

WELL DECOMMISSIONING ON THE LUMMI INDIAN RESERVATION DURING 2015

Prepared for: Water Resources Division of the
Lummi Natural Resources Department

Project No. 130218 • December 29, 2015



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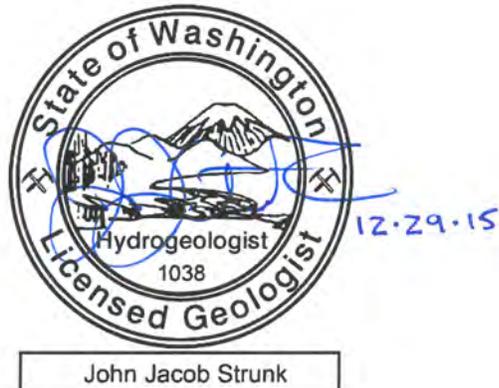


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Aspect Consulting, LLC



A handwritten signature in black ink that reads "Jared Bean".

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ASPECT CONSULTING

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Introduction

This report documents well evaluation and decommissioning activities completed during December 2015 on the Lummi Indian Reservation (Reservation) in northwestern Washington State (Figure 1). Since the formation of the Lummi Water District in the 1970s, use of many domestic water supply wells has been discontinued (Salix, 2010). Proper decommissioning of inactive domestic water supply wells eliminates potential groundwater contamination pathways and protects the Reservation's groundwater system. The Lummi Natural Resources Department (LNRD) well decommissioning effort began in 2006. Thirty-two wells have been decommissioned to date (Table 1, Figure 2), including four in 2015 (Table 2, Figure 3). Aspect Consulting, LLC's (Aspect) 2015 scope of work included a site visit to candidate wells, completion of well evaluation worksheets, documentation of decommissioning activities, and preparation of this report.

The Erratum Summary section at the end of this report documents LNRD's updated Well IDs for three wells that were decommissioned in 2013.

Well Decommissioning Methods and Results

The LNRD provided Aspect with a list of candidate wells to evaluate for decommissioning or conversion to monitoring wells. The LNRD contracted with Aquatech Well Drilling & Pumps (Aquatech) to conduct decommissioning activities in accordance with Lummi standard 17 LAR 04.130.

After obtaining landowner permission, Aspect, LNRD, and Aquatech conducted field assessments of four domestic wells in December 2015 (Appendix A: Well Evaluation Worksheets). All four wells assessed in consultation with LNRD were confirmed as inactive and appropriate candidates for decommissioning in 2015 (see Appendix A worksheets for additional details). The location of a fifth suspected inactive domestic well (GW055 at 3273 Robertson Road) was inspected by Aspect, LNRD, and Aquatech on December 3, 2015; however, the well was not located. Upon determination of the well's location, a proper well evaluation could be conducted in 2016.

Aquatech provided LNRD with proposed decommissioning methods. Decommissioning methods conformed to 17 LAR 04.130 except for GW157 and the Unknown Well ID well for which a variance was submitted to and approved by LNRD (see Appendix B and Appendix C).

Decommissioning activities occurred December 15 through 17, 2015. Well casing and decommissioning material volumes are estimated in Table 1. Pre-decommissioning, during decommissioning, and post-decommissioning photographs are provided in Figures 4 through 7. Appendix D contains Aquatech's Well Decommissioning Report forms and

available driller logs documenting original well drilling and construction (logs available for GW047 and GW157, only).

GW047

GW047 was located at 1096 Scott Road. The drilled well consisted of 6-inch-diameter steel casing with approximately 1.6 feet (ft) of casing stick-up above ground surface (ags), and a total depth of approximately 158.5 ft below the top of casing (btoc). Well decommissioning began on December 16, 2015, and was completed on December 17, 2015. Pre-decommissioning static water level was 114.5 ft btoc. Decommissioning activities included removing the pump; cutting the casing to 2 ft below ground surface (bgs); perforating the casing from the bottom to top; placing 2 50-pound (lb) bags of bentonite at the bottom of the well; pressure grouting the casing from the bottom up with 19 50-lb bags of grout mixture; topping the grout with 7 50-lb bags of bentonite; and covering the decommissioned well with topsoil.

GW157

GW157 was located at 2488 Kwina Road. The dug well consisted of 3-ft-diameter concrete tile casing with approximately 2 ft of casing stick-up ags, and a total depth of 14.2 ft btoc. The well was decommissioned on December 15, 2015. Approximately 2 inches of water were present in the bottom of the well prior to decommissioning. Decommissioning activities involved an approved variance from 17 LAR 04.130 (Appendices B and C) and included removing the uppermost concrete tiles to 3 ft bgs; filling the well from bottom to top with 100 50-lb bags of bentonite chips; and covering the decommissioned well with topsoil.

GW164

GW164 was located just north of 2359 Lummi Shore Road on Assignment 69-G. The drilled well consisted of 6-inch-diameter steel casing with approximately 1.25 ft of casing stick-up ags, and a total depth of approximately 106 ft btoc. Well decommissioning began on December 16, 2015, and was completed on December 17, 2015. Pre-decommissioning static water level was 4.5 ft btoc. Decommissioning activities included removing the pump; cutting the casing to 2 ft bgs; perforating the casing from bottom to top; pressure grouting the casing from the bottom up with 14 50-lb bags of grout mixture; topping the grout with 1 50-lb bag of bentonite chips; and covering the decommissioned well with topsoil.

Unknown Well ID

The Unknown Well ID well was located at 2273 Lummi Shore Road. The dug well consisted of 10-inch diameter ceramic tile casing with approximately 2.3 ft of casing stick-up ags, and a total depth of 8.5 ft btoc. The well was decommissioned on December 15, 2015. Pre-decommissioning static water level was 2.6 ft btoc. Decommissioning activities involved an approved variance from 17 LAR 04.130 (Appendices B and C) and included removing the uppermost ceramic tiles to 3.7 feet bgs; filling the well from bottom to top with 9 50-lb bags of bentonite chips; and covering the decommissioned well with topsoil.

