Well No. 1 MALH 52730 Construction Well

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765)
Instructions for completing this report are on the last page of this form.

WELL I.D. # L 07417
START CARD # W-35100

(1) LAND OWNER Well Number
Name Treasure Valley Community College
Address 650 College Blvd
City Ontario State OR Zip 97914

(2) TYPE OF WORK
☒ New Well ☐ Deepening ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD:
☐ Rotary Air ☐ Rotary Mud ☒ Cable ☐ Auger
☐ Other

(4) PROPOSED USE:
☐ Domestic ☐ Community ☐ Industrial ☒ Irrigation
☐ Thermal ☐ Injection ☐ Livestock ☐ Other

(5) BORE HOLE CONSTRUCTION:
Special Construction approval ☐ Yes ☒ No Depth of Completed Well 40 ft.
Explosives used ☐ Yes ☒ No Type Amount

HOLE Diameter	From	To	SEAL Material	From	To	Sacks or pounds
16	0	18	Bentonite	0	18	1 sack
12	18	40				

How was seal placed: Method ☐A ☐B ☐C ☐D ☐E
☒ Other Sacked Installed AS Temporary casing Removed
Backfill placed from ft. to ft. Material
Gravel placed from ft. to ft. Size of gravel

(6) CASING/LINER:

	Diameter	From	To	Gauge	Steel	Plastic	Welded	Threaded
Casing:	16"	+1½	32½	250	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐
Liner:					☐	☐	☐	☐
					☐	☐	☐	☐

Drive Shoe used ☐ Inside ☒ Outside ☐ None
Final location of shoe(s) 31½

(7) PERFORATIONS/SCREENS:
☒ Perforations Method Torch
☐ Screens Type Material

From	To	Slot size	Number	Diameter	Tele/pipe size	Casing	Liner
18½	28	4x4	132	16		☒	☐
						☐	☐
						☐	☐
						☐	☐

(8) WELL TESTS: Minimum testing time is 1 hour
☒ Pump ☐ Bailer ☐ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Drill stem at	Time
50	11		1 hr.

Temperature of water 54° Depth Artesian Flow Found
Was a water analysis done? ☐ Yes By whom
Did any strata contain water not suitable for intended use? ☐ Too little
☐ Salty ☐ Muddy ☐ Odor ☐ Colored ☐ Other
Depth of strata:

(9) LOCATION OF WELL by legal description:
County Malheur Latitude 44°00'16" Longitude 116° 54' 183" W
Township 18 N or S Range 47 E or W. WM.
Section 9 1/4 SW 1/4 SE
Tax Lot 500 Lot Block Subdivision
Street Address of Well (or nearest address) 650 College Blvd

(10) STATIC WATER LEVEL:
6' 10" ft. below land surface. Date 7-6-05
Artesian pressure lb. per square inch Date

(11) WATER BEARING ZONES:
Depth at which water was first found 6' 10"

From	To	Estimated Flow Rate	SWL
7	21	50	6' 10"

(12) WELL LOG:
Ground Elevation 2158

Material	From	To	SWL
Pit Run gravel	0	½	
Soil silt loam	½	4	
silt clay	4	7	
Sand & gravel	7	21	6' 10"
brown clay	21	26	
clay blue	26	40	

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WATER RESOURCES DEPT
SALEM, OREGON

Date started 6-28-05 Completed 7-6-05

(unbonded) Water Well Constructor Certification:
I certify that the work I performed on the construction, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.
WWC Number
Signed Date

(bonded) Water Well Constructor Certification:
I accept responsibility for the construction, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.
WWC Number 1481
Signed Date 7-17-05

ORIGINAL – WATER RESOURCES DEPARTMENT FIRST COPY – CONSTRUCTOR SECOND COPY – CUSTOMER

T 11015

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Well No. 2 - Deep

MALH 53555

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 100201

START CARD # 1006369

(1) LAND OWNER

Owner Well I.D. _____

First Name _____ Last Name _____

Company STATE OF OREGON OREGON MILITARY DEPARTMENT

Address 1330 S.W. 4TH ST

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[ ] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger [ ] Cable Mud
[X] Reverse Rotary [ ] Other _____

(4) PROPOSED USE

[ ] Domestic [ ] Irrigation [ ] Community
[X] Industrial/ Commericial [ ] Livestock [ ] Dewatering
[ ] Thermal [ ] Injection [ ] Other _____

(5) BORE HOLE CONSTRUCTION

Special Standard [ ] Attach copy

Depth of Completed Well 197 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
20	0	165	Cement	0	50	6	
18	165	200					

How was seal placed: Method [ ] A [ ] B [X] C [ ] D [ ] E

[ ] Other _____

Backfill placed from _____ ft. to _____ ft. Material _____

Filter pack from 50 ft. to 200 ft. Material SAND Size 12/20

Explosives used: [ ] Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
[X]	[ ]	10	[X]	2	78	.365	[X]	[ ]	[X]	[ ]
[X]	[ ]	10	[ ]	108	118	.365	[X]	[ ]	[X]	[ ]
[X]	[ ]	10	[ ]	128	133	.365	[X]	[ ]	[X]	[ ]
[X]	[ ]	10	[ ]	138	192	.365	[X]	[ ]	[X]	[ ]
[ ]	[ ]		[ ]				[ ]	[ ]	[ ]	[ ]

Shoe [ ] Inside [ ] Outside [ ] Other Location of shoe(s) _____

Temp casing [ ] Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type WIRE WRAP Material S.S.

Perf/Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	10	78	108	.015			
Screen	Casing	10	118	128	.015			
Screen	Casing	10	133	138	.015			
Screen	Casing	10	192	197	.015			

(8) WELL TESTS: Minimum testing time is 1 hour

(•) Pump ( ) Bailer ( ) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
102	35	108	5

Temperature 58 °F Lab analysis [ ] Yes By _____

Water quality concerns? [ ] Yes (describe below)

From	To	Description	Amount	Units

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WATER RESOURCES DEPT
SALEM, OREGON

(9) LOCATION OF WELL (legal description)

County MALHEUR Twp 18 S N/S Range 47 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or _____ DMS or DD

Long ° ' " or _____ DMS or DD

(•) Street address of well ( ) Nearest address

1330 S.W. 4TH ST, ONTARIO, OR

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening			[ ]	
Completed Well	05-12-2009		[ ]	10.8

Flowing Artesian? [ ] Dry Hole? [ ]

WATER BEARING ZONES Depth water was first found 77

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
03-16-2009	8.3	25	102		[ ]	10.8
03-17-2009	77	79	102		[ ]	10.8
03-17-2009	80	82	102		[ ]	10.8
03-17-2009	83	85	102		[ ]	10.8
03-17-2009	95	108	102		[ ]	10.8

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	7
SAND, GRAVEL	7	25
HARD BLUE CLAY	25	77
FINE SAND	77	79
HARD BLUE CLAY	79	80
FINE SAND	80	82
HARD CLAY	82	83
FINE SAND	83	85
HARD CLAY	85	90
SOFT SANDY CLAY W/ FINE SAND	90	95
FINE SAND	95	108
HARD BLUE CLAY	108	120
FINE SAND	120	127
GREY CLAY	127	134
FINE SAND	134	137
GREY CLAY	137	165
SILTSTONE, CLAYSTONE	165	167
GREY CLAY	167	182
SILTSTONE, CLAYSTONE	182	183

Date Started 04-16-2009 Completed 05-12-2009

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number _____ Date _____

Password : (if filing electronically) _____

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 06-08-2009

Password : (if filing electronically) _____

Signed _____

Contact Info (optional) _____

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.89

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FEB 08 2010

MALH 53555

WATER SUPPLY WELL REPORT - continuation page

WELL I.D. # L 100201

START CARD # 1006369

(5) BORE HOLE CONSTRUCTION

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
03-17-2009	120	127	102			10.8
03-17-2009	134	135	102			10.8
03-18-2009	193	195	102			10.8

(11) WELL LOG

Material	From	To
GREY CLAY	183	193
SILTSTONE	193	195
GREY CLAY	195	200

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WATER RESOURCES DEPT
SALEM, OREGON

Comments/Remarks

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Well No.3 - West Shallow

MALH 53556

MALH 53556

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

WELL LABEL # L 100202

START CARD # 1006499

(1) LAND OWNER

Owner Well I.D. _____

First Name _____ Last Name _____

Company STATE OF OREGON MILITARY DEPARTMENT

Address 1330 SOUTH WEST 4TH ST

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

[X] New Well [ ] Deepening [ ] Conversion
[ ] Alteration (repair/recondition) [ ] Abandonment

(3) DRILL METHOD

[ ] Rotary Air [ ] Rotary Mud [ ] Cable [ ] Auger [ ] Cable Mud
[X] Reverse Rotary [ ] Other _____

(4) PROPOSED USE

[ ] Domestic [ ] Irrigation [ ] Community
[X] Industrial/ Commericial [ ] Livestock [ ] Dewatering
[ ] Thermal [ ] Injection [ ] Other _____

(5) BORE HOLE CONSTRUCTION

Special Standard [ ] Attach copy

Depth of Completed Well 31 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
20	0	31	Bentonite	0	10	5,000	P

How was seal placed: Method [ ] A [ ] B [ ] C [ ] D [ ] E

[X] Other DRY POUR

Backfill placed from _____ ft. to _____ ft. Material _____

Filter pack from 10 ft. to 31 ft. Material 3/8 Size pea gravel

Explosives used: [ ] Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
[X]	[ ]	10	[X]	2	16	.365	[X]	[ ]	[X]	[ ]
[X]	[ ]	10	[ ]	26	31	.365	[X]	[ ]	[X]	[ ]
[ ]	[ ]		[ ]				[ ]	[ ]	[ ]	[ ]
[ ]	[ ]		[ ]				[ ]	[ ]	[ ]	[ ]
[ ]	[ ]		[ ]				[ ]	[ ]	[ ]	[ ]

Shoe [ ] Inside [ ] Outside [ ] Other Location of shoe(s) _____

Temp casing [ ] Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type WIRE WRAP Material S.S.

