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September 22, 2015

City of Laramie
City Manager's Office
P.O. Box C
Laramie, Wyoming 82073

Attn.: Mr. Darren Parkin
Water Resources Manager

Re: Site Specific Investigation
Soldier Springs Wellfield
Technical Review

Dear Mr. Parkin:

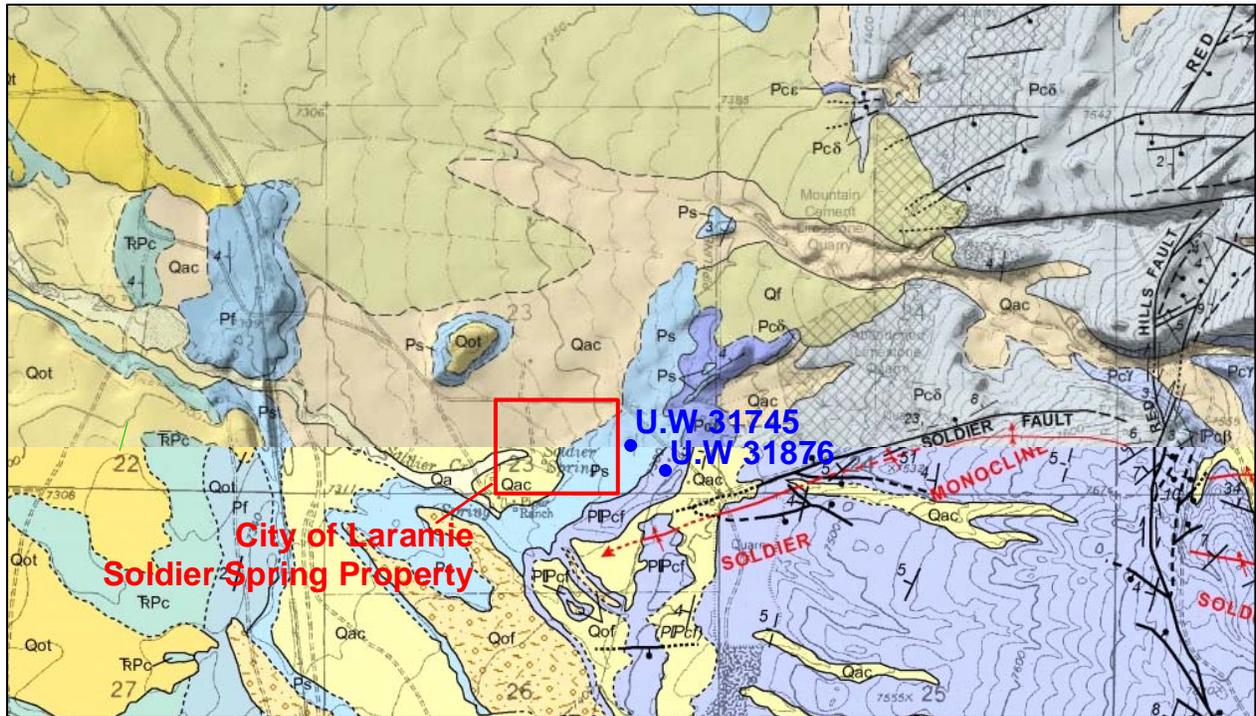
This letter serves to present the findings of our technical review of the site specific investigation prepared by Trihydro Corporation (Trihydro) for the City of Laramie for the City owned Soldier Springs Wellfield parcel of land located within the Casper Aquifer Protection Area. Our review comments will be presented to address the adequacy of this site specific investigation in fulfilling the requirements of the City of Laramie's Unified Development Code, subsection 15.08.040.A.8.

15.08.040.A.8(d)(i) A literature search to determine the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the subject property.

Trihydro's literature search to address the presence of mapped faults, folds, fractures, and other evidence of conduit flow on the site of the proposed subdivision is adequate. Trihydro identified two mapped vulnerable features; the Soldier fault and Soldier monocline. The SSI further points out the evidence for conduit flow by the presence of Soldier Spring as a result of the fracturing in the Casper and overlying Satanka Formations by these two structural features.

