State of Utah

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Executive Director

DIVISION OF DRINKING WATER
Tim Davis
Director

April 14, 2021

Clint McAffee
Park City Water System
PO Box 1480
Park City, Utah 84060

Subject: **Plan Approval**, 3 Kings Water Treatment Plant (TP015) with UV as Additional Primary Disinfectant & **UV Disinfection Credit of Cryptosporidium and Giardia Inactivation**; Park City Water System, System #22011, File #10433

This Approval Supersedes the July 6, 2020 Conditional Plan Approval Letter

Dear Clint. McAffee:

This letter issues Plan Approval and provides a summary of the Division of Drinking Water's (the Division) review for Park City Water System's (the System) 3 Kings Water Treatment Plant (3KWTP). Initial Conditional Plan Approval was issued July 6, 2020 requiring the UV validation for complete plan approval. The UV validation report was provided to the Division for review on March 5, 2021. The Division received your request dated April 7, 2021 for UV disinfection credits of Cryptosporidium and Giardia Inactivation for these UV facilities. The proposed 3KWTP is identified as TP015 in the Division's database and replaces the Spiro Treatment Plant (TP003), which has abandoned/demolished.

In the letter dated March 8, 2008, the District provided Preliminary UV Compliance Plan by Harold Wright of Carollo Engineers. This Plan identified possible methodology of combining the data from several UV validations of the Trojan UV Swift 2L12 reactor and applying validation data to Programmable Logic Controller (PLC) programming. The data sets referenced in this report include previous validations per Tier 1 approach of the Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006 Final UVDGM), as well as MS2 and Tl phage data.

The Division reviewed the plans and specifications of the proposed 3KWTP (TP015) as both a metals removal water treatment plant and as a future surface water treatment plant. This letter includes the following sections and addenda:

- Plan Approval for 3 Kings Water Treatment Plant (TP015)
- **Addendum 1.** Project Overview

- **Addendum 2.** Metals Removal Water Treatment – Preliminary Summary of Monitoring and Reporting Regulations
- **Addendum 3.** Proposed Strategy for Achieving Future Surface Water Treatment Goals
- **Addendum 4.** Future Surface Water Treatment – Preliminary Summary of Monitoring and Reporting Regulations

We have completed our review of your UV disinfection credit request and the supporting documents and find that they comply with applicable portions of *Utah's Administrative Rules for Public Drinking Water Systems* in *R309*. **We hereby approve the use of UV as an additional primary disinfectant at the subject treatment plants** per *R309-520-5 Allowable Primary Disinfectants* and *R309-520-8 UV Light,* subject to the following conditions:

- Chlorine will continue to be used for virus disinfection and as a secondary disinfectant.

- If the UV system is off specification or offline, Park City Water System shall have a mechanism in place to use either chlorine or other approved primary disinfectant to achieve the log removal/inactivation required for compliance within a maximum response time of 15 minutes. For example, the off-specification UV train must be shut down and either a parallel UV train must be brought on line or a back-up chlorine system must be initiated within 15 minutes, so the continuous duration of an off specification event is limited to no more than 15 minutes.

Overall, the proposed design of the 3KWTP is anticipated to meets the required treatment for *Cryptosporidium* for surface water classified as in Bin **1** under *R309-215-15* of Utah's Rules. The System will need to conduct Bin classification monitoring once the plant is in operation for determination of Surface Water Treatment. The processes of granular media filtration, UV reactor, and the post-chlorination together will achieve the treatment goals of:

- ≥3.0-log removal/inactivation required for *Giardia lamblia,*
- ≥2-log removal/inactivation required for *Cryptosporidium* (Bin 1 requirement), and,
- ≥4-log removal/inactivation for virus.

We received UV validation report on March 5, 2021, in addition to the plans and specifications that were dated February 10, 2020, stamped, and signed by Joseph Zalla, P.E. We find that the plans and specifications comply with the applicable portions of *Utah's Administrative Rules for Public Drinking Water Systems* in *R309*, specifically, metals and surface water treatment requirements.

On this basis, we hereby:

1. **Approve the proposed plans to construct 3 King Water Treatment Plant**
2. **Concurrence with the methodology used for validation and PLC programming of the UV reactors and**
3. **Grant 0.5 disinfection credits of Cryptosporidium and Giardia for the Trojan UV Swift Model 2L12 reactors installed at the 3 Kings water treatment plant to meet the required minimum surface water treatment goals.**

The treatment processes and other primary disinfectants enable this water treatment plant to achieve the treatment goals of:

- ≥3.0-log removal/inactivation required for *Giardia lamblia,*
- ≥2-log removal/inactivation required for *Cryptosporidium* (Bin 1 requirement), and,
- ≥4-log removal/inactivation for virus.

We also understand that these water treatment plants have the ability to achieve higher UV inactivation targets by adjusting the PLC setting if needed.

This approval pertains to construction only. **An Operating Permit must be obtained from the Director before 3 King Water Treatment Plant may be put in service.** A checklist outlining the items required for operating permit issuance is enclosed for your information.

The following two sections summarize the 3KWTP operating as a metals removal water treatment plant versus as a surface water treatment plant.

Metals Treatment Approval

3KWTP provides a multiple barrier approach originally designed to treat mine impacted groundwater (Judge Tunnel (WS001) and Spiro Tunnel (WS006)) through pre-oxidation, conventional rapid mix, flocculation, and sedimentation at elevated pH for optimized metals removal, granular media filtration through pyrolusite media, and post-filter titanium dioxide adsorption, pH adjustment for the distribution system, UV disinfection, and free chlorine contact time.

The proposed 3KWTP (TP015) has a plant design capacity of 5,000 gallons per minute (gpm) or 7.2 million gallons per day (MGD). The design includes redundant trains for each treatment process to meet redundancy requirements. The expected operational design is approximately 3,500 gpm with an expected peak operational flow of up 4,890 gpm. Water from the blended adsorber treated water may also be dechlorinated and discharged to the local stream system.

Our understanding is that Park City (the City) is required to treat Mine Impacted Water (MIW) according to the City's Amended Stipulated Compliance Order (ASCO) by the Division of Water Quality (DWQ) to reduce metals in the locally impacted streams. The DWQ ASCO requires the City to treat to DWQ standards, which are lower than drinking water maximum contaminant levels (MCLs), for Antimony [found in Judge (WS001) and Spiro (WS006)) and Cadmium (Judge (WS001)]. Drinking water primary and secondary MCLs dictate the following metal removal: Arsenic (Spiro), Thallium (Spiro), lead (Spiro), and Zinc (Judge).

The Division received your request for exceptions to Rule R309-525-13(3)(d) Sedimentation, R309-525-15(4) Filter and Adsorber media type and loading rate, and R309-525-15(a) Filter and Adsorber Backwash Supply regarding the construction of the 3 Kings Water Treatment Plant. These exceptions were reviewed and granted on March 11, 20120 (under Division File #12020), based are on the pilot study validation testing completed on the various treatment technologies to ensure all surface water and metals treatment goals are met and provide equivalent protection for public health to meet the intent of the rule. The design capacity limits associated with each

exception are detailed under the applicable treatment in Addendum 1 and in the attached copy of Division File #12012 Exception Approval letter.

See Table 1: Treatment Processes Summary in Addendum 1 for detailed information of treatment goal for each of the treatment processes included in the 3KWTP, and key design information.

See Table 2: Preliminary Treatment Monitoring and Reporting Requirements Table 1: Treatment Processes Summaryin Addendum 2 for preliminary information of monitoring and reporting requirements that will be required when the 3KWTP obtains an Operating Permit and is placed in service for metals removal treatment purpose.

Surface Water Treatment Approval

The design of the 3KWTP has been expanded to meet Surface Water Treatment requirements in the future should any of the source waters (Judge Tunnel (WS001), Spiro Tunnel Bulkhead (WS006), Spiro Tunnel Prioritized (WS008) (WS008), or Thiriot Spring (WS003)) for the 3KWTP become under the direct influence of surface water.

The Division's plan review covered all applicable Surface Water Treatment Plan requirements to establish that the 3KWTP, as designed, may be able achieve Surface Water Treatment in the future, if required.

In the future, when the 3KWTP is operated as a surface water treatment plant, the City will need to demonstrate these requirements, as incorporated in Utah's Rules R309, as follows:

- 3.0-$\log_{10}$ removal/inactivation required for *Giardia lamblia*
- 2.0-$\log_{10}$ k Computational Fluid Dynamics (CFD) model of the clearwell inlet hydraulics and efficiency of the clearwell design configuration and determine the following:
    - Actual hydraulic retention time of 10.17 minutes.
    - A baffle factor of 0.68.
    - Worst case: flow rate 7.2 MGD, pH of 8, clearwell depth of 15 feet and volume of 74,786 gallons, temperature of 4 °C, and residual of 1 mg/L.

See Addendum 1, Table 1: Treatment Processes Summary, for detailed information of treatment goal for each of the treatment processes included in the 3KWTP and key design information.

See Addendum 4 for preliminary information of monitoring and reporting requirements that will be required when the 3KWTP is in operation for surface water treatment purpose in the future.