Perf/Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	10	16	26	.1			

(8) WELL TESTS: Minimum testing time is 1 hour

(•) Pump ( ) Bailer ( ) Air ( ) Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
70	11.1	23	4

Temperature 58 °F Lab analysis [ ] Yes By _____

Water quality concerns? [ ] Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County MALHEUR Twp 18 S N/S Range 47 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or _____ DMS or DD

Long ° ' " or _____ DMS or DD

(•) Street address of well ( ) Nearest address

1330 SOUTH WEST 4TH ST ONTARIO, OR 97914

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well	05-19-2009			8.3

Flowing Artesian? [ ] Dry Hole? [ ]

WATER BEARING ZONES Depth water was first found 8.3

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
04-21-2009	8.3	25	70			8.3

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	7
SAND, GRAVEL	7	25
HARD BLUE CLAY	25	31

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JUL 17 2009
WATER RESOURCES DEPT
SALEM, OREGON

Date Started 04-21-2009 Completed 05-19-2009

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number _____ Date _____

Password : (if filing electronically) _____

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 06-19-2009

Password : (if filing electronically) _____

Signed _____

Contact Info (optional) _____

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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FEB 08 2010

Well No. 4 - East Shallow

MALH 53568

STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

09-02-2009

WELL LABEL # L 100204

START CARD # 1007723

(1) LAND OWNER

Owner Well I.D. WELL 3

First Name _____ Last Name _____

Company STATE OF OREGON MILITARY DEPARTMENT

Address 1330 S.W. 4th STREET

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other _____

(4) PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Community ☒ Industrial/ Commericial ☐ Livestock ☐ Dewatering ☐ Thermal ☐ Injection ☐ Other _____

(5) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)

Depth of Completed Well 24.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
12	0	18	Bentonite Chips	0	18	12	S
8	18	26					

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other DRY POUR

Backfill placed from _____ ft. to _____ ft. Material _____

Filter pack from _____ ft. to _____ ft. Material _____ Size _____

Explosives used: ☐ Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
◉	○	8	☒	2	19	.322	◉	○	☒	☐
○	◉	6	☐	14	19	.280	◉	○	☒	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

Shoe ☒ Inside ☐ Outside ☐ Other Location of shoe(s) 19

Temp casing ☐ Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type WIRE WRAP Material S.S

Perf/Screen	Casing/Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/pipe size
Screen	Casing	7.5	19	24	1			8

(8) WELL TESTS: Minimum testing time is 1 hour

◉ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
62	6	22	48

Temperature 58 °F Lab analysis ☐ Yes By _____

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Malheur Twp 18.00 S N/S Range 47.00 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or _____ DMS or DD

Long ° ' " or _____ DMS or DD

◉ Street address of well ○ Nearest address

1330 S.W. 4th STREET

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well	08-13-2009			8

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found 8

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
08-12-2009	8	24				8

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	2
CLEACHY	2	8
GRAVEL	8	24
HARD BLUE CLAY	24	26

FEB 08 2010

Date Started 08-12-2009 Completed 08-13-2009

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number _____ Date _____

Electronically Filed

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 09-02-2009

Electronically Filed

Signed TERRY DAUGHERTY (E-filed)

Contact Info (optional) _____

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

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WATER SUPPLY WELL REPORT - continuation page

MALH 53568

09-02-2009

WELL I.D. # L 100204

START CARD # 1007723

(5) BORE HOLE CONSTRUCTION

BORE HOLE

Dia	From	To

SEAL

Material	From	To	Amt	sacks/ lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/Screen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To
FEB 08 2010		

Comments/Remarks

NOTE: 7"x 8" K-PACKER AT 14'

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STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

MALH 53625

12-14-2009

WELL LABEL # L 100207

START CARD # 1008831

(1) LAND OWNER

Owner Well I.D. WELL # 4

First Name _____ Last Name _____

Company STATE OF OREGON, OREGON MILITARY DEPARTMENT

Address 1330 S.W. 4TH STREET

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other _____

(4) PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Community ☒ Industrial/ Commercial ☐ Livestock ☐ Dewatering ☐ Thermal ☒ Injection ☐ Other _____

(5) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)

Depth of Completed Well 23.00 ft.

BORE HOLE

Dia	From	To
12	0	18
8	18	23

SEAL

Material	From	To	Amt	sacks/ lbs
Bentonite	0	18	550	P

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other DRY POUR

Backfill placed from _____ ft. to _____ ft. Material _____

Filter pack from _____ ft. to _____ ft. Material _____ Size _____

Explosives used: ☐ Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Sd	Plstc	Wld	Thrd
◉	○	8	☒	2	18	.332	◉	○	☒	☐
○	◉	6	☐	13	18	.250	◉	○	☒	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

Shoe ☒ Inside ☐ Outside ☐ Other Location of shoe(s) 18

Temp casing ☐ Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type JOHNSON Material S.S.

Perf/Screen	Casing/Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	7	18	23	1			

(8) WELL TESTS: Minimum testing time is 1 hour

◉ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
15	9	20	4

Temperature 60 °F Lab analysis ☐ Yes By _____

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Malheur Twp 18.00 S N/S Range 47.00 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or 44.01573600 DMS or DD

Long ° ' " or -116.97054700 DMS or DD

◉ Street address of well ○ Nearest address

1330 S.W. 4TH STREET, ONTARIO, OREGON

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well	12-09-2009			8

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found 8

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
12-01-2009	7	23				8

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	3
BROWN CLAY	3	7
GRAVEL	7	23
BLUE CLAY	23	23

RECEIVED
FEB 08 2010
WATER RESOURCES DEPT
SALEM, OREGON

Date Started 11-30-2009 Completed 12-09-2009

(unbonded) Water Well Constructor Certification

I certify that the work I performed on the construction, deepening, alteration, or abandonment of this well is in compliance with Oregon water supply well construction standards. Materials used and information reported above are true to the best of my knowledge and belief.

License Number _____ Date _____

Electronically Filed

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 12-14-2009

Electronically Filed

Signed TERRY DALGHERTY (E-filed)

Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT

THIS REPORT MUST BE SUBMITTED TO THE WATER RESOURCES DEPARTMENT WITHIN 30 DAYS OF COMPLETION OF WORK

Form Version: 0.95

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WATER SUPPLY WELL REPORT - continuation page

MALH 53625

12-14-2009

WELL I.D. # L 100207

START CARD # 1008831

(5) BORE HOLE CONSTRUCTION

BORE HOLE

Dia	From	To

SEAL

Material	From	To	Amt	sacks/lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/Screen	Casing/Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To

FEB 0 8 2010

Comments/Remarks

6"x8" K-PACKER LOCATED AT 13'

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STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

MALH 53626

12-14-2009

WELL LABEL # L 100208

START CARD # 1008832

(1) LAND OWNER

Owner Well I.D. WELL # 5

First Name _____ Last Name _____

Company STATE OF OREGON, OREGON MILITARY DEPARTMENT

Address 1330 S.W. 4TH STREET

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other _____

(4) PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Community ☒ Industrial/ Commercial ☐ Livestock ☐ Dewatering ☐ Thermal ☒ Injection ☐ Other _____

(5) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)

Depth of Completed Well 24.00 ft.

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs
12	0	18	Bentonite	0	18	550	P
8	18	24					

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other DRY POUR

Backfill placed from _____ ft. to _____ ft. Material _____

Filter pack from _____ ft. to _____ ft. Material _____ Size _____

Explosives used: ☐ Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
◉	○	8	☒	2	19	.322	◉	○	☒	☐
○	◉	6	☐	14	19	.250	○	◉	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

Shoe ☒ Inside ☐ Outside ☐ Other Location of shoe(s) 19

Temp casing ☐ Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type JOHNSON Material S.S

Perf/S creen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	7	19	24	1			

(8) WELL TESTS: Minimum testing time is 1 hour

◉ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
35	9.6	20	4

Temperature 60 °F Lab analysis ☐ Yes By _____

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Malheur Twp 18.00 S N/S Range 47.00 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or 44.01573600 DMS or DD

Long ° ' " or -116.97054700 DMS or DD

◉ Street address of well ○ Nearest address

1330 S.W. 4TH STREET, ONTARIO, OREGON

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well	12-10-2009			7.1

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found 8

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
12-01-2009	8	24				6

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	3
BROWN CLAY	3	8
GRAVEL	8	24
BLUE CLAY	24	24

FEB 08 2010

Date Started 12-01-2009 Completed 12-10-2009

(unbonded) Water Well Constructor Certification

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License Number _____ Date _____

Electronically Filed

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 12-14-2009

Electronically Filed

Signed TERRY DAUGHERTY (E-filed)

Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT

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WATER SUPPLY WELL REPORT - continuation page

MALH 53626

12-14-2009

WELL I.D. # L 100208

START CARD # 1008832

(5) BORE HOLE CONSTRUCTION

BORE HOLE Dia	From	To	SEAL Material	From	To	Amt	sacks/ lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/S creen	Casing/ Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To

FEB 08 2010

Comments/Remarks

6"X8" K-PACKER LOCATED AT 19'

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STATE OF OREGON
WATER SUPPLY WELL REPORT
(as required by ORS 537.765 & OAR 690-205-0210)

MALH 53627

12-14-2009

WELL LABEL # L 100209

START CARD # 1008833

(1) LAND OWNER

Owner Well I.D. WELL # 6

First Name _____ Last Name _____

Company STATE OF OREGON, OREGON MILITARY DEPARTMENT

Address 1330 S.W. 4TH STREET

City ONTARIO State OR Zip 97914

(2) TYPE OF WORK

☒ New Well ☐ Deepening ☐ Conversion ☐ Alteration (repair/recondition) ☐ Abandonment

(3) DRILL METHOD

☒ Rotary Air ☐ Rotary Mud ☐ Cable ☐ Auger ☐ Cable Mud ☐ Reverse Rotary ☐ Other

(4) PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Community ☒ Industrial/ Commercial ☐ Livestock ☐ Dewatering ☐ Thermal ☒ Injection ☐ Other

(5) BORE HOLE CONSTRUCTION

Special Standard ☐ (Attach copy)

Depth of Completed Well 25.00 ft.

BORE HOLE

Dia	From	To
12	0	25

SEAL

Material	From	To	Amt	sacks/ lbs
Bentonite	0	18	550	P

How was seal placed: Method ☐ A ☐ B ☐ C ☐ D ☐ E

☒ Other DRY POUR

Backfill placed from ____ ft. to ____ ft. Material _____

Filter pack from ____ ft. to ____ ft. Material _____ Size _____

Explosives used: ☐ Yes Type _____ Amount _____

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd
◉	○	8	☒	2	20	.322	◉	○	☒	☐
○	◉	6	☐	15	20	.250	○	◉	☒	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐
○	○		☐				○	○	☐	☐

Shoe ☒ Inside ☐ Outside ☐ Other Location of shoe(s) 20

Temp casing ☐ Yes Dia _____ From _____ To _____

(7) PERFORATIONS/SCREENS

Perforations Method _____

Screens Type JOHNSON Material S.S.

Perf/Screen	Casing/Liner	Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/ pipe size
Screen	Casing	7	20	25	1			

(8) WELL TESTS: Minimum testing time is 1 hour

◉ Pump ○ Bailer ○ Air ○ Flowing Artesian

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)
45	6.5	20	4

Temperature 60 °F Lab analysis ☐ Yes By _____

Water quality concerns? ☐ Yes (describe below)

From	To	Description	Amount	Units

(9) LOCATION OF WELL (legal description)

County Malheur Twp 18.00 S N/S Range 47.00 E E/W WM

Sec 9 NE 1/4 of the SE 1/4 Tax Lot 500

Tax Map Number _____ Lot _____

Lat ° ' " or 44.01573600 DMS or DD

Long ° ' " or -116.97054700 DMS or DD

◉ Street address of well ○ Nearest address

1330 S.W. 4TH STREET, ONTARIO, OREGON

(10) STATIC WATER LEVEL

	Date	SWL(psi)	+	SWL(ft)
Existing Well / Predeepening				
Completed Well	12-11-2009			8.6

Flowing Artesian? ☐ Dry Hole? ☐

WATER BEARING ZONES Depth water was first found 9

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)
12-04-2009	9	25				8.6

(11) WELL LOG

Ground Elevation _____

Material	From	To
TOP SOIL	0	3
BROWN CLAY	3	9
GRAVEL	9	25
BLUE CLAY	25	25

FEB 08 2010

Date Started 12-04-2009 Completed 12-11-2009

(unbonded) Water Well Constructor Certification

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License Number _____ Date _____

Electronically Filed

Signed _____

(bonded) Water Well Constructor Certification

I accept responsibility for the construction, deepening, alteration, or abandonment work performed on this well during the construction dates reported above. All work performed during this time is in compliance with Oregon water supply well construction standards. This report is true to the best of my knowledge and belief.

