



State of Utah

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Department of  
Environmental Quality

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DIVISION OF DRINKING WATER  
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October 8, 2020

Rodger Smith  
Highland Subdivision Water System  
5880 N Highland Drive  
Mountain Green, UT 84050

Subject: **Required to Disinfect and Evaluation of 4-log Virus Inactivation**, Gordon Creek Spring 2 and Gordon Creek Spring 7 (WS002 and WS003), Highland Subdivision; System #15005, File #12204

**This is not an Operating Permit or Plan Approval**

Dear Mr. Smith:

The Division of Drinking Water (the Division) records indicate that you are the responsible party for the Highland Subdivision Water System (the System). The Highland Subdivision Water System is a public water system and thus subject to the Administrative Rules for Public Drinking Water Systems (copy available upon request).

This letter includes the following determinations, which are explained in detail below:

1. The System is required to provide continuous disinfection of the water from Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003).
2. The System must turn out spring box #4 and #5 at Gordon Creek Spring 7 (WS003) until further notice from the Division.
3. The System is required to submit the reports on primary and secondary disinfection monitoring to the Division.
4. Gordon Creek Chlorinator (TP002) is capable of providing a contact time (CT) that meets 4-log virus inactivation.
5. The system must collect monthly total coliform compliance samples from each spring box at Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003) when accessible until further notice from the Division.
6. Lead and Copper monitoring and reporting requirements from the June 15, 2020 Increased Monitoring Letter from the Division.

### **Background**

Our understanding is that the System serves a population of less than 3,300 and has three active sources: Gordon Creek Spring 2 (WS002), Gordon Creek Spring 7 (WS003), and Highlands Well #1 (WS005).

Our records indicate that water from Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003) flow from various spring boxes and are combined into a spring transmission line that feeds through the Gordon Creek Chlorinator (TP002) before entering the 250K gallon Gordon Creek #1 Storage Tank (ST003) and 700K gallon Gordon Creek #2 Storage Tank (ST004). Highlands Well #1 (WS005) only flows to the lower pressure zone of the water system and is not considered in this letter. The System voluntarily installed the Gordon Creek Chlorinator (TP002) in 1996.

This determination is only applicable to the Highlands Subdivision water system's hydraulic operations at the time of this review, as described above. Specifically, that all three of the water systems zones can be supplied by the Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003) and that only the lowest pressure zone can be supplied by the Highlands Well (WS005). Any change in the water flows from the Highlands Well (WS005) to the other pressure zones within the distribution system may necessitate additional disinfection requirements on the System (e.g., system wide primary and/or secondary requirements).

### **Required to Disinfect**

The Division has determined that Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (W003) are low quality ground water sources because they cannot consistently meet the bacteriological drinking water requirements of R309-200-5(6). Therefore, the System must provide continuous disinfection of Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (W003). This determination is based on the following bacteriological samples collected by the System:

1. 5/21/2020 – Total Coliform Positives at WS003: SB-4, SB-5, & SB-7
2. 5/28/2020 – Total Coliform Positives at WS003: SB-4, SB-5, & SB-7
3. 5/28/2020 – *E. coli* Positive at WS003: SB-5
4. 8/28/2020 – Total Coliform Positive at WS002: SB-2
5. 8/28/2020 – Total Coliform Positive at WS003: SB-4
6. 8/28/2020 – Total Coliform Positive at Master Meter Bldg. (WS002 & WS003)
7. 8/28/2020 – *E. coli* Positive at WS003: SB-4
8. 9/4/2020 – Three (3) Total Coliform Positives at WS003: SB-4

### **Turn Out Spring Box #4 and #5 at Gordon Creek Spring 7 (WS003)**

Based on the *E. coli* positive samples collected by the System at WS003 Spring Box #4 and #5 on the dates shown above, the System must turn out flow from the spring boxes until the Division determines whether the spring is under the direct influence of surface water (UDI). See the attached *UDI Definition and Possible Causes* for more information.