Approvals or permits by local authority or county may be necessary before beginning construction of this project. As the project proceeds, notice of any changes in the approved design, as well as any change affecting the quantity or quality of the delivered water, must be submitted to the Division. We may also conduct interim and final inspections of this project. Please notify us when actual construction begins so that these inspections can be scheduled.

This approval must be renewed if construction has not begun or if substantial equipment has not been ordered within one year of the date of this letter.

If you have any questions regarding this conditional plan approval, please contact Cheryl Parker, of this office, at (385) 271-7039, or Mike Newberry, Engineering Manager, at (385) 515-1464.

Sincerely,

Michael Newberry, P.E.
Engineering Manager

CP/mrn/mdb

Enclosures

1. Operating Permit Checklist
2. Addendum 1. Project Overview
3. Addendum 2 Metals Removal Water Treatment – Preliminary Summary of Monitoring and Reporting Regulations,
4. Addendum 3. Proposed Strategy for Achieving Future Surface Water Treatment Goals
5. Addendum 4. Future Surface Water Treatment – Preliminary Summary of Monitoring and Reporting Regulations Exception Approval File #12012
6. Division File #12012 Exception Approval letter

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DDW-2021-010895

Utah Division of Drinking Water — Checklist for Issuing Operating Permits

Water System Name: _____ System Number: _____

Project Description: _____ File Number: _____

Items 1 through 8 below must be submitted to the Division and found to be acceptable prior to operating permit issuance (unless a water line project meets the requirements of R309-500-7 and is not required to obtain an Operating Permit).

☐ 1. Certification of Rule Conformance by a professional engineer (P.E.) that all conditions of Plan Approval were accomplished, and if applicable, changes made during construction were in conformance with rules R309-500 through 550

☐ 2. As-built or record drawings incorporating all changes to approved plans and specifications (unless no changes were made to the previously approved plans during construction)

☐ 3. Confirmation that as-built or record drawings have been received by the water system

☐ 4. Satisfactory bacteriological samples as evidence of proper disinfection and flushing in accordance with the appropriate ANSI/AWWA standards:

- ☐ ANSI/AWWA C651-14 AWWA Standard for Disinfecting Water Mains

  Two consecutive sample sets at least 16 hours apart, none positive (e.g., every 1,200 feet, end-of-line, each branch)

- ☐ ANSI/AWWA C652-11 AWWA Standard for Disinfection of Water-Storage Facilities

  One or more samples, none positive

- ☐ ANSI/AWWA C653-13 AWWA Standard for Disinfection of Water Treatment Plants

  Two consecutive samples per unit, none positive, no less than 30 minutes apart

- ☐ ANSI/AWWA C654-13 AWWA Standard for Disinfection of Wells

  Two consecutive samples, none positive, no less than 30 minutes apart

☐ 5. Water quality data — ***Specify*** *the required finished water and/or raw water data to demonstrate WTP performance before an OP can be issued, e.g., turbidity data/interval/frequency/sampling location, UVT data/off specs %, chlorine residual.*

☐ 6. If applicable, all other documentation that may have been required during the plan review process

☐ 7. If applicable, confirmation that the water system owner has received the O&M manual for the new facility

☐ 8. If applicable, **location data of new** storage tank, **treatment facility**, or source

ADDENDUM 1

Project Overview

Park City Water System (UTAH#22011)
3 Kings Water Treatment Plant (TP015)

PROJECT SUMMARY

Our understanding of the project is that the proposed 3KWTP will treat Judge Tunnel (WS001), Thiriot Spring (WS003), Spiro Tunnel Bulkhead (WS006), and Spiro Prioritized (WS008) for metals removal. Park City (the City) is required to treat Mine Impacted Water (MIW) according to the City's Amended Stipulated Compliance Order (ASCO) by the Division of Water Quality (DWQ) to reduce metals in the locally impacted streams.

The DWQ ASCO requires the City to treat to DWQ standards, which are lower than drinking water maximum contaminant levels (MCLs), for Antimony (found in Judge (WS001) and Spiro (WS006)) and Cadmium (Judge (WS001)). Drinking water primary and secondary MCLs dictate the following metal removal: Arsenic (Spiro), Thallium (Spiro), lead (Spiro), and Zinc (Judge).

A full scale pilot plant operated at the site from April 2016 until October 2016 to demonstrate proof of performance and validate the treatment technology effectiveness to treat mine influenced water from the Judge and Spiro Tunnel water. The Division concurred with the Pilot Test protocol on October 12, 2016. The System continued to operate the adsorption testing on Spiro Water Treatment plant until the plant was demolished in late 2019.

The Division of Drinking Water (the Division) received the plans and specifications of the proposed 3 Kings Surface Water Treatment Plant (3KWTP), stamped and signed by Joseph Zalla, P. E., and dated February 10, 2020, from you on March 9, 2020.

The Division received the 90% design of this project on October 18, 2019, and provided review comments on January 30, 2020 and on February 10, 2020. Supplemental information was provided to the Division on February 19, 2020. Construction ready drawing and specifications were provided to the Division on March 9, 2020. The 3 Kings Water Treatment Plant is identified as TP015 in the Division's database.

PROJECT DESIGN

3KWTP provides a multiple barrier approach originally designed to treat mine impacted groundwater (Judge Tunnel (WS001) and Spiro Tunnel (WS006 and WS008) through metals water treatment technology.

The 3KWTP design includes a Micro Hydro Facility and Raw Water Mix Basin. The Raw Water Mix basin will allow the System to have the ability to manage the blending of flows from Spiro Prioritized (WS008), Spiro Portal (WS006), and Judge Tunnel flow (WS001).

Thiriot Spring (WS003) will be pumped from the existing spring box to tie into the 3KWTP downstream of adsorption for UV, chlorine disinfection, and pH adjustment before sending the combined treated flow to the distribution system. Thiriot Spring (WS003) is currently classified as a pristine groundwater source. The 3KWTP includes space for a future addition of pre and final cartridge filter units in the event the spring is classified as under the direct influence of surface water in the future. This future package will provide the require filtration to treat ground

water under the direct influence of surface water while not impacting the 3KWTP's capacity to treat mine impacted water through the metal removal specific filter and adsorber media.

The 3KWTP treatment will consist of pre-oxidation, conventional rapid mix, flocculation and sedimentation at elevated pH for optimized metals removal, granular media filtration through pyrolusite media, and post-filter titanium dioxide adsorption, pH adjustment for the distribution system, UV disinfection, and free chlorine contact time. Water from the blended adsorber treated water may also be dechlorinated and discharged to the local stream system.

The proposed 3KWTP (TP015) has a plant design capacity of 5,000 gallons per minute (gpm) or 7.2 million gallons per day (MGD). The design includes redundant trains for each treatment process for redundancy. The expected operational design is around 3,500 gpm with a peak operational flow of up 4,890 gpm.

This project was reviewed against the following metals treatment and surface treatment design requirements:

- R309-215 Treatment Plant Monitoring Requirements.
- R309-520-1 through R305-520-6 Disinfection.
- R309-520-7(3) Disinfection-Additional Requirements for Hypochlorite systems.
- R309-520-8 Disinfection-Ultraviolet Light.
- R309-525-5 Conventional Surface Water Treatment Plant Capacity and Number of Treatment Trains.
- R309-525-6 Conventional Surface Water Treatment Plant Plant Sitting.
- R309-525-7 Conventional Surface Water Treatment Plant Plant Reliability.
- R309-525-8 Conventional Surface Water Treatment Plant Color Coding and Pipe Marking.
- R309-525-9 Conventional Surface Water Treatment Plant Diversion Structure and Pretreatment.
- R309-525-11 Conventional Surface Water Treatment Plant Chemical Addition.
- R309-525-12 Conventional Surface Water Treatment Plant Mixing.
- R309-525-13 Conventional Surface Water Treatment Plant Sedimentation.
- R309-525-14 Conventional Surface Water Treatment Plant Solids Contact Units.
- R309-525-15 Conventional Surface Water Treatment Plant Filtration.
- R309-525-16 Conventional Surface Water Treatment Plant In Plant Finished Drinking Water Storage.
- R309-525-17 Conventional Surface Water Treatment Plant Miscellaneous Plant Facilities.
- R309-525-18 Conventional Surface Water Treatment Plant Sample Taps.
- R309-525-19 Conventional Surface Water Treatment Plant Operation and Maintenance Manuals.
- R309-525-20 Conventional Surface Water Treatment Plant Operator Instruction.
- R309-525-21 Conventional Surface Water Treatment Plant Safety.
- R309-525-22 Conventional Surface Water Treatment Plant Disinfection Prior to Use.
- R309-525- Conventional Surface Water Treatment Plant Disposal of Treatment Plant Waste.
- R309-525- Conventional Surface Water Treatment Plant Other Considerations.
- R309-525-25 Conventional Surface Water Treatment Plant Operation and Maintenance.
- R309-535-11 Iron and Manganese Control.

- R309-535-13 New Treatment Processes or Equipment.
- R309-540 Pumping.
- R309-545 Storage Tanks.
- R309-550- Transmission and Distribution Pipelines.

