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Complete Water Management

March 12, 2021

Jim Pex, P.E., Principal Engineer
Flagline Engineering
686 NW York Drive, Suite 100
Bend, OR 97703

# RE: HYDROGEOLOGIC INVESTIGATION, JOHN DAY, OREGON

Dear Mr. Pex:

CwM H2O, LLC (CwM) is pleased to provide Flagline Engineering (Flagline) with this scope of work and cost estimate to develop a hydrogeologic investigation to assist with Oregon Department of Environmental Quality negotiations and the development of a Water Pollution Control Facility Permit (WPCF) for the City of John Day, Oregon.

Flagline previously approved a scope of work for CwM and Kennedy-Jenks Consultants (KJC) to meet with Oregon Department of Environmental Quality (ODEQ) to discuss the status of the project and assess the regulatory path required by ODEQ to develop a new WPCF permit for the City. CwM and KJC met with ODEQ on January 28th and February 11th, 2021. The goal of the meetings was to establish the institutional and technical benchmarks required for developing a WPCF permit under the new United States Environmental Protection Agency (EPA) guidance (EPA, 2021) which is based on the U.S. Supreme Court Maui Decision (see Regulatory Background in the section that follows).

The purpose of this scope of work is to provide sufficient hydrogeologic evidence to ODEQ to establish that a permitting path for a state issued WPCF permit (a discharge to groundwater) is appropriate and meets the new criteria under a 2020 change in federal law and the recently published United States Environmental Protection Agency (EPA) guidance (EPA, 2021). Based on CwM's review of the new regulatory framework posed by the U.S. Supreme Court Maui Decision (see Regulatory Background in the following section) a robust analysis of the groundwater system is proposed to establish a fact pattern that will allow ODEQ to issue the WPCF permit under new permitting criteria.

CwM is proposing three phases of consulting and investigation to meet this goal. Each phase will be followed by a check-in with ODEQ on the findings of the previous phase and to provide the regulator the opportunity for input on the next proposed phase of work. CwM will document each meeting. If ODEQ proposes valid technical comments or requests for additional work beyond that proposed, CwM will either incorporate the request into the next phase of work or address the ODEQ request in writing as to how the comment or request is met by the



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original proposed scope of work. Following each post-phase meeting and response to ODEQ, CwM will request approval to proceed from Flagline for the next Phase of work.

The proposed phases of work as follows:

- Phase One – Project Planning, Hydrogeologic Conceptual Model and Field Plan
- Phase Two – Site Investigation and Preliminary Groundwater Model
- Phase Three – Infiltration Design and Pollutant Loading Evaluation

CwM proposes each of these three phases of work based on the project objectives and goals. The sections that follow outline new regulatory framework for developing a permit to allow the release of treated wastewater. CwM's project understanding is also presented based on the available information reviewed to date.

## Regulatory Background

On April 23, 2020, the United States Supreme Court decided on the County of Maui v. Hawaii Wildlife Fund case and issued a final decision (the Maui decision or Maui) that directed the Environmental Protection Agency (EPA) to develop new rules that define when a regulatory agency may use a state issued WPCF permit or when the federal permitting path for an NPDES permit is required. In this case, the County of Maui was sued by the Hawaii Wildlife Fund to prevent the discharge of wastewater to a lava tube (groundwater) that conveyed the wastewater offshore and emptied into the Pacific Ocean. The County of Maui lost the case because their discharge to the lava tube and out to the Pacific was found to be the "functional equivalent" of a pipeline discharging offshore as a point source of pollution. The County of Maui was required to abandon their WPCF permit and seek a federal NPDES permit.

On January 14, 2021, EPA issued guidance that clarifies how the Maui decision should be applied under the NPDES permit program. The guidance is intended to help clarify when a NPDES permit is necessary under the Clean Water Act or if a state can issue a WPCF permit in the place of an NPDES permit.

The guidance includes seven non-exclusive factors for the regulated community (City) and permitting authorities (ODEQ) to consider when evaluating whether a discharge of a pollutant from a point source that travels through groundwater to a water of the United States is the "functional equivalent" of a direct discharge from a point source to a Water of the United States (WOTUS). This guidance places the functional equivalent analysis into context within the existing NPDES permitting framework and identifies an additional factor for the City and ODEQ to consider when evaluating whether and how to perform a "functional equivalent" analysis.

CwM proposes to address each of the seven non-exclusive factors of these new criteria as part of this scope of work. This work will assist ODEQ in developing their functional equivalency analysis, support the City's desired outcome for a WPCF permit, establish optimum discharge loads that can be accommodated by the groundwater system, help the engineering design



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team select an optimum treatment process, refine the site selection of the infiltration site to optimize subsurface treatment and residence time, and provide input on a technically sound and operationally pragmatic point of compliance for long-term groundwater monitoring .

