GEOLOGIC LOG OF DRILL HOLE NO. MW-09-121

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Left, Merced County
BEGUN: 11/16/09 FINISHED: 11/16/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.2 ft. (El. 58.54 ft.) 11/16/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,364,957.5 E 5,999,424.0 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 64.9 ft. (NAVD88)
T.O.C ELEVATION: 64.74 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
Kevin Coy, Driller
Ernie Gonzales, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-121 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D., and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 50.0 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 10.0 ft. - smooth drilling
10.0 to 20.0 ft. - add water, wet soils
20.0 to 50.0 ft. - difficult recovery conditions poor recovery

DRILL FLUID, RETURN AND COLOR:
0.0 to 10.0 ft. - None
10.0 to 50.0 ft. - Water, no return

WATER LEVEL:
6.2 ft. bgs, on 11/16/2009

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

HOLE COMPLETION:
Well Casing - 0.2 to 28.7 ft. (T.O.C. El. 64.74 ft.)
Dual Pre-pack Screen - 28.7 to 48.7 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 15.0 to 50.0 ft. (Native material caved)
Bentonite Seal - 2.0 to 15.0 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
											CL 62.4	
	94	42.0	17.0	59.0	41.0	0.0	24.6	1.5	18.9	s(ML) 6.2 ft. (El. 58.54 ft.) 58.1	s(ML) 58.1	
5												
	98	40.3	21.4	61.7	38.3	0.0	38.1	10.2	29.7	s(ML) 56.4	s(CL/ML) 56.4	
		12.0	6.5	18.5	81.5	0.0	NP	NP	36.1	SM 53.7	SM 53.7	
10											s(ML) 53.1	
	86										(ML)s 51.5	Qal
		7.3	0.7	8.0	92.0	0.0	NP	NP	26.0	SP-SM 44.7	SP/SM 44.7	
15	44											
20	4										SM 40.9	
											CL/ML 40.7	
25												

0.0 to 50.0 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.3 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; dry, dark brown, weak reaction with HCl; soft consistency; roots and wood debris.

2.3 to 6.6 ft.: SANDY SILT, s(ML): About 60% non-plastic fines with rapid dilatancy; about 40% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency; organics.

Laboratory Data Interval
2.3 to 6.6 ft.

6.6 to 8.3 ft.: SANDY SILTY CLAY, s(CL/ML): About 65% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 35% fine sand; maximum size: fine sand; medium brown, no reaction with HCl; firm consistency; organics.

Laboratory Data Interval
6.6 to 8.3 ft.

8.3 to 11.0 ft: SILTY SAND, SM: About 80% fine to coarse sand; about 20% non-plastic fines with rapid dilatancy; maximum size: coarse sand; wet, gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
8.3 to 11.0 ft.

11.0 to 11.6 ft.: SANDY SILT, s(ML): About 60% non-plastic fines with rapid dilatancy; about 40% fine sand; maximum size: fine sand; wet, gray, no reaction with HCl.

11.6 to 13.2 ft.: SILT WITH SAND, (ML)s: About 80% non-plastic fines with rapid dilatancy; about 20% fine sand; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.

13.2 to 20.0 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
13.2 to 20.0 ft.

20.0 to 23.8 ft.: No Recovery - SILTY SAND, SM Description based on drilling conditions and an adjacent CPT (CPT-09-121).

23.8 to 24.0 ft.: SILTY CLAY, CL/ML: About 95% fines with medium plasticity, low toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; moist, gray, no reaction with HCl; firm consistency.

24.0 to 45.0 ft.: No Recovery - SILTY SAND, SM Description based on drilling conditions and an adjacent CPT (CPT-09-121).

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-09-121

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Left, Merced County
BEGUN: 11/16/09 FINISHED: 11/16/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 6.2 ft. (El. 58.54 ft.) 11/16/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,364,957.5 E 5,999,424.0 (NAGD83)
TOTAL DEPTH: 50.0 ft.

STATE: California
GROUND SURFACE ELEVATION: 64.9 ft. (NAVD88)
T.O.C ELEVATION: 64.74 ft. (NAVD88)
HOLE LOGGED BY: 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
	30	0														
	35	0											SM			
	40	0													Qal	
	45	0												19.7		
			4.0	2.8	6.8	93.2	0.0	NP	NP	27.1	SP-SM		SP/SM			
			35.8	47.4	83.2	16.8	0.0	45.0	24.2	47.9	(CL)S	18.4 18.2	CL	18.4 18.2		
		30											SM			
	50													14.7		

BOTTOM OF HOLE

45.0 to 46.3 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
45.0 to 46.3 ft.

46.3 to 46.5 ft.: LEAN CLAY, CL: About 90% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 10% fine to coarse, sub-angular, hard sand; maximum size: coarse sand; moist, gray, no reaction with HCl; firm consistency.

Laboratory Data Interval
46.3 to 46.5 ft.

