

## Groundwater Application Review Summary Form

Application # G- 18761

GW Reviewer Phil Marcy Date Review Completed: 12/20/2018

### Summary of GW Availability and Injury Review:

[ ] Groundwater for the proposed use is either over appropriated, will not likely be available in the amounts requested without injury to prior water rights, OR will not likely be available within the capacity of the groundwater resource per Section B of the attached review form.

### Summary of Potential for Substantial Interference Review:

☒ There is the potential for substantial interference per Section C of the attached review form.

### Summary of Well Construction Assessment:

[ ] The well does not appear to meet current well construction standards per Section D of the attached review form. Route through Well Construction and Compliance Section.

*This is only a summary. Documentation is attached and should be read thoroughly to understand the basis for determinations and for conditions that may be necessary for a permit (if one is issued).*

[illegible]

# PUBLIC INTEREST REVIEW FOR GROUNDWATER APPLICATIONS

TO: Water Rights Section Date 12/20/2018  
 FROM: Groundwater Section Phillip I. Marcy  
 SUBJECT: Application G- 18761 Reviewer's Name  
 Supersedes review of \_\_\_\_\_ Date of Review(s)

## **PUBLIC INTEREST PRESUMPTION; GROUNDWATER**

**OAR 690-310-130 (1)** *The Department shall presume that a proposed groundwater use will ensure the preservation of the public welfare, safety and health as described in ORS 537.525. Department staff review groundwater applications under OAR 690-310-140 to determine whether the presumption is established. OAR 690-310-140 allows the proposed use be modified or conditioned to meet the presumption criteria. This review is based upon available information and agency policies in place at the time of evaluation.*

**A. GENERAL INFORMATION:** Applicant's Name: David Lowe; Jordan Creek Ranch, LLC County: Union

A1. Applicant(s) seek(s) 2.72 cfs from 1 well(s) in the Grande Ronde Basin,  
 \_\_\_\_\_ subbasin

A2. Proposed use Irrigation (162.9 acres) Seasonality: March 1<sup>st</sup> – October 31<sup>st</sup> (245 days)

A3. Well and aquifer data (attach and number logs for existing wells; mark proposed wells as such under logid):

| Well | Logid    | Applicant's Well # | Proposed Aquifer* | Proposed Rate(cfs) | Location (T/R-S QQ-Q) | Location, metes and bounds, e.g. 2250' N, 1200' E fr NW cor S 36 |
|------|----------|--------------------|-------------------|--------------------|-----------------------|------------------------------------------------------------------|
| 1    | Proposed | 1                  | Bedrock           | 2.72               | 4S/37E-5 SW-SW        | 110'N, 930'E fr SW cor S 5                                       |
| 2    |          |                    |                   |                    |                       |                                                                  |
| 3    |          |                    |                   |                    |                       |                                                                  |
| 4    |          |                    |                   |                    |                       |                                                                  |
| 5    |          |                    |                   |                    |                       |                                                                  |

\* Alluvium, CRB, Bedrock

| Well | Well Elev ft msl | First Water ft bls | SWL ft bls | SWL Date | Well Depth (ft) | Seal Interval (ft) | Casing Intervals (ft) | Liner Intervals (ft) | Perforations Or Screens (ft) | Well Yield (gpm) | Draw Down (ft) | Test Type |
|------|------------------|--------------------|------------|----------|-----------------|--------------------|-----------------------|----------------------|------------------------------|------------------|----------------|-----------|
| 1    | 4159             | NA                 | NA         | NA       | 400-600         | TBD                | TBD                   | NA                   | TBD                          | NA               | NA             | NA        |
|      |                  |                    |            |          |                 |                    |                       |                      |                              |                  |                |           |
|      |                  |                    |            |          |                 |                    |                       |                      |                              |                  |                |           |
|      |                  |                    |            |          |                 |                    |                       |                      |                              |                  |                |           |
|      |                  |                    |            |          |                 |                    |                       |                      |                              |                  |                |           |

Use data from application for proposed wells.

A4. **Comments:** The applicant proposes to complete POA well into basalt, listing UNIO 52096 (a nearby domestic well) as an example of expected lithology in the proposed well. Well specifics, however, are left "to be determined" as meeting with approval from the Department. The surrounding area is mapped as undifferentiated R2 and N2 Columbia River Basalt, with NNW trending faults dictating major drainage patterns.