## Project Understanding

CwM proposes to complete a hydrogeologic evaluation of an alluvial sand and gravel deposit and its associated shallow aquifer. This deposit in the area of the proposed facility has been extensively modified by gold dredging operations from approximately 1898 to 1948. Most of the finer grained materials have been removed in the gold dredging process and the remaining materials are identified as primarily washed gravel and cobble dredge deposits. The dredge deposits of interests were left in-place along the north shore of the John Day River, just west of the City of John Day, Oregon (City). The City is developing an approach to designing a new WWTP with an option to discharge effluent to a subsurface infiltration system. This study is intended to evaluate the proposed effluent infiltration proposed and how this option will meet the new federal EPA Guidance and state required regulatory framework for a WPCF permit.

CwM understands that the alluvial sand and gravel deposit and aquifer is intended to act as part of an infiltration system for treated effluent under a proposed new WPCF permit application. Among several effluent constituents CwM assumes that temperature loading, the total nitrogen loading, and resulting nitrate concentrations in groundwater are the primary contaminants of concern. Based on these assumptions, CwM's work will focus on developing an infiltration strategy to manage and naturally attenuate the potential temperature and nitrogen loading in the alluvial aquifer, and ultimately to the John Day River.

The goal of this hydrogeologic and water quality investigation is to demonstrate that the performance of a thoughtfully placed and designed infiltration system can meet ODEQ's new "Maui" matrix of criteria for allowing treated effluent infiltration through the unsaturated vadose zone and into a groundwater system under a WPCF permit. Specifically, the goal is to demonstrate that changes to the effluent occur in the subsurface, be they chemical, dilution, dispersion, or temperature and that the release of effluent to groundwater is not "functionally equivalent" to a point source discharge to the John Day River. The objectives of this work include the following:

- Demonstrate "proof of concept" that there is a chemical change in the form of denitrification occurring in the subsurface. Denitrification is the loss or removal of nitrogen or nitrogen compounds by bacteria that usually results in the escape of nitrogen into the air. Even a small rate of denitrification will have a significant impact on the reduction of nitrate in the groundwater system.
- Demonstrate "proof of concept" that there is significant dilution and dispersion of infiltrated effluent constituents along the groundwater flow path between the proposed facility and the point of discharge to the John Day River



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- Demonstrate that either the current location of the infiltration system is sufficient, or that a new location can improve the residence time in the aquifer and the dilution and degree of dispersion of infiltrated effluent. Both factors reduce the concentration of nitrate and other wastewater constituents along the groundwater flow path as well as the ultimate potential load to the John Day River.
- Demonstrate the attenuation of thermal energy of the discharged effluent in the subsurface.
- Use a groundwater flow model to identify optimum location(s) for the development of an infiltration system on the alluvial deposit.
- Use a groundwater flow model to optimize effluent loading rates at the infiltration system and limit the duration and extent of groundwater mounding under the system.
- Use a groundwater flow model as a tool to run loading scenarios and to size infiltration operations to meet peak flows while maintaining optimum groundwater levels and subsurface treatment.

The proposed work incorporates previous field work completed by other consultants. In addition, CwM's scope of work addresses technical questions posed by ODEQ staff regarding aquifer transmissivity estimates, final infiltration system design parameters for managed natural attenuation of key water quality components, infiltration rates, as well as the fate and transport of nitrogen in infiltrated waters. The groundwater modeling component will inform the infiltration design, the resulting groundwater quality, and the appropriate groundwater monitoring design for the purpose meeting WPCF monitoring conditions.



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# Phase One – Project Planning and Hydrogeologic Conceptual Model

This phase of work includes five tasks. In this phase of work CwM proposes to:

- Develop a project plan to meet new ODEQ requirements,
- collect information on the regional and local geology,
- report on the hydrogeologic conditions present in the alluvial aquifer targeted for infiltration,
- develop a field approach, schedule, and investigation plan,
- complete a Field Plan that includes a site Health and Safety Plan and a Sampling and Analysis Plan,
- develop technical specifications for a drilling and pump contractor, and;
- prepare and attend a review meeting with ODEQ.

