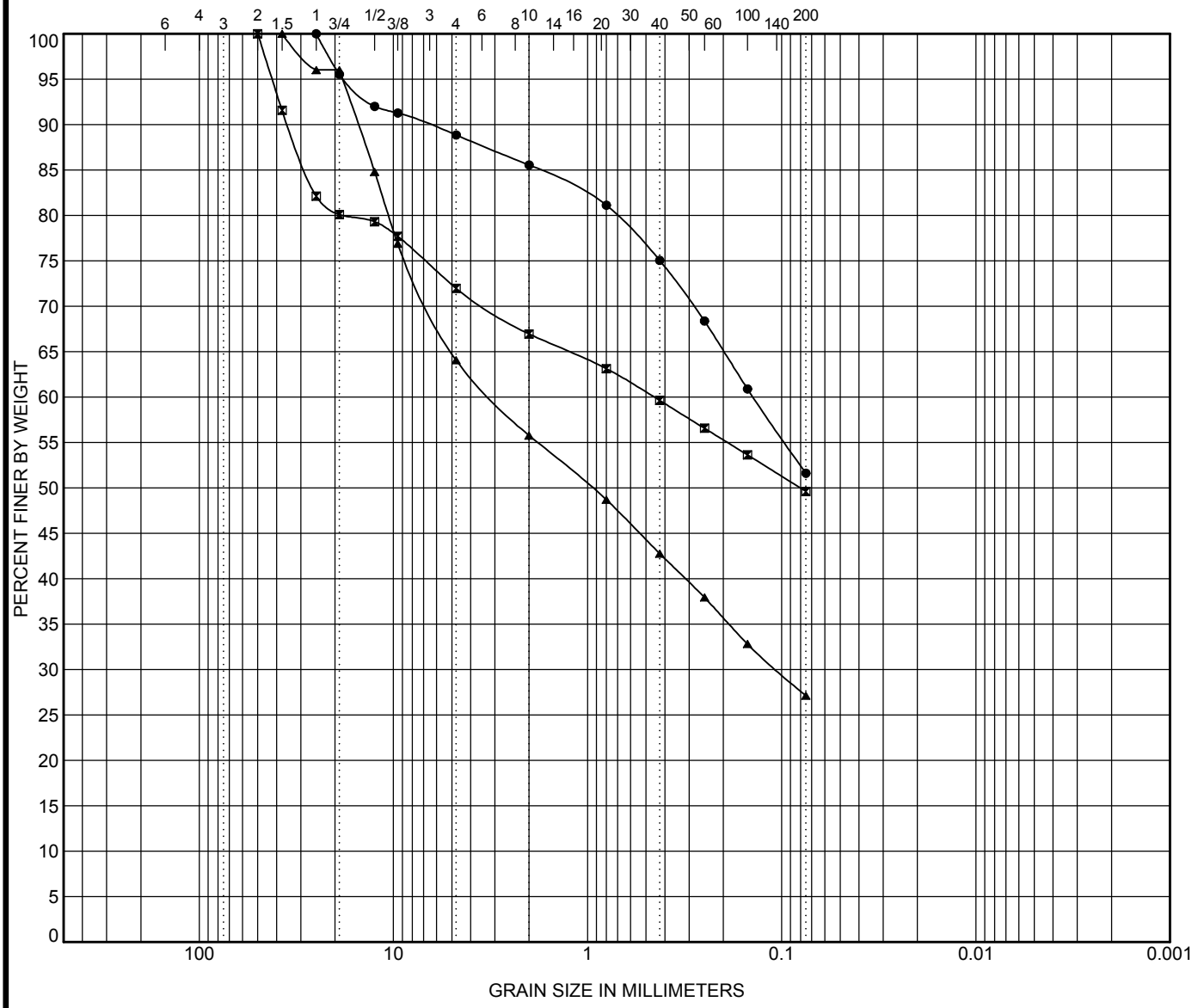
Appendix C: Infiltration Test Plots and Grain Size Analysis



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample No.	Classification	LL	PL	PI	Cc	Cu
●	SI-DR-3						
⊠	SI-DR-6						
▲	SI-DR-8						

	Sample No.	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	SI-DR-3	**25**	**0.14**			**11.1**	**37.2**	**51.6**	
⊠	SI-DR-6	**50**	**0.455**			**28.0**	**22.4**	**49.6**	
▲	SI-DR-8	**37.5**	**3.112**	**0.107**		**35.9**	**36.9**	**27.1**	

Geocon Consultants, Inc
3160 Gold Valley Drive, Suite 800
Rancho Cordova, CA 95742
Telephone: 916-852-9118
Fax: 916-852-9132
GEOCON

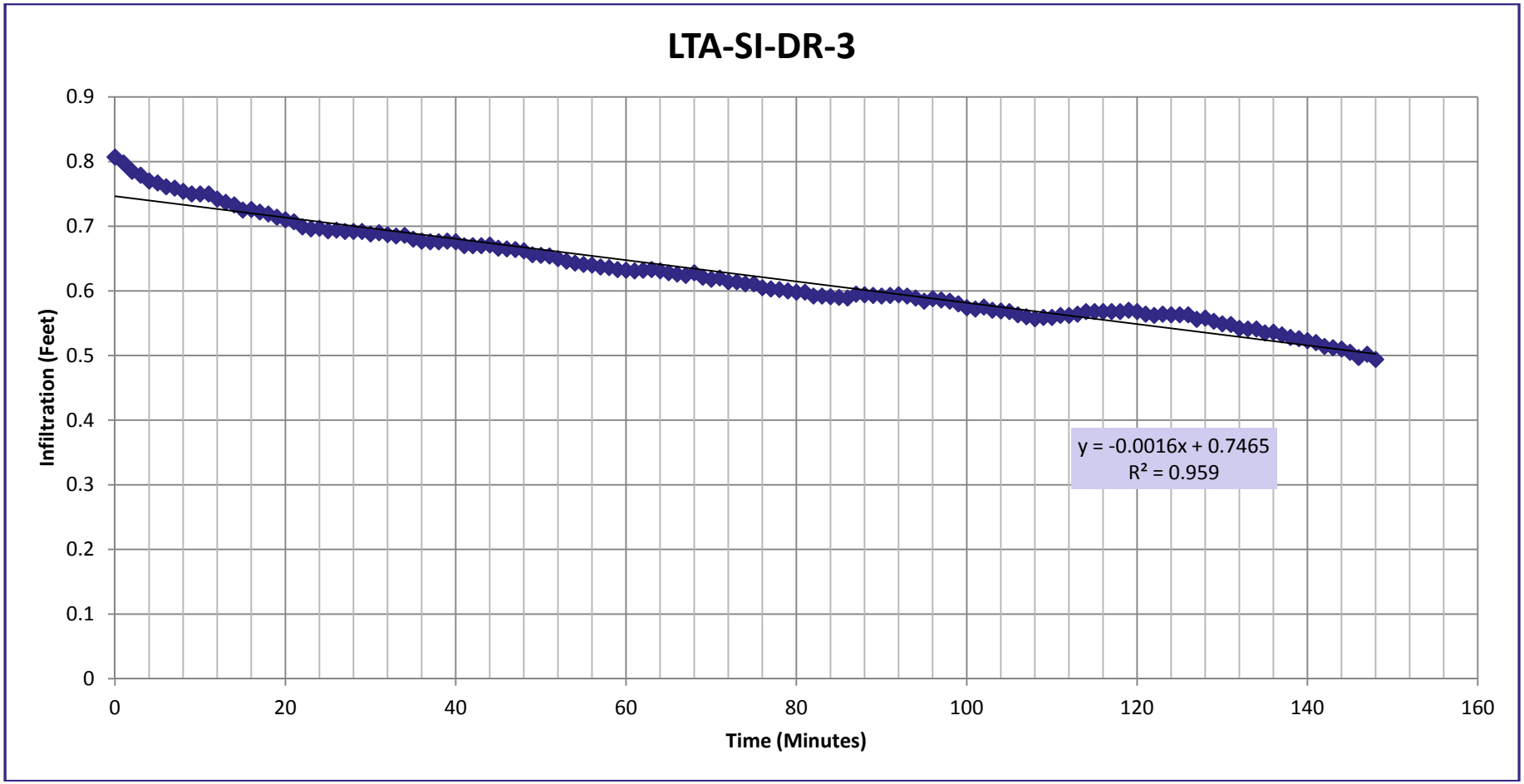
GRAIN SIZE DISTRIBUTION

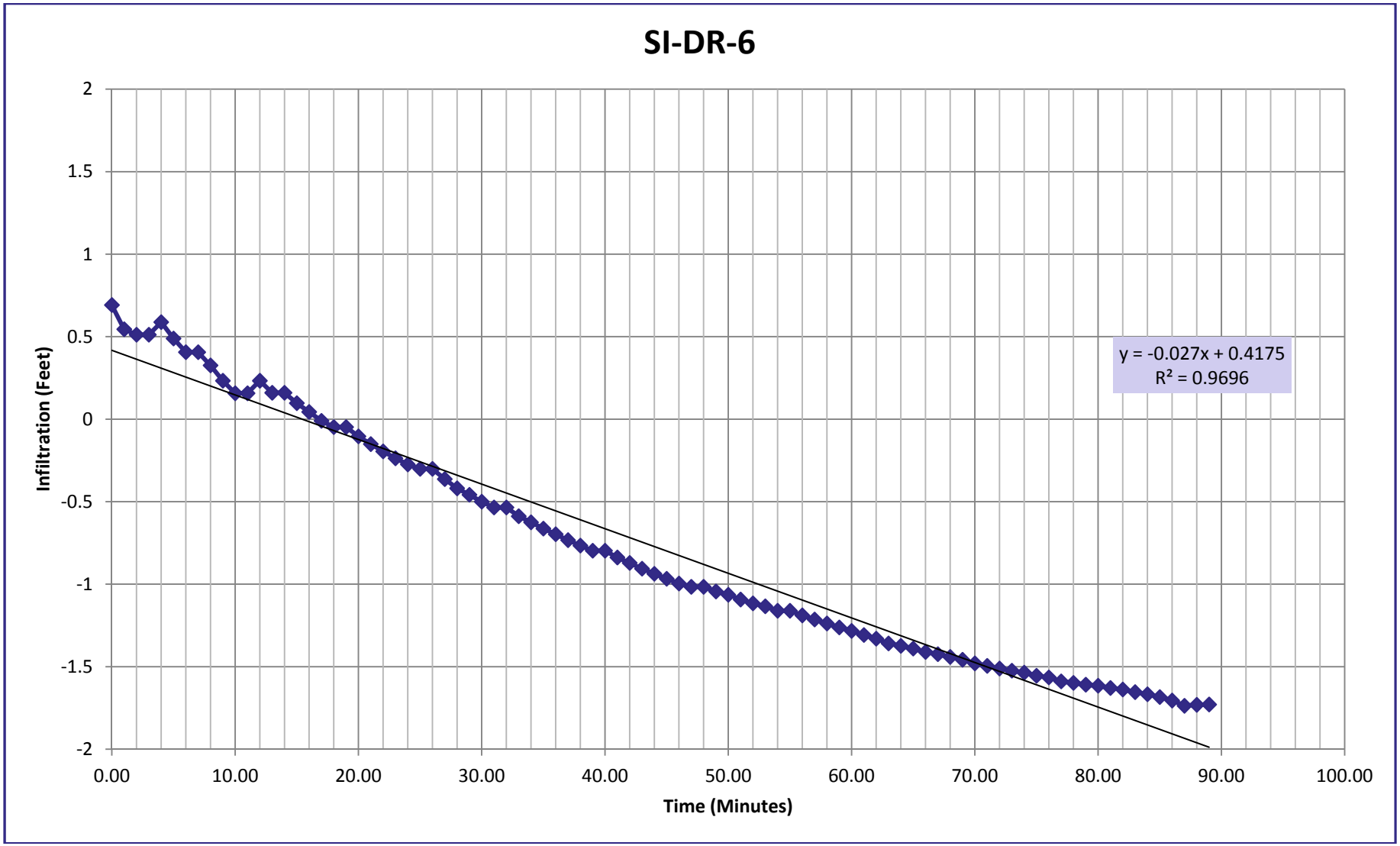
Project: Lower Tuscan Aquifer (138604.400)

