

RECORD READY FOR WEB (C32) Y C P L
ready to display | conditional | proprietary | local use only

REMARKS (C806)

FOOTNOTES

1 SITE TYPE (C802)

GL	Glacier	OC	Ocean	GW	Well	SB	Subsurface
WE	Wetland	OC-CO	Coastal	GW-CR	Collector or Ranney type well	SB-CV	Cave
AT	Atmosphere	LK	Lake, Reservoir, Impoundment	GW-EX	Extensometer well	SB-GWD	Groundwater drain
ES	Estuary			GW-HZ	Hyporheic -zone well	SB-TSM	Tunnel, shaft, or mine
LA	Land	SP	Spring	GW-IW	Interconnected wells	SB-UZ	Unsaturated zone
LA-EX	Excavation	ST	Stream	GW-TH	Test hole not completed as a well		
LA-OU	Outcrop	ST-CA	Canal	GW-MW	Multiple wells		
LA-SNK	Sinkhole	ST-DCH	Ditch				
LA-SH	Soil hole	ST-TS	Tidal strea m				
LA-SR	Shore	FA-WIW	Waste-Injection well				

2 WS DO CO IN IR MI LV PH ST RM TE AQ
water supply | domestic | commercial | industrial | irrigation | mining | livestock | power hydroelectric | waste water treatment | remediation | thermoelectric power | aquaculture

C22 Other (see manual for codes)
C36 Other (see manual for codes)
C39 is mandatory for all sites having data in SWUDS.

Figure 3. Groundwater Site Schedule, Form 9-1904-A.

GENERAL SITE DATA

DATA RELIABILITY (C3): C L M U
(field checked; poor location; minimal data; unchecked)

DATE OF FIRST CONSTRUCTION (C21): ___ – ___ – ____ (month – day – year)

USE OF SITE (C23): A C D E G H M O P R S T U V W X Z
(anode; standby emer. supply; drain; geothermal; seismic; heat reservoir; mine; observation; oil or gas; recharge; represurize; test; unused; withdrawal/return; withdrawal; waste; destroyed)

SECONDARY USE OF SITE (C301) (See use of site): ___

TERTIARY USE OF SITE (C302) (See use of site): ___

USE OF WATER (C24): A B C D E F H I J K M N P Q R S T U Y Z
(air cond.; bottling; commercial; dewater; power; fire; domestic; irrigation; industrial (cooling); mining; medicinal; industrial; public supply; aquaculture; recreations; stock; institutional; unused; desalination; other)

SECONDARY USE OF WATER (C25) (see use of water): ___

TERTIARY USE OF WATER (C26) (see use of water): ___

AQUIFER TYPE (C713): U N C M X
(unconfined single; unconfined multiple; confined single; confined multiple; mixed)

PRIMARY AQUIFER (C714): _____

NATIONAL AQUIFER (C715): _____

HOLE DEPTH (C27): _____.__

WELL DEPTH (C28): _____.__

SOURCE OF DEPTH DATA (C29): A D G L M O R S Z
(other gov't; driller; geologist; logs; memory; owner; other reported; reporting agency; other)

WATER-LEVEL DATA

DATE WATER-LEVEL MEASURED (C235): ___ – ___ – ____ (month – day – year)

TIME (C709): _____

WATER-LEVEL TYPE CODE (C243): L M S
(land surface; meas. pt.; vertical datum)

WATER LEVEL (C237/241/242): _____.__

MP SEQUENCE NO. (C248) (Mandatory if WL type=M): ___

WATER-LEVEL DATUM (C245) (Mandatory if WL type=S): NGVD29 (National Geodetic Vertical Datum 0f 1929); NAVD88 (North American Vertical Datum 0f 1988); _____ (Other (See manual for codes))

SITE STATUS FOR WATER LEVEL (C238): A B C D E F G H I J M N O P R S T V W X Z
(atmos. pressure; tide stage; ice; dry; recently flowing; flowing; nearby flowing; nearby recently flowing; injector site; injector site monitor; plugged; measurement discontinued; obstruction; pumping; recently pumped; nearby pumping; nearby recently pumped; foreign substance; well destroyed; affected by surface water; other)