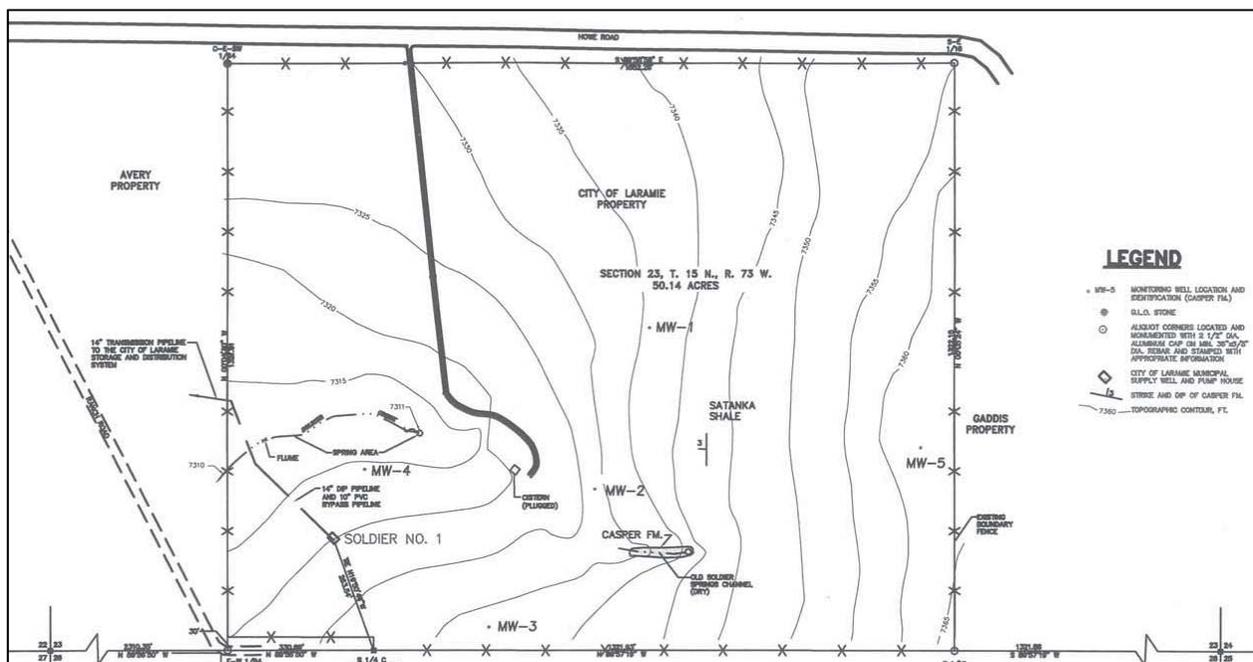
It should be noted that Figure 1 of the SSI report is incomplete. This map has been constructed by Trihydro utilizing the geologic maps prepared by Alan J. Ver Ploeg as the background (Ver Ploeg, Alan J., 2009, Revised Geologic Map of the Laramie Quadrangle, Albany County, Wyoming, Wyoming State Geological Survey, Map Series 50; and Ver Ploeg, Alan J., 2007, Geologic Map of the Red Buttes Quadrangle, Albany County, Wyoming, Wyoming State Geological Survey, Map Series 76). However, the location of the extension of the Soldier Fault and Soldier monocline from Section 23 into Section 26, of Township 15 North, Range 73 West, as portrayed on the Ver Ploeg maps, was not shown in Trihydro's Figure 1. A copy of a portion of Ver Ploeg's two maps with the City of Laramie Soldier Springs acreage called out is shown on the following page. This figure shows the extension of the Soldier Fault and Soldier monocline and their relationship to the subject property.

One item that was researched and discussed in later sections of Trihydro's SSI, but not listed in this section of their report, were the State Engineer's Office completion records for the 26 wells in the subject property area. A review of the statement of completion records for these wells reveals that "lost circulation" was encountered in two of these wells – the BK #1 well (U.W. 31745) and the Lane #1 well (U.W. 31876). Lost circulation is typically an indication of very permeable zones which in this area would be primarily from fractures and voids. The locations of these two wells are shown in the figure on the following page.



15.08.040.A.8(d)(ii) A site narrative that includes historical information on previous land use, contaminant releases, abandoned wells, underground storage tanks, and septic systems as well as any other information relevant to the site.