License Number 1505 Date 12-14-2009

Electronically Filed

Signed TERRY DAUGHERTY (E-filed)

Contact Info (optional)

ORIGINAL - WATER RESOURCES DEPARTMENT

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WATER SUPPLY WELL REPORT - continuation page

MALH 53627

12-14-2009

WELL I.D. # L 100209

START CARD # 1008833

(5) BORE HOLE CONSTRUCTION

BORE HOLE

Dia	From	To

SEAL

Material	From	To	Amt	sacks/lbs

FILTER PACK

From	To	Material	Size

(6) CASING/LINER

Casing	Liner	Dia	+	From	To	Gauge	Stl	Plstc	Wld	Thrd

(7) PERFORATIONS/SCREENS

Perf/Screen	Casing/Liner	Screen Dia	From	To	Scrn/slot width	Slot length	# of slots	Tele/pipe size

(8) WELL TESTS: Minimum testing time is 1 hour

Yield gal/min	Drawdown	Drill stem/Pump depth	Duration (hr)

Water Quality Concerns

From	To	Description	Amount	Units

(10) STATIC WATER LEVEL

Water Bearing Zones

SWL Date	From	To	Est Flow	SWL(psi)	+	SWL(ft)

(11) WELL LOG

Material	From	To

FEB 0 8 2010

Comments/Remarks

6"X8" K-PACKER LOCATED AT 15'

T 11015

SPF WATER ENGINEERING, LLC

TECHNICAL MEMORANDUM

To: Terry Daugherty - Riverside, Inc.

From: Terry Scanlan – SPF Water Engineering

CC: Bob Tikker – Tikker Engineering
Hal Maxey – Maxey Tookey Architects

Subject: Analysis of Two-Day Hydronic Well Pumping Test and Recommendations for Additional Wells and Mechanical Equipment – Ontario Readiness Center Project

Date: September 8, 2009

Project No.: 739.0010

Three hydronic system wells have been completed and test pumped at the Ontario Readiness Center project site. This memo provides analysis of a recent two-day pumping test of the third well. Recommendations for additional well construction are included. This memo builds on previous analyses presented by SPF Water Engineering in documents dated May 28, 2009 and September 12, 2008.

BACKGROUND

Existing Wells. There are currently a total of four wells on the property, including three wells drilled for the hydronic system in 2009 and a well drilled for irrigation purposes in 2005 for Treasure Valley Community College (TVCC).

Three of the wells tap the shallow aquifer and one well taps the deep aquifer. The shallow aquifer consists of sand and gravel and extends from a depth of approximately 7 feet to a depth of 20 to 25 feet. The deep aquifer extends from approximately 70 to more than 200 feet, and consists of intermittent fine sand layers between thicker layers of clay and shale. The deep aquifer has different water chemistry than the shallow aquifer. There is no direct hydraulic connection between the shallow and deep aquifers.

For purpose of this memorandum, the four wells are numbered and described as follows.

- **Well No. 1 (Construction Well or TVCC Well)** – Well No. 1 was drilled using the cable-tool method in 2005 for TVCC. The well is completed with 10-inch diameter casing to 40 feet. The casing is perforated from 18.5 to 28 feet. The well taps the shallow aquifer. Well No. 1 is located in the northwest portion of the project site, approximately 300 to 400 feet from Wells 2, 3, and 4.

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- **Well No. 2 (ORC Deep Well, ORC Hydronic Well 1)** – Well No. 2 was drilled to a total depth of 200 feet using the reverse-rotary method in April and May 2009 and is completed to a total depth of 197 feet. Well screen intervals are 78 to 108 feet, 118 to 128 feet, 133 to 138 feet, and 192 feet to 197 feet. The well taps the deep aquifer.

- **Well No. 3 (ORC Shallow West Well, ORC Hydronic Well 2)** – Well No. 3 was drilled using the reverse-rotary method in April and May 2009 to a total depth of 31 feet, and is completed with a single string of 10-inch casing and well screen from +2 to 31 feet. The screen is 0.100-inch slot pipe-size well screen placed from approximately 16 to 26 feet. The well taps the shallow aquifer, and is located a few feet adjacent to Well No. 2.

- **Well No. 4 (ORC Shallow East Well, ORC Hydronic Well 3)** – Well No. 4 was drilled using the air-rotary method in August 2009 to a total depth of 26 feet. The well is completed with 8-inch casing from +2 to 19 feet, with a separate string of 6-inch or 7-inch casing from 14 to 19 feet and 8-inch telescope well screen from 19 to 24 feet. A 7x8-inch neoprene packer at 14 feet is used to seal the two casing strings together. The well screen is 0.100-inch slot size. The well taps the shallow aquifer, and is located approximately 100 feet east of Wells Nos. 2 and 3.

Note that the well identification numbers used during this test differ from the well identifications numbers used to identify the wells in my previous memo of May 8, 2009. Well reports are provided as Attachment A.

PUMPING TEST DESCRIPTION

The test consisted of pumping Well No. 4 for 49.5 hours at an average rate of 64 gpm. Water levels were measured in the pumping well (Well No. 4), and in three observation wells (Well Nos. 1 through 3). Water levels were measured using electric-line well sounders in all four wells. In addition, the water level was monitored using a data logging pressure transducer in Well No. 3. Pumping equipment consisted of a 4-inch submersible pump with electric motor powered by a portable generator. Water from the pump was discharged to an adjacent agricultural field, approximately 200 feet to the south. Flow rate was monitored using a 2.5-inch x 4-inch circular orifice weir.

The pumping test began on August 19, 2009 at 12:40 pm, and was concluded on August 21, 2009 at 2:10 pm. Pumping rate was held constant between 62 and 66 gpm for the duration of the test except for short-periods of generator failure during the late evening of August 19 and early morning of August 20. The generator failure was apparently due to clogged fuel filters. Following replacement of the filters at approximately 9:00 am on August 20, the generator and pump operated continuously until the end of the pumping test.

Following the conclusion of pumping, water-level recovery was measured for 70 minutes in all four wells. The transducer was left in Well No. 3 for one additional week, after

which the transducer was removed and all four wells were measured with an electric-line well sounder. Test data are provided as Attachment B.

PUMPING TEST RESPONSES

Well No. 4. Static water level at the start of the test was 3.38 feet below ground surface in Well No. 4. Pumping water level at the end of the pumping period was 12.58 feet below ground surface, for a total drawdown of 9.2 feet. Specific capacity at 4 hours and again at 49.5 hours was 7.0 gpm per foot. This specific capacity is similar to the 6.3 gpm/ft capacity measured at Well No. 3 during the pumping test of that well in May 2009.

Pumping water levels after the first hour of pumping showed a total fluctuation of approximately 1.2 feet. This fluctuation was partially due to generator failure. However, much of the fluctuation is likely caused by barometric or other influences.

Although the pumping water level after four hours of pumping was equal to the pumping water level at 49.5 hours, the logarithmic trend suggests that water levels were declining over the test period. The apparent trend appears to be approximately 0.4 feet per log cycle. Therefore, continuous pumping of the well at 65 gpm for a period of two or more months would have likely resulted in total drawdown approaching 10 feet.

Analysis of the drawdown response of Well No. 4 indicates an apparent aquifer transmissivity of approximately 44,000 gpd/ft. Analysis of the recovery response of Well No. 4 indicates an apparent aquifer transmissivity of approximately 34,000 gpd/ft.

Well No. 3. Static water level in Well No. 3 was 4.58 feet below ground surface at the start of the test. Drawdown in the well after 49.5 hours was 1.56 feet.

The logarithmic trend suggests that continuous pumping of Well No. 4 for period of two or more months would have likely resulted in total interference drawdown of approximately 2.5 feet at Well No. 3.

Analysis of the drawdown response in Well No. 3 suggests a transmissivity of approximately 24,000 gpd/ft and a storage coefficient of 0.005. Analysis of the recovery response of Well No. 4 indicates an apparent aquifer transmissivity of approximately 34,000 gpd/ft for the first 6 hours of recovery, and a transmissivity of approximately 20,000 gpd/ft for the remainder of the recovery period.

Well No. 2. Well No. 2 is completed in a deep-aquifer zone that is not in direct hydraulic connection with the shallow aquifer tapped by the pumping well (Well No. 4). As a result, no response was anticipated in Well No. 2. However, monitoring during the test period showed fluctuations in excess of 3 feet. The cause of the fluctuation is unknown, but assumed to be related to barometric pressure changes, pumping of other deep-aquifer wells in the area, or other unidentified factors. There was no apparent direct water-level response to pumping of Well No. 4.

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During the test it was noted that gas could be seen bubbling to the surface of the well. The nature of this gas in not known, but could be methane or carbon dioxide. The presence of gas coming out of solution in the well should be noted in the design of mechanical equipment.

Well No. 1. The water-level response, if any, at Well No. 1 to pumping of Well No. 4 appears to be 0.25 feet or less. Therefore, pumping from shallow aquifer production wells is not anticipated to significantly reduce water levels in the vicinity of shallow aquifer injection wells.

DISCUSSION

Groundwater Production. Sustained pumping of Well No. 4 at approximately 65 gpm will result in approximately 2.5 feet of interference drawdown at Well No. 3. Similarly, simultaneous sustained pumping of Well No. 3 at 65 gpm should result in a minimum of 2.5 feet of interference drawdown at Well No. 4. The actual interference drawdown may be greater, because as the aquifer water level is lowered in the vicinity of the pumping wells, the saturated aquifer thickness decreases thereby decreasing the effective aquifer transmissivity.

Pumping of a third shallow well at 65 gpm, located equidistant from Well Nos. 3 and 4, will result in a minimum of 2.5 feet of additional interference drawdown at both Well Nos. 3 and 4. Therefore, the result of sustained pumping of three equidistant shallow-aquifer wells at 65 gpm each (195 gpm total) will be approximately 10 feet of pumping drawdown in each well and 5 feet of interference drawdown at each well. Assuming static water levels of 5 feet in each well, the calculated pumping water level will be 20 feet in each well (i.e., 10' pumping drawdown + 5' interference drawdown + 5 feet static depth to water). These wells are generally screened between 16 and 26 feet, and drawing down water levels to approximately 20 feet is probably not practical. Therefore, it will be necessary to pump at a lower rate in each well. Reducing the pumping rate to approximately 50 gpm per well (150 gpm total) appears to be feasible. Therefore, production of up a maximum of 150 gpm from the shallow aquifer is recommended.

As noted in the May 28, 2009 memo, two deep-aquifer wells spaced 100 feet or more apart should produce a total of 200 gpm. Therefore, three shallow-aquifer wells and two deep-aquifer wells should produce approximately 350 gpm, very close to the target capacity of 360 gpm. Note that this total capacity does not allow for any redundancy or for future declines in well productivity.

Groundwater Injection. Within an aquifer, injection of groundwater generally results in the opposite hydraulic response as production of groundwater. Thus, if sustained shallow-aquifer pumping of 65 gpm results in 2.5 feet of water-level drawdown at a distance of 100 feet, injection of 65 gpm will result in 2.5 feet of water-level rise at a distance of 100 feet. Furthermore, the water-level rise should be proportional to injection rate. Therefore, if 130 gpm (i.e., double the 65 gpm rate) is injected into the shallow aquifer, water-level rise at a radius of 100 feet will be about 5 feet (i.e., double the water-

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level rise at 65 gpm). Water-level rise at a distance of less than 100 feet from the injection well will be more than 5 feet, while the water-level rise at a distance of more than 100 feet from the injection well will be less than 5 feet. This magnitude of water-level rise is significant at the ORC because the depth to the water table ranges from 6.34 feet below ground surface at Well No. 1 to 3.38 feet below ground surface at Well No. 4. Therefore, water logging of soils in the vicinity of a shallow injection well is possible at injection rates of more than about 75 gpm.

Given the issues associated with water table rise, shallow injection wells should be spaced as widely as possible within the site. Furthermore, shallow injection wells should be operated such that the average injection rate is limited to prevent water logging of surrounding soils. The maximum rate can likely be determined through operation, and will depend on spacing of the wells. However, assuming two wells spaced 200 feet apart, maximum average injection rates of approximately 50 to 100 gpm per well should be assumed

Injection into the deep aquifer does not pose the issues associated with water-table rise that occur with the shallow aquifer. The clay layers located between the shallow and deep aquifer zones are adequate to prevent deep-aquifer injection activities from raising the water table in the shallow aquifer. It is reasonable to assume that the deep aquifer can accept the full 360 gpm target flow rate with initial injection pressures of less than 100 psi. Two deep injection wells, spaced a minimum of 200 feet apart, are recommended.