See Table 1: Treatment Processes Summary below for detailed information of treatment goal for each of the treatment processes included in the 3KWTP, and key design information.

See Table 2: Preliminary Treatment Monitoring and Reporting Requirements Table 1: Treatment Processes Summaryin Addendum 2 for preliminary information of monitoring and reporting requirements that will be required when the 3KWTP obtains an Operating Permit and is placed in service for metals removal treatment purpose.

Table 1: Treatment Processes Summary

Treatment Process	Treatment Goals	Key Information
Pre-treatment	• **Metals-**Pre-oxidation to precipitate metals cadmium and zinc removal • **Surface Water** - Pre-chlorination to target metals removal, limit softening, and accumulation of calcium particles through plant.	• pH elevation goal of 8.2 (8-1 to 8.3) with sodium hydroxide • Target free chlorine residual of 0.3 mg/L (as NaOCl) to meet the target oxidation reduction potential of 500 mV required for partial metals removal
Rapid Mix	• **Metals-** Addition of primary coagulant to aid flocculation to remove arsenic, cadmium, lead, and zinc • **Surface Water** - Addition of primary coagulant to aid flocculation to remove suspended solids, organics, microbiological materials, and colloidal matter	• Dosing ferric sulfate (10-12% Fe) as primary coagulant • Two Rapid Mix trains that operate in a duty-standby orientation, with jet injection lines designed to achieve turbulent flow, and meeting mixing requirements
Flocculation	• **Metals-** Removal of arsenic, cadmium, lead, and zinc through flocculation and sedimentation • **Surface Water** –Removal of suspended solids, organics, microbiological materials,	• Three flocculation trains • Single train total volume of 7,470 cubic feet • Minimum detention time of 30 minutes (approximately 1,850 gpm per train • Peak flow rate influent of 5,551 gpm (7.99 MGD)

	and colloidal matter	including recycle flows • Staged velocity gradients of 60, 40 and 20 per second
Sedimentation	• **Metals-R**emoval of arsenic, cadmium, lead, and zinc • **Surface Water**-Removal of suspended solids including metals	• Three sedimentation basins with lamella plate settlers • See Division File #12020 for exception granted R309-525-13 (3)(d) • All trains used in normal operation with peak operation capacity of 5,551 gpm (7.99 MGD)
Filtration	• **Metals-** Removal of manganese, and thallium • **Surface Water** – Removal of suspended solids, organics, microbiological materials, and colloidal matter	• Eight filters total with six active filters and two filters on standby during peak flow to achieve MCL removal of metals. • Mono media bed of pyrolusite (manganese dioxide) that is NSF/ANSI 61 certified • Average flow rate into filters is 2,972 gpm, with peak operation flow rate at 5,507 gpm (7.93 MGD) • See Division File #12020 for exception granted for Filtration Rule R309-525-15 (4)(a-d) for a filter media type, bed depth, and loading rate.
Adsoprtion	• **Metals-** Removal of antimony and a secondary barrier for all metals with a titanium dioxide media. • **Surface Water** –Additional filtration but no credit given due bypass options/blending plan	• Six adsorber vessels, with number of online adsorbers depending on plant flowrate and water quality with a blending plan option to either partially or totally bypass. • Vessels utilize MetSorb® HMRG titanium dioxide media, supplied by Graver Technologies that is NSF/ANSI Standard 61 certified. • Average flow rate entering is 2,972 gpm, with peak operation flow rate at 5,507 gpm (7.93 MGD) • See Division File #12020 Exceptions to R309-525-14

		Adsorber media type, depth and loading and R309-525-15 for backwash rate • Blending is controlled to meet the primary MCL for antimony. Bypassing or blending will allow the City to extend the life of the expensive media. • Finished water is analyzed to determine the LSI (Langelier Saturation Index), which provides an indication of the corrosivity of the finished water.
UV Disinfection	• **Metals-** Provide voluntary primary disinfection with pathogen inactivation • **Surface Water** – Provide required primary disinfection with pathogen inactivation	• Three UV disinfection trains (two duty one standby). • Treat water from all sources [Judge Tunnel (WS001), Spiro Tunnel Bulkhead (WS006), and Spiro Prioritized(WS008) as well as Thiriot Spring (WS003)] • Trojan 2L12 medium pressure reactors. • UV facility must meet R309-520(2) and (3) validation and design criteria • The goal of the UV disinfection system is to achieve at least 0.5-log Giardia inactivation with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UV Design Guide Manual. • UV reactors will be sized for a peak flow rate into the reactor of 7.2 MGD
Primary Disinfection Clearwell	• **Metals-** provide voluntary pathogen inactivation • **Surface Water** – provide required pathogen inactivation	• Finished water adjusted pH with either Sulfuric Acid (93%) or sodium hydroxide (25%) as needed. The 3KWTP will include a chlorinator according to the following: • An onsite generation process

	that converts brine solution to sodium hypochlorite solution (0.8%). • Add sodium hypochlorite to the UV treated water • A detail review of the CT calculation reviewed by the Division can be found at the end of this Addendum 1.

SURFACE WATER TREATMENT PROCESSES

The design of the 3KWTP has been expanded to meet Surface Water Treatment requirements in the future should any of the source waters [Judge Tunnel (WS001), Spiro Tunnel Bulkhead (WS006), Spiro Tunnel Prioritized (WS008) (WS008), or Thiriot Spring (WS003)] for the 3KWTP become under the direct influence of surface water.

The Division's plan review covered all applicable Surface Water Treatment Plan requirements to establish that the 3KWTP, as designed, may be able achieve Surface Water Treatment Plant in the future, if required.

In the future, when the 3KWTP is operated as a surface water treatment plant, the City will need to demonstrate these requirements, as incorporated in Utah's Rules R309, as follows:

- 3.0-$\log_{10}$ removal/inactivation required for *Giardia lamblia*
- 2.0-$\log_{10}$ removal/inactivation required for *Cryptosporidium* (Bin 1 source)
- 4.0-$\log_{10}$ removal/inactivation required for virus

The 3KWTP designed treatment processes, if operated well, are expected to achieve log removal credit during operations:

- Conventional treatment defined as coagulation, flocculation, sedimentation, and filtration receive nominal credit of 2.5-$\log_{10}$ for Giardia, 2-$\log_{10}$ for virus, and 3-$\log_{10}$ for Cryptosporidium.[R309-215-7(5); 40 CFR Part 141, Subpart W Table IV.B-3]
    - A well-operated plant shall provide filtered water turbidity less than 0.15 NTU [R309-215-17].
- Following filtration, the 3KWTP flow will be disinfected with ultraviolet (UV) light to provide the remaining required 0.5-$\log_{10}$ Giardia credit through inactivation.
- Free chlorine inactivation through a clearwell will provide the remaining required 2.0 $\log_{10}$ virus inactivation credit to achieve the total 4.0-$\log_{10}$ removal/inactivation required for virus for the 3KWTP facility.
    - Jacobs completed a Computational Fluid Dynamics (CFD) model of the clearwell inlet hydraulics and efficiency of the clearwell design configuration and determined the following:
        - Actual hydraulic retention time of 10.17 minutes
        - A baffle factor of 0.68
        - Worst case: flow rate 7.2 MGD, pH of 8, clearwell depth of 15 feet and volume of 74,786 gallons, temperature of 4 °C, and residual of 1 mg/L.

See Table 1: Treatment Processes Summary in this addendum for detailed information of treatment goal for each of the treatment processes included in the 3KWTP and key design information.

See Addendum 4 for preliminary information of monitoring and reporting requirements that will be required when the 3KWTP is in operation for surface water treatment purpose in the future.

SPECIFIC APPROVALS REVIEW

Park City requested Division approval of the following specific design elements to meet all applicable R309-525 requirements. The following discussion highlights the Division's specific review and approval of following specific facilities within the 3KWTP design.

1. Adsorber Design

The 3KWTP pilot study compared three adsorber media profiles to remove antimony and to provide a multi-barrier approach to overall metals removal at the 3KWTP. The three media tested during the pilot study include:

- Titanium dioxide media (MetSorb®),
- Ferric oxide media (Bayoxide® E33), and
- Ferric hydroxide media (GFH®).

Unlike filter media, adsorber media cannot be regenerated during a backwash and metals accumulate in the adsorber media over time. The adsorber media profiles were primarily compared based on the rate of antimony accumulation in the media.

Pilot study results showed that antimony accumulated in the titanium dioxide media at a slower rate compared to the ferric oxide and ferric hydroxide adsorbers. The titanium dioxide adsorber at a pH of 7.0 and 6.5 (pH was adjusted at the midpoint of the pilot study) performed the best of all adsorber media profiles. No detectable antimony concentrations were measured from this adsorber treated water throughout the pilot study. The MetSorb® titanium dioxide media also provided an additional barrier to metals removal during the pilot study, particularly during the stress tests described in the Pilot Report Section 4.9 Challenge Tests. More detail information can be found in the Pilot Report Section 4.2 Metals Removal Through Adsorption which summarizes results from the adsorber testing during the pilot study.