## *Task 1.1 – Project Planning*

CwM will work with Flagline and the design consultant, Kennedy Jenks Consultants (KJC), to develop at project approach and permit strategy to address ODEQ requirements. The project planning will incorporate the technical tasks required by ODEQ and a timeline to complete those tasks. Project planning will include adaptive management of the project tasks and close communication with Flagline and KJC on project progress and substantive changes in the proposed scope of work. Changes in the scope of work may occur as new information from technical tasks is analyzed and reported. Changes may include additions or deletions from this scope of work to best meet the City's goals for the project. All proposed changes will be documented and if incorporated into the scope of services, any changes will be budgeted, scheduled, and provided to Flagline for approval.

## *Task 1.2 – Hydrogeologic Conceptual Model*

CwM will collect available technical reports for review and incorporation into the hydrogeologic evaluation of the alluvial aquifer. These include available information from the City, previous consultant reports, well logs from Oregon Water Resources Department (OWRD), water quality records reported to ODEQ, river hydrology, regional and local geology, other geologic or hydrogeologic reports available from the US Geologic Survey, and Geographic Information Systems (GIS) databases available from public and proprietary sources.

### Local Hydrogeology

This data will be used to develop our understanding of the geologic, hydraulic, and hydrogeologic conditions in and around the alluvial dredge deposits in preparation for post-Phase One meetings with ODEQ regulators and design team members. CwM will characterize the local hydrogeology of the local John Day area with a focus on the alluvial aquifer. A hydrogeologic conceptual model of the alluvial aquifer and its interactions with the John Day



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River and existing infiltration basins will be presented. The thickness and extent of the alluvial aquifer will be evaluated based on previous work and available historic records and well logs that penetrate the aquifer. Geologic cross-sections of the alluvial deposits will be developed based the available information and presented in a Preliminary Hydrogeology Report.

### Environmental History

CwM will also conduct a review of ODEQ's Environmental Cleanup Site Information (ECSI) database. DEQ maintains its Environmental Cleanup Site Information database to track sites in Oregon with known or potential contamination from hazardous substances, and to document sites where DEQ has determined that no further action is required. CwM will identify and document known environmental clean-up actions that might be affected by the infiltration of the City's treated wastewater. The results of this review will inform CwM on the potential for existing subsurface conditions at identified environmental clean-up sites. Any modifications of this scope due to identified environmental conditions in the subsurface are currently outside the scope of this work.

CwM will review the location of previous proposed infiltration locations based on the hydrogeologic evaluation and the review of historic environmental clean-up site status. CwM may propose new alternate locations for the infiltration system based on these evaluations.

## Task 1.3 Field Investigation Plan

In CwM's discussions with ODEQ, two data gaps in the subsurface conditions of the proposed infiltration site were identified. ODEQ requires representative estimates of vertical conductivity in the unsaturated zone and of the aquifer transmissivity. The subsurface at the infiltration site includes both an upper unsaturated zone, called the vadose zone, and a deeper saturated aquifer zone. The vadose zone extends from the land surface to the saturated aquifer. The vertical conductivity will be tested in a series of excavated test pits above the seasonal high groundwater elevation. The aquifer transmissivity will be determined by stressing the aquifer with a constant rate pumping test that meets professional standards.

CwM proposes to develop a field investigation plan that outlines the methods and procedures that will be used to complete this testing. A copy of the plan will be shared with ODEQ, Flagline, and KJC for review and comment. The plan will include a field work schedule to fill data gaps noted by ODEQ technical staff in our recent January 2021 meetings, confirm previous subsurface investigations, and investigate any approved alternate location for infiltration systems based on the hydrogeologic conceptual model completed in this task. The locations for the wells and test pits will be presented in the field investigation plan for review by ODEQ, KJC and Flagline.

The Field Plan will also incorporate field Health and Safety Plan for all CwM personnel and a Sampling and Analysis Plan to document sampling methods and sample handling procedures.



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## *Task 1.4 Contractor Technical Specifications*

Due to the shallow nature of the alluvial aquifer, the proposed pumping well and monitoring wells for the aquifer test cannot be installed under Oregon's standard well construction rules. CwM proposes to work with Oregon Water Resources Department to confirm pumping well and monitoring well designs that can be approved for a variance in Oregon's well construction standards. CwM will then develop a technical specification for the test pit excavation, installation of the pumping well, monitoring wells, and constant rate aquifer test. The technical specification will be provided to a minimum of two drilling contractors for the purpose of driller selection.

The contractor selection will occur in Task 2.1 Initial Site Visit and Contractor Selection.

