APPENDIX D

Field Forms

Form 1: Typical Bore Log Form Used to Describe Split Spoon Samples

Form 2: The Unified Soil Classification System (USCS)

Form 3: Well Abandonment Form

Form 4: Overburden Monitoring Well Construction Diagram

Form 5: Overburden Monitoring Well Construction Diagram for Wells with a Flush-Mount Surface Completion

Form 6: Double-Cased Monitoring Well Construction Diagram

Form 7: Double-Cased Monitoring Well Construction Diagram for Wells with a Flush-Mount Surface Completion

Form 8: Well Development Record and Water Quality Field Data Sheet

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Form 1. Typical Bore Log Form used to Describe Split-Spoon Samples

HTRW DRILLING LOG	DISTRICT	HOLE NUMBER
1.COMPANY NAME	2.DRILL SUBCONTRACTOR	SHEET 1 OF SHEETS

3.SITE	4.LOCATION
5.NAME OF DRILLER	6.MANUFACTURER'S DESIGNATION OF DRILL
7.SIZES AND TYPES OF DRILLING AND SAMPLING EQUIPMENT	8.HOLE LOCATION
	9.SURFACE ELEVATION
	10.DATE STARTED / 11.DATE COMPLETED
12.OVERBURDEN THICKNESS	15.DEPTH GROUNDWATER ENCOUNTERED
13.DEPTH DRILLED INTO ROCK	16.DEPTH TO WATER AND ELAPSED TIME AFTER DRILLING COMPLETED
14.TOTAL DEPTH OF HOLE	17.OTHER WATER LEVEL MEASUREMENTS (SPECIFY)

18.GEOTECHNICAL SAMPLES	DISTURBED	UNDISTURBED	19.TOTAL NUMBER OF CORE BOXES			
20.SAMPLES FOR CHEMICAL ANALYSIS	VOC	METALS	SVOC	Pest/PCB	Cyanide/TRPH	21.TOTAL CORE RECOVERY %
	BACKFILLED	MONITORING WELL	OTHER (SPECIFY)	23.SIGNATURE OF INSPECTOR		

22.DISPOSITION OF HOLE	SCALE 1 inch = 1 foot

LOCATION SKETCH/COMMENTS

PROJECT	HOLE NO.

Form 1. Typical Bore Log Form used to Describe Split-Spoon Samples (Concluded)

HTRW DRILLING LOG	SITE		LOCATION	HOLE NUMBER
PROJECT #	DISTRICT	INSPECTOR PATRICIA WESTON		SHEET 2 OF SHEETS

ELEV. (a)	DEPTH (ft.) (b)	DESCRIPTION OF MATERIALS (c)	USCS CLASS. (d)	FIELD SCREEN RESULTS (e)	REMARKS (f)
	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				
	13				
	14				
	15				
	16				
	17				
	18				
	19				
	20				

Form 2. The Unified Soil Classification System (USCS)

Revised 07-12-02

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS (more than 50% of material is larger than No. 200 sieve size.)		
	Clean Gravels (Less than 5% fines)	
GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	GW	Well-graded gravels, gravel-sand mixtures, little or no fines
	GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
	GM	Silty gravels, gravel-sand-silt mixtures
	GC	Clayey gravels, gravel-sand-clay mixtures
	Clean Sands (Less than 5% fines)	
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	SW	Well-graded sands, gravelly sands, little or no fines
	SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
	SM	Silty sands, sand-silt mixtures
	SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more of material is smaller than No. 200 sieve size.)		
SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
	CH	Inorganic clays of high plasticity, fat clays
	OH	Organic clays of medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

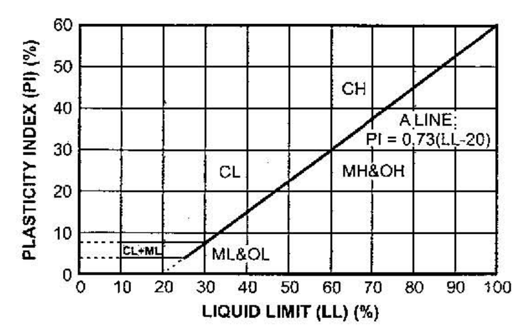
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