### **Disinfection Monitoring and Reporting Requirements**

Highland Subdivision is required to record and report disinfection monitoring data that demonstrate **primary and secondary disinfection requirements are met, by completing the monthly disinfection reports for the Gordon Creek Chlorinator (TP002)** using the template provided by the Division on August 17, 2020 (attached).

**The monthly disinfection reports are submitted quarterly.** The reports are due to the Division by the 10th day following the end of each reporting quarter (i.e., January 10th, April 10th, July 10<sup>th</sup> and October 10th). The reports can be submitted by hardcopy, fax, or email at DDWreports@utah.gov.

### **Primary Disinfection Reporting**

1. The Gordon Creek Chlorinator (TP002) will be operated **continuously** to achieve **primary disinfection** of the water from the Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003), i.e., a minimum of 4-log<sub>10</sub> virus inactivation for groundwater sources. [R309-215-16(1)(a)(iii); R309-520-6(4)(c)]
2. The Gordon Creek Chlorinator (TP002) will provide sufficient disinfection CT and conduct compliance monitoring to demonstrate treatment effectiveness.
  - a. Sufficient disinfection CT will be demonstrated by **monitoring and reporting the actual CT achieved during operation in the monitoring sheet the Division provided to Highland Subdivision operator on August 17, 2020 (attached)**. The monitoring and reporting will include chlorine residuals measured at the POE to the distribution system and other parameters for calculating CT. [R309-520-6(4); R309-215-16(3)(b)(iii)(A)]
3. **Chlorine Residual – Point of Entry (POE) to Distribution System (EP002)**
  - a. The POE sampling location for the Gordon Creek Chlorinator (TP002) is **the sample tap located in the first PRV station downstream of the chlorinator**. This POE sampling location is identified as **EP002** in the Division's database.
  - b. Maintain a minimum of 0.2 mg/L residual (measured as free chlorine) at the POE sampling location. [R309-215-16(3)(b)(iii)(A)(I) and (II)]
  - c. The chlorine residual concentration measured at the POE sampling location shall not exceed the maximum residual disinfectant level (MRDL) of 4.0 mg/L (measured as free chlorine). [R309-200-5(3)(c)(iv)]
  - d. Record and report the lowest daily chlorine residual concentration, measured as free chlorine, at the Gordon Creek Chlorinator (TP002) POE sampling location (EP002) a minimum of 3 days a week. [R309-210- 8(3)(a)(ii)]
    - i. Our records show that your water system serves 1,200 people. Please be aware that R309-215-16(3)(b)(iii)(A)(II) requires water systems serving 3,300 people or fewer to monitor the POE chlorine residuals and take daily grab sample(s). Alternatively, instead of taking daily grab samples, a groundwater system serving 3,300 or fewer people may choose to use an online analyzer to continuously monitor the POE chlorine residuals entering the distribution system.

### **Secondary Disinfection Reporting**

1. **Chlorine Residual – Distribution System (DS001)**
  - a. Maintain a detectable residual throughout the distribution system. It is recommended to maintain the chlorine residual above 0.1 ppm in the distribution system. [R309-520-5]
  - b. The chlorine residual measured in the distribution system shall not exceed the maximum residual disinfectant level (MRDL) of 4.0 mg/L (measured as free chlorine). [R309-200-5(3)(c)(iv)]
  - c. Take a minimum of three (3) chlorine residual samples per week at varying locations throughout the distribution system (DS001). [R309-105-10(1)(c)]
  - d. Take distribution system chlorine residuals in conjunction with total coliform sampling. [R309-215-10(3) and (4)]

### **Evaluation of 4-log Virus Inactivation - Primary Disinfection CT**

The Division has completed a review of Highland Subdivision's information and schematics provided regarding your disinfection facilities. The Division received the information of the worst-case scenario disinfection CT estimated by your consultant, which is described in more detail in the Addendum of this letter. The addendum also includes all the operating parameters and schematics provided to the Division for this review.

