City of Morro Bay
Water Reclamation Facility Project

Recycled Water Management Plan
SPECIAL CONDITION NO. 6

FINAL | October 2019

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Abbreviations

AFY	acre-feet per year
BOD	biochemical oxygen demand
CCC	California Coastal Commission
Carollo	Carollo Engineers, Inc.
CCC	California Coastal Commission
CDP	Coastal Development Permit
City	City of Morro Bay
CWA	Clean Water Act
DDW	Division of Drinking Water
F	Fahrenheit
FBV	Filanc and Black & Veatch
FMP	Water Reclamation Facility Master Plan
ft	feet
GSI	GSI Water Solutions
HI	Hydrogeological Investigation
IPR	indirect potable reuse
MBMWC	Morro Bay Mutual Water Company
MBR	Membrane bioreactor
MCL	maximum contaminant limit
mgd	million gallons per day
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRC	National Research Council
Plan	Recycled Water Management Plan
RO	reverse osmosis
ROWD	Report of Waste Discharge
RWMP	Recycled Water Management Plan
RWQCB	Regional Water Quality Control Board
SWRCB	State Water Resources Control Board
SWP	State Water Project
TDS	total dissolved solids
TSS	total suspended solids
UV AOP	Ultraviolet advanced Oxidation Process
Vistra	Vistra Energy

WRFCAC	Water Reclamation Facility Citizens Advisory Committee
WRF	water reclamation facility
WRF Plan	Morro Bay Water Reclamation Facility Plan
WWTP	wastewater treatment plant
WTP	water treatment plant

Section 1

PROJECT BACKGROUND

On July 11, 2019, the California Coastal Commission (CCC) approved Coastal Development Permit (CDP) 3-19-0463 for the City of Morro Bay's (City's) Water Reclamation Facility (WRF) Project. On July 19, 2019, the City received the Notice of Intent (NOI) for the CDP, which contains sixteen special conditions. Four special conditions must be met prior to issuance of the CDP or prior to construction of the WRF including:

- Special Condition No. 1 - Final Plans and Specifications
- Special Condition No. 2 - Construction Plan
- Special Condition No. 6 - Recycled Water Management Plan
- Special Condition No. 13 - Other Authorizations

The existing Morro Bay-Cayucos wastewater treatment plant is located at 160 Atascadero Road in Morro Bay and is jointly owned and operated by the City of Morro Bay (City) and the Cayucos Sanitary District. The wastewater treatment plant was originally built in 1954 in a low-lying area near the confluence of Morro Creek with the Pacific Ocean, and it provides wastewater treatment services to the City and to the unincorporated community of Cayucos approximately six miles to the north. The wastewater treatment plant was built before modern state and federal water quality standards, and does not meet federal Clean Water Act (CWA) standards for full secondary treatment. Instead, the wastewater treatment plant has been operating under a CWA waiver for full secondary treatment requirements for biochemical oxygen demand (BOD) and total suspended solids (TSS) since 1984. In 2018, the City received a time schedule order from the Central Coast Regional Water Quality Control Board (RWQCB) requiring compliance with full CWA secondary treatment requirements by February 28, 2023.

Because of the age of the existing wastewater treatment plant, its failure to meet core CWA water quality standards and the possibility of potential fines/penalties for failure to meet the RWQCB's mandate for CWA compliance by 2023, the City has been pursuing a new upgraded wastewater treatment facility for more than a decade. The City and the Cayucos Sanitary District initially proposed to redevelop the wastewater treatment plant at its current site, but the Coastal Development Permit (CDP) was appealed to the California Coastal Commission (CCC), and ultimately in 2013, the CCC denied the City's redevelopment-in-place proposal on the basis of inconsistencies regarding avoiding coastal hazards, land use priorities, recycled water provisions and public view protections.

Following the CDP denial and given the CCC's direction to the City and the Cayucos Sanitary District on the appropriate path to upgraded wastewater and water reclamation functions, the City developed a Water Reclamation Facility Citizens Advisory Committee (WRFCAC), identified 17 potential sites for plant relocation, and developed criteria for a potential water reclamation facility project, including coastal hazards avoidance through plant relocation inland, water quality improvement through compliance with applicable water quality standards, and water supply security through recycled water provision.

Over the past six and a half years, through significant public input that shaped this project, including making critical decisions in public forums regarding WRF siting (e.g., in town vs. outside of town), components/operations, recycled water end uses (e.g., agricultural uses only or full potable reuse), funding (e.g., through two City-wide votes to raise utility fees to pay for the project), and process (i.e., two public hearings to approve the project Environmental Impact Report and two affirmative votes by the Morro Bay City Council and County Board of Supervisors to authorize a consolidated CDP approval process).

