

GWPD 11—Measuring well depth by use of a graduated steel tape

VERSION: 2010.1

PURPOSE: To measure the total depth of a well below land-surface datum by using a weighted graduated steel tape.

Materials and Instruments

1. A steel tape graduated in feet, tenths and hundredths of feet. A break-away weight should be attached to a ring on the end of the tape with wire strong enough to hold the weight, but not as strong as the tape, so that if the weight becomes lodged in the well the tape can still be pulled free. The weight should be made of brass, stainless steel, or iron. A lead weight should not be used. The weight should be heavy enough to amplify the weight-transfer sensation when the bottom of the well is struck.
2. Clean rag
3. Cleaning supplies for water-level tapes as described in the National Field Manual (Wilde, 2004)
4. Two wrenches with adjustable jaws or other tools for removing well cap
5. Key for well access
6. Pencil or pen, blue or black ink. Strikethrough, date, and initial errors; no erasures
7. Field notebook
8. Groundwater Site Inventory (GWSI) System, Groundwater Site Schedule Form 9-1904-A

Data Accuracy and Limitations

1. A graduated steel tape is commonly accurate to 0.01 foot. Accuracy of well-depth measurement decreases with increasing depth.
2. The steel tape should be calibrated against another acceptable steel tape. An acceptable steel tape is one that

is maintained in the office for use only for calibrating steel and electric tapes.

3. Corrections are necessary for measurements made in angled well casings.
4. When measuring well depth in deep wells, tape expansion and stretch is an additional consideration (Garber and Koopman, 1968).

Advantages

1. The weighted graduated steel tape is considered to be the most accurate method of measuring well depth.
2. Easy to use.

Disadvantages

1. Not recommended for measuring the depth of wells that are being pumped.

Assumptions

1. An established measuring point (MP) exists. See GWPD 3 for technical procedures on establishing an MP.
2. The MP is clearly marked and described.
3. The steel tape has been calibrated.
4. The well is free of obstructions that could affect the plumbness of the steel tape and cause errors in the measurement.

Instructions

1. Measure from the zero point on the tape to the bottom of the weight. Record this number in the field notebook as the length of the weight interval.
2. Lower the weight and tape into the well until the weight reaches the bottom of the well and the tape slackens.
3. Partially withdraw the tape from the well until the weight is standing in a vertical position, but still touching the bottom of the well. A slight jerking motion will be felt as the weight moves from the horizontal to the vertical position.
4. Repeat step 3 several times by lowering and withdrawing the tape to obtain a consistent reading.
5. Record the tape reading held at the MP.
6. Withdraw the tape from the well 1 to 2 feet, so that the weight will hang freely above the bottom of the well. Repeat steps 2–4 until two consistent depth readings are obtained.
7. Calculate total well depth below land-surface datum (LSD) as follows:

<i>Tape reading held at the MP</i>	84.30 feet
<i>Length of the weight interval</i>	<u>+1.20 feet</u>
<i>Total well depth below MP</i>	85.50 feet
<i>MP correction</i>	<u>-3.40 feet</u>
<i>Total well depth below LSD</i>	82.10 feet

8. After completing the well-depth measurement, disinfect and rinse that part of the tape that was submerged below the water surface, as described in the National Field Manual (Wilde, 2004). This will reduce the possibility of contamination of other wells from the tape.

Data Recording

Data are recorded in a field notebook. Well-depth data are recorded in the groundwater site data section of the GWSI Groundwater Site Schedule (fig. 1, Form 9-1904-A). Recommended precision is depth dependent and should be shown in field C28 on Form 9-1904-A (fig. 1).

References

- Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater technical procedures of the U.S. Geological Survey, GWPD 3—Establishing a permanent measuring point and other reference marks: U.S. Geological Survey Techniques and Methods 1–A1, 13 p.
- Garber, M.S., and Koopman, F.C., 1968, Methods of measuring water levels in deep wells: U.S. Geological Survey Techniques of Water-Resources Investigations, book 8, chap. A1, 23 p.
- Hoopes, B.C., ed., 2004, User's manual for the National Water Information System of the U.S. Geological Survey, Groundwater Site-Inventory System (version 4.4): U.S. Geological Survey Open-File Report 2005–1251, 274 p.
- Katz, B.G., and Jelinski, J.C., 1999, Replacement materials for lead weights used in measuring ground-water levels: U.S. Geological Survey Open-File Report 99–52, 13 p.
- Wilde, F.D., ed., 2004, Cleaning of equipment for water sampling (version 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, section 3.3.8., p. 50–53, accessed May 17, 2010, at <http://pubs.water.usgs.gov/twri9A3/>.