METHOD OF WATER-LEVEL MEASUREMENT(C239): A B C D E F G H L M N O P R S T V Z
(airline; analog; calibrated airline; differential GPS; estimated; transducer; pressure gage; calibrated press. gage; geophysical logs; manometer; non-rec. gage; observed; acoustic pulse; reported; steel tape; electric tape; calibrated elec. tape; other)

WATER-LEVEL ACCURACY (C276): 0 1 2 9
(foot; tenth; hundredth; not to nearest foot)

SOURCE OF WATER-LEVEL DATA (C244): A D G L M O R S Z
(other gov't; driller's log; geologist; geophysical logs; memory; owner; other reported; reporting agency; other)

PERSON MAKING MEASUREMENT (C246) (WATER LEVEL PARTY): _____

MEASURING AGENCY (C247) (SOURCE): _____

EQUIP ID (C249) (20 char): _____

REMARKS (C267) (256 char): _____

RECORD READY FOR WEB (C858): Y C P L
(ready to display; conditional; proprietary; local use only)

CONSTRUCTION DATA

RECORD TYPE (C754): C O N S

RECORD SEQUENCE NO. (C723): ___

DATE OF COMPLETED CONSTRUCTION (C60): ___ – ___ – ____ (month – day – year)

NAME OF CONTRACTOR (C63): _____

SOURCE OF DATA (C64): A D G L M O R S Z
(other gov't; driller; geologist; logs; memory; owner; other reported; reporting agency; other)

METHOD OF CONSTRUCTION (C65): A B C D H J P R S T V W Z
(air-rotary; bored or augered; cable tool; dug; hydraulic rotary; jetted; air percussion; reverse rotary; sonic; trenching; driven; drive wash; other)

TYPE OF FINISH (C66): C F G H O P S T W X Z
(porous concrete; gravel w/perf.; gravel screen; horiz. gallery; open end; perf or slotted screen; sand point; walled; open hole; other)

TYPE OF SEAL (C67): B C G N Z
(bentonite; clay; cement grout; none; other)

BOTTOM OF SEAL (C68): _____

METHOD OF DEVELOPMENT (C69): A B C J N P S Z
(air-lift pump; bailed; compressed air; jetted; none; pumped; surged; other)

HOURS OF DEVELOPMENT (C70): ___

SPECIAL TREATMENT (C71): C D E F H M Z
(chemicals; dry ice; explosives; deflocculent; hydrofracturing; mechanical; other)

CONSTRUCTION HOLE DATA (3 sets shown)

RECORD TYPE (C756) HOLE RECORD SEQUENCE NO. (C724) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

RECORD SEQUENCE NO. (C724)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

RECORD SEQUENCE NO. (C724)

DEPTH TO TOP OF INTERVAL (C73) . DEPTH TO BOTTOM OF INTERVAL (C74) . DIAMETER OF INTERVAL (C75) .

CONSTRUCTION CASING DATA (4 sets shown)

RECORD TYPE (C758) CSNG RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

RECORD SEQUENCE NO. (C725) SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF CASING (C77) . DEPTH TO BOTTOM OF CASING (C78) . DIAMETER OF CASING (C79) .

4 CASING MATERIAL (C80) CASING THICKNESS (C81) .

FOOTNOTE:

4 CASING MATERIAL CODES

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	U	V	W	X	Y	Z	4	6
abs	brick	concrete	copper	PTFE	Fiber-glass	galv. iron	Fiber-glass plastic	wrought iron	Fiber-glass epoxy	PVC thread-ed	glass	other metal	PVC glued	PVC or plastic	FEP	rock or stone	steel	tile	coated steel	stain-less steel	wood	steel carbon	steel galva-nized	other mat.	stain-less 304	stain-less 316

CONSTRUCTION OPENINGS DATA (3 sets shown)

RECORD TYPE (C760) O P E N

RECORD SEQUENCE NO. (C726)

SEQUENCE NO. OF PARENT RECORD (C59)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

RECORD SEQUENCE NO. (C726)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

RECORD SEQUENCE NO. (C726)

DEPTH TO TOP OF INTERVAL (C83) .

DEPTH TO BOTTOM OF INTERVAL (C84) .

DIAMETER OF INTERVAL (C87) .

[5] MATERIAL TYPE (C86)

[6] TYPE OF OPENING (C85)

LENGTH OF OPENING (C89) .

WIDTH OF OPENING (C88) .