**The estimated worst-case scenario disinfection CT before the chlorinated water reaches the point-of-entry to distribution system (POE) is 14.2, which meets the 4-log virus inactivation goal.**

The worst-case scenario is a measure to ensure that disinfection facilities have been adequately designed and are capable of providing sufficient disinfection. A water system must monitor and record the ongoing water parameters to demonstrate actual disinfection achieved to meet disinfection compliance.

Chlorinated water enters 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004) storage tanks before flowing into the distribution system. The two tanks run in parallel as they are hydraulically connected from the chlorinator and to the distribution system. A total volume of 25,000 gallons from both tanks is utilized towards disinfection as a clear well. The Highland Subdivision will set a SCADA alarm to prevent the combine tank storage from ever dropping below a total volume of 25,000 gallons for 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004). A total volume of less than 25,000 gallons between both tanks 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004) will result in insufficient CT and failure in the primary disinfection requirements.

#### **Increased Lead and Copper Monitoring Required**

Based on sample results from 2020, the Highland Subdivision drinking water system has exceeded the Action Level for copper. This, along with the addition of a new source, has triggered the need to continue to conduct additional lead and copper monitoring per Utah Administrative Code R309-210-6. Note that these requirements were included in the June 15, 2020, Increased Monitoring Letter from the Division. The monitoring requirements have not changed, but reporting requirements have been specified. The monitoring and reporting requirements are as follows:

1. **Continue to collect twenty (20) lead and copper samples every six (6) months.**
  - a. The next round of 20 samples must be collected by December 31, 2020. These samples must be marked as routine. The system shall notify customers of sample results according to the requirements set in R309-210-6(7). Sample results must be shared with any customer who has a sample collected from their residence.
  - b. The results of lead and copper tap monitoring must be reported to the division either via electronic submission from the laboratory or via email to Luke Treutel, the Division's Lead and Copper rule Manager, at [ltreutel@utah.gov](mailto:ltreutel@utah.gov). Results must be received by the Division no later than the 10<sup>th</sup> of the month following the end of the monitoring period. The results for the next monitoring period must be received by the Division no later than January 10, 2021.
2. **Monitor water quality parameters at all active sources monthly.**
  - a. The water quality parameters to be monitored are: pH, alkalinity, calcium, conductivity, and temperature. Temperature shall be recorded in the field; pH may be measured in the field.
  - b. Samples shall be collected from each active spring box, as well as from any active well(s). The Division recognizes that access to the springs is hindered in the winter and will accept combined samples at the master meter within the chlorination building as backup when the spring boxes cannot be accessed.

- c. These parameters shall be monitored at least twice monthly at each active spring box during the spring runoff months (April, May, and June). The parameters shall be monitored at least once during all other months.
  - d. The results of Water Quality Parameter monitoring must be emailed to Luke Treutel, the Division's Lead and Copper rule Manager, at [ltreutel@utah.gov](mailto:ltreutel@utah.gov) no later than the 10<sup>th</sup> of the following month.
3. **Monitor water quality parameters at three locations in the Distribution System monthly.**
- a. The water quality parameters to be monitored are: pH, alkalinity, calcium, conductivity, and temperature. Temperature shall be recorded in the field; pH may be measured in the field. The sampling locations should be spread throughout the Distribution System and be designated and approved by the Division prior to sampling. Please contact Luke Treutel at (385) 258-6084 or [ltreutel@utah.gov](mailto:ltreutel@utah.gov) to have these locations approved.
  - b. These parameters shall be monitored at least twice monthly during the spring runoff months (April, May, and June). The parameters shall be monitored at least once during all other months.
  - c. The results of Water Quality Parameter monitoring must be emailed to Luke Treutel, the Division's Lead and Copper rule Manager, at [ltreutel@utah.gov](mailto:ltreutel@utah.gov) no later than the 10<sup>th</sup> of the following month.
4. **Based on the System's history of consumer complaints, the Division requests that for the System to continue to sample for iron and manganese at the spring boxes monthly.**
- a. Please contact Emily Nettle at (385) 515-5271 or [emilyfrary@utah.gov](mailto:emilyfrary@utah.gov) with any questions on these sampling requirements.