As described in Trihydro's SSI report, the City's property is presently undeveloped with the exception of the Soldier No. 1 well house, five monitoring wells, the 14-inch ductile iron pipe transmission pipeline, the concrete flume on the Soldier Spring channel and the old plugged and abandoned concrete cistern. A detailed map of the Soldier Spring wellfield area from the Laramie Water Management Plan, Level II Report (WWC, 2006) is shown below.



A review of the WDEQ Solid and Hazardous Waste Division's website and EPA's Enviromapper databases shows that there have been no recorded contaminant releases and we concur that there is no evidence of any contaminant releases on the project site.

Our review of the Wyoming State Engineer's Office (SEO) E-Permit website indicates that there have been no wells permitted with the SEO in the south half of Section 23 and the north half of Section 26 of Township 15 North, Range 73 West since Trihydro prepared the SSI. Therefore, based on the data presented in the SSI report and as discussed in the site investigation narrative, Trihydro has confirmed that other than the production well Soldier No. 1 well (U.W. 105576) and the five monitoring wells (U.W. 92936 and U.W. 99770 – 99773) there are no other wells on the project site.

With the data presented, and from their narrative with respect to their contaminant release and well research, Trihydro has met the requirements of this section.

15.08.040.A.8(d)(iii) A site plan showing the proposed use and zoning of the property including existing and proposed ground contours accurate to a two-foot interval as referenced to the USGS contour map for the area or other specified elevation standard as required by the city, and for a distance of at least five hundred feet beyond any proposed development activity, existing and proposed structures, parking areas, driveways, landscaping areas, setbacks, surface and subsurface drainage facilities, potential contaminant storage locations and methods of storage, above ground storage tanks, best management practices, utilities, roads, stormwater management, and a vicinity map. Where necessary, specific construction details shall be provided to assure adequacy to accepted design standards.

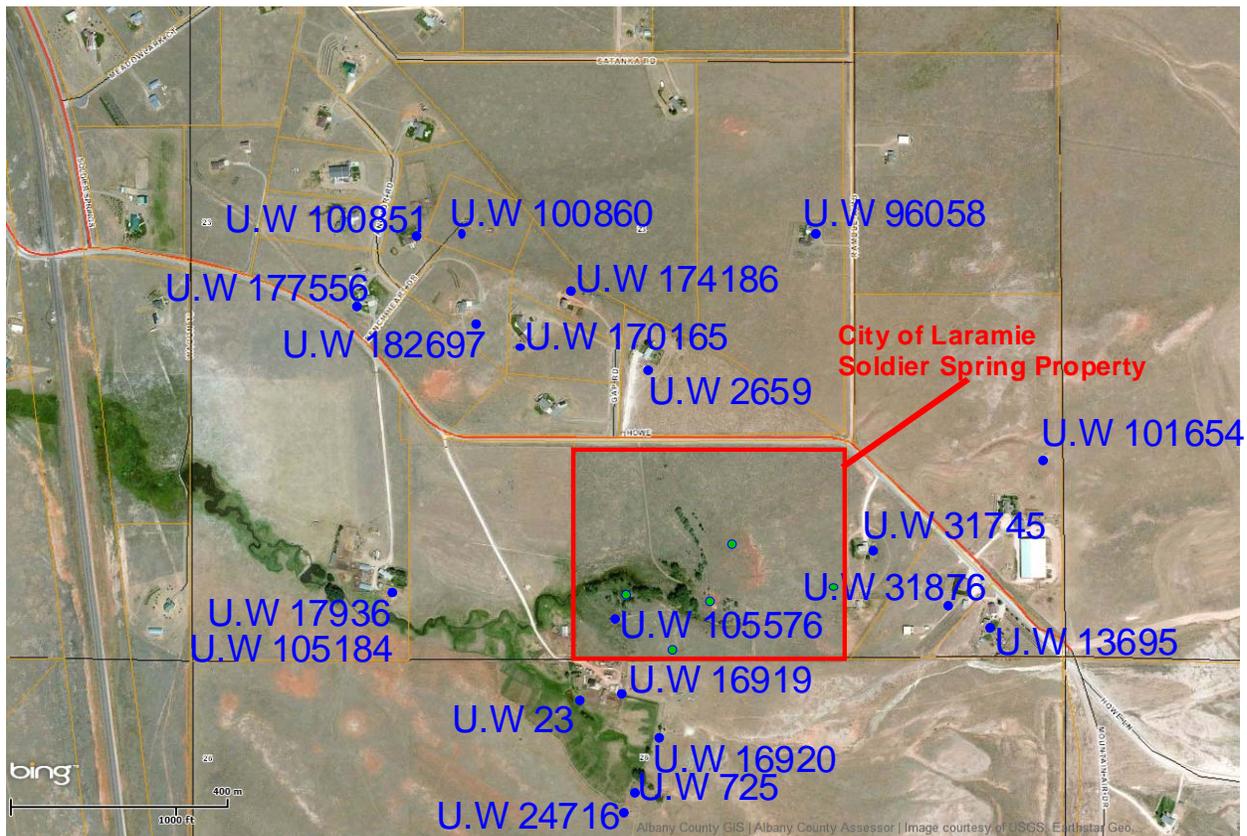
The SSI prepared by Trihydro indicates that the only planned improvements for the Soldier Springs Wellfield property is to construct a chain link security fence around the immediate wellfield facilities. The two fencing options were shown on figure 2 in the Trihydro SSI report. This figure serves as the site plan to satisfy the requirements of the City of Laramie's Unified Development Code, subsection 15.08.040.A.8. The ground contour information specified was not presented, and based on the proposed improvements is not essential information. The SSI report did present a surface geology map that has the Laramie USGS 7.5 Minute topographic map as a background (Figure 1). However, the scale of this map did not accurately reflect the topography (scale of map was too large to show adequate number of contours and the contour labeling). Contour information for the wellfield is available from the Laramie Water Management Plan, Level II Report (WWC, 2006), as shown on the bottom figure of page 2 of this letter report. The contour interval for this figure is 5 feet.