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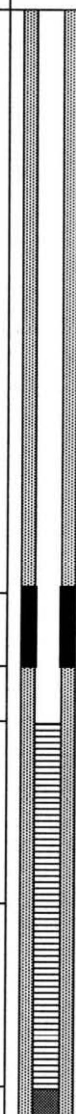
Form 3. Well Abandonment Form

Well Abandonment Form	Project Name	Borehole Number
	Location	Well Number
	Project Number	Page ______ of ______

Logged By	Checked By	Reason For Abandonment
Driller		
Drilling Method		Measured Depth of Well / Depth to Water
Sampling Method		Was Old Well Removed? Yes / No / Partial
Start Date	End Date	Drilled Diameter / Quality of Backfill (Gal)

DEPTH (feet)	SAMPLE NUMBER	MATERIAL DESCRIPTION	BACKFILL DESCRIPTION	WELL CONSTRUCTION DETAILS	WELL SCHEMATIC
				TOP OF SEAL ______	
				TOP OF SAND ______	
				TOP OF SCREEN ______	
				WATER LEVEL ______	
				DEPTH OF WELL ______	
				DEPTH OF HOLE	



Form 3. Well Abandonment Form (Concluded)

Denver Federal Center Boring Log	**Project Name** **Contractor** **Project Number**	**Boring Number** Page ______ of ______

Depth (ft-bgs)	**Blows/6"** (recovery)	**PID (ppm)**	**Graphic Log**	**MATERIAL DESCRIPTION**	**REMARKS**

Form 4. Overburden Monitoring Well Construction Diagram

OVERBURDEN
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ____________

PROJECT ______________________________
PROJECT NO. ______________________________
DATE ______________ BORING NO.: ____________
ELEVATION ______________________________
FIELD
GEOLOGIST ______________________________

DRILLER ______________________________
DRILLING
METHOD ______________________________
DEVELOPMENT
METHOD
____

ELEVATION OF TOP OF SURFACE CASING: ________
ELEVATION OF TOP OF RISER PIPE: ________
STICK-UP TOP OF SURFACE CASING: ________
STICK-UP RISER PIPE: ________
TYPE OF SURFACE SEAL: ______________

I.D. OF SURFACE CASING: ______________
TYPE OF SURFACE CASING: ______________
____

RISER PIPE I.D. ______________
TYPE OF RISER
PIPE: ______________

BOREHOLE
DIAMETER: ______________

TYPE OF BACKFILL: ______________
____

ELEVATION/DEPTH TOP OF SEAL: ________
TYPE OF SEAL: ______________
____

DEPTH TOP OF SAND PACK: ________

ELEVATION/DEPTH TOP OF SCREEN: ________
TYPE OF
SCREEN: ______________
SLOT SIZE X LENGTH: ______________
TYPE OF SAND PACK: ______________
____