#### **Monthly Source Sampling Required**

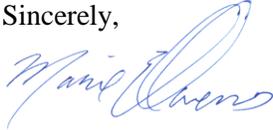
The Highland Subdivision drinking water system has detected total coliform and *E. coli* positive samples between May 2020 and August 2020, according to the Division of Drinking Water's records. This has triggered the need to conduct a source water quality assessment per Utah Administrative Code R309-215-16. The Highland Subdivision water system must comply with additional source monitoring requirements described as following:

1. **Take one bacteriological sample per month from each individual spring box prior to treatment.**
  - a. The purpose of this source sampling requirement is to gather data to evaluate the quality of this source.
2. **Make sure to mark these samples as routine.**
  - a. These samples will be in addition to the monthly distribution samples.
3. **This source sampling requirement shall begin October 2020 and extend at least 18 months for each month the spring is in operation and accessible.**
  - a. The Division recognizes that access to the springs is hindered in the winter and we will accept combined samples at the master meter within the chlorination building as backup when the spring boxes cannot be accessed. Please understand that these combine results will then reflect on all the spring boxes flowing to that sample point. The Division may evaluate the source sampling requirements after 12 months based on the data available at that time.

Rodger Smith  
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If you have any questions regarding this review, please contact Cheryl Parker, of this office, at (385) 271-7039, or Michael Newberry, Engineering Manager, at (385) 515-1464.

Sincerely,



Marie E. Owens, P.E.  
Director

CP/mrn/md/rr/lt/en/sf/nl/as/mdb

Enclosure: Addendum – Information of Estimated Disinfection CT & Summary  
UDI Definition  
Disinfection CT Calculation Sheet  
August 2020 Monthly Reporting Spreadsheet

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DDW-2020-018982

**ADDENDUM**  
**Information of Estimated Disinfection CT**  
Highland Subdivision (UTAH #15005)  
Gordon Creek Chlorinator (TP002)

The Gordon Creek Chlorinator, referenced as TP002 in the Division's database, operates under the following parameters:

- The Gordon Creek Chlorinator (TP002) is designed to provide voluntary primary and secondary disinfection of the water from Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003).
- The Gordon Creek Chlorinator (TP002) is a gas chlorinator.
- The Gordon Creek Chlorinator (TP002) treats water from the Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003).
- The injection point of the chlorine is to the combined spring flow transmission line at chlorinator building.
- The chlorinated water then enters 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004) storage tanks before flowing into the distribution system. The two tanks run in parallel as they are hydraulically connected from the chlorinator and to the distribution system. A total volume of 25,000 gallons from both tanks is utilized towards disinfection as a clear well. The Highland Subdivision will set a SCADA alarm to prevent the combine tank storage from ever dropping below a total volume of 25,000 gallons for 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004). A total volume of less than 25,000 gallons between both tanks 250K gallon Gordon Creek #1 (ST003) and 700K gallon Gordon Creek #2 (ST004) will result in insufficient CT and failure in the primary disinfection requirements.
- The gas chlorine used for disinfection meets the ANSI/NSF 60 standard.
- A design target dose of 1.0 mg/L (measured as free chlorine) is based on a typical peak flow of 429 gallons per minute (gpm) from Gordon Creek Spring 2 (WS002) and Gordon Creek Spring 7 (WS003).
- The chlorine dose is adjusted by a manually adjusted rotometer set for the flow from the combined water meter in the Gordon Creek Chlorinator building.
- The Point of Entry (POE) for the chlorinator is the first PRV station (PRV1-Z3), downstream of the two storage tanks, and is equipped with a sample tap and is before any connections to the treated water distribution line.