Conclusions

Four inactive wells located on the Reservation were decommissioned in 2015 in accordance with 17 LAR 04.130 or approved variances (Appendices B and C). The LNRD well decommissioning program has decommissioned a total of 32 wells since 2006. Additional domestic wells are expected to become inactive as connections to the Lummi Water District increase. Inactive wells can present physical safety and environmental concerns including becoming conduits for contaminant migration. We recommend that LNRD's decommissioning program of inactive wells continue.

Erratum Summary of 2013 and 2014 Well Decommissioning Reports

The LNRD has updated the IDs of three wells that were decommissioned in 2013. The old Well IDs were originally reported in Aspect (2013) and also presented on Figure 2 of Aspect (2014).

In this report, the revised Well IDs are listed in the "Well ID" column of Table 2; and the old Well IDs are listed in the "Comment" column of Table 2. The revised Well IDs are also reported in Figure 2 of this report.

References

Aspect Consulting, LLC (Aspect), 2013, Well Decommissioning on the Lummi Indian Reservation During 2013. Prepared for the Water Resources Division of the Natural Resources Department. December 31, 2013.

Aspect Consulting, LLC (Aspect), 2014, Well Decommissioning on the Lummi Indian Reservation During 2014. Prepared for the Water Resources Division of the Natural Resources Department. December 1, 2014.

Salix Environmental Services (Salix), 2010, Well Decommissioning on the Lummi Indian Reservation During 2010. Prepared for the Water Resources Division of the Natural Resources Department of the Lummi Indian Business Council.

Limitations

Work for this project was performed for the Water Resources Division of the Lummi Natural Resources Department (Client), and this report was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This report does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

TABLES

Table 1 - Wells Decommissioned or Improved 2006-2015

FINAL

Project No. 130218, Lummi Indian Reservation, Washington

Well ID	Address	Decommissioned / Improved	Year	Comment
GW046	2581 Scott Road	Decommissioned	2006	-
GW048	3411 Lummi Shore Road	Decommissioned	2006	-
GW049	3411 Lummi Shore Road	Decommissioned	2006	-
GW068	3292 Lighting Bird Lane	Decommissioned	2006	-
GW087	Below Wexliem Community Center	Decommissioned	2006	-
GW095	2101 Lummi Shore Road	Decommissioned	2006	-
GW130	Gooseberry Sewer Treatment Plant	Decommissioned	2006	-
GW081	Across from 2562 Mackenzie Road	Decommissioned	2008	-
GW082	Across from 2562 Mackenzie Road	Decommissioned	2008	-
GW406	Across from 2562 Mackenzie Road	Decommissioned	2008	-
GW416	2690 Haxton Way	Decommissioned	2008	-
Munson Well	2195 Lummi Shore Road	Decommissioned	2008	-
GW037	2616 Kwina Road	Decommissioned	2009	-
GW066	2985 Lummi Shore Road	Improved	2009	-
GW089	3230 Wekes Lane	Decommissioned	2009	-
GW128	Mackenzie Neighborhood near playground	Decommissioned	2010	-
GW175	2201 Lummi Shore Road	Decommissioned	2010	-
GW651	4119 Germaine Road	Decommissioned	2010	-
GW043	3745 Haxton Way	Decommissioned	2013	-
GW052	3319 Lummi Shore Road	Decommissioned	2013	-
GW092	2289 Lummi Shore Road	Decommissioned	2013	-
GW443	3415 Lummi Shore Road	Decommissioned	2013	Old ID GW436
GW444	3413 Lummi Shore Road	Decommissioned	2013	Old ID GW437
GW445	2119 Lummi Shore Road	Decommissioned	2013	Old ID GW438
GW066	2985 Lummi Shore Road	Decommissioned	2014	-
GW113	3310 Robertson Road	Decommissioned	2014	-
GW447	3415 Lummi Shore Road	Decommissioned	2014	-
GW448	3415 Lummi Shore Road	Decommissioned	2014	-
GW449	2581 Scott Road	Decommissioned	2014	-
GW157	2488 Kwina Road	Decommissioned	2015	-
GW047	1096 Scott Road	Decommissioned	2015	-
Unknown Well ID	2273 Lummi Shore Road	Decommissioned	2015	-
GW164	Assignment 69-G	Decommissioned	2015	-

Table 2 - Well Casing and Decommissioning Material Volumes

Project No. 130218, Lummi Indian Reservation, Washington

Well ID	Drilled / Dug	Casing (Pre-Decommissioning)					Decommissioning Material				
		Material	Diameter (ft)	Stick-Up (ft)	Total Depth (ft bgs)	Volume (ft ³ bgs)	Bags Bentonite Chips	Bentonite Chip Volume ¹ (ft ³)	Bags Grout	Grout Volume ² (ft ³)	Total Volume (ft ³)
GW047	Drilled	Steel	0.5	1.6	156.9	30.8	9	6.3	19	77.9	84.2
GW157	Dug	Concrete tile	3	2	12.2	86.2	100	70	0	0	70
GW164	Drilled	Steel	0.5	1.25	104.8	20.6	1	0.7	14	57.4	58.1
Unknown Well ID	Dug	Ceramic tile	0.83	2.3	6.2	3.4	9	6.3	0	0	6.3

Notes:

ft = feet

bgs = below ground surface

¹ Assumes 0.7 ft³ per 50-pound bag of bentonite chips.

² Assumes 31 gallons (4.1 ft³) of grout mixture per 50-pound bag of grout.