In general we agree with the concept presented in the SSI report that the information provided is adequate to demonstrate the proposed development plans for this parcel of land. However, we feel it would be beneficial to the City to include some of the requested information such as a topographic map, a discussion of the existing land use practices in the area and some general discussion with respect to development constraints or issues associated with this parcel of land due to its proximity to the vulnerable features identified in paragraph 15.08.040.A.8(d)(i).

15.08.040.A.8(d)(iv) Identification of potential contaminants and amounts stored, generated or handled on the subject property.

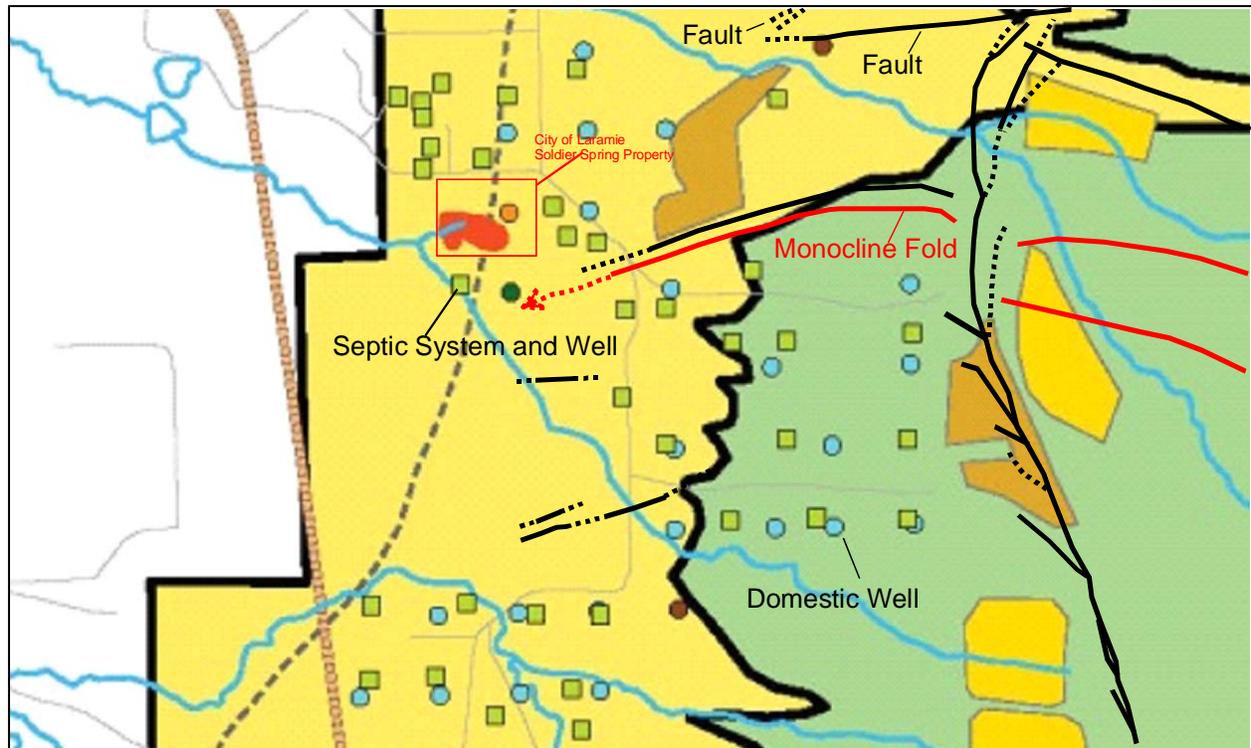
As identified in the SSI, the City of Laramie presently has no plans to develop the property with the possible exception of constructing the security fence. As such, Trihydro has identified that no contaminants are stored or will be stored on the property and have identified the potential contaminant sources that will be required on a temporary basis during the construction of the construction of the proposed security fence.