This proposed Project meets Coastal Act consistency on many fronts—for the protection and enhancement of coastal resources, for providing essential public services to Morro Bay residents and visitors, and for providing adaptation and resiliency in an era of increased hazards exacerbated by climate change. The Commission directed the City to propose a project of this type back in 2013, finding that a project that perpetuated the City's water and wastewater status quo was not appropriate or consistent with the Coastal Act. The City responded to the CCC's directive, and the proposed project is the end result that addresses the Coastal Act concerns previously raised by the CCC in a way that provides a more sustainable wastewater and water supply future for the City.

Section 2

PROJECT COMPONENTS

The City's WRF project involves replacing the existing wastewater treatment plant with an advanced water purification facility that will meet state regulations, protect the environment, and contribute a safe and reliable water source for Morro Bay. The project will create a drought buffer and will be capable of providing up to 80 percent of the City's water needs in the future.

The Project includes construction of a new one million gallon per day (mgd) advanced treatment facility on South Bay Boulevard north of Highway 1, two new lift stations, approximately 3.5 miles of pipelines and wells to inject the purified water into the groundwater aquifer as the recycled water component in the form of indirect potable reuse (IPR) for groundwater augmentation. The current schedule includes construction beginning in 2019 and project completion by 2023. The recycled water component consists of the design and construction of the purified water injection wells which are broken into two, distinct project phases:

- Project Phase 1:
  - Acquiring authorization from CCC to continue and complete Phase 2 hydrogeological work
  - Acquiring authorization from CCC to begin and complete Phase 3 hydrogeological work
  - Preliminary design of the injection wells
  - Final design of the injection wells
- Project Phase 2:
  - Bidding and construction of the injection wells

Before the Project Phase 2 begins, the City will submit final plans, specifications, and a construction plan for the recycled water project component to the CCC per Special Condition No.1 and 2 to obtain authorization for bidding and construction of the injection wells. The City shall also submit to the CCC an update to this Recycled Water Management Plan that reflects the results of the Phase 1 studies and shows conformance with Special Condition 6.

Section 3

DOCUMENT PURPOSE

This Plan discusses the work the City has completed to date regarding the recycled water component and the implementation of the Project phases. The objective of this Recycled Water Management Plan (Plan) is to meet the requirement of Special Condition No. 6 for CDP 3-19-0463 and to present the information required to acquire a CDP to begin Project Phase 1 and continue ongoing hydrogeological studies necessary to advance the design of the injection wells and permitting for the WRF.

Section 4

PREVIOUS RECYCLED WATER STUDIES

The following sections presents the overall background of the previous recycled water studies completed to date that establish the City's position on pursuing the current WRF project.

4.1 Water Reclamation Facility Master Plan

In 2016, Black & Veatch developed a Water Reclamation Facility Master Plan (FMP) for the City. The FMP established the current WRF Project and included an evaluation of an influent pump station, raw wastewater force main, secondary wastewater treatment, and a brine/wet weather discharge pipeline. Advanced treatment, storage, and pumping required for recycled water were also addressed. Pipelines, injection wells, and other recycled water system components outside the WRF itself were not included in the FMP.

4.2 Water Reclamation Facility Plan

To further investigate recycled water treatment and use options, a separate Morro Bay Water Reclamation Facility Plan (WRF Plan) was started in 2017 (i.e., Draft Master Reclamation Plan) and was later finalized in 2019. The WRF Plan evaluated several different non-potable and potable reclamation alternatives and ultimately concluded with a recommended alternative. The development of the WRF Plan was funded in part by a Recycled Water Planning Grant from the State Water Resources Control Board (SWRCB).

The WRF Plan summarizes existing water supplies and wastewater flows in Morro Bay, includes a recycled water market assessment, summarizes recycled water requirements and regulations,

identifies recycled water alternatives (treatment facilities and customers), performs an alternatives analysis, and recommends the best possible alternative for recycled water usage for the City.

The City's current water supplies consist of an appropriative permit to withdraw water from two local groundwater basins (associated with Morro Creek and Chorro Creek) and water imported by the SWP. In 2014, approximately 87 percent of the City's water was supplied by the SWP and the remaining 13 percent was supplied via groundwater from the Morro Valley Groundwater Basin treated at the City's Brackish Groundwater Desalination Plant. The Chorro Valley Groundwater Basin serves as a secondary source of groundwater, but currently there is no infrastructure in place to treat this groundwater.

In the event of a drought, SWP supply reductions, or service outages, seawater can be treated in Morro Bay's desalination plant and provide a backup and emergency water supply of up to 645 acre-feet per year (AFY).