FIGURES

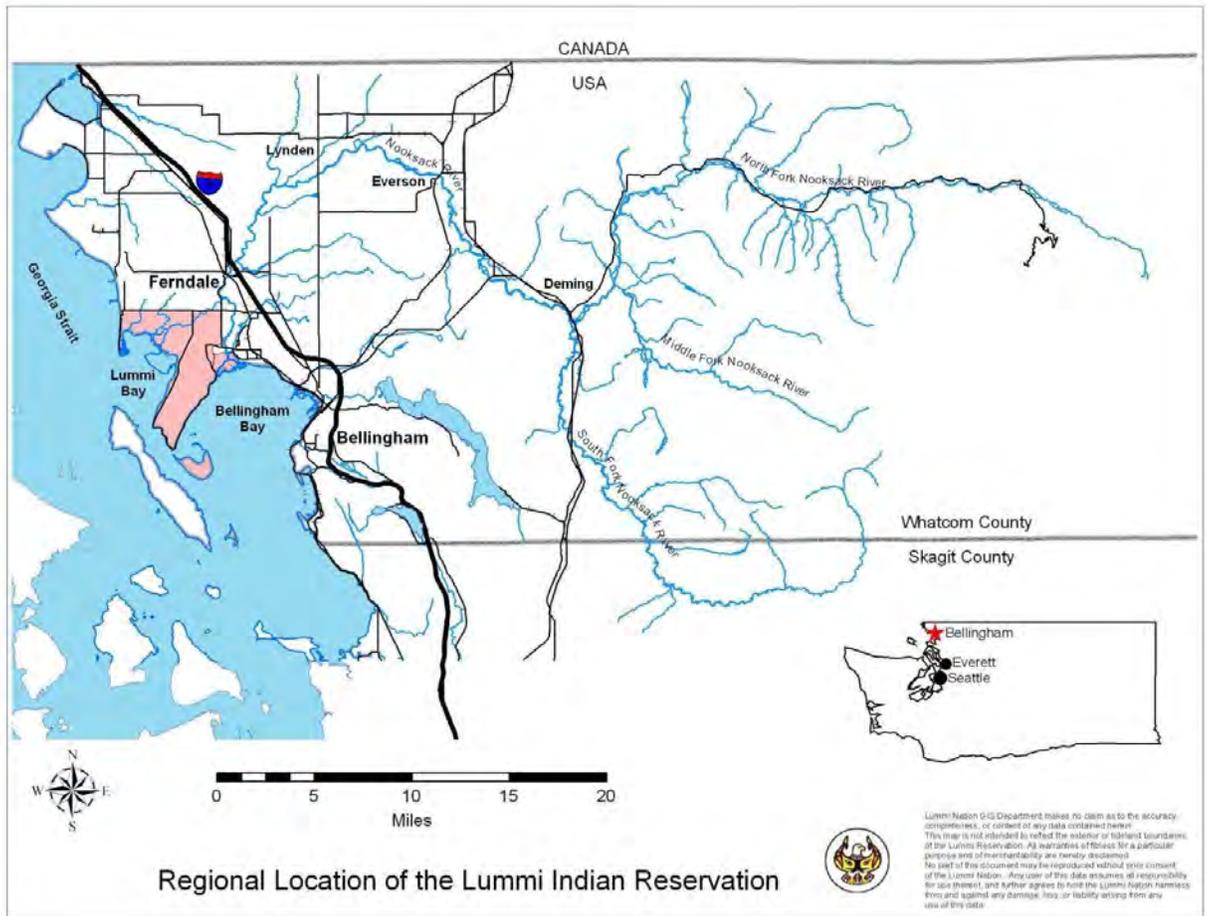


Figure 1. Location of the Lummi Indian Reservation (from Salix, 2010).