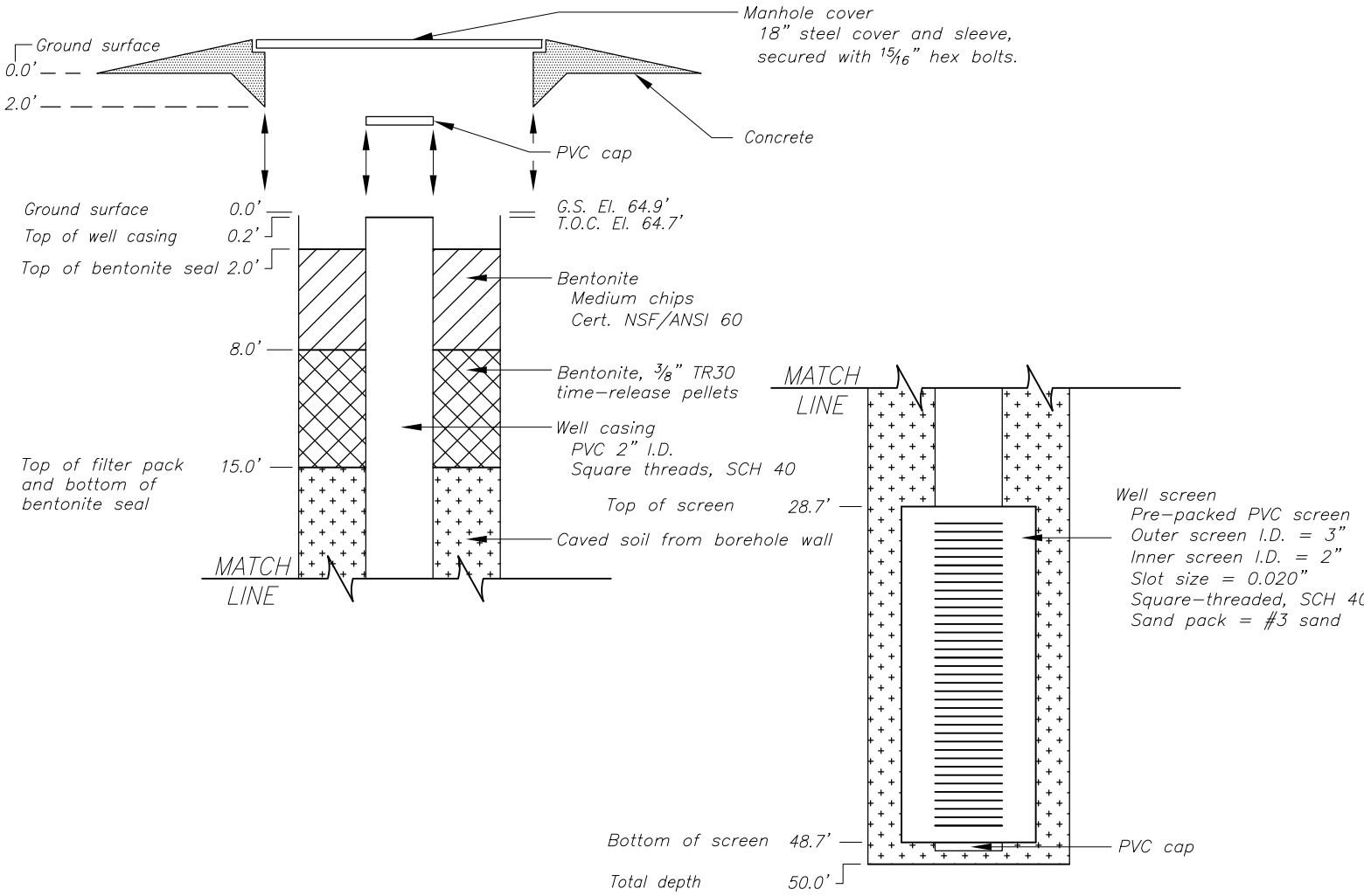
46.5 to 50.0 ft.: No Recovery - SILTY SAND, SM Description based on drilling conditions and an adjacent CPT (CPT-09-121).

T.D. = 50.0 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–09–121	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/16/2009	HELPER: E. GONZALES
TOP OF WELL CASING COORDINATES: N2364957.5 E5999424.0 (NAD83) ELEVATION 64.7' (NAVD88) GROUND SURFACE ELEVATION 64.9' (NAVD88)	



*NOT TO SCALE

NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Drill hole was terminated at 50.0' b.g.s. Sand heave filled augers to about 46.0'. Drill hole was cleaned out to 49.2'. Screen was set at 49.2'. Natural material backfilled around screen and well casing from bottom to 15.0'. Bentonite pellets were poured into augers at 15.0' and dropped when augers were lifted up to 8.0'. Hole stayed open from 8.0' to surface and chips were poured into open hole.
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-123

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Left, Merced County
BEGUN: 11/13/09 FINISHED: 11/14/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.9 ft. (El. 59.00 ft.) 11/14/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,365,513.5 E 6,000,144.7 (NAGD83)
TOTAL DEPTH: 54.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 70.3 ft. (NAVD88)
T.O.C ELEVATION: 69.90 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

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
Kevin Coy, Driller
Ernie Gonzales, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-123 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D., and 4-1/4-inch I.D., and a 5-foot-long, 3-inch I.D. split sample barrel.