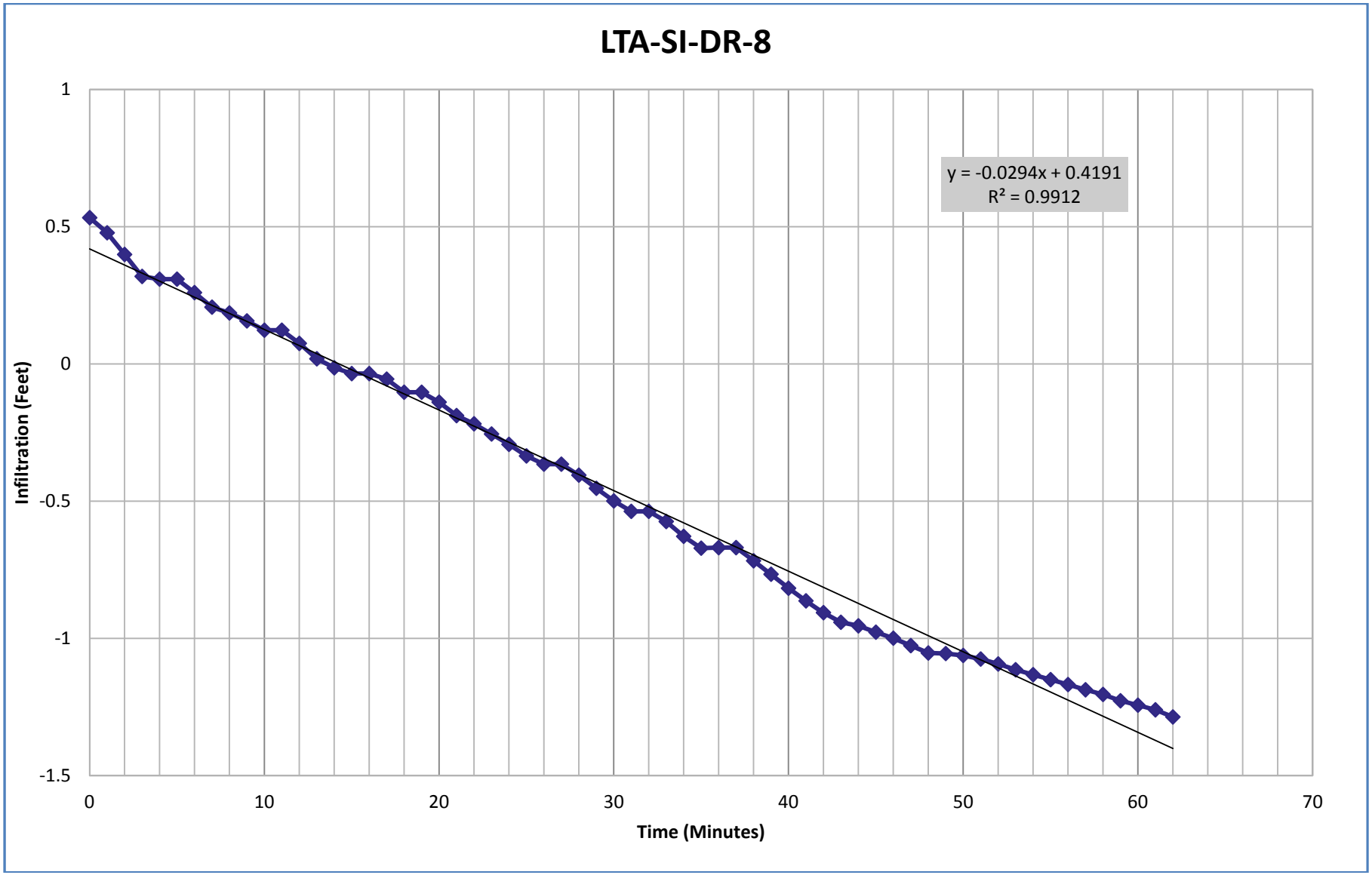
Location: Chico, CA

Number: S9555-06-01

GRAIN SIZE COPY 3 S9555-06-01 LOWER TUSCAN AQUIFER.GPJ US LAB.GDT 9/22/11


LTA-SI-DR-3
Infiltration (Feet)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
120
140
160
Time (Minutes)
y = -0.0016x + 0.7465
R² = 0.959


SI-DR-6
Infiltration (Feet)
Time (Minutes)
y = -0.027x + 0.4175
R² = 0.9696
2
1.5
1
0.5
0
-0.5
-1
-1.5
-2
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00


LTA-SI-DR-8
y = -0.0294x + 0.4191
R² = 0.9912
Infiltration (Feet)
Time (Minutes)
1
0.5
0
-0.5
-1
-1.5
0
10
20
30
40
50
60
70

Appendix D: Finalized Geologic Boring Logs and Well Construction Diagrams

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0136959

Page 1 of 8

Owner's Well Number MW-MT-1(shallow/inter/dp)

Date Work Began 08/16/2010 Date Work Ended 10/25/2011

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000009 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid Polymer mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	11	Sand - dk reddish brown (alluvium)
11	34	Clay - light tan (alluvium)
34	63	Gravelly sand (alluvium)
63	70	Sandstone - reddish brwn (alluvium)
70	108	Silty clay/clay - light tan (alluvium)
108	115	Sandy gravel (alluvium)
115	153	Clayey sand/clay - light gray (alluvium)
153	162	Sandy gravel (alluvium)
162	179	Clay - reddish brown (Tuscan Unit D)
179	183	Sandstone - dk reddish brwn (Tuscan Unit D)
183	225	Sand/Sandy clay/gravelly sand (Tuscan Unit D)
225	234	Clay w/sand - brwn (Tuscan Unit D)
234	352	Sand/silty sand - light brn to gray (Tuscan Unit D)
352	374	Sandy gravel (Tuscan Unit C)
384	388	Conglomerate (Tuscan Unit C)
388	400	Sandstone - dk reddish brown (Tuscan Unit C)
400	420	Claystone - light reddish brown (Tuscan Unit C)
420	455	Sandstone (Tuscan Unit C)
455	555	Claystone - reddish brown (Tuscan Unit C)
555	584	Clayey sand (Tuscan Unit C)
584	588	Sandstone - brown (Tuscan Unit B)
588	605	Clayey sand (Tuscan Unit B)
605	645	Claystone (Tuscan Unit B)
645	648	Sandstone - black (Tuscan Unit B)
648	657	Claystone - brown (Tuscan Unit B)
657	659	Sand - black (Tuscan Unit B)
659	670	Claystone - brown (Tuscan Unit B)
670	693	Clayey sand - brown (Tuscan Unit B)
693	697	Sandstone - reddish brown (Tuscan Unit B)
697	702	Clayey sand - brown (Tuscan Unit B)

Total Depth of Boring 897 Feet

Total Depth of Completed Well 830 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 3964 Chico River Road

City Chico County Butte

Latitude 38 Deg. 40 Min. 23 Sec. N Longitude 121 Deg. 55 Min. 14 Sec. W

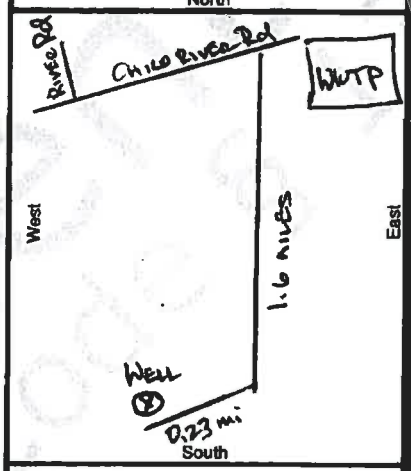
Datum Decimal Lat. 39.6730236 Decimal Long. 121.92068

APN Book 038 Page 530 Parcel 018

Township 21N Range 1W Section 3

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
◉ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 14 (Feet) Date Measured 05/12/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	355	12	Blank	PVC Sch. 80	0.276	2.875		
355	385	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	570	12	Blank	PVC Sch. 80	0.276	2.875		
570	590	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	780	12	Blank	PVC Sch. 80	0.276	2.875		
780	820	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	60	Cement	Sanitary seal
60	280	Bentonite w/sand	Transition seal
280	400	Filter Pack	#3 sand
400	550	Bentonite w/sand	Transition seal
550	610	Filter Pack	#2/12 sand
610	758	Bentonite w/sand	Transition seal

Attachments

☑ Geologic Log
☑ Well Construction Diagram
☑ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name [illegible] Person, Firm or Corporation

[illegible] Address Zamora City CA State 95698 Zip

Signed [illegible] C-57 Licensed Water Well Contractor

9/17/11 Date Signed

783526 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to [illegible] No. (

Page 2 of 8

Owner's Well Number MW-MT-1(shallow/inter/dp)

Date Work Began 08/16/2010 Date Work Ended 10/25/2011

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000009 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid Polymer mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
702	708	Sand - black (Tuscan Unit B)
708	712	Claystone - grayish brown (Tuscan Unit B)
712	719	Sandy gravel - grayish brown (Tuscan Unit B)
719	738	Clayey sand - brown (Tuscan Unit B)
738	766	Sand - black (Tuscan Unit B)
766	775	Claystone - grayish brown (Tuscan Unit B)
775	803	Sand/Clayey Sand - gray brn to blk (Tuscan Unit B)
803	825	Sandstone/Sand - gray to black (Tuscan Unit A)
825	827	Claystone - brown (Tuscan Unit A)
827	897	Sand/Sandy gravel - black (Tuscan Unit A)

Total Depth of Boring 897 Feet

Total Depth of Completed Well 830 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 3964 Chico River Road

City Chico County Butte

Latitude 38 Deg. 40 Min. 23 Sec. N Longitude 121 Deg. 55 Min. 14 Sec. W

Datum Decimal Lat. 39.6730236 Decimal Long. 121.92060

APN Book 038 Page 530 Parcel 018

Township 21N Range 1W Section 3

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North / West / East / South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply

☐ Domestic ☐ Public

☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

◉ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 14 (Feet) Date Measured 05/12/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
758	830	Filter Pack	#3 sand
830	848	Bentonite w/sand	Bottom seal
848	897	Fill	sluff

Attachments

☑ Geologic Log

☑ Well Construction Diagram

☑ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Ron Nees

Person, Firm or Corporation

Address Zamora City CA State 95698 Zip

Signed [signature] 9/7/11 785326

C-57 Licensed Water Well Contractor Date Signed C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
SCREEN INTERVAL	(ft-bgs)	355 to 385	570 to 590	780 to 820
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -500 to 0; 64 in (ohm-m) -3 to 250; Gamma (api) -3 to 250; 16 in (ohm-m) -1 to 100

QUARTERNARY ALLUVIUM

Sand: with silt, dark reddish brown, dry; poorly sorted, subrounded grains, mixed compostion volcanics (rhyloite and basalt), quartz, and some metamorphics, some pebbles

8.5 ft bgs: increase in pebbles, subrounded to rounded, basalt, clasts up to 1 cm

Clay: light tan, some silt, trace very fine sand, low plasticity, moist

33.5 ft bgs: decrease in moisture, clays balling, minor 0.5 cm rounded basalt clasts

Gravelly Sand: medium to coarse sand, subangular to subrounded, gravel up to 4 cm; subangular to subrounded, mixed composition of volcanics (basalt, rhyolite, andesite), quartz, and trace metamorphics

40-48 ft bgs: increasing gravel

SANDSTONE: reddish brown, moderatley indurated, >20% fines

Silty Clay: light tan, trace fine sand, low plasticity

88-90 ft bgs: color change to light brown, incresae in fine sand

Clay: 100-108 ft bgs: increase in sand; poor to no returns

Sandy Gravel: rounded to subrounded clasts, up to 4 cm, mixed composition volcanics, quartz, metamorphics