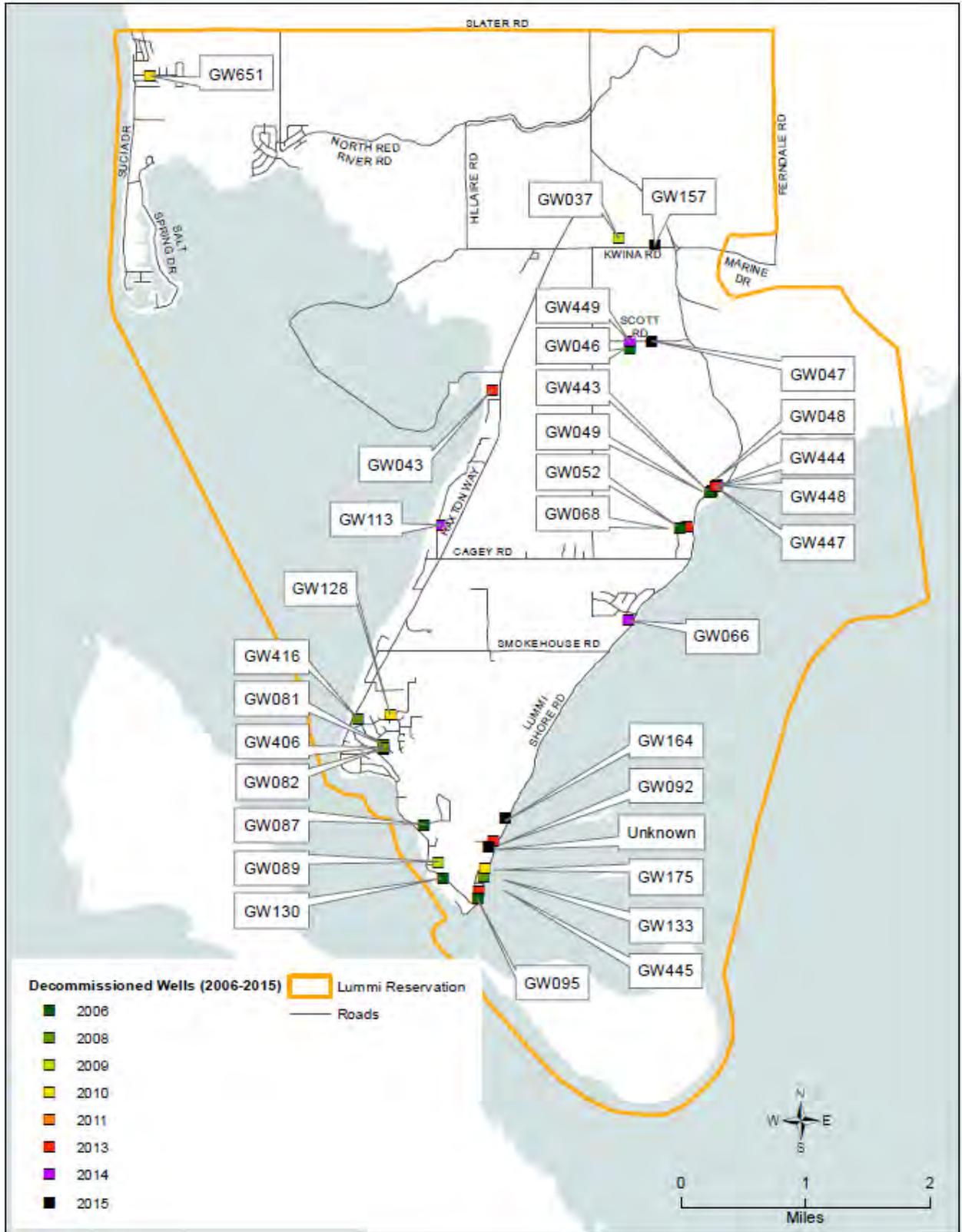


Figure 2. Location of all wells decommissioned on the Lummi Indian Reservation since 2006.

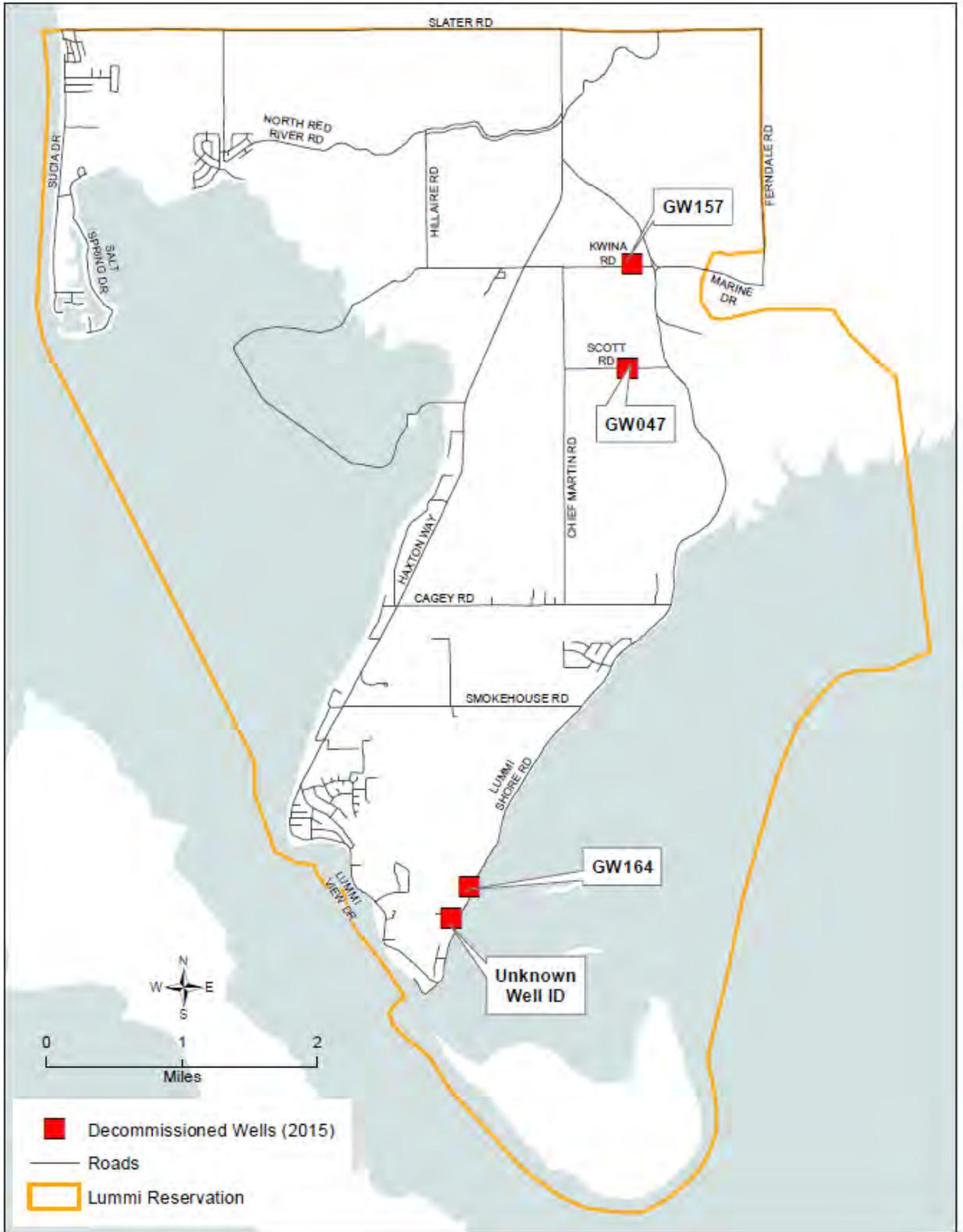


Figure 3. Location of wells decommissioned on the Lummi Indian Reservation in 2015.



(a)



(b)



(c)

Figure 4. GW047 (a) pre-decommissioning, (b) during decommissioning, and (c) post-decommissioning (before decommissioned well covered with topsoil).



(a)



(b)



(c)

Figure 5. GW157 (a) pre-decommissioning, (b) during decommissioning, and (c) post-decommissioning.



(a)



(b)



(c)

Figure 6. GW164 (a) pre-decommissioning, (b) during decommissioning, and (c) post-decommissioning.



