SEASIDE BASIN WATERMASTER
REQUEST FOR SERVICE

**DATE:** September 2, 2021 **RFS NO.** 2021-01 Amendment No. 1
(To be filled in by WATERMASTER)

**TO:** Hale Barter
Montgomery & Associates
PROFESSIONAL

**FROM:** Robert Jaques
WATERMASTER

**Services Needed and Purpose:** Perform additional hydrogeologic consulting services as described herein.

**Completion Date:** All work of this RFS shall be completed not later than December 31, 2021, and shall be performed in accordance with the Schedule described in Attachment 2.

**Method of Compensation:** Time and Materials (As defined in Section V of Agreement.)

**Total Price** The Total Price for RFS No. 2021-01 is increased by $19,290.00 by this Amendment No. 1, and the Total Price for RFS No. 2021-01 is therefore increased to $36,610.00.

**Total Price** may not be exceeded without prior written authorization by WATERMASTER in accordance with Section V. COMPENSATION.

**Requested by:** Robert Jaques Date: 9/2/21.
WATERMASTER Technical Program Manager

**Agreed to by:** Date: 9/3/21.
PROFESSIONAL

# ATTACHMENT 1

## SCOPE OF WORK

PROFESSIONAL was authorized by RFS No. 2021-01 to perform general on-call hydrogeologic consulting services. WATERMASTER wishes to also have PROFESSIONAL perform an analysis of groundwater flow directions and velocities to determine where seawater that might potentially intrude into the Paso Robles aquifer along the coastline will move and at what speed. This Amendment No. 1 to RFS No. 2021-01 authorizes the performance of the work described in Attachment 2 hereto.

# ATTACHMENT 2

MONTGOMERY & ASSOCIATES
Water Resource Consultants

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1814 Franklin Street, Ste. 501
Oakland, CA 94612
510.903.0458

June 3, 2021

Mr. Bob Jaques
Seaside Watermaster Technical Program Manager
83 Via Encanto
Monterey, CA 93940

**SUBJECT: SCOPE FOR ASSESSMENT OF SEASWATER INTRUSION TRAVEL TIME TO SEASIDE PRODUCTION WELLS**

Dear Mr. Jaques

Montgomery & Associates (M&A) appreciates the opportunity to provide this scope of work for assessing the trajectories and potential range of travel times of potential seawater intrusion from locations along the coastline to municipal and irrigation water supply wells screened in the Paso Robles formation in the Northern Coastal Subarea of the Seaside Basin. As per your request, we also provide an additional cost estimate for an expanded scope to perform the same the analysis for both the shallow Paso Robles and the deeper Santa Margarita aquifers.

While the Seaside Basin Watermaster Model ("the Model") could be used for this type of analysis, this would require first updating the model to reflect current and recent pumping operations, estimated groundwater recharge and boundary conditions, and validating the updated model against recently observed water levels. The Model was most recently updated in 2018 to include historical operations and conditions through the end of 2017. Some of these new model update activities are already scheduled to occur as part of ongoing work that M&A is carrying out in support of the permitting for the Pure Water Monterey (PWM) aquifer replenishment project, which will also include estimates on the impacts of the PWM injection future water levels. These PWM activities, however, will likely not be completed until later this summer and would thus delay a preliminary analysis of potential seawater intrusion travel times.

What we propose as an alternative, is a hybrid analytic approach for estimating travel trajectories and travel times from the coastline that integrates aquifer parameters for the Paso Robles formation from the calibrated Seaside model, including aquifer thickness, hydraulic conductivity and storage coefficients, with groundwater elevation maps based on recent groundwater level monitoring data in the shallow aquifer that reflect current conditions and operations in and around the Northern Coastal Subarea of the basin. These groundwater elevation maps would be conceptually similar to the contour maps of the shallow aquifer that are regularly developed for the annual Sea Water Intrusion Analysis Reports, but would focus only on the Northern Coastal subarea and would include refined contours based on all available monitoring data, including available data from the Cal-Am ASR and PWM projects.