## *Task 1.5 Phase One - ODEQ Review Meeting*

CwM will organize a post-Phase One meeting with ODEQ's case worker and regional hydrogeologist to review the Alluvial Aquifer Hydrogeologic Conceptual Model and Field Investigation Plan. CwM will provide ODEQ with the Technical Memorandum and Field Investigation Plan one week prior to the date of the meeting. CwM's meeting with ODEQ will be documented. ODEQ comments and requests will be noted by CwM for the project record. CwM will respond to ODEQ on each noted comment.

Any changes to the following phase of work, Phase Two- Site Investigation and Testing, will be incorporated or addressed in writing to ODEQ. Any changes that require a change in the scope of work or cost estimate will be documented and provided to Flagline for review and approval.

## Phase One Deliverables:

- Preliminary Report - Alluvial Aquifer Hydrogeologic Conceptual Model
- Field Investigation Plan
- Field Investigation Technical Specifications
- Documentation of ODEQ requests and comments and any response to ODEQ.

## Phase One Consulting Cost Estimate

Table 1.1 – Phase One Cost Estimate presents the costs estimates for services described in Tasks 1.1 to 1.5. CwM's professional consulting service is presented separately from the estimated costs for outside contractors.



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Table 1.1 – Phase One Cost Estimate

| Phase | Description | Consulting Hours | Consulting Costs | Outside Services | Total |
|---|---|---|---|---|---|
| One | Project Planning, Hydrogeologic Conceptual Model, and Field Plan | 183 | $23,330 | $0 | $23,330 |



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# Phase Two – Site Investigation and Preliminary Groundwater Model

Phase Two presents the preliminary scope of work for the field investigation and follow-on development of a preliminary groundwater model. The intent of the field investigation is to conduct testing to estimate vadose zone and aquifer hydraulics and the potential for denitrification in the subsurface. The results of this work will feed into a preliminary groundwater contaminant fate and transportation model.

Completing the field investigation will directly address ODEQ concerns regarding the measurement of the vadose zone infiltration rates and aquifer transmissivity. Developing the preliminary model will create a tool for discussion of the modeled system and an opportunity to get direct input from ODEQ on location and configuration options for the infiltration design.

## *Task 2.1 – Field Investigation and Contractor Selection*

The schedule of field work is split into three field visits. These field visits include an initial site walk to mark the locations for the installation of an aquifer test well, monitoring wells, new test pits, and a final visit to complete water quality sampling and conduct a constant rate aquifer test. The contractor needed to support the field task will be contacted and selected following the first field visit. CwM will update Flagline on final contactor cost estimates.

### Field Visit 1 – Initial Site Visit and Contractor Selection

CwM hydrogeologists will complete the first field visit to review site conditions and mark sites for test pits, a pumping well, and two monitoring wells. Wood stakes will be used to mark proposed locations and Geographic Positioning System (GPS) coordinates will be collected for each marked location. CwM expects to coordinate with City and Flagline staff to complete this initial visit.

Following this visit CwM will coordinate with local or regional subcontractors to obtain cost estimates based on the Technical Specifications developed in Phase One. CwM proposes to select and manage the subcontractors needed to complete this work. One or more contractors may be selected based on the qualifications, availability, and cost for each component of the work. CwM will provide a final selection recommendation to Flagline for review and approval.

### Field Visit 2 - Test Pits, Pumping Well, and Monitoring Wells.

A CwM hydrogeologist or geologist will meet the selected excavation subcontractor on-site to observe the excavation of up to four test pits or up to one-day of excavation operations. The test pits will target the proposed infiltration system location. Test pits will be dug to approximately 8-feet in depth, or until the water table is reached. A geologic log of the soils and sediments observed in the excavation will be completed to record the findings.



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During Field Visit 2, the hydrogeologist will also meet with the selected drilling contractor to observe and record the geologic log and as-built construction of the nominal 8-inch diameter aquifer test well and screen and two 2-inch PVC monitoring wells. All new wells installed will be developed by the drilling contractor under observation of a CwM hydrogeologist. Transducers will be placed in the pumping well, monitoring wells, and in the John Day River to assess long-term background water level response between the river and the wells in the alluvial aquifer. The documentation of each excavation and well installation will be included in the Phase Two Technical Memorandum- John Day Field Investigation Results.

### Field Vist 3 – Three Day Aquifer Test

CwM's meeting with ODEQ identified the lack of reliable aquifer transmissivity analysis and vertical permeability evaluation as a significant data gaps in the site characterization. Accurate aquifer characterization is critical to demonstrating the function of the proposed infiltration system as well as the best location for the infiltration system. To address ODEQ concerns, CwM proposes to complete a constant rate aquifer test at the pumping well installed during Field Visit 2. Vertical infiltration of the vadose zone will also be tested near the proposed infiltration site. The details of the means and methods will be documented in the Field Investigation Plan.