FOOTNOTES:

[5] TYPE OF MATERIAL CODES FOR OPEN SECTIONS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Q	R	S	T	V	W	X	Y	Z	4	6
ABS	brass or bronze	concrete	ceramic	PTFE	fiber-glass	galv. iron	fiber-glass plastic	wrought iron	fiber-glass epoxy	PVC thread-ed	glass	other metal	PVC glued	PVC	FEP	stain-less steel	steel	tile	brick	mem-brane	steel carbon	steel galva-nized	other	stain-less 304	stain-less 316

[6] TYPE OF OPENINGS CODES

F	L	M	P	R	S	T	W	X	Z
fractured rock	louvered or shutter-type	mesh screen	perforated, porous or slotted	wire-wound screen	screen (unk.)	sand point screen	walled or shored	open hole	other

CONSTRUCTION MEASURING POINT DATA

RECORD TYPE (C766) M P N T

RECORD SEQUENCE NO. (C728)

BEGINNING DATE (C321) – – (month – day – year)

ENDING DATE (C322) – –

M.P. HEIGHT (C323) .

ALTITUDE OF MEASURING POINT (C325)

ALTITUDE METHOD (C326)

ALTITUDE ACCURACY (C327)

ALTITUDE DATUM (C328)

M.P. REMARKS (C324)

RECORD READY FOR WEB (C857)

Y	C	P	L
ready to display	condi-tional	proprie-tary	local use only

CONSTRUCTION LIFT DATA

RECORD TYPE (C752): L I F T
RECORD SEQUENCE NO. (C254):
TYPE OF LIFT (C43): A air | B bucket | C centrifugal | J jet | P piston | R rotary | S submersible | T turbine | U unknown | X no lift | Z other
DATE RECORDED (C38): month – day – year
PUMP INTAKE DEPTH (C44):
TYPE OF POWER (C45): D diesel | E electric | G gasoline | H hand | L LP gas | N natural gas | S solar | W windmill | Z other
HORSEPOWER RATING (C46): .
MANUFACTURER (C48):
SERIAL NO. (C49):
POWER COMPANY (C50):
POWER COMPANY ACCOUNT NUMBER (C51):
POWER METER NUMBER (C52):
PUMP RATING (C53) (million gallons/units of fuel): .
ADDITIONAL LIFT (C255):
PERSON OR COMPANY MAINTAINING PUMP (C54):
RATED PUMP CAPACITY (gpm) (C268):
STANDBY POWER (C56) (see TYPE OF POWER):
HORSEPOWER OF STANDBY POWER SOURCE (C57): .

MISCELLANEOUS OWNER DATA

RECORD TYPE (C768): O W N R
RECORD SEQUENCE NO. (C718):
DATE OF OWNERSHIP (C159): – –
WU OWNER TYPE (C350): CP Corporation | GV Government | IN Individual | MI Military | OT Other | TG Tribal | WS Water Supplier
END DATE OF OWNERSHIP (C374): – –
OWNER'S NAME (C161):
EXAMPLES: JONES, RALPH A.
JONES CONSTRUCTION COMPANY
OWNER'S PHONE NUMBER (C351):
ACCESS TO OWNER'S NAME (C352): 0 Public Access | 1 Cooperator | 2 USGS Only | 3 District Only | 4 Proprietary
OWNER'S ADDRESS (LINE 1) (C353):
OWNER'S ADDRESS (LINE 2) (C354):
OWNER'S CITY NAME (C355):
STATE (C356):
OWNER'S ZIP CODE (C357): –
OWNER'S COUNTRY NAME (C358):
ACCESS TO OWNER'S PHONE/ADDRESS (C359): 0 Public Access | 1 Cooperator | 2 USGS Only | 3 District Only | 4 Proprietary

MISCELLANEOUS VISIT DATA

RECORD TYPE (C774): V I S T
RECORD SEQUENCE NO. (C737):
DATE OF VISIT (C187): month – day – year
NAME OF PERSON (C188):

MISCELLANEOUS OTHER ID DATA (2 sets shown)

RECORD TYPE (C770) O T I D

RECORD SEQUENCE NO. (C736)

OTHER ID (C190)

ASSIGNER (C191)

RECORD SEQUENCE NO. (C736)

OTHER ID (C190)

ASSIGNER (C191)

MISCELLANEOUS OTHER DATA

RECORD TYPE (C772) O T D T

RECORD SEQUENCE NO. (C312)