ELEVATION/DEPTH BOTTOM OF SCREEN: ________

ELEVATION/DEPTH BOTTOM OF SAND PACK: ________
TYPE OF BACKFILL BELOW OBSERVATION
WELL: ______________
____

ELEVATION/DEPTH OF HOLE: ________

NOT TO SCALE

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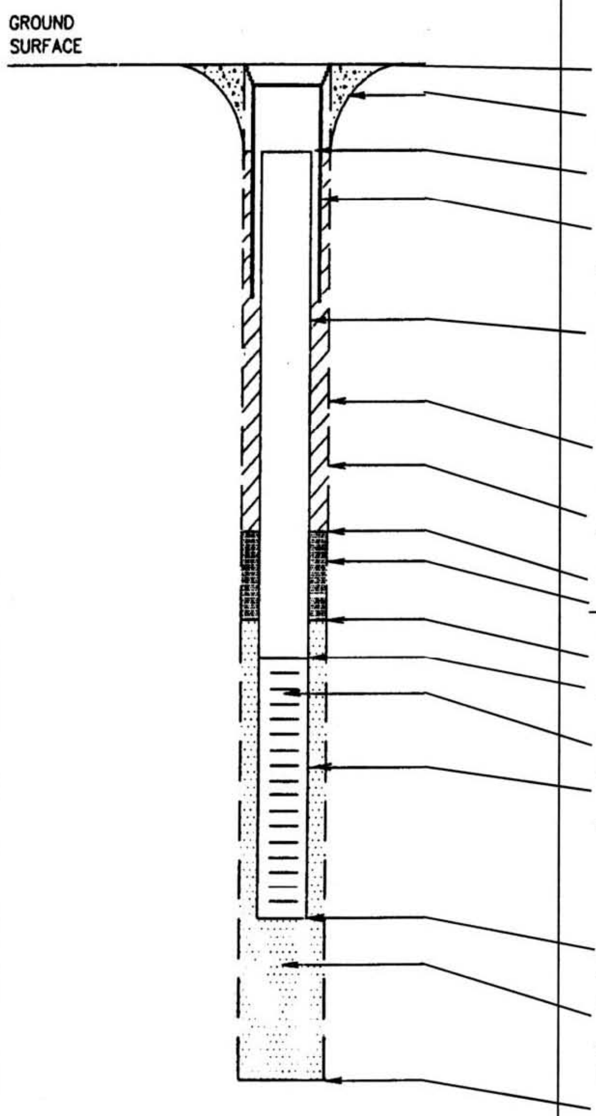
Form 5. Overburden Monitoring Well Construction Diagram for Wells with a Flush-Mount Surface Completion

UNCONSOLIDATED
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ______________

PROJECT ______________________________
PROJECT NO. ______________________________
DATE ______________ BORING NO.: ______________
ELEVATION ______________________________
FIELD GEOLOGIST ______________________________

DRILLER ______________________________
DRILLING METHOD ______________________________
DEVELOPMENT METHOD ______________________________



ELEVATION OF TOP OF SURFACE CASING: ________
TYPE OF SURFACE SEAL: ______________
GROUND SURFACE ELEVATION: ________
ELEVATION OF TOP OF RISER: ________

I.D. OF SURFACE CASING: ______________
TYPE OF SURFACE CASING: ______________
____

RISER PIPE I.D. ______________
TYPE OF RISER PIPE: ______________

BOREHOLE DIAMETER: ______________

TYPE OF BACKFILL: ______________
____

ELEVATION/DEPTH TOP OF SEAL: ________
TYPE OF SEAL: ______________
____

ELEVATION/DEPTH TOP OF SAND PACK: ________
ELEVATION/DEPTH TOP OF SCREEN: ________

TYPE OF SCREEN: ______________
SLOT SIZE X LENGTH: ______________
TYPE OF SAND PACK: ______________
____

ELEVATION/DEPTH BOTTOM OF SCREEN: ________
ELEVATION/DEPTH BOTTOM OF SAND PACK: ________
TYPE OF BACKFILL BELOW OBSERVATION WELL: ______________
____

