GEOLOGIC LOG OF DRILL HOLE NO. MW-09-52

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/14/09 FINISHED: 7/16/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,172,063.1 E 6,178,000.7 (NAGD83)
TOTAL DEPTH: 45.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 162.1 ft. (NAVD88)
T.O.C ELEVATION: 162.01 ft. (NAVD88)
HOLE LOGGED BY: S. Lee
REVIEWED BY: J. Vauk

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
											SC 161.5	Road Base
	100	17.6	12.0	29.6	70.4	0.0	NP	NP	3.7	SM 159.8		
	61										SM 157.3	
5	100	48.7	38.6	87.3	12.7	0.0	38.7	16.0	24.6	CL		
		60.4	27.4	87.8	12.2	0.0	33.4	19.1	18.9	CL 155.2		
										155.1		
	100										CL 151.3	
10	100	22.6	4.7	27.3	72.7	0.0	NP	NP	6.3	SM 150.8		
	100										SM 148.1	Qal
15	100											
		58.1	9.0	67.1	32.9	0.0	NP	NP	16.8	s(ML) 145.6		
	100											
	100	2.3	3.8	6.1	93.9	0.0	NP	NP	3.5	SP-SM 142.1	ML	
20	100											
	100										137.3	

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Kevin Coy, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-52 was advanced using hollow stem flight augers (HSA) with a 7-5/8-1/4-inch O.D. and 4-1/4-inch I.D. A 2.3-foot-long, 3-1/2-inch I.D. drive sampler (California Sampler) was used to continuously core materials from the ground surface to a total depth of 45.2 feet. The drive sampler was advanced 2.0 to 2.3 feet per run, with a hydraulic hammer advancing in-front of the augers. Auger were then advanced to the previous depth sampled.

Interval Method
0.0 to 45.2 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 36.0 ft. - smooth drilling
36.0 to 38.3 ft. - core barrel was stuck in augers
38.3 to 45.2 ft. - core barrel sanded in augers, caving conditions from 43.0 to 45.2 ft. b.g.s.

DRILL FLUID, RETURN AND COLOR:
0.0 to 45.2 ft. - None

WATER LEVEL:
39.4 ft. from T.O.C. on 7/17/09

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing - 0.1 to 22.5 ft. (T.O.C. El. 162.01 ft.)
Dual Pre-pack Screen - 22.5 to 42.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 18.0 to 43.0 ft. (#3 Sand)
Bottom Backfill - 43.0 to 45.2 ft. (Native material caved)
Bentonite Seal - 3.0 to 18.0 ft.
Backfill - 1.0 to 3.0 ft. (#3 Sand)
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 4.8 feet
RECENT FILL (FILL)

0.0 to 0.6 ft.: FILL/ROAD BASE - CLAYEY SAND, SC: NOT LOGGED

0.6 to 4.8 ft.:FILL/ROAD EMBANKMENT - SILTY SAND, SM: : About 80 % fine to medium sand; about 20 % fines; dry, green; trace round coarse sand, grades to about 60 % sand and 40 % fines with depth.

Laboratory Data Interval
1.0 to 2.3 ft.

4.8 to 45.2 feet
QUATERNARY ALLUVIUM (Qal)

4.8 to 10.8 ft.:SILTY CLAY, CL/ML:

Laboratory Data Interval
4.7 to 6.9 ft.
6.5 to 7.0 ft.

10.8 to 14.0 ft.:SILTY SAND, SM About 85 % fine sand; about 15 % fines; dry.

Laboratory Data Interval
10.8 to 11.3 ft.

14.0 to 24.8 ft.:SILT, ML: About 95 % fines low plasticity toughness and dry strength, and rapid dilatancy; about 5 % fine sand; maximum size fine sand; gray; sand is in occasional laminated lenses.

Laboratory Data Interval
16.0 to 16.5 ft.
19.0 to 20.0 ft.

24.8 to 25.5 ft.:SILTY SAND, SM About 85 % fine sand; about 15 % fines; moist to wet.

Laboratory Data Interval
25.0 to 25.5 ft.

25.5 to 28.0 ft.:SILTY CLAY, CL/ML:

Laboratory Data Interval
26.5 to 27.0 ft.

28.0 to 31.0 ft.:SILTY SAND, SM About 85 % fine to medium sand; about 15 % fines; moist, gray; micaceous.

Laboratory Data Interval
28.5 to 29.0 ft.

31.0 to 40.0 ft.:POORLY GRADED SAND WITH SILT, SP/SM About 90 to 95 % fine to medium sand; about 5 to 10 % fines; moist to wet, light gray; micaceous, trace organics at 37.0 ft.

Laboratory Data Interval
31.0 to 32.0 ft.
35.0 to 36.0 ft.

40.0 to 45.2 ft.:POORLY GRADED SAND, SP: About 100% fine to medium sand; wet, gray to light gray; sand is granitic and micaceous, trace organics.

Laboratory Data Interval
42.0 to 43.0 ft.
44.0 to 45.0 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-52

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/14/09 FINISHED: 7/16/09
DEPTH AND ELEVATION OF WATER LEVEL AND DATE MEASURED: NA

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,172,063.1 E 6,178,000.7 (NAGD83)
TOTAL DEPTH: 45.2 ft.

STATE: California
GROUND SURFACE ELEVATION: 162.1 ft. (NAVD88)
T.O.C ELEVATION: 162.01 ft. (NAVD88)
HOLE LOGGED BY: S. Lee
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
			19.8	4.6	24.4	75.6	0.0	NP	NP	17.0	SM 136.6	SM 136.6		
		100												
			72.3	23.6	95.9	4.1	0.0	26.0	5.9	22.4	CL-ML 135.2	CL/ML 134.1		
		100												
			6.7	4.2	10.9	89.1	0.0	NP	NP	6.0	SP-SM 133.1	SM 131.1		
	30	100												
			7.7	2.5	10.2	89.8	0.0	NP	NP	5.7	SP-SM 130.1			
		100												
		100												
	35		2.2	2.4	4.6	95.4	0.0	NP	NP	4.8	SP 126.1	SP/SM 122.1	Qal	
		100												
		100												
	40													
		100												
			1.6	2.3	3.9	96.1	0.0	NP	NP	17.3	SP 119.1	SP		
		87												
			2.4	2.2	4.6	95.4	0.0	NP	NP	13.3	SP			
	45			1.1	1.9	98.1	0.0	NP	NP	0.1	SP 116.9	116.9		

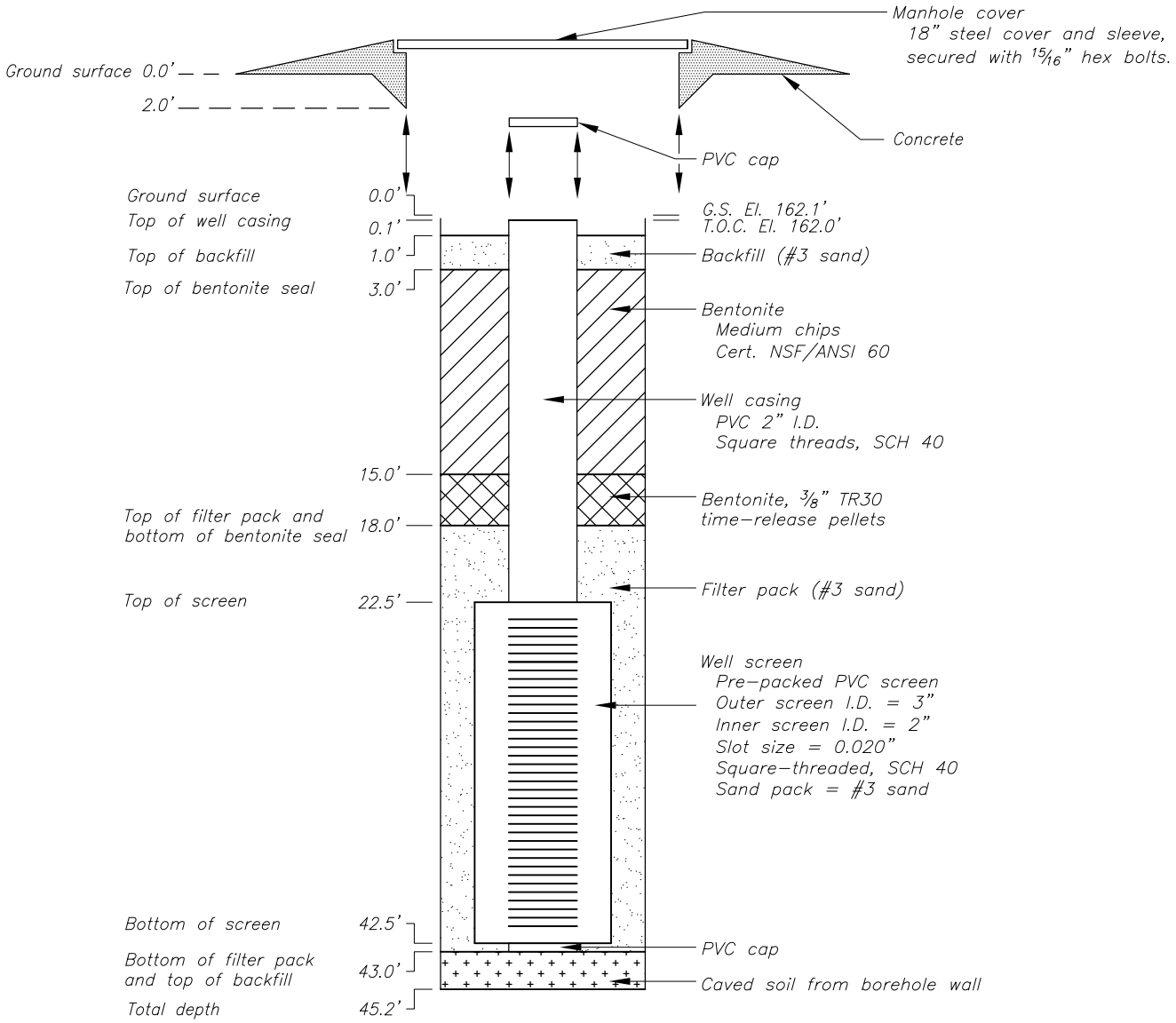
T.D. = 45.2 ft.