This field visit will focus on the field set-up, operation, and observation of a three-day aquifer pumping and recovery test. The 72-hour aquifer test is the professional standard recommended for developing a reliable estimate of aquifer properties in an unconfined alluvial aquifer. During this field visit, a CwM hydrogeologist will work with the selected contractor to complete a 72-hour constant rate test and the follow-on 72-hour recovery period, or to aquifer recovery to at least 95 percent of draw down.

Water levels will be monitored by hand and by automated datalogging transducers in the pumping well, two monitoring wells, and at the river. Other key monitoring points may be identified in Field Visit 1 and included in the by-hand water level data collection. A satellite telemetry survey of the elevations of the wells and other measuring points will also be included in the consulting scope of work.

## *Task 2.2 – Water Quality and Nitrogen Isotope Analysis*

Nitrogen isotope studies of groundwater are proposed here because of their potential to reveal critical information concerning nitrogen sources and biochemical cycling processes. Published literature suggests that significant denitrification can occur in alluvial aquifers and along the groundwater flow path, even in variable oxygenation conditions. Confirming that denitrification occurs is one component of the strategy to demonstrate to ODEQ that infiltration of treated effluent into the groundwater is not the "functional equivalent" a point source discharge to surface water.



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This task proposes a nitrogen isotope analysis of groundwater as part of a water quality investigation to demonstrate "proof of concept" that some degree of denitrification is occurring along the groundwater flow path from the existing WWTP end-of-pipe, at the infiltration ponds, and then to the three down gradient monitoring wells. Because of their locations within the same section of the alluvial aquifer, the processes observed down-gradient of the existing WWTP are assumed to occur at the proposed facility as well. Gathering evidence that denitrification occurs is part of demonstrating that infiltration to the subsurface can provide managed natural attenuation of the nitrogen load to the groundwater system and ultimately the John Day River.

To complete this water quality investigation, CwM will collect approximately nine (9) groundwater samples. The samples will include two grab-samples of treated effluent, one from the end-of-pipe and one from an active infiltration pond, and five groundwater quality samples. The groundwater will be collected at five groundwater monitoring locations. One sample each will be collected from the two existing monitoring wells immediately downgradient from the existing infiltration ponds and one sample each will be collected from the proposed pumping well and monitoring wells. Two samples will be used as duplicates. This group of samples will be tested for stable isotope concentrations of nitrogen and oxygen within nitrate molecules that are present in the water. The results will assess the relative denitrification process occurring in the groundwater system. The samples will also be tested for overall nitrate concentration. These two datasets together can help identify the relative contributions of dilution and denitrification to changes in nitrate levels.

The water quality samples will be collected during Field Visit 3 and shipped to a qualified water quality laboratory. The results of this analysis will be reported in the Phase Two - Technical Memorandum John Day Field Investigation and Preliminary Groundwater Model (Task 2.4).

## *Task 2.3 – Preliminary Groundwater Model (Model)*

The information gathered in the Conceptual Hydrogeologic Model and Field Investigations will be incorporated into two separate groundwater models available from the United States Geologic Survey (USGS). CwM selected the USGS three-dimensional MODFLOW model for groundwater flow as well as fate and transport of nitrate. The MODFLOW model will be used to characterize the existing groundwater flow conditions within the alluvial aquifer and between the aquifer and the John Day River. A two-dimensional USGS heat transport model, VS2DH Ver. 1.3, was selected to demonstrate heat transport and attenuation in the aquifer. As a work of the United States Government, these USGS software products are in the public domain within the United States and are free to use without copyright.

The groundwater modeling work is proposed in two steps: 1) develop the model based on existing conditions and the current infiltration pond sites and 2) utilize the model to assess variations in the location and configuration of the proposed infiltration trench as well as



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changes in pollutant loading to assess an optimum treatment capacity in the vadose zone and alluvial aquifer system. The first step is presented here in Phase Two. The second step, optimization and assessment of design options, is presented in Phase Three to get ODEQ input on the model and design options and to contrast the potential for design improvement in the operation of the infiltration trench.

## Hydrogeology and Groundwater System Modeling

The work under this task will evaluate current conditions with average seasonal effluent loading to the existing (old) infiltration ponds and current average end-of-pipe nitrogen concentrations. The goal of this task is to characterize the response of the aquifer to the following;

- Fate and transport of nitrate in groundwater,
- aquifer residence time,
- natural attenuation of nitrate along the groundwater flow path (denitrification), and;
- the thermal attenuation of infiltrated effluent along the groundwater flow path and where the modified effluent re-enters the John Day river.