ELEVATION/DEPTH OF HOLE: ________

<u>**NOT TO SCALE**</u>

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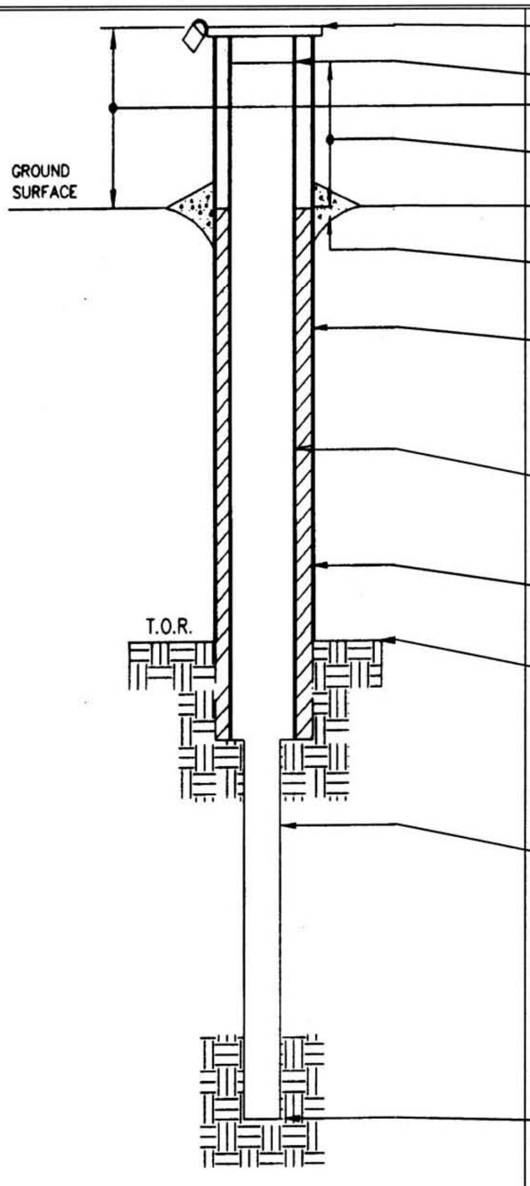
Form 6. Double-Cased Monitoring Well Construction Diagram

DOUBLE CASED
OPEN HOLE BEDROCK
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ______________

PROJECT ______________
PROJECT NO. ______________
DATE ______________ BORING NO.: ______________
ELEVATION ______________
FIELD GEOLOGIST ______________

DRILLER ______________
DRILLING METHOD ______________
DEVELOPMENT METHOD ______________



ELEVATION OF TOP OF OUTER CASING: ________

ELEVATION OF TOP OF INNER CASING: ________
STICK-UP OF OUTER CASING: ________

STICK-UP OF INNER CASING: ________

GROUND SURFACE ELEVATION: ________

TYPE OF SURFACE SEAL: ______________

I.D. OF OUTER CASING: ______________
TYPE OF CASING: ______________
DEPTH OF OUTER CASING: ______________

I.D. OF INNER CASING: ______________
TYPE OF CASING: ______________
DEPTH OF INNER CASING: ______________

TYPE OF CASING SEAL: ______________

ELEVATION/DEPTH TO TOP OF ROCK: ________

DIAMETER OF HOLE IN BEDROCK: ________
DESCRIPTION OF BEDROCK: ______________

ELEVATION/DEPTH OF HOLE: ________

Field Forms Templates (FF-4 BED-2CAS)
Proprietary Information

Version Date: 08/01/2001
Version 1

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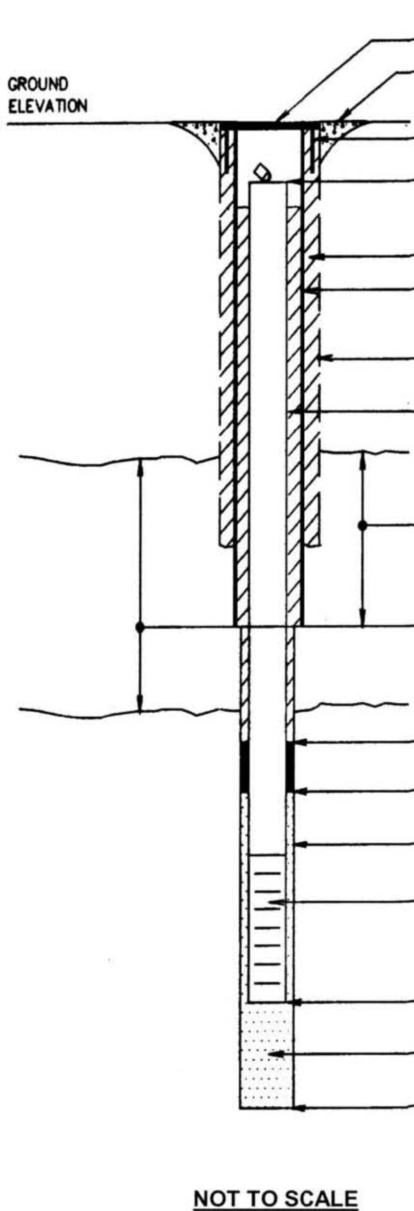
Form 7. Double-Cased Monitoring Well Construction Diagram for Wells with a Flush-Mount Surface Completion