During the pilot study, adsorber treated water turbidity was analyzed via grab samples and a bench top turbidimeter. These bench-scale measurements indicated that the MetSorb® titanium dioxide adsorber treated water remained below 0.1 NTU for most grab samples after an initial start-up period for the pilot-scale adsorbers.

During the pilot study, flow rates to the MetSorb® titanium dioxide adsorbers were set to provide a 5-minute EBCT. A sampling port was included at the mid-point to test the media at a 2.5-minute EBCT as well. Pilot study results indicated that antimony accumulated at a slower rate in the titanium dioxide media for both EBCTs compared to the ferric oxide and ferric hydroxide media.

The Pilot Report details sufficient justification and treatment parameters for the Division to

concur with the MetSorb® titanium dioxide as a media for the adsorber vessels for use in the 3KWTP for antimony and secondary metal removal.

2. Clearwell Baffle Factor

Park City completed a computation fluid dynamics (CFD) model of the 3KWTP clearwell to determine the baffle factor for CT calculations. The CFD model results determined a baffling factor of 0.68. The Division concurs with these findings and will use a baffling factor of0.68 in CT calculations for the 3KWTP.

3. UV Validation

Below is a summary regarding the UV reactor (Trojan UV Swift Model 2L12) that met the original plan approval conditional requirements:

1. The following conditions related to the UV process design were addressed:
    a. The goal of the UV disinfection system is to achieve at least 0.5-log Giardia inactivation with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UV Design Guide Manual.
        i. The remaining 2.5-log Giardia removal/inactivation required will be achieved through meeting filtered water turbidity requirements..
    b. On March 5, 2021 the Division received a UV reactor validation report in accordance with R309-520-8(2) for review.
    c. The UV disinfection system will use the calculated dose approach for the UV dose monitoring strategy as specified in the Construction Documents and as shown in the equipment submittal.
    d. The proposed UV process design meets all applicable design criteria in R309-520-8 and includes the capability of monitoring the delivered UV dose using a validated dose monitoring mechanism including:
        i. Historical water quality data and collected data show the source water is within the limits of UV disinfection, including Calcium, Alkalinity, Hardness, Manganese, Turbidity, pH, Oxidation reduction potential, and particle content/algae.
        ii. The design minimum UV Transmittance is 97.5% based on the water quality data collected. The UV equipment being provided assumes a UV Transmittance of 95% in the validated dose calculations for any measured UVT greater than 95%. Therefore, at the design UV Transmittance of 97.5% the UV dose applied will exceed the dose required.
        iii. The UV system is designed to accommodate flows from 600 GPM to 5,000 GPM. The UV Transmittance is not expected to vary seasonally. The UV reactors being provided are designed to deliver the adequate dose for this flow range and the UV Transmittance as described above.
        iv. The UV system is designed in a 2+1 (one standby unit) configuration with a common header which allows flow to be conveyed to any of the three treatment trains. If one reactor is off-line 100% of flow can be sent to the remaining two on-line reactors.
        v. Each reactor can be isolated using an isolation valve on the upstream side and a flow control valve on the downstream side of the reactor.
        vi. The required alarms are all included in the EPA validated equipment provided by Trojan, and per the 2006 UVDGM. Critical, Major, and

Minor alarms will be sent back to SCADA and the UV reactors will be shut-down as necessary.

vii. All materials are NSF 61 certified. This requirement was also included in the specification.

viii. The ActiClean cleaning system provided by Trojan is a patented chemical/mechanical cleaning system which uses stainless steel wiper collars containing a NSF 60 certified acid cleaning solution located between two food-grade rubber wiper seals.

ix. If a UV reactor goes off-specification it will be shutdown and the standby UV reactor will be brought online within 15 minutes or less. The UV system is on a uninterruptible power supply.

x. The UV disinfection system will use the calculated dose approach for the UV dose monitoring strategy as stated in the 2006 UVDGM and the UV validation report. This approach is also specified in the Construction Documents and identified in the equipment submittal.

xi. Individual Control Power Panels (CPPs) with PLCs provided by Trojan will control the UV reactors in accordance with the validated dose monitoring algorithm in the UV validation report. The vendor supplied PLC will monitor all the UV reactor's PLC or microprocessor shall be programmed to record off specification events conditions.

Park City Water system continues to coordination with DWQ regarding their construction and all approval will be copied to DDW upon receipt.

4. HVAC System Water Use

Park City proposes to utilize raw water from 3KWTP raw water mixing basin to supply the 3KWTP HVAC system. Raw water is diverted to the HVAC heat pump at approximately 30 to 180 gpm before returning to the raw water mix basin upstream of all treatment processes. There are no cross connections included in the design as the sole source of water for the HVAC heat pump is the raw water mixing basin. The HVAC heat pump uses copper piping and is not anticipated to leach into the raw water, however, HVAC return flow stream can be sampled via grab samples before it re-enters the raw water flow to monitor for any increase in copper concentration.

The Division concurs with use of raw water to supply the HVAC heat pump with the raw water returned to the raw water mixing basin and a sampling tap to identify any possible contamination.

5. Standby Power

Utah DDW Rule R309-525-7 (5) states that “The plant shall have standby power available to permit operation of essential functions during power outages.” A natural gas generator is included in the 3KWTP design. The Division concurs with the System that the natural gas generator meets the intent of rule R309-525-7 (5).

6. Chlorine Disinfection Redundancy

An onsite sodium hypochlorite generation unit is included for primary sodium hypochlorite

supply at the 3KWTP with a refillable 330-gallon tank within the sodium hypochlorite generation. The storage area is designed to accept 12% sodium hypochlorite solution to be diluted to a 0.8% concentration and fill the 0.8% sodium hypochlorite storage tank instead of having a second redundant onsite sodium hypochlorite generation unit.

Rule R309-520-7 (k)(ii) states that, as a requirement for standby and backup equipment, "where chlorination is required for disinfection of a water supply, standby equipment of sufficient capacity shall be available to replace the largest unit in the event of its failure." Park City utilizes 12% sodium hypochlorite at several of its other facilities and in the event of the generation unit is offline, 12% sodium hypochlorite can be brought to the 3KWTP storage and be diluted to a 0.8% concentration.

To provide redundancy for the sodium hypochlorite feed system, per sections R309-520-7 (1)(k)(ii) and R309-525-11 (7)(b)(i) and (ii), standby feed pumps are included in the design for each chemical application point.

In addition to the equipment redundancy described, standby power is provided in the design for all equipment per section R309-520-7 (1)(k)(iii) and spare parts kits are included in the design for all equipment per sections R309-520-7 (1)(k)(i) and R309-525-11 (7)(b)(v).

The Division concurs that this process is considered a sufficient backup supply of sodium hypochlorite to be used in an emergency situation.

7. Recycle Flows

There are no uncontrolled bypass lines to blend untreated water with finished water. All finished water will be treated.

Several continuous and intermittent flows are recycled from the treatment processes to the raw water mix basin upstream of the treatment processes. Backwash waste clarifier decant flow will be returned continuously to the raw water mix basin at flow rates ranging from 367 gpm at average plant flow to 680 gpm at peak plant flow. At minimum plant flow rates, the backwash waste decant recycle pumps will send backwash waste decant recycle flows at 80 gpm intermittently.

Sample flows sent to the laboratory will also be continuously returned to the raw water mix basin at a flow rate of 2 gpm per sample flow. Twelve sample flows will flow to the laboratory and then raw water mix basin, as follows:

1) Judge Tunnel Raw Water.
2) Spiro Portal Raw Water.
3) Spiro Prioritized Raw Water.
4) Rapid Mix Influent Train #1 (only operating continuously when Train #1 is online).
5) Rapid Mix Influent Train #2 (only operating continuously when Train #2 is online).
6) Thiriot Spring Pump Treated water.
7) Settled Water.
8) Combined Filter Treated water.
9) Combined Adsorber Treated water.
10) Clearwell (At Weir).
11) Clearwell (At Finished Water Pumps).

12) Backwash Waste Decant Recycle.

Filter-to-waste flows at the end of each backwash cycle will flow to the backwash waste equalization basin under normal operations. However, as a potential energy savings measure the flows can be returned to the raw water mix basin. Filter-to-waste flows at a rate of 495 gpm at average plant flow (without standby filter(s) in service) and 918 gpm at peak plant flow (without standby filter(s) in service). Filter backwash cycles will occur regularly, although filter-to-waste may only be sent to the raw water mix basin periodically. The filter-to-waste portion of the backwash cycle will take approximately 29 minutes during average plant flow and 16 minutes during peak plant flow.

The sum of all flows recycled to the raw water mix basin ranges from 102 gpm (80 gpm from backwash waste clarifier decant and 22 gpm from sample flows) at minimum plant flow (11.2% of total plant flow into pre-treatment is recycled water) to 702 gpm (680 gpm from backwash waste clarifier decant and 22 gpm from sample flows) at peak plant flow (12.6% of total plant flow into pre-treatment is recycled water). If filter-to-waste flows are recycled to the raw water mix basin for energy savings, the fraction of recycled water in the total plant flow into pre-treatment would be up to 25%. However, this would last for less than 30 minutes during a backwash sequence.