A system's pathogen treatment effectiveness is typically expressed in terms of  $\log_{10}$  removal or inactivation. For example, primary disinfection of a groundwater source is demonstrated by meeting a 4- $\log_{10}$  inactivation for virus. The level of inactivation by disinfection is calculated by taking the disinfection residual (Concentration) multiplied by the contact Time, or is referred to in terms of **CT**. For groundwater sources that must have continuous disinfection, a minimum CT of 12 is required for 4-log virus inactivation for water pH ranges between 6 and 9 and a worst-case scenario of water temperature of 0.5°C.

Please note that the Division's review of estimated CT information is limited to the disinfection CT that can be achieved in a **worst-case scenario** based on the current system configuration. The

worst-case scenario disinfection CT estimate does not reflect the actual CT achieved during ongoing operation. The water system is required to monitor and report the actual CT achieved when Gordon Creek Chlorinator (TP002) is in operation. The actual CT values are compared to the CT associated with the required log treatment to determine compliance.

The Division received the following information of the worst-case scenario disinfection CT estimated by your consultant.

1. The estimated worst-case scenario disinfection CT before the chlorinated water reaches the point of entry to distribution system (POE) sampling location is **14.2**, which meets the 4-log virus inactivation of groundwater sources (a minimum CT of 12).
2. **POE Sampling Location:** The POE sampling location was specifically identified as **the first PRV station in the upper zone that is downstream of the chlorinator and before any connection to the treated water distribution line**
3. **Chlorine Residual at POE:** The CT estimate is based on chlorine residual at POE at 0.3 mg/L (measured as free chlorine) as the worst-case scenario.
4. **pH:** The CT estimate is based on water pH ranging between 6 and 9.
5. **Temperature:** The CT estimate is based on the worst-case scenario of winter water temperature of 0.5°C.
6. **Disinfection CT:** The estimated worst-case scenario disinfection CT of 14.2 encompasses the CT segments described in the attached CT summary table. An updated DDW monitoring sheet was created by the Permitting Staff and delivered to the water system on August 24, 2020, for Highlands Subdivision to track their monitoring monthly requirements.

## UDI Definition and Possible Causes

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A groundwater source that is Under the Direct Influence of surface water (UDI) is vulnerable to contamination by pathogens found in surface water. This vulnerability could be because the sub-surface formation is not sufficiently filtering water as it percolates through the formation or because the groundwater collection device is poorly constructed and permits surface water to directly contaminate the ground water. The Division of Drinking Water determines and classifies a ground water source as UDI based on one or more of the following factors:

1. Geology and water flow conditions of the sub-surface formation
2. Construction of the groundwater collection device
3. Physical evidence of surface water intrusion or persistent water quality problems
4. Results of a microscopic particulate analysis (MPA) test
5. Water quality data showing surface water contamination (e.g. confirmed *E. coli* positive)

An MPA test (Item #4) consists of running the source water through a spiral-wound filter for a period of time. Particles collected by the filter are extracted in a laboratory, examined under a microscope, and identified. The particles indicate the risk that the water is contaminated by surface water. Particles that are expected to be found only above ground or in surface water indicate a risk of surface water contamination. Such indicators include chlorophyll-bearing algae, parts of flying insects, plant debris, *Cryptosporidium*, *Giardia*, etc. Some of these indicators are not pathogens, but their presence in the source water means it is susceptible to contamination by pathogens found in surface water.

An MPA sample is rated as having a low, moderate, or high risk of UDI if the score is 0-9, 10-19, or 20 and above, respectively. When basing the classification of a ground water source on MPA results, the Division classifies a source as UDI if any MPA sample is high risk or if any two MPA samples are moderate risk or above.