The contour maps will represent the potentiometric surface that drives groundwater flow and in combination with the aquifer parameters from the model by applying Darcy's law, they can be used to generate flow fields that can be used to estimate groundwater velocities and travel times from one point in the aquifer to another. The advantage of this approach is that we benefit both from using aquifer data already developed for the Model combined with actual groundwater level measurements reflecting current basin operations and conditions.

The travel trajectory and travel time analysis can be automated in GIS using an existing groundwater particle tracking toolset implemented and available within the ESRI ArcGIS Spatial Analyst Toolbox. M&A has recently used these tools in support of work in the Santa Cruz Mid-County groundwater basin to estimate travel times between proposed injection wells and water supply and will adapt existing workflows developed during that work to minimize the effort necessary for this analysis. Particles will be released along the entire extent of the coastline of the Seaside basin and the portions of the neighboring Monterey basin and tracked inland to determine if, and when they reach the vicinity of the supply wells screened in the Paso Robles formation. Groundwater travel times are very sensitive to the effective porosity of the aquifer; and since the effective porosity of the Paso Robles is not a calibrated parameter from the Model, upper and lower bound estimates on the travel times will be developed based on considering a reasonable range of aquifer effective porosities supported by available field data and literature values to provide a range of possible travel times.

A map displaying the trajectories of the released particles, color coded by the travel times from their initial locations will be produced to provide a clear visualization of the potential pathways and travel times from the coastline. Similar types of visualization have been developed in support of planning and permitting for the Pure Water Monterey project and the Cal-AM/MPWMD ASR projects. An example is shown in Figure 1 which shows simulated particle travel paths and travel times from existing and proposed Pure Water Monterey deep injection wells to downgradient productions wells in the Santa Margarita formation for modeling conducted in support of the proposed Pure Water Monterey Project Expansion Supplemental EIR. For the analysis proposed in this scope of work we would instead have these particle path-lines that start off along the coastline and then move inland, with the color-coding indicating estimates for how much time it takes to move inland.

The tasks to be performed are detailed in the following scope of work.

**Scope of Work**

**TASK 1 – Develop Groundwater Elevation Surface Map Snapshots of Aquifer(s)**

M&A will review available groundwater level monitoring data for supply and monitoring wells in the Northern Coastal Subarea and will develop a dataset to be used for creating a groundwater elevation map of the Paso Robles aquifer, representative of recent conditions in the subarea. Generally speaking, even when groundwater levels fluctuate seasonally in relation to seasonal demands, the average velocity can be evaluated through use of an

average groundwater level (e.g. during periods of peak pumping, gradients are steeper and groundwater velocities are faster, and in periods of lower pumping, the gradients decrease and groundwater velocities are slower, and average gradients will adequately represent the average velocities). The groundwater elevation map will incorporate observed levels in the Paso Robles aquifer (and optionally also the Santa Margarita aquifer) along the coastline and will also incorporate overlapping pumping cones of depression and injection mounds associated with extraction and injection wells during the monitoring period.

The analysis will assume that average groundwater levels remain at the same conditions for the duration of the travel time analysis.

**TASK 2 – Perform Particle Tracking and Travel Time Analysis on the Developed Water Elevation Map**

M&A will extract the spatially variable hydraulic aquifer properties from the Model grid and convert into the GIS format used by the particle tracking tool set.

The travel time analysis tools assume that hydraulic heads remain constant for the duration of the analysis. This is equivalent to assuming that moving forward the pumping and recharge conditions in the basin will be such that the current hydraulic heads would still be a representative snapshot of conditions in the future. This is a simplification that will allow for an initial assessment of an average ground water velocity field representative of current basin conditions and a range of potential travel times under the assumption that we could temporarily freeze the conditions in the basin. The approach also assumes that flow is two-dimensional and horizontal and uniform across the thickness of the aquifer. Broadly speaking this is the same approach used for preliminary assessment of well head protection zones for the Pure Water Monterey Project.

The particle tracking analysis will be performed for the groundwater level map developed in Task 1, and a lower and upper range effective porosity will be evaluated, for a total of two sets of particle tracking runs.

The analysis considers only advective groundwater transport and does not consider spreading of a potential salinity plume due to hydrodynamic dispersion which would have the effect of some particle flow paths getting farther out in a shorter amount of time.