The results of this modeling task will support CwM's proposed response to EPA's seven point permitting matrix for a WPCF permit. Based on EPA guidance the seven-point decision matrix must demonstrate that infiltration of the treated effluent is not "functionally equivalent" to a direct discharge to the John Day River under an NPDES permit. Based on CwM's discussions with ODEQ, the elements of the future internal ODEQ decision matrix may include rate of infiltration, degree of mounding, residence time in the aquifer, flow path of infiltrated effluent, temperature loading to the John Day river, and the chemical fate of the contaminants of concern focused on total nitrogen and nitrate. Each of these criteria will be addressed in this groundwater modeling task.

The groundwater modeling will include developing the model to simulate current background conditions and operations, and finally the thermal attenuation model to demonstrate the cooling of the infiltrated effluent along the groundwater flow path. The following list captures the proposed computational scenarios during this characterization:

**Background Conditions:**

- Operations of each existing percolation pond.
    - SWL in aquifer each season.
    - Recharge from and discharge to the river each season.
    - Flow-paths from ponds to the river each season.
    - Nitrate plume with and without denitrification.

- Aquifer without any input to percolation ponds.
    - SWL in aquifer (for mounding comparison) each season.



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- Recharge from and discharge to the river each season.
- Flow-paths through the alluvial aquifer each season.

**Thermal Parameter Modeling:**

- Heat transport through aquifer.
  - VS2DH model of heat fate and transport.
  - Approx. temperature at discharge to the river.

## *Task 2.4 Technical Memoranda- Field Investigation, Nitrogen Isotopes in Groundwater Investigation, and Preliminary Groundwater Model*

In this Task, CwM will summarize the procedures, analyses, and results of the field testing, water quality, and preliminary groundwater model in three separate technical memoranda. A draft copy of each report will be provided to Flagline and KJC for review and comment before submittal to ODEQ. Flagline and KJC will have 14-days to comment. Comments on the draft reports will be reviewed and incorporated into the final reports at the discretion of CwM. CwM will respond to all comments provided by Flagline and KJC within 14 days. The final reports will be stamped by an Oregon Registered Geologist.

### Field Investigation

The first memorandum will discuss the test pit excavation, well installation, percolation tests, and aquifer pump test analysis. The focus of this report will be describing the physical characteristics of the alluvium in the area immediately around the proposed facility based on direct observations, as well as the hydraulic properties of both the vadose zone and saturated aquifer. The long-term observation data from the transducers over the length of this project phase will be used to discuss the hydraulic connection between the John Day River and the observation wells at the proposed location. The first report will also describe how this information will be incorporated into the groundwater model.

### Nitrogen Isotopes in Groundwater

The groundwater quality study will be described in a second memorandum. The report will include a brief review of literature on the use of isotopes in similar systems and a review of field procedures. The nitrate concentration data and isotope ratio data will be interpreted. Finally, the report will discuss how the results fit into the Maui functional equivalency criteria framework and how the results will be incorporated into the groundwater model.

### Preliminary Groundwater Models

The third memorandum will discuss the model development process and the structure of the resulting baseline model. This will include a form of model calibration using existing historical data and simulations of operations of the existing percolation pond facilities.



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## *Task 2.5 Phase Two ODEQ Technical Meeting*

CwM will organize a post-Phase Two meeting with ODEQ's case worker and regional hydrogeologist to review the results of the field investigation and use the preliminary model to illustrate the fate and transport of nitrate, and thermal attenuation of effluent under current conditions. CwM will lead a discussion on options to change the location and configuration of the infiltration trenches to increase the treated effluent travel time in the alluvial aquifer and establish meaningful compliance criteria and monitoring. ODEQ input on these options will be important to establish the final infiltration trench location and configuration.

CwM will provide ODEQ with the Phase Two Technical Memorandum – Field Investigation Preliminary Groundwater Model one week prior to the date of the meeting. CwM's meeting with ODEQ and the discussed decision points will be documented. ODEQ comments and requests will be noted by CwM for the project record. CwM will respond to ODEQ on each noted comment.

Any changes to the following phase of work, Phase Three –Groundwater Model, will be incorporated or addressed in writing to ODEQ. Any changes that require a change in the scope of work or cost estimate will be documented and provided to Flagline for review and approval.

### Phase Two Deliverables:

- Bid Sheet and Final Contractor Selection Recommendations
- Technical Memorandum – John Day Field Investigation (Draft/Final)
- Technical Memorandum – Nitrogen in Groundwater Investigation (Draft/Final)
- Technical Memorandum - Preliminary Groundwater Model (Draft/Final)
- Technical presentation summarizing the findings for the ODEQ Meeting (PowerPoint)
- Documentation of ODEQ review and comments.