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW–09–52	GEOLOGIST: S. LEE
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 7/16/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2172063.1 E6178000.7 (NAD83) ELEVATION 162.0' (NAVD88) GROUND SURFACE ELEVATION 162.1' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-53

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/17/09 FINISHED: 7/19/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 38.0 ft. (El. 125.06 ft.) 7/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,171,394.0 E 6,177,716.8 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 162.8 ft. (NAVD88)
T.O.C ELEVATION: 162.63 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Kevin Coy, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-53 was advanced using hollow stem flight augers (HSA) with an 7-5/8-inch O.D. and 4-1/4-inch I.D. A 2.3-foot-long, 3-1/2-inch I.D. drive sampler (California Sampler) was used to continuously core materials from the ground surface to a depth of 44.0 feet. The drive sampler was advanced 2.0 to 2.3 feet per run, with a hydraulic hammer advancing in-front of the augers. Augers were then advanced to the previous depth sampled. Augers were advanced with a wooded plug (knock-out plug) from 44.0 to a total depth of 50.0 feet b.g.s. At 50.0 feet, the HSA were pulled up 0.5 feet and a pilot bit and center drill rods were inserted to knock the plug out of the bottom of the augers. The well is installed at 48.5 feet bgs.

Interval Method
0.0 to 44.0 ft. - FADC
44.0 to 50.0 ft. - FADC with wood plug.

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 44.0 ft. - smooth drilling
44.0 ft. - sand heave and equipment breakdown, pull drill string out.
44.0 to 50.0 ft. - HSA with plug were advanced from the surface to 50.0 feet.

DRILL FLUID, RETURN AND COLOR:
0.0 to 44.0 ft. - None
44.0 to 50.0 ft. - Water, no return

WATER LEVEL:
38.2 ft. from T.O.C. on 7/20/09

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	87										SM 162.1	
	87	33.8	25.2	59.0	41.0	0.0	33.6	14.7	11.4	s(CL) 159.6	s(CL) 159.1	Fill
5	87										SP 156.7	
	100										CH 155.7	
10	100	63.3	28.0	91.3	8.7	0.0	34.3	11.9	20.2	CL 152.6	CL/ML 150.5	
	100											
	87	3.1	2.3	5.4	94.6	0.0	NP	NP	1.9	SP-SM 148.1	SP 148.1	
15	87										CL/ML 146.7	Qal
	100											
	100										SP/SM 141.9	
20	100											
	100	2.2	2.3	4.5	95.5	0.0	NP	NP	3.3	SP 139.1	SP 137.1	
25	100											
	100											

0.0 to 6.4 feet
RECENT FILL (FILL)

0.0 to 1.0 ft.: FILL/ROAD MATERIAL - SILTY SAND, SM About 80% fine to medium sand; about 20% fines; dry, light brown; loose, micaceous.

1.0 to 4.0 ft.: FILL/ROAD BASE - SANDY LEAN CLAY, s(CL) About 60% fines with medium plasticity and toughness, high dry strength, and no dilatancy; about 40% fine to medium sand; maximum size: medium sand, light brown.

Laboratory Data Interval
3.0 to 3.5 ft.

4.0 to 6.4 ft.: FILL/ROAD BASE - POORLY GRADED SAND, SP About 95% medium to coarse, rounded sand; about 5% fines; dry; micaceous.

6.4 to 50.0 feet
QUATERNARY ALLUVIUM (Qal)

6.4 to 7.4 ft.: FAT CLAY, CH: dark brown; iron-oxidation throughout core.

7.4 to 12.6 ft.: SILTY CLAY, CL/ML: NOT LOGGED

Laboratory Data Interval
10.0 to 10.5 ft.

12.6 to 15.0 ft.: POORLY GRADED SAND, SP: About 95% fine to medium sand; about 5% non-plastic fines; light brown; micaceous.

Laboratory Data Interval
14.0 to 15.0 ft.

15.0 to 16.4 ft.: SILTY CLAY, CL/ML: Light brown; iron-oxidized mica.

16.4 to 21.2 ft.: POORLY GRADED SAND WITH SILT, SP/SM About 90% sand; about 10% fines; dry to moist, light brown.

21.2 to 26.0 ft.: POORLY GRADED SAND, SP: About 95% sand; 5% non-plastic fines; moist to dry, light brown; dense, trace iron-oxidation.

Laboratory Data Interval
23.0 to 24.0 ft.

26.0 to 31.4 ft.: SILTY CLAY, CL/ML: NOT LOGGED

Laboratory Data Interval
26.0 to 27.0 ft.
30.0 to 31.0 ft.

31.4 to 32.0 ft.: SILTY SAND, SM About 80% fine sand; about 20% fines; wet, brown.

32.0 to 35.8 ft.: SILTY CLAY, CL/ML: About 95% fines with high toughness; about 5% sand; light brown; infrequent thin sand lamina. Bottom of oxidation zone at about 35.8 feet.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-53

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/17/09 FINISHED: 7/19/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 38.0 ft. (El. 125.06 ft.) 7/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,171,394.0 E 6,177,716.8 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 162.8 ft. (NAVD88)
T.O.C ELEVATION: 162.63 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

HOLE COMPLETION:
Well Casing - 0.2 to 33.0 ft. (T.O.C. El. 162.63 ft.)
Dual Pre-pack Screen - 33.0 to 48.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 26.0 to 48.5 ft. (#3 Sand)
Bottom Backfill - 48.5 to 50.0 ft. (Native material caved)
Bentonite Seal - 2.0 to 26.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

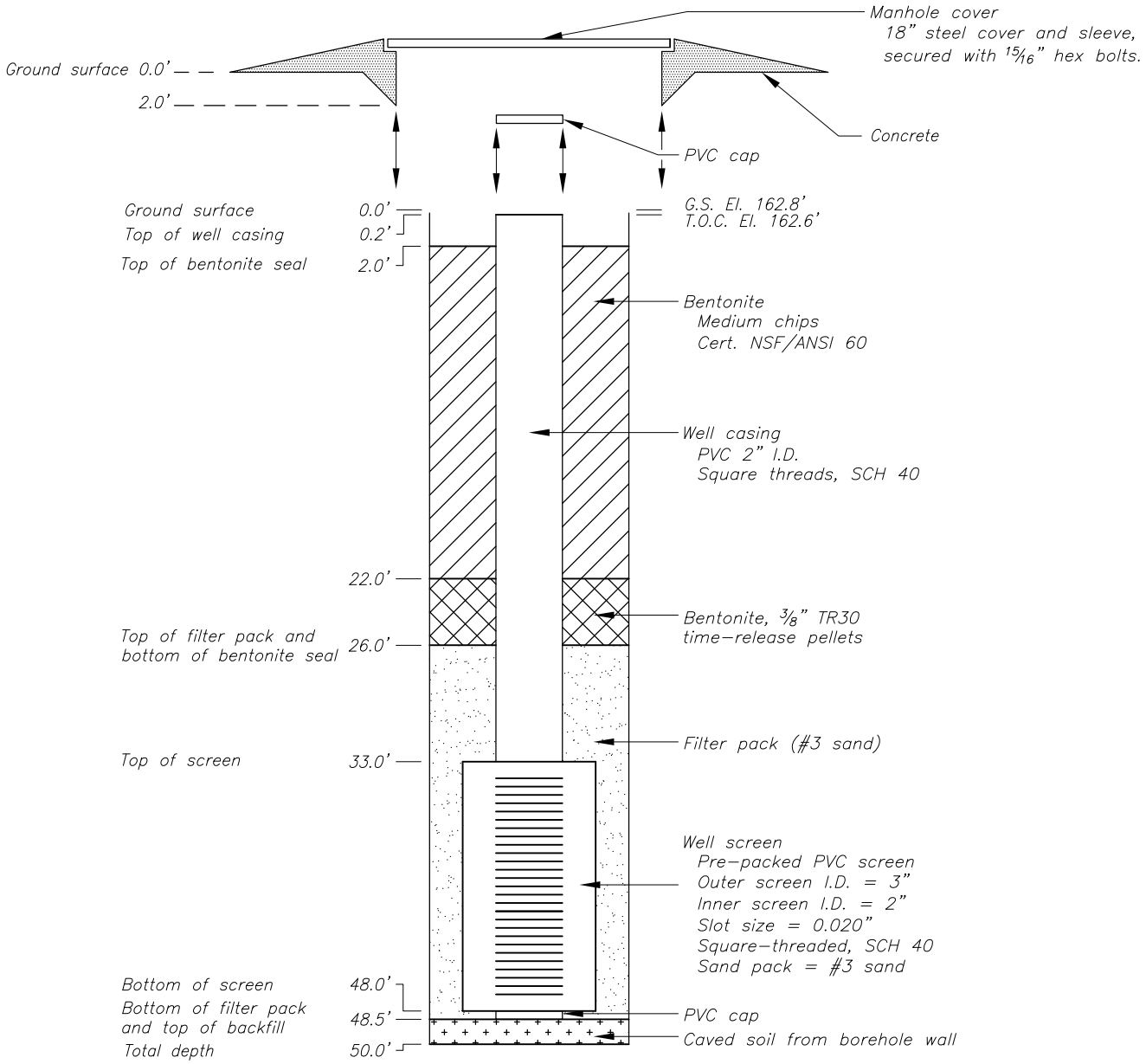
DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		71.1	19.2	90.3	9.7	0.0	NP	NP	22.0	ML 136.1			**35.8 to 44.0 ft.:<u>POORLY GRADED SAND, SP</u>:** About 95% fine to medium sand; about 5% fines; wet, dark gray; micaceous.
	100												<u>Laboratory Data Interval</u> 37.0 to 38.0 ft. 40.0 to 41.0 ft. 43.0 to 44.0 ft.
	100										CL/ML		**44.0 to 50.0 ft.:<u>No Recovery</u>:**
30		47.5	42.7	90.2	9.8	0.0	23.5	7.4	15.7	CL 132.1	131.7		***T.D. = 50.0 ft.***
	100										SM 131.1		
	100										CL/ML		
35											127.3		
	100												
		1.6	1.3	2.9	97.1	0.0	NP	NP	15.6	SP 125.1		Qal	
	100									38.0 ft. (El. 125.06 ft.)			
40											SP		
		5.3	2.0	7.3	92.4	0.3	NP	NP	18.1	SP-SM 122.1			
	100												
	100												
		4.4	2.5	6.9	93.1	0.0	NP	NP	12.9	SP-SM 119.1	119.1		
45													
	0										NR		
50											113.1		