A5. ☒ **Provisions of the** Grande Ronde Basin rules relative to the development, classification and/or management of groundwater hydraulically connected to surface water ☐ are, or ☒ are not, activated by this application. (Not all basin rules contain such provisions.)  
 Comments: \_\_\_\_\_

A6. ☐ **Well(s) #** \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, tap(s) an aquifer limited by an administrative restriction.  
 Name of administrative area: \_\_\_\_\_  
 Comments: \_\_\_\_\_

**B. GROUNDWATER AVAILABILITY CONSIDERATIONS, OAR 690-310-130, 400-010, 410-0070**

B1. Based upon available data, I have determined that groundwater\* for the proposed use:

- a. ☐ is over appropriated, ☒ is not over appropriated, or ☐ cannot be determined to be over appropriated during any period of the proposed use. \* This finding is limited to the groundwater portion of the over-appropriation determination as prescribed in OAR 690-310-130;
- b. ☐ will not or ☐ will likely be available in the amounts requested without injury to prior water rights. \* This finding is limited to the groundwater portion of the injury determination as prescribed in OAR 690-310-130;
- c. ☐ will not or ☐ will likely to be available within the capacity of the groundwater resource; or
- d. ☒ will, if properly conditioned, avoid injury to existing groundwater rights or to the groundwater resource:
  - i. ☒ The permit should contain condition #(s) 7N; "Large Water Use Reporting";
  - ii. ☐ The permit should be conditioned as indicated in item 2 below.
  - iii. ☐ The permit should contain special condition(s) as indicated in item 3 below;

- B2.
- a. ☐ Condition to allow groundwater production from no deeper than \_\_\_\_\_ ft. below land surface;
  - b. ☐ Condition to allow groundwater production from no shallower than \_\_\_\_\_ ft. below land surface;
  - c. ☐ Condition to allow groundwater production only from the \_\_\_\_\_ groundwater reservoir between approximately \_\_\_\_\_ ft. and \_\_\_\_\_ ft. below land surface;
  - d. ☐ Well reconstruction is necessary to accomplish one or more of the above conditions. The problems that are likely to occur with this use and without reconstructing are cited below. Without reconstruction, I recommend withholding issuance of the permit until evidence of well reconstruction is filed with the Department and approved by the Groundwater Section.

**Describe injury** –as related to water availability– that is likely to occur without well reconstruction (interference w/ senior water rights, not within the capacity of the resource, etc): \_\_\_\_\_

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- B3. **Groundwater availability remarks:** There has been little to no development of any CRBG aquifer system in this area, therefore no pertinent data regarding sustainability of the resource. It is unlikely that the proposed use would result in injury to any nearby groundwater user.

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**C. GROUNDWATER/SURFACE WATER CONSIDERATIONS, OAR 690-09-040****C1. 690-09-040 (1):** Evaluation of aquifer confinement:

| Well     | Aquifer or Proposed Aquifer                  | Confined                            | Unconfined               |
|----------|----------------------------------------------|-------------------------------------|--------------------------|
| <b>1</b> | <b>Single interflow zone within the CRBG</b> | <input checked="" type="checkbox"/> | <input type="checkbox"/> |
|          |                                              | <input type="checkbox"/>            | <input type="checkbox"/> |
|          |                                              | <input type="checkbox"/>            | <input type="checkbox"/> |
|          |                                              | <input type="checkbox"/>            | <input type="checkbox"/> |
|          |                                              | <input type="checkbox"/>            | <input type="checkbox"/> |

**Basis for aquifer confinement evaluation:** The water-bearing zones accessed by nearby UNIO 52096 (the template for the proposed POA well) exist at elevations hundreds of feet below the resultant static head elevation within the well.

**C2. 690-09-040 (2) (3):** Evaluation of distance to, and hydraulic connection with, surface water sources. All wells located a horizontal distance less than ¼ mile from a surface water source that produce water from an unconfined aquifer shall be assumed to be hydraulically connected to the surface water source. Include in this table any streams located beyond one mile that are evaluated for PSI.

| Well     | SW #     | Surface Water Name   | GW Elev<br>ft msl | SW Elev<br>ft msl | Distance<br>(ft) | Hydraulically Connected?            |                          |                          | Potential for Subst. Interfer. Assumed? |                                     |
|----------|----------|----------------------|-------------------|-------------------|------------------|-------------------------------------|--------------------------|--------------------------|-----------------------------------------|-------------------------------------|
|          |          |                      |                   |                   |                  | YES                                 | NO                       | ASSUMED                  | YES                                     | NO                                  |
| <b>1</b> | <b>1</b> | <b>Jordan Creek</b>  | <b>4060*</b>      | <b>3695-3889</b>  | <b>4335</b>      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>                | <input checked="" type="checkbox"/> |
| <b>1</b> | <b>2</b> | <b>Whiskey Creek</b> | <b>4060*</b>      | <b>3742-4150</b>  | <b>2300</b>      | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>                | <input checked="" type="checkbox"/> |