Injection Well Plugging. A common problem with injection wells is plugging. Although all wells have a tendency to lose capacity over time due to various physical and biochemical mechanisms, injection wells are especially problematic in this regard because fluids are forced into the well which tends to promote plugging. At the ORC, plugging is more likely to occur in deep-aquifer injection wells due to the low-permeability, fine-grained sands that comprise the deep aquifer. Conversely, all other things being equal, plugging of shallow-aquifer injection wells should be less likely to occur due to the coarser, more permeable, sands and gravel that form the shallow aquifer.

To combat plugging, it is strongly recommended that each injection well be equipped with a high-capacity submersible pump for periodic flushing of each well to waste. Reversing the flow by pumping tends to unplug an injection well. Although loss of injection capacity will likely still occur over time, the rate of loss will be diminished by frequent flushing. The pumps should be automated to flush at intervals.

Water Chemistry Issues. It is not known if the chemistry of the deep-aquifer water is compatible with the chemistry of the shallow-aquifer water, and vice versa. As a result, mixing of the two waters within the injection wells and surrounding aquifer zones could result in undesirable chemical reactions, resulting in precipitation of inorganic compounds or release of dissolved gasses. Such chemical reactions may cause plugging of a well that cannot be cured simply by flushing. For this reason, it may be

best to minimize mixing of the different water chemistries to the extent possible. This is an operational and design issue, and may not be practical if flow rates in excess of 150 gpm are required by the hydronic system.

Injection Well Mechanical Issues. Mechanical equipment required for proper operation of the injection wells include individual flow meters, pressure gages, pressure sustaining valves, flushing pumps, injection tubes, isolation valves (manual and solenoid controlled), and throttling valves. Well heads must be configured for injection operations.

- Flow meters and pressure gages at each injection well are needed for assessing well performance.
- Pressure sustaining valves are needed to maintain pressure within the hydronic system. Without pressure sustaining valves (or a similar device), there is the potential for the injection piping from the building to drain each time the pumps cycle off.
- Flushing pumps are necessary to minimize well plugging.
- Injection tubes are useful to prevent cascading and air entrainment in the wells. At this project site, static water levels are relatively high so that injection tubes can be short (i.e., 10 feet or less).
- Manual isolation valves allow wells to be serviced while the system is operational.
- Solenoid controlled isolation valves are needed to allow automatic flushing.
- Throttling valves or other flow control devices are needed to prevent excessive injection into the shallow-aquifer zone.
- Well heads must be configured to accept injection pressures of up to 100 psi. To do so may require flanged casing, air and vacuum release valves, and sealed electrical penetrations. In addition, freeze protection may be required.

RECOMMENDATIONS

Production Wells

1. Drill one additional shallow production well and one additional deep production well to maximize groundwater production at this site. The two wells can be located side-by-side, but the well pair should be located as far as practical from the existing wells, and in no case should the well pair be less than 100 feet from existing wells. Estimated maximum production from five wells is 350 gpm.

2. Equip the shallow production wells with nominal 50 gpm pumps. Assuming pumping water levels of approximately 15 feet, and typical injection pressures of 25 psi, nominal 2 hp pump motors are required. To allow for higher injection pressures (in the event of well plugging), 3 hp pumps could be considered if the hydronic system pressure sustaining valve is set for 40 to 50 psi. Grundfos 40S pump are applicable for this purpose. Pump setting depths of at least 20 feet are recommended.

3. Equip the deep production wells with nominal 100 gpm pumps. Assuming pumping water levels of 70 feet and injection pressures of 50 psi, 7.5 hp pump motors are required. Grundfoss 85S pumps are applicable for this purpose. Pump setting depths of approximately 110 feet are recommended.

4. Pumps should be equipped with motor shrouds for cooling purposes. Flow switches (or other devices) should be provided for low-flow rate protection. Pumps should be equipped with check valves. Isolation valves should be provided for each well.

5. Reserve space and stub piping for future production wells if the two additional production wells are insufficient or if the five wells lose productivity over time.

Injection Wells

6. Construct two shallow and two deep injection wells. The deep and shallow injection well pairs should be spaced a minimum of 200 feet apart. In addition, it may be possible to equip Well No. 1 for injection purposes.

7. Provide pumps and flush lines in each injection well.
   - Deep injection well pumps should be 150 gpm, 5 hp. Grundfos 150S pumps are applicable for the deep wells.
   - Shallow injection well pumps should be 75 gpm, 1.5 hp or 2 hp. Grundfos 75S or Sta-Rite 70 Series pumps are applicable for the shallow wells. These pumps may need to be throttled to prevent overpumping.

8. Set up the injection well pumps for automated flushing to waste. Control wires between the mechanical room and well sites are recommended to provided start and stop signals to pumps and valves. Solenoid valves can be used to open flush lines.

9. Provide the necessary mechanical equipment (flow meters, pressure gages, pressure sustaining valves, injection tubes, isolation valves, throttling valves, and air and vacuum venting, freeze protection) to allow operation of the injection wells.

General Recommendations

10. Attempt to reconfigure the design or operation of the hydronic system to reduce the water demand. A maximum system demand of 150 gpm is much more practical at this location than a maximum system demand of 360 gpm. If maximum hydronic water system demands are reduced to 150 gpm, well operational and maintenance problems will be reduced and redundancy will be provided. Shallow wells can be operated with deep wells as back up (and vice versa). Alternatively, a maximum demand of 150 gpm could reduce the number of wells required (although redundancy will be limited).

11. Significant monitoring of injection well and production well water levels, pressures, and flow rates will be necessary during initial operation of the system. Modifications in operations will likely be necessary based on system responses to pumping and injection. Long-term monitoring will be necessary to detect and remedy well plugging or other issues.

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48-Hour Pumping Test Data

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Ontario Readiness Center - Shallow East Well Test, Q~64gpm																		
Tests Performed By:	SPF and Riverside Inc.																	
Test Pump:	Grundfos , 75 gpm, 8 bowls																	
Measurements Taken By:	SPF and Riverside Inc.																	
Flow Measurement:	2.5" x 4" orifice																	
Shallow East Well MP:	1.67 feet ags						1.72 toc - feet ags						WL measurements with riverside powers sounder					
Shallow West Well MP:	3.08 feet ags												WL measurements with 150' white waterline sounder					
Deep Well MP:	1.52 feet ags												WL measurements with 300' orange waterline sounder					
Construction Well MP:	2.68 feet ags @ electrical junction box						2.43 feet ags @ welded coupler						WL measurments with 300' blue waterline sounder					
					Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)				
Date	Time	t (min)	t' (min)	t/t'	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	Comments	
8/19/2009					4.75	3.38		7.66	4.58		14.03	12.51		9.02	6.34			
8/19/2009	12:40																Static WLs	
8/19/2009	12:41	1			15.98	14.61	11.23										pump on	
8/19/2009	12:42	2			13.23	11.86	8.48										adjusting valve	
8/19/2009	12:43	3			13.10	11.73	8.35											
8/19/2009	12:43:30	3.5						7.84	4.76	0.18								
8/19/2009	12:44	4			13.08	11.71	8.33											
8/19/2009	12:44:30	4.5									14.01	12.49	-0.02					
8/19/2009	12:45	5			13.16	11.79	8.41										clear	
8/19/2009	12:45:30	5.5						7.86	4.78	0.20								
8/19/2009	12:46	6			13.21	11.84	8.46										Q~63-65gpm	
8/19/2009	12:47	7			13.24	11.87	8.49	7.89	4.81	0.23								
8/19/2009	12:48	8			13.24	11.87	8.49	7.90	4.82	0.24								
8/19/2009	12:49	9			13.22	11.85	8.47	7.93	4.85	0.27								
8/19/2009	12:50	10			13.22	11.85	8.47	7.93	4.85	0.27							Q~65-66gpm	
8/19/2009	12:51	11						7.95	4.87	0.29								
8/19/2009	12:52	12			13.22	11.85	8.47	7.96	4.88	0.30								
8/19/2009	12:53	13						7.96	4.88	0.30								
8/19/2009	12:54	14									13.99	12.47	-0.04					
8/19/2009	12:55	15			13.23	11.86	8.48	7.97	4.89	0.31								
8/19/2009	12:57	17												9.02	6.34	0.00		
8/19/2009	12:58	18			13.27	11.90	8.52											
8/19/2009	13:00	20			13.30	11.93	8.55											
8/19/2009	13:01:30	21.5						7.99	4.91	0.33								
8/19/2009	13:04	24			13.32	11.95	8.57											
8/19/2009	13:05	25						7.98	4.90	0.32								
8/19/2009	13:06	26									13.93	12.41	-0.10					
8/19/2009	13:07	27															removed junction box and conduit @ construction well, mp changed to welded coupler	
8/19/2009	13:08	28			13.36	11.99	8.61											
8/19/2009	13:09	29						8.03	4.95	0.37								
8/19/2009	13:11	31			13.38	12.01	8.63							8.75	6.32	-0.02		
8/19/2009	13:13	33						8.06	4.98	0.40								
8/19/2009	13:16	36			13.40	12.03	8.65											
8/19/2009	13:17	37						8.06	4.98	0.40								
8/19/2009	13:18	38									13.90	12.38	-0.13					
8/19/2009	13:21	41						8.08	5.00	0.42								
8/19/2009	13:23:30	43.5												8.75	6.32	-0.02		
8/19/2009	13:24	44			13.48	12.11	8.73										Q~65gpm	

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/19/2009	13:26	46						8.10	5.02	0.44							
8/19/2009	13:27	47									13.87	12.35	-0.16				
8/19/2009	13:28	48						8.10	5.02	0.44							
8/19/2009	13:30	50						8.12	5.04	0.46							
8/19/2009	13:33	53												8.74	6.31	-0.03	
8/19/2009	13:34	54			13.50	12.13	8.75										
8/19/2009	13:42	62			13.55	12.18	8.80										
8/19/2009	13:42:30	62.5						8.15	5.07	0.49							
8/19/2009	13:43:30	63.5									13.81	12.29	-0.22				noticed cascading water or gas in deep well
8/19/2009	13:49	69												8.73	6.30	-0.04	
8/19/2009	13:50	70															Riverside nomenclature: construction-1, deep-2, shallowwest-3, shalloweast-4 Q~64gpm
8/19/2009	14:05	85															
8/19/2009	14:16	96			13.69	12.32	8.94										
8/19/2009	14:19	99						8.45	5.37	0.79							
8/19/2009	14:20	100									13.88	12.36	-0.15				
8/19/2009	14:23	103												8.82	6.39	0.05	Riverside to measure WLs, Well No. 4 from toc
8/19/2009	14:36	116			13.79	12.37	8.99										
8/19/2009	14:38	118						8.38	5.30	0.72							
8/19/2009	14:40	120									14.15	12.63	0.12				
8/19/2009	14:45	125.0												8.95	6.52	0.18	
8/19/2009	15:10	150.0			13.92	12.50	9.12										
8/19/2009	15:12	152						8.60	5.52	0.94							
8/19/2009	15:13	153									14.35	12.83	0.32				
8/19/2009	15:17	157.0												8.85	6.42	0.08	
8/19/2009	15:30	170			13.92	12.50	9.12										
8/19/2009	15:40	180.0						8.47	5.39	0.81							
8/19/2009	15:43	183									14.53	13.01	0.50				
8/19/2009	15:47	187												8.80	6.37	0.03	
8/19/2009	16:15	215			13.92	12.50	9.12										
8/19/2009	16:17	217						8.48	5.40	0.82							
8/19/2009	16:20	220									14.50	12.98	0.47				
8/19/2009	16:23	223												8.86	6.43	0.09	Q between 62 & 66 mark
8/19/2009	16:35	235			14.00	12.58	9.20										
8/19/2009	16:37	237						8.52	5.44	0.86							
8/19/2009	16:38	238									14.39	12.87	0.36				
8/19/2009	16:43	243												8.81	6.38	0.04	
8/19/2009	17:00	260			14.00	12.58	9.20	8.56	5.48	0.90							Q~64gpm
8/19/2009	17:05	265									14.25	12.73	0.22				
8/19/2009	17:08	268												8.83	6.40	0.06	
8/19/2009	17:24	284			14.00	12.58	9.20										
8/19/2009	17:28	288						8.54	5.46	0.88							
8/19/2009	17:29	289									14.25	12.73	0.22				
8/19/2009	17:32	292												8.83	6.40	0.06	
8/19/2009	18:04	324			14.00	12.58	9.20										
8/19/2009	18:06	326						8.69	5.61	1.03							
8/19/2009	18:08	328									14.01	12.49	-0.02				

