CALIFORNIA
Water Boards

Gavin Newsom
Governor

Jared Blumenfeld
Secretary for
Environmental Protection

Central Coast Regional Water Quality Control Board

September 24, 2021

Sent Via Electronic Mail

Joe Mueller, Utilities Division Manager
City of Morro Bay Public Works
955 Shasta Ave.
Morro Bay, CA 93442
Email: jmueller@morrobayca.gov

Dear Mr. Mueller:

NOTICE OF APPLICABILITY, ENROLLMENT OF CITY OF MORRO BAY IN WATER QUALITY ORDER 2012-0010, *GENERAL WASTE DISCHARGE REQUIREMENTS FOR AQUIFER STORAGE AND RECOVERY PROJECTS THAT INJECT DRINKING WATER INTO GROUNDWATER*, AND TRANSMITTAL OF MONITORING AND REPORTING PROGRAM NO. R3-2021-0067

Central Coast Regional Water Quality Control Board (Central Coast Water Board) staff reviewed GSI Water Solution Inc.'s April 14, 2021 *Draft Technical Report: Notice of Intent to Enroll in ASR General Order (2012-0010) For Injection Well Testing* and GSI's August 26, 2021 *Draft Injection Testing Work Plan for Groundwater Replenishment and Reuse Project,* submitted on behalf of the City of Morro Bay. According to the information provided, the proposed pilot aquifer storage and recovery (ASR) project meets the conditions of Water Quality Order 2012-0010, *General Waste Discharge Requirements for Aquifer Storage and Recovery Projects that Inject Drinking Water into Groundwater* (General Permit). This letter serves as a notice of applicability for enrollment of a **pilot** ASR project in the General Permit. This letter also includes site-specific requirements and facility information (Attachment 1), your monitoring and reporting program requirements (Attachment 2), a copy of the notice of intent with figures (Attachment 3), and a copy of the injection testing work plan (Attachment 4).

The City of Morro Bay must comply with the following:

1. **General Permit** – The City of Morro Bay must comply with all conditions and requirements of the General Permit. As described in the General Permit, ongoing

operation, maintenance, monitoring, and reporting are required. A copy of the General Permit is available electronically at the following link:

General Permit:
https://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2012/wqo2012_0010_with%20signed%20mrp.pdf

2. **Monitoring and Reporting Program** – The City of Morro Bay must comply with the requirements of Monitoring and Reporting Program No. R3-2021-0067 (Attachment 2).

   Per the Monitoring and Reporting Program, you are required to submit quarterly reports for the first four quarters of operation. These quarterly reports will be due by the **first day of the third month after the quarter.** Your first quarterly report for the October-December quarter is due on **March 1, 2022**.

   In additional to the quarterly reports, annual reports are required by April 1. Your first annual report is due on **March 1, 2022,** and every year afterwards for the duration of this project.

   The City of Morro Bay is required to submit all requested information electronically in a searchable PDF format by email to RB3-WDR@Waterboards.ca.gov using the transmittal sheet found at the link below as the cover page:

   https://www.waterboards.ca.gov/centralcoast/water_issues/programs/wastewater_permitting/docs/transmittal_sheet.pdf

   Additionally, the City of Morro Bay is required to submit reports in a searchable PDF format and laboratory data in EDF format electronically via GeoTracker (see Attachment 2 for instructions). Each monitoring report must include the transmittal sheet found at the link above as the cover page.

3. **Fees** – The City of Morro Bay paid an application fee of $2,848 on May 13, 2021, for coverage in the General Permit. The application fee will be prorated according to the notice of applicability's effective date and the remainder will be applied to next year's annual fee.

   The City of Morro Bay must also pay an annual fee to maintain coverage in the General Permit. Annual fees are determined by the State Water Resources Control Board's fee program and cover the state fiscal year of July 1 through June 30. Your current annual fee is $2,848. A copy of the current state fee schedule is available electronically at the following link:

   https://www.waterboards.ca.gov/resources/fees/water_quality/

Your facility currently is assigned a threat and complexity rating of 3C.

4. **Notification** – The Central Coast Water Board will be notified of your enrollment at a regularly scheduled public meeting on December 9-10, 2021. Details about that meeting are available on our website at:

   http://www.waterboards.ca.gov/centralcoast/board_info/agendas/

5. **Future Discharge Modification** – Pursuant to California Water Code section 13260, you must inform the Central Coast Water Board at least 120 days prior to modifying your discharge. Prior to any modification of your discharge, you must submit a revised notice of intent to the Central Coast Water Board for review and approval that documents proposed changes to the potable water and injection system at the facility. If there are any significant changes in either treatment or disposal methodologies, or the volume or character of the treated wastewater, you must notify the Central Coast Water Board immediately of such changes.

6. **Regulatory Coverage Duration** – Operation of the pilot test must not extend beyond 24 months from the date this notice of applicability is issued.

7. **Responsible Party** – The City of Morro Bay is responsible for the management and disposal of the wastewater in compliance with the conditions of the General Permit. Any noncompliance with this General Permit constitutes a violation of the California Water Code and subjects the City of Morro Bay to enforcement action and/or termination of enrollment under this General Permit.

8. **Change in Ownership** – In the event of any change in control or ownership of the property, the City of Morro Bay must notify the succeeding owner or operator of the existence of this General Permit by letter. A copy of the letter must immediately be forwarded to the Central Coast Water Board so that the new owner or operatory can be enrolled in the General Permit and your enrollment in the General Permit can be terminated.

If you have any questions, please contact Monique Gaido at (805) 549-3150 or **by email at Monique.Gaido@waterboards.ca.gov** or Jennifer Epp at (805) 594-6181 or by email at Jennifer.Epp@waterboards.ca.gov.

Sincerely,

Harvey Packard

Harvey C. Packard
2021.09.24 11:15:02 -07'00'

for Matthew T. Keeling
Executive Officer

Attachments:

1. Site-specific Requirements and Facility Information
2. Monitoring and Reporting Program No. R3-2021-0067
3. Draft Technical Report: Notice of Intent to Enroll in ASR General Order (2012-0010)
4. Injection Testing Work Plan for Groundwater Replenishment and Reuse Project

cc:
Tim Nicely, GSI Water Solutions, tnicely@gsiws.com
Lydia Holmes, Carollo, lholmes@carollo.com
Brynne Weeks, Carollo, bweeks@carollo.com
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WDR Program, RB3-WDR@Waterboards.ca.gov

MG
ECM/CIWQS Place = 868768
GeoTracker No. = WDR100053984
Rev 4/30/20
ECM Subject Name = INJECTION WELL TESTING – ENROLLMENT IN GENERAL WDR FOR AQUIFER STORAGE AND RECOVERY PROJECTS

R:\RB3\Shared\WDR\WDR Facilities\San Luis Obispo Co\City of Morro Bay IPR and ASR\City of Morro Bay ASR pilot\NOA for ASR GO - Pilot Test\Morro_Bay_NOA_ASR_Pilot_final.docx

ATTACHMENT 1

SITE-SPECIFIC LIMITS, REQUIREMENTS, AND FACILITY INFORMATION

1. PROJECT DESCRIPTION AND FACILITY INFORMATION

A. The City of Morro Bay intends to conduct a pilot aquifer storage and recovery (ASR) project by injecting potable water into a newly constructed well, Injection Well No. 1, storing the injected water in the Lower Morro Valley groundwater basin, and monitoring changes in water quality and water table elevations at a newly installed monitoring well, 21P-01 (see NOA Attachment 3). In accordance with the requirements of the Statewide General Order 2012-0010, a pilot injection test shall not exceed a length of time of two years. The intent of this project is to assess the feasibility of a permanent groundwater recharge project that would inject advanced purified recycled water. The injectate source water of the ASR pilot will be the City's State Water Project supply, which is treated to drinking water standards at the Polonio Pass Water Treatment Plant, pursuant to the requirements in the district's State Water Resources Control Board Division of Drinking Water (DDW) permit. Facility and ownership information are shown in Table 1.

On May 11, 2021, the City submitted a draft technical report describing the proposed well installation, development and pump-testing, injectate water quality, native groundwater quality, plans for injection, and plans for water quality and sediment sample collection (NOA Attachment 3). On August 26, 2021 the City submitted its *Draft Injection Testing Work Plan for Groundwater Replenishment and Reuse Project* (NOA Attachment 4).

B. **ASR Pilot Schedule:** The pilot injection test will be performed to obtain site-specific, empirical data that can be used to predict long-term performance, flow rates, number of wells needed, spacing of wells, and potential impacts to water quality. First, Injection Well No. 1 and Monitoring Well 21P-01 will be drilled, installed, and developed according to the proposed workplan (NOA Attachment 3). Pressure transducers will be installed in both the monitoring and the injection wells to monitor pressure, conductivity, and temperature throughout the initial aquifer testing and pilot injection testing. An eight-hour step drawdown test will be performed at Injection Well No. 1, followed by a 24-hour constant rate aquifer test to assess aquifer properties and flow rates for injection testing. To obtain relevant site-specific data while minimizing the potential for adverse water quality impacts, the ASR pilot injection test will be conducted in a stepwise manner. Initially a step injection test will be conducted using discrete flow rates, ranging between 10 to 80 gallons per minute (GPM) for 2-hour periods. Step-test data will be used to determine the optimal injection flow rate for a seven-day constant-rate test. Additional details of the injection testing work plan are presented in NOA Attachment 4. ASR pilot test data will be used to improve the groundwater model, evaluate area of influence, recommend optimal injection rates, and determine the number of wells and spacing of wells for recharge project planning.

Table 1. Facility and ownership information for the City of Morro Bay aquifer storage and recovery pilot project

Facility Name	City of Morro Bay Aquifer Storage and Recovery Project Pilot
Owner and Permittee	City of Morro Bay
Facility Physical Address	955 Shasta Ave, Morro Bay, CA 93442
Owner of Facility	City of Morro Bay
Operator of Facility	City of Morro Bay
Legally Responsible Official of Owner	Joe Mueller
Owner Mailing Address	955 Shasta Ave, Morro Bay, CA 93422
Employee Contact for Owner	Joe Mueller, Water System Manager
Employee Contact Phone	(805) 564-5571
Employee Contact Email	jmueller@morrobayca.gov

C. **ASR Sampling Schedule:** Prior to any injection activities, native groundwater quality samples will be collected from both Injection Well No. 1 and Monitoring Well 21P-01 on the last day of the constant-rate pumping test. During ASR pilot testing, Injection Well No. 1 will be sampled on the first and last day of the constant rate injection test to characterize injectate water quality and groundwater quality. Injection Well No. 1 will be tested weekly for the full suite of testing constituents for four weeks following injection testing to monitor changes in groundwater quality. Groundwater quality will be monitored at Monitoring Well 21P-01 using pressure, conductivity and temperature data obtained by the transducer. If transducer data indicate changes in groundwater quality, samples will be collected at Monitoring Well 21P-01 on the 3rd, 5th and 7th day of the constant-rate injection test and weekly for four weeks after the test completion for a full suite of testing constituents listed in NOA Attachment 4. If transducer data do not indicate changes in groundwater quality, samples will be collected weekly after the injection test has concluded for a reduced list of constituents. Sampling schedule and constituents are detailed in NOA Attachment 4.

D. **Geochemical Sampling and Testing:** Undisturbed sediment samples will be collected from the target aquifer zone at monitoring well 21P-01 for laboratory testing. The objectives of this testing are twofold: 1) to assess the potential for geochemical reactions that could clog the well screens and or soil pores during testing and 2) to assess the potential for adverse groundwater quality in the recovered water. Both native groundwater samples and treated injectate water will be used in the testing. The City of Morro Bay's consultant will also incorporate the USGS geochemical modeling package PHREEQC to investigate potential geochemical reactions occurring as a result of mixing water from two sources with the local aquifer sediments.

2. SITE-SPECIFIC REQUIREMENTS AND LIMITS

A. **Injection Rate Limits:** Maximum injection rate at Injection Well No. 1 must not exceed 350 GPM.

B. **Groundwater Limitations:** The City of Morro Bay must manage the operation to comply with the *Water Quality Control Plan for the Central Coastal Basin*[1] (Basin Plan). Specifically, the city must comply with section 3.3.4, Objectives for Groundwater, which currently includes:

   i. General objectives for tastes and odors and radioactivity for all groundwaters.

   ii. Objectives for municipal/domestic supply including organic chemicals, inorganic chemicals, and radio nucleotides, which are established at the drinking water Maximum Contaminant Levels (MCLs) as defined in California Code of Regulations, title 22, division 4, chapter 15[2].

[1] The 2019 edition of the Water Quality Control Plan for the Central Coastal Basin can be accessed on the Internet via the following webpage:
https://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/2019_basin_plan_r3_complete_webaccess.pdf

[2] Current MCLs are available at:
https://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/MCLsandPHGs.html

3. GROUNDWATER BASIN AND AQUIFER TARGET INJECTION ZONE

A. **Groundwater Basin:** Injection will occur into the Lower Morro Valley Groundwater Basin, basin number 3-41 per the numbering convention of the Department of Water Resources. The Basin Plan refers to this groundwater basin as the Morro Valley groundwater subbasin.

B. **Aquifer Target Injection Zone:** Treated surface water will be injected into the Lower Morro Valley Groundwater Basin (LMVGB). The LMVGB consists of two hydrostratigraphic units; both consist of unconsolidated sands and gravels. The target aquifer zone is the older, deeper alluvial aquifer, called the Lower Basin, at 60 to 80 feet below ground surface (bgs). The lower target aquifer is overlain by finer-grained deposits, creating confined conditions. Previous aquifer test results have shown the Lower Basin to have higher permeability than the shallower younger alluvial deposit. GSI's groundwater monitoring data have shown that the basin's major source of recharge is from Morro Creek streambed percolation. Water levels are also influenced by City extraction wells located north of Morro Creek (NOA Attachment 3). Injection Well No. 1 proposed construction includes a screened interval from 60-80 feet bgs, entirely within the Lower Basin. Proposed construction information for Injection Well No. 1 is shown in Table 2. Non-pumping groundwater flow direction is believed to be from northeast to southwest.

Table 2. City of Morro Bay proposed injection well location, well depth, screened intervals, and injection rate

Well name	Latitude	Longitude	Well depth (ft)	Screened interval depths (ft)	Injection Rate (GPM)
Injection Well No. 1	35.375999	-120.85584	90-100	60-80	350

4. INJECTATE WATER QUALITY AND SOURCE

A. **Water Treatment:** The City's primary water source is surface water from the State Water Project, which is sometimes blended with local groundwater. The City obtains State Water Project water from the Central Coast Water Authority's treatment plant located at 10923 Antelope Road, Shandon, San Luis Obispo County. Treatment of injectate water to drinking water standards is the responsibility of the Central Coast Water Authority. Groundwater extracted from the Lower Morro Valley Groundwater Basin will not be used in this pilot study. State Water Project water quality data is shown in Table 3.

B. **Injectate Water Quality:** According to the information provided, all of the treated water quality constituents of concern (as shown in Table 3) meet primary state and federal drinking water standards. The Basin Plan does not designate Basin-specific water quality objectives for the Lower Morro Valley Groundwater Basin.

5. AMBIENT GROUNDWATER QUALITY

Ambient groundwater quality reported for the City's well field complies with drinking water standards for all constituents except for nitrate and total dissolved solids. These constituents exceed the recommended concentrations for drinking water. The Basin Plan does not specify basin-specific water quality objectives for the Lower Morro Valley Groundwater Basin. Native groundwater quality for select constituents is shown in Table 3.

6. GROUNDWATER QUALITY MONITORING WELLS

A. To verify that injection water is not impairing groundwater quality, the City of Morro Bay will monitor groundwater quality in monitoring well 21P-01, located approximately 80 feet from Injection Well No. 1. The injection well and Monitoring Well 21P-01 will be monitored for temperature, pressure, and conductivity with dedicated transducers throughout the pilot project. Groundwater will be sampled at both locations during the constant rate aquifer test, prior to any injection activities, and weekly for four weeks after injection testing. Well 21P-01 will be drilled and screened entirely within the LMVGB with similar construction to Injection Well No. 1. The proposed location and construction details are summarized in Table 4.

Table 3. Groundwater Limitations, Anticipated Injectate Water Quality, and Native Groundwater Quality

Constituent	Units	Groundwater Limitations	Injectate Concentration[a]	Native Groundwater[b]
Arsenic	µg/L	10[c]	ND	3
Boron	mg/L	0.75[d]	ND	125
Chloride	mg/L	106[e]	73	238
Specific Conductance	µmhos /cm	900[f]	503	1,749
Iron	µg/L	300[g]	No data	No data
Manganese	µg/L	50[g]	No data	No data
Nitrate as N	mg/L	10[c]	ND	15
Sodium	mg/L	69[e]	56	94
Sulfate	mg/L	250[g]	63	127
Total Dissolved Solids	mg/L	500[g]	280	1,175
Haloacetic acids[h]	µg/L	60[c]	13	14.6
Trihalomethanes[i]	µg/L	80[c]	40	35

µg/L = micrograms per liter
mg/L = milligrams per liter
µmhos/cm = micromhos/centimeter
ND = non-detect
NA = not applicable

a. Injectate water data are reported for 2020 in the City of Morro Bay Annual Consumer Confidence Report.
b. Native groundwater data are raw water results taken from all City of Morro Bay groundwater wells as reported in the 2020 City of Morro Bay Annual Consumer Confidence Report. Note that nitrate and dissolved arsenic samples were for 2018.
c. US EPA and California Primary Maximum Contaminant Levels.
d. Central Coast Basin Plan Table 3-2 Water Quality Objectives for Agricultural Use
e. Central Coast Basin Plan Table 3-1. Guidelines for Interpretation of Quality of Water for Irrigation, Specific ion toxicity from foliar absorption.
f. California Code of Regulations, Title 22, Div 4, Chapter 15, Article 16 Recommended consumer acceptance contaminant levels
g. California Code of Regulations, Title 22, Div 4, Chapter 15, Article 16 Secondary Drinking Water Standards
h. Haloacetic acids include bromoacetic acid, chloroacetic acid, dibromoacetic acid, dichloroacetic acid, and trichloroacetic acid.

i. Trihalomethanes include bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

Table 4. Aquifer Monitoring Wells for Groundwater Quality

Well Name	Latitude	Longitude	Distance from Injection Well No. 1 (ft)	Proposed Well Depth (ft)	Proposed Screened Interval (ft bgs)	Aquifer Zone Completed
21P-01	35.37621	-120.855932	80.4	90-100	60-80	LMVGB

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
CENTRAL COAST REGION
895 Aerovista Place, Suite 101
San Luis Obispo, California 93401

MONITORING AND REPORTING PROGRAM NO. R3-2021-0067

for
THE CITY OF MORRO BAY'S
AQUIFER STORAGE AND RECOVERY PILOT PROJECT
SAN LUIS OBISPO COUNTY

This Monitoring and Reporting Program (MRP) describes requirements for monitoring an aquifer storage and recovery pilot project operated by the City of Morro Bay. This MRP is issued pursuant to Water Code section 13267. The City of Morro Bay must not implement any changes to this MRP unless and until a revised MRP is issued by the Central Coast Water Quality Control Board (Central Coast Water Board) Executive Officer.

