

Ed Squires

RECEIVED
FEB 04 2014
DEPARTMENT OF
WATER RESOURCES

From: Ed Squires
Sent: Monday, February 03, 2014 2:13 PM
To: Shelley Keen
Subject: 2-1-2014 City of Meridian Response to Hemenway Letter of 1-27-2014 Concerning Permit No. 63-31630
Importance: High
Attachments: 2-3-2014 HLI Response to Sandy Hemenway Letter of January 27, 2014 Concerning Permit No. 63-31630 with Figures.pdf

Hydro Logic, Inc.

1002 W. Franklin St. Boise, ID 83702 (208) 342-8369 Fax: (208) 342-3100 Cell: (208) 631-6781

Good afternoon Shelley,

Attached above is a courtesy digital PDF-format version of the City's response to Sandy Hemenway's letter of January 27, 2014 concerning City of Meridian water right Permit No. 63-31630 for the Department's file. As we discussed, a clean signed original hard copy is also being sent to your attention by today's US Mail.

The Department's letter does not request additional information and appears to make the conclusion that the IDWR has determined that Permit No. 63-31630 will not include City Well #25 as a point of diversion. The letter does invite me to provide additional information if I disagree with the determination.

Because the Department's letter refutes the information I provided in the licensing examination concerning how the Well #25 is constructed, and because I do disagree with many of the assertions and conclusions made by the reviewer, I submit the following letter explanation of what I see as some glaring misinterpretations of the submitted beneficial use exam along with the proof of the details of well construction that I hope will allow the Department to continue with the processing of the City's water right. It might be helpful if the reviewer consult with Rob Whitney, who is an excellent resource on well construction for the Department, so he can confirm my submitted cross-sections and explain the details of well construction.

I wish the reviewer would have picked up a phone and simply called me with respect to the assertions made in the Department's letter so that we might have avoided all of this extra work.

Thank you, I look forward to your review of the submitted data.

Sincerely,
Ed Squires

2/3/2014

Hydro Logic, Inc.

1002 W. Franklin Street, Boise, ID 83702 (208) 342-8369, Fax (208) 342-3100, hli@hydrologicinc.net

January 31, 2014

Shelley Keen
Manager, Water Rights Section
Idaho Department of Water Resources
322 East Front Street
P.O. Box 83720
Boise, Idaho 83720-0098

Subject: City of Meridian Water Right Permit No. 63-31630 (City Wells #25 and #28)

Dear Shelley,

Thank you for beginning to process the City's water right permit No. 63-31630 (Permit) referenced above and for the time spent helping me get the City's water rights in order. I am in receipt of Sandy Hemenway's January 27, 2014 letter (Letter) which impugns the information I submitted on details of well construction for the Meridian Well #25 and presents the Department's position that Well #25 should not be listed as a point of diversion for City water right No. 63-31630 unless the City provides additional information addressing the issues raised in the Letter in response to the proof of beneficial use exam I submitted on May 1, 2013 (Exam). The Letter identifies four "concerns" IDWR has about how City Well #25 was constructed pursuant to the conditions of approval of the water right Permit. Variances from two Permit conditions referenced in the Letter were identified and addressed in my licensing examination along with my recommended changes for the license. The Letter's remaining expressed concerns and the conclusions drawn from them are, in large part, incorrect mainly due to a misinterpretation of the submitted data, that I identify and further clarify below. This response is aimed to address IDWR's four bulleted concerns, in order of their appearance in Ms. Hemenway's Letter:

1) CONCERN NO. 1:

- a. The reviewer's assertions state: *"The well does not conform with Condition 9 on the permit which states "The right holder shall extend unperforated surface casing from land surface to a confining layer directly overlying the top of the aquifer open to the wells." The well screened interval begins at 183 feet, in a sand and gravel sequence that extends from 105 to 194 feet."*
 - i. The reviewer must have misinterpreted the cross-sectional diagram I supplied with the Exam and/or the Well Driller's Report¹ for Well #25 to

¹ The depths cited in the Letter appear to match depths recorded on the Well Driller's Report rather than the depths reported by HLI from its own on-site measurements and submitted with the Exam. Although the Driller-reported depths are very close to those reported by HLI, HLI actually measured the materials, placements, and depths before reproducing them in our submittals to IDWR so it is best to use HLI's measurements to be correct. The proof of the correctness of HLI's measurements is included in this response letter.