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW–09–53	GEOLOGIST: S. LEE
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 7/19/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2171394.0 E6177716.8 (NAD83) ELEVATION 162.6' (NAVD88) GROUND SURFACE ELEVATION 162.8' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-54

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/20/09 FINISHED: 7/21/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 22.0 ft. (El. 146.00 ft.) 7/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,651.8 E 6,177,383.5 (NAGD83)
TOTAL DEPTH: 51.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 168.0 ft. (NAVD88)
T.O.C ELEVATION: 167.80 ft. (NAVD88)
HOLE LOGGED BY: S. Lee & J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE. MW-09-54 was drilled and continuously sampled on 7/20 and 7/21/2009, with the well installed the final day. MW-09-54B was drilled and completed as a well on 1/25/2009 using hollow stem flight augers and a pilot bit. The well was completed about 5 feet south of MW-09-54. **PURPOSE OF HOLE:** To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well. **DRILLED BY:** USGS Drill Crew James Huckaby, Driller Kevin Coy, Helper **DRILL RIG:** CME-550 **DRILLING & SAMPLING METHODS:** Drill hole MW-09-54 was advanced using hollow stem flight augers (HSA) with a 7-5/8-inch O.D. and 4-1/4-inch I.D. A 2.3-foot-long, 3-1/2-inch I.D. drive sampler (California Sampler) was used to continuously core materials from the ground surface to a total depth of 51.8 feet. The drive sampler was advanced 2.0 to 2.3 feet per run, with a hydraulic hammer advancing in-front of the augers. Augers were then advanced to the previous depth sampled. Interval Method 0.0 to 45.0 ft. - FADC 45.0 to 46.8 ft. - FAPB 46.8 to 51.8 ft. - FADC Drill hole MW-09-54B was advanced using HSA and a pilot bit from the ground surface to a total depth of 29.8 feet. The HSA used has a 3-3/4-inch I.D. with a 7-7/8-inch O.D. The drill hole was advanced and well installed using a truck-mounted CME-45 operated by Reclamation staff, Rodger Burnett and Stephen Lee. Interval Method 0.0 to 29.8 ft. HSA with Pilot Bit **DRILLING CONDITIONS AND DRILLER'S COMMENTS:** MW-09-54 0.0 to 29.2 ft. - smooth drilling 29.2 to 31.5 ft. - groundwater encountered, add water 31.5 to 33.8 ft. - sampler and augers temporarily stuck, running sands had to insert pilot bit to return to 33.8' 33.8 to 45.0 ft. - smooth drilling with poor recovery														
												(CL/ML)s		**SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-54.** ***0.0 to 12.4 feet*** ***RECENT FILL (FILL)***
		100	37.4	23.4	60.8	39.0	0.2	29.6	10.7	10.3	s(CL) 166.6	166.6		
												SP/SM	Fill	**0.0 to 1.4 ft.: FILL/ROAD BASE - SILTY CLAY WITH SAND, (CL/ML)s**About 80% fines; 20% sand; dry, light brown; hard, layer of light brown silty sand from 0.0 to 0.3 ft.
		100	4.0	2.5	6.5	93.5	0.0	NP	NP	2.2	SP-SM 164.0			**1.4 to 5.0 ft.: FILL/LEVEE - POORLY GRADED SAND WITH SILT, SP/SM** About 90% fine to medium sand; about 10% fines; dry, light brown; medium dense. Laboratory Data Interval 0.0 to 1.4 ft. 3.0 to 4.0 ft.
5												163.0		
		100	29.7	12.4	42.1	57.9	0.0	NP	NP	9.9	SM 162.0	(ML)s		**5.0 to 8.4 ft.: FILL/LEVEE - SILT WITH SAND, (ML)s** About 75% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 25% fine to medium sand; maximum size: medium sand; light brown. Laboratory Data Interval 5.0 to 6.0 ft. 8.0 to 9.0 ft.
		100	52.7	11.5	64.2	35.8	0.0	NP	NP	16.9	s(ML) 159.0	159.6 s(ML) 158.6		**8.4 to 9.4 ft.: FILL/LEVEE - SANDY SILT, s(ML):** About 70% fines low plasticity, toughness and dry strength, and rapid dilatancy; 30% fine sand; maximum size: fine sand; dry, light brown.
10		100	11.5	3.4	14.9	83.5	1.6	NP	NP	3.6	SM 156.0	SM 155.6		**9.4 to 12.4 ft.: FILL/LEVEE - SILTY SAND, SM:** About 80% fine to medium sand; 20% fines with low plasticity, toughness, and dry strength, and rapid dilatancy; maximum size: medium sand; dry, brown. Laboratory Data Interval 11.0 to 12.0 ft.
		100											Qal	***12.4 to 51.2 feet*** ***QUATERNARY ALLUVIUM (Qal)*** **12.4 to 19.5 ft.:LEAN CLAY WITH SAND, (CL)s:** About 75% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 25% fine sand; maximum size: fine sand; dry, light brown; abundant iron-oxidation and mica.
15		100	30.4	23.3	53.7	46.3	0.0	21.4	4.7	15.3	s(CL-ML) 152.0	(CL)s		Laboratory Data Interval 15.0 to 16.0 ft. **19.5 to 20.4 ft.:SILTY SAND, SM** About 80% fine to medium sand; about 20% fines; maximum size: medium sand; moist to wet; medium dense. Laboratory Data Interval 19.5 to 20.4 ft.
		?												**20.4 to 24.0 ft.: SANDY SILT, s(ML)** About 70% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 30% fine sand; maximum size: fine sand. Laboratory Data Interval 23.0 to 24.0 ft.
		100	12.4	6.1	18.5	81.5	0.0	NP	NP	17.7	SM 147.6	148.5 SM 147.6		
20														

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram.
Well development information is provided in attached Monitoring Well Development form.

MW-09-54B
TOC Coordinates= N 2170647.4 E 6177381.3 (NAGD83) El. 168.08 (NAVD88)
Ground surface El.= 168.2 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-54

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/20/09 FINISHED: 7/21/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 22.0 ft. (El. 146.00 ft.) 7/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,651.8 E 6,177,383.5 (NAGD83)
TOTAL DEPTH: 51.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 168.0 ft. (NAVD88)
T.O.C ELEVATION: 167.80 ft. (NAVD88)
HOLE LOGGED BY: S. Lee & J. Vauk
REVIEWED BY: A. Warren

NOTES

45.0 to 46.8 ft. - running sands had to insert pilot bit and blind drilled to 46.8'
46.8 to 51.8 ft. - running sands with poor recovery

MW-09-54B
0.0 to 29.8 ft. - blind drilled

DRILL FLUID, RETURN AND COLOR:
MW-09-54
0.0 to 29.2 ft. - None
29.2 to 51.8 ft. - Water, no return

MW-09-54B
0.0 to 29.8 ft. - None

WATER LEVEL:
22.0 ft. b.g.s. on 7/20/2009 (MW-09-54)

REASON FOR HOLE TERMINATION:
The holes were terminated upon successful completion to the target depths.

HOLE COMPLETION:
MW-09-54
Well Casing - 0.2 to 36.2 ft. (T.O.C. El. 167.80 ft.)
Dual Pre-pack Screen - 36.2 of 51.2 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 31.3 to 51.8 ft. (#3 Sand)
Bentonite Seal - 1.0 to 31.3 ft.
Well Protection - 2- by 3-foot vault.

MW-09-54B
Well Casing - 0.3 to 9.2 ft. (T.O.C. El. 168.08 ft.)
Well Screen - 9.2 to 29.2 ft. (Slotted 0.010-inch)
Filter Pack - 6.0 to 29.8 ft. (#3 Sand)
Bentonite Seal - 1.0 to 6.0 ft.
Well Protection - flush-mounted 12-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	% SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	83									▼ 22.0 ft. (El. 146.00 ft.)		s(ML)		Qal	**24.0 to 28.0 ft.:SANDY SILT, s(ML)** About 60% fines; about 40% fine sand; wet, light brown; abundant iron-oxidized silt lamina, micaceous. Laboratory Data Interval 26.0 to 27.0 ft.
	100	51.2	15.9	67.1	32.9	0.0	NP	NP	17.6	s(ML)	144.0		144.0		**28.0 to 32.2 ft.:SILTY SAND, SM** About 70% fine to medium sand; about 30% fines; moist to wet, light brown; medium dense. Laboratory Data Interval 30.0 to 31.0 ft.
25	?	61.2	2.9	64.1	35.9	0.0	NP	NP	23.7	s(ML)	141.0	s(ML)	140.0		**32.2 to 32.5 ft.:SILT, ML:** About 90% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 10% fine sand; maximum size: fine sand; moist, light brown; firm. Laboratory Data Interval 32.2 to 32.5 ft.
	65														**32.5 to 34.5 ft.:SILT WITH SAND, (ML)s** About 85% fines with no to low plasticity and toughness, medium dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, light gray brown; firm. Laboratory Data Interval 33.8 to 34.5 ft.
30	?	17.9	3.5	21.4	78.6	0.0	NP	NP	18.3	SM	137.0	SM	135.8		**34.5 to 35.0 ft.:SILTY SAND, SM** About 55% fine to medium sand; about 45% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, light gray brown with reddish brown iron-oxidation veinlets; firm.
	91	45.4	40.7	86.1	13.9	0.0	22.0	5.1	18.5	CL-ML	135.5	ML	135.5		**35.0 to 35.4 ft.:SILT WITH SAND, (ML)s** About 75% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 25% fine sand; maximum size: medium sand; moist, light gray brown.
												(ML)s			**35.4 to 38.9 ft.:SILT, ML:** About 90 to 95% fines with medium plasticity, toughness and dry strength, and slow dilatancy; about 5 to 10% fine to medium sand; maximum size: medium sand; moist, light brown gray with reddish brown iron-oxidation veinlets; firm.
	91	33.7	39.4	73.1	26.9	0.0	24.4	8.1	23.1	(CL)s	133.5		133.5		
35												SM	133.0		Laboratory Data Interval 36.0 to 38.2 ft.
	NR											(ML)s	132.6		
	91	40.2	50.7	90.9	9.1	0.0	32.1	15.4	20.1	CL	129.8	ML			**38.9 to 40.9 ft.:SILTY SAND, SM** About 70% fine to medium sand; 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, dark grey; no reaction with HCl; soft to firm consistency. Laboratory Data Interval 38.9 to 40.5 ft.
													129.1		
	91	25.3	6.3	31.6	68.4	0.0	NP	NP	16.2	SM	127.5	SM	127.1		**40.9 to 45.0 ft.:POORLY GRADED SAND WITH SILT, SP/SM** About 90% fine to coarse sand (mostly fine to medium); about 10% non-plastic fines with rapid dilatancy; moist, dark grey and light brown layers, no reaction with HCl; soft consistency. Laboratory Data Interval 40.9 to 42.8 ft.
40															
	70	12.2	1.5	13.7	86.3	0.0	NP	NP	20.6	SM					

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram.
Well development information is provided in attached Monitoring Well Development form.