The City of Morro Bay receives State Water Project water from the Polonio Pass Water Treatment Plant (PPWTP), which is owned and operated by the Central Coast Water Authority. The City of Morro Bay is subject to the Central Coast Water Board's notice of applicability, dated September 24, 2021, for Water Quality Order 2012-0010-DWQ*, General Waste Discharge Requirements for Aquifer Storage and Recovery Projects that Inject Drinking Water Into Groundwater* (General Permit).

1. SUPPLEMENTAL MONITORING AND REPORTING FOR ASR PILOT PROJECT

On August 26, 2021, GSI Water Solutions, Inc. submitted the updated *Draft Injection Testing Work Plan for Groundwater Replenishment and Reuse Project, Morro Bay, California*, which describes a water quality monitoring and reporting program for the ASR pilot testing. The Central Coast Water Board has reviewed and approves the proposed monitoring and reporting program submitted by the City of Morro Bay. The City of Morro Bay must at all times comply with this monitoring and reporting program and to the Draft Injection Testing Work Plan.

2. SAMPLING AND ANALYSIS

Within 90 days after issuance of the notice of applicability, the City of Morro Bay must submit a Sampling and Analysis Plan (SAP) to the Central Coast Water Board for approval. All samples must be representative of the volume and nature of the injected potable water or matrix of materials sampled. The name of the sampler, sample type (grab or composite), time, date, location, bottle type, and any preservative used for each sample must be recorded on the sample chain of custody form. The chain of custody form must also contain all custody information including date, time, and to whom the samples were relinquished. If composite samples are collected, the basis for sampling (time or flow weighted) must be approved by the Central Coast Water Board. Unless otherwise specified, sampling must be performed as specified in Table 1.

Table 1. Sampling Schedule

Monitoring Period	Sample Collection Month
Monthly	Each Calendar Month
Quarterly	February, May, August, November

Field instruments (such as those used to test pH, dissolved oxygen, and electrical conductivity) may be used provided that they are operated by a State Water Board California Environmental Laboratory Accreditation Program (ELAP) certified laboratory, or each of the following requirements are met:

1. The operator is trained in the proper use of the instrument;
2. The instruments are field calibrated prior to each use;
3. Instruments are serviced and/or calibrated by the manufacturer at the recommended frequency; and
4. Field calibration reports are submitted as described in the “Reporting” section of this MRP.

3. INJECTION WELL MONITORING

Injection wells must be monitored when water is being injected into the aquifer. Monitoring of the injection wells must include the constituents and parameters shown in Table 2. Injection wells to be monitored are shown in Table 3.

Table 2. Injection Well Monitoring

Parameter	Units	Type of Sample	Sampling Frequency
Well Operational Status	N/A	Recorded	Daily
Daily Average Injection Rate	gpd	Meter	Continuous
Injected Water, cumulative total for year to date	ac•ft/yr	Meter	Continuous
Extracted Water, cumulative total for year to date	ac•ft/yr	Meter	Continuous

Parameters must be reported for each well associated with the ASR project.
Injection activity must be recorded daily.
N/A = not applicable
gpd = gallons per day
ac•ft/yr = acre-feet per year

Table 3. Proposed Injection Well to be Monitored

Well name	State Well ID	Latitude	Longitude	Well depth (feet)	Screened interval depth (feet)
Injection Well No. 1	Not yet issued	35.375999	-120.855744	90-100	60-80

4. INJECTED WATER MONITORING

Injected water quality must be monitored at the wellhead inflow line when water is being injected into the aquifer. Monitoring of the injection well must include the constituents and frequencies shown in Tale 4. Sampling events will be timed according to injection activities as described in NOA Attachment 4. The sampling schedule includes four weekly sampling events following the injection testing at both the injection well and the monitoring well. If transducer data indicate changes in groundwater quality at the monitoring well, additional sampling during the aquifer test will occur as described in NOA Attachment 4. If transducer data do not show changes in groundwater quality at the monitoring well, weekly testing following the injection test will occur at the monitoring well for a reduced list of constituents as specified in NOA Attachment 4. If the City of Morro Bay chooses to continue injection testing activities, the City may request an alternative reduced frequency sampling schedule for injected water quality.

Table 4. Injection Water Monitoring

Constituent/Parameter	Units	Type of Sample	Sampling Frequency[a]
Dissolved Oxygen	mg/L	Meter	Quarterly
ORP	mV	Meter	Quarterly
pH	pH units	Meter	Quarterly
Specific Conductance	µmhos/cm	Meter	Quarterly
Arsenic (dissolved)	µg/L	Grab	Quarterly
Iron (dissolved)	µg/L	Grab	Quarterly
Manganese (dissolved)	µg/L	Grab	Quarterly
Nitrate (as Nitrogen)	mg/L	Grab	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly
Haloacetic acids	µg/L	Grab	Quarterly
Trihalomethanes	µg/L	Grab	Quarterly

[a] Injected water sampling is not required for any monitoring period during which injection did not occur.

mg/ L = milligrams per liter

ORP = oxidation-reduction potential

mV = millivolts
µg/L = micrograms per liter

5. EXTRACTION WELL MONITORING

The City of Morro Bay's injection well will also serve as an extraction well. An extraction well must be monitored if either of the following conditions apply:

1. An extraction well was used for injection the previous calendar year
2. An extraction well that is pumping a substantial amount of previously injected water

After four sampling events consistent with the frequencies described in this MRP, the City of Morro Bay may request annual extraction well monitoring. Monitoring of each extraction well must include the constituents and parameters shown in Table 5.

Table 5. Extraction Well Monitoring

Constituent/Parameter	Units	Type of Sample	Sampling Frequency[c]
Well Activity[a]	N/A	Recorded	Daily
Daily Average Pumping Rate	gpd	Meter	Continuous
Extracted Water/Year[b]	ac•ft/yr	Meter	Continuous
Specific Conductance	µmhos/cm	Meter	Quarterly
Arsenic (dissolved)	µg/L	Grab	Quarterly
Iron (dissolved)	µg/L	Grab	Quarterly
Manganese (dissolved)	µg/L	Grab	Quarterly
Nitrate (as Nitrogen)	mg/L	Grab	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly
Haloacetic acids	µg/L	Grab	Quarterly
Trihalomethanes	µg/L	Grab	Quarterly

[a] - Well Activity must be reported for all wells associated with the ASR project. Injection/extraction activity must be recorded on a daily basis.
[b] - Extracted Water/Year represents the total amount of water extracted from a well for the calendar year.
[c] - Extracted water sampling is not required for any quarter during which extraction did not occur.
µmhos/cm = micromhos per centimeter

6. AQUIFER MONITORING FOR GROUNDWATER QUALITY

To verify that injection water is not impairing groundwater quality, the City will monitor groundwater quality at one monitoring well before, during, and after this ASR pilot project. The installation and development of the injection and monitoring well pair will occur in the initial phase of this pilot test project. The monitoring well and corresponding injection well are shown in Table 6.

Table 6. Aquifer Monitoring Wells for Water Quality

Monitoring Well Name	Latitude	Longitude	Injection Well Name	Distance from Injection Well (ft)	Well Depth (ft)	Screened Intervals (ft bgs)
21P-01	35.37621	-120.855932	Injection Well No. 1	80.4	90-100	60-80

All aquifer monitoring samples must be collected using approved EPA methods. Groundwater elevations must be measured to determine injection-related drawup and radius of hydraulic influence for each injection well as well as regional groundwater gradient and direction of flow.

Prior to sampling, the groundwater elevations must be measured as described in section 7 below, and the wells must be purged of at least three well casing volumes until temperature, pH, and electrical conductivity have stabilized. Use of low flow or passive sampling methods that do not require well purging are acceptable if described in the approved SAP. Samples must be filtered using a 0.45-micron filter for dissolved constituents such as metals. Groundwater monitoring must include the constituents and frequencies described in Table 7. Groundwater quality monitoring must be conducted in accordance with Table 7 for each quarter that injection testing has occurred.

7. REPORTING

In reporting monitoring data, the City of Morro Bay must arrange the data in tabular form so that the date, sample type (e.g., source water, injection well, extraction well, etc.), and reported analytical result for each sample are readily discernible. The data must be summarized in such a manner to clearly illustrate compliance with the General Permit, notice of applicability (NOA), and Basin Plan. The results of any monitoring done more frequently than required at the locations specified in this MRP must be reported in the next scheduled monitoring report.

As required by the California Business and Professions Code sections 6735, 7835, and 7835.1, all groundwater monitoring reports must be prepared under the supervision of a registered professional engineer or geologist and signed by the registered professional.

Table 7. Aquifer Monitoring Parameters and Constituents for Groundwater Quality

Constituent/Parameter	Units	Type of Sample	Sampling Frequency[c]
Groundwater Depth	Feet	Measuring Tape	Quarterly
Groundwater Elevation	Feet NAVD88	Recorded	Quarterly
Specific Conductance	µmhos/cm	Meter	Quarterly
Dissolved Oxygen	mg/L	Meter	Quarterly
ORP	mV	Meter	Quarterly
pH	pH units	Meter	Quarterly
Arsenic (dissolved)	µg/L	Grab	Quarterly
Iron (dissolved)	µg/L	Grab	Quarterly
Manganese (dissolved)	µg/L	Grab	Quarterly
Nitrate (as Nitrogen)	mg/L	Grab	Quarterly
Total Dissolved Solids	mg/L	Grab	Quarterly
Haloacetic acids	µg/L	Grab	Quarterly
Trihalomethanes	µg/L	Grab	Quarterly

A letter transmitting monitoring reports must accompany each report. The letter must summarize the numbers and severity of violations found during the reporting period, and actions taken or planned to correct the violations and prevent future violations. The transmittal letter must contain the following penalty of perjury statement and must be signed by the Administrator or the Administrator's authorized agent:

> "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of the those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

The transmittal letter can be accessed via the following website: https://www.waterboards.ca.gov/centralcoast/water_issues/programs/wastewater_permitting/docs/transmittal_sheet.pdf

A. QUARTERLY MONITORING REPORT

The City of Morro Bay must **submit quarterly monitoring reports** for the first year of operation and annually thereafter. The monitoring period and corresponding report due date are described in Table 8. Quarterly monitoring reports must be submitted to the Central Coast Water Board by the **1st day of the third month after the quarter.** Quarterly reporting must occur in accordance with Table 8.

Table 8. Quarterly Reporting Schedule

Report	Monitoring Period	Report Due Date
First Quarter	January 1 to March 31	June 1
Second Quarter	April 1 to June 30	September 1
Third Quarter	July 1 to September 31	December 1
Fourth Quarter	October 1 to December 31	March 1

The quarterly monitoring report must include the following:

1. A discussion of compliance with the general order and a description of any violations.

2. A discussion of the status (dates of injection, extraction, storage, and idle time) for all extraction/injection wells associated with the ASR project.

3. A narrative description of all preparatory, monitoring, sampling, and analytical testing activities for the injection, extraction, and groundwater monitoring. The narrative must be sufficiently detailed to verify compliance with the General Permit, the NOA, this MRP, and the Standard Provisions and Reporting Requirements. The narrative must be supported by field logs for each monitoring well documenting depth to groundwater; parameters measured before, during, and after purging; method of purging; calculation of casing volume; and total volume of water purged.

4. Calculation of groundwater elevations, an assessment of groundwater flow direction and gradient on the date of measurement, comparison of previous flow direction and gradient data, and discussion of seasonal trends, if any.

5. Calculation of maximum groundwater drawup and maximum hydraulic radius of influence for each injection well.

6. Results of groundwater monitoring (analytical results tabulated with reporting limits for nondetectable results).

7. A narrative discussion of the analytical results for all groundwater locations monitored including spatial and temporal trends, with reference to summary data tables, graphs, and appended analytical reports (as applicable).

8. A comparison of monitoring data to the groundwater limitations presented in the NOA and an explanation of any violation of those requirements. Any other violation of the General Permit with explanation and corrective action to prevent future violations.

9. Summary data tables of historical and current groundwater elevations and analytical results.

10. A scaled map showing relevant structures and features of the facility, the locations of monitoring wells and any other sampling stations, and groundwater elevation contours referenced to mean sea level datum.

11. Copies of laboratory analytical report(s) for groundwater monitoring.

12. The Central Coast Water Board executive officer may modify the reporting requirements by issuing a revised MRP at any time.

B. ANNUAL MONITORING REPORT

The annual monitoring report must be submitted to the Central Coast Water Board by **March 1** each year, in accordance with Table 9.

Table 9. Annual Reporting Schedule

Report	Monitoring Period	Report Due Date
Annual Report	January 1 to December 31	March 1

The first year's annual monitoring report must summarize the first four quarters of reporting. Each annual monitoring report after the first year must include all the components that are required of quarterly monitoring reports. In addition, all annual reports must include the following:

1. **Water Quality and Public Health Goal Report**
   The annual water quality report and public health goal report published during the calendar year (if required by the Division of Drinking Water).

2. **Data Tables and Graphs**
   Tabular and graphical summaries of all monitoring data collected during the year.

3. **ASR Project Activity**
   Projected ASR project activity for the next calendar year.

4. **Compliance and Performance Discussion**
    - A discussion of compliance and corrective actions taken, as well as any planned or proposed actions needed to bring the discharge into full compliance with the General Permit and/or the notice of applicability.
    - An evaluation of water treatment facilities' performance, including concentration of the main pollutants (boron, chloride, sulfate, etc.) over time, nuisance conditions, system problems, etc.
    - An evaluation of treatment.
    - Note any changes or upgrades that were made over the past year (or need to be made) to the treatment plant to improve performance.
    - Groundwater elevation maps, flow direction, and concentration contours.

8. ELECTRONIC SUBMITTAL

The City of Morro Bay must submit all requested information electronically in a searchable PDF format using the transmittal sheet found in the link below as the cover page.

> https://www.waterboards.ca.gov/centralcoast/water_issues/programs/wastewater_permitting/docs/transmittal_sheet.pdf

Electronic submittals should be made to the State Water Resources Control Board's GeoTracker[3] database for the City of Morro Bay's aquifer storage and recovery project in San Luis Obispo County, GeoTracker No. WDR100053984. This information must be submitted via the internet at:

> http://www.waterboards.ca.gov/ust/electronic_submittal/index.shtml

Table 10 below summarizes all the electronic reporting requirements. Staff may request submittal of some documents on paper, particularly drawings or maps that require a large size to be readable, or in other electronic formats where evaluation of data is required.

[3] Information for first-time GeoTracker users is available here:
https://www.waterboards.ca.gov/ust/electronic_submittal/docs/beginnerguide2.pdf

Table 10. GeoTracker Electronic Submittal Information (ESI) Data Requirements

Electronic Submittal	Description of Action	Action	Frequency
Reports and Documents	Complete copy of all documents including monitoring reports (in searchable PDF format) and any other associated documents related to the facility.	Upload directly to GeoTracker all monitoring reports (in searchable PDF format) and any other associated documents.	On or before the due dates required by this General Permit and for other documents when requested by Central Coast Water Board staff.
Laboratory Data	All analytical data (including geochemical data) in electronic deliverable format (EDF). This includes all water samples collected when monitoring.	Direct your State Certified Laboratory staff to upload all laboratory data directly to GeoTracker.	On or before the due date of the required monitoring report.
Location Data (Geo XY)	Survey and mark all permanent sampling locations (i.e., monitoring wells, drinking water wells, and permanent injection source water sampling locations). These data points are required prior to laboratory data uploads.	Upload the survey data to the GeoTracker Geo_XY file.	Every time a permanent monitoring point is established.
Depth to groundwater	Monitoring wells must have the depth-to-water information reported.	Upload depth-two-water information to the GeoTracker GEO_WELL file.	On or before the due date of the required monitoring report.
Elevation data (Geo Z)	Survey and mark the elevation at the top of the groundwater well casing for all permanent groundwater wells. These points are required prior to depth-two-water data uploads.	Upload the survey data to the GeoTracker GEO_Z file.	One-time, for all groundwater monitoring wells.
Geo Map	Site layout, map of facilities, potable water treatment system, and disposal area(s).	Upload the Site layout PDF to the GeoTracker site plan file.	Year one and every five years thereafter and when the facilities are modified.