Plan Review – Estimated Disinfection CT

Park City (UTAH #22011)

Proposed 3 Kings Water Treatment Plant (TP015, File #10433)

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 (**C**oncentration) multiplied by the contact **T**ime, 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.

- The 3KWTP will include a UV reactor (Trojan UV Swift Model 2L12) according to the following design specifications and UV validation report:
    - The goal of the UV disinfection system is to achieve at least 0.5-log Giardia inactivation with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UV Design Guide Manual.
        - The remaining 2.5-log Giardia removal/inactivation required will be achieved through meeting filtered water turbidity requirements..
    - On March 5, 2021 the Division received a UV reactor validation report in accordance with R309-520-8(2) for review.
    - The proposed UV process design meets all applicable design criteria in R309-520-8 and includes the capability of monitoring the delivered UV dose using a validated dose monitoring mechanism including:
        - Historical water quality data and collected data show the source water is within the limits of UV disinfection, including Calcium, Alkalinity, Hardness, Manganese, Turbidity, pH, Oxidation reduction potential, and particle content/algae.
        - The UV system is designed to accommodate flows from 600 GPM to 5,000 GPM. The UV Transmittance is not expected to vary seasonally. The UV reactors being provided are designed to deliver the adequate dose for this flow range and the UV Transmittance as described above.
        - The UV system is designed in a 2+1 (one standby unit) configuration with a common header which allows flow to be conveyed to any of the three treatment trains. If one reactor is off-line 100% of flow can be sent to the remaining two on-line reactors.
        - All materials are NSF 61 certified. This requirement was also included in the specification.
        - The ActiClean cleaning system provided by Trojan is a patented chemical/mechanical cleaning system which uses stainless steel wiper collars containing a NSF 60 certified acid cleaning solution located between two food-grade rubber wiper seals.
        - If a UV reactor goes off-specification it will be shutdown and the standby UV reactor will be brought online within 15 minutes or less. The UV system is on a uninterruptible power supply.

- The 3KWTP will include a chlorinator according to the following design specifications:

- The proposed 3KWTP chlorinator is an onsite generation process that converts brine solution to sodium hypochlorite solution (0.8%).
- This chlorinator will add sodium hypochlorite to the water from the 3KWTP process [Judge Tunnel (WS001), Spiro Tunnel Bulkhead (WS006), and Spiro Tunnel Prioritized (WS008)] as well as Thiriot Spring (WS003) after the UV reactors.
- This chlorinator is intended for primary to achieve the remaining 2.0 $\log_{10}$ virus inactivation credit and secondary disinfection in the distribution system.
- The proposed onsite generation sodium hypochlorite solution for disinfection meets the ANSI/NSF 60 standard.
- The proposed design target dose of 1.5 mg/L or ppm (measured as free chlorine) is based on a typical flow of 3,500 gallons per minute (gpm) from 3KWTP treated flow rate.
- The chlorine dose will be adjusted by an automatic flow-paced control.

- Free chlorine inactivation through a clearwell will provide the remaining required 2.0 log10 virus inactivation credit.
  - Finished water is treated with Sodium Hypochlorite (0.8%) at a rate of 1 to 2.5 mg/L to meet primary disinfection requirements for CT. The Sodium Hypochlorite meter pump is designed to treat up to 7.2 MDG.
  - Jacobs completed a Computational Fluid Dynamics (CFD) model of the clearwell inlet hydraulics and efficiency of the clearwell design configuration and determined the following:
    - Actual hydraulic retention time of 10.17 minutes at worst case
    - A baffle factor of 0.68
    - A T10, or time for the outlet concentration to reach 10 percent of the inlet tracer concentration , of 10.6 minutes
    - Worst case: flow rate 7.2 MGD, pH of 8, clearwell depth of 15 feet and volume of 74,786 gallons, temperature of 4 °C, and residual of 1 mg/L.

- Secondary Chlorination in the Distribution network
  - The chlorinated water then enters Boot Hill tank (ST004) before entering the distribution system directly.
  - The proposed onsite generation sodium hypochlorite solution for disinfection meets the ANSI/NSF 60 standard.
  - The proposed design target dose of 1.5 mg/L or ppm (measured as free chlorine) is based on a typical flow of 3,500 gallons per minute (gpm) from 3KWTP treated flow rate.
  - The chlorine dose will be adjusted by an automatic flow-paced control.
  - Park City maintains an internal goal of maintaining a residual free chlorine of 1 mg/L throughout the distribution network.

The Division's review of estimated CT information is limited to the disinfection CT that may be achieved in a **worst-case scenario** based on the proposed system configuration. The estimated worst-case scenario disinfect CT value may not reflect the actual CT that will be achieved when the proposed chlorinator is used for ongoing operation in the future. The Park City water system will be required to monitor and report the actual CT achieved when 3KWTP (TP015) is in operation. At that time, the actual CT values will be 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 during the plan review phase.

1. The worst-case scenario disinfection CT before the chlorinated water reaches the point of entry to distribution system (POE) sampling location is estimated to be **10.17**, which is anticipated to meet the additional 2-log virus inactivation of groundwater sources (a minimum CT of 12 is required to achieve 4.0 log virus removal credit, 0.5-log10 Giardia lamblia and 0.5-log inactivation for Cryptosporidium with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UVDGM) through the 3KWTP.
2. The 3KWTP achieves 4.0-log virus removal/inactivation credit with the 2.0-log virus removal credit from the well run conventional treatment plant in addition to the >2.0-log virus inactivation credit from the clearwell), 0.5-log10 Giardia lamblia and 0.5-log inactivation for Cryptosporidium with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UVDGM) through the 3KWTP.
3. **POE Sampling Location:** The proposed POE sampling location is described as **the weir exit of the clear well basin.**
4. **Chlorine Residual at POE:** The CT estimate is based on chlorine residual at POE at **1.0** mg/L (measured as free chlorine) as the worst-case scenario.
5. **pH:** The CT estimate is based on water pH ranging between 6 and 9.
6. **Temperature:** The CT estimate is based on the worst-case scenario of winter water temperature of 4°C.
7. Disinfection CT: The estimated worst-case scenario disinfection CT of 10.17 encompasses the CT segments described in the attached CT summary table.

ADDENDUM 2

Metals Removal Water Treatment
Preliminary Summary of Monitoring and Reporting Regulations
Park City Water System (UTAH#22011)
3 Kings Water Treatment Plant (TP015)

Metals Treatment Monitoring and Reporting Requirements

The following Table 2: Preliminary Treatment Monitoring and Reporting Requirements summarizes the treatment monitoring and reporting requirements is provided for informational purposes to inform you what will be required from Park City when you receive an Operating Permit for the 3KWTP. Exact and detailed monitoring and reporting requirements will be detailed at the time of the Operating Permit issuance:

Table 2: Preliminary Treatment Monitoring and Reporting Requirements

Parameter	Sampling Frequency	Reporting Frequency	Sampling Site
Primary Metals-**Antimony, Arsenic, Cadmium, and Thallium**	Quarterly	Quarterly	Clearwell Outlet of 3KWTP (TP015)
Primary Metals-**all other primary metals**	Yearly	Yearly	Clearwell Outlet of 3KWTP (TP015)
Secondary Metals-**Lead, Zinc, Manganese, and Iron**	Quarterly	Quarterly	Clearwell Outlet of 3KWTP (TP015)
Lead and Copper	40 samples for lead and copper every six months.	Six months	Throughout the Distribution System (DS001)
Water Quality-pH, alkalinity, calcium, conductivity, temperature, orthophosphate (if used)	Quarterly	Quarterly	Clearwell Outlet of 3KWTP (TP015)
Raw Water Source Turbidity	Continuously	Quarterly	Raw Water mixing basin of 3KWTP (TP015)

Detailed information regarding the monitoring requirements will be available at the time of the Operating Permit issuance. Please contact Emily Frary at emilyfrary@utah.gov or at (801) 536-0070 if you have any questions about the future metals monitoring requirements. Please contact the Division's lead and copper rule manager, Luke Treutel at: ltreutel@utah.gov or at (385) 258-6084, with any questions you may have concerning the future increased lead and copper or water quality parameter requirements.

Raw Water Turbidity Monitoring

Please note that, when the 3KWTP has an Operating Permit and is placed in service for metals removal treatment purpose, the System will be required to continuously monitor the raw water turbidity from the raw water mixing basin. The purpose of the raw water turbidity monitoring requirement is to gather the data for determining whether this water system can continue operating as a metals treatment plant.

The raw water turbidity measurements will be used as a trigger to evaluate whether the bin classification sampling requirements per the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) will become applicable to the water sources supplying to 3KWTP The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) established four bin classifications for *Cryptosporidium* based on concentration in the source water. For example, if a water system has source water classified in Bin 1, LT2ESWTR requires 2-$\log_{10}$ removal for *Cryptosporidium.* If a water system has source water in Bin 2, Bin 3, or Bin 4, LT2ESWTR requires additional treatment, disinfection or inactivation for *Cryptosporidium*, as outlined in EPA's "*Long Term 2 Enhance Surface Water Treatment Rule Toolbox Guidance Manual*."