Clayey Sand: fine grained with minor gravel. poor sample return

Quaternary Alluvium

Cement grout

Bentonite chips and #60 sand

12" dia. borehole

2.5" dia. Sch 80 PVC

0 — 50 — 100

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
- Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
- Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

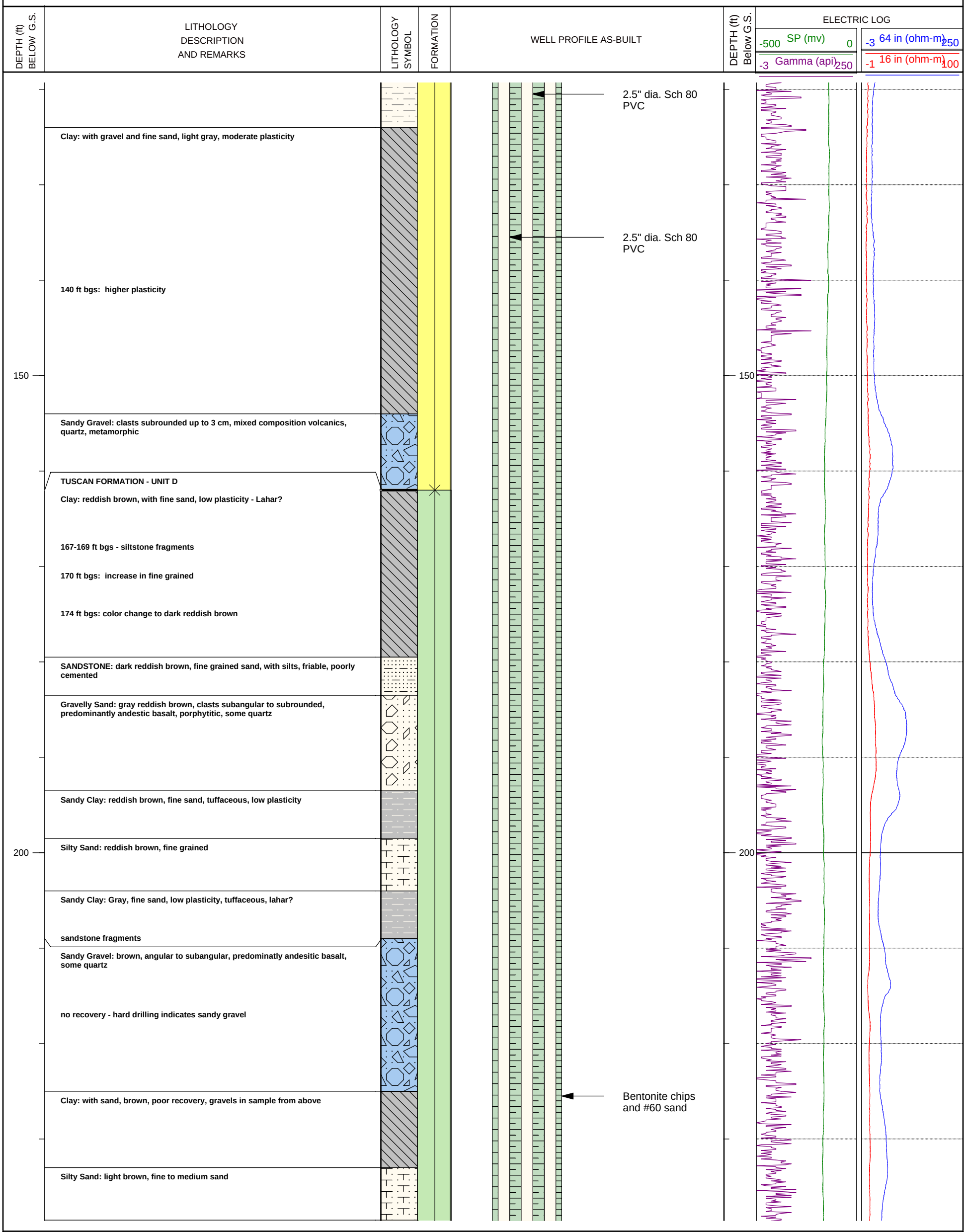
Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
SCREEN INTERVAL	(ft-bgs)	355 to 385	570 to 590	780 to 820
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)



Legend:
ft bgs - feet below ground surface
ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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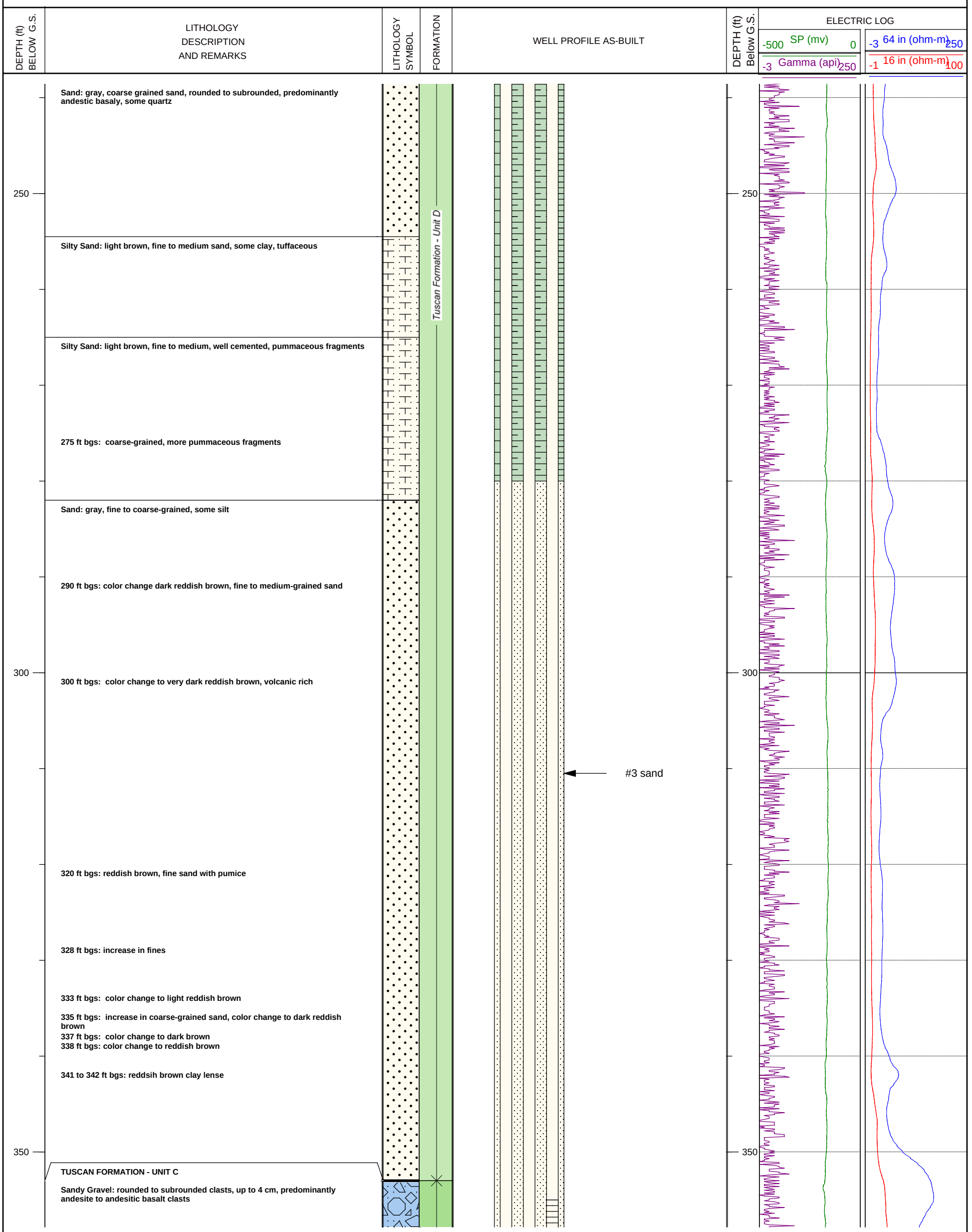

Legend: ft bgs - feet below ground surface; ft msl - feet above mean sea level

GSE - ground surface elevation

Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs

Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs

Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
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WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
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SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)

DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
	CONGLOMERATE: clast-supported, gravel to ~ 15 cm, andestic-basalt, rhyolite clasts, some chert.
	SANDSTONE: fine to medium sand,matrix-supported, dark reddish brown, Lahar
400	**399 ft bgs: color change to light brown/tan**
	CLAYSTONE: light reddish brown; chips returning in cuttings with fine sand
	403 ft bgs: color change to dark reddish brown
	405 ft bgs: drive casing very difficult to advance - stop ARCH drilling - cannot control water production - change to flooded reverse circulation drilling
	411 ft bgs: color change to reddish brown, hard, well indurated, tuffaceous, some sand
	416 ft bgs: increase in coarse sand, matrix-supported, fragments of lahar (predominantly andesite/dacite)
	418 ft bgs: decrease in coarse sand, claystone as above
	SANDSTONE: increase in sand from above
	425 ft bgs: moderate plasticity, soft to stiff
	430 ft bgs: increase in sand content, claystone/sandstone, hard
	435 ft bgs: decrease in sand content
	445 ft bgs: increase in coarse and fine sand content, matrix-supported, fragments of lahar
450	**450 ft bgs: claystone/sandstone, decrease in coarse sand, fine to medium grained sand**
	CLAYSTONE: reddish brown, increase in clay, some sand
	475 ft bgs: increase in sand, some gray-brown sandy clay fragments

LITHOLOGY SYMBOL

FORMATION

Tuscan Formation - Unit C

WELL PROFILE AS-BUILT

0.020-in slotted Sch 80 PVC

#3 sand

Bentonite chips and #60 sand

DEPTH (ft) Below G.S.

ELECTRIC LOG

SP (mv): -500 to 0

64 in (ohm-m): -3 to 250

Gamma (api): -3 to 250

16 in (ohm-m): -1 to 100

400

450

Legend:
ft bgs - feet below ground surface
ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs

Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
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Brown AND Caldwell

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LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
SCREEN INTERVAL	(ft-bgs)	355 to 385	570 to 590	780 to 820
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -500 to 0; Gamma (api) -3 to 250; 64 in (ohm-m) -3 to 250; 16 in (ohm-m) -1 to 100

480 ft bgs: no gray-brown sandy clay fragments

485 ft bgs: some fragments very well indurated

500

500 ft bgs: some light brown clay fragments

525 ft bgs: trace fragments of white tuff

530 ft bgs: no tuff fragments

535 ft bgs: white tuff fragments

540 ft bgs: increase in tuff fragments, increase in hard, well indurated red-brown fragments

545 ft bgs: increase in sand (coarse), no tuff fragments, clay (low to medium plasticity), few well indurated fragments

550

Clayey Sand: Increase in sand, no observable tuff fragments

565 ft bgs: increase in clay content, decrease in sand content

570 ft bgs: increase in sand, fine to medium-grained

575 ft bgs: increase in coarse sand, trace white tuff fragments

TUSCAN FORMATION - UNIT B

SANDSTONE: Brown, hard sandstone (fine to medium) with clay

Clayey Sand: Grayish-brown, increase in coarse sand, low plasticity

593 ft bgs: increase in clay

0.020-in slotted Sch 80 PVC

#2/12 sand

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
- Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
- Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
SCREEN INTERVAL	(ft-bgs)	355 to 385	570 to 590	780 to 820
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -500 to 0; Gamma (api) -3 to 250; 64 in (ohm-m) -3 to 250; 16 in (ohm-m) -1 to 100

600

603 ft bgs: color change to reddish brown

CLAYSTONE: decrease in sand to claystone

610 ft bgs: increase in sand

615 ft bgs: clay fragments stiff to hard

620 ft bgs: Increase in sand, fragments hard, sandstone/claystone

635 ft bgs: increase in fines

SANDSTONE: coarse-grained black sand, some claystone fragments

650

CLAYSTONE: with sand, brown

Sand: black,medium to coarse

CLAYSTONE: with sand, brown

664 ft bgs: interbedded sand zones

Clayey Sand: brown, sandy clay to clayey sand, fine to coarse sand

680 ft bgs: increase coarse sand

683 to 684 ft bgs: small coarse black sand zone

687 ft bgs: white tuff fragments

SANDSTONE: reddish-brown, coarse gravel (up to 0.3 cm), basalt, rhyolite, tuff clasts, matrix-supported