Interval Method
0.0 to 54.8 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 17.5 ft. - smooth drilling
17.5 to 24.5 ft. - add water, wet soils
24.5 to 54.8 ft. - difficult recovery conditions, poor recovery

DRILL FLUID, RETURN AND COLOR:
0.0 to 17.5 ft. - None
17.5 to 54.8 ft. - Water, no return

WATER LEVEL:
10.9 ft. from ground surface, on 11/14/09

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

HOLE COMPLETION:
Well Casing - 0.4 to 34.3 ft. (T.O.C. El. 69.90 ft.)
Dual Pre-pack Screen - 34.3 to 54.3 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 13.5 to 54.8 ft. (Native material caved)
Bentonite Seal - 2.0 to 13.5 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
	100										(ML)s 67.2	
											SM 67.0	
											ML 65.8	
5	96										(ML)s 63.7	
											SM 63.3	
		7.1	2.9	10.0	90.0	0.0	NP	NP	5.9	SP-SM	SM	
10	90									58.9	58.9	
										10.9 ft. (El. 59.00 ft.)		
		5.4	1.5	6.9	93.1	0.0	NP	NP	22.1	SP-SM		
15	60									52.4	SP/SM	Qal
	20											
20	38	6.4	0.9	7.3	92.7	0.0	NP	NP	26.2	SP-SM		
										45.4	45.4	
25	0										SM	

CLASSIFICATION AND PHYSICAL CONDITION

0.0 to 54.8 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 2.7 ft.: SILT WITH SAND, (ML)s: About 75% fines with low to medium plasticity, low toughness and dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; dry, dark brown, no reaction with HCl; soft consistency.

2.7 to 2.9 ft.: SILTY SAND, SM: About 55% fine sand; about 45% non-plastic fines with rapid dilatancy; maximum size: fine sand; dry, medium brown, no reaction with HCl; soft consistency.

2.9 to 4.1 ft.: SILT, ML: About 95% fines with medium plasticity, low toughness and dry strength, and slow dilatancy; about 5% fine sand; maximum size: fine sand; dry, dark brown, no reaction with HCl; soft consistency.

4.1 to 6.2 ft.: SILT WITH SAND, (ML)s: About 75% non-plastic fines with rapid dilatancy; about 25% fine sand; maximum size: fine sand; dry, medium brown, no reaction with HCl; soft consistency.

6.2 to 6.6 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light brown to light gray, no reaction with HCl.

Laboratory Data Interval
6.3 to 11.0 ft.

6.6 to 11.0 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, medium brown and light gray, no reaction with HCl.

7.0 to 11.0 ft.: SILTY SAND, SM: About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; dry, light gray, no reaction with HCl.

11.0 to 24.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand (mostly fine); about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, orange brown (iron-oxide stained) and gray, no reaction with HCl.

Laboratory Data Interval
11.0 to 17.5 ft.
19.5 to 24.5 ft.

24.5 to 33.4 ft.: No Recovery - SILTY SAND, SM: Description is based on drilling conditions and an adjacent CPT (CPT-09-123).

33.4 to 33.8 ft.: SILTY SAND, SM: About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, greenish-gray, no reaction with HCl.

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-09-123

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Left, Merced County
BEGUN: 11/13/09 FINISHED: 11/14/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.9 ft. (El. 59.00 ft.) 11/14/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,365,513.5 E 6,000,144.7 (NAGD83)
TOTAL DEPTH: 54.8 ft.

STATE: California
GROUND SURFACE ELEVATION: 70.3 ft. (NAVD88)
T.O.C ELEVATION: 69.90 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

