GWPD 8—Estimating discharge from a pumped well by use of the trajectory free-fall or jet-flow method

VERSION: 2010.1

PURPOSE: To estimate the discharge from a pumped well from a non-vertical standard pipe by using the trajectory free-fall or jet-flow method.

Materials and Instruments

1. L-shaped measuring device (carpenter's square)
2. Support for measuring device
3. Small hand level
4. Clamp
5. Field notebook
6. Pencil or pen, blue or black ink. Strikethrough, date, and initial errors; no erasures
7. Groundwater Site Inventory (GWSI) System Groundwater Site Schedule, Form 9-1904-A

Data Accuracy and Limitations

1. Under ordinary field conditions, with reasonable care, measurements can be made in which the error seldom exceeds 10 percent.
2. The most accurate estimated discharge will be obtained when the pipe is truly horizontal.
3. The discharge pipe should be a straight length of standard pipe at least 5 feet long, so that the open end is at least this distance from the nearest elbow or bend in the pipe.
4. If the discharge pipe slopes upward, the estimated discharge will be too high; if it slopes downward, the estimated discharge will be too low.
5. The principal difficulty with using this method is in measuring the coordinates (X and Y) of the jet-flow stream accurately.
6. Well flow should be constant so that the top of the stream at the open end of the pipe does not vary appreciably.
7. Not accurate for small flows. For small flows, measure the well discharge with a flowmeter or a bucket and stopwatch.

Advantages

1. This method provides a simple, inexpensive, and practical means of estimating flow from horizontal and inclined pipes for field tests.
2. No special training is needed to use this method.

Disadvantages

1. This method provides only an approximate discharge from wells with horizontal or inclined pipes.
2. Well flow should be constant. The top of the stream at the open end of the pipe should not vary appreciably.

Assumptions

1. The discharge pipe does not have a circular orifice weir.
2. The discharge pipe does not have an in-line flowmeter.

Instructions

1. Measure the inside diameter (D) of the pipe accurately, in inches (fig. 1*A*).
2. Measure the distance (X) that the jet flow of water travels, in inches parallel to the top of the pipe for a 12-inch vertical drop (Y; fig. 1*B*).
3. If the jet flow is brooming or spreading from the end of the horizontal pipe, the center of the falling stream (P) can be located more reliably than can a point on the surface of the stream. When brooming or spreading flow occurs, measure X from the center of the pipe for a 12-inch vertical drop, and measure Y from the center of the pipe to the center of the falling stream (fig. 1*C*).
4. Estimate well discharge by using the discharge curves for measurement of flow from non-vertical standard pipes (fig. 2). For example, see the sample calculation in figure 2 for a 5-inch well with a jet stream of 16 inches (X) and a 12-inch vertical drop (Y). Discharge from this well is about 330 gallons per minute.
5. For partially filled non-vertical pipes, measure the freeboard (F) and the inside diameter (D) of the pipe (fig. 1C). Calculate the ratio of F/D as a percentage. Measure the distance X of the jet stream for a 12-inch vertical drop (Y), and estimate a well discharge using the discharge curves in figure 2. The actual estimated discharge will be the value for a full pipe multiplied by a correction factor obtained from table 1. Use the correction factor in the column opposite the ratio of F/D calculated above for the partially filled non-vertical pipe.
6. Record estimated discharge in the field notebook and in the discharge data section on the GWSI Groundwater Site Schedule (fig. 3, Form 9-1904-A).

Data Recording

Data are recorded in a field notebook. Discharge data should also be recorded in the discharge data section of the GWSI Groundwater Site Schedule (Form 9-1904-A). This is best described as a trajectory method and should be coded as "T" in field C152 on Form 9-1904-A.