From the results of the particle tracking analysis the map that will be produced will show the path that particles of water released at the coast take as they travel inland, color-coded by the estimated travel time. A table will also be produced summarizing the range of estimated travel times to the supply wells for the simulated conditions.

**TASK 3 –Technical Memorandum and TAC Presentation**

M&A will prepare a technical memorandum which documents Tasks 1 and 2, with a synthesis of the results for the conditions and scenarios evaluated. For costing purposes, we

assume preparing one draft, responding to and addressing one round of review comments, and one final version of the report. The report will be provided in Microsoft Word and PDF formats.

M&A will present the results to the Seaside Basin Technical Advisory Committee (TAC) at a regularly scheduled TAC meeting. The presentation will review the analysis assumptions and results, and provide any additional information requested by the TAC. After making the TAC presentation M&A will also make a similar presentation of the results to the Watermaster Board at one of its meetings.

**Staffing Plan**

Georgina King, P.G., C.Hg., will be the project manager, and Pascual Benito, Ph.D. will be the technical lead overseeing the work. Pascual is an experienced hydrogeologist who is currently supporting the Pure Water Monterey indirect potable reuse project and as needed hydrogeological services for the Seaside Basin Watermaster and it also supporting modeling work for the Salinas Valley groundwater basin sustainability plans. Derrik Williams, P.G., C. Hg., will provide senior review.

**Project Budget and Schedule**

We anticipate that the work for only the Paso Robles aquifer can be completed within a two-month period, though the timing may depend on the scheduling of TAC and Board meetings. We can begin work on this immediately following notice to proceed.

The total cost estimate for these tasks for the Paso Robles aquifer is $19,290 as detailed in the attached Table 1.

Please feel free to contact us with any questions about the proposed scope of work and budgets.