have arrived at these conclusions. It appears that the reviewer was not familiar with the intricacies of well construction and confused the top of the headpipe in the well with the screen completion interval? As explained on page 5 and shown on Figure 11 of the Exam, the completion interval of the well, that is the depth interval open to the aquifer sands, starts at 203 ft below ground level (bgl) *not* 183 ft bgl as concluded by the Department in Concern No. 1. Please note that the centralized (in the bore) primary casing is terminated *within* a low-permeability clay stratum at 196 ft bgl with the "full depth" annular seal extending continuously from 196 ft to land surface. The clay stratum itself is proven herein to extend to a depth of 203 ft bgl² (Figure 1 this document). The installation of this bentonite chip and pumped bentonite grout seal was documented on site by down hole tagging with an incremented sounding line and cross-confirmed with volumetric calculations (see Figure 11 text captions) by experienced hydrogeologists with Hydro Logic, Inc. (HLI). We also have the retained drill-cuttings from this well should the Department wish to see those. Thus it is not possible for the well to draw from the "*sand and gravel sequence that extends from 105 to 194 feet*" as asserted by the reviewer in Concern No. 1.

- ii. The Well Driller's Report for the Well #25 (Attachment A) also lists the depth of the PVC "shoe" (the base of the primary well casing) as 195.6 bgl, just a few inches different than the 196 ft depth that HLI actually measured (Figures 2 & 3) and later documented with an underwater camera survey (Figure 4 this document).
- iii. Therefore, the assertions of Concern No. 1 are incorrect. First, Well #25 is in compliance with the Permit condition No. 9 because the unperforated surface casing extends from land surface to a confining layer directly overlying the top of the aquifer open to the wells. As shown on Figure 11 of the Exam, the "sticky" clay layer into which the casing is terminated (Figure 1 of this document) is also the most significant (thickest and least permeable) unit in the 336 drilled geologic section of Well #25. Secondly, the well screen interval does not begin "at 183 feet, in a sand and gravel sequence that extends from 105 to 194 feet." As Figure 11 of the Exam and the Well Driller's Report (Attachment A) show, the first screen interval outside the primary casing is at 196 ft bgl and the first screen open to permeable aquifer sands is at 203 ft bgl.

2) CONCERN NO. 2:

- a. The reviewer's assertion states: "*The well is inconsistent with condition 10 on the permit, as the casing extends to a depth of 195 feet, not the minimum of 200 feet stipulated in the condition*".

² The Well Driller's Report for Well #25 shows this clay to exist from 194-to-212-ft bgl (thicker than what I reported in the Exam) but this may be due to a "lag" in the observed drill-cuttings in the mud stream by the driller because the borehole geophysics (Figure 1 of this letter) confirm HLI's interpretation.

- b. This discrepancy was identified and explained in the Exam under the NARRATIVE/REMARKS/COMMENTS section on page 5 where I stated: "Condition 10 of the Permit No. 63-31630 states "The wells proposed as points of diversion for this water right shall be constructed with a surface casing that shall not, under any discovered (during drilling) circumstances, be less than 200 feet in depth". The surface casing installed at Well #25, although meeting the intent of the condition, was 4 feet short of the 200-ft requirement. As shown on Figure 11, in order to stop the primary casing within a low permeability stratum, it was placed to 196 feet below land surface. This is not considered a significant breach of the condition and no action is recommended or needed."
- c. The primary (pump-chamber) casing string ends at 196-ft bgl, not the 195-ft suggested by the IDWR reviewer in the Letter. The one foot difference is technically significant so I have attached geophysical data, underwater camera, inspection notes, on-site measurement data, and the Well Driller's Report (Figure 2-4 and Attachment A of this report) to confirm the seated depth of the casing which we extended to the central and most dense portion of the clay at 196 ft bgl (Figure 1 this report).
- d. The 200-foot Permit settlement/requirement depth is somewhat of an arbitrary depth (until the geologic section is actually drilled) with the intent of limiting ground water wells from drawing on surface water resources.³ However, the condition No. 10 does not state that the primary casing be extended to a clay stratum deeper than 200 feet bgl, just that the casing extend to 200 feet. The City chose not to extend its casing below the depth of the confining layer over the targeted aquifer because it wanted to terminate the casing in the most solid part of the clay stratum to support the casing without disturbing the base of the clay at the 23-inch diameter. We did not want to penetrate the clay before seating the casing into it because this could have the effect of compromising the full depth seal which would be contrary to the intent of the condition⁴. The four foot differential between casing depth and the permit condition makes no difference whatsoever to the aquifer depths Well #25 draws from because the clay stratum extends to 203 ft bgl (see attached Figure 1). In other words, for all intents and purposes, the borehole through the clay layer serves the same purpose of the casing because Well #25 cannot physically draw on aquifer waters above 203 ft bgl whether the casing was extended the extra 4 feet, to the 200-ft depth, or not. I made the mistake of assuming that this was self-evident in my Exam submittal but I hope the additional explanation above is now sufficient.