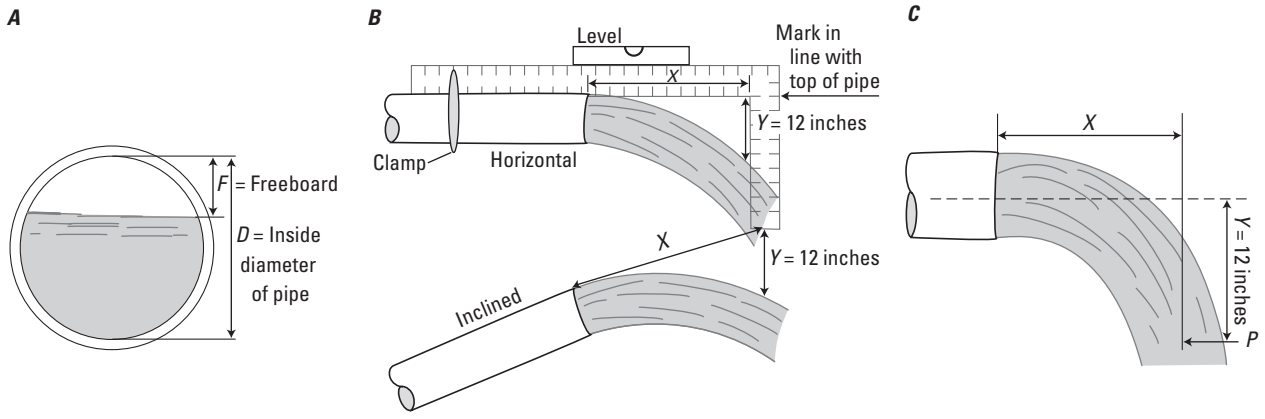


Figure 1. Measurements for estimating flow from (*A*) a partially filled pipe (Anderson, 1963), (*B*) a horizontal or inclined pipe with steady flow (Anderson, 1963), and (*C*) a horizontal pipe when brooming or spreading flow occurs (Driscoll, 1986).

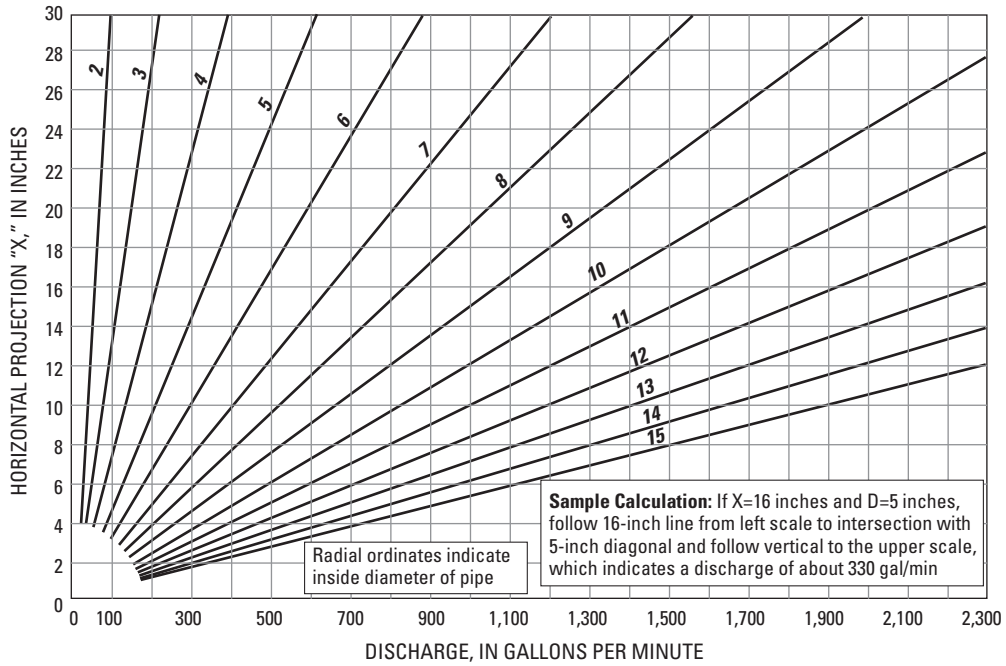


Figure 2. Discharge curves for measurement of flow from non-vertical standard pipes based on a constant value of 12 inches for *Y*. If the discharge in the pipe is not flowing full, multiply the discharge by the correction factor found in table 1 (McDonald, 1950).

Table 1. Correction factors for percentages of discharge (see fig. 2).

[F, freeboard; D, inside diameter]

F/*D* percent	Correction factor
5	0.981
10	.948
15	.905
20	.858
25	.805
30	.747
35	.688
40	.627
45	.564
50	.500
55	.436
60	.375
65	.312
70	.253
75	.195
80	.142
85	.095
90	.052
95	.019
100	.000

References

Anderson, K.E., 1963, Water well handbook (2d ed.): Missouri Water Well Drillers Association, p. 156.

Bureau of Reclamation, 1975, Water measurement manual, A water resources technical publication (2d ed., reprinted): U.S. Department of the Interior, p. 200.

Driscoll, F.G., 1986, Groundwater and wells (2d ed.): St. Paul, Minnesota, Johnson Filtration Systems, Inc., 1089 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.