Park City will contact the Division to initiate LT2ESWTR source sampling procedures in the event the City documents a continued significant increase in turbidity variations that extends over two quarters of raw water monitoring.

Secondary Disinfection in the Distribution System (DS001)

The plan review of the proposed 3KWTP for metals treatment includes a chlorinator that is based on providing secondary disinfection throughout the distribution system for the current source water classifications.

When this chlorinator is installed and placed in operation, after the Operating Permit issuance, the Park City Water System will be required to demonstrate ongoing compliance with the following secondary disinfection requirements as long as 3KWTP is in operation for metals treatment and is only required to provide secondary disinfection in the distribution system (DS001).

I. Chlorine Residual – Distribution System (DS001)
   a. This water system will continue be required to 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 must not exceed the maximum residual disinfectant level (MRDL) of 4.0 mg/L (measured as free chlorine). [R309-200-5(3)(c)(iv)]
   c. This water system will be required to *continue taking* **a minimum of three (3) chlorine residual samples per week at varying locations throughout the distribution system** (**DS001**). [R309-105-10(1)(c)]
   d. Monitor distribution system chlorine residuals in conjunction with total coliform sampling. [R309-215-10(3) and (4)]

II. Chlorine Residual – Point of Entry to Distribution System (EP003)
   a. The Point of Entry (POE) sampling location for the 3KWTP will be **outlet weir of the clearwell**. This POE sampling location will be identified during the Division's review for an operating permit.

b. This water system will be required to 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 measured at the POE sampling location must not exceed the maximum residual disinfectant level (MRDL) of 4.0 mg/L (measured as free chlorine). [R309-200-5(3)(c)(iv)]
d. This water system will be required to record and report the chlorine residual measured as free chlorine, (lowest value of the day if continuous monitoring) at **the 3KWTP POE sampling location (a minimum of 3 days a week.** [R309-210-8(3)(a)(ii)]
    - Our records show that your water system serves 8,500 people. Please be aware that R309-215-5(1) requires water systems serving greater than 3,300 people to continuously monitor the POE chlorine residuals. Therefore, an online analyzer to continuously monitor the POE chlorine residuals entering the distribution system is needed.

ADDENDUM 3

Proposed Strategy for Achieving Future Surface Water Treatment Goals
Park City Water System (UTAH#22011)
3 Kings Water Treatment Plant (TP015)

Future Surface Water Monitoring and Reporting Requirements

In addition to the monitoring requirements established in Table 2: Preliminary Treatment Monitoring and Reporting Requirements , when the 3KWTP is placed in operation as a Surface Water Treatment Plant, the City will be required to demonstrate ongoing compliance with the following monitoring and reporting requirements to meet surface water treatment:

1. Surface Water Treatment Plant Monitoring and Treatment Goals per Surface Water Treatment Rules

The 3 Kings Water Treatment Plant (3KWTP) is a conventional and metals water treatment plant. Treatment technologies consists of pre-oxidation, conventional rapid mix, flocculation and sedimentation at elevated pH for optimized metals removal, granular media filtration through pyrolusite media, and post-filter titanium dioxide adsorption, pH adjustment for the distribution system, UV disinfection, and free chlorine contact time. This plant shall be designed to meet the requirements of the surface water treatment rules, as incorporated into Utah's Rules in R309. These surface water treatment rules require removal and/or inactivation, expressed in terms of $\log_{10}$ credit, of *Cryptosporidium*, *Giardia lamblia*, and *viruses* through treatment techniques.

- The Surface Water Treatment Rule (SWTR) requires:
  — **3-log removal/inactivation for *Giardia lamblia*,** and
  — **4-log removal/inactivation for virus**.

- The Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) established four bin classifications for *Cryptosporidium* based on concentration in the source water. If a water system has source water classified in Bin 1, LT2ESWTER requires 2-log removal for *Cryptosporidium.* If a water system has source water in Bin 2, Bin 3, or Bin 4, LT2ESWTR requires additional treatment, disinfection or inactivation for *Cryptosporidium*, as outlined in EPA's "*Long Term 2 Enhance Surface Water Treatment Rule Toolbox Guidance Manual*."

Water sources supplying this treatment plant are the Judge Tunnel (WS001), Thiriot Spring (WS003), Spiro Tunnel Bulkhead (WS006), and Spiro Tunnel Prioritized (WS008). The source water is expected to be classified as Bin 1. In the event additional log removal credit is needed for a higher Bin classification based on source monitoring requirements, additional treatment will need to be installed. The 3KWTP is designed to meet the **Bin 1** requirements, i.e., **2-$\log_{10}$ removal for *Cryptosporidium***.

Primary Filtration
3KWTP will operate granular media filtration through pyrolusite media with an average flow rate of 4.28 MGD with a hydraulic loading rate between 5.21 to 9.66 gpm/sf, per approved exception.

The Division approves the granular media filtration for primary filtration under the surface water treatment rules. Upon receiving water quality results that demonstrate effective performance of the proposed treatment plant, the Division will grant **2.0-log credit for *Virus* removal, 2.5-log credit for *Giardia lamblia* removal,** and 3**-log credit for *Cryptosporidium* removal** for the first stage compliance filter.

Please note that the turbidity performance standards for the proposed treatment plant will be **less than 0.3 NTU 95% of the time, and shall not exceed 1.0 NTU** (per *R309-200-5(a)(ii)* and *R309-530-9)*.

Disinfection

Two disinfection processes will be installed following the granular media filters to provide additional treatment to meet surface water treatment disinfection requirements:

- **Ultraviolet (UV) disinfection** (Trojan UV Swift Model 2L12) UV reactor manufactured by Trojan will be installed immediately following the adsorber compliance filter for metals treatment.
    - The System provided the goals of the UV process as part of a comprehensive disinfection strategy including target pathogens, target log inactivation and corresponding required UV does that is required.
    - This UV reactor was validated by Harold Write, P.E with Carollo Engineers in the validation report dated March 7, 2008.
    - The Division concurs with this validation report. Per R309-520-8(3),the Division accepts the calculated dose (or single set point) UV dose approach proposed by Trojan UV Swift.
        - 0.5-$\log_{10}$ Giardia lamblia and 0.5-log inactivation for Cryptosporidium with a validated UV dose of 1.5 mJ/cm2 per Table 1.4 in the UVDGM) through the 3KWTP.
        - UV reactors will be sized for a peak flow rate into the reactor of 7.2 MGD to achieve a design minimum UVT of 97.50% with turbidity less than 0.3 NTU more than 95% of the time and always less than 0.1 NTU.

- **Post chlorination** at free chlorine residual of 1.00 ppm will be provided for additional disinfection following the UV treatment. The 3KWTP will provide disinfection through onsite sodium hypochlorite generation. Free chlorine inactivation through a clearwell will provide the remaining **required 2.0 $\log_{10}$ virus inactivation credit**.
    - Jacobs completed a Computational Fluid Dynamics (CFD) model of the clearwell inlet hydraulics and efficiency of the clearwell design configuration and determined the following:
        - Actual hydraulic retention time of 14.96 minutes
        - A baffle factor of 0.68
        - A T10, or time for the outlet concentration to reach 10 percent of the inlet tracer concentration , of 10.6 minutes
        - Worst case: flow rate 7.2 MGD, pH of 8, clearwell depth of 15 feet and volume of 74,786 gallons, temperature of 4 °C, and residual of 1 mg/L.
    - The Point of Entry for the chlorination system is the exit weir of the clearwell.

Overall, the proposed design of the 3KWTP is anticipated to meets the required treatment for *Cryptosporidium* for surface water classified as in Bin **1** under *R309-215-15* of Utah's Rules. The System will need to conduct Bin classification monitoring once the plant is in operation for determination of Surface Water Treatment. The processes of granular media filtration, UV reactor, and the post-chlorination together will achieve the treatment goals of:

- ≥3.0-log removal/inactivation required for *Giardia lamblia,*
- ≥2-log removal/inactivation required for *Cryptosporidium*(Bin 1 requirement), and,
- ≥4-log removal/inactivation for virus.

ADDENDUM 4

Future Surface Water Treatment
Preliminary Summary of Monitoring and Reporting Regulations
Park City Water System (UTAH#22011)
3 Kings Water Treatment Plant (TP015)

This addendum summarizes the monitoring and reporting regulations related to the 3 Kings Surface Water Treatment Plant (TP015) (3KWTP). It is provided to you for informational purpose, and may be helpful in PLC and SCADA programming after the plant is constructed.

The actual monitoring and reporting requirements for this treatment plant will be provided to the water system by staff of the Rules Sections in the Division of Drinking Water following the issuance of the Operating Permit.