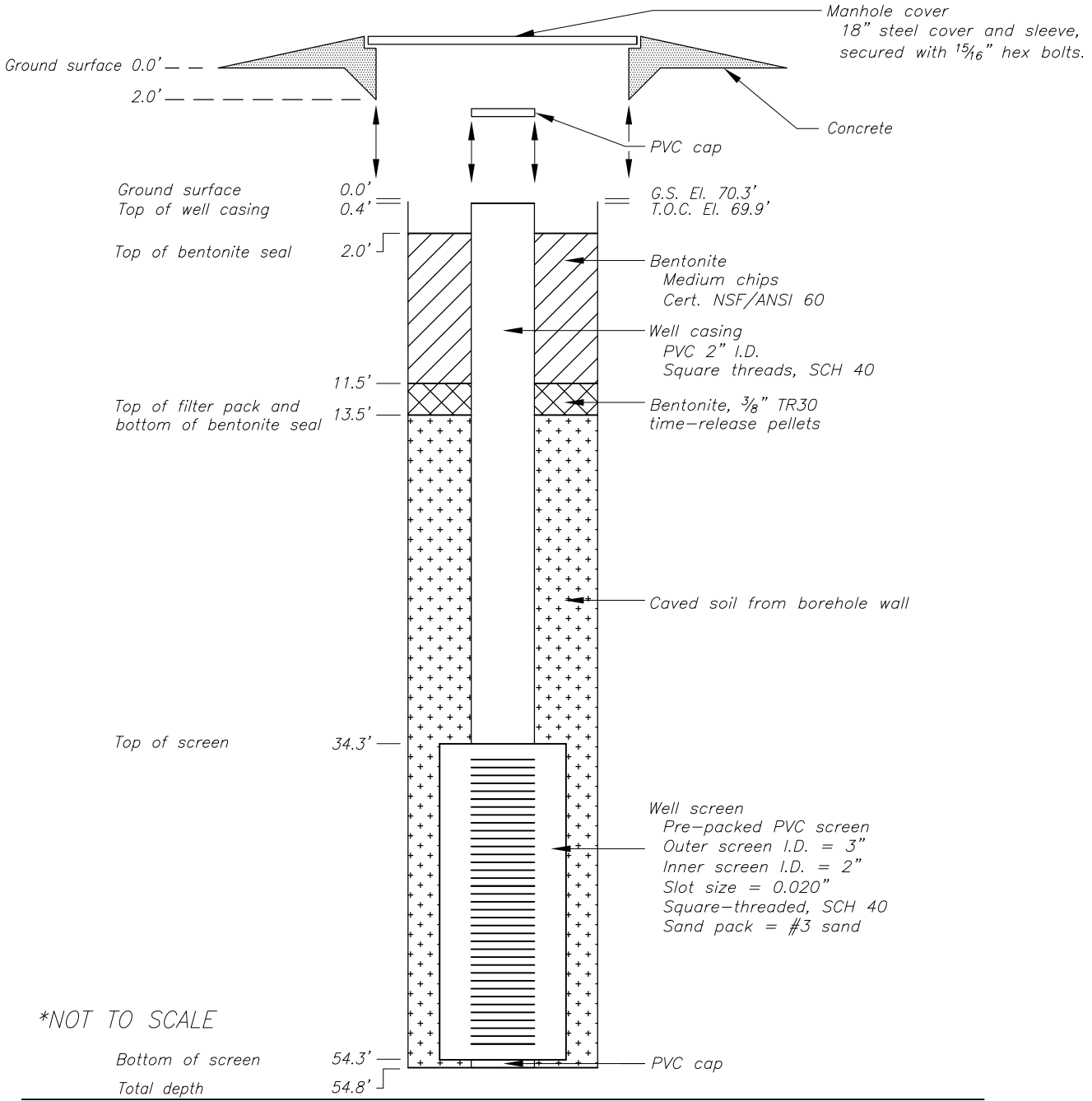
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		46										36.5		**33.8 to 33.9 ft.: FAT CLAY, CH:** About 90% fines with medium to high plasticity, medium toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; moist, greenish-gray, no reaction with HCl; firm consistency; zone was slightly disturbed.
			6.0	0.8	6.8	93.2	0.0	NP	NP	23.9	SP-SM 35.4	SM 36.1 / CH 36.0 / SM 35.4		**33.9 to 34.5 ft.: SILTY SAND, SM:** About 75% fine to medium sand; about 25% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, greenish-gray, no reaction with HCl.
	35													Laboratory Data Interval 33.9 to 34.5 ft.
		0										SM 30.4		**34.5 to 39.5 ft.: No Recovery - SILTY SAND, SM:** Description is based on drilling conditions and an adjacent CPT (CPT-09-123).
	40													**39.5 to 44.5 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction with HCl; soft consistency; disturbed when recovered.
		14	4.3	0.0	4.3	95.7	0.0	NP	NP	22.0	SP 25.4	SP 25.4	Qal	Laboratory Data Interval 39.5 to 44.5 ft.
														44.5 to 49.5 ft.: No Recovery - SILTY SAND, SM: Description is based on drilling conditions and an adjacent CPT (CPT-09-123).
	45													**49.5 to 54.5 ft.: SILTY SAND, SM:** About 85% fine to medium sand; about 15% non-plastic fines with rapid dilatancy; maximum size: medium sand; wet, gray, no reaction with HCl; soft consistency; disturbed.
		0										SM 20.4		Laboratory Data Interval 49.5 to 54.5 ft.
	50													***T.D. = 54.8 ft.***
		22	4.2	2.5	6.7	92.6	0.7	NP	NP	14.5	SP-SM 15.4	SM 15.4		

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–09–123	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/14/2009	HELPER: E. GONZALES
TOP OF WELL CASING COORDINATES: N2365513.5 E6000144.7 (NAD83) ELEVATION 69.9' (NAVD88) GROUND SURFACE ELEVATION 70.3' (NAVD88)	



NOTES:
T.O.C. = Top of well casing, I.D. = Inner Diameter, G.S. = Ground Surface, El. = Elevation
Drill hole was terminated at 54.8'. Running sands (clean) were very difficult to sample, no confining clay or silt layers were encountered below.
Sand backfills the well above the top of bentonite seal, inside the manhole.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-124

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Right, Merced County
BEGUN: 11/17/09 FINISHED: 11/19/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.3 ft. (El. 59.60 ft.) 11/19/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,365,953.6 E 6,000,779.3 (NAGD83)
TOTAL DEPTH: 50.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 70.0 ft. (NAVD88)
T.O.C ELEVATION: 69.90 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
Kevin Coy, Driller
Ernie Gonzales, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-124 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D., and 4-1/4-inch I.D., and a 5-foot-long 3-inch I.D. split sample barrel.