McDonald, H.R., 1950, How to estimate flow from pipes: Engineering News-Record, August 31, 1950, p. 48.

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 (North American Datum of 1927) NAD83 (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 (National Geodetic Vertical Datum of 1929) NAVD88 (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
WE	Wetland	OC-CO	Coastal	GW-CR	Collector or Ranney type well
AT	Atmosphere	LK	Lake, Reservoir, Impoundment	GW-EX	Extensometer well
ES	Estuary	SP	Spring	GW-HZ	Hyporheic -zone well
LA	Land	ST	Stream	GW-IW	Interconnected wells
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 strea m	SB	Subsurface
LA-SH	Soil hole	FA-WIW	Waste-Injection well	SB-CV	Cave
LA-SR	Shore			SB-GWD	Groundwater drain
				SB-TSM	Tunnel, shaft, or mine
				SB-UZ	Unsaturated zone

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
(C field checked; L poor location; M minimal data; U 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
(A anode; C standby emer. supply; D drain; E geothermal; G seismic; H heat reservoir; M mine; O observation; P oil or gas; R recharge; S repressurize; T test; U unused; V withdrawal/return; W withdrawal; X waste; Z 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
(A air cond.; B bottling; C commercial; D dewater; E power; F fire; H domestic; I irrigation; J industrial (cooling); K mining; M medicinal; N industrial; P public supply; Q aquaculture; R recreations; S stock; T institutional; U unused; Y desalination; Z 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
(U unconfined single; N unconfined multiple; C confined single; M confined multiple; X 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
(A other gov't; D driller; G geologist; L logs; M memory; O owner; R other reported; S reporting agency; Z other)

WATER-LEVEL DATA

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

TIME (C709): ____

WATER-LEVEL TYPE CODE (C243): L M S
(L land surface; M meas. pt.; S 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 NAVD88 ____
(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
(A atmos. pressure; B tide stage; C ice; D dry; E recently flowing; F flowing; G nearby flowing; H nearby recently flowing; I injector site; J injector site monitor; M plugged; N measurement discontinued; O obstruction; P pumping; R recently pumped; S nearby pumping; T nearby recently pumped; V foreign substance; W well destroyed; X affected by surface water; Z 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
(A airline; B analog; C calibrated airline; D differential GPS; 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)

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

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

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

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

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

BOTTOM OF SEAL (C68): ___

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

HOURS OF DEVELOPMENT (C70): ___

SPECIAL TREATMENT (C71): C D E F H M Z
(C chemicals; D dry ice; E explosives; F deflocculent; H hydrofracturing; M mechanical; Z 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 centri-fugal; J jet; P piston; R rotary; S submer-sible; T turbine; U un-known; X no lift; Z other

DATE RECORDED (C38) month – day – year
PUMP INTAKE DEPTH (C44)
TYPE OF POWER (C45) D diesel; E electric; G gaso-line; H hand; L LP gas; N natural gas; S solar; W windmill; Z 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) O W N R
RECORD SEQUENCE NO. (C718)
DATE OF OWNERSHIP (C159) – –

WU OWNER TYPE (C350) CP Corporation; GV Govern-ment; 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 Coop-erator; 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 Coop-erator; 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 D R Z

C — Cooperator's Office, D — District Office, R — Reporting Agency, Z — other

DATA FORMAT (C261) F M P Z

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 D G L M O R S Z

A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225) F M P Z

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 D G L M O R S Z

A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225) F M P Z

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 D G L M O R S Z

A other gov't, D driller, G geol-ogist, L logs, M memory, O owner, R other reported, S reporting agency, Z other

DATA FORMAT (C225) F M P Z

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, E estimated, G pressure gage, H calibrated press. gage, L geophysical logs, M manometer, N non-rec. gage, R reported, S steel tape, T electric tape, U unknown, 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, 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)

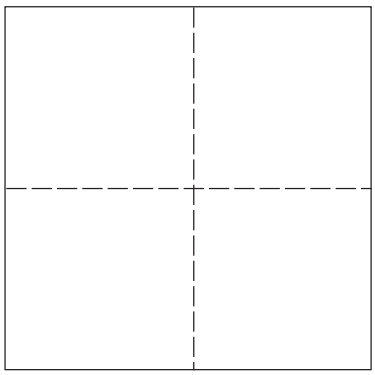
STATIC WATER LEVEL (C126) ____.__

CONTRIBUTION (C132)

SITE LOCATION SKETCH AND DIRECTIONS

Township _____ Range _____

Section # _____



8 - Ground-water site schedule