(a)



(b)



(c)

Figure 7. Unknown Well ID (a) pre-decommissioning, (b) during decommissioning, and (c) post-decommissioning.

APPENDIX A

Well Evaluation Worksheets

WORKSHEET FOR DETERMINING IF ABANDONED WATER WELLS SHOULD BE MONITORING WELLS OR DECOMMISSIONED

Criteria to determine if abandoned wells should be decommissioned or become candidates for use as a monitoring well. If the answer for questions 1 through 7 is "yes" then the well is a candidate for use as a monitoring well.

Well number, owner, and street address: *GW047, Edwards, 1096 Scott Road*

Person performing determination and date: *Annaliese Eipert, December 3, 2015*

Criteria Description	Sub-category/Explanation	Actual Well Information	Evaluation	Answer (Yes or No)
1. Is the well in good condition?	Good, not good, or unknown. In rare situations, unknown condition may not preclude use as a monitoring depending upon location of the well and if sufficient information can be gathered about its condition.	<i>Unknown. Monument and cap rusty but apparently in good condition.</i>	Good condition = Yes If unknown but important location and sufficient information gathered about condition = Yes Otherwise = No	<i>Yes</i>
2. Is the well <u>unlikely</u> to be a source of ground water contamination now or in the foreseeable future?	For example, is the well located at the bottom of a local depression?	<i>Yes. Well located in side yard; substantial nearby trash and debris.</i>	Unlikely to be a source of contamination = Yes Otherwise = No	<i>Yes</i>
3. Is the well located a sufficient distance from current and foreseeable sources of contamination?	Case-specific. In general, are sources of contamination located or likely to be proximate to the well (e.g., septic tank, gas station).	<i>Unclear. Substantial nearby trash and debris. Nearby motor vehicle traffic.</i>	Sources of current and foreseeable contamination unlikely to be proximate to the well = Yes Otherwise = No	<i>No</i>
4. Is the well <u>unlikely</u> to be influenced by factors which diminish the utility of the well to serve as a monitoring well?	For example, is the well shallow and close to home with a foundation drain?	<i>Yes.</i>	Unlikely that well influenced by factors that diminish use as a monitoring well = Yes Otherwise = No	<i>Yes</i>
5. Is the well suitable for use as a monitoring well?	For example, is the well conducive to water level measurements or obtaining water quality measurements? Both water level and quality are not necessary, depending upon the location of the well.	<i>Yes.</i>	Suitable for use as a monitoring well = Yes Otherwise = No	<i>Yes</i>
6. Is there a Well Log for the well?	<ul style="list-style-type: none"> • Well dimensions known? • Water level, production known? • Well construction details known? • Stratigraphy recorded and reliable? <p>Not all information is necessary, depending upon location and need for monitoring well.</p>	<i>Yes. Driller log summary available.</i>	Sufficient information in well log = Yes Otherwise = No	<i>Yes</i>
7. Does the well tap an aquifer where additional information would be useful?	For example: <ul style="list-style-type: none"> • The aquifer is not tapped by other wells. • Are wells that tap the aquifer proximate or distant? • There is access to other wells that tap the aquifer. • Are aquifer characteristics or uses sufficiently variable or unique to warrant an additional monitoring well? 	<i>No.</i>	Additional aquifer information at well location useful = Yes Otherwise = No	<i>No</i>

Check the appropriate result:

decommission well, candidate for use as monitoring well, or further information is required.

Assessment Completed by: *Annaliese Eipert*

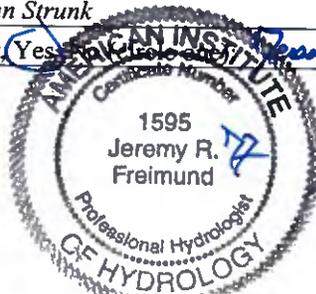
Date: *December 3, 2015*

Assessment Reviewed by: *Jared Bean, John Strunk*

Date: *December 4, 2015*

Concurrence by Water Resources Manager: *Yes*

Date: *12/10/2015*



WORKSHEET FOR DETERMINING IF ABANDONED WATER WELLS SHOULD BE MONITORING WELLS OR DECOMMISSIONED

Criteria to determine if abandoned wells should be decommissioned or become candidates for use as a monitoring well. If the answer for questions 1 through 7 is "yes" then the well is a candidate for use as a monitoring well.

Well number, owner, and street address: *GW157, Karen Williams, 2488 Kwina Road*
 Person performing determination and date: *Jared Bean, December 11, 2015*

Criteria Description	Sub-category/ Explanation	Actual Well Information	Evaluation	Answer (Yes or No)
1. Is the well in good condition?	Good, not good, or unknown. In rare situations, unknown condition may not preclude use as a monitoring depending upon location of the well and if sufficient information can be gathered about its condition.	<i>No. Dug well. Wooden cover decayed. The well was dry at December 11, 2015 site visit.</i>	Good condition = Yes If unknown but important location and sufficient information gathered about condition = Yes Otherwise = No	<i>No</i>
2. Is the well <u>unlikely</u> to be a source of ground water contamination now or in the foreseeable future?	For example, is the well located at the bottom of a local depression?	<i>No. Wood cover decayed.</i>	Unlikely to be a source of contamination = Yes Otherwise = No	<i>No</i>
3. Is the well located a sufficient distance from current and foreseeable sources of contamination?	Case-specific. In general, are sources of contamination located or likely to be proximate to the well (e.g., septic tank, gas station).	<i>No. Located adjacent to house and propane tank.</i>	Sources of current and foreseeable contamination unlikely to be proximate to the well = Yes Otherwise = No	<i>No</i>
4. Is the well <u>unlikely</u> to be influenced by factors which diminish the utility of the well to serve as a monitoring well?	For example, is the well shallow and close to home with a foundation drain?	<i>No. Dry.</i>	Unlikely that well influenced by factors that diminish use as a monitoring well = Yes Otherwise = No	<i>No</i>
5. Is the well suitable for use as a monitoring well?	For example, is the well conducive to water level measurements or obtaining water quality measurements? Both water level and quality are not necessary, depending upon the location of the well.	<i>No. Dry, and proper well cover would need to be constructed.</i>	Suitable for use as a monitoring well = Yes Otherwise = No	<i>No</i>
6. Is there a Well Log for the well?	<ul style="list-style-type: none"> Well dimensions known? Water level, production known? Well construction details known? Stratigraphy recorded and reliable? Not all information is necessary, depending upon location and need for monitoring well.	<i>Well log – yes, but no stratigraphy information. Dug well. 3-foot diameter concrete tile casing. Approximately 14 feet deep below top of casing.</i>	Sufficient information in well log = Yes Otherwise = No	<i>No</i>
7. Does the well tap an aquifer where additional information would be useful?	For example: <ul style="list-style-type: none"> The aquifer is not tapped by other wells. Are wells that tap the aquifer proximate or distant? There is access to other wells that tap the aquifer. Are aquifer characteristics or uses sufficiently variable or unique to warrant an additional monitoring well? 	<i>No.</i>	Additional aquifer information at well location useful = Yes Otherwise = No	<i>No</i>