Interval Method
0.0 to 50.0 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 35.0 ft. - smooth drilling
35.0 to 50.0 ft. - difficult recovery conditions, poor recovery

DRILL FLUID, RETURN AND COLOR:
0.0 to 50.0 ft. - None

WATER LEVEL:
10.3 ft. b.g.s. on 11/19/2009

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

HOLE COMPLETION:
Well Casing - 0.1 to 29.5 ft. (T.O.C. El. 69.90 ft.)
Dual Pre-pack Screen - 29.5 to 49.5 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand Filter Pack - 27.0 to 50.0 ft. (#3 Sand and Native material caved)
Bentonite Seal - 2.0 to 27.0 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
5	80										(CL)s 64.7	
	100	52.9	31.0	83.9	16.1	0.0	29.2	12.8	13.9	(CL)s 60.6	(CL)s 60.6	
10										▼ 10.3 ft. (El. 59.60 ft.)	CL 57.5	
	100	61.9	27.0	88.9	11.1	0.0	29.4	8.4	24.1	CL 55.4	CL/ML 55.4	
15		39.4	55.8	95.2	4.8	0.0	39.5	23.4	20.0	CL 53.0	CL/CH 53.0	Qal
	100										CL 52.4 / CL/CH 51.1 / s(CL) 50.7	
20	6	9.6	5.3	14.9	85.1	0.0	NP	NP	37.2	SM 44.9	SM 44.6	
25	100	53.0	19.1	72.1	27.9	0.0	NP	NP	24.7	(ML)s 39.9	(ML)s 39.9	

0.0 to 50.0 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 5.2 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, strong reaction with HCl; hard consistency; organics.

5.2 to 9.3 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; dry, light brown, weak reaction with HCl; hard consistency.

Laboratory Data Interval
5.2 to 9.3 ft.

9.3 to 12.4 ft.: LEAN CLAY, CL: About 90% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; hard consistency.

12.4 to 14.5 ft.: SILTY CLAY, CL/ML: About 90% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
12.4 to 14.5 ft.

14.5 to 16.9 ft.: LEAN TO FAT CLAY, CL/CH: About 95% fines with high plasticity, toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; hard consistency.

Laboratory Data Interval
14.5 to 16.9 ft.

16.9 to 17.5 ft.: LEAN CLAY, CL: About 95% fines with medium plasticity, toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; firm consistency.

17.5 to 18.8 ft.: LEAN TO FAT CLAY, CL/CH: About 95% fines with high plasticity, toughness and dry strength, and no dilatancy; about 5% fine sand; maximum size: fine sand; dry, light brown, no reaction with HCl; hard consistency.

18.8 to 19.2 ft.: SANDY LEAN CLAY, s(CL): About 60% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 40% fine to medium sand; maximum size: medium sand; dry, gray, no reaction with HCl; firm consistency.

19.2 to 25.3 ft.: SILTY SAND, SM: About 70% fine sand; about 30% non-plastic fines with rapid dilatancy; maximum size: fine sand; dry, gray, no reaction with HCl; soft consistency.

Laboratory Data Interval
19.2 to 25.0 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-09-124

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Right, Merced County
BEGUN: 11/17/09 FINISHED: 11/19/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.3 ft. (El. 59.60 ft.) 11/19/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,365,953.6 E 6,000,779.3 (NAGD83)
TOTAL DEPTH: 50.3 ft.

STATE: California
GROUND SURFACE ELEVATION: 70.0 ft. (NAVD88)
T.O.C ELEVATION: 69.90 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