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

File Code _____

Coded by _____
Checked by _____
Entered by _____

U.S. DEPT. OF THE INTERIOR
GEOLOGICAL SURVEY

Date _____

GROUNDWATER SITE SCHEDULE
General Site Data

AGENCY CODE (C4) **USGS** SITE ID (C1) _____ PROJECT (C5) _____

STATION NAME (C12/900) _____

SITE TYPE (C802) Primary Secondary DISTRICT (C6) _____ COUNTRY (C41) _____ STATE (C7) _____

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

LAT/LONG METHOD (C35) **C D G L M N R S U** LAT/LONG DATUM (C36) **NAD27 NAD83** ALTITUDE (C16) _____
land net DGPS GPS LORAN map inter-reported survey un-known North American Datum of 1927 North American Datum of 1983

ALTITUDE ACCURACY (C18) _____ ALTITUDE METHOD (C17) **A D G I J L M N R U** ALTITUDE DATUM (C22) **NGVD29 NAVD88**
altimeter DGPS GPS IFSAR LIDAR Level map DEM reported un-known National Geodetic Vertical Datum of 1929 North American Vertical Datum of 1988

LAND NET (C13) _____ S _____ T _____
1/4 1/4 1/4 section township range merid

TOPO-GRAPHIC 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 pediment hill-side terrace undulating valley flat upland draw

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

MAP NAME (C14) _____ MAP SCALE (C15) _____

AGENCY USE (C803) **A D I L M O R** 2 NATIONAL WATER-USE (C39) _____
active no/na discon-tinued inactive site active written active oral inventory remediated

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 rec-order graphic rec-order tele-metry land line tele-metry radio tele-metry satellite AHDAS crest-stage gage tide gage deflec-tion meter bubble gage stilling well CR type recorder weigh-ing rain gage tipping bucket rain gage acoustic velocity meter electro-magnetic flowmeter pressure transducer

DATE INVENTORIED (C711) _____ RECORD READY FOR WEB (C32) **Y C P L**
month day year ready to display condi-tional proprie-tary 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	SP	Spring	GW -HZ	Hyporheic -zone well	SB-TSM	Tunnel, shaft, or mine
LA	Land	ST	Stream	GW -IW	Interconnected wells	SB-UZ	Unsaturated zone
LA-EX	Excavation	ST-CA	Canal	GW -TH	Test hole not completed as a well		
LA-OU	Outcrop	ST-DCH	Ditch	GW -MW	Multiple wells		
LA-SNK	Sinkhole	ST-TS	Tidal stream				
LA-SH	Soil hole	FA-WIW	Waste-Injection well				
LA-SR	Shore						

2 **WS DO CO IN IR MI LV PH ST RM TE AQ**
water supply domestic commercial industrial irrigation mining livestock power hydro-electric waste water electric treatment remedia-tion thermo-electric aqua-culture

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

Figure 1. Groundwater Site Schedule, Form 9-1904-A.

GENERAL SITE DATA

DATA RELIABILITY (C3) **C L M U**
field poor minimal un-
checked location data checked

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 drain geo- seismic heat mine obser- oil or recharge repres- test unused with- with- waste des-
emer. supply water thermal reservoir vation gas gas culture re-surize reations stock insti- unused desalin- other
return drawal drawal destroyed

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 bottling comm- de- power fire domes- irri- indus- mining medi- indus- public aqua- recrea- stock insti- unused desalin- other
cond. em- ercial water water thermal reservoir tic gation trial (cooling) cinal trial supply culture reations tional ation

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

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 driller geo- logs memory owner other reporting other
gov't gov't ologist agency

WATER-LEVEL DATA

DATE WATER-LEVEL MEASURED (C235) - - TIME (C709)
month day year

WATER LEVEL (C237/241/242) MP SEQUENCE NO. (C248) (Mandatory if WL type=M)

WATER-LEVEL DATUM (C245) (Mandatory if WL type=S) **NGVD29 NAVD88**
National Geodetic Vertical Datum Of 1929 North American Vertical Datum Of 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. tide ice dry recently flowing nearby nearby injector injector plugged measure- obstruction pumping recently nearby nearby foreign well affected by
pressure stage ice dry recently flowing nearby recently flowing site site monitor dis-continued tion pumped pumped pumped substance destroyed 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 calibrated differ- esti- trans- pressure calibrated geophys- mano- non-rec. observed acoustic reported steel electric calibrated other
airline GPS mated ducer gage press. gage gage cal- gage gage logs meter gage gage pulse pulse tape tape elec. tape elec. tape

WATER-LEVEL ACCURACY (C276) **0 1 2 9** SOURCE OF WATER-LEVEL DATA (C244) **A D G L M O R S Z**
foot tenth hun- not to SOURCE OF WATER-LEVEL DATA (C244) **A D G L M O R S Z**
dredth foot other gov't driller's geo- geophys- memory owner other reporting other
foot log ologist cal logs owner reported 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 condi- proprie- 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 geo- logs memory owner other reporting other
gov't gov't ologist agency