OTHER DATA TYPE (C181)

OTHER DATA LOCATION (C182) C Cooperator's Office, D District Office R Reporting Agency Z other

DATA FORMAT (C261) F files, M machine readable, P published, Z other

MISCELLANEOUS LOGS DATA (3 sets shown)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202) A other gov't D driller G geologist L logs M memory O owner R other reported S reporting agency Z other

DATA FORMAT (C225) F files M machine readable P published Z other

OTHER DATA LOCATION (C226)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202) A other gov't D driller G geologist L logs M memory O owner R other reported S reporting agency Z other

DATA FORMAT (C225) F files M machine readable P published Z other

OTHER DATA LOCATION (C226)

RECORD TYPE (C778) L O G S

RECORD SEQUENCE NO. (C739)

TYPE OF LOG (C199)

BEGINNING DEPTH (C200) .

ENDING DEPTH (C201) .

SOURCE OF DATA (C202) A other gov't D driller G geologist L logs M memory O owner R other reported S reporting agency Z other

DATA FORMAT (C225) F files M machine readable P published Z other

OTHER DATA LOCATION (C226)

ACOUSTIC LOG:
AS Sonic
AV Acoustic velocity
AW Acoustic waveform
AT Acoustic televiewer

CALIPER LOG:
CP Caliper
CS Caliper, single arm
CT Caliper, three arm
CM Caliper, multi arm
CA Caliper, acoustic

DRILLING LOG:
DT Drilling time
DR Drillers
DG Geologists
DC Core

ELECTRIC LOG:
EE Electric
ER Single-point resistance
EP Spontaneous potential
EL Long-normal resistivity
ES Short-normal resistivity
EF Focused resistivity
ET Lateral resistivity
EN Microresistivity
EC Microresistivity, forused
EO Microresistivity, lateral
ED Dipmeter

ELECTROMAGNETIC LOG:
MM Magnetic log
MS Magnetic susceptibiity log
MI Electromagnetic induction log
MD Electromagnetic dual induction log
MR Radar reflection image log
MV Radar direct-wave velocity log
MA Radar direct-wave amplitude log

FLUID LOG:
FC Fluid conductivity
FR Fluid resistivity
FT Fluid temperature
FF Fluid differential temperature
FV Fluid velocity
FS Spinner flowmeter
FH Heat-pulse flowmeter
FE Electromagnetic flowmeter
FD Doppler flowmeter
FA Radioactive tracer
FY Dye tracer
FB Brine tracer

NUCLEAR LOG:
NG Gamma
NS Spectral gamma
NA Gamma-gamma
NN Neutron
NT Neutron activitation
NM Neuclear magnetic resonance

OPTICAL LOG:
OV Video
OF Fisheye video
OS Sidewall video
OT Optical televiewer

COMBINATION LOG:
ZF Gamma, fluid resistivity, temperature
ZI Gamma, electromagnetic induction
ZR Long/short normal resistivity
ZT Fluid resistivity, temperature
ZM Electromagnetic flowmeter, fluid resistivity, temperature
ZN Long/short normal resistivity, spontaneous potential
ZP Single-point resistance, spontaneous potential
ZE Gamma, long/short normal resistivity, spontaneous potential, single-point resistance, fluid resitivity, temperature

WELL CONSTRUCTION LOG:
WC Casing collar
WD Borehold deviation

OTHER LOG:
OR Other

MISCELLANEOUS NETWORK DATA (3 types shown)

RECORD TYPE (C780) N E T W | RECORD SEQUENCE NO. (C730) | TYPE OF NETWORK (C706) Q W (water quality) | BEGINNING YEAR (C115) | ENDING YEAR (C116)

TYPE OF ANALYSIS (C120)

A	B	C	D	E	F	G	H	I	J	K	L	M	N	P	Z
physical properties	common ions	trace elements	pesticides	nutrients	sanitary analysis	codes D&B	codes B&E	codes B&C	codes B&F	codes D&E	codes C,D&E	all or most	codes B&C& radioactive	codes B,C&A	other

SOURCE AGENCY (C117) | [7] FREQUENCY OF COLLECTION (C118) | ANALYZING AGENCY (C307) | [8] PRIMARY NETWORK SITE (C257) | [8] SECONDARY NETWORK SITE (C708)