1. **Monthly Report — General**

    a. The Park City Water System (the water system) is required to complete a monthly report for 3KWTP **using a template approved by the Division of Drinking Water** (the Division). As a minimum, the monthly surface water treatment plant report must include the following data and other applicable information.
        i. Combined filter treated water (CFE) turbidity [R309-215-9(1)(a)]
        ii. Minimum chlorine residual of the treated water at the point of entry (POE)
        iii. Verification and calibration dates of turbidimeter(s)
        iv. Disinfection CT and/or Inactivation ratio demonstrating whether the log removal/inactivation requirements are met R309-200-5(7), R309-215-15(19); R309-215-15(19)(d) and R309-520-8]

    b. Submit the surface water treatment plant report for the entire month to the Division by the 10th of the following month. This report can be submitted by hardcopy, fax, or e-mail at **DDWReports@utah.gov**. Please contact **Michelle Deras** at (801) 536-42765 or mderas@utah.gov to schedule training regarding proper reporting.

    c. The water systems using surface water or ground water under the direct influence of surface water must provide treatment consisting of both disinfection and filtration. [R309-200-5(5)(a)]

2. **Treatment Adequacy** [R309-200-5(7), R309-215-15(19) and (20)]

    a. The surface water treatment plant monthly report must include **both disinfection and filtration** processes. The monthly report shall contain sufficient information to indicate whether the minimum surface water treatment requirements (i.e., log removal/inactivation of *Giardia*, virus, and *Cryptosporidium*) are met.
    b. **Required Treatments Credit —** The treatment credits required and granted for the processes in 3KWTP (TP015) are summarized below.

Park City Water System (UTAH#22011)
3 Kings Surface Water Treatment Plant (TP015)
When operating as a Surface
Primary Treatment Technique: Conventional Filtration

Treatment Goals (Minimum Treatment Requirements)	***Giardia***	***Virus***	***Cryptosporidium***
	3-log removal / inactivation	**4-log removal / inactivation**	**2-log removal (Bin 1 source water)**
Processes	Credit Granted		
Conventional Filtration[1]	2.5-log removal	2-log removal	3-log removal
Chlorine[2]		≥2-log inactivation	
Ultraviolet[3]	0.5-log inactivation		0.5-log inactivation
Total Treatment Credit	**≥3-log removal / inactivation**	**≥4-log removal / inactivation**	**≥2-log removal / inactivation**

1. Granted based on R309-215-7(5) Table 215-1
2. *Based on the CT calculation by Jacobs during the plan review process*
3. *Based on NSF validation per the Environmental Technology Verification Report dated May 2013 (NSF 13/38/EPADWCTR, EPA/600/R-13/096)*

c. **Total Organic Carbon (TOC) Removal Requirement**— The required **TOC removal** percentage for the 3KWTP plant will be determined based raw water TOC and alkalinity levels shown in the table below:

Raw Water TOC (mg/L)	**Raw Water Alkalinity** (mg/L as $CaCO_3$)		
	0 to 60	>60 to 120	>120
>2.0 to 4.0	35%	25%	15%
>4.0 to 8.0	45%	35%	25%
>8.0	50%	40%	30%

d. Disinfection

i. The water system is required to continuously disinfect the treated water from this WTP.
ii. The disinfection treatment shall be sufficient to ensure the total treatment processes of this WTP achieve at least 3-log inactivation/removal of *Giardia lamblia*, 4-log inactivation/removal virus, and a minimum of **2**-log *Cryptosporidium* removal (for treating Bin **1** source water). [R309-200-5(7)(a)(i); R309-215-15(12)].
iii. The calculated disinfection CT for all processes shall be reported monthly to indicate the level of disinfection effectiveness. [R309-215-15(19)]

3. <u>Disinfection at Point of Entry (POE)</u> [R309-200-5(7), R309-215-15(19)]

a. The water system is required to continuously disinfect the treated water from this WTP. [R309-200-5(7)]

b. The Point of Entry (POE) location is defined as the weir at the end of the chlorine clearwell basin.
c. The chlorine residual must not be below **0.2** milligram per liter (mg/L) free chlorine residual at the point of entry (POE), where the treated water enters the distribution system, for more than four hours. [R309-200-5(7)(a)(ii)]
d. The chlorine residual must not exceed the maximum residual disinfectant level (MRDL) of **4.0** mg/L free chlorine residual. [R309-200-5(3)(c)(iv) Table 200-5]
e. **Daily** POE chlorine residual readings shall be collected and recorded on the monthly report.
f. The chlorine analyzer should be verified for accuracy or calibrated at least **quarterly** per Standard Method 334.0 *Determination of Residual Chlorine in Drinking Water Using an Online Chlorine Analyzer.* [EPA 815-B-09-013 September 2009 11.1.1.2 Page 13]
    i. A Hach Pocket Colorimeter DPD colorimetric method (e.g. Method 8021) is an acceptable method for verifying on-line chlorine residual analyzers (e.g. for Hach Cl17 online analyzer). If the verification fails, online analyzer adjustments will be made until the accuracy is achieved. A calibration will be conducted if verification testing cannot be accomplished successfully.

4. **<u>Turbidity Limit Issues</u>**

a. Conventional Filtration
The **combined filter treated water (CFE)** turbidity shall be less than or equal to **0.3** NTU in **at least 95%** of the measurements taken each month. The **CFE** turbidity shall at no time exceed **1.0** NTU. [R309-200-5(5)(a)(i); R309-215-9(1)]

5. <u>Turbidity Monitoring and Reporting — General</u>

a. The turbidity readings during the operation and maintenance procedures, such as plant start-up, clean in place, enhanced flux maintenance, air scrub, integrity tests, etc., can be excluded from the report. Operational logs and/or SCADA shall reflect the conditions causing false turbidity readings.

b. The turbidity of the combined filter treated water (CFE) and each individual filter treated water (IFE) shall be **continuously monitored**. [See R309-215-9(1)(a) for CFE monitoring, and R309-525-15(4)(b)(vi) and (4)(c)(vii) for IFE monitoring.]

c. The turbidity of the combined filter treated water (CFE) and each individual filter treated water (IFE) shall be **continuously recorded**. [R309-215-9(1)(b)]

d. The water system shall monitor the turbidity results of each CFE at a minimum frequency of every 15 minutes. [R309-215-9(1)(b)]

e. **The highest CFE turbidity reading at the end of each four-hour (or shorter) interval** of operation must be included in the monthly surface water treatment plant report submitted to the Division, excluding data described in #5a. [R309-215-9(1)(b)]

f. Turbidity Measurements Reporting [R309-215-9(1) (c), R309-215-9(4)(a) and R309-215-9(5)(a)]
    i. Total number of the 4-hour combined filter treated water (CFE) turbidity measurements reported during the month (see #5e).
    ii. The number and percentage of 4-hour combined filter treated water (CFE) turbidity measurements reported during the month, which are less than or equal to 0.3 NTU, excluding data described in #5a.
    iii. The date and value of any turbidity measurement taken during the month, which exceed 1.0 NTU for a water system using conventional or direct filtration

g. If there is a failure in continuous monitoring equipment, the water system shall conduct grab sampling for turbidity every **four** hours. [R309-215-9(1)(b)]
    i. The grab sampling, in lieu of continuous monitoring, cannot be more than five working days for water systems serving a population of 10,000 or more, following the failure of equipment.
    ii. The grab sampling, in lieu of continuous monitoring, cannot be more than fourteen days for water systems serving a population less than 10,000, following the failure of equipment.

h. If any treated water turbidity measurements exceed **5.0** NTU, the water system shall report to the Director as soon as practical, but no later than 24 hours after the turbidity exceedance is known. The date and value of any turbidity measurements exceeding 5.0 NTU shall be reported. [R309-215-9(1)(c)(iii)]

i. If the set turbidity limit for the approved treatment technology is exceeded, the water system must comply with the re-sampling and notification requirements. [R309-215-9(2)]
    i. Re-sample as soon as practicable and preferably within one hour.
    ii. If re-sampling confirms the exceedance of the turbidity limit —
        1. The water system shall collect at least one bacteriological sample near the first service connection from the source within 24 hours of the turbidity exceedance. This sample result shall be included in determining bacteriological compliance for that month.
        2. The water system shall report this turbidity re-sampling exceedance to the Director as soon as practical, but no later than 24 hours after the turbidity exceedance is known. This reporting is in addition to reporting the incident on any monthly WTP reports.

j. The water system using conventional filtration or direct filtration shall inform the Division as soon as possible, but no later than the end of the next business day if any time the combined filter treated water (CFE) turbidity exceeds **1.0** NTU. [R309-215-9(6)(a)]

6. <u>Turbidity Equipment Verification and Calibration</u>

Continuous turbidity monitoring equipment for the combined filter treated water (CFE) and each individual filter treated water (IFE) shall be checked for accuracy and/or re-calibrated at a minimum frequency of **monthly**. [R309-215-9(1)(d)]

a. The accuracy of each turbidimeter shall be **verified** at least **once per month**.

b. The turbidimeters should be thoroughly **cleaned and calibrated** with primary standards at least **quarterly**.

c. It is not allowed to calibrate on-line instruments by comparison with a bench-top turbidimeter.

d. The most recent verification/calibration date for the CFE turbidimeter and each IFE turbidimeter shall be reported on the monthly report.