Trihydro in their SSI report further identifies, as potential contaminant sources, the domestic wastewater systems associated with the homes within a half mile area of Soldier Springs. In addition to the wastewater systems, domestic wells can also be a potential source of contamination to the aquifer. The figure below identifies the location of the domestic wells within the immediate area of the Soldier Springs wellfield. Most of these wells are less than twenty (20) years old and should have been properly constructed with an adequate surface seal of neat cement grout and/or bentonite. However, five of these wells are over 50 years old and may also be a potential source of contamination depending upon their current use, their condition and the condition of the area around them (enclosed area, corral, shop area, etc.).



The figure on the following page is a portion of Figure 4-2a from the Casper Aquifer Protection Plan (Wittman, 2008) which shows the locations of the wells and septic systems in the area of Soldier Springs Property. The Casper Aquifer Protection Plan identifies twenty (20) septic systems that are cross-gradient or up-gradient from Soldier Springs. Superimposed upon this figure are the geologic structures (faults and monocline folds) in the area from the Ver Ploeg mapping (2007 and 2009). This figure shows that most of these septic systems and wells are

located in an area that has not been structurally disturbed which will minimize the potential for conduit flow and the rapid movement of potential contaminants through the aquifer.



15.08.040.A.8(d)(v) A field inspection shall be conducted to verify the presence or absence of vulnerable features as defined in subsection 15.08.040.A.7.a A summary of the field inspection shall include a written report, maps identifying the vulnerable features, and the distance and direction of the nearest well and vulnerable feature. Where subsurface wastewater disposal is proposed, the investigator shall conduct deep pit soil analysis to a depth at least five feet below the proposed bottom of the leaching system to establish that there are no obstructions such as bedrock, water table or other forms of refusal that could interfere with the proper functioning of the wastewater disposal system.

The requirements of this section were met by the Trihydro SSI. A field inspection was conducted on May 15, 2015 and the wells on the property were identified in the text and in Figures 1 and 2 of the report. These figures provide the requested distance and direction information of the wells. Other wells in the immediate area of the City's Soldier Springs Property were not identified. These wells have been shown in this technical review document on the previous page and are tabulated in Table 1 on the following page.

One error noted in the Trihydro SSI report was the reference to a drainage that "flows from the northern boundary of the property and exits the property to the southeast." This verbiage appears to be from the Upland Heights Block 2 Lot 1 SSI Report and did not get edited out of the Soldier Springs Wellfield SSI report. This clerical error has no bearing on the validity or findings of this SSI report.