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/20/2009	2:06	806						8.63	5.55	0.97							
8/20/2009	2:07	807									15.50	13.98	1.47				
8/20/2009	2:09	809												8.83	6.40	0.06	
8/20/2009	2:59	859			13.67	12.25	8.87										
8/20/2009	3:00	860						8.67	5.59	1.01							
8/20/2009	3:01	861									16.00	14.48	1.97				
8/20/2009	3:05	865												8.83	6.40	0.06	
8/20/2009	4:00	920			13.33	11.91	8.53										
8/20/2009	4:03	923						8.67	5.59	1.01							
8/20/2009	4:04	924									16.54	15.02	2.51				
8/20/2009	4:07	927												8.81	6.38	0.04	
8/20/2009	5:00	980			13.50	12.08	8.70										
8/20/2009	5:01	981						8.63	5.55	0.97							
8/20/2009	5:03	983									16.83	15.31	2.80				
8/20/2009	5:06	986												8.83	6.40	0.06	
8/20/2009	6:00	1040			13.33	11.91	8.53										
8/20/2009	6:02	1042						8.58	5.50	0.92							
8/20/2009	6:03	1043									17.13	15.61	3.10				
8/20/2009	6:06	1046												8.83	6.40	0.06	
8/20/2009	7:00	1100			13.33	11.91	8.53										
8/20/2009	7:04	1104						8.63	5.55	0.97							
8/20/2009	7:06	1106									16.75	15.23	2.72				
8/20/2009	7:08	1108												8.83	6.40	0.06	
8/20/2009	8:00	1160			13.21	11.79	8.41										
8/20/2009	8:03	1163						8.75	5.67	1.09							
8/20/2009	8:04	1164									16.25	14.73	2.22				
8/20/2009	8:07	1167												8.85	6.42	0.08	
8/20/2009	8:58	1218			13.17	11.75	8.37										changed fuel filters on generator, pump off
8/20/2009	8:59	1219						8.67	5.59	1.01							
8/20/2009	9:00	1220									15.92	14.40	1.89				
8/20/2009	9:03	1223												8.85	6.42	0.08	
8/20/2009	9:16	1236			13.33	11.91	8.53										
8/20/2009	9:17	1237						8.71	5.63	1.05							
8/20/2009	9:18	1238									15.79	14.27	1.76				
8/20/2009	9:21	1241												8.88	6.45	0.11	
8/20/2009	9:31	1251			13.29	11.87	8.49										
8/20/2009	9:32	1252						8.75	5.67	1.09							
8/20/2009	9:33	1253									15.71	14.19	1.68				
8/20/2009	9:35	1255												8.85	6.42	0.08	
8/20/2009	9:47	1267			13.25	11.83	8.45										
8/20/2009	9:48	1268						8.75	5.67	1.09							
8/20/2009	9:49	1269									15.63	14.11	1.60				
8/20/2009	9:51	1271												8.85	6.42	0.08	
8/20/2009	10:02	1282			13.23	11.81	8.43										
8/20/2009	10:03	1283						8.75	5.67	1.09							
8/20/2009	10:04	1284									15.54	14.02	1.51				
8/20/2009	10:07	1287												8.85	6.42	0.08	
8/20/2009	11:00	1340			13.08	11.66	8.28										
8/20/2009	11:02	1342						8.71	5.63	1.05							

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/20/2009	11:03	1343									15.25	13.73	1.22				
8/20/2009	11:05	1345												8.88	6.45	0.11	
8/20/2009	12:00	1400			13.83	12.41	9.03										
8/20/2009	12:04	1404						8.71	5.63	1.05							
8/20/2009	12:06	1406									15.08	13.56	1.05				
8/20/2009	12:08	1408												8.89	6.46	0.12	
8/20/2009	13:02	1462			13.83	12.41	9.03										
8/20/2009	13:06	1466						9.14	6.06	1.48							
8/20/2009	13:07	1467									14.83	13.31	0.80				
8/20/2009	13:09	1469												8.88	6.45	0.11	
8/20/2009	14:01	1521			13.88	12.46	9.08										
8/20/2009	14:03	1523						8.98	5.90	1.32							
8/20/2009	14:05	1525									14.50	12.98	0.47				
8/20/2009	14:10	1530												8.90	6.47	0.13	
8/20/2009	14:35	1555															SPF meas., Q~63gpm
8/20/2009	14:37	1557			13.69	12.27	8.89										
8/20/2009	14:41	1561						9.03	5.95	1.37							SPF meas.
8/20/2009	14:42	1562									14.50	12.98	0.47				SPF meas.
8/20/2009	14:46	1566												8.88	6.45	0.11	SPF meas.
8/20/2009	14:50	1570															increase Q~65-66gpm, 58 with spf thermometer
8/20/2009	14:51	1571			14.00	12.58	9.20										
8/20/2009	15:00	1580						9.21	6.13	1.55							
8/20/2009	15:01	1581									14.54	13.02	0.51				
8/20/2009	15:03	1583												8.88	6.45	0.11	
8/20/2009	15:59	1639			14.08	12.66	9.28										
8/20/2009	16:01	1641						9.17	6.09	1.51							
8/20/2009	16:04	1644									14.46	12.94	0.43				
8/20/2009	16:06	1646												8.89	6.46	0.12	
8/20/2009	17:00	1700			14.13	12.71	9.33										
8/20/2009	17:02	1702						9.17	6.09	1.51							
8/20/2009	17:03	1703									14.42	12.90	0.39				
8/20/2009	17:06	1706												8.90	6.47	0.13	
8/20/2009	17:56	1756			14.08	12.66	9.28										
8/20/2009	17:58	1758						9.15	6.07	1.49							
8/20/2009	18:00	1760									14.10	12.58	0.07				
8/20/2009	18:04	1764												8.96	6.53	0.19	
8/20/2009	18:57	1817						9.15	6.07	1.49							
8/20/2009	19:00	1820			14.13	12.71	9.33				14.17	12.65	0.14				
8/20/2009	19:02	1822												8.96	6.53	0.19	
8/20/2009	19:59	1879			14.08	12.66	9.28										
8/20/2009	20:00	1880						9.17	6.09	1.51							
8/20/2009	20:01	1881									14.25	12.73	0.22				
8/20/2009	20:03	1883												8.98	6.55	0.21	
8/20/2009	21:06	1946			14.10	12.68	9.30										
8/20/2009	21:08	1948						9.19	6.11	1.53							
8/20/2009	21:09	1949									14.63	13.11	0.60				
8/20/2009	21:11	1951												8.98	6.55	0.21	
8/20/2009	22:01	2001			14.21	12.79	9.41										
8/20/2009	22:03	2003						9.19	6.11	1.53							

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/20/2009	22:04	2004									14.96	13.44	0.93				
8/20/2009	22:06	2006												8.96	6.53	0.19	
8/20/2009	23:05	2065			14.19	12.77	9.39										
8/20/2009	22:06	2006						9.21	6.13	1.55							
8/20/2009	22:07	2007									14.88	13.36	0.85				
8/20/2009	22:09	2009												8.98	6.55	0.21	
8/21/2009	0:00	2120			14.33	12.91	9.53										
8/21/2009	0:01	2121						9.17	6.09	1.51							
8/21/2009	0:02	2122									14.47	12.95	0.44				
8/21/2009	0:09	2129												8.99	6.56	0.22	
8/21/2009	1:01	2181			14.33	12.91	9.53										
8/21/2009	1:03	2183						9.17	6.09	1.51							
8/21/2009	1:04	2184									15.08	13.56	1.05				
8/21/2009	1:08	2188												8.98	6.55	0.21	
8/21/2009	2:01	2241			14.29	12.87	9.49										
8/21/2009	2:02	2242						9.21	6.13	1.55							
8/21/2009	2:03	2243									15.63	14.11	1.60				
8/21/2009	2:06	2246												8.98	6.55	0.21	
8/21/2009	3:00	2300			14.25	12.83	9.45										
8/21/2009	3:01	2301						9.21	6.13	1.55							
8/21/2009	3:03	2303									16.21	14.69	2.18				
8/21/2009	3:05	2305												8.98	6.55	0.21	
8/21/2009	4:01	2361			14.25	12.83	9.45										
8/21/2009	4:02	2362						9.21	6.13	1.55							
8/21/2009	4:03	2363									16.67	15.15	2.64				
8/21/2009	4:07	2367												9.00	6.57	0.23	
8/21/2009	5:01	2421			14.21	12.79	9.41										
8/21/2009	5:02	2422						9.21	6.13	1.55							
8/21/2009	5:03	2423									17.00	15.48	2.97				
8/21/2009	5:07	2427												8.98	6.55	0.21	
8/21/2009	6:02	2482			14.23	12.81	9.43										
8/21/2009	6:04	2484						9.19	6.11	1.53							
8/21/2009	6:05	2485									16.75	15.23	2.72				
8/21/2009	6:08	2488												8.98	6.55	0.21	
8/21/2009	7:02	2542			14.21	12.79	9.41										
8/21/2009	7:04	2544						9.27	6.19	1.61							
8/21/2009	7:05	2545									16.08	14.56	2.05				
8/21/2009	7:08	2548												8.98	6.55	0.21	
8/21/2009	8:01	2601			14.17	12.75	9.37										
8/21/2009	8:02	2602						9.25	6.17	1.59							
8/21/2009	8:03	2603									15.96	14.44	1.93				
8/21/2009	8:07	2607												8.98	6.55	0.21	
8/21/2009	9:01	2661			14.17	12.75	9.37										
8/21/2009	9:02	2662						9.21	6.13	1.55							
8/21/2009	9:03	2663									15.63	14.11	1.60				
8/21/2009	9:08	2668												8.98	6.55	0.21	
8/21/2009	10:02	2722			14.08	12.66	9.28										
8/21/2009	10:03	2723						9.25	6.17	1.59							
8/21/2009	10:04	2724									15.33	13.81	1.30				
8/21/2009	10:07	2727												9.00	6.57	0.23	