³ If the base of the clay were penetrated by the 23-inch borehole, there would be no physical stratigraphic support for the casing. Furthermore, if the 23-inch bore were to penetrate the clay and terminate in a sand layer, renewed drilling inside of the 17-inch PVC casing would "wash" and erode the sand at base of the and cause a void in the underlying sediments, this would undermine the natural stratigraphic support for the clay layer which would, over time, either erode away colloiddally or it would break off and collapse compromising the annular seal of the well this condition was designed to protect.

⁴ I was closely involved with the protest by USBR and the subsequent settlement discussions and agreement and this was the intent of the Bureau.

3) CONCERN No. 3:

- a. The reviewer's expressed concern states: *"The well is inconsistent with Condition 12 on the Permit, as the screened interval is from 183-334 feet, above the specified "water bearing zone to be appropriated, which is 300 to 900 feet" (condition 12). The upper portion of the screen set at 183 feet is in a sand and gravel sequence that extends up to 104 feet below land surface. Therefore, by placing the screen within this water bearing zone, the well is capable of withdrawing water from the upper 105-194 foot water bearing zone"*.
- b. As mentioned in the Exam, in the NARRATIVE/REMARKS/COMMENTS section on page 5, it is true that the completion interval of Well #25 does not entirely comport with Condition 12 of the Permit because the actual constructed well completion interval only partially overlaps the water-bearing zone specified in the Application for Permit, hence my recommendation to change the water-bearing zone on the License to 196-to-900 ft bgl⁵.
- c. The water-bearing zone to be appropriated is specified on an Application for Permit well in advance of the drilling for a new municipal supply well and before ground water quality for municipal use can be ascertained. In the City's case, the original Application for Permit signed by the Mayor, the zone to be appropriated was specified as 150-to-900 ft bgl. In response to concerns expressed by the Bureau of Reclamation at the time, and as noted in the IDWR Letter referenced above, the City agreed to extend the primary casing to 200 ft bgl. It is somewhat confusing that the water-bearing zone to be appropriated was then listed as 300-to-900 ft on the approved permit (perhaps it was a typographical error) and subsequent amendment of the same. The City did not object to the 300-to-900 foot condition because it did not appear to be a significant change under the language of §42-211. In any case, the City's October 13, 2003 application for well drilling permit No. D0030863, which referenced the water right number, submitted a proposed well construction diagram with the completion interval of the proposed well being above 300 feet bgl (270 ft) that was reviewed and approved by the Department. Thus it was assumed that the Department also did not consider the change "significant".
- d. As I read the statute language of §42-211, the main concern of the Department would appear to be the impact of such a change on existing water users. To that end, Well #25 has been producing large volumes of ground water since it came on line in January of 2005. Indeed, over that 8-year period, the well has produced an average of 272 million gallons per year with three years producing between 400-to-500 million gallons per year. Last year, 2013, Well #25 produced 497 million gallons or the averaged equivalent of approximately 950 gpm continuous pumping over the year. With respect to potential near-well interference effects (cone of depression interference), Well #25 has been produced for extended

⁵ Note that the City would not object to amending the depth interval to 203-to-900 ft because the actual water-bearing zone does not start until 203 ft bgl.

periods at over 2,000 gpm without any known or expected interference affects to other water right holders.

- e. The information submitted with the Exam showed the non-pumping water level HLI measured in Well #25, prior to the hydraulic testing of the newly completed well, to be 39.7 ft bgl on March 8, 2004⁶. For this response, HLI returned to Well #25 to obtain a second non-pumping water level measurement on January 29, 2014 of 43.5 feet bgl after the pumping plant had been removed from the well for routine maintenance. The non-pumping water level was recorded on a down-well camera inspection a few days earlier by Layne of Idaho if the Department would like confirmation, we can supply it. Alternatively, as of this writing, the pumping plant remains out of the well. If the Department distrusts our measurement, the city is happy to facilitate IDWR obtaining its own. After 8 years of almost continuous water production, we observed that the water level was still recovering (increasing) as would be expected when we measured the water level repeatedly over time last Wednesday. These measurements, coupled with the two hydraulic tests of the well submitted with the Exam, clearly show that pumping of Meridian Well #25 has not caused measurable long-term water level decline in the well itself much less in wells located at distance from the supply well. In other words, there is zero evidence of adverse affects to other water users.
- f. In summary, I renew my recommendation that the water bearing zone to be appropriated for City Well #25 be changed on the License to reflect 196-to-900 feet bgl (or more accurately 203-to-900 ft bgl if the Department prefers) to preserve the City's right to deepen the well if necessary in the future or to add additional points of diversion for deeper wells through future transfer applications. This change would bring Well #25 in alignment with the water-bearing zones of other City wells and water rights.
- g. Since the settlement of the USBR protest of this water right application in 2003, the Department has delineated an area of the Boise Valley where it believes wells completed above 200 feet may interfere with surface water resources. Well #25 is not open to aquifers above 200 feet and it is also not located within this designated area (area tributary to the Boise River above Star Bridge).
- h. The other assertions and conclusions of Concern No. 3 with respect to the inferred completion interval and which aquifer units are drawn upon by Well #25 are incorrect and have no basis in fact as previously addressed in the Condition #1 response above.