Clayey Sand: brown, sandy clay to clayey sand, increase in coarse sand at 699 ft bgs, tuffaceous (pink to white) @ 699 ft bgs to 700 ft bgs

700

699 ft bgs: increase in coarse sand, tuffaceous (pink to white) @699 ft bgs to 700 ft bgs

Sand: black, fine to coarse-grained

707 ft bgs: abundant tuff fragments

CLAYSTONE: grayish-brown claystone with sand,tuffaceous

Sandy Gravel: grayish brown,subangular to subrounded, clasts up to 1-inch, volcanic (andesitic basalt and rhyolites)

Tuscan Formation - Unit B

Bentonite chips and #60 sand

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
- Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
- Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

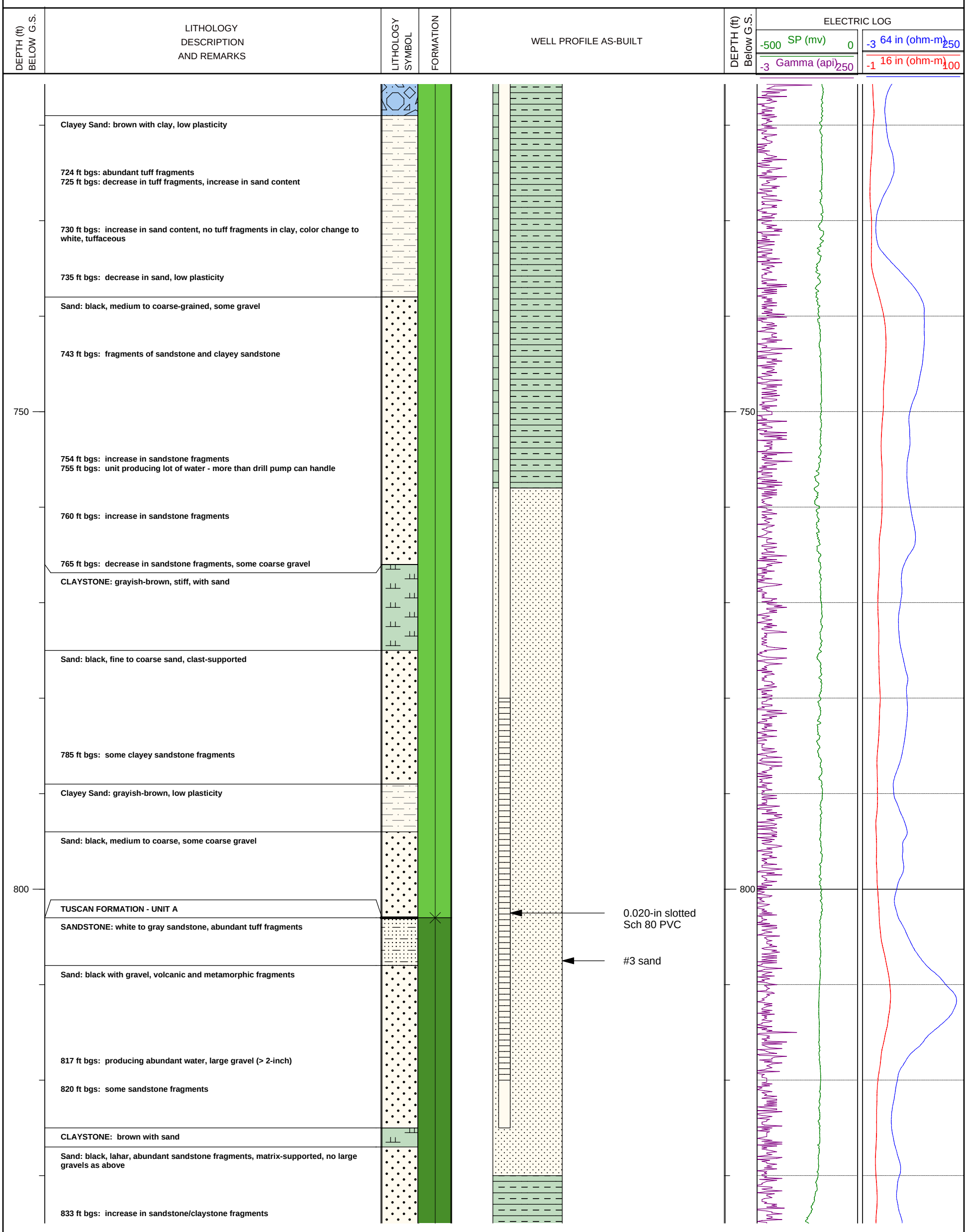
Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
SCREEN INTERVAL	(ft-bgs)	355 to 385	570 to 590	780 to 820
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)



Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	M&T Ranch, 3964 Chico River Road, Chico, CA
LATITUDE	39.6730236
LONGITUDE	121.9206227
GSE (ft-msl)	127.68 (NW corner of concrete slab)
DATE COMPLETED	10/25/11
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SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 847 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 355	Dual tube reverse circulation	5
355 to 405	Air rotary casing hammer	10
405 to 897	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-MT-1-shallow	MW-MT-1-intermediate	MW-MT-1-deep
WELL DEPTH	(ft-bgs)	390	595	825
TEST HOLE DEPTH	(ft-bgs)	897	897	897
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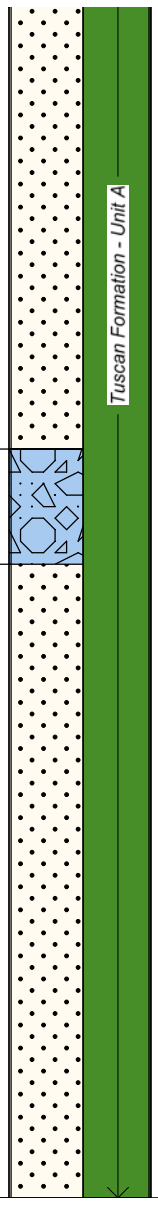
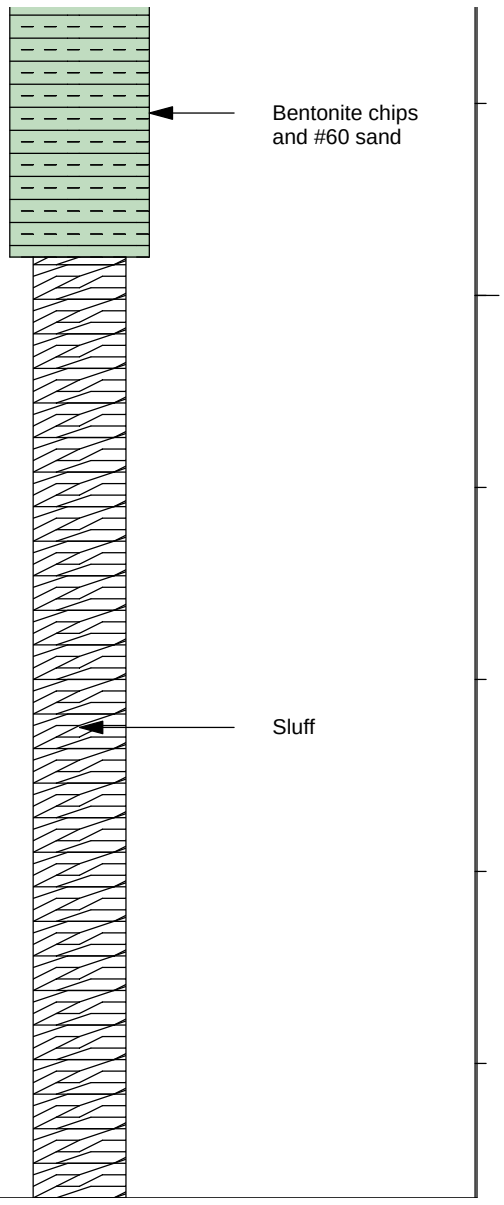
SANITARY SEAL	(ft-bgs)	0 to 280	400 to 550	610 to 758
REFERENCE POINT	(ft-msl)	129.46 (top of casing)	129.21 (top of casing)	128.94 (top of casing)

DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
850	**835 ft bgs: some coarse gravel fragments**
	840 ft bgs: increase in coarse sand and gravel
	843 ft bgs: increase in coarse-grained sand and gravel, sandstone fragments
	850 ft bgs: lahar, matrix-supported
	855 ft bgs: increase coarse sand and gravel, decrease in lahar/sandstone fragments
	Sandy Gravel: gravel up to 1-inch in size, coase sand
	Sand: black, lahar, abundant sandstone fragments, matrix-supported, no large gravels as above
	870 ft bgs: increase in sandstone (matrix-supported) fragments
	873 ft bgs: thiin clay seam
	875 ft bgs: fragments of basalt?
	879 ft bgs: thin clay seam and basalt fragments
	886 ft bgs: very slow drilling, rough
	894 ft bgs: sandstone stringer

LITHOLOGY SYMBOL / FORMATION

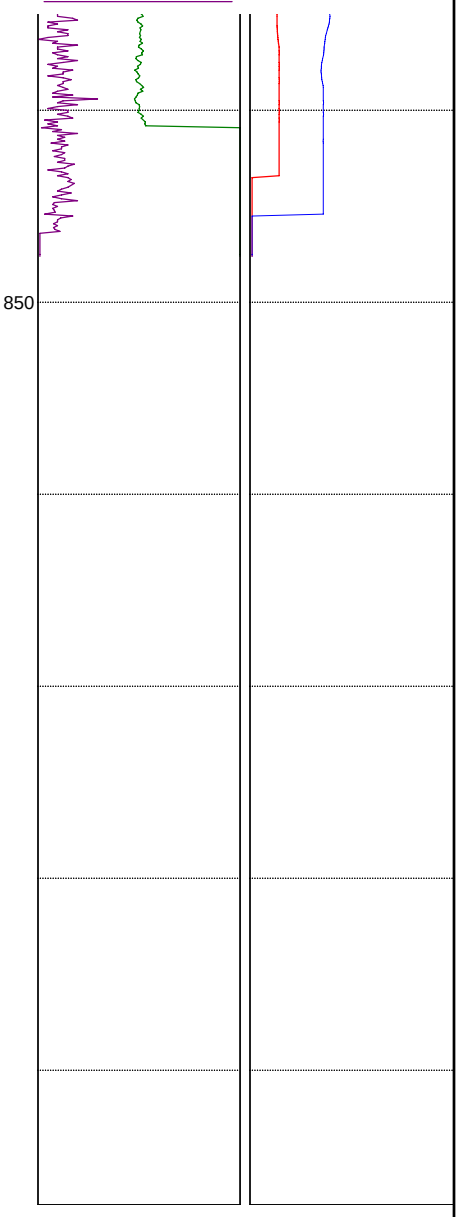


WELL PROFILE AS-BUILT



DEPTH (ft) Below G.S.