### Phase Two Consulting Cost Estimate

Table 2.1 Phase Two Cost presents CwM's consulting and Outside Services for subcontractors. Table 2.2 Subtotal Details on Outside Services.



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Table 2.1 – Phase Two Cost Estimate

| Phase | Description | Consulting Hours | Consulting Costs | Consulting Expenses | Outside Services | Total |
|---|---|---|---|---|---|---|
| Two | Site Investigation and Preliminary Groundwater Model | 419 | $50,308 | $5,045 | $84,288 | $139,641 |

Table 2.2 – Subtotal Details on Outside Services

| Item | Description | Estimated Subtotal |
|---|---|---|
| 1 | Excavation Contractor | $1752 |
| 2 | Well Installation | $28,481 |
| 3 | Well Abandonment | $17,060 |
| 4 | Pumping Equipment and Labor | $25,899 |
| 5 | Beta Analytic (Isotope Lab) | $4,166 |
| 6 | Water Quality Lab | $714 |
| 7 | Transducer Rental | $1,984 |
| 8 | Sampling Equip. Rental | $1,587 |
| 9 | Elevation Survey | $2645 |
| | **Subtotal** | **$84,288** |



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# Phase Three - Infiltration Design and Pollutant Loading Evaluation

The groundwater model developed in Phase Two will be used to simulate several potential design options for the proposed infiltration system. The design options will include input from ODEQ and the KJC WWTP design team based on their review comments of the preliminary model.

## *Task 3.1 – Groundwater Modeling-Design Options*

This information will be used to construct and run several groundwater modeling scenarios to support the approval of a WPCF permit. The infiltration options considered will include the primary infiltration site selected in the latest Wastewater Master Plan Update (Anderson Perry, 2019) as well as up to two alternate locations. The goal of this task is to characterize the response of the aquifer to variations of the following;

- Fate and transport of nitrate at a targeted likely effluent concentration,
- mounding potential beneath the infiltration sites to assess optimum infiltration rates at average monthly flow rates,
- aquifer residence time for each scenario,
- natural attenuation of nitrate along the groundwater flow path, and;
- the thermal attenuation of infiltrated effluent before the groundwater flow path re-enters the John Day river for seasonal average rates.

The model scenarios will be used to demonstrate that infiltration of the treated effluent is not "functionally equivalent" to a direct discharge to the John Day River under an NPDES permit.

The groundwater modeling will include developing the model to simulate:

- The proposed primary trench location operations with three trench configurations,
- then provide two scenarios for alternative trench locations, and;
- the thermal attenuation model to demonstrate the cooling of the infiltrated effluent on a seasonal basis and at annual average monthly rate.

The following list captures the proposed computational scenarios during this optimization exercise:

**Planned Infiltration Trench Location Operations:**

- Single Trench (200 x 4.25 ft, 5 ft deep) at 0.30 MGD
    - Mounding level and shape each season.
    - Treated water flow path and residence time each season.
    - Discharge area into river each season.



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  - Change in Nitrate concentrations from infiltration to joining with the John Day River with denitrification based on the water quality analysis in Phase Two, Task 2.3.

- Two Trenches (200 x 4.25 ft, 5 ft deep) at 0.15 MGD each, spread north-south.
  - Mounding level and shape each season.
  - Treated water flow path and residence time each season.
  - Discharge area into river each season.
  - Nitrate concentration at discharge with denitrification.

- Three Trenches (200 x 4.25 ft, 5 ft deep) at 0.10 MGD each, overlapping north-south
  - Mounding level and shape each season.
  - Treated water flow path and residence time each season.
  - Discharge area into river each season.
  - Nitrate concentration at discharge with denitrification.

**Alternative Site Infiltration Trench Operations:**

- Single Trench (200 x 4.25 ft, 5 ft deep) at 0.30 MGD
  - Mounding level and shape each season.
  - Treated water flow path and residence time each season.
  - Discharge area into river each season.
  - Nitrate concentration at discharge with denitrification.

- Two Trenches (200 x 4.25 ft, 5 ft deep) at 0.15 MGD each, spread north-south.
  - Mounding level and shape each season.
  - Treated water flow path and residence time each season.
  - Discharge area into river each season.
  - Nitrate concentration at discharge with denitrification.