RECORD TYPE (C780) N E T W | RECORD SEQUENCE NO. (C730) | TYPE OF NETWORK (C706) W L (water level) | BEGINNING YEAR (C115) | ENDING YEAR (C116)

SOURCE AGENCY (C117) | [7] FREQUENCY OF COLLECTION (C118) | [8] PRIMARY NETWORK SITE (C257) | [8] SECONDARY NETWORK SITE (C708)

RECORD TYPE (C780) N E T W | RECORD SEQUENCE NO. (C730) | TYPE OF NETWORK (C706) W D (pumpage or withdrawals) | BEGINNING YEAR (C115) | ENDING YEAR (C116)

SOURCE AGENCY (C117) | [7] FREQUENCY OF COLLECTION (C118) | METHOD OF COLLECTION (C133)

C	E	M	U	Z
calculated	estimated	metered	unknown	other

[8] PRIMARY NETWORK SITE (C257) | [8] SECONDARY NETWORK SITE (C708)

FOOTNOTES:

[7] FREQUENCY OF COLLECTION CODES

A	B	C	D	F	I	M	O	Q	S	W	Z	2	3	4	5	X
annually	bi monthly	continuously	daily	semi-monthly	intermittent	monthly	one-time only	quarterly	semi-annually	weekly	other	bi-annually	every 3 years	every 4 years	every 5 years	every 10 years

[8] NETWORK SITE CODES

1	2	3	4
national,	district,	project,	co-operator,

MISCELLANEOUS REMARKS DATA (4 types shown)

RECORD TYPE (C788) R M K S | RECORD SEQUENCE NO. (C311) | DATE OF REMARK (C184) month – day – year

REMARKS (C185)

Subsequent entries may be used to continue the remark. Miscellaneous remarks field is limited to 256 characters.

RECORD TYPE (C788) R M K S | RECORD SEQUENCE NO. (C311) | DATE OF REMARK (C184) month – day – year

REMARKS (C185)

Subsequent entries may be used to continue the remark. Miscellaneous remarks field is limited to 256 characters.

DISCHARGE DATA

RECORD SEQUENCE NO. (C147)

DATE DISCHARGE MEASURED (C148) — month / day / year

TYPE OF DISCHARGE (C703): P pumped, F flow

DISCHARGE (gpm) (C150)

ACCURACY OF DISCHARGE MEASUREMENT (C310): E excellent (LT 2%), G good (2%-5%), F fair (5%-8%), P poor (GT 8%)

SOURCE OF DATA (C151): A other gov't, D driller, G geologist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

METHOD OF DISCHARGE MEASUREMENT (C152): A acoustic meter, B bailer, C current meter, D Doppler meter, E estimated, F flume, M totaling meter, O orifice, P pitot-tube, R reported, T trajectory, U venturi meter, V volumetric meas, W weir, X unknown, Z other

PRODUCTION WATER LEVEL (C153)

STATIC WATER LEVEL (C154)

SOURCE OF DATA (C155): A other gov't, D driller, G geologist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

METHOD OF WATER-LEVEL MEASUREMENT (C156): A airline, B recorder, C calibrated airline, D differential GP, E estimated, F transducer, G pressure gage, H calibrated press. gage, L geophysical logs, M manometer, N non-rec. gage, O observed, P acoustic pulse, R reported, S steel tape, T electric tape, V calibrated elec. tape, Z other

PUMPING PERIOD (C157)

SPECIFIC CAPACITY (C272)

DRAWDOWN (C309)

GEOHYDROLOGIC DATA

RECORD TYPE (C748): GEOH

RECORD SEQUENCE NO. (C721)

DEPTH TO TOP OF UNIT (C91)

DEPTH TO BOTTOM OF UNIT (C92)

UNIT IDENTIFIER (C93)

LITHOLOGY (C96)

CONTRIBUTING UNIT (C304): P principal aquifer, Q aggregate of lithologic units, S secondary aquifer, N no contribution, U unknown

LITHOLOGIC MODIFIER (C97)

GEOHYDROLOGIC AQUIFER DATA

RECORD TYPE (C750): AQFR

RECORD SEQUENCE NO. (C742)

SEQUENCE NO. OF PARENT RECORD (C256)

DATE (C95) — month / day / year

STATIC WATER LEVEL (C126)

CONTRIBUTION (C132)

SITE LOCATION SKETCH AND DIRECTIONS

Township _____ Range _____

Section # _____