ELECTRIC LOG



Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/12/11) MW-MT1- shallow: 13.60 ft bgs
- Static DTW: (5/12/11) MW-MT1- intermediate:14.00 ft bgs
- Static DTW: (5/12/11) MW-MT1- deep: 14.52 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0136335

Page 1 of 9

Owner's Well Number MW-CSU-1(shallow/inter/deep)

Date Work Began 08/26/2010 Date Work Ended 10/8/2010

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000008 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

N W

Latitude Longitude

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid Polymer mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	18	Alluvium - silty sand, sandy gravel, gravelly clay
18	50	Gravelly clay - brown (alluvium)
50	85	Sandy clay - brown (alluvium)
85	102	Sandy Clay/Clayey Sand - brown (Tuscan Unit D)
102	115	Sandy Gravel - brown (Tuscan Unit D)
115	125	Clay (Tuscan Unit D)
125	140	Sandstone (Tuscan Unit D)
140	172	Gravel/Clay/Sandy Gravel (Tuscan Unit D)
172	178	Claystone/Sandstone (Tuscan Unit D)
178	196	Gravel/Sandy Gravel (Tuscan Unit D)
196	214	Sandstone/Conglomerate (Tuscan Unit D)
214	235	Mudstone (Tuscan Unit C)
235	319	Sandy Gravel (Tuscan Unit C)
319	334	Silty Sand - black to gray (Tuscan Unit C)
334	341	Gravel - gray (Tuscan Unit C)
341	399	Sandstone - brown (Tuscan Unit C)
399	425	Gravelly Sand - black (Tuscan Unit C)
425	494	Claystone w/ clayey sand - brown (Tuscan Unit B)
494	507	Silty Sand (Tuscan Unit B)
507	518	Mudstone - grayish brown (Tuscan Unit B)
518	532	Sand - black (Tuscan Unit A)
532	540	Sandy Clay - olive gray (Tuscan Unit A)
540	560	Gravelly Sand - gray to black (Tuscan Unit A)
560	579	Clay - light brown (Tuscan Unit A)
579	605	Sand with clay- black (Tuscan Unit A)
605	639	Claystone and Clayey Sand - brn (Tuscan Unit A)
639	649	Gravelly Sand - gray (Tuscan Unit A)
649	701	Claystone - brown (Tuscan Unit A)
701	714	Sandstone - black (Tuscan Unit A)
714	733	Mudstone - brown (Tuscan Unit A)

Total Depth of Boring 798 Feet

Total Depth of Completed Well 821 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 311 Nicholas C. Shouten Lane

City Chico County Butte

Latitude 39 Deg. 40 Min. 25 Sec. N Longitude 121 Deg. 48 Min. 52 Sec. W

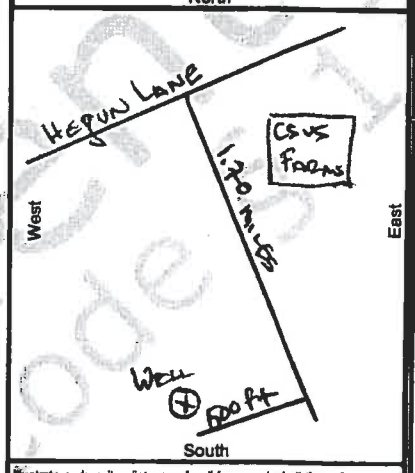
Datum Decimal Lat. 39.6734804 Decimal Long. 121.8144[illegible]

APN Book 039 Page 220 Parcel 017

Township 21N Range 1E Section 13

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply ☐ Domestic ☐ Public ☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

◉ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 69 (Feet) Date Measured 05/04/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)
0	240	12	Blank	PVC Sch. 80	0.276	2.875		
240	340	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	540	12	Blank	PVC Sch. 80	0.276	2.875		
540	560	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	735	12	Blank	PVC Sch. 80	0.276	2.875		
735	760	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	60	Cement	Sanitary seal
60	229	Bentonite w/sand	Transition seal
229	353	Filter Pack	#3 sand
353	524	Bentonite w/sand	Transition seal
524	574	Filter Pack	#3 sand
574	718	Bentonite w/sand	Transition seal

Attachments

☑ Geologic Log

☑ Well Construction Diagram

☑ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name [illegible] Person, Firm or Corporation

[illegible] Address Zamora City CA State 95698 Zip

Signed [illegible] C-57 Licensed Water Well Contractor

9/12/11 Date Signed

783376 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

Page 2 of 9

Owner's Well Number MW-CSU-1(shallow/inter/d No.

Date Work Began 08/26/2010 Date Work Ended 10/8/2010

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000008 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid Polymer mud

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
733	762	Sandstone - brown (Tuscan Unit A)
762	773	Claystone - brown (Tuscan Unit A)
773	798	Clay - greenish blue (Ione Formation)
		See attached log for detailed geologic description

Total Depth of Boring 798 Feet

Total Depth of Completed Well 821 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 311 Nicholas C. Shouten Lane

City Chico County Butte

Latitude 39 Deg. 40 Min. 25 Sec. N Longitude 121 Deg. 48 Min. 52 Sec. W

Datum Decimal Lat. 39.6734804 Decimal Long. 121.8144

APN Book 039 Page 220 Parcel 017

Township 21N Range 1E Section 13

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North / West / East / South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well

○ Modification/Repair

○ Deepen

○ Other

○ Destroy

Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply ☐ Domestic ☐ Public ☐ Irrigation ☐ Industrial

○ Cathodic Protection

○ Dewatering

○ Heat Exchange

○ Injection

◉ Monitoring

○ Remediation

○ Sparging

○ Test Well

○ Vapor Extraction

○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 69 (Feet) Date Measured 05/04/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size If Any (Inches)

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
718	771	Filter Pack	#3 sand
771	821	Bentonite w/san	Bottom seal

Attachments

☑ Geologic Log

☑ Well Construction Diagram

☑ Geophysical Log(s)

☐ Soil/Water Chemical Analyses

☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name [illegible] Person, Firm or Corporation

[illegible] Address Zamora City CA State 95698 Zip

Signed [illegible] C-57 Licensed Water Well Contractor

3/17/11 Date Signed

753376 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	CSUS Chico Farms, 311 Nicholas C. Shouten Lane, Chico, CA
LATITUDE	39.6734804
LONGITUDE	121.8144029
GSE (ft-msl)	179.85 (north corner of concrete slab)
DATE COMPLETED	10/8/10
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 821 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 415	Dual tube reverse circulation	5
415 to 798	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-CSU1-shallow	MW-CSU1-intermediate	MW-CSU1-deep
WELL DEPTH	(ft-bgs)	350	574	771
TEST HOLE DEPTH	(ft-bgs)	798	798	798
SCREEN INTERVAL	(ft-bgs)	240 to 340	540 to 560	735 to 760
SANITARY SEAL	(ft-bgs)	0 to 229	423 to 524	574 to 718
REFERENCE POINT	(ft-msl)	182.06 (top of casing)	181.99 (top of casing)	181.90 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -50 to 100; 64 in (ohm-m) 0 to 250; Gamma (api) -5 to 250; 16 in (ohm-m) 0 to 250

0

QUARTERNARY ALLUVIUM

Silty Sand: brown, medium to coarse grained sand, subrounded to rounded, mixed composition, non-plastic, dry

Sandy Gravel: brown, some silt, clast- supported, subrounded to rounded, mixed composition, metamorphic, volcanic, chert clasts, dry

Gravelly Clay: brown, matrix-supported, gravel up to 1-inch, rounded to subrounded, mixed compositions, low plasticity clay

40 ft bgs: rounded to well-rounded gravel, saturated, increasing clay content, decreasing sand content

45 ft bgs: tuffaceous fragments

50

Sandy Clay: brown, some gravel, medium to coarse-grained sand, mixed composition, plastic to low plasticity

60 ft bgs: increasing gravel to gravelly clay, matrix-supported, increase in volcanic fraction

80 ft bgs: decreasing gravels to a sandy clay

TUSCAN FORMATION - UNIT D

Sandy Clay: brown, low plasticity, tuffaceous, predominant volcanic (andesite/diorite) and some quartz clasts, gravels at contact with Quaternary alluvium

90 ft bgs: decreasing sand

Clayey Sand: increasing sand to clayey sand

100

producing water, saturated

Sandy Gravel: brown, matrix-supported, clasts subrounded to rounded, volcanic (andesite, rhyolite) and trace metamorphic

110 ft bgs: decrease in gravel size, increase in coarse-grained sand

115 ft bgs: increase in clay content

Clay: brown, with sand, low plasticity clay

Quaternary - alluvium

WELL PROFILE AS-BUILT:
- 12" dia. borehole
- Cement grout
- 2.5" dia. Sch 80 PVC
- Bentonite chips and #60 sand
- 2.5" dia. Sch 80 PVC
- 2.5" dia. Sch 80 PVC

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs
- Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs
- Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	CSUS Chico Farms, 311 Nicholas C. Shouten Lane, Chico, CA
LATITUDE	39.6734804
LONGITUDE	121.8144029
GSE (ft-msl)	179.85 (north corner of concrete slab)
DATE COMPLETED	10/8/10
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 821 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 415	Dual tube reverse circulation	5
415 to 798	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-CSU1-shallow	MW-CSU1-intermediate	MW-CSU1-deep
WELL DEPTH	(ft-bgs)	350	574	771
TEST HOLE DEPTH	(ft-bgs)	798	798	798
SCREEN INTERVAL	(ft-bgs)	240 to 340	540 to 560	735 to 760
SANITARY SEAL	(ft-bgs)	0 to 229	423 to 524	574 to 718
REFERENCE POINT	(ft-msl)	182.06 (top of casing)	181.99 (top of casing)	181.90 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -50 to 100; Gamma (api) -5 to 250; 64 in (ohm-m) 0 to 250; 16 in (ohm-m) 0 to 250

SANDSTONE: brown, with silt, fine grained, some medium sand, moderately indurated, matrix-supported

Gravel: brown, with silt, matrix-supported, predominantly volcanic clasts up to 1-inch in size, some quartzite clasts, subrounded to well rounded, some fine to medium sand

150

Clay: brown, with sand, low plasticity, poorly indurated

Sandy Gravel: brown, subrounded to well rounded gravel, clast-supported, volcanic (andesite, diorite, basalt)

170 ft bgs: decreasing sand

CLAYSTONE: reddish brown, with sand, fine to medium, some coarse sand, low plasticity

SANDSTONE: increase in sand to sandstone

Gravel: brown, subrounded to subangular clasts up to 1.5 cm, volcanic (basalt, rhyolitic), some volcanclastic fragments, clast-supported, some sand medium to coarse

182 ft bgs: minor tuff fragments

185 ft bgs: tuffaceous volcaniclastic mudstone fragments

Sandy Gravel: brown, subrounded to rounded clasts up to 2-inch in size, clast-supported, volcanic (andesite, basaltic andesite and dacite), medium to coarse sand

195 ft bgs: gravelly fragments, dense non-vesicular basaltic fragments

SANDSTONE: brown, with silt, fine to medium sand, some fine volcanic gravel (andesite, basalt), subangular clasts, matrix-supported, lahar?

200

CONGLOMERATE: brown, subangular clasts up to 2 cm, volcanic (vesicular basalt, andesite, dacite, rhyolite), some fine to coarse sand, trace fines, clast-supported

SANDSTONE: GRAVELLY, brown to reddish brown, fine to coarse sand, subangular to subrounded gravel up to 2 cm, volcanic (andesite, basalt, rhyolite), some metamorphic clasts, some fines, matrix-supported, tuffaceous

TUSCAN FORMATION - UNIT C

MUDSTONE: reddish brown, with fine to medium sand, tuff fragments (up to 0.5 mm), moderately indurated

218 - 220 ft bgs: very fine sand, hard drilling; 220 ft bgs: matrix-supported, tuff fragments

224 ft bgs: hard sandstone fragments, moderately to well indurated

230 ft bgs: well indurated

235 ft bgs: minor coarse sand, fine gravel, basalt

Sandy Gravel: dark reddish brown to grey, angular to subrounded, volcanic

Tuscan Formation - Unit D

12" dia. borehole

Bentonite chips and #60 sand

Legend:
ft bgs - feet below ground surface
ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs
Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs
Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\

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RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 821 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 415	Dual tube reverse circulation	5
415 to 798	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-CSU1-shallow	MW-CSU1-intermediate	MW-CSU1-deep
WELL DEPTH	(ft-bgs)	350	574	771
TEST HOLE DEPTH	(ft-bgs)	798	798	798
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SANITARY SEAL	(ft-bgs)	0 to 229	423 to 524	574 to 718
REFERENCE POINT	(ft-msl)	182.06 (top of casing)	181.99 (top of casing)	181.90 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -50 to 100; 64 in (ohm-m) 0 to 250; Gamma (api) -5 to 250; 16 in (ohm-m) 0 to 250

(andesitic basalt) boulders/cobbles, very slow drilling, fine to medium sand, well indurated sandstone fragments

243 ft bgs: some rounded gravel

250

249 ft bgs: increase in black sand, abundant basalt/andesitic basalt clasts (dark gray to black)

255 ft bgs: decrease in gravel, no rig chatter

260 ft bgs: increase in basalt fragments, large boulder or thick clast-supported boulder conglomerate/debris flow deposit, angular to subangular, hard drilling

#3 sand

269 ft bgs: easier drilling, some gravel
270 ft bgs: increase in black sand to gravelly sand, medium to coarse sand

0.020-in slotted Sch 80 PVC

285 ft bgs: increase in gravel to sandy gravel as above, up to 3 cm, subrounded to subangular

289 ft bgs: increase in black sand to gravelly sand

300

300 ft bgs: drill circulation problems in sand and gravel

302 ft bgs: tan, brown, andesite and brown claystone/sandstone fragments

Silty Sand: black, coarse sand, matrix is tannish brown, no gravel

315 ft bgs: matrix-supported

317 ft bgs: color change to gray

325 ft bgs: decreasing sand, some fine gravel, angular to subangular, volcanic (andesite, basaltic andesite)

Gravel: gray, with sand, subangular gravel up to 2 inches, volcanic (andesitic basalt, andesite, rhyolite), coarse sand

338 ft bgs: color change to black, increase in fine to medium-grained sand to gravelly sand, rounded gravel (broken), some subangular fragments, trace fines, water is clear, clast supported

SANDSTONE: brown, medium to coarse sand, fine gravels, volcanic clasts (rhyolite, andesite), fines washed out in water, matrix-supported, lahar?