9. LEGAL REQUIREMENTS

Water Code section 13267 states, in part:

> "In conducting an investigation specified in subdivision (a), the regional board may require that any person who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge waste within its region, or any citizen or domiciliary, or political agency or entity of this state who has discharged, discharges, or is suspected of having discharged or discharging, or who proposes to discharge, waste outside of its region that could affect the quality of waters within its region shall furnish, under penalty of perjury, technical or monitoring program reports which the regional board requires. The burden, including costs, of these reports shall bear a reasonable relationship to the need for the report and the benefits to be obtained from the reports. In requiring those reports, the regional board shall provide the person with a written explanation with regard to the need for the reports, and shall identify the evidence that supports requiring that person to provide the reports."

Water Code section 13268 states, in part:

> "(a) Any person failing or refusing to furnish technical or monitoring program reports as required by subdivision (b) of section 13267, or failing or refusing to furnish a statement of compliance as required by subdivision (b) of section 13399.2, or falsifying any information provided therein, is guilty of a misdemeanor and may be liable civilly in accordance with subdivision (b).
>
> (b)(1) Civil liability may be administratively imposed by a regional board in accordance with article 2.5 (commencing with section 13323) of chapter 5 for a violation of subdivision (a) in an amount which shall not exceed one thousand dollars ($1,000) for each day in which the violation occurs."

The burden and cost of preparing the reports is reasonable and consistent with the intent of the state in maintaining water quality. These reports are necessary to ensure that the City of Morro Bay complies with the NOA and General Permit. Pursuant to Water Code section 13267, the City of Morro Bay must implement this MRP and must submit the monitoring reports described herein.

The City of Morro Bay must implement the above monitoring program as of the effective date of enrollment in the General Permit.

Ordered by:

Harvey C. Packard
2021.09.24 11:16:42 -07'00'

for Matthew T. Keeling
Executive Officer

MG
ECM/CIWQS Place = 868768
GeoTracker No. = GT-WDR100053984
ECM Subject Name = City of Morro Bay NOA Order WQ 2012-0010 pilot

R:\RB3\Shared\WDR\WDR Facilities\San Luis Obispo Co\City of Morro Bay IPR and ASR\City of Morro Bay ASR pilot\NOA for ASR GO - Pilot Test\Morro_Bay_NOA_ASR_Pilot_final.docx

ATTACHMENT 3

DRAFT TECHNICAL REPORT

City of Morro Bay

Notice of Intent to Enroll in ASR General Order (2012-0010) for Injection Well Testing

City of Morro Bay Groundwater Replenishment and Reuse Project

April 14, 2021

Prepared by:
GSI Water Solutions, Inc.
418 Chapala Street, Suite H, Santa Barbara, CA 93101

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Contents

Tables

Figures

Appendices

Abbreviations and Acronyms

µg/L	microgram per liter
AFY	acre-feet per year
Basin	Morro Valley Groundwater Basin
bgs	below ground surface
BWRO	Brackish Water Reverse Osmosis
CCRWQCB	Central Coast Regional Water Quality Control Board
CEQA	California Environmental Quality Act
COC	chemical of concern
DDW	California Department of Drinking Water
DTSC	California Department of Toxic Substances Control
EIR	environmental impact report
ft	feet
GRRP	Groundwater Replenishment Reuse Project
GSI	GSI Water Solutions, Inc.
in	inches
IPR	indirect potable use
LUC	land use covenant
LUST	leaking underground storage tank
MBMWC	Morro Bay Mutual Water Company
MBTE	methyl tertiary butyl ether
MCL	maximum contaminant level
mg/L	milligram per liter
NAVD88	North American Vertical Datum of 1988
PCA	potentially contaminating activity
PG&E	Pacific Gas and Electric
PHG	public health goal
ROWD	Report of Waste Discharge
RWQCB	California Regional Water Quality Control Board
SMP	soil management plan
SWRCB	California State Water Resources Board
TDS	total dissolved solids
THM	trihalomethanes
TPH	petroleum hydrocarbon
UST	underground storage tank
WQ	water quality
WRF	water recycling facility

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SECTION 1: **Project Overview**

1.1 Background

The City of Morro Bay (City) is seeking permitting compliance from the California Regional Water Quality Control Board (RWQCB) for injection testing at a new injection well proposed to be installed on City-owned property within the Lower Morro Groundwater Basin in the vicinity of the City's existing production wells. GSI Groundwater Solutions, Inc. (GSI), is supporting the City with permitting and installation of the planned indirect potable use (IPR) project. The installation and operation of a series of injection wells is planned and will comply with the Groundwater Replenishment Reuse Project (GRRP) regulations for subsurface application.

Results of injection testing will provide diagnostic information of injection rates at the first injection well currently planned for this project. The installation of a nearby monitoring well (21P-01) will also be conducted as part of this effort. Injection testing will be conducted at the proposed Injection Well No. 1 site, located on vacant property along the west side of Highway 1, as shown on Figure 1.

To date, GSI has conducted hydrogeologic evaluations and modeling in support of the City's goal of establishing an IPR project. After consideration of cost-effective alternative uses of the highly treated recycled water to enhance the City's water supply from the new water recycling facility (WRF) currently under construction, two areas were evaluated for the planned IPR project. These areas are referred to as the Narrows Project Area (east of Highway 1, along Morro Creek), and the Western Project Area (west of Highway 1, also along Morro Creek). Both are located within the lower Morro Valley Groundwater Basin. The Western Project Area was selected as the preferred location.

Subsequent hydrogeologic assessments, including field characterization and groundwater modeling, support the selection of the Western Project Area (Figure 1). The water supply for the IPR project will be highly treated recycled water from the WRF, which will include the advanced treatment steps of microfiltration, reverse osmosis, and ultraviolet light advanced oxidation to produce purified effluent that meets the California State Water Resources Board's (SWRCB's) GRRP regulations. The water from the WRF will be conveyed to the several planned injection wells for subsurface application. Preliminary modeling has indicated that the requirement for adequate retention time, in compliance with the GRRP requirements, can be met prior to extraction at the City's production wells. Geochemical mixing analysis will also be conducted to assess the potential for any adverse reactions associated with the proposed injection.

The proposed WRF will be completed in 2023. The source water for injection testing at Injection Well No. 1 will be supplied from the City of Morro Bay's treated drinking water supply system, using the City's State Water supply (rather than groundwater pumped from the City's groundwater wells. Using the City's State Water Project water will more closely represent the conditions expected under full-scale IPR operations.

1.2 Statement of Intent

As part of this project, this technical report provides the data and information necessary to complete the Notice of Intent to comply with the terms and conditions of the SWRCB Water Quality (WQ) Order 2012-0010 (General Waste Discharge Requirements for Aquifer Storage and Recovery Projects that Inject Drinking Water into Groundwater). The purpose of this report is to demonstrate the compliance by the City of Morro Bay with the General Waste Discharge Requirements in WQ Order 2012-0010 to test a single injection well (Injection Well No. 1) in the lower portion of the Morro Valley Groundwater

Basin in the vicinity of the City's existing production wells. This report also provides additional information needed to describe and characterize the IPR project and anticipated effects on groundwater quality (Attachment C of the Order).

1.3 Public Outreach and Coordination

As part of the permitting required for a GRRP, there will be a Report of Waste Discharge (ROWD) prepared for submittal to RWQCB.

As part of the ROWD and GRRP approval process, there are public outreach and notification requirements to be followed. In compliance with the anticipated ROWD, the City will (1) provide notification via U.S. Postal Service mail to the owners of record for properties adjacent to injection well site and area, (2) include notification of the project via the City monthly newsletter to its customers, and (3) give two presentations at City Council meetings. The City will use the newsletters and meetings to provide project updates and notify interested parties of changes in operation. Newsletters are also available online and via free subscription. The City's community outreach activities include updates to its website to provide information on water quality, water supply, and relevant topics that may affect customers.

SECTION 2: **Hydrogeologic Setting**

2.1 Morro Valley Groundwater Basin

The Morro Valley Groundwater Basin (Basin) (DWR Bulletin 118 basin 3-41) is a shallow alluvial basin that encompasses approximately 1.9 square miles and is bounded on the west by the Pacific Ocean and surrounded and underlain on all other sides by consolidated and impermeable rocks of the Franciscan Complex (Jurassic to Cretaceous age). The Basin is further divided into lower and upper parts by a restriction in the valley commonly referred to as the Narrows, located approximately 1,000 feet (ft) east of Highway 1, where the alluvium underlying Morro Creek is constrained by the bedrock to a narrow corridor about 300 ft wide. The principal water-bearing units in the Lower Basin are younger alluvium, dunes sand, and Holocene- and Pleistocene-aged terrace deposits that extend approximately 60 to 80 ft beneath the valley floor. Two aquifer zones (shallow and deep) have been identified within the Lower Basin sediments (Brown and Caldwell, 1981; Cleath, 1993).

Groundwater monitoring conducted by GSI for the proposed project refined the inflow and outflow of the existing water conditions in the groundwater basin (GSI, 2017). The primary source of recharge to the Lower Basin is mostly from Morro Creek streambed percolation. Morro Creek is predominantly a losing stream (i.e., water in the creek is usually percolating down into and recharging the underlying aquifer). However, during wet periods, portions of Morro Creek can become a gaining stream (i.e., water from the underlying aquifer rises up enough to discharge into the stream and support its flow). The volume of Morro Creek percolation is believed to be partly affected by City pumping from its existing wells. The higher the rate of pumping, the more water Morro Creek loses to the aquifer, because groundwater levels decrease and do not support the creek flow.

Aquifer testing on existing wells conducted during GSI modeling studies for the GRRP revealed that the aquifer has a large contrast in permeability between the upper (shallow) and lower (deep) aquifers, with the lower aquifer being more permeable than the upper aquifer.

2.2 Target Aquifer Zones

Recent alluvial deposits are the primary water-bearing unit in the Lower Morro Valley Basin and are composed primarily of unconsolidated sand, silt, and clay. The hydrostratigraphy of the Lower Basin has been divided into hydrostratigraphic zones based on data from geologic and geophysical logs. The zones that produce meaningful amounts of groundwater include a younger shallow alluvial aquifer and an older deep alluvial aquifer, both of which consist of well-graded sand and gravels. The deep alluvial aquifer is typically overlain by finer sediments ranging from clayey silt to silty clay, creating confining conditions in the Lower Basin area (B&C, 1981). The target aquifer zone (approximately 60 to 80 ft below ground surface [bgs]) for the injection testing of Injection Well No. 1 (and for future injection wells will be the deep alluvial aquifer. As discussed above, modeling of these two sub-aquifer units favors the deep alluvial aquifer for injection purposes (because of its higher permeability and higher hydraulic conductivity values).

2.3 Area of Hydrologic Influence

Planned injection wells for the proposed IPR project will be distributed along the southern boundary of the Western Project Area. Predictive numerical modeling scenarios performed by GSI suggest the area of hydrologic influence during full-scale injection operations will predominantly cover the areas between the planned injection wells and the City's existing wells to the north. Figures 2a and 2b were adapted from GSI's January 2021 technical memorandum, *Characterization and Selection of Project Area for Injection Testing*, and show the modeled heads and particle tracking results for the pumping scenario of baseline pumping (pumping 581 AFY from the City's 7 existing production wells) plus 75 percent of total injection volume (1,200 acre-feet per year [AFY]) from planned injection wells during dry and wet conditions. The extent of hydrologic influence will depend on the duration, volume, and frequency of future injection. For injection testing, the area of hydrologic influence is anticipated to be much smaller than the full-scale project, and will likely not extend outside those areas of influence at full-scale injection operations, as shown on Figures 2a and 2b.

2.4 Land Use

Current land use in the Western Project Area (area of planned injection for the initial injection well and testing) of the Lower Basin is undeveloped and covers an area of approximately 17 acres. The Western Project Area is essentially flat and centrally located relative to the City's infrastructure. The Western Project Area is adjacent to the currently planned alignment of the forthcoming recycled water pipeline. The Western Project Area is also adjacent to (north of) the former Morro Bay Power Plant (Power Plant) site (shown by a light blue triangle on Figure 4). Portions of the adjacent former Power Plant site are going through land use covenant (LUC) procedures associated with its closure by the California Department of Toxic Substances Control (DTSC). This proposed LUC procedure would restrict some areas of the former Power Plant site outside of the project area to future commercial/industrial uses. The Western Project Area is not located within these areas and therefore is not subject to the forthcoming LUC. This is discussed in more detail in Section 3.3.

The existing land use designations for the proposed injection well area (i.e., the Western Project Area) and surrounding areas are depicted in Figure 3.

SECTION 3: **Regional Groundwater Conditions**

3.1 Groundwater Elevations

Groundwater elevation data for three of the City's existing production wells (Well MB-4, Well MB-14, and Well MB-15) located near the proposed injection area reveal that static (non-pumping) water elevations for these three wells have fluctuated between a high of about 20 ft above mean sea level to a low of about 15 ft below mean sea level (GSI, 2017) during the period of observed data between 1994 and 2016. Water levels tend to be at their highest each year during the wet winter months when rainfall recharge is higher, and deepest during the dry summer months when rainfall recharge is limited. Water levels generally appear to recover each year; no significant declines in water level were apparent.

Groundwater movement in the Lower Basin is largely controlled by the City wells. Pumping from the City wells develops a water level depression that slopes radially towards the City wells, and can include seawater during drought (Cleath, 2007). The regional groundwater gradient is generally from northeast to southwest. During non-pumping periods, groundwater flows below the Narrows toward the coast at a nominal hydraulic gradient of 0.005 ft/ft (Aqui-Ver, 2005). This gradient reflects the migration of water from the recharge areas mostly in the areas above the Narrows toward the areas where significant pumping occurs in the Lower Basin.

In December 2018, GSI installed 11 pressure transducers in existing City production and desalination wells for the purpose of long-term groundwater elevation monitoring. This work was completed in support of the IPR project proposed for the City. The transducers are programmed to measure water pressure (convertible to water level), temperature, and specific conductivity (convertible to chloride concentration) every 4 hours to document aquifer water levels and quality. The data will also provide warning of any potential seawater intrusion.

3.2 Groundwater Quality Trends and Constituents of Concern

General water quality data collected from City water supply production wells between 2011 and 2015 are summarized in Table 1, along with California Department of Drinking Water (DDW) maximum contaminant levels (MCLs), including primary and secondary drinking water standards; and public health goals (PHGs) (MKN, 2017)[10]. More recent water quality results for the City's existing wells (i.e., the average and range of detections) as presented in the City's *Annual Water Quality Report 2019* (City of Morro Bay, 2020) are also shown on Table 1. The data indicate nitrates and seawater intrusion are the predominant concerns for water quality (MKN, 2017; MNS, 2016).

Nitrate levels are elevated due to agricultural application of nitrogen fertilizers in the watershed, which is restricting the City's ability to use groundwater as a potable water supply. In the past 20 to 30 years, pumpage has been significantly reduced from its permitted amount due in part to elevated nitrate concentrations observed in groundwater pumped from City wells. Historically, Basin wells have experienced elevated nitrate concentrations as high as 110 milligrams per liter (mg/L) as nitrate (MKN, 2017). The current primary MCL for nitrate (as nitrogen) is 10 mg/L for potable domestic use; nitrate also has a PHG of 10 mg/L. Periodically, high iron (which has a secondary MCL of 300 micrograms per liter [µg/L]) and manganese (with a secondary MCL of 50 µg/L) levels have

[10] Table 1 has been adapted from the *Morro Bay Water Reclamation Facility Draft Environmental Impact Report* (ESA, 2018) and from the *Annual Water Quality Report 2019* (City of Morro Bay, 2020).

also been detected. To meet MCLs, the City operates a brackish water reverse osmosis facility that treats water pumped for potable use from the City's Well Field.

In general, under natural conditions, the seaward movement of freshwater prevents seawater from encroaching on coastal aquifers (USGS, 2018). An interface between freshwater and seawater is maintained with denser seawater underlying freshwater. When groundwater is pumped from a coastal aquifer, lowered water levels can cause seawater to be drawn toward the freshwater zones of the aquifer. The intruding seawater decreases the freshwater storage in the aquifers. In the mid-1980s, total dissolved solids (TDS) concentrations in groundwater downstream of the Narrows near Highway 1 began to exceed 1,000 mg/L seasonally due to seawater intrusion and tidal influences (MNS, 2016).

In 2007, TDS concentrations in the Basin were typically between 400 and 800 mg/L and increasing toward the coast, except for an area beneath agricultural fields in the lower valley where TDS concentrations reached 1,000 mg/L, and nitrate concentrations reached 220 mg/L as nitrate (MNS, 2016). Groundwater wells in the Basin have experienced elevated levels of salinity during dry periods, with TDS levels as high as 4,000 mg/L, exceeding the secondary MCL of 1,000 mg/L by factor of four.

Historical data and groundwater modeling indicate that the City's wells are at risk of seawater intrusion if the full permitted pumpage is produced with no corresponding injection. Predictive modeling scenarios indicate that an injection well layout in the Western Project Area would mitigate against seawater intrusion during pumping of City wells. Predictive nitrate modeling scenarios indicate that, during combined IPR injection and City pumping, all City wells will have improved water quality over time with significantly lower nitrate concentrations.

3.3 Contamination

A preliminary inventory of past and current potentially contaminating activities (PCAs) was compiled using readily available data for the proposed injection well field. An initial assessment was performed using the RWQCB GeoTracker website, which provides a compilation of environmentally impacted sites, and is also linked to the DTSC EnviroStor website that shows sites for cleanup, land disposal, waste permits, permitting underground storage tanks (USTs), and leaking underground storage tanks (LUSTs).

Figure 4, Potentially Contaminating Activity Sites, shows the locations of PCAs in the general area of the proposed injection area. The GeoTracker and EnviroStor websites show there are four closed LUST sites with a half-mile radius of the Western Project Area. The sites listed gasoline and/or diesel as the "potential contaminant of concern" and generally listed groundwater as the "potential media of concern." At these four closed LUST sites, cleanup actions have been completed and the case has been closed by that lead agency. All four sites, delineated by red squares with an "X" through them, are located east of Highway 1, as shown on Figure 4.