MW-09-54B
TOC Coordinates= N 2170647.4 E 6177381.3 (NAGD83) El. 168.08 (NAVD88)
Ground surface El.= 168.2 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-54

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Right, Madera County
BEGUN: 7/20/09 FINISHED: 7/21/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 22.0 ft. (El. 146.0 ft.) 7/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,651.8 E 6,177,383.5 (NAGD83)
TOTAL DEPTH: 51.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 168.0 ft. (NAVD88)
T.O.C ELEVATION: 167.80 ft. (NAVD88)
HOLE LOGGED BY: S. Lee & J. Vauk
REVIEWED BY: A. Warren

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
											125.2	SP/SM 123.0	Qal	**45.0 to 46.8 ft.: No Recovery.**
	45	68												**46.8 to 48.1 ft.:SILTY SAND, SM** About 85% fine to medium sand; 15% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, grey; no reaction with HCl; recovered disturbed.
														Laboratory Data Interval 46.8 to 48.1 ft.
		NR										NR 121.2		**48.1 to 51.8 ft.:No Recovery.**
		39	13.1	5.5	18.6	81.4	0.0	NP	NP	17.8	SM 119.9	SM 119.9		***T.D. = 51.8 ft.***
	50	NR										NR 116.2		

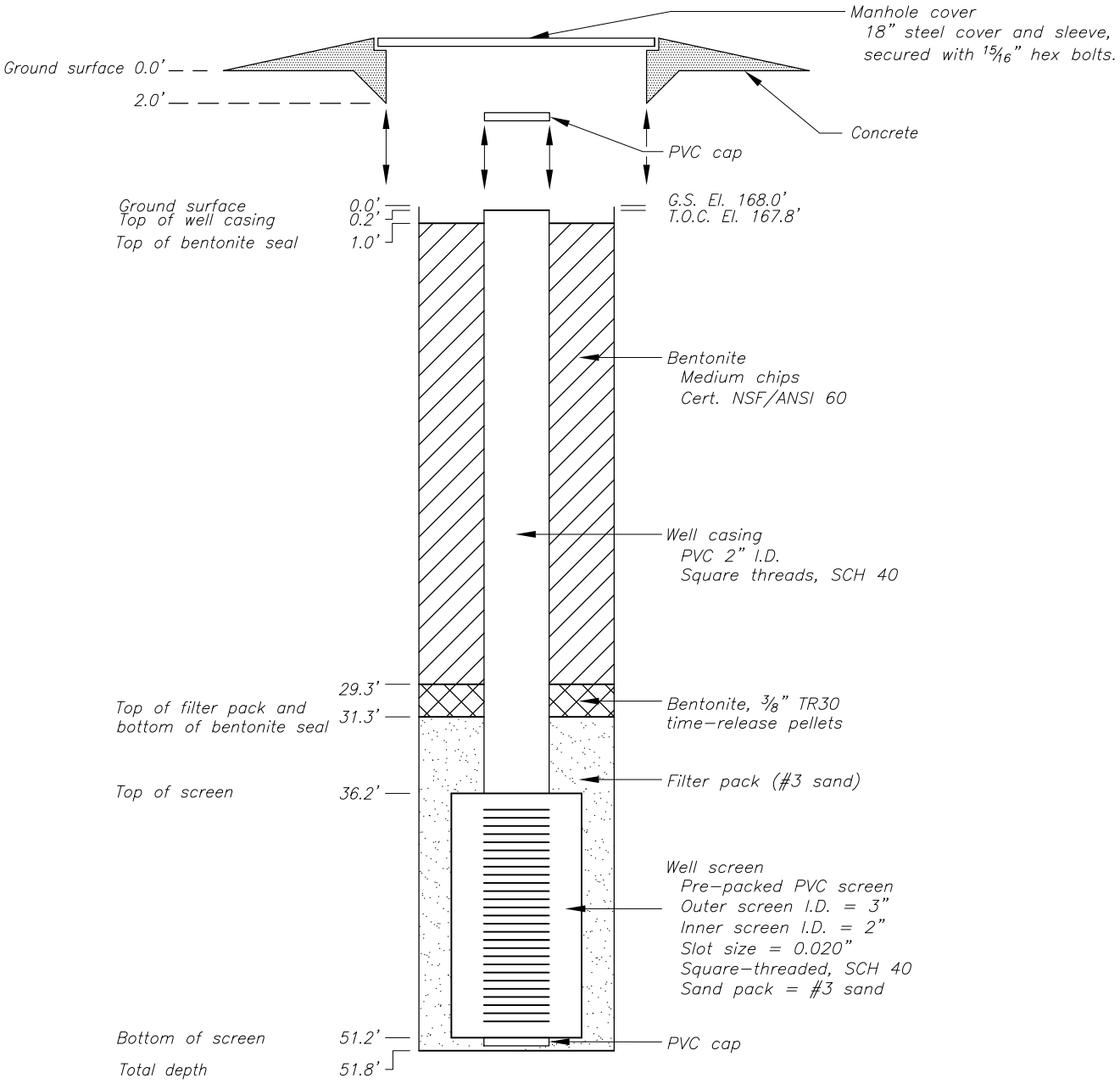
BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram.
Well development information is provided in attached Monitoring Well Development form.

MW-09-54B
TOC Coordinates= N 2170647.4 E 6177381.3 (NAGD83) El. 168.08 (NAVD88)
Ground surface El.= 168.2 (NAVD88)

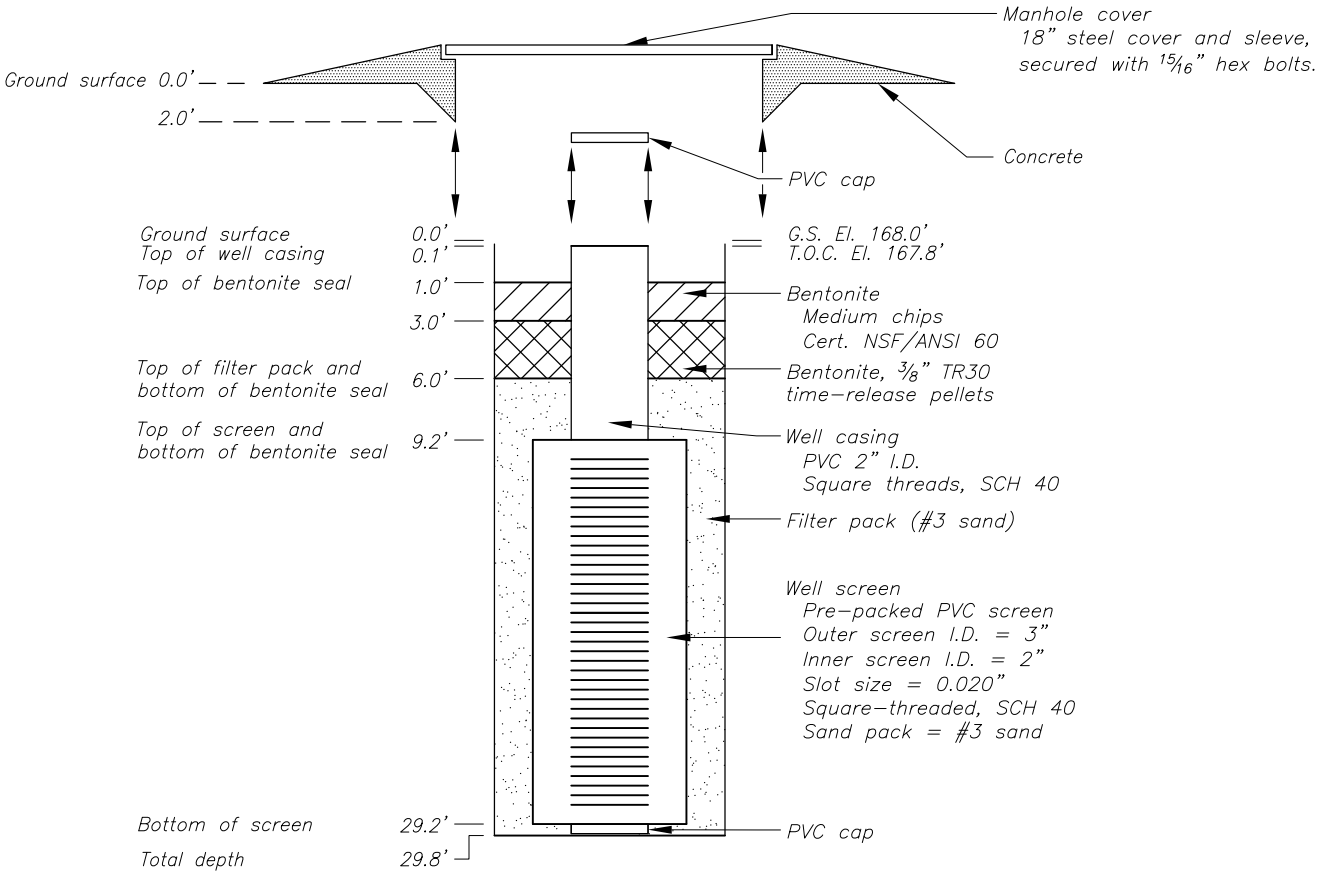
MW–09–54	GEOLOGIST: S. LEE
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 7/21/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2170651.8 E6177383.5 (NAD83) ELEVATION 167.8' (NAVD88) GROUND SURFACE ELEVATION 168.0' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

MW–09–54B	GEOLOGIST: S. LEE
WELL COMPLETION DIAGRAM	DRILLER: R. BURNETT
DATE COMPLETED: 1/25/2010	HELPER: J. OSTERBERG
TOP OF WELL CASING COORDINATES: N2170647.4 E6177381.3 (NAD83) ELEVATION 168.1' (NAVD88) GROUND SURFACE ELEVATION 168.2' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-55

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 8/1/09 FINISHED: 8/2/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 27.5 ft. (El. 138.59 ft.) 8/3/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,239.3 E 6,177,224.3 (NAGD83)
TOTAL DEPTH: 55.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 166.1 ft. (NAVD88)
T.O.C ELEVATION: 168.69 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

MW-09-55 was drilled and continuously sampled on 8/01/2009 and 8/02/2000 using hollow-stem flight augers and split sample barrel.