**Basis for aquifer hydraulic connection evaluation:** Jordan Creek has incised to the elevation of water-bearing zones within UNIO 52096 and the proposed POA well (see attached cross-section). Due to this incision, it is likely that efficient communication exists between local groundwater in the proposed aquifer and surface water in the channel of Jordan Creek through exposure of the permeable interflow zones to be accessed by the proposed POA well. Whiskey Creek, within 1 mile, also reaches the elevation of interflow zones within the well, and is therefore likely to have an efficient connection to the productive aquifer.

**Water Availability Basin the well(s) are located within:** Whisqr Cr > Grande Ronde R – At Mouth (ID# 30810411)

**C3a. 690-09-040 (4):** Evaluation of stream impacts for each well that has been determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. Limit evaluation to instream rights and minimum stream flows that are pertinent to that surface water source, and not lower SW sources to which the stream under evaluation is tributary. Compare the requested rate against the 1% of 80% *natural* flow for the pertinent Water Availability Basin (WAB). If Q is not distributed by well, use full rate for each well. Any checked ☒ box indicates the well is assumed to have the potential to cause PSI.

| Well     | SW #     | Well < ¼ mile?           | Qw > 5 cfs?              | Instream Water Right ID | Instream Water Right Q (cfs) | Qw > 1% ISWR?            | 80% Natural Flow (cfs) | Qw > 1% of 80% Natural Flow?        | Interference @ 30 days (%) | Potential for Subst. Interfer. Assumed? |
|----------|----------|--------------------------|--------------------------|-------------------------|------------------------------|--------------------------|------------------------|-------------------------------------|----------------------------|-----------------------------------------|
| <b>1</b> | <b>1</b> | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> | <b>0.47</b>            | <input checked="" type="checkbox"/> | <b>&gt;25 %</b>            | <input checked="" type="checkbox"/>     |
| <b>1</b> | <b>2</b> | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> | <b>0.47</b>            | <input checked="" type="checkbox"/> | <b>&gt;25 %</b>            | <input checked="" type="checkbox"/>     |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |
|          |          | <input type="checkbox"/> | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>            |                            | <input type="checkbox"/>                |

C3b. **690-09-040 (4):** Evaluation of stream impacts by total appropriation for all wells determined or assumed to be **hydraulically connected and less than 1 mile** from a surface water source. **Complete only if Q is distributed among wells.** Otherwise same evaluation and limitations apply as in C3a above.

|  | SW # |  | Qw > 5 cfs?              | Instream Water Right ID | Instream Water Right Q (cfs) | Qw > 1% ISWR?            | 80% Natural Flow (cfs) | Qw > 1% of 80% Natural Flow? | Interference @ 30 days (%) | Potential for Subst. Interfer. Assumed? |
|--|------|--|--------------------------|-------------------------|------------------------------|--------------------------|------------------------|------------------------------|----------------------------|-----------------------------------------|
|  |      |  | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>     |                            | <input type="checkbox"/>                |
|  |      |  | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>     |                            | <input type="checkbox"/>                |
|  |      |  | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>     |                            | <input type="checkbox"/>                |
|  |      |  | <input type="checkbox"/> |                         |                              | <input type="checkbox"/> |                        | <input type="checkbox"/>     |                            | <input type="checkbox"/>                |

**Comments:** Hydraulic connection facilitated by incision of the productive interflow zones in CRBG aquifers results in rapid response to perturbations in these aquifer systems due to their confined nature and low storativity. There does not exist an appropriate analytical model to accurately predict stream depletion in this scenario, but our conceptual model suggests that stream depletion experienced in nearby Jordan and Whiskey Creeks are expected to be substantially greater than 25% of the proposed pumping rate after 30 days.