Check the appropriate result:

decommission well, candidate for use as monitoring well, or further information is required.

Assessment Completed by: *Victor "Turtle" Johnson*

Date: *December 11, 2015*

Assessment Reviewed by: *Jared Bean, John Strunk*

Date: *December 11, 2015*

Concurrence by Water Resources Manager (Yes/No): *Yes*

Date: *12/14/2015*



WORKSHEET FOR DETERMINING IF ABANDONED WATER WELLS SHOULD BE MONITORING WELLS OR DECOMMISSIONED

Criteria to determine if abandoned wells should be decommissioned or become candidates for use as a monitoring well. If the answer for questions 1 through 7 is "yes" then the well is a candidate for use as a monitoring well.

Well number, owner, and street address: *GW164, Bewley, North of 2359 Lummi Shore Road*

Person performing determination and date: *Jared Bean, September 22, 2014*

Criteria Description	Sub-category/Explanation	Actual Well Information	Evaluation	Answer (Yes or No)
1. Is the well in good condition?	Good, not good, or unknown. In rare situations, unknown condition may not preclude use as a monitoring depending upon location of the well and if sufficient information can be gathered about its condition.	<i>Unknown Above-ground monument appears to be in good condition</i>	Good condition = Yes If unknown but important location and sufficient information gathered about condition = Yes Otherwise = No	<i>Yes</i>
2. Is the well <u>unlikely</u> to be a source of ground water contamination now or in the foreseeable future?	For example, is the well located at the bottom of a local depression?	<i>Unlikely No septic; house is on municipal sewer; well located about 1 ft from the house</i>	Unlikely to be a source of contamination = Yes Otherwise = No	<i>Yes</i>
3. Is the well located a sufficient distance from current and foreseeable sources of contamination?	Case-specific. In general, are sources of contamination located or likely to be proximate to the well (e.g., septic tank, gas station).	<i>No Located next to house in side yard; potential for contamination from yard activities</i>	Sources of current and foreseeable contamination unlikely to be proximate to the well = Yes Otherwise = No	<i>No</i>
4. Is the well <u>unlikely</u> to be influenced by factors which diminish the utility of the well to serve as a monitoring well?	For example, is the well shallow and close to home with a foundation drain?	<i>Unlikely</i>	Unlikely that well influenced by factors that diminish use as a monitoring well = Yes Otherwise = No	<i>Yes</i>
5. Is the well suitable for use as a monitoring well?	For example, is the well conducive to water level measurements or obtaining water quality measurements? Both water level and quality are not necessary, depending upon the location of the well.	<i>No Access issues: gated driveway, well behind house, no well log</i>	Suitable for use as a monitoring well = Yes Otherwise = No	<i>No</i>
6. Is there a Well Log for the well?	<ul style="list-style-type: none"> Well dimensions known? Water level, production known? Well construction details known? Stratigraphy recorded and reliable? Not all information is necessary, depending upon location and need for monitoring well.	<i>No log TD = 113 ft bTOC DTW = 5.06 ft bTOC on 9/15/14 Monument = 6" steel casing</i>	Sufficient information in well log = Yes Otherwise = No	<i>No</i>
7. Does the well tap an aquifer where additional information would be useful?	For example: <ul style="list-style-type: none"> The aquifer is not tapped by other wells. Are wells that tap the aquifer proximate or distant? There is access to other wells that tap the aquifer. Are aquifer characteristics or uses sufficiently variable or unique to warrant an additional monitoring well? 	<i>No</i>	Additional aquifer information at well location useful = Yes Otherwise = No	<i>No</i>

Check the appropriate result:

decommission well, candidate for use as monitoring well, or further information is required.

Assessment Completed by: *Victor Johnson*

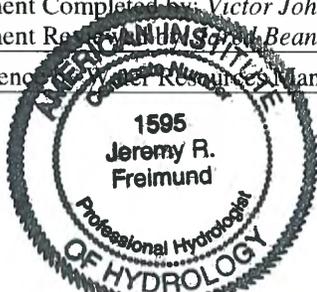
Date: *September 15, 2014*

Assessment Reviewed by: *Jared Bean, Erick Miller*

Date: *September 22, 2014*

Concurrent with Water Resources Manager Yes No (circle one):

Jeremy Freimund Date: *9/26/2014*



WORKSHEET FOR DETERMINING IF ABANDONED WATER WELLS SHOULD BE MONITORING WELLS OR DECOMMISSIONED

Criteria to determine if abandoned wells should be decommissioned or become candidates for use as a monitoring well. If the answer for questions 1 through 7 is "yes" then the well is a candidate for use as a monitoring well.