DOUBLE CASED
MONITORING WELL
CONSTRUCTION DIAGRAM

WELL NO. ____________

PROJECT ____________	DRILLER ____________
PROJECT NO. ____________	DRILLING METHOD ____________
DATE ________ BORING NO.: ________	DEVELOPMENT METHOD ____________
ELEVATION ____________	
FIELD GEOLOGIST ____________	



ELEVATION OF TOP OF SURFACE CASING: ________
TYPE OF SURFACE SEAL: ________

I.D. OF SURFACE CASING: ________
TYPE OF SURFACE CASING: ________
ELEVATION OF TOP OF RISER: ________

TYPE OF BACKFILL: ________
I.D. OF UPPER AQUIFER CASING: ________
TYPE OF UPPER AQUIFER CASING: ________

BOREHOLE DIAMETER: ________

RISER PIPE I.D. ________
TYPE OF RISER PIPE: ________

DEPTH CASING IS SET IN CONFINING LAYER ________

APPROXIMATE THICKNESS OF CONFINING LAYER ________

ELEVATION/DEPTH TOP OF SEAL: ________
TYPE OF SEAL: ________
ELEVATION/DEPTH TOP OF SAND PACK: ________
TYPE OF SAND PACK: ________
BOREHOLE DIAMETER: ________

TYPE OF SCREEN: ________
SLOT SIZE X LENGTH: ________
I.D. OF SCREEN: ________

ELEVATION/DEPTH BOTTOM OF SCREEN: ________

TYPE OF BACKFILL BELOW OBSERVATION WELL: ________
ELEVATION/DEPTH OF HOLE: ________

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Form 8. Well Development Record and Water Quality Field Data Sheet

Well Development Record and Water Quality Field Data Sheet

Page 1 of ______

Project:	______	Well No:	______
Project No.:	______		______
Date:	______	*Samplers:*	______
Time Start:	______		______
Time Finish:	______	Checked by:	______

Well Information

Depth to Water: ______ ft. Casing Diameter: ______ in. = ______ ft. Casing Stickup: ______ ft.

Bottom of Screen: ______ ft. Borehole Diameter: ______ in. = ______ ft. Screened Interval: ______ ft.

Sample Depth: ______ ft. Saturated Screen Well Volume: ______ gallons

Drawdown Limit: ______ ft.

Note: All depths measured from top of casing.

Calculations:

Casing Volume (CV) = π (cr^2) h (7.48)

Filter Pack Volume (FPV) = π ($br^2 - cr^2$)[BS-(TS or H)] P (7.48)

Saturated Screen Well Volume = CV + FPV

Calculation Notes:

cr = casing radius	h = bottom of screen – depth of water in ft.	If TS>H use TS, if TS<H use H
br = borehole radius	P = estimated porosity of filter pack (35%)	BS = bottom of screen
H = depth to water	TS = top of screen	

Field Equipment

pH Meter:	______	Serial No.:	______	Water Level Meter:	______	Serial No.:	______
Conductivity Meter:	______	Serial No.:	______	Turbidity Meter:	______	Serial No.:	______
Temperature Meter:	______	Serial No.:	______	Bailer:	______	Size:	______

Sample Equipment *(check one)*

☐ *Submersible Pump* *Pump Type (circle one):* *Piston* *Bladder* *Impeller*

☐ *Disposable Teflon Bailer* *Pump Model:* ______

Serial No.: ______

Field Chemistry

pH ______ = @ ______ °C pH ______ = @ ______ °C pH ______ = @ ______ °C Time ______