Sincerely,

E.L. MONTGOMERY & ASSOCIATES

Pascual Benito, Senior Hydrogeologist

Pascual U. Benito

MONTGOMERY
& ASSOCIATES

Georgina King. Senior Hydrogeologist

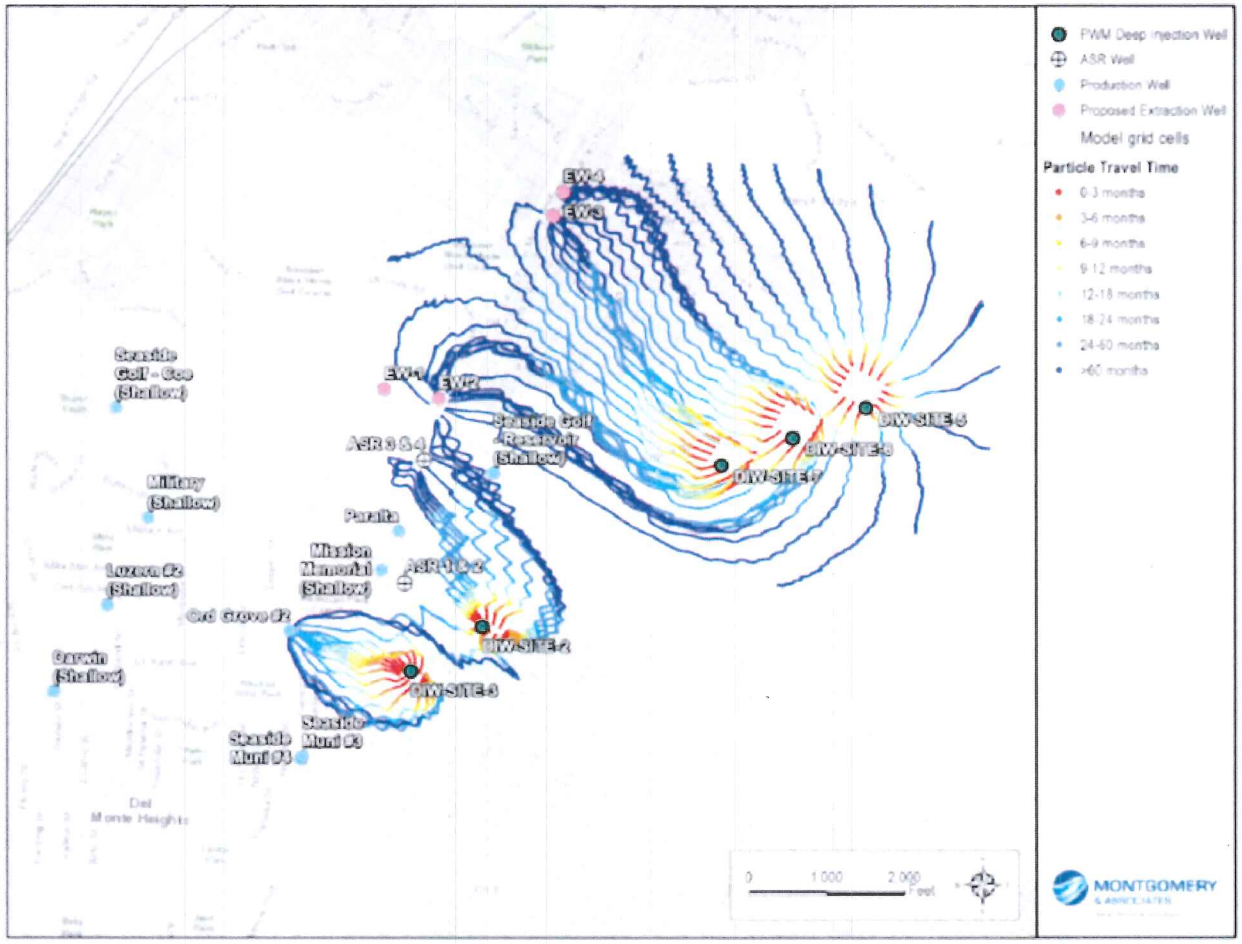


*Figure 1. Sample visualization of particle travel paths and travel times. Source: Expanded Pure Water Monterey Groundwater Replenishment Project Supplemental EIR Groundwater Modeling Analysis Memo (M&A, 2019).*

MONTGOMERY & ASSOCIATES

*Table 1. Detailed Cost Table –Analysis for Paso Robles Aquifer Only*

| Cost Estimate for Seaside Basin Sea Water Intrusion Travel Time Estimates | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Montgomery & Associates Labor | | | | | | Other Direct Costs | TOTALS |
| | | Scientist VIII | Scientist VI | Scientist V | Scientist III | Labor Total | | | |
| | | D. Williams | G. King | P. Benito | | | | | |
| Task | Hourly Rates | $260 | $215 | $195 | $150 | Hours | ($) | ($) | |
| 1.0 | DEVELOP GROUNDWATER LEVEL MAPS | | | | | | | | |
| | Review and compile monitoring data & previous modeling results and develop hydraulic head maps for current conditions | 1 | 2 | 6 | 12 | 21 | $3,660 | $0 | $3,660 |
| | *Task 1 Subtotal* | *1* | *2* | *6* | *12* | *21* | *$3,660* | *$0* | *$3,660* |
| 2.0 | PERFORM PARTICLE TRACKING & TRAVEL TIME ANALYSIS | | | | | | | | |
| 2.1 | Prepare Aquifer Parameter + hydraulic head GIS grid input files | 0 | 0 | 4 | 8 | 12 | $1,980 | $0 | $1,980 |
| 2.2 | Particle Tracking Runs & Travel Analysis | 0 | 0 | 8 | 16 | 24 | $3,960 | $0 | $3,960 |
| 2.3 | Develop travel time maps and tables | 0 | 0 | 4 | 14 | 18 | $2,880 | $0 | $2,880 |
| | *Task 2 Subtotal* | *0* | *0* | *16* | *38* | *54* | *$8,820* | *$0* | *$8,820* |
| 3.0 | TECHNICAL MEMORANDUM AND TAC & BOARD PRESENTATIONS | | | | | | | | |
| | Document, Summarize & Synthesize Analysis and Results | 4 | 8 | 10 | 14 | 36 | $6,810 | $0 | $6,810 |
| | *Task 3 Subtotal* | *4* | *8* | *10* | *14* | *36* | *$6,810* | *$0* | *$6,810* |
| | **Total** | **5** | **10** | **32** | **64** | **111** | **$19,290** | **$0** | **$19,290** |