The groundwater model can also be used to complete additional computational runs to optimize the location, design, operations, and monitoring of the proposed facility. Additional model runs are not included in this scope of work. If requested CwM estimates that each would take approximately 20-hours of staff time to discuss the changes, complete the model set-up, and report on the results.

## *Task 3.2 – Infiltration Optimization Results and Recommendations*

In this Task, CwM will summarize the procedures, analyses, and results of the infiltration optimization exercises and provide recommendations for infiltration system design in a report format. Recommendations will include optimum infiltration trench location and configuration.



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Summaries of the field work and analysis completed, and the results of the proposed groundwater model computational scenarios, will also be presented in this report. Previous technical memoranda will be included as appendices. A draft copy of the report will be provided to Flagline and KJC for review and comment before submittal to ODEQ. Flagline and KJC will have 14-days to comment. Comments on the Draft Report will be reviewed and incorporated into the final report at the discretion of CwM. CwM will respond to all comments provided by Flagline and KJC within 14 days. The final report will be stamped by an Oregon Registered Geologist.

### *Task 3.3 – Presentation of Results to ODEQ*

The results of this hydrogeology and groundwater system modeling work will also be presented as a PowerPoint presentation suitable to support a technical meeting with ODEQ.

### Phase Three Deliverables:

- Draft Report- Infiltration Design and Pollutant Loading Evaluation.
- Technical Presentation of findings, conclusions, and recommendations (PowerPoint).
- Documentation of ODEQ review and comments.
- Final Report

### Phase Three Consulting Cost Estimate

The cost estimate for CwM's consulting and estimated outside expenses is presented in Table 3.1 Phase Three Cost Estimate, below.



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Table 3.1 – Phase Three Cost Estimate

| Phase | Description | Consulting Hours | Consulting Costs | Consulting Expenses | Outside Services | Total |
|---|---|---|---|---|---|---|
| Three | Infiltration Design and Pollutant Loading Evaluation | 143 | $17,840 | $0 | $0 | $17,840 |



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## Summary of Project Cost Estimate and Schedule

Please see the time and materials cost estimate to provide these services below. CwM estimates that approximately 745 hours of professional time will be required to support the proposed services for an estimated cost of approximately **$91,487** plus **$5,043** of direct expenses for a consulting services total of **$96,523**. The costs CwM estimates for contractors, equipment, instruments, and laboratory analysis is **$84,288**.

CwM assumes that contractors will be selected by CwM under a CwM contract with costs passed on to Flagline Engineering or directly to the City at a 15% mark-up.

We anticipate an approximate 16-week schedule following the first field visit. The general schedule for proposed activities includes:

**Phase One- Project Planning, Hydrogeologic Conceptual Model, and Field Plan**

- March 26th to April 23rd 2021
- Meeting with ODEQ the Week of May 3rd

**Phase Two – Site Investigation and Preliminary Groundwater Model**

- May 10th to June 18th , 2021
- Meeting with ODEQ the Week of June 29th

**Phase Three – Infiltration Design and Pollutant Loading Evaluation**

- July 5th to July 16th
- Meeting with ODEQ to present the final findings the Week of August 2nd.

This schedule assumes a late-March start, incremental approval of each of the three phases of work by the City and three check-in meetings with ODEQ. Reviewing of the findings of each phase of work with ODEQ adds approximately six additional weeks to the schedule. The schedule also assumes minimal delays occur with scheduling ODEQ meetings, outside contractor schedules, and laboratory contractors.

## Option for Accelerated Schedule

CwM can accelerate the schedule if the City is willing to approve Phase One and Phase Two immediately to allow the preliminary hydrogeologic conceptual model work to run in parallel with the proposed field investigation and preliminary groundwater model development. If accelerated the project schedule would consolidate Phase One and Phase Two team reviews and ODEQ meetings. However, a request for ODEQ review of the Field Plan would still be requested. This change would essentially eliminate one meeting cycle. This could save up weeks on the entire schedule with potential to complete all phases of work by the end of June.



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Another option to shorten the schedule would be to reduce the team review time to one week for each submittal. This could save an additional two to three weeks.

In closing, CwM sincerely thanks the City of John Day, Oregon and the project team members Flagline Engineering and Kennedy Jenks Consultants for requesting this scope of proposed hydrogeologic services. CwM will endeavor throughout the project to innovate and look for project management options that can decrease costs while maintaining the technical integrity of this hydrogeologic evaluation. We are looking forward to starting this project at Flagline's and the City's earliest convenience.

Sincerely,

**CwM H2O, L.L.C.**

Robert Long, RG, LHG, CWRE
Principal Consultant

Cc: Mark Cullington P.E., Kennedy Jenks Consultants



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