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/21/2009	11:02	2782			14.08	12.66	9.28										
8/21/2009	11:04	2784						9.29	6.21	1.63							
8/21/2009	11:05	2785									15.13	13.61	1.10				
8/21/2009	11:07	2787												9.00	6.57	0.23	
8/21/2009	12:04	2844			14.08	12.66	9.28										
8/21/2009	12:05	2845						9.29	6.21	1.63							
8/21/2009	12:06	2846									14.92	13.40	0.89				
8/21/2009	12:08	2848												9.00	6.57	0.23	
8/21/2009	13:04	2904			14.08	12.66	9.28										
8/21/2009	13:06	2906						9.17	6.09	1.51							
8/21/2009	13:07	2907									14.75	13.23	0.72				
8/21/2009	13:09	2909												9.00	6.57	0.23	
8/21/2009	13:56	2956			14.00	12.58	9.20										
8/21/2009	13:59	2959						9.29	6.21	1.63							
8/21/2009	14:00	2960									14.67	13.15	0.64				
8/21/2009	14:04	2964												8.97	6.54	0.20	SPF meas.
8/21/2009	14:06	2966									14.51	12.99	0.48				
8/21/2009	14:07	2967						9.22	6.14	1.56							
8/21/2009	14:09	2969			14.00	12.58	9.20										
8/21/2009	14:10	2970															pump off
8/21/2009	14:10:30	2970.5	0.5	5941	7.81	6.39	3.01										
8/21/2009	14:11	2971	1	2971	7.10	5.68	2.30										
8/21/2009	14:11:30	2971.5	1.5	1981	6.95	5.53	2.15										
8/21/2009	14:12	2972	2	1486	6.86	5.44	2.06										
8/21/2009	14:13	2973	3	991	6.79	5.37	1.99										
8/21/2009	14:14	2974	4	744	6.75	5.33	1.95										
8/21/2009	14:15	2975	5	595	6.72	5.30	1.92										
8/21/2009	14:16	2976	6	496	6.69	5.27	1.89										
8/21/2009	14:17	2977	7	425	6.65	5.23	1.85										
8/21/2009	14:18	2978	8	372	6.62	5.20	1.82										
8/21/2009	14:19	2979	9	331	6.60	5.18	1.80										
8/21/2009	14:20	2980	10	298	6.57	5.15	1.77										
8/21/2009	14:21	2981	11	271				9.06	5.98	1.40							
8/21/2009	14:22	2982	12	249	6.54	5.12	1.74										
8/21/2009	14:24	2984	14	213	6.57	5.15	1.77										
8/21/2009	14:25	2985	15	199				9.01	5.93	1.35							
8/21/2009	14:26	2986	16	187	6.57	5.15	1.77										
8/21/2009	14:28	2988	18	166	6.56	5.14	1.76										
8/21/2009	14:30	2990	20	150	6.50	5.08	1.70										
8/21/2009	14:31	2991	21	142				9.00	5.92	1.34							
8/21/2009	14:32	2992	22	136							14.46	12.94	0.43				
8/21/2009	14:33:30	2993.5	23.5	127										8.98	6.55	0.21	
8/21/2009	14:36	2996	26	115	6.48	5.06	1.68										Riverside pulled pump, Powers sounder end 149.70
8/21/2009	14:38	2998	28	107				8.95	5.87	1.29							
8/21/2009	14:40	3000	30	100	6.41	4.99	1.61										
8/21/2009	14:42	3002	32	94	6.37	4.95	1.57										
8/21/2009	14:44	3004	34	88				8.91	5.83	1.25							
8/21/2009	14:45	3005	35	86							14.42	12.90	0.39				
8/21/2009	14:47	3007	37	81										8.99	6.56	0.22	

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Date	Time	t (min)	t' (min)	t/t'	Shallow East Well (Well No. 4)			Shallow West Well (Well No. 3)			Deep Well (Well No. 2)			Construction Well (Well No. 1)			Comments
					DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	DTW from top of mp (ft)	DTW bgs (ft)	DD (ft)	
8/21/2009	14:50	3010	40	75	6.27	4.85	1.47										
8/21/2009	14:53	3013	43	70	6.25	4.83	1.45										
8/21/2009	14:56	3016	46	66	6.24	4.82	1.44										
8/21/2009	14:57:30	3017.5	47.5	64				8.85	5.77	1.19							
8/21/2009	14:58:30	3018.5	48.5	62							14.39	12.87	0.36				
8/21/2009	15:00:30	3020.5	50.5	60										9.00	6.57	0.23	
8/21/2009	15:03	3023	53	57	6.19	4.77	1.39										
8/21/2009	15:04	3024	54	56				8.82	5.74	1.16							
8/21/2009	15:09	3029	59	51				8.82	5.74	1.16							
8/21/2009	15:11:30	3031.5	61.5	49							14.35	12.83	0.32				
8/21/2009	15:16:30	3036.5	66.5	46										9.02	6.59	0.25	
8/21/2009	15:19	3039	69	44	6.07	4.65	1.27										
8/21/2009	15:20	3040	70	43	6.32	4.60	1.22										
8/28/2009	10:03	12803	9833	1.3	5.00	3.28	-0.10										white 150' sounder
8/28/2009	10:04	12804	9834	1.3				7.75	4.67	0.09							white 150' sounder, from toc
8/28/2009	10:05	12805	9835	1.3							16.07	14.55	2.04				white 150' sounder, from toc
8/28/2009	10:08	12808	9838	1.3										8.75	6.32	-0.02	white 150' sounder, from toc
8/28/2009	10:12	12812	9842	1.3													pulled solinst levelogger, found broken wire

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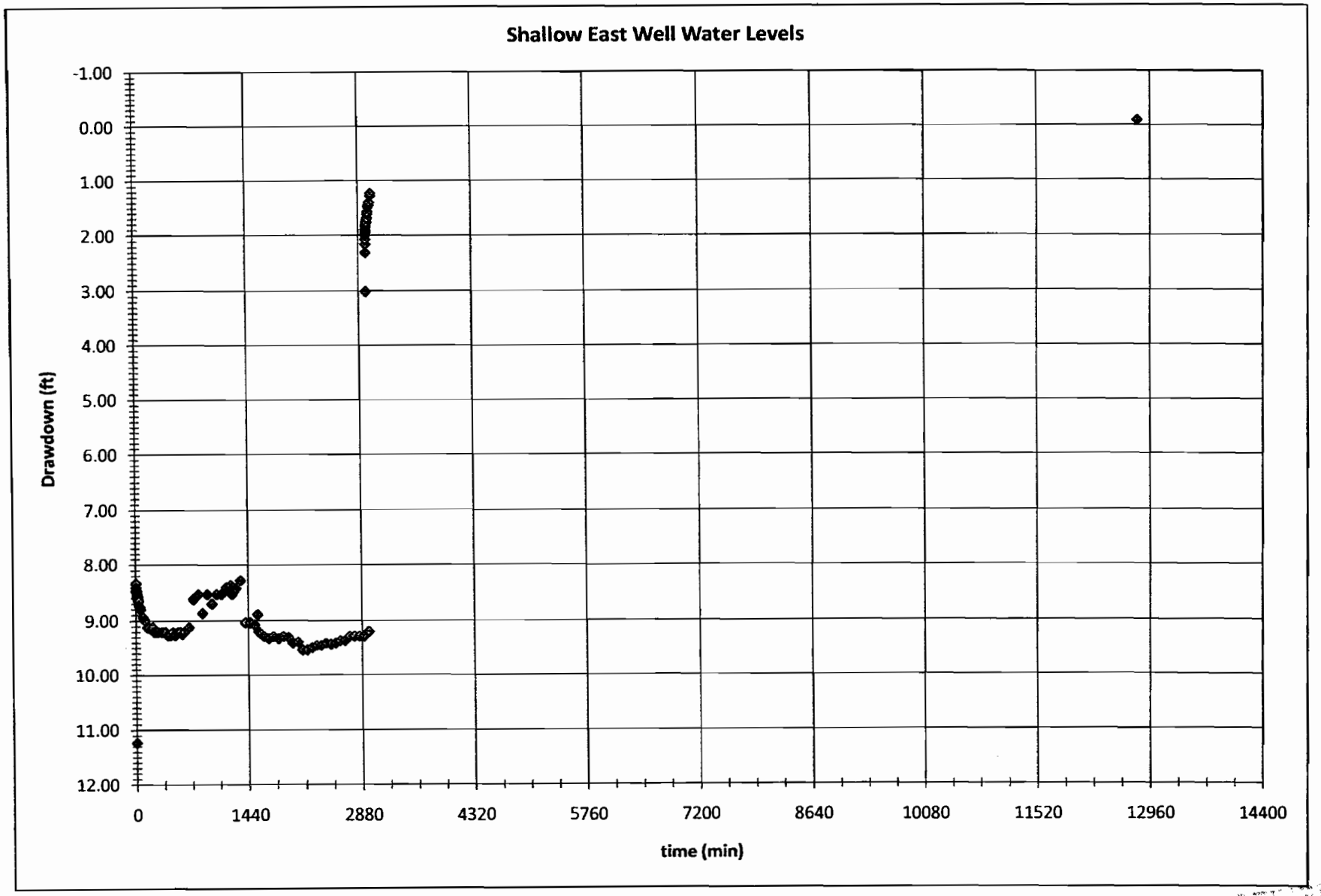

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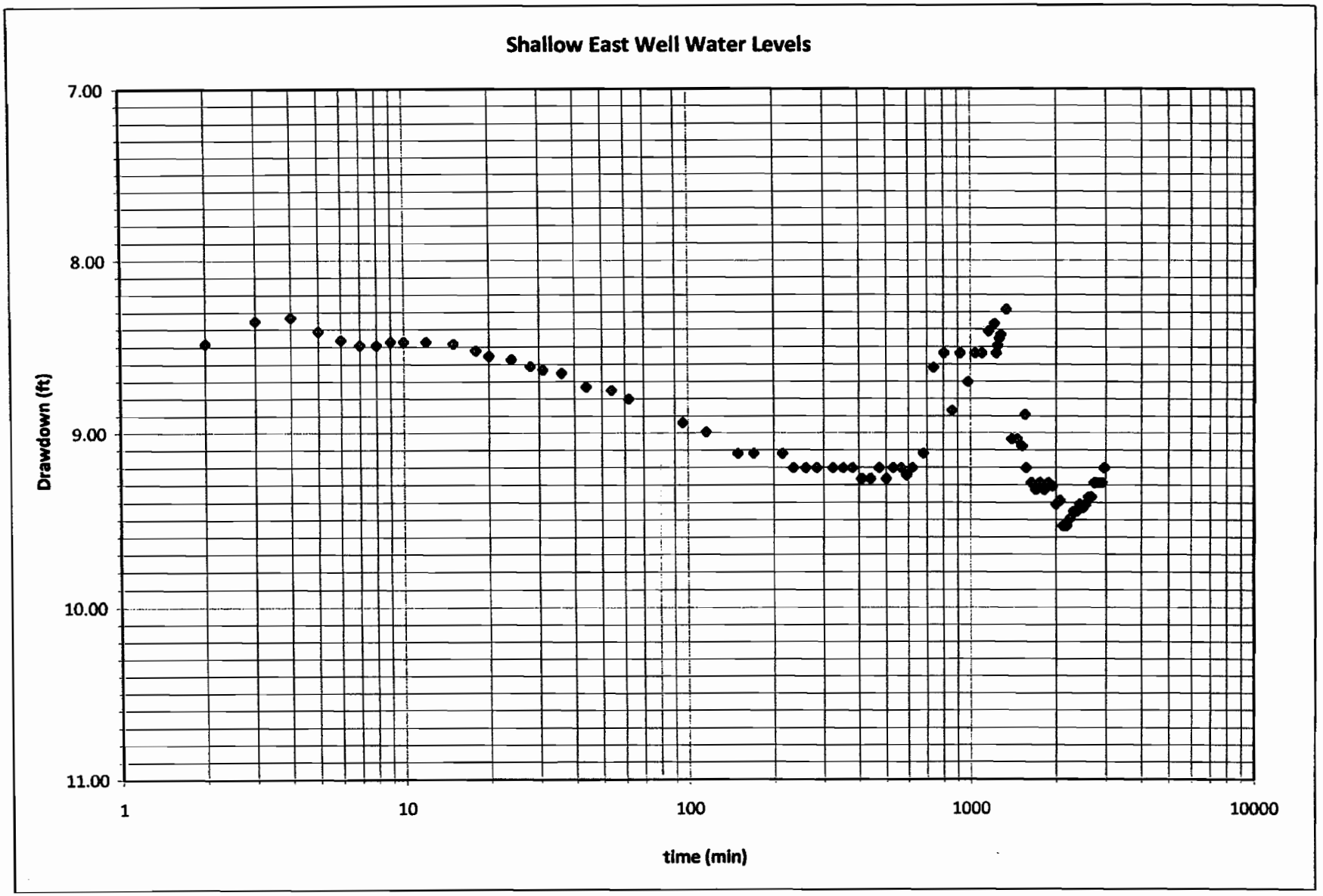