Conductivity Standard: ______ µmhos/cm @ 25°C Reading ______ µmhos/cm @ ______ °C Time ______

Turbidity Standard: ______ N.T.U. @ 25°C Reading ______ N.T.U. @ ______ °C Time ______

Form 8. Well Development Record and Water Quality Field Data Sheet (Continued 2 of 6)

Well Development Record and Water Quality Field Data Sheet

Page 2 of ______

Project:		Well No:	
Project No.:			
Date:		*Samplers:*	
Time Start:			
Time Finish:		Checked by:	

Field Chemistry (cont'd)

Time	Volume gallons	Temp. ºC	pH	Conductivity µmhos/cm	Turbidity N.T.U.	Comments

Was well sampled after development? YES NO

Sample Method:

Sample Name:

Analyses:

Form 8. Well Purge and Water Quality Data Sheet (Continued 3 of 6)

Well Purge and Water Quality Field Data Sheet

Page 1 of ______

Project:	______	Well No:	______
Project No.:	______		______
Date:	______	*Samplers:*	______
Time Start:	______		______
Time Finish:	______	Checked by:	______

Well Information

Depth to Water: ______ ft. Casing Diameter: ______ in. = ______ ft. Casing Stickup: ______ ft.

Bottom of Screen: ______ ft. Borehole Diameter: ______ in. = ______ ft. Screened Interval: ______ ft.

Sample Depth: ______ ft. Saturated Screen Well Volume: ______ gallons

Drawdown Limit: ______ ft. Calculations: Casing Volume (CV) = π (cr^2) h (7.48)

Note: All depths measured from top of casing.

Filter Pack Volume (FPV) = π ($br^2 - cr^2$)[BS-(TS or H)] P (7.48)

Saturated Screen Well Volume = CV + FPV

Calculation Notes: cr = casing radius; h = bottom of screen – depth of water in ft.; If TS>H use TS, if TS<H use H

br = borehole radius; P = estimated porosity of filter pack (35%); BS = bottom of screen

H = depth to water; TS = top of screen

Field Equipment

pH Meter:	______	Serial No.:	______	Water Level Meter:	______	Serial No.:	______
Conductivity Meter:	______	Serial No.:	______	Turbidity Meter:	______	Serial No.:	______
Temperature Meter:	______	Serial No.:	______	Bailer:	______	Size:	______

Sample Equipment (check one)

☐ *Submersible Pump* *Pump Type (circle one):* *Piston* *Bladder* *Impeller*

☐ *Disposable Teflon Bailer* *Pump Model:* ______

Serial No.: ______

Field Chemistry

pH ______ = @ ______ °C pH ______ = @ ______ °C pH ______ = @ ______ °C Time ______

Conductivity Standard: ______ µmhos/cm @ 25°C Reading ______ µmhos/cm @ ______ °C Time ______

Turbidity Standard: ______ N.T.U. @ 25°C Reading ______ N.T.U. @ ______ °C Time ______

Form 8. Well Purge and Water Quality Data Sheet (Continued 4 of 6)

Page 2 of ______

Water Quality Field Data Sheet

Project: ______ Well No: ______

Project No.: ______ ______

Date: ______ *Samplers:* ______

Time Start: ______ ______

Time Finish: ______ Checked by: ______

Field Chemistry (cont'd)

Time	Volume gallons	Temp. °C	pH	Conductivity µmhos/cm	Turbidity N.T.U.	Comments

Form 8. Well Development Record and Water Quality Field Data Sheet (Continued 5 of 6)

Quick Conversions for Water Volumes

Conversions for low-flow purge volumes

Monitoring well casing only

Size Conversion
2” 0.17 Multiply the height of the water column in the well (Bottom of screen -DTW)
4" 0.65 Multiply the height of the water column in the well (Bottom of screen -DTW)
5" 1.02 Multiply the height of the water column in the well (Bottom of screen -DTW)
6" 1.47 Multiply the height of the water column in the well (Bottom of screen -DTW)
Note: With a dedicated system, where the water is above the top of screen multiply the conversion by the screen
length. With a non-dedicated system the whole water column must be included in the calculation.