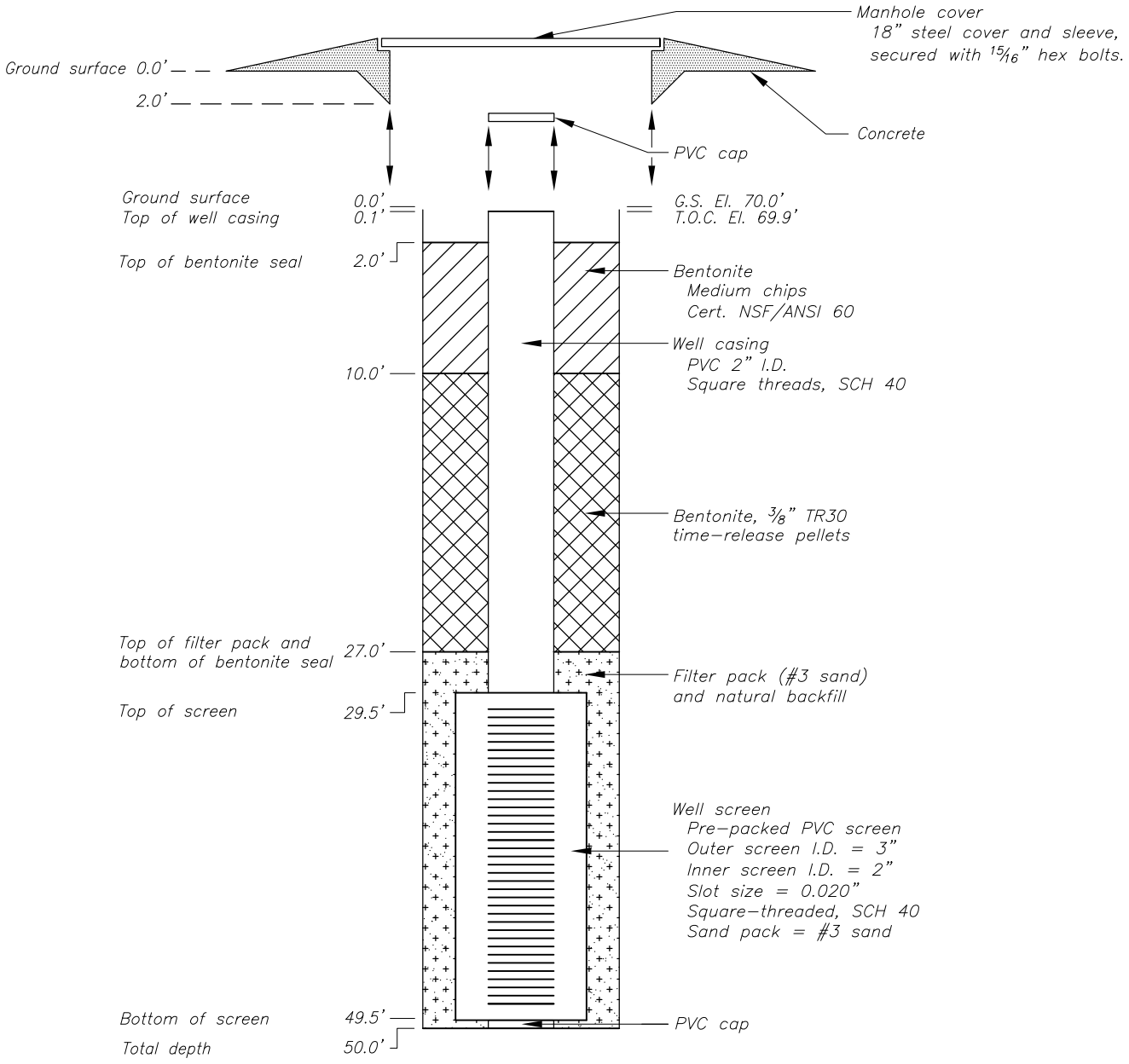
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
												SM 38.4		**25.3 to 30.0 ft.: SILT WITH SAND, (ML)s:** About 75% fines with low plasticity, toughness and dry strength, and slow dilatancy; about 25% fine sand; maximum size: fine sand; moist, gray, no reaction with HCl; soft consistency.
		56	3.4	0.0	3.4	96.6	0.0	NP	NP	23.4	SP 34.9	SP 34.9		Laboratory Data Interval 25.3 to 30.0 ft.
	35													**30.0 to 31.5 ft.: SILTY SAND, SM:** About 80% fine to medium sand; about 20% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, gray, no reaction with HCl; soft consistency.
		14										SM 30.9		**31.5 to 35.0 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; gray, no reaction with HCl; soft consistency; core loss throughout run, disturbed.
												SP 30.7		Laboratory Data Interval 31.5 to 35.0 ft.
	40												Qal	**35.0 to 39.0 ft.: No Recovery - SILTY SAND, SM:** Description based on drilling conditions.
		0												**39.0 to 39.2 ft.: POORLY GRADED SAND, SP:** About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; gray, no reaction with HCl; soft consistency; core loss throughout run, disturbed.
	45											SM		**39.2 to 50.0 ft.: No Recovery - SILTY SAND, SM:** Description based on drilling conditions.
		0												***T.D. = 50.0 ft.***
	50											19.9		

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–09–124	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/19/2009	HELPER: E. GONZALES
TOP OF WELL CASING COORDINATES: N2365953.6 E6000779.3 (NAD83) ELEVATION 69.9' (NAVD88) GROUND SURFACE ELEVATION 70.0' (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.

GEOLOGIC LOG OF DRILL HOLE NO. MW-09-125

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Right, Merced County
BEGUN: 11/19/09 FINISHED: 11/20/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.1 ft. (El. 63.99 ft.) 11/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,367,038.9 E 6,004,739.0 (NAGD83)
TOTAL DEPTH: 49.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 74.4 ft. (NAVD88)
T.O.C ELEVATION: 74.09 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
Kevin Coy, Driller
Ernie Gonzales, Helper

DRILL RIG:
CME-550

DRILLING & SAMPLING METHODS:
Drill hole MW-09-125 was advanced using hollow stem flight augers dry core system (FADC) with a 7-5/8-inch O.D., and 4-1/4-inch I.D., and a 5-foot-long 3-inch I.D. split sample barrel.