MW-09-55B was drilled and completed as a well on 8/02/2009 and 8/03/2009 using hollow stem flight augers and a wooden plug.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Kevin Coy, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-55 was advanced using hollow stem flight augers with continuous dry core sampling system (FADC) from the ground surface to a total depth of 55.0 feet bgs. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers, with a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 55.0 ft. - FADC

Drill hole DH-09-55B was advanced using hollow stem flight augers (FADC) and a wooden plug from the ground surface to a total depth of 15.4 feet bgs. FADC uses 7-5/8-inch O.D., 4-1/4-inch I.D. hollow stem augers and a wooden (knock-out) plug.

Interval Method
0.0 to 15.4 ft. FADC with wooden plug

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
MW-09-55
0.0 to 40.0 ft. - smooth drilling
40.0 to 45.0 ft. - very firm, difficult drilling
45.0 to 55.0 ft. - flowing saturated sands in augers

MW-09-55B
0.0 to 15.4 ft. - blind drilled
15.4 ft. - knocked out wooden plug and set well

DRILL FLUID, RETURN AND COLOR:
MW-09-55
0.0 to 55.0 ft. - Not Recorded

MW-09-55B
0.0 to 15.4 ft. - None

DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
	74	13.6	4.1	17.7	82.3	0.0	NP	NP	3.3	SM 163.1	SM	
		12.9	4.7	17.6	82.4	0.0	NP	NP	2.2	SM 161.1		
5											160.2	
	80										SP 158.6	
											SM 158.2	
10		4.1	1.5	5.6	94.4	0.0	NP	NP	4.9	SP-SM 155.1	SP	Qal
	68										153.1	
											SP/SM 151.1	
15												
	100										(CL/ML)s	
	97	38.5	12.9	51.4	48.6	0.0	NP	NP	17.2	s(ML) 147.6	147.1	
											SM 146.1	

SOIL DESCRIPTIONS CHARACTERIZE SAMPLES FROM DRILL HOLE MW-09-55.

0.0 to 55.0 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 5.9 ft.: SILTY SAND, SM: About 75 to 85% fine to medium sand with grains consisting of quartz, mica, and various other minerals; about 15 to 25% fines; maximum size: medium sand; dry, brown, no reaction with HCl; very soft consistency; increase in the percentage of sand with depth.

Laboratory Data Interval
2.5 to 3.0 ft.
4.5 to 5.0 ft.

5.9 to 7.5 ft.: POORLY GRADED SAND, SP: About 95% fine to coarse sand (coarse sand is subangular and hard); about 5% fines; trace of fine, hard, sub-angular gravel; maximum size: 1/4 inches; dry, gray, no reaction with HCl; very soft consistency

7.5 to 7.9 ft.: SILTY SAND, SM: About 60% fine to medium sand; about 40% fines; maximum size: medium sand; dry, brown, no reaction with HCl; soft consistency.

7.9 to 13.0 ft.: POORLY GRADED SAND, SP: About 95% fine to medium sand; about 5% fines; maximum size: medium sand; dry (moist below 12.7 ft.), light gray-brown, no reaction with HCl; very soft consistency.

Laboratory Data Interval
10.5 to 11.0 ft.

13.0 to 15.0 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 85% fine to coarse sand (coarse sand is sub-rounded to sub-angular, and hard; about 10% fines; about 5% fine, hard, sub-rounded gravel; maximum size: 1/2 inches; moist (wet below 14.0 ft.), light gray-brown, no reaction with HCl; very soft consistency.

15.0 to 19.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 75% fines with low plasticity, medium toughness and dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; moist, greenish-gray (slightly mottled with rust colored iron staining), no reaction with HCl; firm to hard consistency; slightly sandier toward bottom 0.5 ft.

Laboratory Data Interval
18.0 to 18.5 ft.

19.0 to 20.0 ft.: SILTY SAND, SM: About 60% fine sand; about 40% fines; maximum size: fine sand; dry, greenish-gray, no reaction with HCl; soft consistency.

20.0 to 22.0 ft.: SILTY SAND, SM: About 85% fine sand; about 15% fines; maximum size: fine sand; moist to wet, greenish-gray, no reaction with HCl; soft consistency.

22.0 to 23.5 ft.: SILTY SAND, SM: About 75% fine sand; about 25% fines; maximum size: fine sand; moist to wet, greenish-gray, no reaction with HCl; soft consistency.

23.5 to 24.5 ft.: SILTY SAND, SM: About 85% fine to medium sand; about 15% fines;

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-09-55B
TOC Coordinates= N 2170244.6 E 6177225.0 (NAGD83) El. 165.54
Ground Surface El.= 165.7 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-55

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 8/1/09 FINISHED: 8/2/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 27.5 ft. (El. 138.59 ft.) 8/3/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,239.3 E 6,177,224.3 (NAGD83)
TOTAL DEPTH: 55.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 166.1 ft. (NAVD88)
T.O.C ELEVATION: 168.69 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

WATER LEVEL:
27.5 ft. b.g.s. on 8/03/2009 (MW-09-55)

REASON FOR HOLE TERMINATION:
The holes were terminated upon successful completion to the target depths.

HOLE COMPLETION:
MW-09-55
Well Casing - +2.6 to 40.0 ft. (T.O.C. El. 168.69 ft.)
Dual Pre-pack Screen - 40.0 to 50.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 35.5 to 55.0 ft. (#3 Sand)
Bentonite Seal - 2.0 to 35.5 ft.
Well Protection - locking well casing (2.6' above ground surface)

MW-09-55B
Well Casing - 0.1 to 10.0 ft. (T.O.C. El. 165.54 ft.)
Dual Pre-pack Screen - 10.0 to 15.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 8.0 to 15.4 ft. (#3 Sand)
Bentonite Seal - 2.0 to 8.0 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL
											SM (144.1)	
	80										SM (142.6)	
											SM (141.6)	
25												
	74	45.4	43.9	89.3	10.7	0.0	23.3	6.5	21.6	CL-ML ▼ 138.6 (27.5 ft. (El. 138.59 ft.))	(CL/ML)s	
											(136.1)	Qal
30											SM (133.9)	
	84										(CL/ML)s (132.8)	
											SM (131.6)	
35												
		44.8	37.9	82.7	17.3	0.0	22.7	6.2	18.2	(CL-ML)s 129.1	s(CL)	
	88										(128.1)	
											SP/SM	

maximum size: medium sand; moist to wet, greenish-gray, no reaction with HCl; soft consistency.

24.5 to 30.0 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 85% fines with medium plasticity and toughness, low dry strength, and slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, greenish-gray (slightly mottled with rust colored iron staining), no reaction with HCl; firm to hard consistency.

Laboratory Data Interval
27.2 to 27.5 ft.

30.0 to 32.2 ft.: SILTY SAND, SM: About 85% fine to fine sand; about 15% fines; maximum size: fine sand; moist to wet, greenish-gray, no reaction with HCl; soft consistency.

32.2 to 33.3 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 75% fines with low to medium plasticity, medium toughness, low dry strength, and slow to rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, greenish-gray, no reaction with HCl; firm to hard consistency.

33.3 to 34.5 ft.: SILTY SAND, SM: About 70% fine sand; about 30% fines; maximum size: fine sand; wet, greenish-gray (slightly mottled with rust-colored iron staining), no reaction with HCl; very soft to soft consistency.

34.5 to 38.0 ft.: SANDY LEAN CLAY, s(CL): About 70% fines with medium plasticity, toughness and dry strength, and slow dilatancy; about 30% fine sand; maximum size: fine sand; moist, greenish-gray (slightly mottled with rust-colored iron staining), no reaction with HCl; hard to very hard consistency.

Laboratory Data Interval
36.6 to 36.9 ft.

38.0 to 40.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% fines; maximum size: fine sand; wet, gray (slightly mottled with dark gray to black streaks), no reaction with HCl; soft consistency; interval contains lenses with higher fines content.

40.5 to 44.5 ft.: SILTY SAND, SM: About 70 to 75% fine to medium sand (mostly fine); about 25 to 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray and dark gray (slightly mottled with dark gray to black streaks), no reaction with HCl; very soft and soft consistency.

Laboratory Data Interval
44.0 to 44.5 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-09-55B
TOC Coordinates= N 2170244.6 E 6177225.0 (NAGD83) El. 165.54
Ground Surface El.= 165.7 (NAVD88)

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-55

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 8/1/09 FINISHED: 8/2/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 27.5 ft. (El. 138.59 ft.) 8/3/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,170,239.3 E 6,177,224.3 (NAGD83)
TOTAL DEPTH: 55.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 166.1 ft. (NAVD88)
T.O.C ELEVATION: 168.69 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
												125.6		
		40										SM		
			21.8	3.1	24.9	75.1	0.0	NP	NP	29.2	SM 121.6	121.6		
	45											SP/SM	Qal	
		32												
			3.6	2.2	5.8	94.2	0.0	NP	NP	15.5	SP-SM 116.7	116.3		
	50											SM		
		78										112.9		
			39.6	13.7	53.3	46.7	0.0	NP	NP	20.1	s(ML) 111.8	s(ML)		
	55											111.1		

BOTTOM OF HOLE

44.5 to 49.8 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% fines; maximum size: fine sand; wet, gray (slightly mottled with dark gray to black streaks), no reaction with HCl; very soft consistency; sand flowing into augers, making progress slow and recovery poor. Recovered samples may have lost some fines content due to washing out.

Laboratory Data Interval
49.0 to 49.4 ft.

49.8 to 53.2 ft.: SILTY SAND, SM: About 65% fine sand; about 35% fines; maximum size: fine sand; wet, dark gray, no reaction with HCl; soft to firm consistency

53.2 to 55.0 ft.: SANDY SILT, s(ML): About 55% fines with low plasticity, medium toughness, low dry strength, and rapid dilatancy; about 45% fine to medium sand; maximum size: medium sand; moist, dark greenish-gray, no reaction with HCl; firm consistency.