Well number, owner, and street address: *Unknown – ceramic tile well, Kamkoff, 2273 Lummi Shore Road*
 Person performing determination and date: *Annaliese Eipert, December 3, 2015*

Criteria Description	Sub-category/ Explanation	Actual Well Information	Evaluation	Answer (Yes or No)
1. Is the well in good condition?	Good, not good, or unknown. In rare situations, unknown condition may not preclude use as a monitoring depending upon location of the well and if sufficient information can be gathered about its condition.	<i>No. No cap, no well log, unknown construction.</i>	Good condition = Yes If unknown but important location and sufficient information gathered about condition = Yes Otherwise = No	<i>No</i>
2. Is the well unlikely to be a source of ground water contamination now or in the foreseeable future?	For example, is the well located at the bottom of a local depression?	<i>No. No cap, unknown construction.</i>	Unlikely to be a source of contamination = Yes Otherwise = No	<i>No</i>
3. Is the well located a sufficient distance from current and foreseeable sources of contamination?	Case-specific. In general, are sources of contamination located or likely to be proximate to the well (e.g., septic tank, gas station).	<i>No. Motor vehicle traffic and parking nearby.</i>	Sources of current and foreseeable contamination unlikely to be proximate to the well = Yes Otherwise = No	<i>No</i>
4. Is the well unlikely to be influenced by factors which diminish the utility of the well to serve as a monitoring well?	For example, is the well shallow and close to home with a foundation drain?	<i>No. Well was supposedly already partially filled-in.</i>	Unlikely that well influenced by factors that diminish use as a monitoring well = Yes Otherwise = No	<i>No</i>
5. Is the well suitable for use as a monitoring well?	For example, is the well conducive to water level measurements or obtaining water quality measurements? Both water level and quality are not necessary, depending upon the location of the well.	<i>No.</i>	Suitable for use as a monitoring well = Yes Otherwise = No	<i>No</i>
6. Is there a Well Log for the well?	<ul style="list-style-type: none"> Well dimensions known? Water level, production known? Well construction details known? Stratigraphy recorded and reliable? Not all information is necessary, depending upon location and need for monitoring well.	<i>No log. Ceramic tile well. Tile casing stick-up = 2.3 feet. Total depth below top of casing = 8.5 feet. Static water level = 2.6 feet below top of casing.</i>	Sufficient information in well log = Yes Otherwise = No	<i>No</i>
7. Does the well tap an aquifer where additional information would be useful?	For example: <ul style="list-style-type: none"> The aquifer is not tapped by other wells. Are wells that tap the aquifer proximate or distant? There is access to other wells that tap the aquifer. Are aquifer characteristics or uses sufficiently variable or unique to warrant an additional monitoring well? 	<i>No.</i>	Additional aquifer information at well location useful = Yes Otherwise = No	<i>No</i>

Check the appropriate result:

decommission well, candidate for use as monitoring well, or further information is required.

Assessment Completed by: *Annaliese Eipert*

Date: *December 3, 2015*

Assessment Reviewed by: *Jared Bean, John Strunk*

Date: *December 4, 2015*

Concurrence by Water Resources Manager: *Jeremy Freimund*

Date: *12/10/2015*



APPENDIX B

**December 14, 2015 Request for
Variance from 17 LAR 04.130**



MEMORANDUM

Project No.: 130218

December 14, 2015

To: Jeremy Freimund, P.H., Water Resources Manager
Lummi Natural Resources Department

cc: Ron Walden and Ryan Wilhonen
Aquatech Well Drilling and Pumps

From: Jared Bean, Senior Staff Hydrogeologist
Aspect Consulting, LLC

Re: **Request for Variance from 17 LAR 04.130**

The memorandum requests variances from 17 LAR 04.130 for decommissioning of two dug wells on the Lummi Peninsula. Aquatech (Representative: Ron Walden, 360-742-6005, 2675 Butler Creek Rd, Sedro-Woolley, WA 98284) intends to decommission these wells during the week of December 14, 2015. This memorandum documents the procedures proposed by Aquatech for variance approval.

GW157 at 2488 Kwina Road and Unknown Ceramic Tile Well at 2273 Lummi Shore Rd

Aquatech requests a variance from 17 LAR 04.130(e), which calls for clean, chlorinated pea gravel to be installed in dug wells to two feet above static water level.

Aquatech proposes the following methods for effective decommissioning: remove at least the uppermost three feet of casing, fill the well from bottom to top with bentonite or concrete, achieve at least three feet of contact between sealing material and native soil, and cover the decommissioned well with soil. Aquatech states that the proposed methods are consistent with WAC 173-160-381 and will provide an equivalent or better seal than placing chlorinated pea gravel at the bottom of the well.

Limitations

Work for this project was performed for the Lummi Natural Resources Department Water Resources Manager (Client), and this memorandum was prepared in accordance with generally accepted professional practices for the nature and conditions of work completed in the same or similar localities, at the time the work was performed. This memorandum does not represent a legal opinion. No other warranty, expressed or implied, is made.

All reports prepared by Aspect Consulting for the Client apply only to the services described in the Agreement(s) with the Client. Any use or reuse by any party other than the Client is at the sole risk of that party, and without liability to Aspect Consulting. Aspect Consulting's original files/reports shall govern in the event of any dispute regarding the content of electronic documents furnished to others.

W:\130218 Lummi Nation Hydrogeologic Services\Deliverables\Well Decommissioning - 2015\2015 Variance Request Memo.docx



APPENDIX C

**Email Approval of December 14,
2015 Variance Request for Well
Decommissioning**

From: Jeremy Freimund [mailto:JeremyF@lummi-nsn.gov]

Sent: Monday, December 14, 2015 4:49 PM

To: Jared Bean <jbean@aspectconsulting.com>; Victor Johnson <VictorJ@lummi-nsn.gov>; Jamie L. Mattson <JamieM@lummi-nsn.gov>

Cc: 'Ron Walden' (ron@aquatechwellandpump.com) <ron@aquatechwellandpump.com>; Ryan Wilhonen (ryan@aquatechwellandpump.com) <ryan@aquatechwellandpump.com>; Annaliese Eipert <aeipert@aspectconsulting.com>; John Strunk <jstrunk@aspectconsulting.com>

Subject: RE: 2015 well decommissioning

Hi Jared et al.,

I hope that you are doing well. I have reviewed the requested variance for the decommissioning of two hand-dug wells on the Lummi Peninsula of the Lummi Indian Reservation. The purpose of this email is to notify you that the requested variances are approved. Thank you for your work on this important project.