The alternatives identified in the WRF Plan and the recommended alternative are summarized in the following sections.

4.2.1 Alternatives Analysis

The WRF Plan identified five recycled water alternatives, summarized in Table 1. Potential customers and their associated recycled water demands, necessary treatment and conveyance facilities, and project costs were determined for each alternative. Table 1 includes the amount of recycled water each alternative would use as well as the amount of potable water off-sets provided to the City in AFY.

Table 1 WRF Plan Recycled Water Alternatives

Alternative No.	Title	Brief Description	AFY of recycled water used	AFY potable water off-sets
0	No Recycled Water Project	Construct a new full secondary treatment facility without a recycled water component and a discharge pipeline to continue discharging treated effluent at the existing ocean outfall.	0	0
1	Urban Reuse	Construct the WRF with tertiary treatment, storage, and a RW pipeline from the WRF to the City to deliver RW to various urban commercial and landscape irrigation users including the Morro Bay Golf Course.	351.4	45.4
2	Agricultural Exchange	Construct the WRF with tertiary treatment, storage, and a RW pipeline along Hwy 41 to deliver RW to agriculture users in the Morro Valley in exchange for pumped groundwater sent back to the City (two RW to one GW ratio). Alternative would include potable water pipeline from upper Morro Valley to City.	885	442
3	Indirect Potable Reuse – East	Construct the WRF with tertiary treatment, storage, and a RW pipeline conveying RW to four separate injection wells east of Hwy 1 and south of Hwy 41 (near the Narrows) for groundwater replenishment. Groundwater extracted from existing City wells in the Morro Valley would be treated at the City's existing water treatment plant.	825	943
4	Indirect Potable Reuse – West	Construct the WRF with tertiary treatment, storage, and a RW pipeline conveying RW to four new groundwater injection wells west of Hwy 1 and south of Hwy 41, near the bike path adjacent to Lila Keiser Park, for groundwater replenishment. Groundwater extracted from existing City wells in the Morro Valley would be treated at the City's existing water treatment plant.	804	1,119

The recycled water project alternatives were evaluated based on the community goals and evaluation criteria including capital cost, operating cost, neighborhood compatibility, reliability, and potential water supply benefit. Based on the analyses, the recommended recycled water project is IPR, Alternative 3 or 4, with the main difference consisting of the locations for injection and extraction wells. The IPR alternative provides the highest potential water supply benefit.

Additional information on the identified alternatives can be found in Chapter 7 of the WRF Plan.

4.2.2 Recommended Project

The recommended project alternative is to implement indirect portable reuse (IPR) to replenish the groundwater basin. Currently, there are two potential injection sites for the advanced treated water, either in the East near the Narrows (Alternative 3 location) or in the West near the bike path north of the power plant (Alternative 4 location). Figure 1 and Figure 2, taken from the WRF Plan, show the proposed Alternatives 3 and 4 projects, respectively. As stated previously, the City is currently working with GSI Water Solutions (GSI) to complete the necessary hydrogeological analyses to determine which location should be used as the final injection. Both Alternatives 3 and 4 include the same treatment facilities, number of injection wells, and storage tank size. They differ slightly in the recycled water distribution lines and associated pumping requirements.

The recommended IPR project consists of implementing advanced treatment technologies including reverse osmosis and an advanced oxidation process to produce purified effluent that meets the State Water Board's groundwater replenishment regulations. Treated tertiary effluent will then be conveyed to one of two potential injection locations – the East location or the West location – which allow for sufficient residence time.

The East injection site alternative involves conveying recycled water via a pipeline that would run along the west side of Highway 1 to Main Street and then east on Atascadero Road to four separate injection wells near the Narrows where it will be used to replenish the groundwater basin.