Interval Method
0.0 to 49.5 ft. - FADC

DRILLING CONDITIONS AND DRILLER'S COMMENTS:
0.0 to 29.5 ft. - smooth drilling
29.5 to 34.5 ft. - difficult recovery conditions, poor recovery
34.5 to 39.5 ft. - smooth drilling
39.5 to 49.5 ft. - difficult recovery conditions, poor recovery

DRILL FLUID, RETURN AND COLOR:
0.0 to 50.0 ft. - None

WATER LEVEL:
10.1 ft. bgs, on 11/19/2009

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

HOLE COMPLETION:
Well Casing - 0.3 to 29.0 ft. (T.O.C. El. 74.09 ft.)
Dual Pre-pack Screen - 29.0 to 49.0 ft. (Slotted 0.020-inch)
Well Screen Filter Pack - #3 Sand
Filter Pack - 25.0 to 49.5 ft. (#3 Sand)
Bentonite Seal - 2.0 to 25.0 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
	80										SM 68.9	
5		23.3	10.4	33.7	66.3	0.0	NP	NP	11.2	SM 67.2	SM 67.2	
	90											
10		4.7	1.2	5.9	94.1	0.0	NP	NP	11.2	▼ 10.1 ft. (El. 63.99 ft.) SP-SM 59.6	SP/SM 59.6	
	44											
15											SM 54.6	
	0											
20											SP/SM 50.9	
	64	48.2	12.7	60.9	38.9	0.2	NP	NP	24.1	s(ML) 50.0	SM 50.0	
											SM 49.7	
											ML 49.3	
25											(ML)s 49.2	Qal
		8.5	4.4	12.9	87.1	0.0	NP	NP	27.8	SM 48.4	SM 48.4	
											(ML)s 48.0	
	66	4.8	3.7	8.5	91.5	0.0	NP	NP	22.9	SP-SM 45.3	SP 45.3	
											CL/ML 45.0	
											s(ML) 44.6	

0.0 to 49.5 feet
QUATERNARY ALLUVIUM (Qal)

0.0 to 5.2 ft.: SILTY SAND, SM: About 70% fine to medium sand; about 30% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, reddish-brown, no reaction with HCl; soft consistency; organics.

5.2 to 6.9 ft.: SILTY SAND, SM: About 65% fine to medium sand (mostly fine); about 35% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, light brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
5.2 to 6.9 ft.

6.9 to 14.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, medium brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
6.9 to 14.5 ft.

14.5 to 19.5 ft.: No Recovery - SILTY SAND, SM: Description is based on drilling conditions and an adjacent CPT (CPT-09-125).

19.5 to 23.2 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine to medium sand; about 10% non-plastic fines with rapid dilatancy; maximum size: medium sand; moist, medium brown, no reaction with HCl; soft consistency.

23.2 to 24.1 ft.: SILTY SAND, SM: About 60% fine sand: about 40% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, gray, no reaction with HCl.

Laboratory Data Interval
23.2 to 24.1 ft.

24.1 to 24.4 ft.: SILTY SAND, SM: About 55% fine sand; about 45% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.

24.4 to 24.8 ft.: SILT, ML: About 90% fines with low plasticity, toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; moist, gray, no reaction with HCl; soft consistency.

24.8 to 24.9 ft.: SILT WITH SAND, (ML)s: About 85% fines with low plasticity, toughness and dry strength, and rapid dilatancy; about 15% fine sand; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.

24.9 to 25.7 ft.: SILTY SAND, SM: About 85% fine sand; about 15% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, brown, no reaction with HCl; soft consistency.

Laboratory Data Interval
24.9 to 25.7 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-09-125

FEATURE: Groundwater Monitoring
LOCATION: Reach 5, River Bank Right, Merced County
BEGUN: 11/19/09 FINISHED: 11/20/09
DEPTH AND ELEVATION OF WATER LEVEL
AND DATE MEASURED: 10.1 ft. (El. 63.99 ft.) 11/20/2009

PROJECT: San Joaquin River Restoration Project
COORDINATES: N 2,367,038.9 E 6,004,739.0 (NAGD83)
TOTAL DEPTH: 49.5 ft.

STATE: California
GROUND SURFACE ELEVATION: 74.4 ft. (NAVD88)
T.O.C ELEVATION: 74.09 ft. (NAVD88)
HOLE LOGGED BY: J. Vauk
REVIEWED BY: A. Warren