In 1999, methyl tertiary butyl ether (MTBE) was discovered in groundwater in the Basin, and in 2000, SWRCB issued an order prohibiting the use of the City's five Lower Basin wells. The source of the MTBE was found to be the Shell gasoline service station on Main Street at Highway 41; this site is more than 1,500 ft northeast of the proposed injection area, as well as northeast of the City's wells that will recover the injected water. The Central Coast Regional Water Quality Control Board (CCRWQCB) required the Shell service station owner to install monitoring wells and to conduct groundwater and soil sampling. Subsequent investigations confirmed the MTBE contamination originated from this Shell service station. The USTs and gasoline-impacted soils beneath the USTs were removed from the location in January 2002. The owner implemented extensive remedial actions after the discovery of the contamination, which included the excavation of contaminated soil, addition of an oxygen-releasing compound to the UST excavation backfill, soil vapor extraction, and onsite and offsite groundwater extraction and treatment. Extensive monitoring conclusively demonstrated that the City's Well Field was never impacted, even prior to MTBE plume stabilization. On September 26, 2008, RWQCB sent a case closure letter to Shell Oil Company and the City's municipal water supply wells were reinstated for use as a safe water supply for Morro Bay residents.

The Morro Bay Power Plant, located on property south and adjacent to the proposed injection area (Figure 4) was a power generation facility that started producing power in the 1950s under the ownership of Pacific Gas and Electric (PG&E), and was subsequently acquired by Duke Energy in 1998, LS Power in 2006, and Dynegy in 2007. In 2014, operations at the Power Plant ceased, and the plant was shut down. The site was sold in 2018 to Vistra Energy, which currently owns the approximately 90-acre property.

Various environmental investigations have been conducted at the Power Plant since the 1990s. Human health and ecological risk assessments initially identified the chemicals of concern (COCs) in soil and shallow groundwater as petroleum hydrocarbons (TPH) and arsenic, concentrations of which were above commercial screening levels. Subsequent groundwater monitoring evaluations were performed on the Power Plant via sampling from several monitoring wells. The DTSC-approved human health and ecological risk assessment concluded that constituents in groundwater at the site <u>do not pose unacceptable risks</u> to ecological or human health receptors and further evaluation was not warranted (Jacobs, 2018). A request for termination of the groundwater monitoring program on the Vistra site was approved by DTSC in January 2019.

The corrective action objectives and proposed final remedy for the Vistra site recommends that LUC be recorded to address total petroleum hydrocarbons and arsenic at the site in soil and groundwater. The LUC would restrict land use and groundwater uses on the Vistra site and would require a soil management plan (SMP) to verify soil at the site will be managed in the manner protective of human health and the environment. In addition, annual inspections would occur to verify the protectiveness of the remedy over time (DTSC, 2020).

Groundwater flow is generally from northeast to southwest across the site, and thus away from the proposed injection area for the City towards the Pacific Ocean.

3.4 Basin Plan Management Goals and Objectives

The RWQCB regulates GRRPs under numerous state laws and regulations, including the *Water Quality Control Plan for the Central Coast Basin* (Basin Plan) (Central Coast RWQCB, 2019) and SWRCB policies. The Basin Plan includes water quality objectives for municipal and domestic supply groundwater supplies, including the following:

- **Taste and odors:** shall not adversely affect beneficial uses
- **Bacteria:** <2.2/100 milliliter median concentration over any 7-day period
- **Organic chemicals:** shall not exceed MCLs
- **Inorganic chemicals (trace metals):** shall not exceed MCLs
- **Radioactivity:** shall not exceed MCLs

There are no additional water quality objectives for the Basin.

The Basin Plan also applies the SWRCB Antidegradation Policy,[11] which has been further interpreted pursuant to the 2019 SWRCB Water Quality Control Policy for Recycled Water (SWRCB, 2019). Per the Anti-degradation Policy, if the existing water quality of a water body is better than the objectives defined in the Basin Plan, the existing quality shall be maintained. Pertaining to this particular project for the City, the modeling results and the simple basics of reverse osmosis-based purification allow the team to conclude that improvements in groundwater quality will occur due to the very low levels of TDS and nitrogen (including nitrate) in the purified water (compared to the Basin groundwater). An assessment of anti-degradation aspects is provided in Table 2.

Drinking water from the City's existing water supply system will be the source water for injection testing; therefore, it is not anticipated that injection water will be of lesser quality than the existing quality of the Basin groundwater.

[11] Available at https://www.waterboards.ca.gov/plans_policies/antidegradation.html. (Accessed April 13, 2021.)

SECTION 4: **Injection Well Initial Testing**

4.1 Background

Injection testing will be performed to support the assessment of the potential viability of the proposed IPR project that would use highly treated recycled water from the City's planned WRF for groundwater supply augmentation. Injection testing will provide diagnostic information of injection rates and capacity of the first full-scale injection well as part of this project. Initial injection testing will consist of constructing an initial injection well, performing baseline monitoring, and long-term injection tests. The proposed location of the initial injection well is shown on Figure 1. Additionally, the installation of a dedicated monitoring well (21P-01) will also be conducted as part of this effort to support DDW permit requirements.

4.2 Injection Well Construction and Initial Testing

One complete and fully operational, injection well will be installed for this early phase of the overall project. The installation effort will include drilling, construction, development, testing, and completion of the injection well. This work is proposed to begin in May 2021. The new injection well will be located on a vacant property owned by Vistra along the west side of Highway 1 as shown on Figure 1. The location of the site, including the temporary construction areas and temporary discharge hose alignment, are also presented on Figure 1.

The injection well will be drilled by mud-rotary drilling methods to an estimated depth of 90 to100 ft bgs. Following pilot hole drilling, geophysical logging of the well will be conducted, consisting of a spontaneous potential, resistivity, and caliper surveys in the pilot hole. The pilot hole will then be enlarged to 18-inch diameter, followed by installation of 12-inch diameter Type 316 stainless steel casing and wire-wrapped screen. The annulus within the screened interval will be filled with gravel pack gradation consisting of 1.7-to-2.5-millimeter SiLibeads. A concrete sanitary seal will be installed in compliance with state and local standards. The design of the proposed injection well is presented on Figure 5.

Following well construction, the injection well will be developed to remove accumulated drilling fluids. A test pump, drop pipe for conveyance of injection water, and sounding tube for water level measurements will be installed. The pump will be capable of discharging up to 350 gallons per minute. A pair of pumping tests will be conducted, including an 8-hour step drawdown test, and a 24-hour constant rate test to assess pumping performance characteristics of the wells.

4.3 Injection Testing Program

Following completion of the initial pumping tests, a series of injection tests will be conducted by injecting treated potable drinking water from the City's existing municipal supply system into the well for a series of short- and long-term periods for a total duration of up to 4 weeks. During the injection tests, the injection rates will be varied to assess the acceptance rates and variability of the specific capacity during injection. All testing and monitoring will be conducted in compliance with permitting requirements. Details regarding the planned injection testing is included in the *Injection Testing Work Plan for Groundwater Management Replenishment and Reuse Project, Morro Bay, California* (*Injection Testing Work Plan*) (Appendix A of this report).

Results from these analyses will be used to identify potential injection rates, which will be used to estimate the anticipated yield of the full-scale injection wellfield and the ultimate the number of wells needed for the full-scale project. Recommendations will be provided for anticipated operational scheduling and for an approach to minimize adverse consequences while maximizing the benefits of the proposed injection program.

4.4 Geochemical Modeling

The geochemical analysis will use the mineralogical analysis results from a specialized analytical laboratory and the water quality data from the native groundwater and predicted IPR water to assess any potential deleterious conditions associated with the project activities. To obtain these data, the following will be conducted:

1. The chemistry of the in-situ groundwater will be characterized using existing water quality data from the City's production wells, and chemical analysis of water samples collected from the newly installed injection and monitoring wells.
2. The expected chemistry of the water to be injected will be based on water quality estimates from the WRF design engineer/program manager.
3. To characterize the aquifer materials, mineralogical analyses will be conducted on sediment samples collected during drilling of the monitoring well.
4. The data will be used in a geochemical mixing model analyses to assess whether potential deleterious effects may occur.

The results of this analysis will allow GSI to assess potential problems associated with mixing of the injected water and the aquifer materials, including dissolution or precipitation of minerals through geochemical reactions, which can cause clogging in the both the well screen and the pore space of the aquifer. Recommendations will be provided for water quality treatment or operational approaches, if needed, to minimize any potential adverse consequences of the proposed injection program. Additional details of this effort are included in the attached *Geochemical Work Plan for Groundwater Management Replenishment and Reuse Project, Morro Bay, California* (*Geochemical Work Plan*) (Appendix B).

4.5 Injection Testing and Reporting Schedule

The injection testing will be conducted following the completion of the well installation and pumping tests. It is anticipated that injection will begin late May 2021 and require approximately 6 weeks to complete. The results will be provided in a technical memorandum, anticipated to be completed approximately 1 month after completion of the field work (by the end of July), if the proposed drilling and injection testing schedules are met.

The results of this injection testing plan will be incorporated into the Title 22 Engineering Report being prepared by the City. Additionally, the results of the pilot injection testing will be provided in an addendum to this report to complete the information needs of the Notice of Intent.

SECTION 5: **Injection Water and Groundwater Quality**

Source water for planned injection purposes will ultimately come from the proposed WRF, which is under construction until 2023. For the purposes of injection testing at the initial injection well, treated potable drinking water from the City's municipal supply system will be used as the injection water source.

The City's primary source of municipal supply water is surface water from the State Water Project, which is administered locally by the Central Coast Water Authority. The water is treated at the Polonio Pass Water Treatment Plant near Highways 41 and 46 and then conveyed via the Chorro Valley pipeline for use by the City. The State Water Project supply can be augmented by and blended with water pumped from existing City production wells in the Basin.

Some of the well water has nitrate contaminant levels that require treatment through blending or filtration. The City uses its Brackish Water Reverse Osmosis (BWRO) plant to remove nitrates from groundwater and all well water has a disinfectant added prior to distribution. During 2019, State Water Project water made up 90 percent of the City's drinking water and the wells provided the remaining 10 percent with all of this well water being treated by the Brackish Water Reverse Osmosis (BWRO) plant (Morro Bay, 2019).

In accordance with State of California Division of Drinking Water (DDW) requirements, the City regularly collects water samples to determine the presence of radioactive, biological, inorganic (trace metals), volatile organic compound (VOC), or synthetic volatile organic compound (SVOC) contaminants. The range of contamination in the raw well water, at times, has exceeded the drinking water standards, but drinking water served to the public had contaminant levels reduced through either blending or treatment. Detections of constituents from the most recent drinking water samples collected by the City are presented in the *Annual Water Quality Report 2019* (City of Morro Bay, 2019); Table 1 has been adapted from this report and shows a comparison of water quality data results from both City groundwater wells and State Water Project supply for 2019. The presence of these constituents in the water does not necessarily pose a health risk, as DDW allows the City to monitor for certain contaminants less frequently than once per year because the concentration of these contaminants do not change frequently. As shown on this table, municipal supply water for the City meets or exceeds all DDW drinking water MCLs and PHGs.

SECTION 6: **Groundwater Degradation Assessment**

6.1 Constituents of Concern

As discussed in Section 3.2 of this technical report, the primary chemical constituents of concern for the proposed injection testing are nitrate and TDS. Recent and historical measured concentrations of these chemical constituents from existing City wells in the Basin were compiled and used to establish the baseline conditions. Table 1 shows the applicable water quality objectives and the median and range of concentrations for both City well water and State Water Project water sources. None of the listed constituents for State Water Project water are shown to exceed Basin water quality objectives. As discussed in Section 5 above, State Water Project water is a primary water source for the City and will be the source water for initial injection testing purposes for Injection Well No. 1. Thus, injection testing is not anticipated to have any potential impact on the basin groundwater quality and is expected to meet all Basin water quality objectives.

6.2 Impact on Assimilative Capacity

The expected quality of the City water used for injection is discussed in Section 5 and summarized in Table 1. Injection water will meet or exceed all primary and secondary MCLs, state Notification Levels (NLs), and Basin Plan Objectives (BPOs). Using these water quality data, groundwater quality impacts relative to assimilative capacity are not expected to occur as a result of injection of City product water at Injection Well No. 1 during initial injection testing. The results of geochemical modeling analysis from samples collected during injection testing (described in Section 4.4) will allow an assessment of the potential for problems associated with mixing of the injected IPR water, native groundwater, and the aquifer sediments, including dissolution or precipitation of minerals through geochemical reactions, which can cause clogging in the both the well screen and the pore spaces immediately adjacent to the well.

6.3 Impact on Seawater Intrusion and Nitrates

The City's existing wells are approximately one-half mile from the Pacific Ocean. As such, they are at risk of seawater intrusion in times of severe drought, or if the groundwater flow gradient reverses from its natural direction for a significant period of time. Water quality sampling documented in the *Seawater Intake Evaluation Report* (GSI, 2017b) indicates that the nearby seawater intake wells along the Embarcadero boundary show TDS concentrations that range from about 5,000 mg/L to 17,000 mg/L. Evaluation of sampling records from wells on the adjacent Vistra site indicate that that wells have a concentration of about 1,000 mg/L on the northern edge of the site. Baseline TDS concentrations in the City's Highway 1 wells are in the 600 to 800 mg/L range. Groundwater modeling indicates that, under full permitted pumping scenarios, the City wells are susceptible to degradation of water quality due to seawater intrusion. Injection scenarios input into the groundwater model resulted in reducing all the instances of elevated TDS concentrations that had been evident in baseline modeling concentrations (i.e., in scenarios with no injection). Injection conducted at wells located in the Western Project Area would provide benefits to preventing seawater intrusion for the nearby City wells.

Nitrate concentrations have also increased in City wells due in part to the decades-long use of land upstream for agriculture and the growth in that land use. A few years after the establishment of upgradient vegetable fields, significant concentrations of nitrates began to be detected in the City's wellfield. Groundwater modeling scenarios performed by GSI using injection wells in the Western Project Area results in significant reductions in nitrate concentrations at the Highway 1 well field.

6.4 Impact on Existing Contaminant Plumes

As discussed in Section 3.3, groundwater quality in some parts of the Basin has been affected by PCAs in some areas, including the at Vistra property to the southwest of the injection site. In discussions with the City, DTSC determined that it was unlikely that contamination from the Vistra property would affect the planned injection by the City (DTSC, 2020).

As stated in the DTSC (2020) letter, based on groundwater sampling performed at the Vistra property over 9 years and documented in investigative reports, no significant plume of contaminants in groundwater has been found (DTSC, 2020). While there were a few Vistra property wells that when sampled, groundwater contaminants were found above unrestricted use screening levels, these wells were not near proposed Injection Well No. 1 or other planned injection sites on the Vistra property, and nearby wells surrounding these historically sampled wells were free from contaminants.

Vistra is proposing to evaluate groundwater at the site. Vistra submitted an evaluation to DTSC on September 24, 2020, but DTSC has not yet provided a response or comment as of the writing of this report. Continued review of relevant groundwater monitoring investigative reports for the Vistra property will be conducted as they are published by DTSC and/or others.

6.5 Disinfection

In compliance with the DDW, State Water Project water is treated at the Polonio Pass Water Treatment Plant before it conveyed to the City. During groundwater pumping, disinfectant (chlorination) is added to pumped water at the City's BWRO plant prior to distribution to the City's public system. Total residual chlorine has a DDW MCL and PHG of 4 mg/L. Total residual chlorine and total coliform bacteria are measured at the plant before distribution to the City's public system.

6.6 Disinfection By-Products

The City's potable water meets all primary state and federal drinking water standards, including standards for disinfection by-products such as haloacetic acids and trihalomethanes that form when chlorine reacts with naturally occurring organic matter in the surface water supply and/or with organic carbon compounds that may be naturally present in the aquifer. These disinfection by-products continue to remain well below state and federal drinking water standards (see Table 1). These constituents will be monitored during and after the injection testing, as stated in the *Injection Testing Work Plan* (Appendix A).

6.7 Metals Mobilization

In an effort to assess the potential of metals mobilization in response to the IPR project, geochemical analyses as stated in the *Geochemical Work Plan* will be conducted (see Appendix B). A key element of this will be the retrieval of injected water over a period of 4 weeks following the injection test to assess the geochemical changes that have occurred to the injected water. The procedure and suggested analytes for this sampling are provided in the *Injection Testing Work Plan* (Appendix A).

SECTION 7: **Proposed Changes to Monitoring and Reporting Program**

Injection operations at full-scale of the proposed IPR project will adhere to the Monitoring and Reporting Program outlined in Order WQ 2012-0010. For initial pilot injection testing, a work plan that includes monitoring and reporting protocols for the initial injection testing is attached to this report as Appendix A.

SECTION 8: **State and Federal Requirements for Groundwater Replenishment Projects**

8.1 California Environmental Quality Act

Per the California Environmental Quality Act (CEQA), a Draft Environmental Impact Report (EIR) was prepared and issued for comment in March 2018 for the proposed Morro Bay WRF. The Draft EIR found the following:

> "operation of the proposed project would implement the beneficial reuse of a renewable resource – recycled water. This renewable resource would provide a benefit to the City of Morro Bay in the form of a new water supply, improving reliability of the City's water supply portfolio through the use of local resource and decreasing the degree of dependency on imported water through the State Water Project."

The draft EIR was available for public and agency comment and received 35 comment letters that don't significantly change the findings. The Final EIR was published in June 2018 and was certified and adopted by the Morro Bay City Council in August 2018. Injection well construction and operation are included in the proposed IPR project discussed above, and therefore, this injection well construction and testing meet CEQA requirements.

Based on initial studies and modeling scenarios performed by GSI, this initial injection testing would cause no significant impacts to hydrology or water quality in the project area; therefore, mitigation measures are not required.