Figure 1 WRF Plan Alternative 3: IPR East

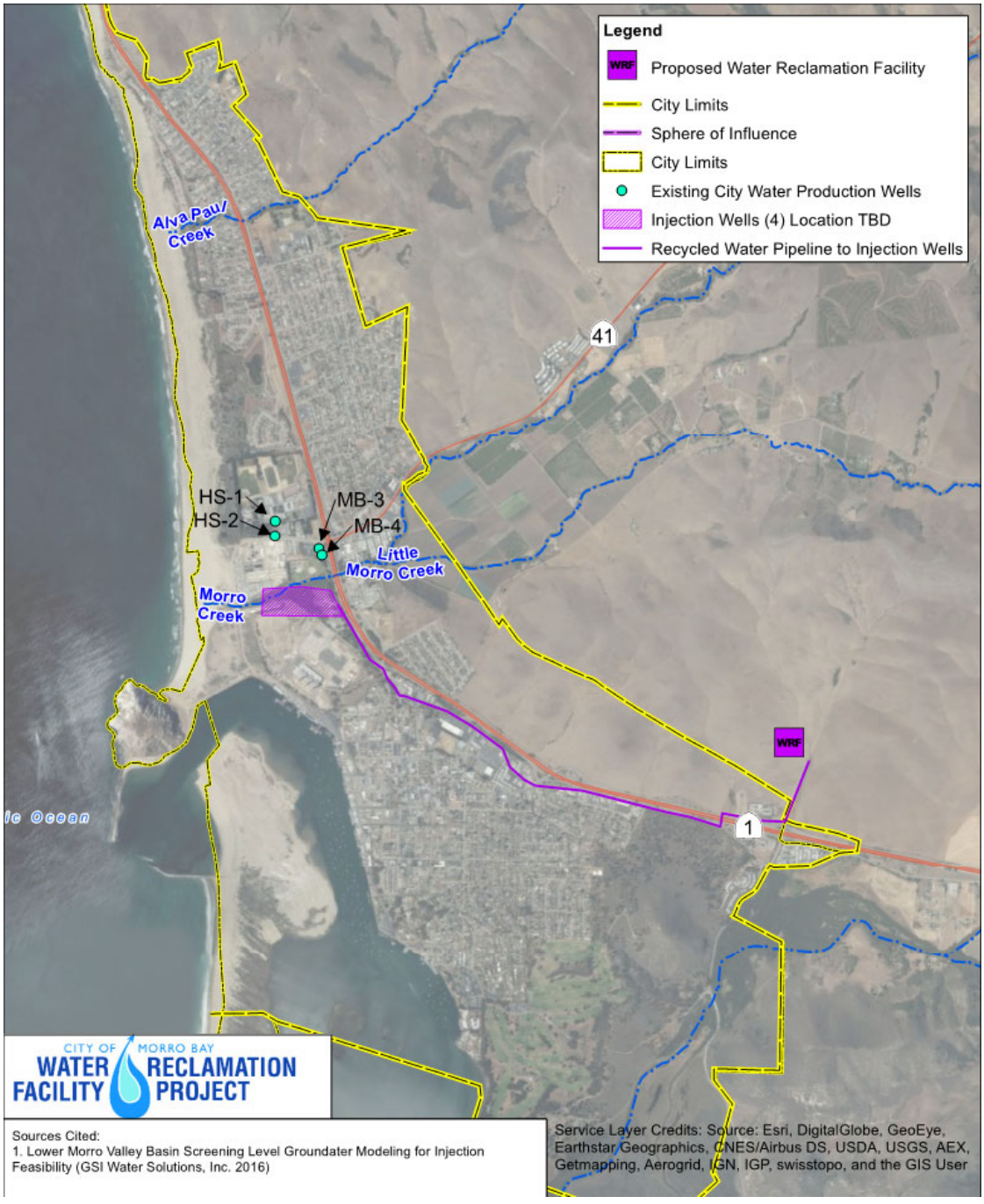

Figure 2 WRF Plan Alternative 4: IPR West

The West injection site alternative involves conveying recycled water via a pipeline that would run along the western side of Highway 1 along Quintana Road to Main Street where it would generally follow the bike path to four separate injection wells north of the power plant where it will be used to replenish the groundwater basin.

Once the advanced treated water is injected into the groundwater basin, the groundwater will be extracted from the City's existing groundwater wells. Based on the results of the ongoing hydrogeological studies currently being performed by GSI, the City has determined that long-term injection and extraction for the Morro Valley Groundwater Basin would reduce nitrate concentrations below the primary drinking water maximum contaminant limit (MCL) and eliminate the need for treatment at the City's Brackish Groundwater Desalination Plant prior to entering the City's potable water system.

This recommended IPR recycled water project does not have specific recycled water customers, but rather involves injecting advanced treated water into the groundwater basin for later use as a potable water supply for the City. The amount of advanced treated water available to inject is limited by the amount of advanced treated water that the WRF can produce (approximately 825 AFY). Preliminary hydraulic modeling was performed for the two proposed injection locations to determine the volume of recycled water that could be injected at each site as well as the volume of water that could be extracted. Table 2 summarizes the injection and extraction volumes for each site.

Table 2 Indirect Potable Reuse – Injection and Extraction

	East Site	West Site
Injection		
Number of New Injection Wells	4	4
Injection Volume (AFY)	Up to 825	Up to 804
Extraction		
Number of Existing City Wells	5	4
Extraction Volume (AFY)	943	1,119

Until the hydrogeological analysis is complete, both alternative site locations are considered recommended.