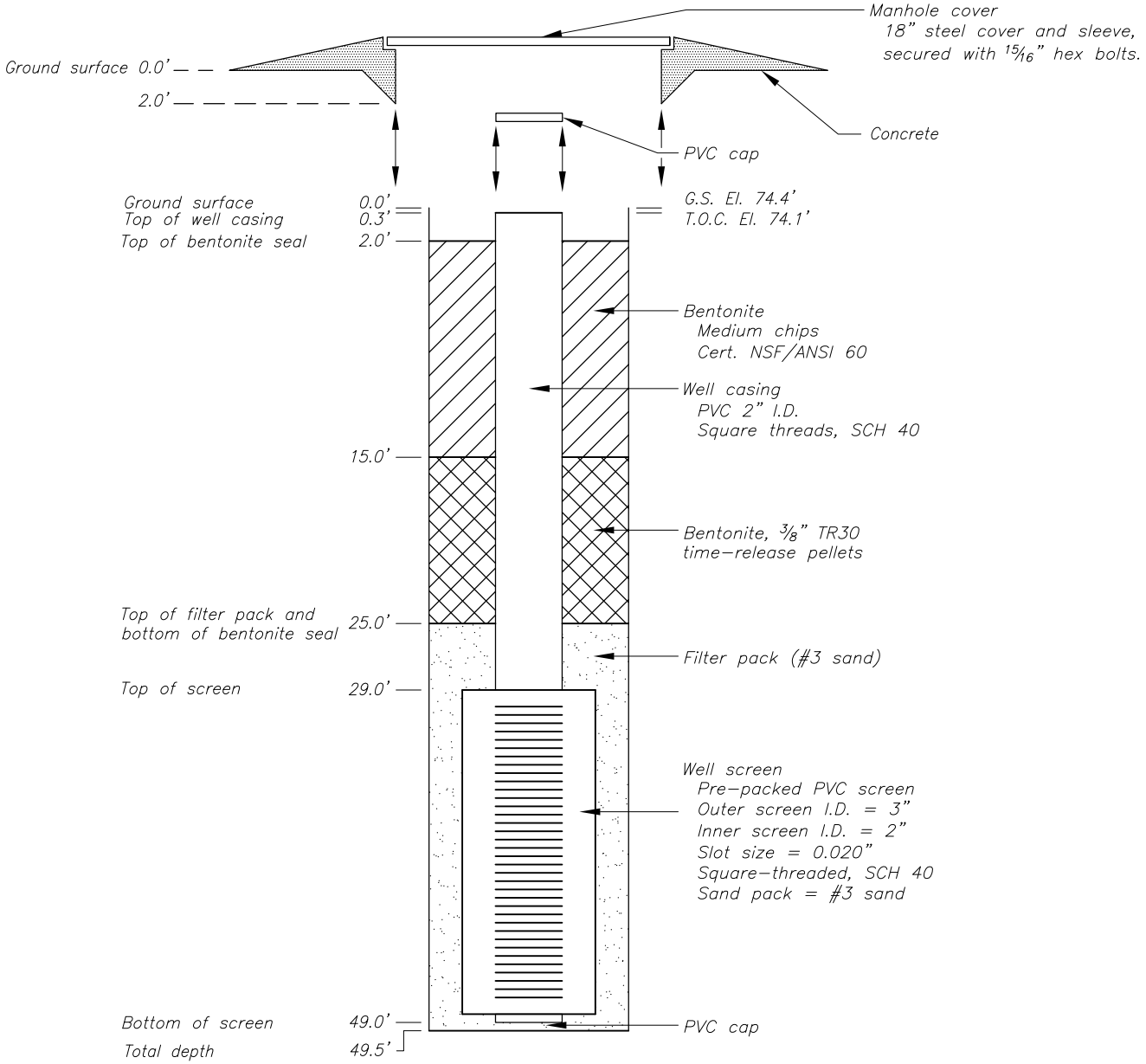
NOTES	DEPTH	% CORE RECOVERY	LABORATORY DATA: % SILT	% CLAY	% FINES	% SAND	% GRAVEL	LIQUID LIMIT	PLASTICITY INDEX	MOISTURE CONTENT %	LABORATORY CLASSIFICATION / ELEVATION	VISUAL CLASSIFICATION / ELEVATION	GEOLOGIC UNIT SYMBOL	CLASSIFICATION AND PHYSICAL CONDITION
		0										SM 39.6		**25.7 to 26.1 ft.: SILT WITH SAND, (ML)s:** About 75% non-plastic fines with rapid dilatancy; about 25% fine sand; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.
														26.1 to 28.8 ft.: POORLY GRADED SAND, SP: About 95% fine to medium sand; about 5% non-plastic fines with rapid dilatancy; maximum size: medium sand; core loss.
	35	68	8.1	1.3	9.4	90.6	0.0	NP	NP	25.2	SP-SM 36.6	SP/SM 34.6	Qal	Laboratory Data Interval 26.1 to 28.8 ft.
														28.8 to 29.1 ft.: SILTY CLAY, CL/ML: About 90% fines with medium plasticity, low toughness and dry strength, and no dilatancy; about 10% fine sand; maximum size: fine sand; moist, gray, no reaction with HCl; soft consistency.
														29.1 to 29.5 ft.: SANDY SILT, s(ML): About 50% non-plastic fines with rapid dilatancy; about 50% fine sand; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.
	40	0												**29.5 to 34.5 ft.: No Recovery - SILTY SAND, SM:** Description is based on drilling conditions and an adjacent CPT (CPT-09-125).
														34.5 to 39.5 ft.: POORLY GRADED SAND WITH SILT, SP/SM: About 90% fine sand; about 10% non-plastic fines with rapid dilatancy; maximum size: fine sand; wet, gray, no reaction with HCl; soft consistency.
	45	0										SM 24.6		Laboratory Data Interval 34.5 to 39.5 ft.
														39.5 to 49.5 ft.: No Recovery - SILTY SAND, SM: Description is based on drilling conditions and an adjacent CPT (CPT-09-125).
														T.D. = 49.5 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–09–125	GEOLOGIST: J. VAUK
WELL COMPLETION DIAGRAM	DRILLER: K. COY
DATE COMPLETED: 11/20/2009	HELPER: E. GONZALES
TOP OF WELL CASING COORDINATES: N2367038.9 E6004739.0 (NAD83) ELEVATION 74.1' (NAVD88) GROUND SURFACE ELEVATION 74.4' (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.