Laboratory Data Interval
54.0 to 54.3 ft.

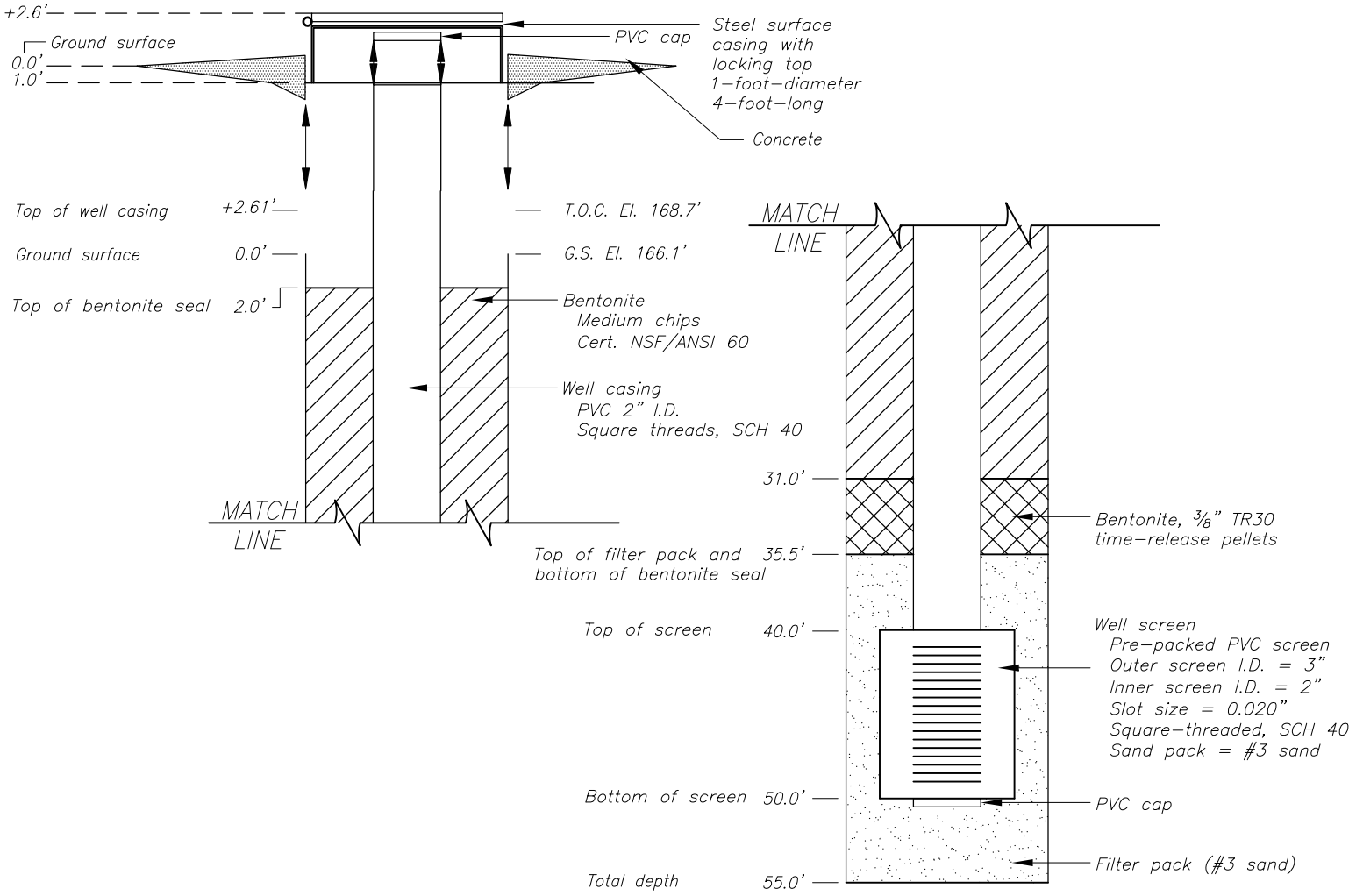
T.D.= 55.0 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW-09-55B
TOC Coordinates= N 2170244.6 E 6177225.0 (NAGD83) El. 165.54
Ground Surface El.= 165.7 (NAVD88)

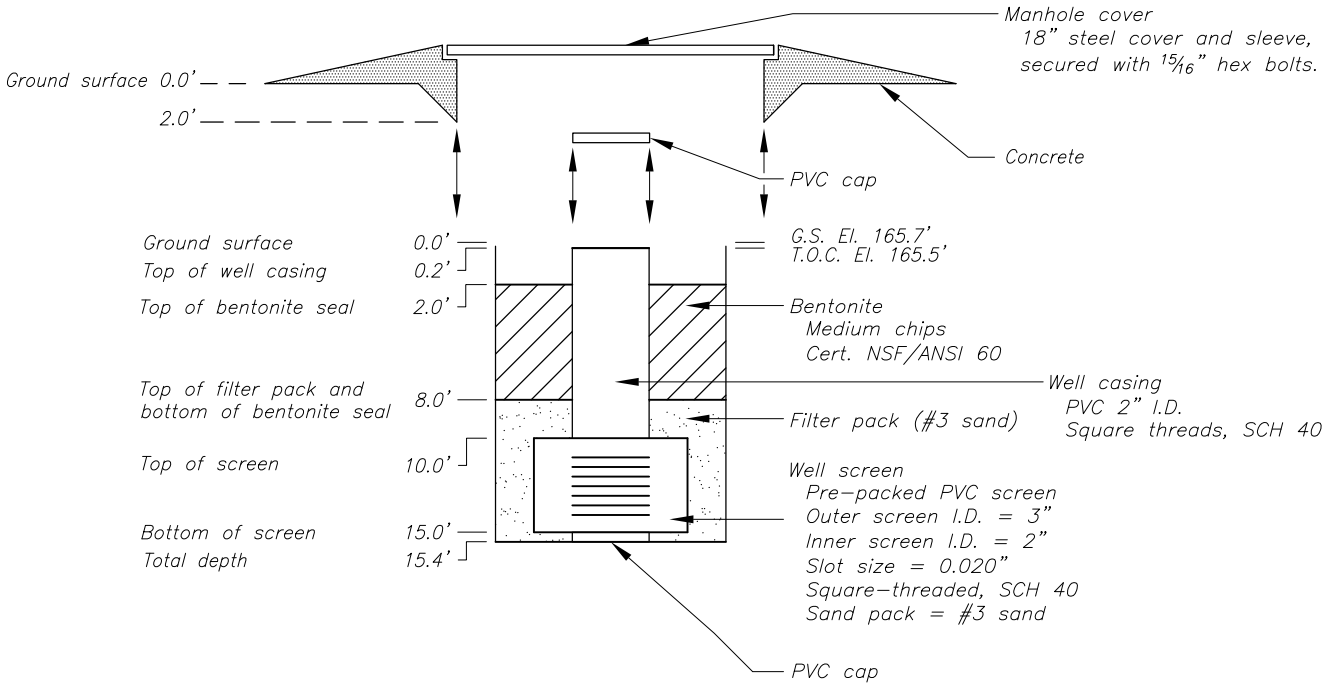
MW–09–55	GEOLOGIST: G. RUSSELL
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 8/2/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2170239.3 E6177224.3 (NAD83) ELEVATION 168.7' (NAVD88) GROUND SURFACE ELEVATION 166.1' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

MW-09-55B	GEOLOGIST: G. RUSSELL
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 8/3/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2170244.6 E6177225.0 (NAD83) ELEVATION 165.5' (NAVD88) GROUND SURFACE ELEVATION 165.7' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-56

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 7/30/09 FINISHED: 8/1/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 14.2 ft. (El. 147.01 ft.) 8/1/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,168,209.4 E 6,176,768.3 (NAGD83)
TOTAL DEPTH: 44.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 161.2 ft. (NAVD88)
T.O.C ELEVATION: 161.01 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

NOTES

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Kevin Coy, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-56 was advanced using hollow stem flight augers (HSA) with a 8-1/4-inch O.D. and 4-1/4-inch I.D. A 3-foot-long, 3-1/2-inch I.D. drive sampler (California Sampler) was used to continuously core materials from the ground surface to a total depth of 44.7 feet. The drive sampler was advanced 2.0 to 2.3 feet per run in-front of the auger bit, with a hydraulic hammer. Augers were then advanced to the previous depth sampled.

Interval Method
0.0 to 44.7 ft. - HSA with Drive Sampler

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 24.8 ft. - smooth drilling
24.8 - encountered water at 22.6 ft., add water during drilling
24.8 to 33.8 ft. - smooth drilling
33.8 to 42.6 ft. - difficult drilling due to heaving sands
42.6 to 44.7 ft. - smooth drilling

DRILL FLUID, RETURN AND COLOR:
0.0 to 24.8 ft. - None
24.8 to 44.7 ft. - Water, no return

WATER LEVEL:
14.2 ft. b.g.s. on 8/01/09

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing - 0.1 to 22.0 ft. (T.O.C. El. 161.01 ft.)
Dual Pre-pack Screen - 22.0 to 42.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 13.5 to 44.7 ft. (#3 Sand and native material)
Bentonite Seal - 2.0 to 13.5 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	95											ML	157.8	
	100	58.5	34.9	93.4	6.6	0.0	42.3	15.4	22.4	ML	157.2			
5	100											(ML)s	154.7	
	91	23.8	23.4	47.2	52.3	0.5	25.3	11.0	9.5	SC	153.4	SC	152.1	
10	100	22.3	14.6	36.9	62.7	0.4	25.0	8.8	12.0	SC	150.9	s(CL/ML)	149.9	
	100	11.0	7.8	18.8	71.4	9.8	NP	NP	4.2	SM	148.9	SM	148.6	Qal
	100													
15	100	5.0	3.7	8.7	91.0	0.3	NP	NP	9.5	SP-SM	145.9	SM	140.6	
	91													
20	100	20.2	22.2	42.4	57.6	0.0	22.3	7.3	14.1	SC	140.3	SC	140.1	
	87											SM	137.5	

14.2 ft. (El. 147.01 ft.)

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 44.7 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 3.4 ft.: SILT, ML: About 90% fines with low to medium plasticity, medium to high dry strength, and slow dilatancy; about 10% fine sand; maximum size: fine sand; dry, medium to dark brown, no reaction with HCl; very firm to hard consistency; containing mica flakes.