Monitoring well casing/Borehole size configuration

2”/6” 0.46 Multiply the occluded screened interval only to get additional volume in gallons 2”/8” 0.86 Multiply the occluded screened interval only to get additional volume in gallons 4"/8" 0.69 Multiply the occluded screened interval only to get additional volume in gallons 4”/10” 1.20 Multiply the occluded screened interval only to get additional volume in gallons 4”/12” 1.83 Multiply the occluded screened interval only to get additional volume in gallons 5"/8" 0.56 Multiply the occluded screened interval only to get additional volume in gallons 5"/10" 1.071 Multiply the occluded screened interval only to get additional volume in gallons 5"/12" 1.70 Multiply the occluded screened interval only to get additional volume in gallons 6"/12" 1.54 Multiply the occluded screened interval only to get additional volume in gallons

Add the two results together to obtain the saturated casing volume in gallons.

Water quality stabilization parameters:

Parameters are stabled after 4 consecutive readings are within the ranges listed below:
The pH range is 6.5 – 8.5. Check meter calibration if current readings are outside this range. Ensure the water quality meter pH is calibrated with either the 4.0/7.0 or 7.0/10.0 pH standard.

Stabilization Requirements

Temp.	pH	Cond.	Tubidity	Dissolved Oxygen	ORP
1 C/2 F	0.1 units	3 % µmhos/ cm	<10 NTUs or 10% when <10 NTUs cannot be achieved	0.3 mg/L	10 millivolts
	6.5 -8.5				

Miscellaneous Notes

3.785 Liters = 1 gallon

Form 8. Well Development Record and Water Quality Field Data Sheet (Concluded 6 of 6)

Conversions for low flow purge volumes

Monitoring well casing only

Size	Conversion	
2"	0.17	Multiply the height of the water column in the well (Bottom of screen - DTW)
4"	0.65	Multiply the height of the water column in the well (Bottom of screen - DTW)
5"	1.02	Multiply the height of the water column in the well (Bottom of screen - DTW)
6"	1.47	Multiply the height of the water column in the well (Bottom of screen - DTW)

Note: With a dedicated system where the water is above the top of screen multiply the conversion by the screen length. With a non-dedicated system the whole water column must be included in the calculation.

Monitoring well casing/Borehole size configuration

2"/6"	0.46	Multiply the occluded screened interval only to get additional volume in gallons
2"/8"	0.86	Multiply the occluded screened interval only to get additional volume in gallons
4"/8"	0.69	Multiply the occluded screened interval only to get additional volume in gallons
4"/10"	1.20	Multiply the occluded screened interval only to get additional volume in gallons
4"/12"	1.83	Multiply the occluded screened interval only to get additional volume in gallons
5"/8"	0.56	Multiply the occluded screened interval only to get additional volume in gallons
5"/10"	1.071	Multiply the occluded screened interval only to get additional volume in gallons
5"/12"	1.70	Multiply the occluded screened interval only to get additional volume in gallons
6"/12"	1.54	Multiply the occluded screened interval only to get additional volume in gallons

Add the two results together to obtain the saturated casing volume in gallons.

Water quality stabilization parameters:

Parameters are stabled after 4 consecutive readings are within the ranges listed below:
The pH range is 6.5 – 8.5. Check meter calibration if current readings are outside this range.
Ensure the water quality meter pH is calibrated with either the 4.0/7.0 or 7.0/10.0 pH standard.

Stabilization Requirements

Temp.	pH	Cond.	Tubidity	Dissolved Oxygen	ORP
± 1°C/2°F	± 0.1 units	± 3 % µmhos/cm	<10 NTUs or ± 10% when <10 NTUs cannot be achieved	± 0.3 mg/L	± 10 millivolts
	6.5 - 8.5				

Miscellaneous Notes

3.785 Liters = 1 gallon