350

Tuscan Formation - Unit C

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs
- Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs
- Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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FEATURE / USE	Monitoring Well
LOCATION	CSUS Chico Farms, 311 Nicholas C. Shouten Lane, Chico, CA
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SITE GEOLOGIST	Tim Godwin, P.G.
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PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
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415 to 798	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-CSU1-shallow	MW-CSU1-intermediate	MW-CSU1-deep
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TEST HOLE DEPTH	(ft-bgs)	798	798	798
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REFERENCE POINT	(ft-msl)	182.06 (top of casing)	181.99 (top of casing)	181.90 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -50 to 100; 64 in (ohm-m) 0 to 250; Gamma (api) -5 to 250; 16 in (ohm-m) 0 to 250

375 ft bgs: increase in fragments of claystone/sandstone

380 ft bgs: increase in sand, some gravel

385 ft bgs: no gravel, increase in sandstone fragments

390 ft bgs: predominantly tuffaceouse sandstone/claystone fragments, tan, some sand

395 ft bgs: increase in sand, decrease in fragments of sandstone/claystone

400

Gravelly Sand: black, coarse to medium sand, fine gravel, subangular, volcanic (basalt, rhyolite), clast-supported

410 ft bgs: no circulation, no sample

415 ft bgs: poor recovery, no water, poor drilling circulation

419 ft bgs: increase in gravel
420 ft bgs: no water, poor drilling circulation

TUSCAN FORMATION - UNIT B

CLAYSTONE: light brown, tuffaceous, hard, lahar?, some sand

436 ft bgs: increasing sand

439 ft bgs: very hard drilling, slow, no cuttings, water circulating clean
440 ft bgs: changed to flooded reverse circulation drilling method

445 ft bgs: brown, hard, some black sand, low to moderate plasticity, moderately indurated

450

Clayey Sand: black, fine to medium grained, light brown matrix, matrix supported

CLAYSTONE: light brown, tuffaceous, hard, lahar?, some sand

460 ft bgs: light tan color, minor fine sand, slightly plastic clay, balling up on return

465 ft bgs: composite bulk sample collected from 460 to 465 ft bgs.

Bentonite chips and #60 sand

Tuscan Formation - Unit B

Legend:
ft bgs - feet below ground surface
ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs
Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs
Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 821 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 415	Dual tube reverse circulation	5
415 to 798	Flooded reverse circulation	8

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SANITARY SEAL	(ft-bgs)	0 to 229	423 to 524	574 to 718
REFERENCE POINT	(ft-msl)	182.06 (top of casing)	181.99 (top of casing)	181.90 (top of casing)

DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
485 ft bgs:	low plasticity fines, washing out in mud, poorer recovery
490 ft bgs:	no sample recovery
	Silty Sand: black, fine to medium sand, minor clay fragments, poor recovery, poorly indurated
500	
	MUDSTONE: grayish brown, with very fine sand, fine matrix washing out
	TUSCAN FORMATION - UNIT A
	Sand: black, fine to coarse, angular to subangular, volcanic (basalt, trace rhyolite and andesite) olivine grains, trace fines and fine gravel
525 ft bgs:	increase in coarse sand with minor increase in andesite and rhyolite/dacite content
530 ft bgs:	trace metamorphic clast (pebble conglomerate)
	Sandy Clay: olive gray, very fine sand, low plasticity, poor recovery
	Gravelly Sand: gray to black, subangular to subrounded grains, volcanic (basalt, andesite, minor rhyolite/dacite, quartz), subangular to subrounded gravel up to 2 cm, clasts basalt to andesitic basalt
545 ft bgs:	increase in coarse sand and gravel, gravel clasts rounded basalt, trace fines
550	
550 ft bgs:	coarse gravels to cobbles, rounded, rhyolite, cinder-like
555 ft bgs:	increase in fine to medium sand, decrease in gravels, gravel up to 0.5 cm, increase in matrix, tan fragments, tuffaceous
559 ft bgs:	increase in fine sand, possible slough from above, poor recovery
	Clay: light brown, some fine sand, moderate plasticity
	Sand: black, with gravel, medium to coarse, gravel angular to subrounded, volcanic (basalt, andesitic basalt, andesite)
	increase in fine matrix, matrix-supported sand, poor recovery, fines washing of sample
	Clay: brown, with fine to coarse sand, hard, returns as fragments

LITHOLOGY SYMBOL | FORMATION

WELL PROFILE AS-BUILT

- Bentonite chips and #60 sand
- #3 sand
- 0.020-in slotted Sch 80 PVC

DEPTH (ft) Below G.S.

ELECTRIC LOG

SP (mv): -50 to 100 | 64 in (ohm-m): 0 to 250

Gamma (api): -5 to 250 | 16 in (ohm-m): 0 to 250

500

550

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level

GSE - ground surface elevation

Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs

Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs

Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

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DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
600	**Sand: black, with gravel, medium to coarse, gravel angular to subrounded, volcanic (basalt, andesitic basalt, andesite), brown clay fragments**
	CLAYSTONE: SANDY, brown, fine sand, moderate plasticity
	Clayey Sand: brown, fine to coarse sand, fines washing out of sample, small hard fragments of matrix, matrix supported
	621 ft bgs: increase in clay
	624 ft bgs: increase in sand
	630 ft bgs: poor recovery, fines washing out, decrease in fine sand
	635 ft bgs: increase in sand
	Gravelly Sand: gray, fine to coarse, fine gravel, subangular to subrounded, volcanic (andesitic basalt, andesite, rhyolite/dacite), fines washing out, matrix supported
	645 ft bgs: greenstone/serpentine clast
650	**CLAYSTONE: brown, with sand, fine to medium grained**
	660 ft bgs: poor recovery, fines washed out, increase in sand
	664 ft bgs: poor recovery, low to no fines
	669 ft bgs: poor recovery, no fines, low volume of sand return, fragments of tuffaceous brown matrix
	674 ft bgs: clay clasts returned, low to moderate plasticity
	679 ft bgs: gravelly, moderate plasticity, better recovery
	695 ft bgs: tuffaceous sand grains, rhyolite, quartzite
700	**700 ft bgs: moderate increase in sand fraction**
	SANDSTONE: black, fine to medium grained, fines washing out
	705 ft bgs: some coarse sand (quartz, olivine, rhyolite, andesite, basalt)
	710 ft bgs: fine to medium sand, coarsening downward
	714 ft bgs: fine rounded gravel

LITHOLOGY SYMBOL / FORMATION: *Tuscan Formation - Unit A*

WELL PROFILE AS-BUILT: Bentonite chips and #60 sand

ELECTRIC LOG

DEPTH (ft) Below G.S.	SP (mv)	64 in (ohm-m)	Gamma (api)	16 in (ohm-m)
	-50 to 100	0 to 250	-5 to 250	0 to 250
600				
650				
700				

Legend:
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DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
	MUDSTONE: brown, with sand, fine to coarse, matrix washing out of sample, matrix supported
	720 ft bgs: increase in fine sand, clay balls are slightly plastic but disintegrate easily
	732 ft bgs: tuff fragments
	SANDSTONE: brown, with silt, fine to coarse-grained, matrix fragments, hard, brittle
	737 to 738.5 ft bgs: increase in coarse-grained sand, very little to no fines
	740 ft bgs: some brown claystone fragments
750	**750 ft bgs: increase in claystone fragments**
	755 ft bgs: decrease in claystone fragments, black sand
	758 ft bgs: black sand, fine to medium-grained, some coarse-grained sand, little fines
	CLAYSTONE: brown, moderately plastic, with fine sand
	772 ft bgs: increase in sand
	IONE FORMATION
	Clay: greenish blue, sharp contact, moderate plasticity, with sand
	Clayey Sand: bluish green, very fine to medium sand, moderate plasticity
	Clay: greenish blue, sharp contact, moderate plasticity, with sand
	790 ft bgs: appears to have ostrocod imprints
800	

LITHOLOGY SYMBOL

FORMATION

Ione Formation

WELL PROFILE AS-BUILT

#3 sand

0.020-in slotted Sch 80 PVC

Bentonite chips and #60 sand

DEPTH (ft) Below G.S.

ELECTRIC LOG

SP (mv): -50 to 100

64 in (ohm-m): 0 to 250

Gamma (api): -5 to 250

16 in (ohm-m): 0 to 250

750

800

Legend:
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GSE - ground surface elevation

Static DTW: (5/4/11) MW-CSU1- shallow: 68.91 ft bgs

Static DTW: (5/5/11) MW-CSU1- intermediate: 70.24 ft bgs

Static DTW: (5/5/11) MW-CSU1- deep: 69.13 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No. e0136941

Page 1 of 8

Owner's Well Number MW-HP-1(shallow/inter/dp)

Date Work Began 09/01/2010 Date Work Ended 10/14/2011

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000007 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
0	3	Fill
3	18	Siltstone/Claystone - brown (Tuscan Unit C/D)
18	24	Sandstone - dark reddish brown (Tuscan Unit C/D)
24	49	Siltstone/Claystone - reddish brn (Tuscan Unit C/D)
49	101	Gravel/Sand/Sandy Gravel (Tuscan Unit C/D)
101	115	Sandstone - light brn (Tuscan Unit C/D)
115	122	Gravel - brown (Tuscan Unit C/D)
122	181	Sandstone - brown (Tuscan Unit C/D)
181	201	Sandy gravel - dark brn/black (Tuscan Unit C/D)
201	240	Claystone - brown (Tuscan Unit C/D)
240	247	Sandstone - black (Tuscan Unit C/D)
247	254	Claystone - brown (Tuscan Unit C/D)
254	256	Tuff - white (Tuscan Unit C/D)
256	284	Clay - brown (Tuscan Unit B)
284	288	Sand - black (Tuscan Unit B)
288	299	Clay - brown (Tuscan Unit B)
299	304	Sandy gravel - brn to gray (Tuscan Unit B)
304	309	Claystone - brown (Tuscan Unit B)
309	321	Sandstone - brown (Tuscan Unit B)
321	333	Sandy gravel - black (Tuscan Unit B)
333	344	Sandstone - brn to reddish brn (Tuscan Unit B)
344	359	Claystone - brown (Tuscan Unit B)
359	369	Sandstone - reddish brn (Tuscan Unit B)
369	379	Claystone - brown (Tuscan Unit B)
379	421	Sandstone - reddish brn (Tuscan Unit B)
421	453	Claystone - reddish brown (Tuscan Unit B)
453	456	Sand - black (Tuscan Unit B)
456	494	Claystone - brown (Tuscan Unit B)
494	499	Sandstone - reddish brown (Tuscan Unit B)
499	501	Tuff - white (Tuscan Unit B)

Total Depth of Boring 577 Feet

Total Depth of Completed Well 553 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 235 Gaia Way

City Chico County Butte

Latitude 39 Deg. 52 Min. 42 Sec. N Longitude 121 Deg. 57 Min. 26 Sec. W

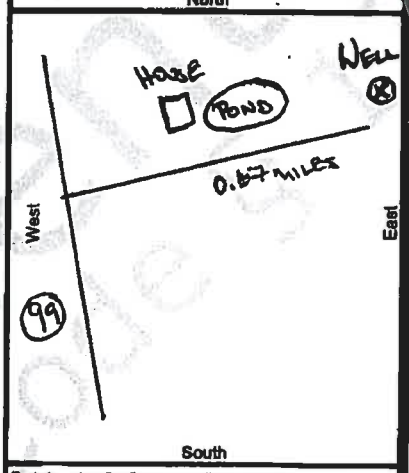
Datum Decimal Lat. 39.8782156 Decimal Long. 121.9570

APN Book 047 Page 070 Parcel 027

Township 23N Range 1W Section 3

Location Sketch

(Sketch must be drawn by hand after form is printed.)



Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
☐ Domestic ☐ Public
☐ Irrigation ☐ Industrial
○ Cathodic Protection
○ Dewatering
○ Heat Exchange
○ Injection
◉ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 33 (Feet) Date Measured 06/03/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)
0	70	12	Blank	PVC Sch. 80	0.276	2.875		
70	100	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	320	12	Blank	PVC Sch. 80	0.276	2.875		
320	340	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020
0	510	12	Blank	PVC Sch. 80	0.276	2.875		
510	540	12	Screen	PVC Sch. 80	0.276	2.875	Milled Slots	0.020

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
0	50	Cement	Sanitary seal
50	60	Bentonite w/san	Transition seal
60	115	Filter Pack	#3 sand
115	309	Bentonite w/san	Transition seal
309	351	Filter Pack	#3 sand
351	468	Bentonite w/san	Transition seal

Attachments

☑ Geologic Log
☑ Well Construction Diagram
☑ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name [illegible] Person, Firm or Corporation

[illegible] Address Ramona City CA State 95698 Zip

Signed [illegible] C-57 Licensed Water Well Contractor Date Signed

C-57 License Number 283326

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

*The free Adobe Reader may be used to view and complete this form. However, software must be purchased to complete, save, and reuse a saved form.

File Original with DWR

State of California

Well Completion Report

Refer to Instruction Pamphlet

No.

Page 2 of 8

Owner's Well Number MW-HP-1(shallow/inter/dp)

Date Work Began 09/01/2010 Date Work Ended 10/14/2011

Local Permit Agency Butte County Public Health, Environmental Health Division

Permit Number WP0000007 Permit Date 8/3/10

DWR Use Only – Do Not Fill In

State Well Number/Site Number

Latitude N Longitude W

APN/TRS/Other

Geologic Log

Orientation ◉ Vertical ○ Horizontal ○ Angle Specify

Drilling Method Reverse Circulation Rotary Drilling Fluid

Depth from Surface Feet	to Feet	Description Describe material, grain size, color, etc
501	509	Claystone - reddish brown (Tuscan Unit A)
509	530	Sand - black (Tuscan Unit A)
530	545	Sandy gravel - black (Tuscan Unit A)
545	577	Sandstone - reddish brown (Tuscan Unit A)
		See attached log for detailed geologic desciption

Total Depth of Boring 577 Feet

Total Depth of Completed Well 553 Feet

Well Owner

Name Butte County Department Water & Resource Conservation

Mailing Address 308 Nelson Avenue

City Oroville State CA Zip 95965

Well Location

Address 235 Gaia Way

City Chico County Butte

Latitude 39 Deg. 52 Min. 42 Sec. N Longitude 121 Deg. 57 Min. 26 Sec. W

Datum Decimal Lat. 39.8782156 Decimal Long. 121.95708

APN Book 047 Page 070 Parcel 027

Township 23N Range 1W Section 3

Location Sketch

(Sketch must be drawn by hand after form is printed.)

North

West East

South

Illustrate or describe distance of well from roads, buildings, fences, rivers, etc. and attach a map. Use additional paper if necessary. Please be accurate and complete.

Activity

◉ New Well
○ Modification/Repair
○ Deepen
○ Other
○ Destroy
Describe procedures and materials under "GEOLOGIC LOG"

Planned Uses

○ Water Supply
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○ Cathodic Protection
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○ Injection
◉ Monitoring
○ Remediation
○ Sparging
○ Test Well
○ Vapor Extraction
○ Other

Water Level and Yield of Completed Well

Depth to first water (Feet below surface)

Depth to Static Water Level 33 (Feet) Date Measured 06/03/2011

Estimated Yield * (GPM) Test Type

Test Length (Hours) Total Drawdown (Feet)

*May not be representative of a well's long term yield.

Casings

Depth from Surface Feet	to Feet	Borehole Diameter (Inches)	Type	Material	Wall Thickness (Inches)	Outside Diameter (Inches)	Screen Type	Slot Size if Any (Inches)

Annular Material

Depth from Surface Feet	to Feet	Fill	Description
468	499	Bentonite	Transition seal
499	553	Filter Pack	#0/30 sand
553	600	Bentonite w/san	Bottom seal

Attachments

☑ Geologic Log
☑ Well Construction Diagram
☑ Geophysical Log(s)
☐ Soil/Water Chemical Analyses
☐ Other

Attach additional information, if it exists.

Certification Statement

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief

Name Ray Thiess
Person, Firm or Corporation

WDC Address Zamora City CA State 95698 Zip

Signed [signature] C-57 Licensed Water Well Contractor

9/17/11 Date Signed 283326 C-57 License Number

DWR 188 REV. 1/2006

IF ADDITIONAL SPACE IS NEEDED, USE NEXT CONSECUTIVELY NUMBERED FORM

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

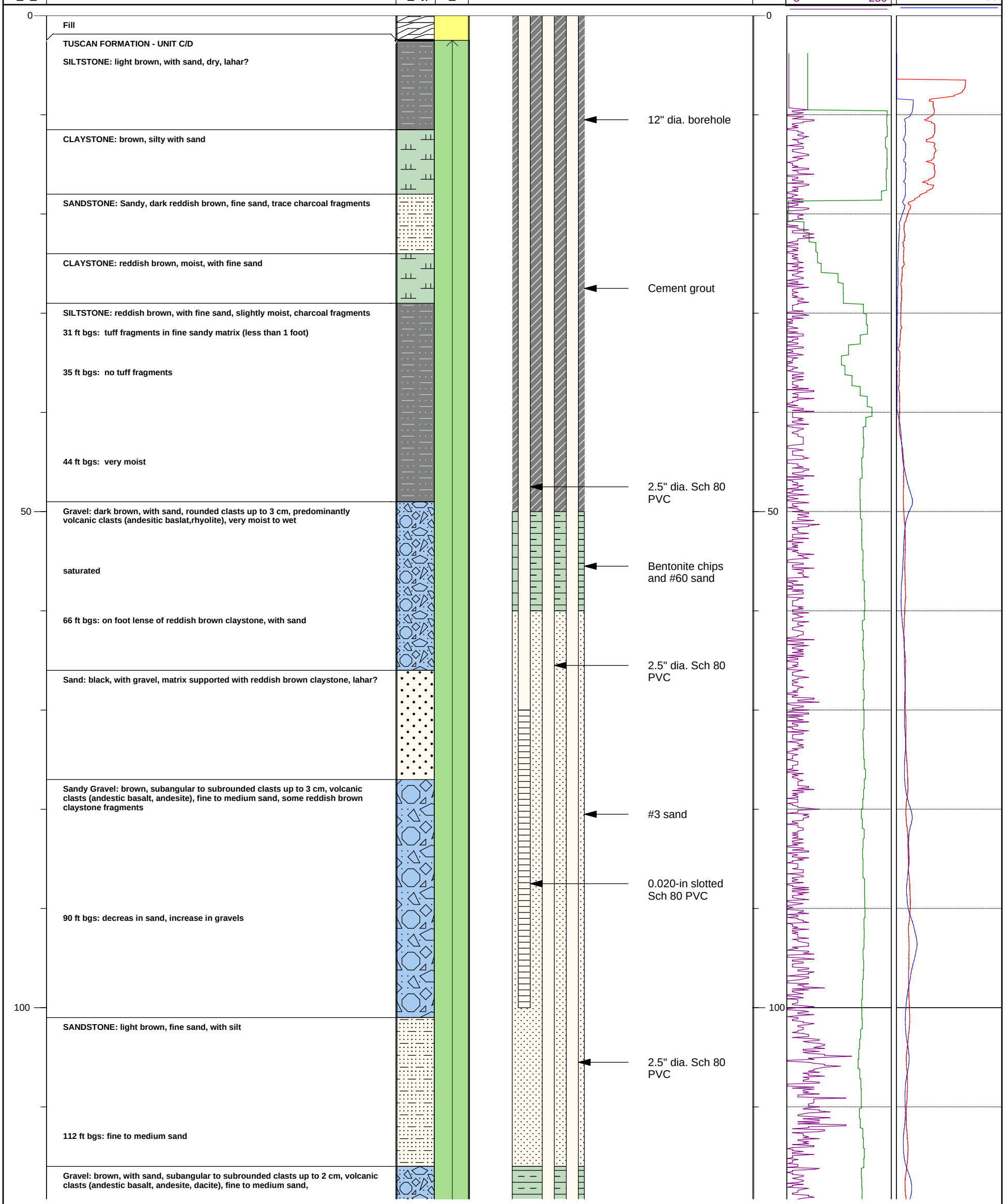
Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	235 Gaia Way, Chico, CA
LATITUDE	39.8782156
LONGITUDE	121.9570981
GSE (ft-msl)	216.88 (NW corner of concrete slab)
DATE COMPLETED	10/14/10
DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 600 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 200	Air rotary casing hammer	10
200 to 577	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-HP-1-shallow	MW-HP-1-intermediate	MW-HP-1-deep
WELL DEPTH	(ft-bgs)	115	351	555
TEST HOLE DEPTH	(ft-bgs)	577	577	577
SCREEN INTERVAL	(ft-bgs)	70 to 100	320 to 340	510 to 540
SANITARY SEAL	(ft-bgs)	0 to 100	115 to 309	351 to 499
REFERENCE POINT	(ft-msl)	219.32 (top of casing)	219.01 (top of casing)	218.84 (top of casing)



Legend: ft bgs - feet below ground surface; ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (6/3/11) MW-HP1- shallow: 33.35 ft bgs
Static DTW: (6/3/11) MW-HP1- intermediate: 37.58 ft bgs
Static DTW: (5/13/11) MW-HP1- deep: 39.46 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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PILOT BORING

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200 to 577	Flooded reverse circulation	8

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DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -25 to 100; 64 in (ohm-m) 0 to 250; Gamma (api) -5 to 250; 16 in (ohm-m) -1 to 250

SANDSTONE: brown, fine sand, with silt, matirx-supported, lahar?

TUSCAN FORMATION - UNIT C/D

145 ft bgs to 147 ft bgs: gravelly, well cemented, fine to medium-grained, increase in clay matrix

150

163 ft bgs: increase in gravels

175 ft bgs: poor sample recovery, significant fines in suspension during sampling

Gravelly Sand: dark brown/black, medium to coarse sand, fine gravel, volcanic clasts (basalt, andestic basalt, andesite, dacite), fragments of reddish brown claystone (matrix?)