TABLE 1
LIST OF SEO WELLS IN SOLDIER SPRINGS WELLFIELD AREA

	WR Number	Priority Date	First Name	Last Name	Facility Name	Uses	Tw	Rng	Sec	Qtr-Qtr	Appropriation (GPM)	Total depth (Ft)	SWL (Ft)
1	P101654.OW	02/28/1996	KEVIN	NELSON	NELSON 1	DOM_GW	015N	073W	23	NE1/4SE1/4	13	200.00	63
2	P170165.OW	10/05/2005			DOYLE #1	DOM_GW	015N	073W	23	NE1/4SW1/4	13	200.00	40
3	P174186.OW	04/18/2006			WEIBEL - 7	DOM_GW; STK	015N	073W	23	NE1/4SW1/4	15	160.00	25
4	P182697.OW	08/07/2007			ASAY #2	DOM_GW	015N	073W	23	NE1/4SW1/4	10	200.00	42
5	P2659.OW	07/14/1969			PRATT #1	DOM_GW	015N	073W	23	NW1/4SE1/4	10.5	60.00	20
6	P96058.OW	07/08/1994	ROBERT AND CAROLYN	HELLING	HELLING #1	DOM_GW; STK	015N	073W	23	NW1/4SE1/4	20	200.00	35
7	P100851.OW	10/05/1995	DAVID/WENDY	PRATT	BENCH HEART #1	DOM_GW; STK	015N	073W	23	NW1/4SW1/4	13	210.00	-4
8	P100860.OW	11/07/1995	SHANE/LOREE	COX	BENCH HEART #2	DOM_GW	015N	073W	23	NW1/4SW1/4	15	215.00	8
9	P177556.OW	10/16/2006			ASAY #1	DOM_GW	015N	073W	23	NW1/4SW1/4	10	150.00	15
10	P13695.OW	04/24/1972	ALFRED D. & CHERYLNN	LEGAULT	LEGAULT #1	DOM_GW	015N	073W	23	SE1/4SE1/4	17.5	140.50	64
11	P31745.OW	01/05/1976	JOANNE LESLIE	MORGAN	BK #1	DOM_GW	015N	073W	23	SE1/4SE1/4	12	100.00	54
12	P31876.OW	01/29/1976	CHARLES D. & NANCY K.	LANE	LANE #1	DOM_GW	015N	073W	23	SE1/4SE1/4	20	100.00	40
13	P105576.OW	02/27/1997	CITY OF	LARAMIE	SOLDIER #1	MIS	015N	073W	23	SE1/4SW1/4	1800	289.00	2
14	P92936.OW	09/27/1993	CITY OF	LARAMIE	SOLDIER MW #1	MON	015N	073W	23	SW1/4SE1/4	0	130.00	16.35
15	P99770.OW	07/17/1995	CITY OF	LARAMIE	SOLDIER MW-2	MON	015N	073W	23	SW1/4SE1/4	0	70.00	10.5
16	P99771.OW	07/17/1995	CITY OF	LARAMIE	SOLDIER MW-3	MON	015N	073W	23	SW1/4SE1/4	0	85.00	13.8
17	P99772.OW	07/17/1995	CITY OF	LARAMIE	SOLDIER MW-4	MON	015N	073W	23	SW1/4SE1/4	0	100.00	1.6
18	P99773.OW	07/17/1995	CITY OF	LARAMIE	SOLDIER MW-5	MON	015N	073W	23	SW1/4SE1/4	0	100.00	44.3
19	P105184.OW	03/14/1997	TY	BATTERSHELL	BATT #2	DOM_GW; STK	015N	073W	23	SW1/4SW1/4	25	200.00	-4
20	P17936.OP	12/31/1938			DESPAIN #3	DOM_GW; STK	015N	073W	23	SW1/4SW1/4	25	200.00	-4
21	P16919.OP	05/15/1940	CINDY	AVERY	PIPER #3	DOM_GW; STK	015N	073W	26	NE1/4NW1/4	20	50.00	-1
22	P23.OG	04/20/1948	CINDY	AVERY	PIPER #1 WELL	IRR_GW; STK	015N	073W	26	NE1/4NW1/4	123	50.00	-6
23	P24716.OW	10/15/1973	CINDY	AVERY	PIPER #7	DOM_GW	015N	073W	26	NE1/4NW1/4	14	66.00	-4
24	P16920.OP	07/01/1944	CINDY	AVERY	PIPER #4	DOM_GW; STK	015N	073W	26	NW1/4NE1/4	30	60.00	15
25	P725.OG	12/10/1957	CINDY	AVERY	PIPER #2	IRR_GW	015N	073W	26	NW1/4NE1/4	400	149.00	11

Since the property is presently not secured with a security fence, a discussion with respect to the vulnerability of the wells would be beneficial (i.e. are the monitoring wells adequately secured from malicious intrusion/contamination)?