7. **Additional Reporting and Recordkeeping Requirements for Water Systems Serving a Population of Less Than 10,000** [R309-215-9(5)]

a. The water systems using conventional and direct filtration shall maintain the results of individual filter (IFE) monitoring for at least three years.

b. The water system shall **record** the results of IFE monitoring every 15 minutes.

c. The water system shall **report** that they have conducted IFE turbidity monitoring.

d. The water system shall **report** IFE turbidity measurement results only if one of the following conditions exists. [R309-215-9(5)(b)]

i. For any IFE (or CFE for water systems with two filters that monitor CFE in lieu of IFE) that has a measured turbidity level greater than **1.0** NTU in two consecutive recordings taken 15 minutes apart, the water system shall include in the monthly report:
   1. Filter number(s)
   2. The corresponding date(s)
   3. The turbidity values exceeding 1.0 NTU
   4. The cause of the exceedance (if known) [R309-215-9(5)(b)(i)]

ii. If a water system is required to report for three months in a row for IFE (or CFE for water systems with two filters that monitor CFE in lieu of IFE) turbidity exceeding **1.0** NTU in two consecutive recordings taken 15 minutes apart, the water system shall conduct a self-assessment of the filter within 14 days of the day the filter exceeded 1.0 NTU in two consecutive measurements for the third straight month unless a comprehensive performance evaluation (CPE) is required. Water systems with two filters that monitor CFE in lieu of IFE must conduct a self-assessment on both filters. [R309-215-9(5)(b)(ii)]

iii. For any IFE (or CFE for water systems with two filters that monitor CFE in lieu of IFE) that has a measured turbidity level greater than **2.0** NTU in two consecutive recordings taken 15 minutes apart for two months in a row:
   1. the water system shall arrange to have a comprehensive performance evaluation (CPE) conducted by the Division or a third party approved by the Director no later than 60 days following the

day of the 2.0 NTU exceedance in two consecutive measurements for the second straight month.
2. The water system must **report** the CPE required and the date it was triggered.
3. The CPE must be completed and submitted to the Division no later than 120 days following the exceedance.
4. If a CPE has been completed within 12 prior months or the water system and the Division jointly participate in an ongoing Comprehensive Technical Assistance (CTA) project, a new CPE is not required. [R309-215-9(5)(b)(iii)]

8. **<u>UV Monitoring and Reporting</u>** [R309-215-15(19)(d) and R309-520-8]

This Monitoring and Reporting Protocol applies to water systems using UV for disinfection inactivation credit.

a. UV Reactor Monitoring Requirements
    i. To obtain disinfection credit of UV disinfection, the water systems shall monitor the parameters used as part of the dose monitoring algorithm continuously, i.e. at least once per minute. For example, UV reactors validated using the Calculated Dose Approach must monitor the following parameters continuously for each UV reactor that is in use, including flow rate, UVT, UV intensity sensor reading, lamp status, number of lamp rows on, calculated or validated dose, power ballast setting, and off-specification time.
    ii. Other parameters that are essential to operation and maintenance shall be monitored at the frequency recommended by the UV manufacturer or per EPA's 2006 Final UVDGM.
        1. Examples of these operational parameters:
        2. Reactor status and run time
        3. Water temperature
        4. Lamp hours
        5. Lamp sleeve cleaning records
        6. Cumulative number of lamp on/off cycles
        7. Calibration and verification of UV sensors
        8. Calibration of on-line UVT analyzers
        9. Date (or frequency) and type of maintenance/replacement of UV reactor components
b. UV Reporting Requirements
    i. Compliance reporting for approved UV disinfection credit shall be submitted to the State as a part of the surface water treatment rule compliance report on a monthly basis. The recording frequency shall be at least every 4 hours. The minimum validated dose recording is the lowest validated dose reading within a period of 4 hours. The daily minimum validated dose is the lowest value among the four-hour minimum values for each day.
    ii. As a minimum, the following parameters shall be included in the UV monthly compliance report:
        1. Daily minimum and maximum flow rate

2. Daily minimum UVT
3. Daily minimum validated dose (This depends on the dose monitoring approach. Use UV intensity in case of UV Intensity Setpoint Approach)
4. Daily minimum ballast power setting
5. Daily production volume for off-specification events
6. Total production volume through UV system in a month
7. Total Production volume for off-specification events in a month
8. Total off-specification percentage (based on monthly volume)
9. Target pathogen (Cryptosporidium, Giardia, and virus)
10. Target log
11. Actual log disinfection
12. Date of monthly verification of duty UV sensor calibration and date of yearly calibration of Reference UV sensor
13. Total number of UV sensors per reactor
14. Number of UV sensors per reactor in service that were verified for calibration
15. Number of verified sensors that were within the acceptable range of tolerance
16. Reactor number and UV intensity sensor correction factor (if any UV intensity sensor does not meet the calibration criteria and remains in service in a particular reactor)
17. Date of weekly calibration of on-line UVT analyzers
18. Indication of whether or not the UV facility met the following criteria:
    a. Total log disinfection greater than target log disinfection
    b. Flow rates less than the maximum validated flow rate
    c. At or above validated minimum UVT (if using the calculated dose approach as monitoring strategy)
    d. At or above validated power ballast minimum setting
    e. At or above the required dose or UV intensity
    f. Within the 5% off specification limit of the total volume of treated water each month

iii. Off Specification Reporting. The requirements of off specification reporting in this section are largely based on Section 6.4.1.3 of the 2006 Final UVDGM
    1. The calculated off specification percentage is based on the volume of water treated through the UV system. The off specification percentage must be no more than 5% of the monthly total production. The off specification total volume should be calculated by totaling the off specification time and associated volume released during those periods for each UV reactor (see Section 6.5.1 of the 2006 Final UVDGM).
    2. Five factors shall be considered contributing to off specification events:
        a. The UV facility operates outside of the validated limits, for example, validated dose is below required dose, flow rate greater than the maximum validated flow rate, UVT below

minimum validated value, ballast setting below the validated power setting, etc.

b. A UV sensor is not in calibration. For example, any of the duty sensors did not meet the calibration criteria, the failed duty sensors were not replaced with calibrated duty sensors, or a UV sensor correction factor was not applied.
c. The UVT analyzer, which is part of the dose monitoring strategy, is found to be out of calibration and the remedial actions are not completed per the protocol prescribed in 6.4.1.2 of the 2006 Final UVDGM.
d. UV equipment and replaced components are not equivalent to or better than the equipment components validated. This UV equipment remains off specification until proper replacement takes place.
e. Failure of flow meters or missing data necessary for dose calculation.

iv. UV Sensor Calibration and Reporting.

1. The monthly compliance report shall contain:
   a. Total number of UV sensors per reactor
   b. Number of UV sensors per reactor in service that were verified for calibration
   c. Number of verified sensors that were within the acceptable range of tolerance
2. The water systems shall have adequate inventory of duty UV sensors to allow immediate replacement of a failed duty UV sensor.
3. Re-calibrate or replace duty UV sensors if excessive drift or error occurs (i.e. greater than 20%).
4. Reference UV sensor shall be calibrated at least once a year at a qualified facility (such as the manufacturer). The date of the most recent UV reference sensor calibration shall be included in the compliance report to the State.
5. Duty sensors shall be verified for calibration at least monthly by verifying with at least two (2) reference sensors. All UV sensors in operation that month shall be verified for calibration. Date of the UV duty sensor verification shall be reported in the monthly report.
6. The water systems shall follow the verification protocol of duty UV sensors specified in Section 6.3 of the EPA Ultraviolet Disinfection Guidance Manual for the Final Long Term 2 Enhanced Surface Water Treatment Rule (2006 Final UVDGM). UV sensor correction factor shall be included in the compliance report if a failed duty UV sensor is not replaced with a calibrated duty UV sensor. However, this approach shall not be used for long-term operation and the UV sensor problem should be resolved as quickly as possible.
7. If a UV sensor correction factor (CF) is applied to allow a UV duty sensor that failed the UV sensor verification criteria to remain in

service on an interim basis, the reactor number, the UV sensor number, and its UV sensor correction factor must be reported. (

v. UVT Analyzer Calibration and Reporting. UVT analyzer calibration is required for the UV reactor validated based on the Calculated Dose Approach, because UVT is an integral part of the dose monitoring strategy.
    1. The online UVT analyzers should be calibrated at least weekly by comparing the on-line UVT measurement using a bench-top spectrophotometer.
    2. The UVT calibration frequency can be reduced to once a month if approved by the Executive Secretary when sufficient data (a minimum of a one-year period) indicate that the UVT analyzer is consistently within the allowable calibration error without adjustment for more than a month.

9. Source Water Bin Classification

The source waters Judge Tunnel (WS001), Thiriot Spring (WS003), Spiro tunnel Bulkhead (WS006), and Spiro tunnel Plan Treated water (WS008) of the 3 Kings WTP (TP015) has not undergone Bin classification for Cryptosporidium respect to R309-215-15(11).These sources are assumed to be classified as in Bin 1 with respect to R309-215-15(11).

Upon determination of any of the following source waters Judge Tunnel (WS001), Thiriot Spring (WS003), Spiro tunnel Bulkhead (WS006), and Spiro tunnel Plan Treated water (WS008) as Ground Water Under the Influence of Surface Water (GWUDI), the system will be required to begin monitoring for Bin classification. This will determine the Bin number and the corresponding Cryptosporidium removal requirement.