The path that surface water takes as it flows to a ground water source can and usually does vary with season and hydrological conditions. It is common for the flow path to be directly influenced by surface water under some conditions, such as during a high surface runoff during spring, but not to be directly influenced under others. So a surface-influenced source may have MPA sample results of various risk levels, depending on the timing of the sampling. A true ground water source that is not under the direct influence of surface water will always have only low-risk MPA samples.

# Estimate Disinfection CT & Whether Meeting 4-Log Virus Inactivation

Enter only the green field

**Highland Water Company**      **Water System # 15005**      **12204**

## Estimate Pipe Volume

$$V=L \cdot \pi \cdot (R)^2$$

Pipe Description	Length (ft)	Diameter (inches)	Diameter (feet)	Volume (ft <sup>3</sup> )	Volume (gal)	% Full	Effective Water Volume (gal)
12" DIP from tanks to EP002	2600	12	1.00	2042.0	15274.4	100%	15274.4
			0.00	0.0	0.0		0.0
			0.00	0.0	0.0		0.0
			0.00	0.0	0.0		0.0
			0.00	0.0	0.0		0.0
			0.00	0.0	0.0		0.0
<b>Total Pipe Effective Volume (gallons)</b>							<b>15274.4</b>

## Estimate Pipe Disinfection CT

Residual Conc., C (mg/L) <sup>1</sup>	pH <sup>2</sup>	Temp. (°C) <sup>3</sup> (See Table B below)	Peak Flow (gpm)	Effective Volume (gal)	Total Detention Time (min)	Contact Time (T) (min)	Total Pipe CT (C*T) <sup>4</sup>
0.3	6-9	0.5	429.0	15274.4	35.6	35.6	10.7

## Estimate Storage Tank Volume & Disinfection CT

Tank Description	Residual Conc., C (mg/L)	pH <sup>2</sup>	Temp. (°C) <sup>3</sup> (See Table B below)	Peak Flow (gpm)	Baffling Factor, BF (See Table A below)	Minimum Volume (gal) (at lowest setting)	Total Detention Time, TDT (min)	Contact Time (T) (min)	CT (C*T)
							Vol/Peak Flow	TDT x BF	C*T
0.7 MG tank (ST004)	0.3	6-9	0.5	214.5	0.1	12,500	58.3	5.8	1.7
0.25 MG tank (ST003)	0.3	6-9	0.5	214.5	0.1	12,500	58.3	5.8	1.7
<b>Total Tank CT <sup>4</sup></b>									<b>3.5</b>

## Summary

<b>CT Req'd for 4-Log Virus Inactivation</b>	<b>12</b>
<b>Total Estimated Disinfection CT <sup>4</sup></b>	<b>14.2</b>
<b>Meeting 4-Log Virus Inactivation?</b>	<b>Yes</b>

(See Table B below, assuming worst scenario)  
(= Total Pipe CT + Total Tank CT)

### Notes:

1. Residual conc. is the disinfectant level measured at (or after) the end of the pipe/vessel [NOT the dose added at the beginning of the pipe/vessel].
2. Assuming pH between 6 and 9
3. Assuming water temperature of 0.5 °C in winter worst scenario
4. This tool provides rough estimate of disinfection CT. For detailed design, apply additional safety factor and other design considerations.

Table A Tank Baffling Factors	
Factor	Description
0.1	None, agitated basin, very low length to width ratio, high inlet/outlet velocities
0.3	Single or multiple unbaffled inlets or outlets, no intra-basin baffles
0.5	Baffled inlet/outlet with some intra-basin baffling
0.7	Perforated inlet baffle, serpentine or perforated intra-basin baffles, outlet weir or perforated launders
1	Very high L to W ratio (pipeline flow), perforated inlet, outlet & intra-basin baffles

Table B Free Chlorine CT Values (per EPA, 1991) 4- Log Inactivation of Viruses		
Temp (°C)	pH	
	6-9	10
<b>0.5</b>	<b>12</b>	90
5	8	60
10	6	45
15	4	30
20	3	22
25	2	15