Kind Regards,

Jeremy

Jeremy R. Freimund, P.H.
Water Resources Manager
Lummi Natural Resources Department
2665 Kwina Road
Bellingham, WA 98226
(O) 360-312-2314
(C) 360-410-1775
<http://lnnr.lummi-nsn.gov/LummiWebsite/>

APPENDIX D

Aquatech's Well Decommissioning Reports

Well 47. Reginald Edwards. Drilled by Hayes, 1970.
Casing: 6-inch to 154 ft. Screen: .018-inch slot,
154-158 ft.

Sand loam, brown	1	1
Clay, tan, and gravel	18	19
Clay, gray	10	59
Sand, fine, and clay, gray (soepage)	2	61
Gravel (pocket - water boils out)	2	63
Clay, gray, sand, and a bit of gravel (dry)	23	86
Sand, gravel, and clay, soft (dry)	30	116
Gravel, fine, caving (dry)	1	117
Sand, gravel, and clay, firm	1	118
Sand and clay (water)	35	153
Sand, fine, clean (water)	5	158
Clay, gray	2	160

Well 48. M. J. Holland. Dug by M. J. Holland, 1956. Casing: 36-inch to 12 ft. Screen: .014-inch slot, 154-159 ft.

Soil	2	2
Sand, fine	10	12
Clay at 12 ft	--	--

Well 49. M. J. Holland. Dug by M. J. Holland, 1956. Casing: 30-inch to 17 ft.

Soil	2	2
Sand, fine	15	17
Clay at 17 ft	--	--

Well 51. W. P. Crumshank. Drilled by William Radke, 1946.
Casing: 5-inch.

Sand, fine	14	14
Clay, blue	96	110
Sand, fine, thin layer (saline water)	--	--
Clay, blue	--	147
Clay, gravelly, compact	10	165
Gravel, sandy (saline water)	5	170

Well 57. Boynton Sunset Tracts Water Association.
Drilled by Hilliard, 1962. Casing: 8-inch to 107 ft.
Screen: .030-inch slot, 107-112 ft.

Topsoil	1	1
Sand, coarse	5	6
Hardpan, yellow	9	15
Clay, blue	25	40
Sand, fine, yellow	10	50
Sand, medium fine	41	91
Rocks, sand and seams of clay	5	96
Sand, fine, and layers of clay	6	102
Sand, medium fine	3	105
Sand, medium, and some gravel	7	112

Well 58. L. T. Nielsen and S. R. Boynton, Jr. Drilled by Mcintosh Well Drilling Co., 1968. Casing: 8-inch to 154 ft. Screen: .014-inch slot, 154-159 ft. .010-inch slot, 159-164 ft.

Topsoil	1	1
Clay, yellow (hardpan)	8	9
Clay, sandy, yellow	12	21
Sand, gray	7	28
Sand, brown	31	59
Sand and gravel, brown	19	78
Clay and gravel	26	104
Sand	2	106
Boulder	2	108
Gravel	4	112
Sand	30	142
Sand, fine (water)	12	154
Sand, medium to fine	5	159
Sand, fine	5	164

Well 59. Lummi Water District No. 2. Drilled by Dahlman Pump and Supply, 1971. Casing: 6-inch to 173 ft. Screen: .015-inch slot, 173-182 ft.

Clay, brown	41	41
Sand, brown	29	70
Sand, brown, and gravel	70	148
Sand and gravel (water)	18	166
Sand, coarse	4	170
Gravel, fine, and sand	5	175
Sand and gravel	10	185

59

Cline, 1974

DECOMMISSIONED
 GW047
 12/16/2015

48

SSM/OIE-13 J03

38/1-12J01

9-185
(October 1950)

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WATER RESOURCES DIVISION

12.50
1.68
10.82

WELL SCHEDULE

Date 4/17 1956 Field No. 38/1-12J01
Record by [Signature] Office No. _____
Source of data Owner & Obs

1. Location: State Wash County Whatcom
Map Lewis Topos
NE 1/4 SE 1/4 sec. 12 T. 38 N. R. 1 W.

2. Owner: Francis Celestine Address Lewis Topos
Tenant _____ Address _____
Driller _____ Address _____

3. Topography Bunch

4. Elevation 60 ft. MSL

5. Type: Dug drilled, driven, bored, jetted _____ 19____

6. Depth: Rept. 13 1/2 ft. Meas. _____ ft.

7. Casing: Diam. 36 in., to _____ in., Type Cement
Depth 13 1/2 ft., Finish _____

	12	
		31

8. Chief Aquifer Sand From _____ to _____ ft.
Others _____

9. Water level 10.82 ft. 4/17/56 1956 above
top of wooden meter which 2.5 ft. above surface
below

10. Pump: Type _____ Capacity _____ G. M.
Power: Kind _____ Horsepower _____

11. Yield: Flow _____ G. M. Meas., Rept. Est. _____
Drawdown _____ ft. after _____ pumping _____ G. M.

12. Use: Dom. Stock, P.S., Ind., Ir., Ob.
Adequacy, permanent _____

13. Quality _____ Temp _____ °F.
Taste, odor, color None very hard Sample Yes
Unfit for _____

14. Remarks (Log, Analyses, etc) Area around well is
dry. Well never goes dry

DECOMMISSIONED
12/15/2015
GW 157