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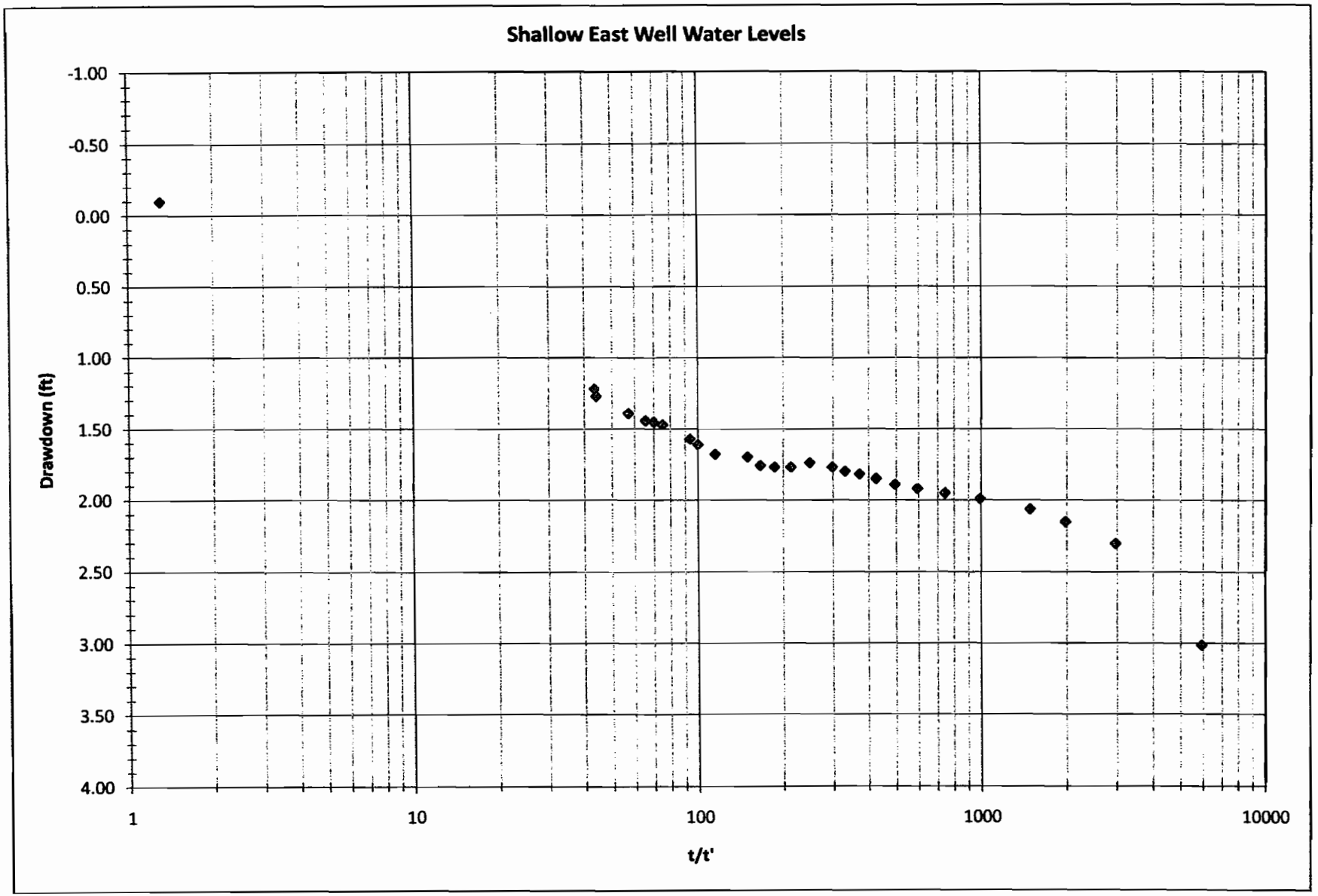