8.2 Division of Drinking Water Permits

The City currently holds a DDW permit for the City water system and its wells. The City's Public Water Supply ID is CA4010011. The California Division of Drinking Water Permit is provided in Appendix C.

8.3 Underground Injection Well Registration (EPA Region 9)

The City has submitted a registration with the U.S. Environmental Protection Agency Region 9 for the initial injection well as a Class V well. The Class V Injection Well Notification Documentation is attached to this report as Appendix D.

SECTION 9: **Conclusions**

The City of Morro Bay's planned IPR project has been carefully evaluated and modeled. The next key step in the development process is to install and test the first injection well. Approval for this effort through this permitting process will support moving forward with the project.

Careful monitoring during the injection testing will track water level and water quality responses to the injection. Results from the monitoring will be used to plan for the installation of the additional wells needed for the overall project. Information developed as part of the geochemical analyses will be used to refine the project operations, if necessary.

SECTION 10: **References**

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MNS. 2016. City of Morro Bay 2015 Urban Water Management Plan. Prepared by MNS Engineers, June 2016.

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Synergistic. 2013. Cooperative Groundwater Monitoring Plan for the Morro Hydrogeologic Basin. Prepared by Synergistic Solutions, March 2013.

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Tables

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Table 1

City Groundwater and Surface Water Quality (2019)

CONSTITUENT	Units	MCL	PHG	YEAR SAMPLED	STATE WATER		GROUNDWATER		
					AVERAGE AMOUNT[1]	RANGE LOW-HIGH[1]	AVERAGE AMOUNT[1,2]	RANGE LOW-HIGH[1,2]	MAXIMUM ANNUAL DETECTED RANGE (All Wells)[3] 2011 to 2015
Primary Drinking Water Standards									
Aluminum	mg/L	1	0.6	2019	0.056	ND - 0.094	ND	ND	ND-0.01
Arsenic	µg/L	10	0.004	2018	ND	ND	3	ND-4	--
Barium	mg/L	1	2	2018	ND	ND	0.135	0.107-0.198	0.0128-100
Total Chromium	µg/L	50	100	2018	ND	ND	15	13-18	--
Fluoride	mg/L	2	1	2018	ND	ND	0.2	0.2	0.2-0.3
Nickel	µg/L	100	12	2018	--	--	--	--	ND-10
Nitrate (as Nitrogen)	mg/L	10	10	2018	ND	ND	15	2-22.8	20.34-37.41
Selenium	µg/L	50	30	2016	ND	ND	20	ND-27	ND-19
Secondary Drinking Water Standards									
Chloride	mg/L	500		2019	59	13-146	238	71-729	64-1480
Color	color units	300		--	--	--	--	--	ND-20
Corrosivity	Aggressivity Index	NA		2019	12	12	12.3	11.6-12.4	--
Manganese	µg/L	50		--	--	--	--	--	ND-30
Specific Conductance	µmhos/cm	1600		2019	403	138-762	1749	1030-3370	715-5050
Sulfate	mg/L	500		2019	46	46	127	63.6-163	36-149
Total Dissolved Solids	mg/L	1000		2019	260	260	--	--	423-2870
Turbidity	NTU	5		2019	0.05	ND-0.12	1.2	0.2-6.8	0.11-11.7
Unregulated and Other Constituents									
2-Methylisborneol	ng/L			2019	0.2	ND-1	--	--	--
Alkalinity	mg/L			2019	56	30-80	393	370-430	--
Boron	µg/L			2019	ND	ND	125	100-200	--
Calcium	mg/L			2019	19	19	107	172	--
Geosmin	mg/L			2019	2.8	ND-6	--	--	--
Hardness (as CaCO3)	mg/L			2019	82	26-144	706	464-1090	533-1800
Heterorophic Plate Count (HPC)	cfu/ml			2019	0	0-2	3.9	1-65	--
Potassium	mg/L			2019	3.1	3.1	0	ND-1	--
pH	Units			2019	8.4	7.7-8.7	7.3	6.7-7.7	--
Sodium	mg/L			2019	58	58	94	53-239	42-317
Total Organic Carbon	mg/L			2019	1.9	1.5-3	NA	NA	--
Vanadium	µg/L			2019	ND	ND	8	6-19	--
Disinfection By-Products and Residual Disinfectants									
Haloacetic Acids	µg/L	60	NA	2019	15 (highest LRAA 15.5)	7.4-25	14	4-21	--
Total Trihalomethanes (TTHMs)	µg/L	80	NA	2019	45 (highest LRAA 47.8)	27-75	30	18-52	--
Total Residual Chlorine	mg/L	4	4	2019	2.47	0.33-3.5	2	0.03-3.95	--
Total Coliform Bacteria	# of positive samples	0	0	2019	0	0	0	0	--

Notes:

1. From City of Morro Bay. 2019. Annual Water Quality Report 2019. Prepared by the City of Morro Bay, PWS ID# CA4010011
2. Sampling from well water is for raw water results. Samples are taken prior to either treatment or blending. Sample dates are from 2018.
3. Adapted from Table 3.9-1 General Groundwater Quality from Morro Bay Reclamation Facility Draft Environmental Impact Report, 2018, and MKN, 2017.

mg/l - milligrams per liter
µg/L - micrograms per liter
ng/L - nanograms per liter
cfu/ml - colony forming units per ml
µmhos/cm - micromhos per cm
NTU - nepheloid turbidity units
MCL - maximum contaminant level
PHG - public health goal
AL - action level
ND - Not Detected

Table 2
Anti-Degradation Assessment

SWRCB Resolution No. 68-16 Component	Anti-Degradation Assessment Result
Water quality changes associated with proposed project are consistent with the maximum benefit of the people of the State.	Water quality changes associated with proposed project in the Lower Morro Basin are consistent with the maximum benefit of the people of the State.
The water quality changes associated with proposed project will not unreasonably affect present and anticipated beneficial uses.	The water quality changes associated with injection will not unreasonably affect present and anticipated beneficial uses.
The water quality changes will not result in water quality less than prescribed in the Basin Plan.	The water quality changes associated with injection will not result in water quality less than prescribed in the Basin Plan. Per the Basin Plan's Anti-degradation Policy, if existing water quality of a water is better than the objectives defined in the Basin Plan, the existing quality shall be maintained. For this project, drinking water from the City's existing water supply system will be the source water for injection testing, so it is not anticipated that injection water will be of lesser quality than existing groundwater quality of the Basin.
The projects are consistent with the use of best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State.	The City project is consistent with the use of the best practicable treatment or control to avoid pollution or nuisance and maintain the highest water quality consistent with the maximum benefit to the people of the State.
The proposed project is necessary to accommodate important economic or social development.	The City project is necessary to accommodate important economic and social development. Given the reliability uncertainties and increasing costs of imported water, increasing use of groundwater storage ensures a diversified and more reliable water supply. The City project provides a sustainable and reliable water source to replenish the groundwater basin, maintains high-quality groundwater, complies with pertinent regulatory requirements by employing an institutionally feasible approach, minimizes costs to customers using groundwater, and engages stakeholders in the decision-making process.
Implementation measures are being or will be implemented to help achieve Basin Plan Objectives in the future.	Injection water will meet drinking water quality standards, thus ensuring Basin Plan Objectives are being met during injection testing.

Figures

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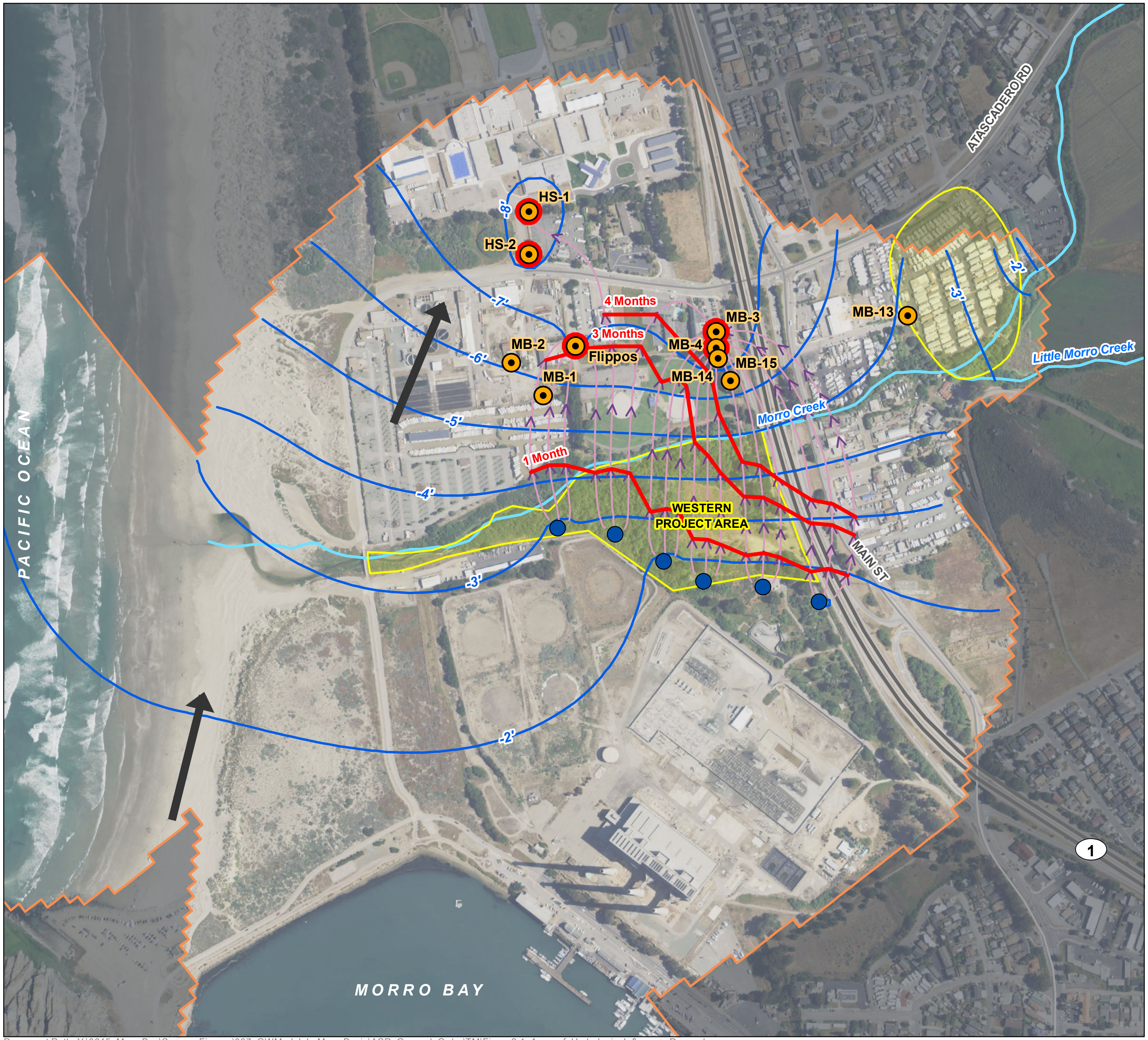

FIGURE 2a

Area of Hydrologic Influence - Dry Conditions

Morro Bay
Indirect Potable Reuse
Program Injection Testing

LEGEND

- City of Morro Bay Well
- Pumping Well
- Simulated Injection Well Location
- Particle Track Arrow (1 month)
- Particle Track
- Month Indicator
- Groundwater Elevation Contour (ft)
- Modeled Groundwater Flow Direction
- Active Area
- Potential Project Area
- Major Road
- Watercourse

NOTES

AFY: acre feet per year
Each travel time arrow along particle track represents 1 month.

Figure is adapted from Figure 14 of GSI "Characterization of Selection of Project Area for Injection Testing, City of Morro Bay" (GSI. 2021).

N

0 350 700
Feet

Date: March 23, 2021
Data Sources: NAIP Imagery, ESRI

GSI Water Solutions, Inc.

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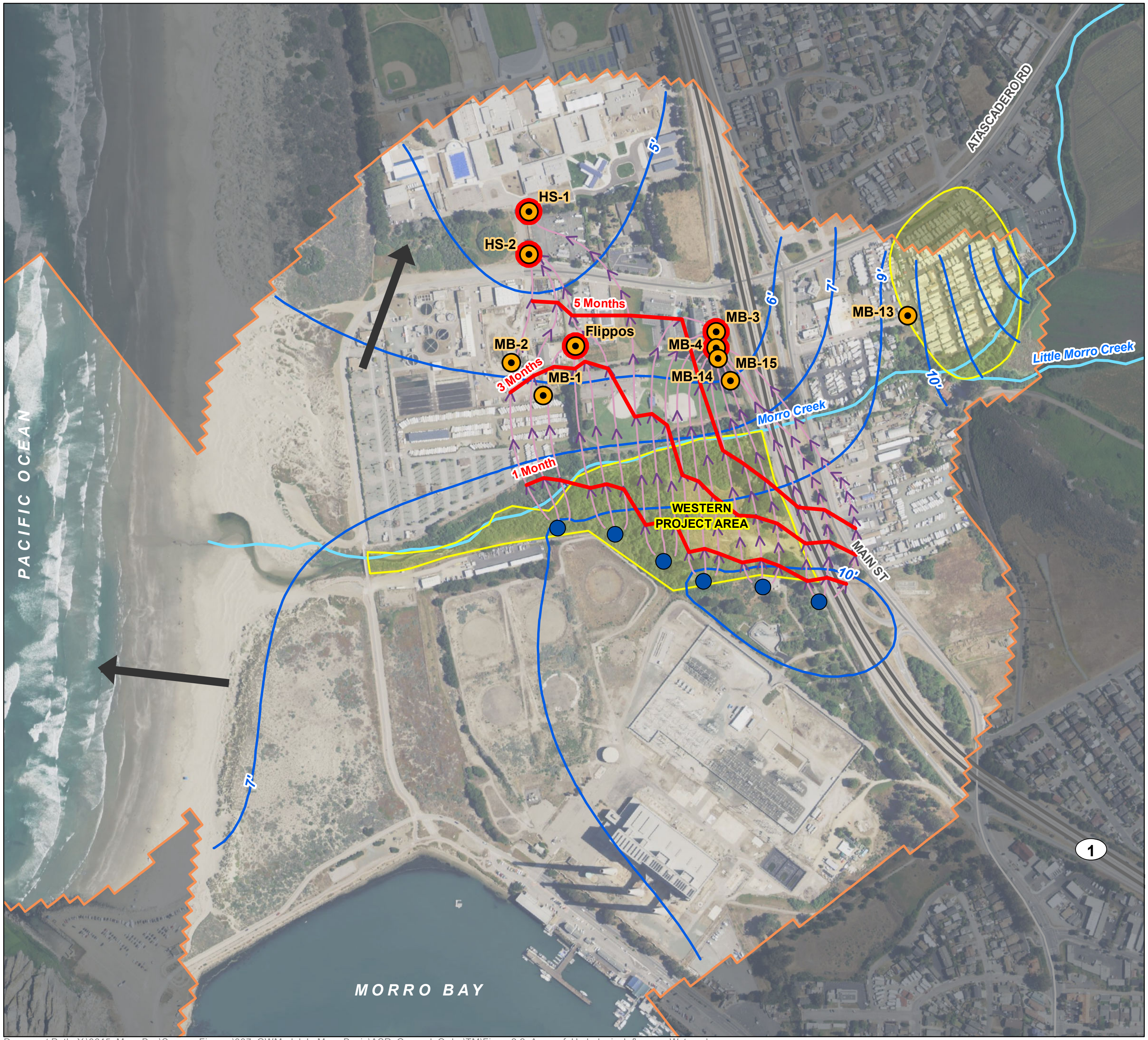


FIGURE 2b

Area of Hydrologic Influence - Wet Conditions

Morro Bay
Indirect Potable Reuse
Program Injection Testing

LEGEND

- City of Morro Bay Well
- Pumping Well
- Simulated Injection Well Location
- Particle Track Arrow (1 month)
- Particle Track
- Month Indicator
- Groundwater Elevation Contour (ft)
- Modeled Groundwater Flow Direction
- Active Area
- Potential Project Area
- Major Road
- Watercourse

NOTES

AFY: acre feet per year
Each travel time arrow along particle track represents 1 month.

Figure is adapted from Figure 15 of GSI "Characterization of Selection of Project Area for Injection Testing, City of Morro Bay" (GSI, 2021).