Onsite wastewater systems are not proposed for future development of the property. Therefore, a deep pit soil analysis for this SSI was not required and was not conducted.

15.08.040.A.8(d)(vi) A map showing the area and types of exposed bedrock, marshes, perennial drainages, intermittent drainages, ephemeral drainages, creeks, and other bodies of water on the subject property.

The report maps and report narrative meet the requirements of this section. Labeling of the drainage on the figures is recommended.

15.08.040.A.8(d)(vii) Where the 100-year flood plain mapping is unavailable, the professional geologist and/or engineer will calculate the 100-year flood plain for the drainage. The flood plain mapping will be provided on a site map with a scale not to exceed 1 inch equals 200 feet.

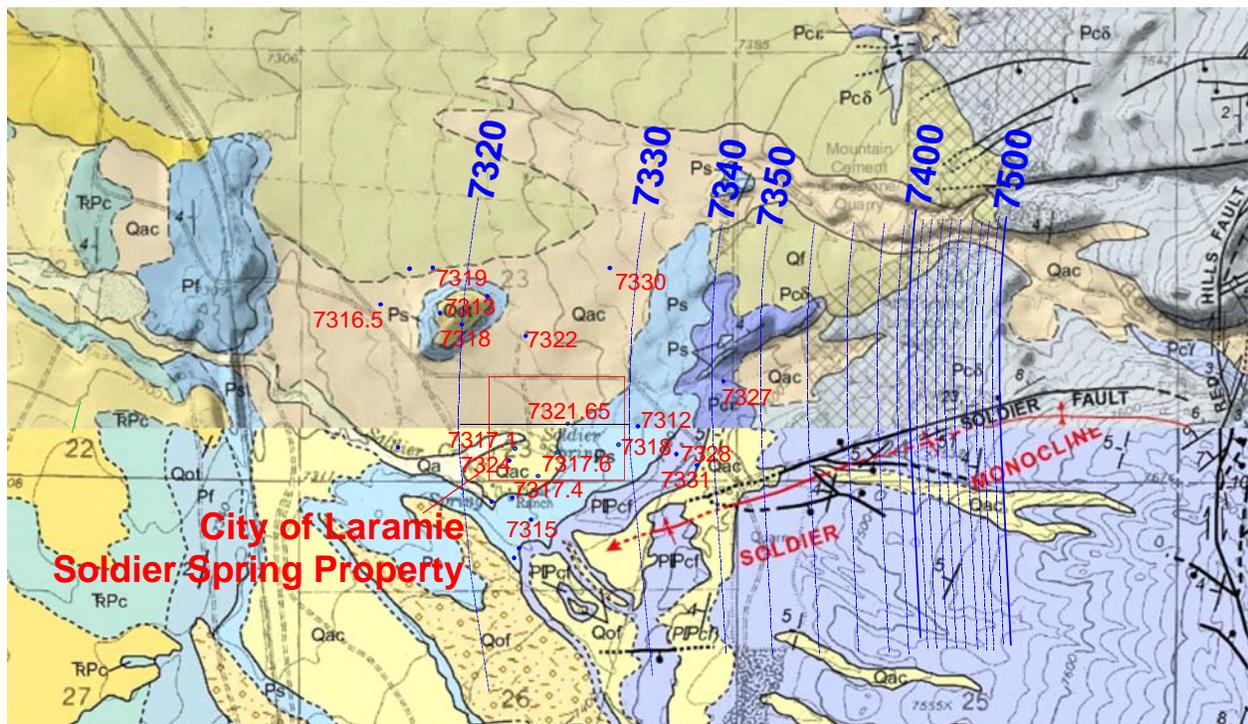
The report narrative satisfies the requirements of this section. Wester-Wetstein agrees with Trihydro's conclusion that the proposed development (chain link security) fence will not be significantly impacted by a 100-year flood event and we agree with their recommendation that if additional development should be proposed in the future that the floodplain calculations should be conducted at that time.

15.08.040.A.8(d)(viii) An evaluation of the water supply and sewage system that includes the potential effects or risks of the systems to the Casper Aquifer and its recharge area and the adequacy and safety of the systems. Items such as floor drains and plumbing schematics and the locations of potential contaminants, waste storage, and liquid transfer area locations shall be provided.