C4a. **690-09-040 (5):** Estimated impacts on **hydraulically connected surface water sources greater than one mile** as a percentage of the proposed pumping rate. Limit evaluation to the effects that will occur up to one year after pumping begins. This table encompasses the considerations required by 09-040 (5)(a), (b), (c) and (d), which are not included on this form. Use additional sheets if calculated flows from more than one WAB are required.

| Non-Distributed Wells |     |     |     |     |     |     |     |     |     |     |     |     |     |
|-----------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Well                  | SW# | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Distributed Wells     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Well                  | SW# | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
|                       |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |
| Well Q as CFS         |     |     |     |     |     |     |     |     |     |     |     |     |     |
| Interference CFS      |     |     |     |     |     |     |     |     |     |     |     |     |     |
| (A) = Total Interf.   |     |     |     |     |     |     |     |     |     |     |     |     |     |
| (B) = 80 % Nat. Q     |     |     |     |     |     |     |     |     |     |     |     |     |     |
| (C) = 1 % Nat. Q      |     |     |     |     |     |     |     |     |     |     |     |     |     |
| (D) = (A) > (C)       |     |     |     |     |     |     |     |     |     |     |     |     |     |
| (E) = (A / B) x 100   |     | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   | %   |

(A) = total interference as CFS; (B) = WAB calculated natural flow at 80% exceed. as CFS; (C) = 1% of calculated natural flow at 80% exceed. as CFS; (D) = highlight the checkmark for each month where (A) is greater than (C); (E) = total interference divided by 80% flow as percentage.

**Basis for impact evaluation:**

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C4b. **690-09-040 (5) (b)** The potential to impair or detrimentally affect the public interest is to be determined by the Water Rights Section.

- C5. ☐ **If properly conditioned**, the surface water source(s) can be adequately protected from interference, and/or groundwater use under this permit can be regulated if it is found to substantially interfere with surface water:
- i. ☐ The permit should contain condition #(s) \_\_\_\_\_;
  - ii. ☐ The permit should contain special condition(s) as indicated in "Remarks" below;

**C6. SW / GW Remarks and Conditions:**

The applicant's proposed well will produce from one or more water-bearing zones in the Columbia River Basalt Group (CRBG), a series of lava flows with a composite thickness up to 1,000 feet in this area (Burns et al., 2010). Each flow is characterized by a series of internal features, including a thin rubble zone at the contact between flows and a thick, dense, low porosity and low permeability interior zone. In some cases, sedimentary layers were deposited during the time between basalt flow emplacements. A flow top, sedimentary interbed and flow bottom are collectively referred to as an interflow zone. Unconfined groundwater occurs near the weathered top of the basalts, but most water occurs in interflow zones at the contacts between lava flows. CRBG flow features result in a series of stacked, thin aquifers that are confined by dense flow interiors. The low permeability of the basalt flow interiors usually results in little connection between stacked aquifers, which generally results in tabular aquifers with unique water level heads (Reidel et al., 2002).

Despite the low vertical permeability in typical CRBG systems, horizontal permeability can be quite high within the interflow horizons. In the case of the applicant's POA well, the incision of these interflow zones by local drainages provides a conduit through which groundwater discharges to surface water streams. Due to confinement and lack of significant barriers to horizontal groundwater flow, once pumping begins within a well producing groundwater from a CRBG interflow zone, the cone of depression spreads quickly producing a rapid response in surface waters and neighboring wells hydraulically connected to the pumping well.

The applicant's proposed well construction appears to target production from the same interflow zone as nearby well UNIO 52096, which has triggered PSI for the proposed use. Given that the thickness of CRBG deposits here is predicted to be roughly 1,000 feet (Burns, et al., 2010), it is likely that additional productive interflow zones exist at depths greater than 545', which are unlikely to be hydraulically connected to nearby surface waters.

If a permit is issued, the following special conditions shall apply:

1. Upon drilling the proposed POA well, whenever possible drill cuttings shall be collected at 10 foot intervals and at changes in lithology, with a labeled split of each sampled interval provided to the Department.

2. Each well shall be open to a single aquifer in the Columbia River Basalt Group and shall meet applicable well construction standards (OAR 690-200 and OAR 690-210). In addition, the open interval in each well shall be no greater than 50 feet. However, a larger open interval may be approved by the Department if the applicant can demonstrate to the satisfaction of the Department that each well is only open to a single aquifer. Following well completion, the wells shall be thoroughly developed to remove cuttings and drilling fluids. Substantial evidence of a single aquifer completion may be collected by video log, downhole flowmeter, water chemistry and temperature, or other downhole geophysical methods approved by the Department. These methods shall characterize the nature of the basalt rock and assess whether water is moving in the borehole. Any discernable movement of water within the well bore when the well is not being pumped shall be assumed as evidence of the presence of multiple aquifers in the open interval.