N

0 350 700
Feet

Date: March 23, 2021
Data Sources: NAIP Imagery, ESRI

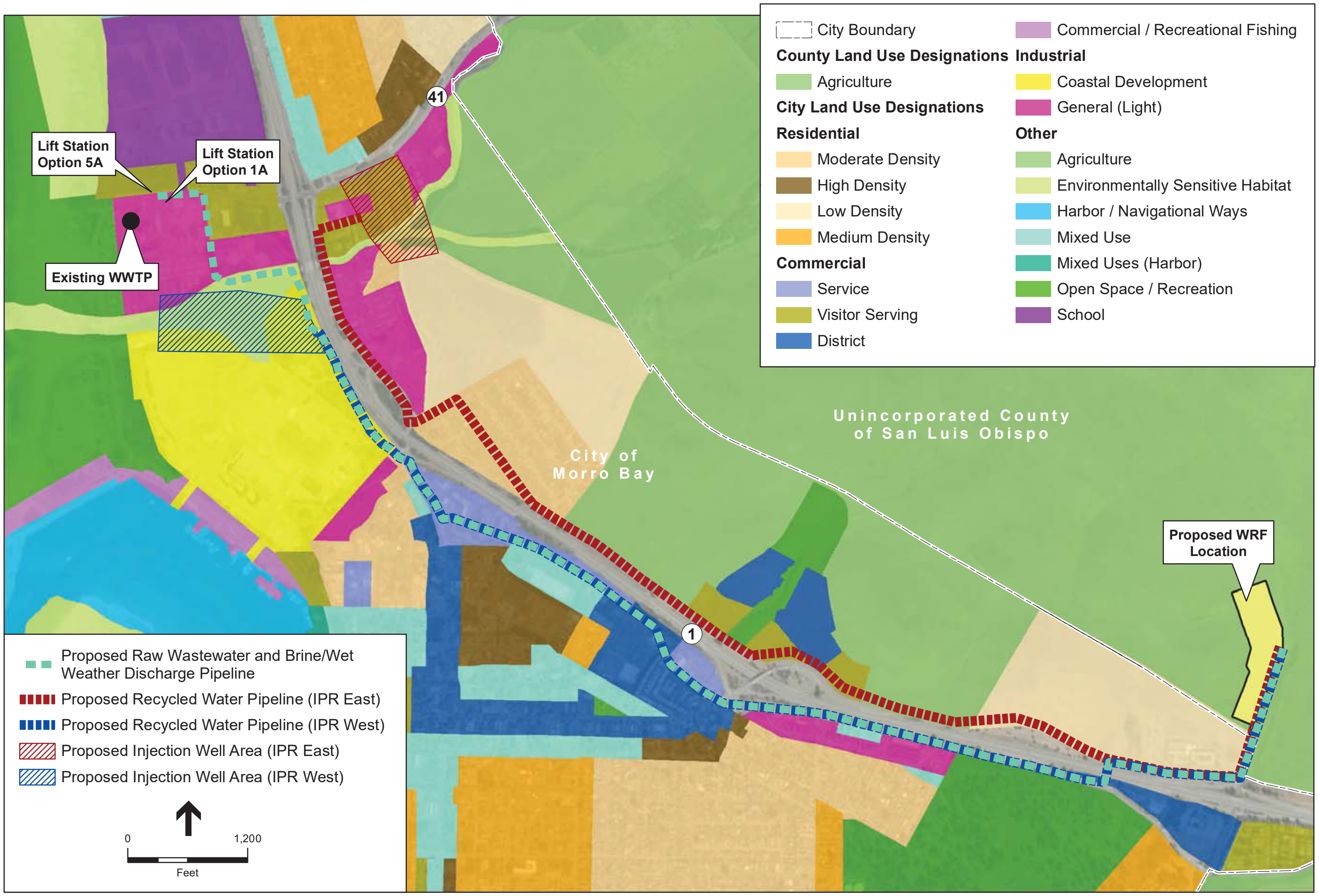
GSI Water Solutions, Inc.

Document Path: Y:\0645_MorroBay\Source_Figures\007_GWModel_L_MorroBasin\ASR_General_Order\TM\Figure2-2_Area_of_Hydrologic_Influence_Wet.mxd

FIGURE 3

City and County Land Use Designation

Morro Bay
Indirect Potable Reuse
Program Injection Testing



NOTES
WRF: Water Reclamation Facility
WWTP: Waste Water Treatment Plant

Adapted from Figure 3.10-1 of "Morro Bay WRF Draft Environmental Impact Report" (ESA 2018)

Data Sources: City of Morro Bay, San Luis Obispo County, ESRI 2016

GSI Water Solutions, Inc.

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FIGURE 4

Potentially Contaminating Activity Sites

Morro Bay
Indirect Potable Reuse Program
Injection Testing

LEGEND

- Injection Well No. 1
- DTSC Cleanup Site
- Closed LUST Cleanup Site
- Western Project Area
- Major Road
- Watercourse

NOTES

DTSC: Department of Toxic Substances Control
LUST: Leaking Underground Storage Tank

N

0 350 700
Feet

GSI Water Solutions, Inc.

Date: April 1, 2021
Data Sources: NAIP Imagery, ESRI, GeoTracker

Document Path: Y:\0645_MorroBay\Source_Figures\007_GWModel_L_MorroBasin\ASR_General_Order\TM\Figure4_Potentially_Contaminating_Activity_Sites.mxd

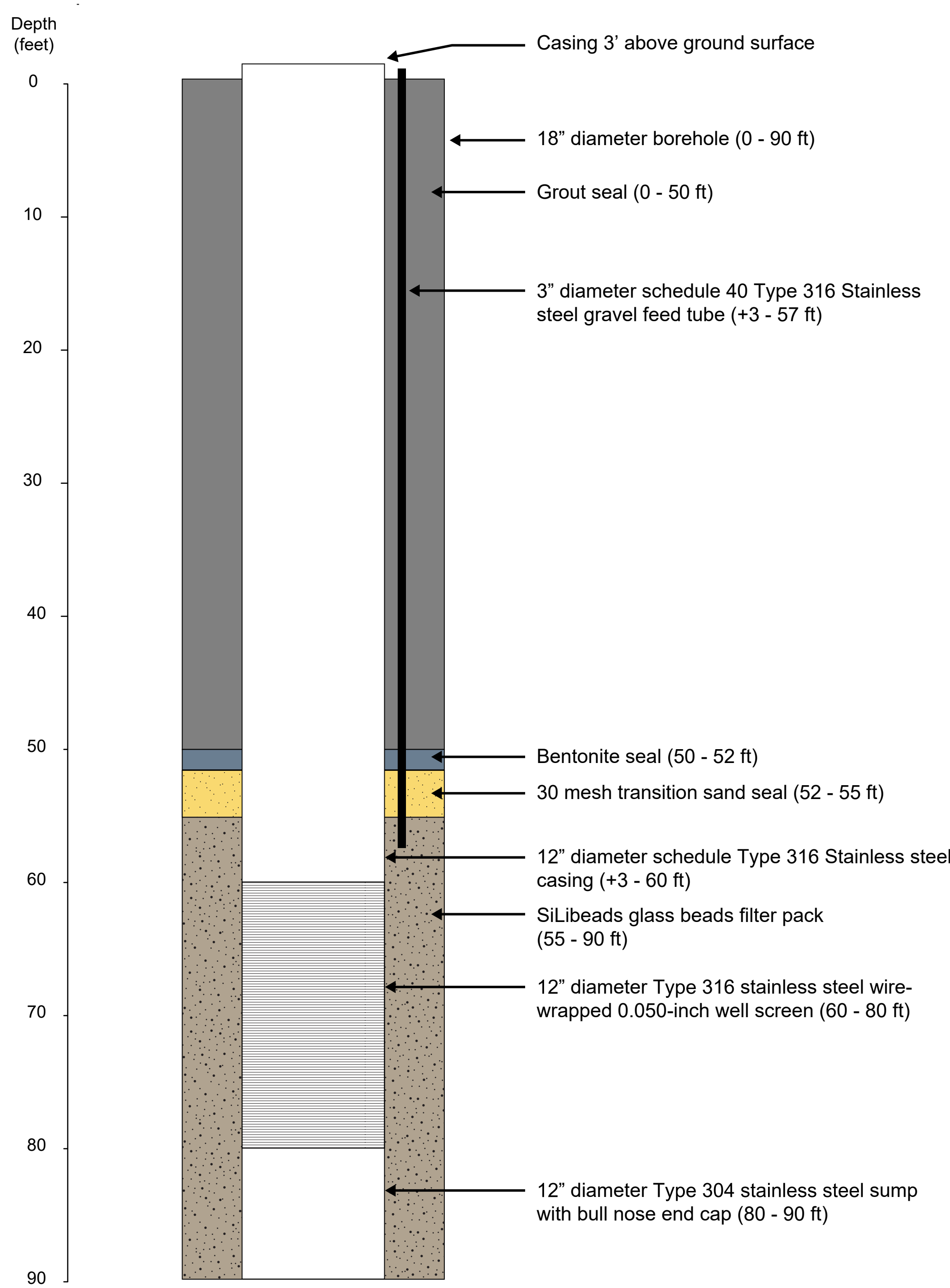

FIGURE 5

Proposed Injection Well Design

Indirect Potable Reuse Program Injection Testing
Morro Bay, CA

GSI Water Solutions, Inc.

Appendices

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APPENDIX A

Injection Testing Work Plan for Groundwater Management Replenishment and Reuse Project, Morro Bay, California

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DRAFT TECHNICAL MEMORANDUM

DRAFT Injection Testing Work Plan for Groundwater Replenishment and Reuse Project, Morro Bay, California

To:	Lydia Holmes and Anthony Cemo, Carollo Engineers
From:	Tim Thompson and Tim Nicely, GSI Water Solutions
CC:	Brynne Weeks and Andrew Salveson, Carollo Engineers
Attachments:	Figure Water Quality Sampling Constituents Table
Date:	April 9, 2021

Introduction and Purpose

GSI Water Solutions (GSI) is supporting the City of Morro Bay with the implementation of a planned indirect potable reuse (IPR) project, which will use highly treated recycled water from the City's forthcoming Water Reclamation Facility (WRF). The installation and operation of a Groundwater Replenishment Reuse Project (GRRP) using injection wells is a key part of the overall project. This memorandum presents the work plan for testing at a new injection well proposed to be installed in Spring 2021.

The injection testing presented in this work plan is a portion of work being performed by GSI for the City of Morro Bay in the lower portion of the Morro Valley Groundwater Basin, which also includes injection well design and installation, groundwater monitoring, permitting support, and groundwater flow modeling.

Injection Work Plan

The injection testing presented in this work plan provides diagnostic information regarding injection rates, aquifer response, and water quality at anticipated injection rates for a single well. Injection testing will be conducted at a newly constructed injection well located as shown on Figure 1.

Injection Testing

A series of injection tests will be conducted by conveying water from the City's municipal water supply distribution system into the new injection well. The injection tests will consist of an 8-hour injection step test and a 7-day injection constant rate test, operated by the Contractor. The wellhead will be sealed and capable of maintaining injection pressures up to 20 psi with anticipated injection pressures of up to 10 psi during testing in order to observe and maintain a range of injection rates. The injected water will consist of chlorinated water provided by the City from their State Water Project source.

City staff will install an outlet fitting and backflow prevention device onto the nearby City distribution pipeline located east of the nearby bike path for the purposes of this project. City staff will also construct a trench across the bike path and install a short section of piping that daylights west of the bike path and, for security purposes, west of the fence within the Dynegy/Vistra property. The drilling Contractor will connect to this fitting, the location of which is shown approximately on Figure 1 and run a temporary pipeline that will convey the water to the injection well for the testing. The pipeline conveying the injection water to the well will be equipped by the Contractor with a flow control valve, flow meter, sampling port, pressure gauge, and a bypass filter. The bypass filter allows for monitoring of the turbidity of the injected water and will verify if turbid water is being injected (which is undesirable because of clogging potential) -- GSI will provide guidance to the Contractor for the materials and setup of this filter. A pressure transducer will be installed by the Contractor in the well to collect continuous water level data, and manual water level (and wellhead pressure) measurements will also be collected. All conveyance piping, measurement devices, and downhole equipment will be installed, maintained, and operated by the Contractor. GSI staff will be onsite to oversee the installation of the equipment. The Contractor will be required to provide temporary fencing around the immediate wellhead, which is assumed to require a 12- by 20-foot fenced area.

The following sections provide details for each phase of the injection testing program. The injection testing activities will be conducted following the drilling, construction, and pump testing of the injection well. The pump testing component will consist of both a step test and a constant rate test using a temporary pump installed and operated by the drilling contractor. The step test will involve pumping the well at 4 successively higher flow rates for 1 to 2 hours each while carefully monitoring water level drawdowns in the injection well and at the nearby monitoring well. The drawdown results of the step test will be used to establish the pumping rate used in the 24-hour constant rate pumping test.

Injection Step Test

The data collected during the pumping tests will be used by GSI to select the injection rates for the injection step test. This initial injection test will consist of four steps conducted at a series of discrete flow rates that will each last approximately 2 hours. The steps for the injection rates will be selected based on the drawdown results of the constant rate aquifer pumping test performed as part of the injection well installation. They will likely vary from approximately 10 to 80 gpm, but final rates will be determined after installation and testing of the injection well. The injection rate will be increased incrementally for each of the steps while simultaneously monitoring the water level in the well. Water level measurements will be recorded both at the injection well and at the nearby monitoring well with transducer and manual measurements. The results of the injection step test will be analyzed to determine appropriate injection rate for the constant rate injection test.

Injection Constant Rate Test

After the well has fully recovered from the injection step test, the constant rate injection test will be run at a continuous injection rate for various durations and ultimately for a continuous period of up to 7 days. During the tests, measurements of the flow rate, and corresponding water level shall be made at both the injection well and the nearby monitoring well. During the injection tests, a pressure transducer will record continuous water level data throughout the test. Manual measurement of water levels will also be collected at the following times relative to the start of the test:

- Every 5 minutes until 30 minutes have elapsed.
- Every 10 minutes until one hour has elapsed.
- Every 20 minutes until two hours have elapsed.
- Every hour until 24 hours have elapsed.
- Every two hours until 48 hours have elapsed.
- Every 4 to 6 hours until the end of the 7-day test.

Immediately after termination of the test, the rate of recovery of the water level shall be monitored for a period of 48 hours at both the injection and monitoring wells. The water levels will be recorded at the same time intervals (logarithmic) as the start of the constant rate injection test.

Analysis of Injection Testing Results

Following the completion of injection testing, data will be analyzed to estimate aquifer properties and provide a range of operational injection rates for the well. This information will also be used to update the groundwater model to evaluate project build out options.

Following updates to groundwater model, a series of scenarios will be developed in coordination with the City and Carollo Engineers to assess the ultimate number and location of wells required for the full project. Additional information from the modeling scenarios will include assessment of retention time within the aquifer, water level changes during and following injection periods and identification of any potential adverse conditions.

Recommendations will be provided for anticipated operational scheduling and approaches to minimize any potential adverse consequences and maximize the benefits of the proposed injection program.

Water Quality Sampling and Geochemical Evaluation

In addition to the collection of aquifer data collected during the tests, water quality samples will be collected at both the Injection well and/or the nearby monitoring well at the following times and analyzed for the list of constituents identified in the attached table:

- Collect samples at both the Injection and monitoring well just prior to the end of the constant rate pumping test (to establish the baseline aquifer water quality)
- Collect a sample at the Injection well during the early phase of injection to document water quality of source water (at the end of the first day of the constant rate injection test)
- Collect a sample at the Injection well during the late phase injection source water (during the final day of the constant rate injection test)
- Samples will be collected from the monitoring well during the constant rate injection test during day 3, day 5, and day 7 (three sampling events). Results from these analyses will be used to assess if water quality changes indicate if injected water has reached the monitor well during the duration of the test.
- After completion of the constant rate injection test, groundwater samples will be collected once a week at the Injection well for four consecutive weeks. For each sampling episode, the well will be pumped to waste until parameters stabilize prior to sampling.

Water quality results for key constituents will be evaluated to identify mixing relationships and/or the presence of geochemical reactions. These field results will be used to verify the findings of the geochemical modeling described in the Geochemical Work Plan for Groundwater Replenishment and Reuse Project (GSI, 2021).

Injection Testing Schedule and Reporting

The injection testing will be conducted following the completion of the well installation and constant rate aquifer test. It is anticipated that the injection testing will begin by late May 2021 and require approximately 6 to 7 weeks to complete, including the 4 weeks of post-testing water quality sampling. Following the completion of the injection testing program, the Contractor will be responsible for removing all equipment and conveyance pipelines. The Contractor will not be provided final payment until the site condition is deemed satisfactory by the City and the terms of the project Technical Specifications are met.

The testing results will be provided in a technical memorandum (TM). This TM is anticipated to be completed by the end of July, approximately one month following the completion of the field work if the proposed drilling and injection testing schedules are met.

Figure

FIGURE 1

Site and Well Location Map

Morro Bay
Indirect Potable Reuse Program
Injection Testing

LEGEND

InjWell

- Injection Well No. 1
- Well Construction Site
- Cuttings and Drilling Fluids Disposal
- Bike Path
- Piezometer
- Temporary Hose
- MBMWC Well
- Yeh Piezometer
- PG&E Property Boundary
- Western Project Area, 17 Acres
- Watercourse

NOTE

MBMWC: Morro Bay Mutual Water Company

N

0 150 300
Feet

Date: March 19, 2021
Data Sources: NAIP Imagery, ESRI

GSI Water Solutions, Inc.