200

CLAYSTONE: brown, with sand, trace tuff fragments

215 ft bgs: some charcoal fragments

220 ft bgs: some white tuff fragments

225 ft bgs: increase in white tuff fragments

230 ft bgs: increase in hard brown matrix fragments

235 ft bgs: decrease in tuff fragments

237 ft bgs: increase in white tuff fragments

Bentonite chips and #60 sand

Legend: ft bgs - feet below ground surface; ft msl - feet above mean sea level

GSE - ground surface elevation
Static DTW: (6/3/11) MW-HP1- shallow: 33.35 ft bgs

Static DTW: (6/3/11) MW-HP1- intermediate: 37.58 ft bgs
Static DTW: (5/13/11) MW-HP1- deep: 39.46 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
LOCATION	235 Gaia Way, Chico, CA
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SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 600 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 200	Air rotary casing hammer	10
200 to 577	Flooded reverse circulation	8

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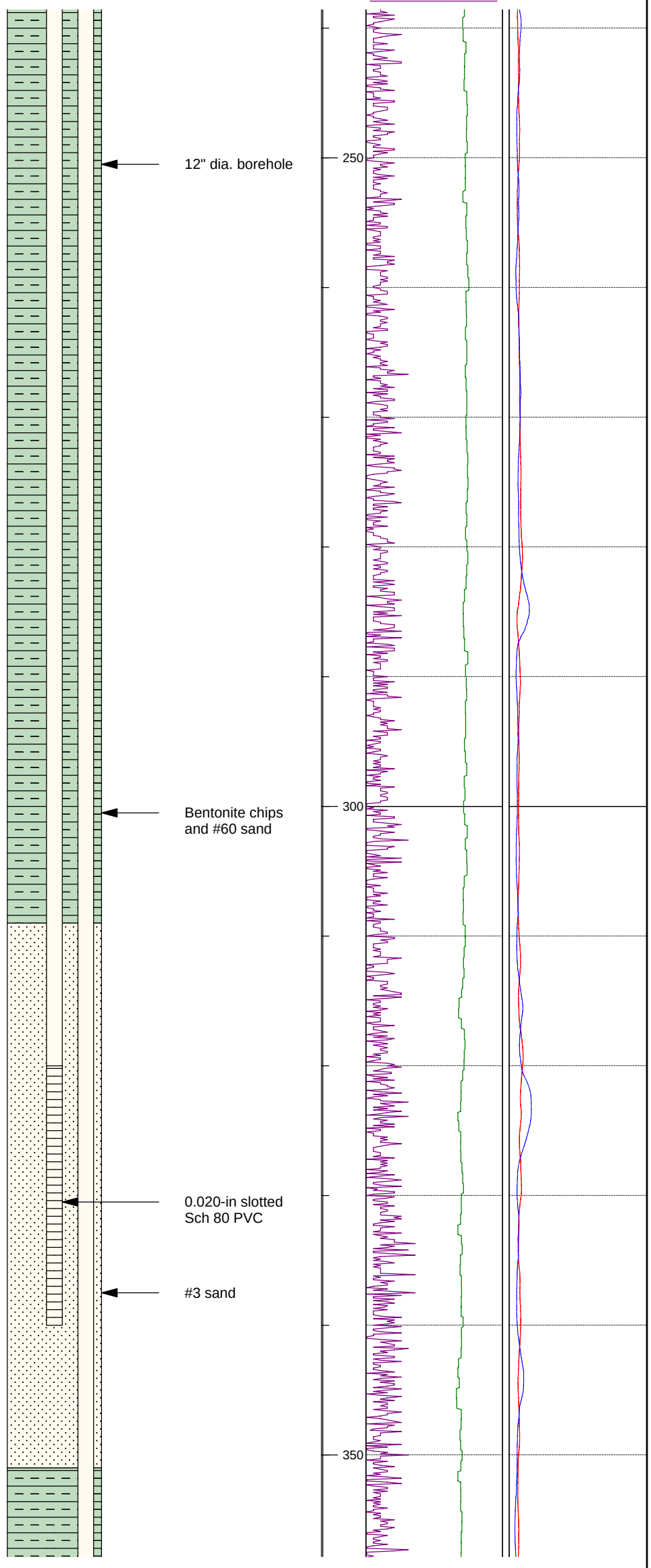
REFERENCE POINT	(ft-msl)	219.32 (top of casing)	219.01 (top of casing)	218.84 (top of casing)

DEPTH (ft) BELOW G.S.	LITHOLOGY DESCRIPTION AND REMARKS
250	**SANDSTONE: black, fine to coarse, abundant volcanics (basalt, andesitic basalt), some tuff fragments, matrix-supported lahar**
	244 ft bgs: increase in fine matrix material
	CLAYSTONE: brown, with sand, some fine gravel
	Tuff: white, hard
	TUSCAN FORMATION - UNIT B
	Clay: brown, sandy, low plasticity, trace tuff fragments
	265 ft bgs: increase in sand content (coarse)
	269 ft bgs: increase in clay, low to moderate plasticity
	275 ft bgs: color change to reddish brown, some claystone, stiff, low plasticity
	280 ft bgs: abundant white tuff fragments, increase in sand
	Sand: black, fine to coarse, matrix-supported
	287 to 288 ft bgs: coarse sand
	Clay: brown, with sand, low plasticity, fine to coarse sand
300	**Sandy Gravel: brown to gray, fine gravel, subangular to subrounded clasts, volcanic (basalt, andesitic basalt), medium to coarse sand, matrix-supported**
	CLAYSTONE: brown, with sand, low plasticity, fine to coasre sand, lahar?
	SANDSTONE: brown, with clay, fine to coasre sand, gradational change from claystone above
	Sandy Gravel: black, subrounded to subangular clasts to 3 cm, volcanic (basalt, andestic basalt, rhyolite, andesite), clast supported
	330 ft bgs: some clay fragments
	SANDSTONE: brown to reddish brown, fine to medium sand, some fine gravels, clay and silt matrix, matrix-supported
350	**CLAYSTONE: brown, fine to medium grained sand**



ELECTRIC LOG

Legend: ft bgs - feet below ground surface; ft msl - feet above mean sea level

GSE - ground surface elevation

Static DTW: (6/3/11) MW-HP1- shallow: 33.35 ft bgs

Static DTW: (6/3/11) MW-HP1- intermediate: 37.58 ft bgs

Static DTW: (5/13/11) MW-HP1- deep: 39.46 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
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Brown AND Caldwell

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PILOT BORING

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DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -25 to 100; 64 in (ohm-m) 0 to 250; Gamma (api) -5 to 250; 16 in (ohm-m) -1 to 250

SANDSTONE: reddish brown, medium to coarse sand, matix hard claystone, some tuff clasts (thin)

CLAYSTONE: reddish brown, with sand, medium to coasre sand

375 ft bgs: decrease in sand, moderately plastic clay

SANDSTONE: reddish brown, fine to coarse grained, tuff fragments, some fine gravel, matrix-supported

400

399 to 402 ft bgs: increase in clay to claystone

405 ft bgs: tuff fragments

409.5 to 413 increase in clay to claystone

CLAYSTONE: reddish brown, fine to medium sand

440 ft bgs: increase in sand, trace tuff fragments

450

450 ft bgs: increase in clay, decrease in sand, drilling slow

Sand: black, fine to coarse-grained, angular to subangular, volcanic clasts (basalt, andesitic basalt)

CLAYSTONE: brown, with sand, low plasticity, slow drilling

469 ft bgs: increase in sand content

474 ft bgs: color change to light brown, tuffaceous, increase in sand

TUSCAN FORMATION - UNIT B

Bentonite chips and #60 sand

Bentonite chips

Legend:
- ft bgs - feet below ground surface
- ft msl - feet above mean sea level
- GSE - ground surface elevation
- Static DTW: (6/3/11) MW-HP1- shallow: 33.35 ft bgs
- Static DTW: (6/3/11) MW-HP1- intermediate: 37.58 ft bgs
- Static DTW: (5/13/11) MW-HP1- deep: 39.46 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

PROJECT	Lower Tuscan Aquifer Study
FEATURE / USE	Monitoring Well
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DRILLING CONTRACTOR	WDC Exploration & Wells
SITE GEOLOGIST	Tim Godwin, P.G.
COMMENTS	Reamed 12-in dia. borehole to 600 ft for well construction using mud rotary drilling.

PILOT BORING

DEPTH ft bgs	DRILLING METHOD	BOREHOLE DIAMETER (inches)
0 to 200	Air rotary casing hammer	10
200 to 577	Flooded reverse circulation	8

LOCAL IDENTIFICATION		MW-HP-1-shallow	MW-HP-1-intermediate	MW-HP-1-deep
WELL DEPTH	(ft-bgs)	115	351	555
TEST HOLE DEPTH	(ft-bgs)	577	577	577
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SANITARY SEAL	(ft-bgs)	0 to 100	115 to 309	351 to 499
REFERENCE POINT	(ft-msl)	219.32 (top of casing)	219.01 (top of casing)	218.84 (top of casing)

DEPTH (ft) BELOW G.S. | LITHOLOGY DESCRIPTION AND REMARKS | LITHOLOGY SYMBOL | FORMATION | WELL PROFILE AS-BUILT | DEPTH (ft) Below G.S. | ELECTRIC LOG

ELECTRIC LOG: SP (mv) -25 to 100; Gamma (api) -5 to 250; 64 in (ohm-m) 0 to 250; 16 in (ohm-m) -1 to 250

480 ft bgs: increase in sand

490 ft bgs: increase in sand

SANDSTONE: reddish-brown, fine to coarse, matrix reddish brown claystone, matrix supported, drilling faster

500

Tuff: white

TUSCAN FORMATION - UNIT A

CLAYSTONE: reddish brown, with sand, fine grain, low plasticity; 505 ft bgs: increase in sand

Sand: black, with gravel, fine to coarse-grained, reddish brown hard claystone matrix, matrix supported

515 to 520 ft bgs: increase coarse sand, fine gravel, clast supported, volcanic clasts (andesitic basalt, andesite, rhyolite, dacite); 520 ft bgs: some coarse gravel

525 ft bgs: gravel up to 3-inches, subrounded to angular

Sandy Gravel: black, subangular to subrounded, medium to coarse sand, volcanic clasts (andesitic basalt, andesite, rhyolite, dacite)

535 ft bgs: decrease in coarse gravel, some clay and sandstone stringers

540 ft bgs: some coarse gravel

SANDSTONE: reddish brown, fine to coarse sand, some fine gravel, matrix supported

550

550 ft bgs: increase fine to medium-grained sand

560 ft bgs: some coarse gravel and clay stringers, metamorphic fragments

565 ft bgs: increase in matrix, decrease in sand

570 ft bgs: increase in clayey fine sand

TUSCAN FORMATION - UNIT A

Bentonite chips

0.020-in slotted Sch 80 PVC

#0/30 sand

Bentonite chips and #60 sand

Legend: ft bgs - feet below ground surface; ft msl - feet above mean sea level

GSE - ground surface elevation

Static DTW: (6/3/11) MW-HP1- shallow: 33.35 ft bgs

Static DTW: (6/3/11) MW-HP1- intermediate: 37.58 ft bgs

Static DTW: (5/13/11) MW-HP1- deep: 39.46 ft bgs

Prepared By: W. Linck Date: 8/5/11 File Name & Location: P:\38000\138604 - Butte Co. Lower Tuscan Aquifer Inv\logplot

LOWER TUSCAN AQUIFER
RECHARGE MONITORING AND DATABASE PROGRAM

Brown AND Caldwell

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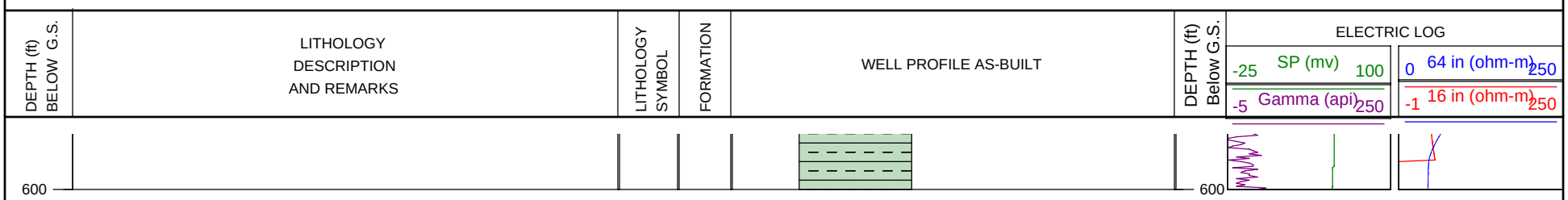

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