4) CONCERN NO. 4:

- a. The misinterpretation by the reviewer, that the well is open to aquifer units above 196 ft bgl is again asserted and those errors have been addressed above. Additional necessary corrections to the statements in Concern No. 4 include the following:

⁶ A very similar non-pumping water level of 40 ft bgl was noted on the Well Driller's Report for Well #25.

- a. Contrary to the assertion in the Letter, Well #25 was not drilled to over 700 ft bgl and, after an exhaustive review of the water right file, I am not aware of the referenced schematic "in the water right file" showing that. Of course, Meridian supply Well #28 was drilled to 713 ft bgl and I did submit a cross-sectional diagram of that well in the Exam. If the Department reviewer is referring to Well #28 in this Concern No. 4, please note that Well #28 was not constructed for over 5-years *after* Well #25 was constructed and would have had no bearing on the construction of Well #25.
- b. A small diameter (8-inch) exploratory test bore was drilled in advance of supply Well #25 to explore for suitable aquifer units and to test ground water quality for municipal use. In this test well, we determined that the color of the sediments changed from oxidized yellowish brown-to-reduced gray at about 335 ft bgl (shown on Figure 11 of the Exam). The City typically prefers to avoid well completions into reduced sediments when possible because the associated hydrogen sulfide smell (sulphurous or rotten egg odor) is objectionable to customers and this dissolved gas results in increased chlorine disinfection costs and other undesirable odors and tastes. A secondary consideration is that the City attempts to avoid commingling of ground waters of differing geochemistry which is suggested by the observed color change of the drilled sediments. These are some of the reasons why the Well #25 was constructed to the depth of the aquifer it was.
- c. The unusual suggestion in the Letter that the City should have completed a well below 500 ft bgl was not considered by the City because this would nearly double the cost of the well to City residents and result in a lower water quality requiring expensive water treatment for no apparent reason.
- d. What we do know is that ground water quality varies significantly with depth and sub-aquifer unit in the Meridian area. The depth interval to which the City decides to complete a well is dependent to a large degree on ground water geochemistry. Specifically, the City targets aquifer units with the best available aesthetic quality for customers that still meets regulatory requirements of the USEPA Safe Drinking Water Act and the IDEQ administrative rules for Public Drinking Water Systems without perpetual expensive water treatment. While I am reasonably certain that the selected completion interval for Well #25 was not the *only* option available to obtain a productive well, in my professional opinion, it was the *best* option for a productive good-quality municipal well. However, the City has the future option of deepening or replacing Well #25 to the depth of 900 ft bgl if it should become necessary to deepen or replace Well #25 to draw from one of the less desirable and more costly deeper sub-aquifer units in the future. Municipal water supplies are unlike irrigation water supplies in that public drinking water must meet stringent quality parameters whereas ground water for irrigation in the Treasure Valley need only be wet.

In summary, the basic assertion stated in the Letter is that that the Well #25 completion interval begins at 183 ft is incorrect as is the subsequently drawn conclusion that the well therefore draws ground water from aquifer units as shallow as 105 feet bgl. It appears that this misconception may actually be at the root of all four expressed concerns. In fact, the Well #25 completion interval open to water-bearing aquifer sands is 203 ft-to-336 ft bgl and the very small four-foot differential in casing depth, from the Permit condition No. 10, is, in my opinion, moot for the reasons cited and evidence presented in the Exam and under cover of this letter.⁷ In my professional opinion, the intent of the City's agreement with BOR, as well as the intent of the Permit conditions, have been met by the details of well construction of City Well #25. It is my further opinion that the actual Well #25 completion interval of 196-to-336 ft bgl is not a significant change to the original intent of the water right application that could impact existing water users. Indeed, the available data suggests that there has been almost no water level impacts in the well itself which has been continuously pumped at high rates of discharge for over eight years now. I am unaware of any statute or rule that would require completion of any well below 300 feet bgl and the City's application for drilling permit's proposed depth of 270 feet was not questioned.

Finally, I hope that, given the additional information provided herein and the clarifications of the data included in the original proof of beneficial use licensing examination, the Department can proceed with the licensing of Permit No. 63-31630 according to the recommendations in the Exam.

Please do not hesitate to call me directly at 631-6781 with any further questions or requests.