Document Path: Y:\0645_MorroBay\Source_Figures\007_GWModel_L_MorroBasin\Pilot_Inject_Well\Figure1_Western_Project_Site_Injection_Well_2021.mxd

Water Quality Sampling Constituents

Parameter Type	Parameter	Method
Field	Dissolved oxygen	YSI 556 or similar
	pH	EPA 150.1
	Oxidation-Reduction Potential	SM2580B
	Specific Conductance	EPA 120.1
	Temperature	YSI 556 or similar
	Turbidity	EPA 180.1
Inorganics	Alkalinity	SM2320B
	Ammonia	SM4500NH3G
	Bicarbonate	SM2320B
	Carbonate	SM2320B
	Chloride	EPA 300.0
	Cyanide (HCN)	EPA 335.4
	Fluoride	EPA 300.0
	Hardness	EPA 200.8
	Nitrate+Nitrite (total N)	EPA 300.0
	Nitrate (as N)	EPA 300.0
	Nitrite-N	EPA 300.0
	Orthophosphate as P	EPA 300.0
	Total Silica (as SiO2)	EPA 200.7
	Dissolved Silica (as SiO2)	EPA 200.7
	Sulfate	EPA 300.0
	Sulfide	SM4500S2F
Metals (Dissolved)	Aluminum	EPA 200.7
	Antimony	EPA 200.8
	Arsenic	EPA 200.8
	Barium	EPA 200.8
	Beryllium	EPA 200.8
	Cadmium	EPA 200.8
	Calcium	EPA 200.7
	Chromium	EPA 200.8
	Cobalt	EPA 200.8
	Copper	EPA 200.8
	Iron	EPA 200.7
	Lead	EPA 200.8
	Lithium	EPA 200.8
	Magnesium	EPA 200.7
	Manganese	EPA 200.8
	Mercury	EPA 245.7
	Molybdenum	EPA 200.8
	Nickel	EPA 200.8
	Potassium	EPA 200.7
	Selenium	EPA 200.8
	Silver	EPA 200.8
	Sodium	EPA 200.7
	Strontium	EPA 200.8
	Thallium	EPA 200.8

	Uranium	EPA 200.8
	Vanadium	EPA 200.8
	Zinc	EPA 200.8
Miscellaneous	Chemical Oxygen Demand	EPA 410.4
	Color	SM 2120B
	Corrosivity	Langelier Index
	Dissolved Organic Carbon	SM 5310C
	Foaming Agents (MBAs)	SM5540C
	Methane	RSK175
	Odor	2150B
	Oxidation-Reduction Potential	SM2580B
	pH	EPA 150.1
	Specific Conductance	EPA 120.1
	Total Dissolved Solids	SM 2540C
	Total Organic Carbon	SM5310C
	Total Suspended Solids	SM 2540D
	Turbidity	EPA 180.1
	Asbestos	Microscope: Hitachi 7000FA
DBPs	Residual Chlorine	SM 4500CL-G
	Dibromoacetic Acid (HAA)	SM6251B
	Dichloroacetic Acid (HAA)	SM6251B
	Monobromoacetic Acid (Bromoacetic acid) (HAA)	SM6251B
	Monochloroacetic Acid (HAA)	SM6251B
	Trichloroacetic Acid (HAA)	SM6251B
	Total Haloacetic Acids (Total HAA's)	SM6251B
	Bromodichloromethane (THM)	EPA 524.3
	Bromoform (THM)	EPA 524.3
	Chloroform (THM)	EPA 524.3
	Dibromochloromethane (THM)	EPA 524.3
	Total Trihalomethane (TTHM)	EPA 524.3
	Chlorite	EPA 300
Other	Bromate	EPA 317
	Hexavalent Chromium	EPA 218.7

APPENDIX B

Geochemical Work Plan for Groundwater Management Replenishment and Reuse Project, Morro Bay, California

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DRAFT TECHNICAL MEMORANDUM

DRAFT Geochemical Work Plan for Groundwater Replenishment and Reuse Project, Morro Bay, California

To:	Lydia Holmes and Anthony Cemo; Carollo Engineers
From:	Tim Thompson and Tim Nicely; GSI Water Solutions
CC:	Brynne Weeks and Andrew Salveson; Carollo Engineers
Date:	April 7, 2021

Introduction and Purpose

GSI Water Solutions (GSI) is supporting the City of Morro Bay with permitting and installation of a planned indirect potable reuse (IPR) project, which will use highly treated recycled water from the City's forthcoming Water Reclamation Facility (WRF). The installation and operation of a Groundwater Replenishment Reuse Project (GRRP) using IPR (subsurface application) is central to the overall project. As a part of this project, this memo presents our work plan to characterize significant subsurface geochemical parameters that may impact the project.

Background

As part of the installation of the monitoring well that will be installed along with the initial injection well, undisturbed physical samples of the aquifer sediments from the primary injection zone will be collected. These samples will be submitted for geochemical analysis by a specialized analytical laboratory (Minerology, Inc). Results of this analysis will be used along with native groundwater water quality and anticipated injection water quality to model the potential for geochemical reactions in the aquifer soil matrix that may occur during project operations.

Two important objectives of this work will be to assess (a) the potential for the injection well screens and filter pack to become clogged due to reactions between injected water, native groundwater, and the aquifer matrix in the vicinity of the injection wells, and (b) the potential for geochemical reactions to occur which could generate adverse groundwater quality in the recovered groundwater. These analyses will assess the potential geochemical reactions that may occur both through reactions associated with the mixing of two different waters (native groundwater and the advanced treated recycled water), and through the chemical reactions of the injected water with the sediments comprising the aquifer.

Additionally, as described in the Injection Testing Work Plan, a series of water quality samples will be collected and analyzed during the injection well testing to assess any changes in water quality following the injection. A series of sampling events will be conducted to ascertain changes in the injected water quality following residence within the aquifer for up to several weeks. The results of this analysis will be used in tandem with the analyses described below to better understand the potential for adverse geochemical reactions to occur.

Laboratory Analyses

The soil samples collected during installation of the new monitoring well to be located near the proposed injection well will be sent to a specialty laboratory (Mineralogy, Inc) for analysis by the following methods:

- X-Ray Diffraction (XRD): This method analyzes soil mineralogy, which is used to evaluate potential mineral-water reactions.
- X-Ray Fluorescence (XRF): This method analyzes soil chemical composition, which provides the abundances of elements not identified by XRD.
- SEM & Thin Section Petrography: Microscopy is used to identify mineral occurrences present below XRD detection limits; it also informs on mineral sizes, reactive coatings, and morphology.
- Particle Size Distribution: This method analyzes the clay content of soil.
- Cation Exchange Capacity: This method quantifies the abundance of reactive cation exchange sites on clay.

We will also send samples to a standard analytical laboratory for analysis of the following constituents:

- Hexavalent Chromium, Total Arsenic, Total Organic Carbon (TOC), Total Selenium, Total Sulfides, and Total Solids

Results from these analyses will be used in combination with the anticipated water quality of the recycled water to be injected to identify potential geochemical reactions that may occur.

Geochemical Modeling

To assess the potential for chemical reactions that could be problematic for injection well operations, GSI's subcontractor SS Papadopoulos & Associates, Inc. will employ the USGS geochemical modeling package PHREEQC to evaluate potential aqueous geochemical calculations. PHREEQC is a widely accepted geochemical modeling tool and is based on an ion-association aqueous model and has capabilities for speciation and saturation-index calculations, reaction-path and advective-transport calculations, mixing of solutions, mineral and gas equilibria, and other geochemical calculations. If the chemistry of the injected advanced treated water and the in-situ groundwater are known, and the minerology of the aquifer is characterized, the modelling package allows a detailed chemical analysis of the expected reaction products between the mixed waters and with the minerals comprising the aquifer sediments.

The chemistry of the in-situ groundwater will be characterized using existing water quality data from the City's production wells, and chemical analysis of the newly installed test and monitoring wells. The expected chemistry of the water to be injected will be based on water quality estimates from the WRF design engineer. To characterize the aquifer materials, mineralogical analyses will be conducted on core samples collected during drilling of the monitoring wells. The results of this analysis will allow GSI to assess the potential for potential problems associated with mixing of the injected water and the aquifer materials including dissolution or precipitation of minerals through geochemical reactions, which can cause clogging in both the well screen and the pore space of the aquifer skeleton itself.

Results

Utilizing the (a) mineralogical analysis results from Minerology Inc., (b) the water quality information of the native groundwater and predicted IPR water, and (c) the water quality results collected during the Injection Well Testing, the geochemical analysis will be conducted and used to develop the assessment of any potentially deleterious conditions associated with the project activities. Recommendations will be provided for water quality treatment or operational approaches to minimize any potential adverse consequences of the proposed injection program.

Schedule

The aquifer sediment sample will be collected during monitoring well installation in late April. . Samples will be sent to Minerology, Inc. for analysis, a process that takes 2-3 weeks. Results will be received and used along with water quality data in the geochemical modeling which will occur over the following 4 weeks. A technical memorandum (TM) will be prepared documenting the work. This TM is anticipated to be complete by the end of May, if the proposed drilling and laboratory analysis schedules are met.

APPENDIX C

California Division of Drinking Water Permit

CA Drinking Water Watch

Links

- PS Code Transition
- Water System Details
- Water System Facilities
- Monitoring Schedules
  - Old Format
  - New Format
- Monitoring Results
- Monitoring Results By Analyte
- Lead And Copper Sampling
  - Summaries
  - Next Sampling Due Dates
  - All Lead Sampling Results
  - All Copper Sampling Results
- Violations/Enforcement Actions
- Site Visits
- Consumer Confidence Reports
  - 2019
  - 2018
  - 2017
  - 2016
- Lead Service Line Documents
  - Certified Form

Water System Details

Water System No. :	CA4010011	**Federal Type :**	C
Water System Name :	MORRO BAY PW DEPT - WATER DIVISION	**State Type :**	C
Principal County Served :	SAN LUIS OBISPO	**Primary Source :**	SWP
Status :	A	**Activity Date :**	03-22-1979
Distribution System Classification :	D3	**Max Treatment Plant Classification :**	T2

Water System Contacts

Type	Address	Phone	Email - Web Address
Physical Location Contact	CA4010011-MORRO BAY PW DEPT - WATER DIV 955 SHASTA AVENUE MORRO BAY,CA 93442	805-772-6261	www.morrobayca.gov There is no web address
Administrative Contact	955 Shasta Avenue MORRO BAY,CA 93442		

Division of Drinking Water District / County Health Dept. Info

Name	Phone	Email	Address
DISTRICT 06 - SANTA BARBARA	805-566-1326	dwpdist06@waterboards.ca.gov	1180 EUGENIA PLACE SUITE 200 CARPENTERIA CA 93013

Annual Operating Periods & Population Served

Start Month	Start Day	End Month	End Day	Population Type	Population Served
1	1	12	31	R	10234

Service Connections

Type	Count	Meter Type	Meter Size Measure
CB	5532	ME	0

Sources of Water

Service Areas

Return Links

Water System Search

County Map

Glossary

Contact Info

Name	Type Code	Status
CALIFORNIA MENS COLONY	CC	A
CCWA - TREATED	CC	A
FLIPPOS WELL	WL	A
HIGH SCHOOL WELL 01	WL	A
HIGH SCHOOL WELL 02	WL	A
WELL 03	WL	A
WELL 04	WL	A
WELL 11A	WL	A
WELL 14	WL	A
WELL 15	WL	A
DESAL RAW - SEAWATER - STANDBY-INACTIVE	IN	I
GOLF COURSE WELL - INACTIVE	WL	I
PG&E WELL 02 - INACTIVE	WL	I
WELL 01 - INACTIVE	WL	I
WELL 02 - INACTIVE	WL	I
WELL 05 - ABANDONED	WL	I
WELL 06 - ABANDONED	WL	I
WELL 07 - ABANDONED	WL	I
WELL 08 - ABANDONED	WL	I
WELL 09 - INACTIVE	WL	I
WELL 09A - INACTIVE	WL	I
WELL 10 - INACTIVE	WL	I
WELL 10A - INACTIVE	WL	I
WELL 11 - DESTROYED	WL	I
WELL 12 -	WL	I

Code	Name
R	RESIDENTIAL AREA

ABANDONED		
WELL 13 - INACTIVE	WL	I
WELL 16 - INACTIVE	WL	I

Water Purchases

Seller Water System No.	Water System Name	Seller Facility Type	Seller State Asgn ID No.	Buyer Facility Type	Buyer State Asgn ID No.
CA4010830	CALIFORNIA MENS COLONY	IN	001	CC	033
CA4210030	CENTRAL COAST WATER AUTHORITY			CC	024

APPENDIX D

Class V Injection Well Notification Documentation

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Underground Injection Well Registration for the Pacific Southwest (Region 9)

Resources

- **Underground Injection Control in Region 9**
- **General Inquiries** or send email to R9iWells@epa.gov
  (Be sure to include your e-mail address if you'd like a response)

Register any class of injection well using the inventory form below.

On this page:

- How to Register Injection Wells
- Frequently Asked Questions
- Injection Well Inventory Form

How to Register Injection Wells

If you own, operate or plan to construct one or more injection wells, you are required to register those features, also known as injection wells, with the Underground Injection Control program. This requirement applies to deep and shallow subsurface disposal systems as defined in 40 CFR part 144. Compliance with the federal Underground Injection Control (UIC) regulations includes fulfilling two basic requirements: (1) - register injection well(s) and (2) - do not use injection wells in a manner that will contaminate underground sources of drinking water.

These instructions and e-Form were developed to assist injection well owners in Arizona, California, Hawaii, and Indian Tribes of the desert southwest comply with the federal UIC regulations. Other state and local regulations may apply. See the regulations at 40 CFR part 144 for more information, at the U.S. Government Printing Office.

Frequently Asked Questions

My runoff discharges to a swale, pond or ditch. Is this injection?

If there is no subsurface (buried) discharge component to the system, then it is not subject to UIC requirements, however it may be subject to Clean Water Act requirements or other water protection regulations.

The injection well serves a single family home. Do I have to register the well?

Injection wells serving single family homes do not have to submit inventory information unless they are used by a home-based business, such as car repair, pet boarding, medical services or other businesses that generate a liquid waste stream that is to be disposed underground.

I have a septic system with multiple leachfield lines. Does each leachfield pipe count as a different injection well?

No, if all of the leachfields receive effluent from the same septic tank or other treatment device, they count as components of one injection well or subsurface fluid distribution system.

Is registering the injection well my only obligation?

Some injection activities are subject to state and local requirements and/or permits. Single-family onsite sewage systems are generally regulated by county environmental health agencies. Large capacity sanitary waste disposal and industrial discharges may be regulated by local or state water quality agencies. If your injection well(s) are subject to a discharge permit from the state, please list that permit number in the comments box to help reduce duplicative requirements.

Depending on multiple factors, such as your location in relation to drinking water supply wells or the type of injectate, your injection well(s) may be subject to additional federal requirements. These requirements may include sampling, characterization, permitting or closure of injection wells. Shallow injection of hazardous waste, untreated sewage and motor vehicle repair fluids is **prohibited** except in ongoing remedial actions overseen by regulatory agencies. See the regulations for more information. **IMPORTANT:** You must notify EPA if the ownership, well operating status or injectate changes.

How does EPA use the information?

EPA will use this information to notify you of applicable regulatory requirements or best management practices to prevent contamination. EPA shares the data with other water quality agencies, public water supply agencies, and in response to Freedom of Information Act requests for the data.

For more information, contact your EPA or state UIC program or email R9iWells@epa.gov.

Injection Well Inventory Form

After submitting this form, a confirmation email with the submitted form data will be sent to the Email address provided.

Transaction Type (choose one): ☒ First time entry ◯ Change

---------- Facility Information ----------

Facility Name: (Required)

City of Morro Bay

This is a private residence ◯ true ☒ false

Street:

955 Shasta Ave

Street 2:

City: (Required)

Morro Bay

State: (Required) CA

Zip: (Required) 93442

Facility Phone: 805-772-6261

---------- Facility Location ----------

County CA-San Luis Obispo

Land ID:

RCRA ID, APN, or TMK or leave blank

066-331-046

Indicate the land ownership of the property: (Required)

◯ Private
☒ Government-local, state
◯ Government-federal
◯ Government-tribal
◯ Non-Profit

If Tribal select Tribe name: - None -

NAICS Code

Numbers only, please. For industry/business, find NAICS code at www.census.gov

Latitude

Latitudes in American Samoa should be entered as *negative* numbers. Free lat/long finder is latlong.net

35.376036 °N

Longitude

Enter positive numbers for degrees longitude east or negative numbers for longitude west, in this field.

120.856095

Longitude (W or E)
Specify "W" for longitudes in the U.S., or "E" for longitudes in Guam & the Northern Mariana Islands.

W

---- Legal Contact Information: Owner or Other Responsible Party ----

Owner Contact Name:

Joe Mueller

Email: (Required)

jmueller@morrobayca.gov

Organization: (Required)

City of Morro Bay

Street:

955 Shasta Ave

Street 2:

City: (Required)

Morro Bay

State: CA

Zip: (Required) 93442

---------- Well Details ----------

Total number of injection wells at this site: (Required)
If you would like to report other types of wells at this site, please submit this form, then use the back button to modify this entry or start over.

1

Number of identical wells reported below (Required)

Well Operating Status of your well(s):

- ☑ Planned/under construction
- ○ Active
- ○ Inactive/not plugged
- ○ Plugged and approved by regulator
- ○ Plugged and abandoned without approval

Plugged & Abandoned?

If well(s) have been plugged and abandoned enter the *numerical* year only.

Injection Well Depth
(# of feet below ground surface)

- [ ] < 50
- [x] 50 - 500
- [ ] > 500

Injection Purpose

- [ ] Disposal
- [ ] Energy production
- [ ] Hydraulic barrier
- [ ] Oil or mineral recovery
- [ ] Remediation
- [ ] Recharge
- [x] Water supply storage and withdrawal

Injectate
Select the primary constituent of injected fluids.

- [ ] Storm drainage
- [ ] Irrigation runoff
- [ ] Non-contact cooling water
- [ ] Brine
- [ ] Combined industrial/sanitary
- [ ] Disinfected Tertiary Effluent (CA Title 22)
- [ ] Geothermal fluids
- [ ] Industrial Non-hazardous (describe in comments)
- [ ] Mine lixiviant
- [x] Potable water
- [ ] Remedial fluids/air
- [ ] Septic tank effluent
- [ ] Untreated sewage

Dispersal Direction
Select the predominant plumbing orientation of the injection well(s): horizontal such as a leachfield; vertical such as a drywell or seepage pit

- [ ] horizontal
- [x] vertical

Injectate Sources
Please select one.

- [x] From this site only
- [ ] This site and others

Comments
Please list any local or state permits that authorize, monitor, or otherwise affect the reported injection well(s). If this site is subject to any local or state permits, or if you have any operational considerations for the injection well(s) that you would like to note, please list them here.

Your Name

If you are NOT the owner listed above, please enter your name here.

Chris Wick

Your Email (Required)

cwick@gsiws.com

Your Organization

Your organization if other than the contact above.

GSI Water Solutions, Inc.

Submit Registration

LAST UPDATED ON AUGUST 21, 2020

ATTACHMENT 4

GSI Water Solutions, Inc.