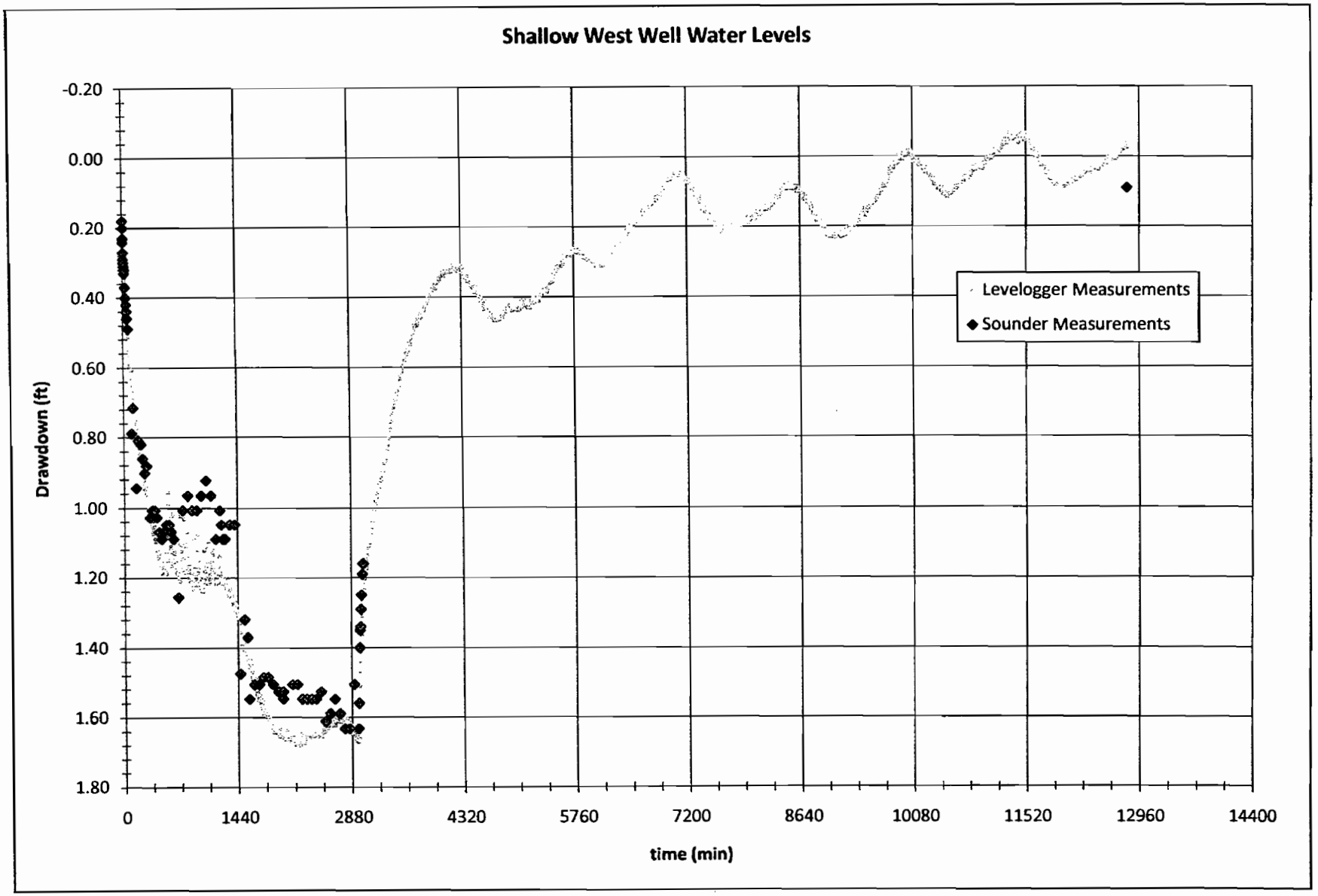

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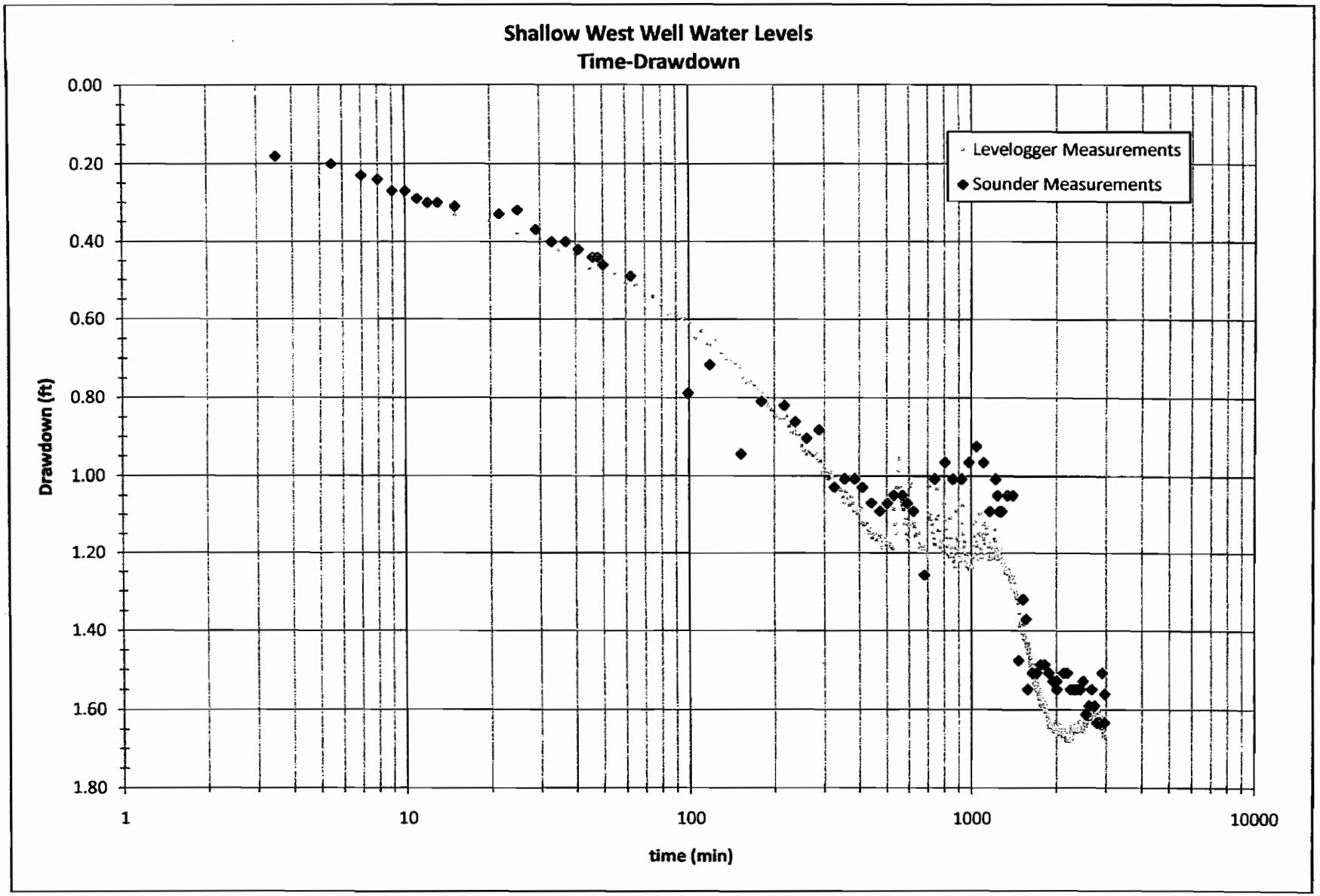
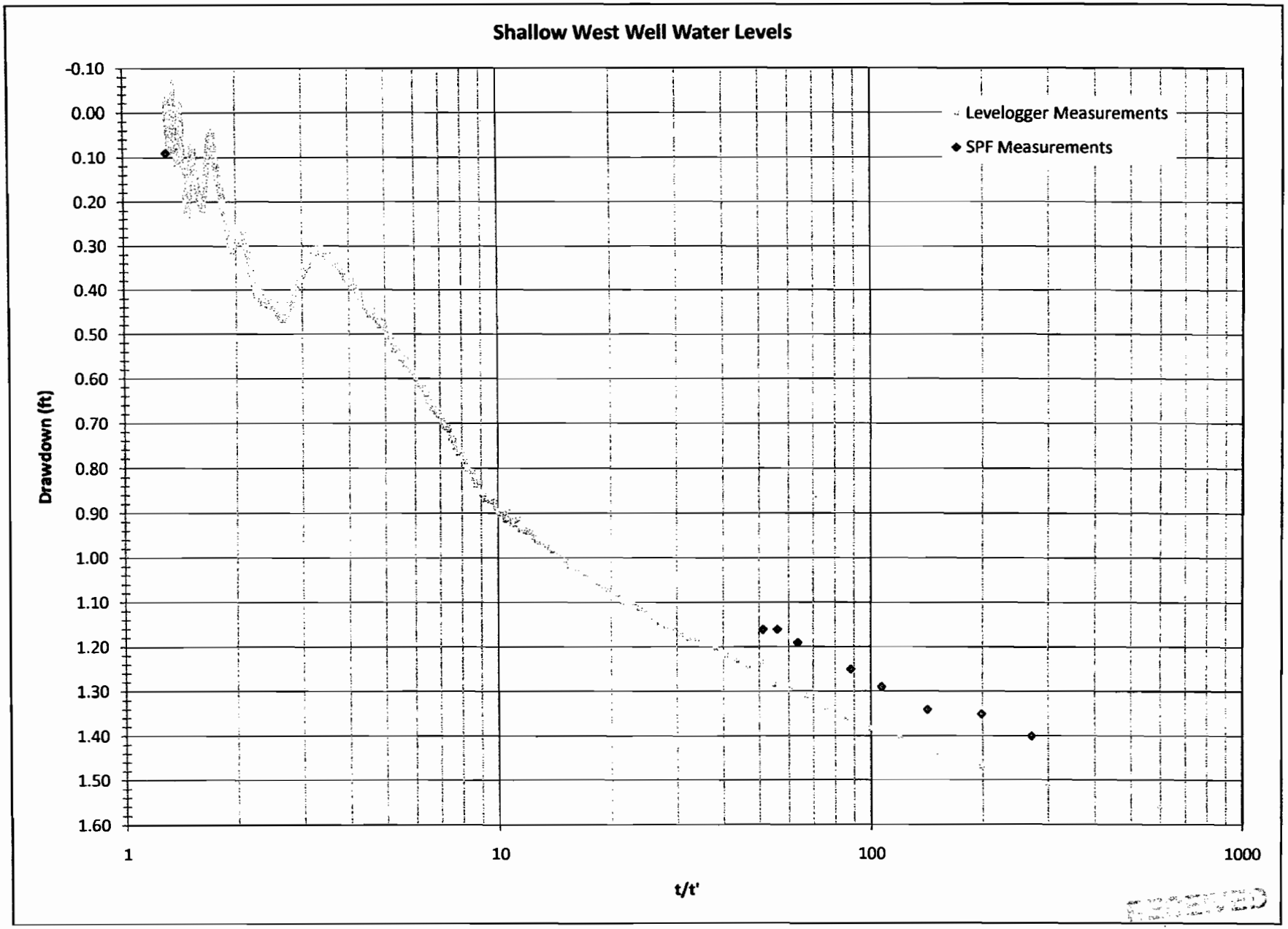
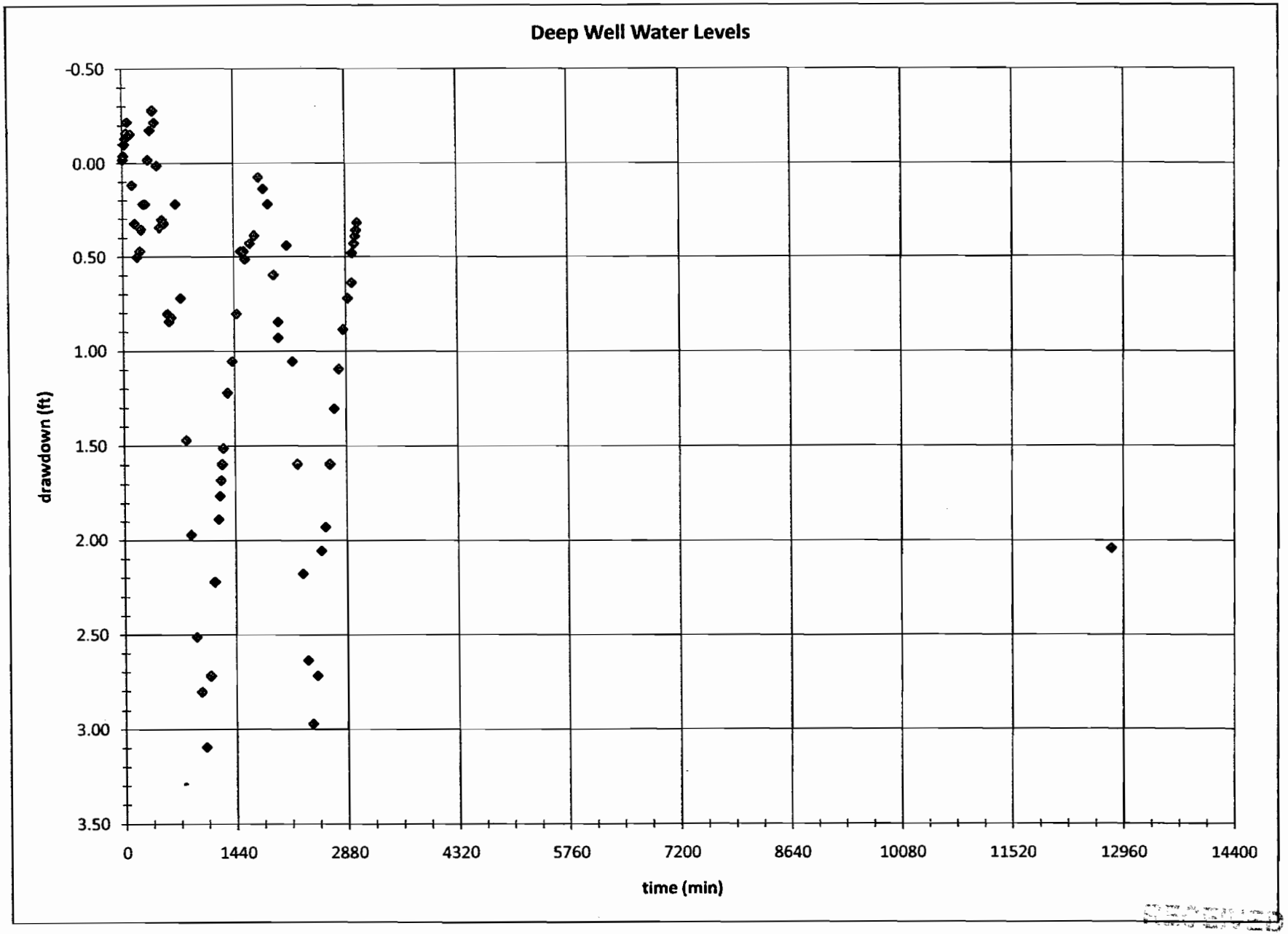
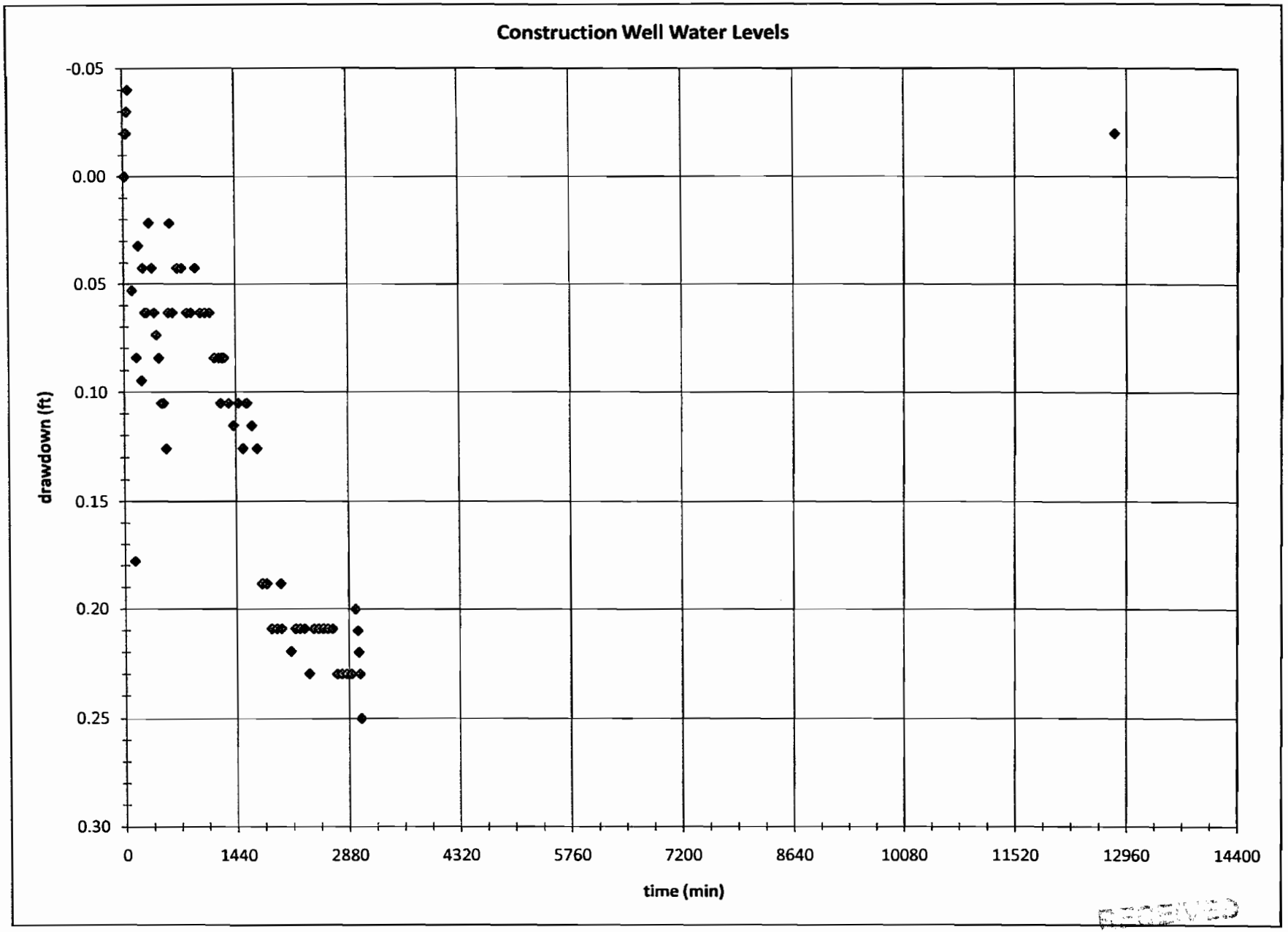





Deep Well Water Levels
drawdown (ft)
-0.50
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
0
1440
2880
4320
5760
7200
8640
10080
11520
12960
14400
time (min)



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