Sincerely,
Ed Squires

c: Kyle Radek, Assistant Meridian City Engineer
Sandy Hemenway, IDWR



⁷ Since the Well #25 was drilled and constructed in 2004, the low-lying area where the well is located was built up significantly with earthen fill for drainage purposes prior to constructing the well house such that the actual depth from current ground level to the base of the primary well casing is most likely very close to 200 ft bgl anyway.

Borehole Geophysical Logs of Meridian Supply Well #25

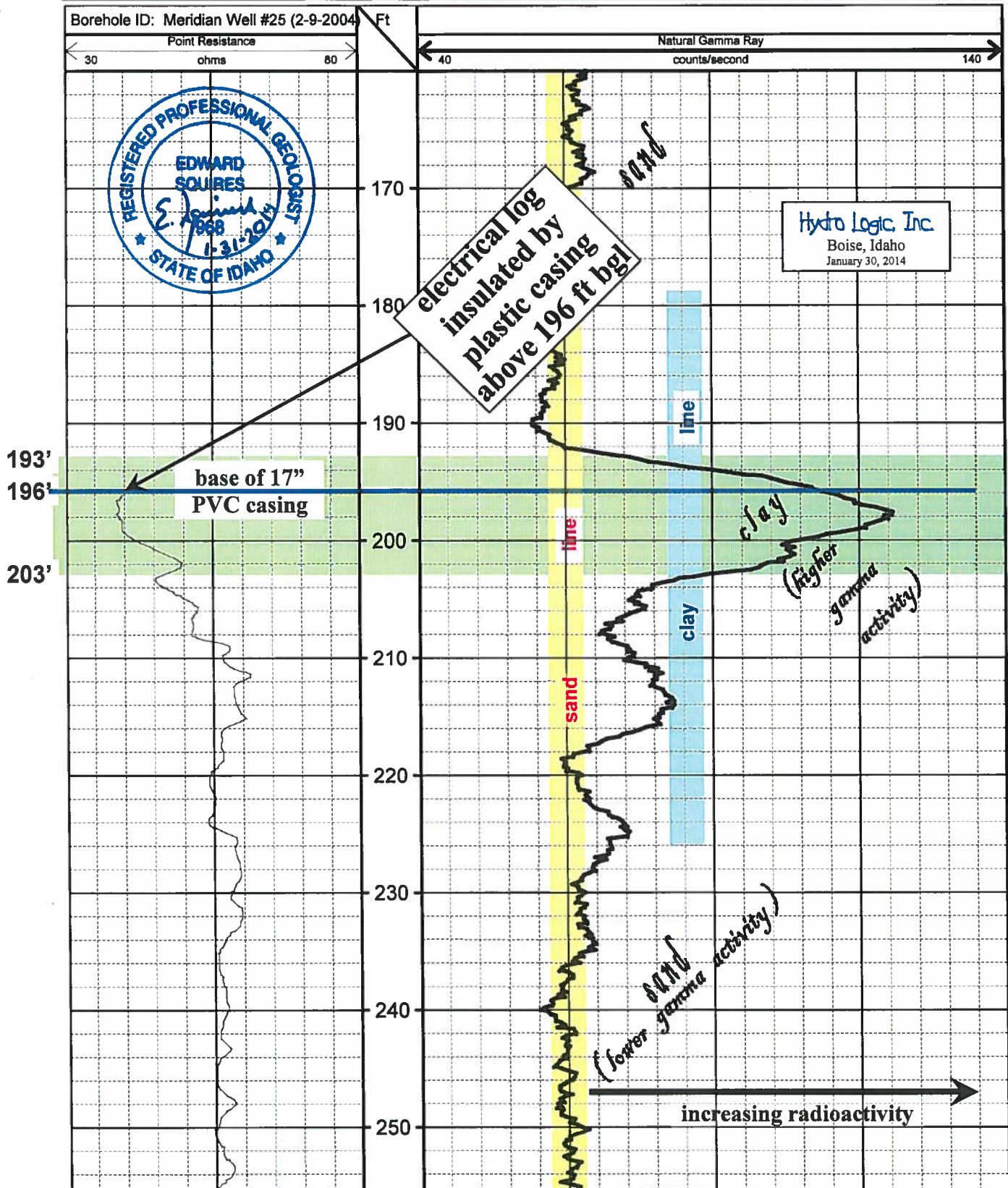


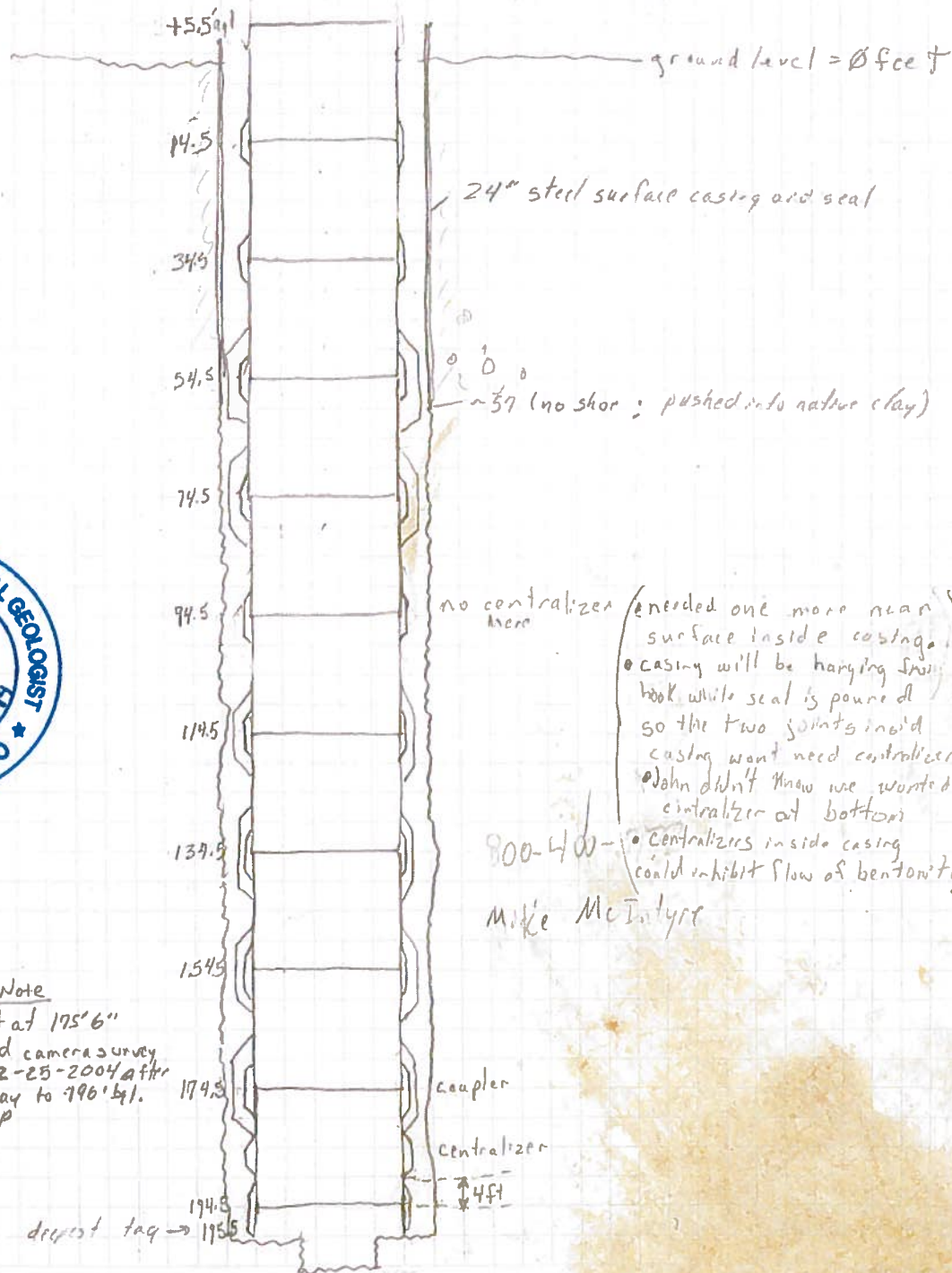
Figure 1. A section of the borehole geophysical logs from the City of Meridian municipal supply Well #25. These annotated strip charts depict the characteristically high natural gamma-ray response of a sticky clay stratum (highlighted in green) located between 193-to-203 ft below ground compared to the lower gamma activity characteristic of clean sands. The single point resistance electrical log on the left shows low resistance in the clay and high resistance in the sand. Together with the drill cuttings, these logs confirm the existence and depth of the clay stratum the Well #25 casing is sealed into at 196 ft bgl.

Figure 1.

CALCULATIONS AND DESIGN DATA		PREPARED BY L. Pearson
SUBJECT	Meridian #25 Supply	DATE 1/14/04
Rough Diagram of 17" PVC Install		SHEET 2 OF 2

(Primary casing string prior to seating shoe and installation of full depth grout seal)

Not to Scale

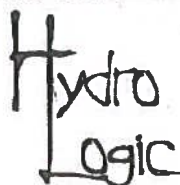


Composite Note
casing joint at 175' 6"
from calibrated camera survey
by HLI on 2-25-2004 after
pushed into clay to 196' bgl.
PHP

Figure 3. The second of two pages of field notes recorded by HLI hydrogeologist Loren Pearson on site during the installation of the 17-inch diameter PVC plastic well casing in the mud-filled 23-inch diameter bore of Meridian Well #25 on January 14, 2004 just prior to the sharpened casing shoe being driven into clay to 196 feet bgl. The notes detail the tagged/measured depths of the borehole and centralizer locations over joints.