DRAFT TECHNICAL MEMORANDUM

DRAFT Injection Testing Work Plan for Groundwater Replenishment and Reuse Project, Morro Bay, California

To:	Lydia Holmes and Anthony Cemo, Carollo Engineers
From:	Tim Thompson and Tim Nicely, GSI Water Solutions
CC:	Brynne Weeks and Andrew Salveson, Carollo Engineers
Attachments:	Figure Water Quality Sampling Constituents Table
Date:	August 26, 2021

Introduction and Purpose

GSI Water Solutions (GSI) is supporting the City of Morro Bay with the implementation of a planned indirect potable reuse (IPR) project, which will use highly treated recycled water from the City's forthcoming Water Reclamation Facility (WRF). The installation and operation of a Groundwater Replenishment Reuse Project (GRRP) using injection wells is a key part of the overall project. This memorandum presents the work plan for testing at a new injection well proposed to be installed in Spring 2021.

The injection testing presented in this work plan is a portion of work being performed by GSI for the City of Morro Bay in the lower portion of the Morro Valley Groundwater Basin, which also includes injection well design and installation, groundwater monitoring, permitting support, and groundwater flow modeling.

Injection Work Plan

The injection testing presented in this work plan provides diagnostic information regarding injection rates, aquifer response, and water quality at anticipated injection rates for a single well. Injection testing will be conducted at a newly constructed injection well located as shown on Figure 1.

Injection Testing

A series of injection tests will be conducted by conveying water from the City's municipal water supply distribution system into the new injection well. The injection tests will consist of an 8-hour injection step test and a 7-day injection constant rate test, operated by the Contractor. The wellhead will be sealed and capable of maintaining injection pressures up to 20 psi with anticipated injection pressures of up to 10 psi during testing in order to observe and maintain a range of injection rates. The injected water will consist of chlorinated water provided by the City from their State Water Project source.

City staff will install an outlet fitting and backflow prevention device onto the nearby City distribution pipeline located east of the nearby bike path for the purposes of this project. City staff will also construct a trench across the bike path and install a short section of piping that daylights west of the bike path and, for security purposes, west of the fence within the Dynegy/Vistra property. The drilling Contractor will connect to this fitting, the location of which is shown approximately on Figure 1 and run a temporary pipeline that will convey the water to the injection well for the testing. The pipeline conveying the injection water to the well will be equipped by the Contractor with a flow control valve, flow meter, sampling port, pressure gauge, and a bypass filter. The bypass filter allows for monitoring of the turbidity of the injected water and will verify if turbid water is being injected (which is undesirable because of clogging potential) -- GSI will provide guidance to the Contractor for the materials and setup of this filter. A pressure transducer will be installed by the Contractor in the well to collect continuous water level data, and manual water level (and wellhead pressure) measurements will also be collected. All conveyance piping, measurement devices, and downhole equipment will be installed, maintained, and operated by the Contractor. GSI staff will be onsite to oversee the installation of the equipment. The Contractor will be required to provide temporary fencing around the immediate wellhead, which is assumed to require a 12- by 20-foot fenced area.

The following sections provide details for each phase of the injection testing program. The injection testing activities will be conducted following the drilling, construction, and pump testing of the injection well. The pump testing component will consist of both a step test and a constant rate test using a temporary pump installed and operated by the drilling contractor. The step test will involve pumping the well at 4 successively higher flow rates for 1 to 2 hours each while carefully monitoring water level drawdowns in the injection well and at the nearby monitoring well. The drawdown results of the step test will be used to establish the pumping rate used in the 24-hour constant rate pumping test.

Injection Step Test

The data collected during the pumping tests will be used by GSI to select the injection rates for the injection step test. This initial injection test will consist of four steps conducted at a series of discrete flow rates that will each last approximately 2 hours. The steps for the injection rates will be selected based on the drawdown results of the constant rate aquifer pumping test performed as part of the injection well installation. They will likely vary from approximately 10 to 80 gpm, but final rates will be determined after installation and testing of the injection well. The injection rate will be increased incrementally for each of the steps while simultaneously monitoring the water level in the well. Water level measurements will be recorded both at the injection well and at the nearby monitoring well with transducer and manual measurements. The results of the injection step test will be analyzed to determine appropriate injection rate for the constant rate injection test.

Injection Constant Rate Test

After the well has fully recovered from the injection step test, the constant rate injection test will be run at a continuous injection rate for various durations and ultimately for a continuous period of up to 7 days. During the tests, measurements of the flow rate, and corresponding water level shall be made at both the injection well and the nearby monitoring well. During the injection tests, a pressure transducer will record continuous water level data throughout the test. Manual measurement of water levels will also be collected at the following times relative to the start of the test:

- Every 5 minutes until 30 minutes have elapsed.
- Every 10 minutes until one hour has elapsed.
- Every 20 minutes until two hours have elapsed.
- Every hour until 24 hours have elapsed.
- Every two hours until 48 hours have elapsed.
- Every 4 to 6 hours until the end of the 7-day test.

Immediately after termination of the test, the rate of recovery of the water level shall be monitored for a period of 48 hours at both the injection and monitoring wells. The water levels will be recorded at the same time intervals (logarithmic) as the start of the constant rate injection test.

Analysis of Injection Testing Results

Following the completion of injection testing, data will be analyzed to estimate aquifer properties and provide a range of operational injection rates for the well. This information will also be used to update the groundwater model to evaluate project build out options.

Following updates to groundwater model, a series of scenarios will be developed in coordination with the City and Carollo Engineers to assess the ultimate number and location of wells required for the full project. Additional information from the modeling scenarios will include assessment of retention time within the aquifer, water level changes during and following injection periods and identification of any potential adverse conditions.

Recommendations will be provided for anticipated operational scheduling and approaches to minimize any potential adverse consequences and maximize the benefits of the proposed injection program.

Water Quality Sampling and Geochemical Evaluation

In addition to the collection of aquifer data collected during the tests, water quality samples will be collected at both the Injection well and/or the nearby monitoring well at the following times and analyzed for the list of constituents identified in the attached table:

- Collect samples at both the Injection and monitoring well on the last day of the constant rate pumping test (to establish the baseline aquifer water quality)
- Collect a sample at the Injection well at the end of the first and last day of contestant rate injection to document water quality of source water
- Samples will be collected from the monitoring well during the constant rate injection test during day 3, day 5, and day 7 (three sampling events). If groundwater quality changes occur based on field parameters (indicating that the injected water has reached the monitor well), the samples will be analyzed for a reduced suite of parameters.
- After completion of the constant rate injection test, groundwater samples will be collected once a week at the Injection well and monitoring well for four consecutive weeks. For each sampling episode, the well will be pumped to waste until parameters stabilize prior to sampling.

Water quality results for key constituents will be evaluated to identify mixing relationships and/or the presence of geochemical reactions. These field results will be used to verify the findings of the geochemical modeling described in the Geochemical Work Plan for Groundwater Replenishment and Reuse Project (GSI, 2021).

Table 1. Sampling Schedule

Stage	Purpose	Injection Well	Monitoring Well 21P-01
		Constituents	**Constituents**
Pumping constant rate (end)	Baseline groundwater quality	Complete suite	Complete suite
Injection Day 1 (end of day)	Source water quality	Complete suite	Field parameters [2]
Injection Day 3	Source water quality changes	--	Field parameters [2]
Injection Day 5	Source water quality changes	--	Field parameters [2]
Injection Day 7	Residence time	Complete suite	Complete suite
Post-Injection Weeks 1, 2, 3 and 4	Geochemical reactions	Complete suite [1]	Reduced / Complete suite [3]

Notes:
Complete and reduced suite defined in Water Quality Testing Constituents attached.
[1] If any trends are evident, a further complete sample will be collected at 6 weeks.
[2] Water quality samples will be collected for reduced suite if field-measured groundwater quality parameters changes.
[2] The monitoring well will be analyzed for the reduced suite (except DPBs) unless the field parameters indicate a change, which would trigger complete suite,

Injection Testing Schedule and Reporting

The injection testing will be conducted following the completion of the well installation and constant rate aquifer test. It is anticipated that the injection testing will begin by late May 2021 and require approximately 6 to 7 weeks to complete, including the 4 weeks of post-testing water quality sampling. Following the completion of the injection testing program, the Contractor will be responsible for removing all equipment and conveyance pipelines. The Contractor will not be provided final payment until the site condition is deemed satisfactory by the City and the terms of the project Technical Specifications are met.

The testing results will be provided in a technical memorandum (TM). This TM is anticipated to be completed by the end of July, approximately one month following the completion of the field work if the proposed drilling and injection testing schedules are met.

Figure

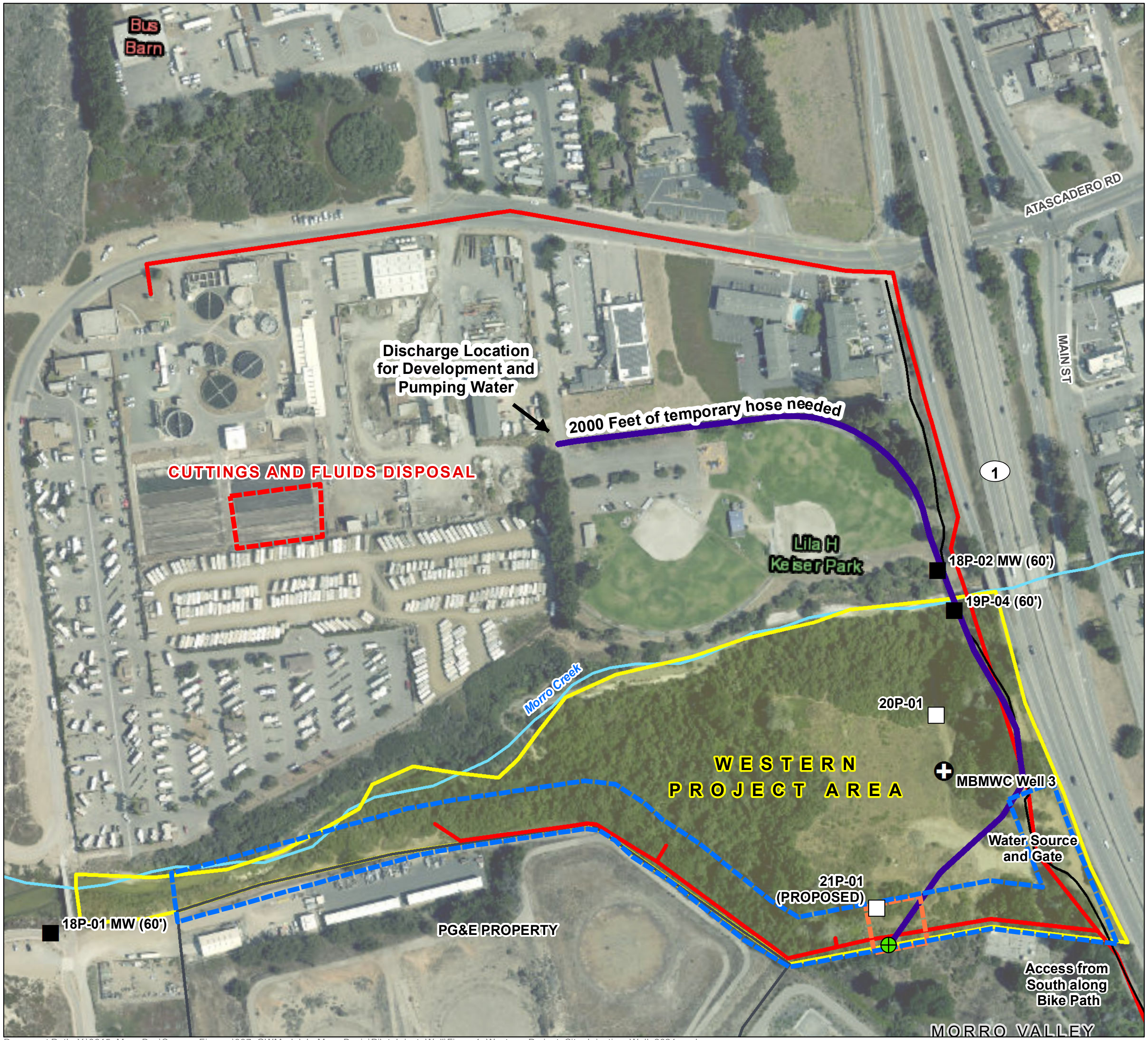

FIGURE 1

Site and Well Location Map

Morro Bay
Indirect Potable Reuse Program
Injection Testing

LEGEND

- Injection Well No. 1
- Well Construction Site
- Cuttings and Drilling Fluids Disposal
- Bike Path
- Piezometer
- Temporary Hose
- MBMWC Well
- Yeh Piezometer
- PG&E Property Boundary
- Western Project Area, 17 Acres
- Watercourse

NOTE

MBMWC: Morro Bay Mutual Water Company

N

0 150 300
Feet

Date: August 26, 2021
Data Sources: NAIP Imagery, ESRI

GSI Water Solutions, Inc.

Document Path: Y:\0645_MorroBay\Source_Figures\007_GWModel_L_MorroBasin\Pilot_Inject_Well\Figure1_Western_Project_Site_Injection_Well_2021.mxd

Water Quality Sampling Constituents

Parameter Type	Parameter	Method
Field	Dissolved oxygen	YSI 556 or similar
	pH	EPA 150.1
	Oxidation-Reduction Potential	SM2580B
	Specific Conductance	EPA 120.1
	Temperature	YSI 556 or similar
	Turbidity	EPA 180.1
Inorganics	Alkalinity	SM2320B
	Ammonia	SM4500NH3G
	Bicarbonate	SM2320B
	Carbonate	SM2320B
	Chloride	EPA 300.0
	Cyanide (HCN)	EPA 335.4
	Fluoride	EPA 300.0
	Hardness	EPA 200.8
	Nitrate+Nitrite (total N)	EPA 300.0
	Nitrate (as N)	EPA 300.0
	Nitrite-N	EPA 300.0
	Orthophosphate as P	EPA 300.0
	Total Silica (as SiO2)	EPA 200.7
	Dissolved Silica (as SiO2)	EPA 200.7
	Sulfate	EPA 300.0
	Sulfide	SM4500S2F
Metals (Dissolved)	Aluminum	EPA 200.7
	Antimony	EPA 200.8
	Arsenic	EPA 200.8
	Barium	EPA 200.8
	Beryllium	EPA 200.8
	Cadmium	EPA 200.8
	Calcium	EPA 200.7
	Chromium	EPA 200.8
	Cobalt	EPA 200.8
	Copper	EPA 200.8
	Iron	EPA 200.7
	Lead	EPA 200.8
	Magnesium	EPA 200.7
	Manganese	EPA 200.8
	Mercury	EPA 245.7
	Molybdenum	EPA 200.8
	Nickel	EPA 200.8
	Potassium	EPA 200.7
	Selenium	EPA 200.8
	Silver	EPA 200.8

	Sodium	EPA 200.7
	Strontium	EPA 200.8
	Thallium	EPA 200.8
	Uranium	EPA 200.8
	Vanadium	EPA 200.8
	Zinc	EPA 200.8
Miscellaneous	Chemical Oxygen Demand	EPA 410.4
	Color	SM 2120B
	Corrosivity	Langelier Index
	Dissolved Organic Carbon	SM 5310C
	Foaming Agents (MBAs)	SM5540C
	Methane	RSK175
	Odor	2150B
	Oxidation-Reduction Potential	SM2580B
	pH	EPA 150.1
	Specific Conductance	EPA 120.1
	Total Dissolved Solids	SM 2540C
	Total Organic Carbon	SM5310C
	Total Suspended Solids	SM 2540D
	Turbidity	EPA 180.1
	Asbestos	Microscope: Hitachi 7000FA
DBPs	Residual Chlorine	SM 4500CL-G
	Dibromoacetic Acid (HAA)	SM6251B
	Dichloroacetic Acid (HAA)	SM6251B
	Monobromoacetic Acid (Bromoacetic acid) (HAA)	SM6251B
	Monochloroacetic Acid (HAA)	SM6251B
	Trichloroacetic Acid (HAA)	SM6251B
	Total Haloacetic Acids (Total HAA's)	SM6251B
	Bromodichloromethane (THM)	EPA 524.3
	Bromoform (THM)	EPA 524.3
	Chloroform (THM)	EPA 524.3
	Dibromochloromethane (THM)	EPA 524.3
	Total Trihalomethane (TTHM)	EPA 524.3
Other	Bromate	EPA 317
	Hexavalent Chromium	EPA 218.7

Parameter Type	Parameter	Method
Field	Dissolved oxygen	YSI 556 or similar
	pH	EPA 150.1
	Oxidation-Reduction Potential	SM2580B
	Specific Conductance	EPA 120.1
	Temperature	YSI 556 or similar
	Turbidity	EPA 180.1
Inorganics	Chloride	EPA 300.0
Metals (Dissolved)	Arsenic	EPA 200.8

Miscellaneous		
	Odor	2150B
	Oxidation-Reduction Potential	SM2580B
	pH	EPA 150.1
	Specific Conductance	EPA 120.1
	Total Dissolved Solids	SM 2540C
	Total Organic Carbon	SM5310C
	Total Suspended Solids	SM 2540D
	Turbidity	EPA 180.1
DBPs	Residual Chlorine	SM 4500CL-G
	Dibromoacetic Acid (HAA)	SM6251B
	Dichloroacetic Acid (HAA)	SM6251B
	Monobromoacetic Acid (Bromoacetic acid) (HAA)	SM6251B
	Monochloroacetic Acid (HAA)	SM6251B
	Trichloroacetic Acid (HAA)	SM6251B
	Total Haloacetic Acids (Total HAA's)	SM6251B
	Bromodichloromethane (THM)	EPA 524.3
	Bromoform (THM)	EPA 524.3
	Chloroform (THM)	EPA 524.3
	Dibromochloromethane (THM)	EPA 524.3
	Total Trihalomethane (TTHM)	EPA 524.3
Other		
	Hexavalent Chromium	EPA 218.7