3.4 to 6.5 ft.: SILT WITH SAND, (ML)s: About 75% fines with low plasticity and toughness, low to medium dry strength, and slow to rapid dilatancy; about 25% fine sand; maximum size: fine sand; moist, dark brown, no reaction with HCl; firm consistency; containing mica flakes.

Laboratory Data Interval
3.7 to 4.0 ft.

6.5 to 9.1 ft.: CLAYEY SAND, SC: About 55% fine to coarse sand with grains consisting of quartz, mica, and various other minerals (coarse sand is sub-angular); about 45% fines; trace of gravel; maximum size: fine gravel; dry, gray-brown, no reaction with HCl; hard consistency.

Laboratory Data Interval
7.5 to 7.8 ft.

9.1 to 11.3 ft.: SANDY, SILTY CLAY, s(CL/ML): About 55% fines with low plasticity, medium dry strength, and slow dilatancy; about 45% fine to coarse sand; trace of gravel; maximum size: fine gravel; dry to moist, orange-brown, no reaction with HCl; hard consistency; abundant iron-oxide staining throughout.

Laboratory Data Interval
10.0 to 10.3 ft.

11.3 to 12.6 ft.: SILTY SAND, SM: About 60% fine to coarse sand; about 35% fines; about 5% gravel; maximum size: 1/2 inches; dry to moist, brown (slightly mottled with rust-colored iron staining), no reaction with HCl; soft to firm consistency.

Laboratory Data Interval
12.0 to 12.3 ft.

12.6 to 20.6 ft.: SILTY SAND, SM: About 85% fine to medium sand (trace of coarse); about 15% non-plastic fines; maximum size: coarse sand; moist, light brown (slightly orange), no reaction with HCl; soft to firm consistency.

Laboratory Data Interval
15.0 to 15.3 ft.

20.6 to 21.1 ft.: CLAYEY SAND, SC: About 60 fine to medium sand (mostly fine); about 40% fines with low to medium plasticity, low toughness, medium dry strength, and slow dilatancy; maximum size: medium sand; moist, brown (mottled with rust-colored staining), no reaction with HCl; firm consistency.

Laboratory Data Interval
20.6 to 20.9 ft.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-56

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 7/30/09 FINISHED: 8/1/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 14.2 ft. (El. 147.01 ft.) 8/1/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,168,209.4 E 6,176,768.3 (NAGD83)
TOTAL DEPTH: 44.7 ft.

STATE: California
GROUND SURFACE ELEVATION: 161.2 ft. (NAVD88)
T.O.C ELEVATION: 161.01 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

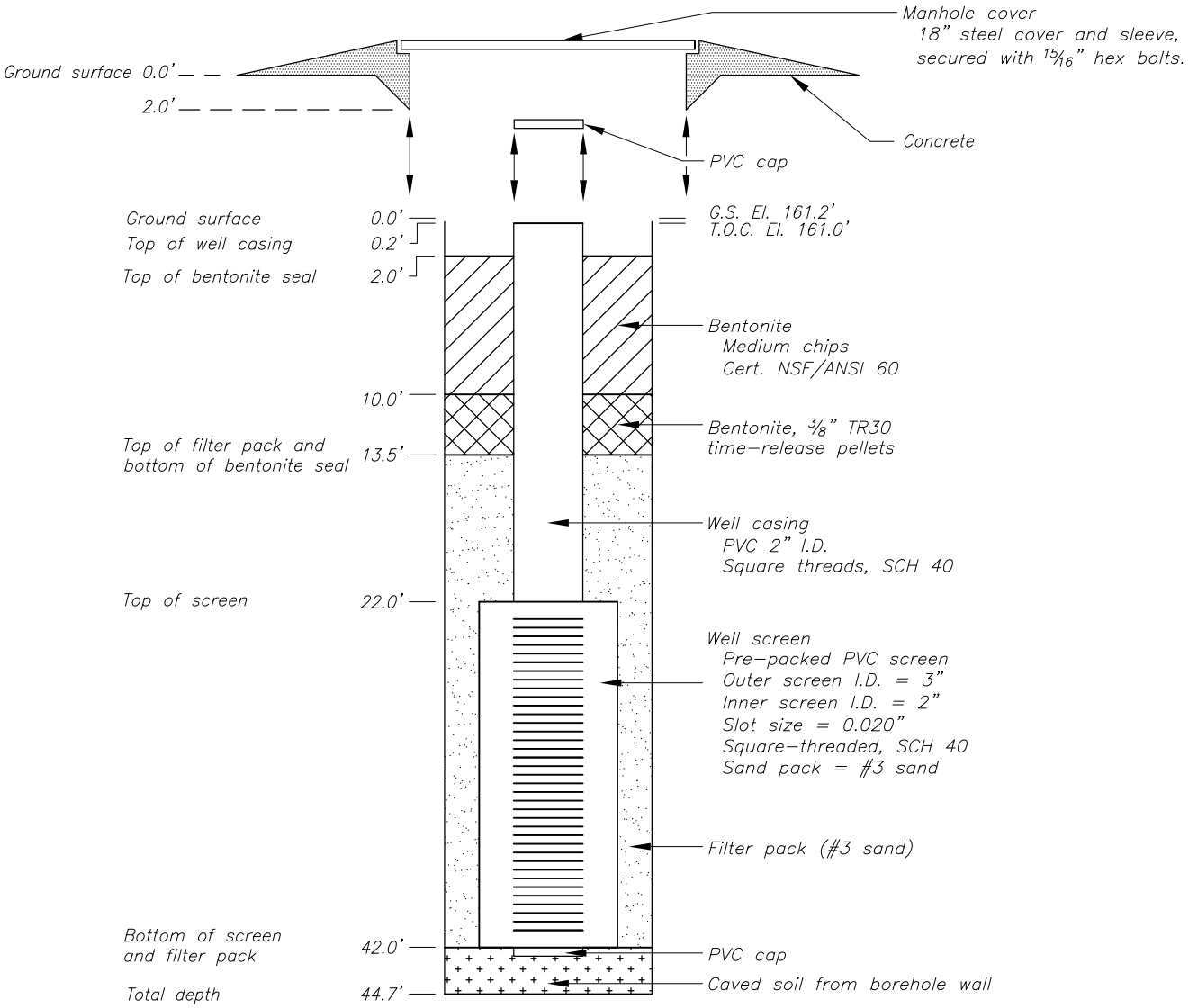
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		100										SM		**21.1 to 23.7 ft.: SILTY SAND, SM:** About 80% fine to medium sand (trace of medium); about 20% fines; maximum size: medium sand; moist to wet, orange brown, no reaction with HCl; very soft consistency.
			30.1	12.9	43.0	57.0	0.0	NP	NP	11.2	SM 134.7			
		96										133.3		**23.7 to 27.9 ft.: SILTY SAND, SM:** About 55% fine to medium sand (trace of medium); about 45% fines with low to medium plasticity and dry strength, and slow dilatancy; maximum size: medium sand; moist to wet, brown-gray, no reaction with HCl; firm to hard consistency; occasional layers (1-3 inches) with higher sand content (to about 40%).
30		95										SP/SM		Laboratory Data Interval 26.2 to 26.5 ft.
		83												**27.9 to 33.8 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine sand; about 10% fines; maximum size: fine sand; wet, gray (mottled with dark gray to black streaks), no reaction with HCl; very soft consistency.
												127.4		**33.8 to 35.7 ft.: SILTY, CLAYEY SAND, SC/SM:** About 65% fine sand; about 35% fines; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency; occasional zones (1-inch layer or fragment) with higher fines content.
35		82										SC/SM	Qal	
			21.2	20.9	42.1	57.9	0.0	NP	NP	4.5	SM 125.3	125.5 SM 125.3		**35.7 to 35.9 ft.: SILTY SAND, SM:** About 60% fine sand; about 40% non-plastic fines with no to slow dilatancy; maximum size: fine sand; moist, light gray, no reaction with HCl; hard to very hard consistency.
		70												Laboratory Data Interval 35.7 to 35.9 ft.
40		NR										SP/SM		**35.9 to 44.7 ft.: POORLY GRADED SAND WITH SILT, SP/SM:** About 90% fine sand; about 10% fines; maximum size: fine sand; wet, gray, no reaction with HCl; very soft consistency. Lower part of depth interval had saturated, soft sand flowing into augers, making the drilling progress slow and recovery poor. Recovered samples may have lost some fines content due to washing out.
		82												Laboratory Data Interval 43.6 to 43.9 ft.
			4.3	1.6	5.9	94.1	0.0	NP	NP	15.5	SP-SM 117.3	116.5		***T.D.= 44.7 ft.***

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW–09–56	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 8/01/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2168209.4 E6176768.3 (NAD83) ELEVATION 161.0' (NAVD88) GROUND SURFACE ELEVATION 161.2' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-57

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 7/28/09 FINISHED: 7/30/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 30.5 ft. (El. 132.64 ft.) 7/30/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,165,785.1 E 6,176,730.5 (NAGD83)
TOTAL DEPTH: 52.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 163.1 ft. (NAVD88)
T.O.C ELEVATION: 162.94 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

ALL MEASUREMENTS ARE IN FEET FROM THE GROUND SURFACE.

PURPOSE OF HOLE:
To recover core, collect data to determine geologic and hydrologic site conditions, and install a groundwater monitoring well.

DRILLED BY:
USGS Drill Crew
James Huckaby, Driller
Kevin Coy, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-57 was advanced using hollow stem flight augers (HSA) with a 7-5/8-inch O.D. and 4-1/4-inch I.D. A 2.3-foot-long, 3-1/2-inch I.D. drive sampler (California Sampler) was used to continuously core materials from the ground surface to a total depth of 52.5 feet. The drive sampler was advanced 2.0 to 2.3 feet per run in-front of the auger bit, with a hydraulic hammer. Augers were then advanced to the previous depth sampled.

Interval Method
0.0 to 52.0 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 40.5 ft. - smooth drilling
40.5 ft. - encountered water at 37.5 ft., add water during drilling
40.5 to 52.5 ft. - sand heave during drilling

DRILL FLUID, RETURN AND COLOR:
0.0 to 40.5 ft. - None
40.5 to 52.5 ft. - Water, no return

WATER LEVEL:
30.5 ft. b.g.s. on 7/30/2009

REASON FOR HOLE TERMINATION:
The hole was terminated upon successful completion to the target depth.