Hydro Logic Inc.
Boise, Idaho
January 30, 2014

Figure 3.



Hydro Logic Inc.

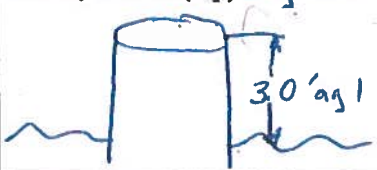
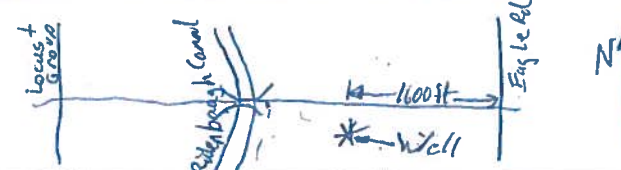
2300 Knight Drive, Boise, Idaho 83702 (208) 342-8369 FAX 342-3100

Downhole Camera Survey

DATE: February 25, 2004.

Geophysical logging
Submersible cameras
Hydrogeologic consultants

WELL NAME: Meridian #25 Supply

Company: City of Meridian	Billing Address:
Address: 660 E. Watertower	Brad Watson, P.E.
Suite 200	City Engineer
Meridian, ID 83642	
Project: Meridian #25 Supply	Customer Order #:
Time/date water last disturbed. 2/25/04	Ordered by: Ed Squires
Time arrive site. 1245hrs	Casing size. 15.1" I.D. PVC (17" O.D.)
Time leave site. 1800hrs	Drilled depth. 334' bgl
Well Log (Y/N) Yes	Date drilled 2/10/04
Water level. 39.01' bgl (sounder)	Driller. Treasure Valley Drilling
Footage filmed. yes	Operator. L. Pearson
Survey datum (mp). = ground level	Witnessed by. N/A
	

DEPTH (feet)	(in)	COMMENTS / OBSERVATIONS	JOINTS (ft. bmp)
0	00	Casing is in good condition; joints appear tight and sealed	15'02"
180	07	Top of packer assembly	35'02"
183	05	Bottom " " ; Top of screen assembly (0.015")	55'03"
194	11	Bottom of 1 st screen ; some mud left; mostly open	75'03"
205	11	Bottom of 2 nd screen ; mostly clean ; small patches of sand	95'04"
222	00	" " 3 rd screen ; " " "	115'05"
231	11	" " 4 th screen (0.015") ; very clean	135'05"
242	00	" " 5 th screen (0.035") ; " "	155'05"
252	00	" " 6 th " (0.035") ; " "	175'06"
262	00	" " 7 th " (0.035") ; " "	
270	00	" " 8 th " (0.000") ; " "	
277	09	" " 9 th " (0.015") ; " "	
288	09	" " 10 th " (0.015") ; " "	
296	09	" " 11 th " (0.000") ; " "	
306	10	" " 12 th " (0.020") ; " "	
317	10	" " 13 th " (0.020") ; " "	
325	10	" " 14 th " (0.025") ; " "	
332	11	Light head touching setting at light depth 334'07" ; in fill at 1'03" thick	

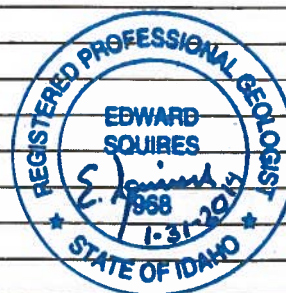


Figure 4. Field notes from HLI's underwater camera traverse of the inside wall of the newly completed Meridian municipal supply Well #25 on February 25, 2004. Yellow highlighted entry is depth below ground of the PVC casing joint at 175 ft 6 in. Therefore, given the standard 20-ft length of the PVC casings, the bottom of the PVC casing would be at 195 ft 6 in (obscured behind telescoped 8 in screen) with PVC shoe extending 6 in deeper; to 196 ft bgl.

Hydro Logic Inc.
Boise, Idaho
January 30, 2014**Figure 4.**

Hydro Logic, Inc.