The SSI prepared by Trihydro does not address this section as they state: "Future development at the property will not require a water supply or sewage system. Therefore, an evaluation of potential risks associated with these facilities is not needed." Because of the critical nature of the water supply and its vulnerability, it is strongly recommended that no future development involving the installation of an on-lot septic system be proposed for this acreage.

15.08.040.A.8(d)(ix) A map(s) depicting the potentiometric surface of the Casper Aquifer at the subject property using data from historical water level measurements and published potentiometric surface maps. No new wells shall be drilled for the purpose of determining the potentiometric surface.

Trihydro's SSI has attempted to satisfy this requirement, however, the potentiometric contours for the Casper Aquifer that were superimposed upon the surface geologic map (Figure 1) are located nearly $\frac{3}{4}$ of a mile to the east of the subject property. The potentiometric surface elevation at the Soldier Springs Wellfield property was never identified in the SSI Report. Using the potentiometric surface contours from Trihydro's SSI, which were based upon data from the Laramie Water Management Study, Level II, and depth to water data from the SEO Statement of Completions for the wells in the area, a potentiometric surface map of the Casper Aquifer was constructed and shown in the figure below. The potentiometric contours indicate that groundwater in the Casper Aquifer beneath the wellfield property is moving in a westerly direction under a gradient of approximately 10 feet per 2,000 feet. The potentiometric surface elevation of the Casper Aquifer at Soldier Springs Well No. 1 is approximately 7,324 feet.



15.08.040.A.8(d)(x) A surface water risk assessment and mitigation plan for any impacts caused by storm water runoff, retention and/or detention basins on the city water supply and the Casper Aquifer.

Wester-Wetstein agrees with Trihydro's evaluation that the risk of impacts to the Casper Aquifer from storm water runoff is very minimal.

15.08.040.A.8(d)(xi) A maintenance plan and agreement for any retention and/or detention basins and associated improvements will be required. Such plan and agreements shall be recorded in the Albany County Clerk's Office.

As stated by Trihydro, a maintenance plan and agreement will probably not be needed since it is not anticipated that retention, detention or other stormwater management facilities will be constructed on this site.

15.08.040.A.8(d)(xii) A groundwater risk assessment and mitigation plan to respond to any evidence of contamination or vulnerability which is the result of the development. Such plan shall not limit the liability of any Person for impacts to the Casper Aquifer.

Wester-Wetstein agrees with the conclusion provided by Trihydro that the risk of contamination to the Casper Aquifer from the present use of the Soldier Springs Wellfield parcel and the proposed construction of a security fence is low. Additionally, due to the vulnerable nature of the wellfield area (thin Satanka cover and fractured zone) it is very unlikely and strongly recommended that no additional development of the acreage that could potentially impact the aquifer be allowed.

Although this SSI was written to address the impact to the Casper Aquifer from the present and proposed use of the wellfield property, there are some actions that the City of Laramie may entertain to help them monitor and potentially limit the impacts to the Casper Aquifer from the surrounding area. These suggestions are listed below.

1. Review the wells and septic systems in the area where conduit flow between these systems and the Soldier Springs wellfield is very likely. A review of the figure on page 5 of this SSI Review letter indicates that there may be as many as 6 septic systems and several wells that are in potential conduit flow areas.
2. Develop a relationship with the landowners of these septic systems and wells. Research the design, age and condition of the facilities.
3. Ask if the City personnel would be allowed access to the property to observe and record the condition of the septic system and well (i.e. conditions around well, status of well seal/cap, etc.). Obtain permission from the landowner to visit the site annually to witness and record any changes to the land use around primarily the well and point out any potential impacts to the aquifer that these changes may represent.
4. Discuss with the landowner any recommended changes that would minimize the potential to compromise the aquifer. The City should compensate the landowner for his efforts/costs to implement these recommended changes.

5. Ask the landowner to inform the City of his/her intentions to replace their wastewater system and offer to compensate the landowner to upgrade their system (if possible) to an enhanced system that will lower the nitrate levels in the leachate.

15.08.040.A.8(d)(xiii) Demonstration of compliance with all applicable city standards.

The SSI has adequately addressed and identified the requirements as mandated by this section of the City of Laramie's Unified Development Code.

If you have any questions, please do not hesitate to call.

Respectfully submitted,
Wester-Wetstein & Associates, Inc.



John Wetstein