3. The POA well shall be continuously cased and continuously sealed at least 5 feet into the confining flow interior overlying the water-bearing zone accessed by the well to prevent commingling with shallower aquifers and hydraulic connection to local surface waters.

**References Used:**

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Burns, E.R., Morgan, D.S., Peavler, R.S., and Kahle, S.C., 2011, Three-dimensional model of the geologic framework for the Columbia Plateau Regional Aquifer System, Idaho, Oregon, and Washington: U.S. Geological Survey Scientific Investigations Report 2010-5246, 44 p.

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Reidel, S.P., Johnson, V.G., and Spane, F.A., 2002, Natural gas storage in basalt aquifers of the Columbia Basin, Pacific Northwest USA—A guide to site characterization: Richland, Wash., Pacific Northwest National Laboratory, 277 p.

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Application file G-18761, OWRD well log database, Application review for G-17183.

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**D. WELL CONSTRUCTION, OAR 690-200**

D1. Well #: \_\_\_\_\_ Logid: \_\_\_\_\_

D2. **THE WELL does not appear to meet current well construction standards based upon:**

- a. ☐ review of the well log;  
 b. ☐ field inspection by \_\_\_\_\_;  
 c. ☐ report of CWRE \_\_\_\_\_;  
 d. ☐ other: (specify) \_\_\_\_\_

D3. **THE WELL construction deficiency or other comment is described as follows:** \_\_\_\_\_D4. ☐ **Route to the Well Construction and Compliance Section for a review of existing well construction.****Water Availability Tables**

| DETAILED REPORT ON THE WATER AVAILABILITY CALCULATION                                  |                           |                                        |                            |                            |                          |                           |
|----------------------------------------------------------------------------------------|---------------------------|----------------------------------------|----------------------------|----------------------------|--------------------------|---------------------------|
| Watershed ID #: 30810411                                                               |                           | WHISKEY CR > GRANDE RONDE R - AT MOUTH |                            |                            | Exceedance Level: 80     |                           |
| Time: 10:27 AM                                                                         |                           | Basin: GRANDE RONDE                    |                            |                            | Date: 12/18/2018         |                           |
| Month                                                                                  | Natural<br>Stream<br>Flow | Consumptive<br>Use and<br>Storage      | Expected<br>Stream<br>Flow | Reserved<br>Stream<br>Flow | Instream<br>Requirements | Net<br>water<br>Available |
| Monthly values are in cfs.<br>Storage is the annual amount at 50% exceedance in ac-ft. |                           |                                        |                            |                            |                          |                           |
| JAN                                                                                    | 1.32                      | 0.01                                   | 1.31                       | 0.00                       | 0.00                     | 1.31                      |
| FEB                                                                                    | 1.48                      | 0.02                                   | 1.46                       | 0.00                       | 0.00                     | 1.46                      |
| MAR                                                                                    | 3.26                      | 0.03                                   | 3.23                       | 0.00                       | 0.00                     | 3.23                      |
| APR                                                                                    | 9.92                      | 0.17                                   | 9.75                       | 0.00                       | 0.00                     | 9.75                      |
| MAY                                                                                    | 9.09                      | 0.69                                   | 8.40                       | 0.00                       | 0.00                     | 8.40                      |
| JUN                                                                                    | 3.51                      | 0.80                                   | 2.71                       | 0.00                       | 0.00                     | 2.71                      |
| JUL                                                                                    | 1.04                      | 0.36                                   | 0.68                       | 0.00                       | 0.00                     | 0.68                      |
| AUG                                                                                    | 0.51                      | 0.10                                   | 0.41                       | 0.00                       | 0.00                     | 0.41                      |
| SEP                                                                                    | 0.47                      | 0.05                                   | 0.42                       | 0.00                       | 0.00                     | 0.42                      |
| OCT                                                                                    | 0.52                      | 0.00                                   | 0.52                       | 0.00                       | 0.00                     | 0.52                      |
| NOV                                                                                    | 0.70                      | 0.00                                   | 0.70                       | 0.00                       | 0.00                     | 0.70                      |
| DEC                                                                                    | 1.01                      | 0.01                                   | 1.00                       | 0.00                       | 0.00                     | 1.00                      |
| ANN                                                                                    | 3,330                     | 135                                    | 3,190                      | 0                          | 0                        | 3,190                     |

## Well Location Map