Boise, Idaho
January 30, 2014Form 238-7
3/95-C96IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Office Use Only			
Inspected by	Twp	Rge	Sec
	1/4	1/4	1/4
Lat:	:	Long:	:

1. DRILLING PERMIT NO. D0030863Other IDWR No. Other IDWR No

2. OWNER:

Name City of Meridian # 25Address 33 E Idaho Ave.City Meridian State ID Zip 83642

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location

w		Twp	<u>3</u>	North ☒	or	South ☐
		Rge	<u>1</u>	East ☒	or	West ☐
		Sec	<u>29</u>	«QQQ» 10' 10' 10'	NW 1/4	NE 1/4
S		Gov't lot	County		Ada	

Lat: : : Long: : :

Address of Well Site 1600 ft W. of Eagle Rd. & Victory Rd.
Intersection City Meridian

(Give at least name of road + Distance to Road or Landmark)

I.L. «L.b» Blk. «Blk» Sub. Name «Subname»

4. USE:

☐ Domestic ☒ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other

5. TYPE OF WORK check all that apply (Replacement etc.)

☒ New Well ☐ Modify ☐ Abandonment ☐ Other

6. DRILL METHOD

☐ Air Rotary ☐ Cable ☒ Mud Rotary ☐ Other

7. SEALING PROCEDURES

SEAL/FILTER PACK		AMOUNT		METHOD
Material	From	To	Feet or Pounds	
Bentonite Chip	0	57	7 yds	Pour
Bentonite Grout	0	190	1650 gal	Pump
Bentonite Chip	190	195	1.5 yds	Pour
Filter Sand 8-16	12-20	190-334	4 yrd	Pour

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 195.6Was drive shoe seal tested? ☒ Y ☐ N How? Pressure

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
24"	1	57	.250	steel	☒	☐	☒	☐
17"	2	195		PVC	☒	☐	☐	☒

Length of Headpipe 0 Length of Tailpipe 0

9. PERFORATIONS/SCREENS

☐ Perforations Method
☒ Screens Screen Type Johnson High Flow Screen

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
183	194	.015		8"	S.S.	☐	☒
194	205	.005		8"	S.S.	☐	☒
205	231	.000		8"	S.S.	☐	☒

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:

40 ft. below ground Artesian Pressure 0 lbDepth flow encountered 200-334 ft. Describe access port or control devices: CAP

11. WELL TESTS:

☒ Pump ☐ Bailor ☐ Air ☐ Flowing Artesian

Yield gal/min.	Drawdown	Pumping Level	Time
2340	132	180	9hr

Water Temp. 56 Bottom hole temp. 56

Water Quality test or comments:

Depth first Water encountered 30

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia	From	To	Remarks: Lithology, Water Quality & Temp.	Water	Y	N
36"	0	3	Top Soil			X
36"	3	57	Sand & Gravel		X	
24"	57	60	Brown Clay			X
24"	60	80	Sand & Gravel		X	
24"	80	85	Brown Clay			X
24"	85	96	Course Sand		X	
24"	96	105	Tan Clay			X
24"	105	194	Sand & Gravel		X	
15"	194	212	Tan Clay			X
15"	212	220	Sand		X	
15"	220	225	Tan Clay			X
15"	225	250	Course Sand & Gravel		X	
15"	250	260	Clay			X
15"	260	288	Course Sand		X	
15"	288	296	Tan Clay			X
15"	296	317	Course Sand		X	
15"	317	324	Course Sand & Gravel		X	
15"	324	326	Tan Clay			X
15"	326	335	Course Sand & Gravel		X	
Continued Screen Placement						
From	To	Slot	Diameter	Material	Liner	
231	262	.035	8"	S.S.	X	
262	270	.000	8"	S.S.	X	
270	288	.015	8"	S.S.	X	
288	296	.000	8"	S.S.	X	
296	317	.020	8"	S.S.	X	
317	325	.025	8"	S.S.	X	
325	288	.015	8"	S.S.	X	

Completed Depth: 334 (Measurable)Date: Started 1-8-04 Completed 3-30-04

13. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed

Firm Name Treasure Valley DrillingFirm No. 560Firm Official [Signature]Date 6-16-04Supervisor or Operator [Signature]Date 6-16-04

(Sign once if Firm Official & Operator)

Date: 6/17/2004 Time: 10:26 AM

RECEIVED

JUN 18 2004

WATER RESOURCES
WESTERN REGION

State of Idaho Well Driller's Report for the City of Meridian municipal supply Well #25. The record for this well shows that a 17-inch diameter PVC plastic casing extends to 195.6 feet below ground level (bgl) inside of a 24-inch drilled bore with the annular space between the drilled hole and the casing being filled with bentonite clay sealants so the well draws on aquifers only below 212 ft bgl. The 8-inch diameter well screen assembly is intentionally telescoped up inside the PVC casing by about 12½ feet such that the upper 16½ feet of well screens are located inside a sealed casing and not open to (and cannot draw from) water-bearing sands above 212 ft bgl.