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

TYPE OF FINISH (C66) **C F G H O P S T W X Z** TYPE OF SEAL (C67) **B C G N Z**
porous gravel gravel horiz. open perf or screen sand walled open other TYPE OF SEAL (C67) **B C G N Z**
concrete w/perf. screen gallery end slotted point rotary hole hole none other
grout

BOTTOM OF SEAL (C68) METHOD OF DEVELOPMENT (C69) **A B C J N P S Z**
air-lift bailed compressed jetted none pumped surged other
pump air

HOURS OF DEVELOPMENT (C70) SPECIAL TREATMENT (C71) **C D E F H M Z**
chemi- dry ice explo- defloc- hydro- mech- other
cals ice sives culent frac- anical
turing

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) **CASNG** 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	wrought-iron	Fiber-glass	thread-ed	PVC	glass	other metal	PVC	PVC or 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 LIFT DATA

RECORD TYPE (C752) **L I F T** RECORD SEQUENCE NO. (C254) TYPE OF LIFT (C43) **A B C J P R S T U X Z**
air bucket centri-fugal jet piston rotary submer-sible turbine un-known no lift other

DATE RECORDED (C38) - - PUMP INTAKE DEPTH (C44) TYPE OF POWER (C45) **D E G H L N S W Z**
month day year diesel electric gaso-line hand LP gas natural gas solar windmill other

HORSE-POWER 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) **OWNR** RECORD SEQUENCE NO. (C718) DATE OF OWNERSHIP (C159) - -

WU OWNER TYPE (C350) **CP GV IN MI OT TG WS** END DATE OF OWNERSHIP (C374) - -
Corporation Govern-ment Individual Military Other Tribal Water Supplier

OWNER'S NAME (C161)

EXAMPLES: JONES, RALPH A.
 JONES CONSTRUCTION COMPANY

OWNER'S PHONE NUMBER (C351) ACCESS TO OWNER'S NAME (C352) **0 1 2 3 4**
Public Access Co-op-erator Only USGS District Proprietary Only

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 1 2 3 4**
Public Access Co-op-erator Only USGS District Proprietary Only

MISCELLANEOUS VISIT DATA

RECORD TYPE (C774) **V I S I T** RECORD SEQUENCE NO. (C737) DATE OF VISIT (C187) - -
month day year

NAME OF PERSON (C188)

MISCELLANEOUS NETWORK DATA (3 types shown)

RECORD TYPE (C780) **NETW** RECORD SEQUENCE NO. (C730) TYPE OF NETWORK (C706) **QW** BEGINNING YEAR (C115) ENDING YEAR (C116)
water quality

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) ⁷FREQUENCY OF COLLECTION (C118) ANALYZING AGENCY (C307) ⁸PRIMARY NETWORK SITE (C257) ⁸SECONDARY NETWORK SITE (C708)

RECORD TYPE (C780) **NETW** RECORD SEQUENCE NO. (C730) TYPE OF NETWORK (C706) **WL** BEGINNING YEAR (C115) ENDING YEAR (C116)
water level

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

RECORD TYPE (C780) **NETW** RECORD SEQUENCE NO. (C730) TYPE OF NETWORK (C706) **WD** BEGINNING YEAR (C115) ENDING YEAR (C116)
pumpage or withdrawals

SOURCE AGENCY (C117) ⁷FREQUENCY OF COLLECTION (C118) METHOD OF COLLECTION (C133) **C E M U Z** ⁸PRIMARY NETWORK SITE (C257) ⁸SECONDARY NETWORK SITE (C708)
calculated estimated metered unknown other

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 inter-mittent 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) **RMKIS** RECORD SEQUENCE NO. (C311) DATE OF REMARK (C184) - -
month day year

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

RECORD TYPE (C788) **RMKIS** RECORD SEQUENCE NO. (C311) DATE OF REMARK (C184) - -
month day year

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 F pumped flow

DISCHARGE (gpm) (C150) .

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

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

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

PRODUCTION WATER LEVEL (C153) .

STATIC WATER LEVEL (C154) .

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

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

PUMPING PERIOD (C157) .

SPECIFIC CAPACITY (C272) .

DRAWDOWN (C309) .

GEOHYDROLOGIC DATA

RECORD TYPE (C748) G E O H

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 Q S N U
principal aquifer aggregate of lithologic units secondary aquifer no contribution unknown

LITHOLOGIC MODIFIER (C97)

GEOHYDROLOGIC AQUIFER DATA

RECORD TYPE (C750) A Q F R

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 # _____