HOLE COMPLETION:
Well Casing - 0.2 to 31.5 ft. (T.O.C. El. 162.94 ft.)
Dual Pre-pack Screen - 31.5 to 51.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 24.5 to 52.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 24.5 ft.
Well Protection - flush-mounted 18-inch manhole (15/16-inch hexbolts)

DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL
	100											SM	162.0	
	100	18.1	10.0	28.1	71.6	0.3	NP	NP	4.8	SM	159.5	SM	158.4	
5	86													
	83	2.5	2.0	4.5	94.5	1.0	NP	NP	1.6	SP	155.1			
10	100											SP/SM	146.1	
	100													
15	100													Qal
	100											SP/SM	145.5	
	95											(CL/ML)s	144.6	
20	100	60.3	28.5	88.8	11.2	0.0	20.4	3.5	19.2	ML	142.2	(ML)s	138.3	
	100													
25	100											SM	135.4	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 52.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 1.1 ft.: SILTY SAND, SM: About 55% fine to coarse sand; about 35% fines; about 10% fine to coarse, hard, rounded to sub-rounded gravel; maximum size: 1 inch; dry, gray-brown, no reaction with HCl; firm consistency.

1.1 to 4.7 ft.: SILTY SAND, SM: About 60% fine to coarse sand (coarse sand is sub-angular to angular); about 40% fines; trace of gravel; maximum size: 1/2 inches; dry, gray-brown, no reaction with HCl; soft to firm consistency; abundant mica flakes, sand percentage increases toward bottom 1-foot.

Laboratory Data Interval
3.3 to 3.6 ft.

4.7 to 17.0 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 85% fine to coarse sand (coarse sand is hard and sub-angular to angular); about 10% fines; about 5% fine to coarse, hard, sub-rounded to rounded gravel; maximum size: 1.5 inches; dry, light whitish-orange to light gray, no reaction with HCl; soft consistency; abundant mica flakes. Sand becomes finer grained below 12.7 feet. Gravel content about 15% from 11.2 to 12.3 ft., and a trace from 14.0 to 17.0 feet.

Laboratory Data Interval
7.7 to 8.0 ft.

17.0 to 17.6 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand (trace of medium); about 10% fines; maximum size: medium sand; dry, light whitish-orange to light gray, no reaction with HCl; loose consistency.

17.6 to 18.5 ft.: SILTY CLAY WITH SAND, (CL/ML)s: About 80% fines with low to medium plasticity, low toughness and dry strength; slow dilatancy; about 20% fine to medium sand (trace of medium); maximum size: medium sand; moist, medium gray, no reaction with HCl; soft to firm consistency; contains occasional irregular laminae with higher sand percentage.

18.5 to 24.8 ft.: SILT WITH SAND, (ML)s: About 85% fines with no to low plasticity, low toughness and dry strength, and rapid to slow dilatancy; about 15% fine sand; maximum size: fine sand; moist, greenish-gray (slightly mottled with rust colored iron staining), no reaction with HCl; very firm to hard consistency; contains occasional irregular laminae with higher sand percentage. Zones of soil with about 25% sand are encountered from 22.0 to 22.4 ft. and 24.3 to 24.8 ft.

Laboratory Data Interval
20.6 to 20.9 ft.

24.8 to 27.7 ft.: SILTY SAND, SM: About 60% fine sand; about 40% fines; maximum size: fine sand; moist, light gray (slightly mottled with rust colored iron staining), no reaction with HCl; soft consistency; mica flakes common.

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-57

FEATURE: Groundwater Monitoring
LOCATION: Reach 2B, River Bank Left, Fresno County
BEGUN: 7/28/09 FINISHED: 7/30/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 30.5 ft. (El. 132.64 ft.) 7/30/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,165,785.1 E 6,176,730.5 (NAGD83)
TOTAL DEPTH: 52.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 163.1 ft. (NAVD88)
T.O.C ELEVATION: 162.94 ft. (NAVD88)
HOLE LOGGED BY: G. Russell
REVIEWED BY: J. Vauk

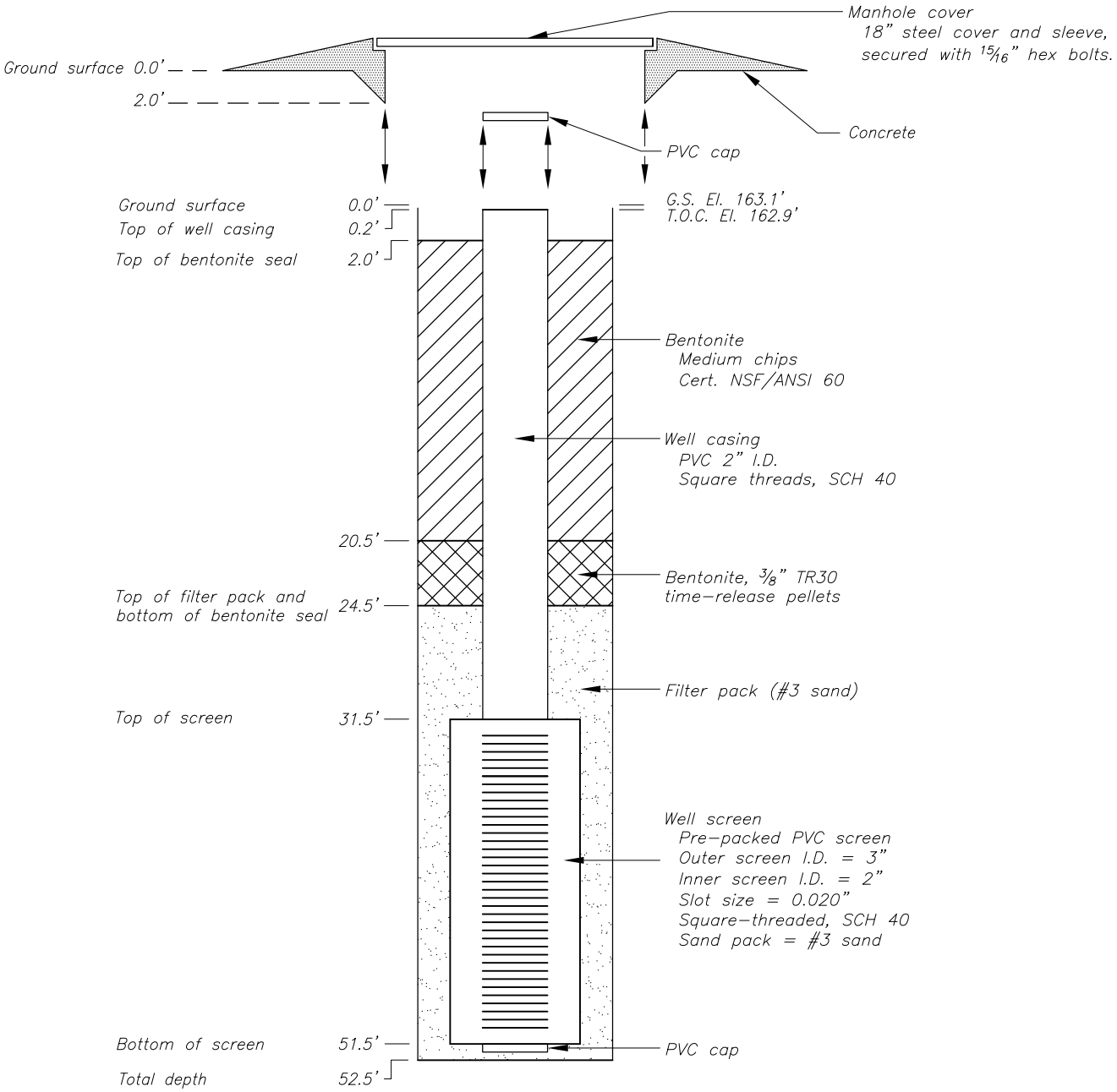
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION	ELEVATION	VISUAL CLASSIFICATION	ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
	30	100											(ML)s			**27.7 to 32.0 ft.: SILT WITH SAND, (ML)s:** About 85% fines with no to low plasticity, low toughness and dry strength, rapid dilatancy; about 15% fine sand; maximum size: fine sand; moist, gray-brown (mottled with rust colored iron staining), no reaction with HCl; firm to hard consistency; contains occasional irregular laminae with higher sand percentage.
		91										30.5 ft. (El. 132.64 ft.)				
														131.1		**32.0 to 51.0 ft.: POORLY GRADED SAND WITH SILT, SP-SM:** About 90% fine to medium sand; about 10% fines; maximum size: medium sand; dry to wet (dry from 32.0 to 37.9 ft., moist from 37.9 to 38.0 ft., and wet below 38.0 ft.), light gray, no reaction with HCl; soft consistency; contains mica flakes.
		96														Laboratory Data Interval 39.0 to 39.4 ft. 43.7 to 44.0 ft. 48.2 to 48.4 ft.
	35	100														
		100														**51.0 to 52.5 ft.: LEAN CLAY WITH SAND, (CL)s:** About 85% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 15% fine sand; maximum size: fine sand; moist to wet, blue-gray, no reaction with HCl; soft consistency; classification based on a small sample stuck to auger bit.
		100	3.1	1.4	4.5	95.5	0.0	NP	NP	16.9	SP	123.7				***T.D.= 52.5 ft.***
	40	96											SP/SM		Qal	
		73	20.6	2.5	23.1	76.9	0.0	NP	NP	25.5	SM	119.1				
	45	59														
		64	6.3	2.2	8.5	91.5	0.0	NP	NP	16.5	SP-SM	114.7				
	50	NR												112.1		
													(CL)s	110.6		

BOTTOM OF HOLE

COMMENTS:
FADC = Flight Auger Dry Core
HSA = Hollow Stem Auger
NP = Non-plastic
NR = No Recovery
NA = Not applicable
G.S. = Ground surface
b.g.s. = Below the ground surface
T.O.C. = Top of well casing

Well completion information is provided in attached Well Completion Diagram. Well development information is provided in attached Monitoring Well Development form.

MW–09–57	GEOLOGIST: G. RUSSELL
WELL COMPLETION DIAGRAM	DRILLER: J. HUCKABY
DATE COMPLETED: 7/30/2009	HELPER: K. COY
TOP OF WELL CASING COORDINATES: N2165785.1 E6176730.5 (NAD83) ELEVATION 162.9' (NAVD88) GROUND SURFACE ELEVATION 163.1' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Sand backfills the well above the top of bentonite seal, inside the manhole.