Additional information on the recommended recycled water project can be found in Chapter 8 of the WRF Plan.

4.3 OneWater Morro Bay

In 2018, the City completed OneWater Morro Bay to update previous water distribution, wastewater collection, and stormwater collection master plans and analyze the City's water supply options. The goal of these analyses was to identify feasible alternatives to correct infrastructure deficiencies and recommend a sustainable water supply portfolio to serve the community through the year 2040.

The water supply evaluation alternative analysis for the City's potable water system presents six main water supply alternatives with sub-alternatives identified related to the potential need for treatment following extraction from the aquifer. Each water supply alternative was developed keeping in mind that the City needs to construct new wastewater facilities to provide a minimum of secondary treatment regardless of the water supplies selected. The goal of this analysis was to identify reliable, drought-tolerant supplies sufficient to provide for the City through 2040. Table 3 displays the water supply evaluation alternatives considered in the OneWater Morro Bay report.

Table 3 OneWater Morro Bay Water Supply Alternatives

Project No.	Project Name
1	Purchased Water from California State Water Project
2A	Morro Well Field with Salinity Treatment
2B	Morro Well Field with Nitrate Treatment
2C	Morro & Chorro Well Fields with Salinity Treatment
2D	Morro & Chorro Well Fields with Nitrate Treatment
2E	Morro & Chorro Well Fields with Nitrate & Salinity Treatment
3A	Chorro Well Fields with Streamflow Augmentation
3B	Chorro Well Fields with Streamflow Augmentation & Nitrate Treatment
4A	Morro Well Field IPR by Groundwater Injection
4B	Morro Well Field IPR by Groundwater Injection with Salinity Treatment
4C	Morro Well Field IPR by Groundwater Injection with Nitrate Treatment
5	Ocean Desalination
6	Direct Potable Reuse

The analysis assumed that all alternatives that do not have the ability to completely meet the future average day demand will be supplemented by imported water from SWP deliveries as shown in Figure 3. Since the City's allocation for SWP cannot meet the total future water demand, the extra supply needed for Alternative 1 is provided with groundwater from the Morro Valley Groundwater Basin.

As Figure 3 shows, Alternative 4B and 4C provide the greatest use of recycled water, and Alternative 4A the next largest.

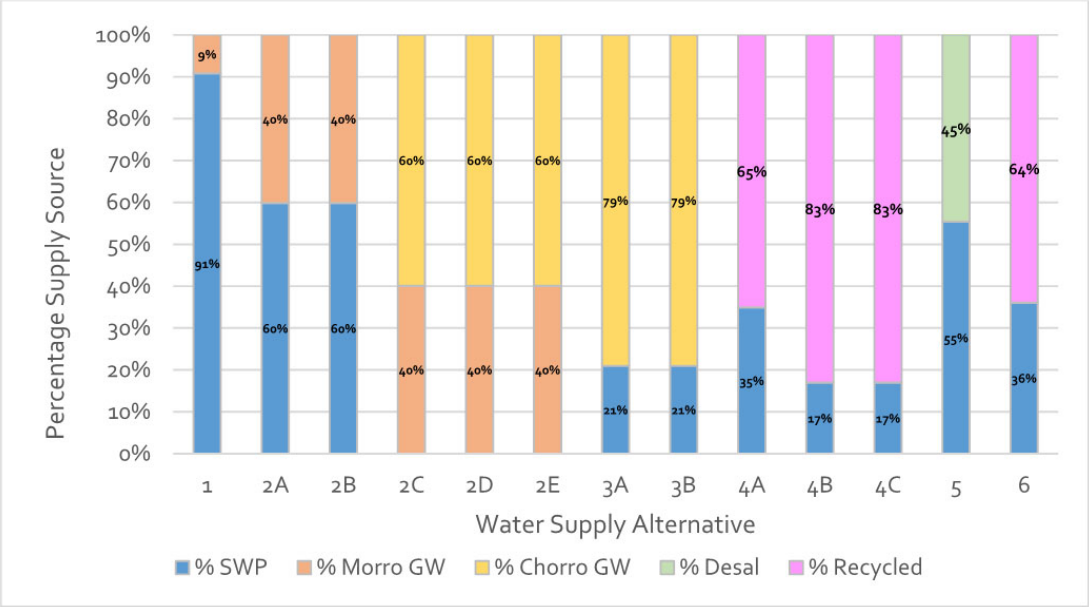

Figure 3 Water Supply Source Percentages of Average Day Demand

Each water supply alternative was evaluated with respect to criteria that reflected Morro Bay's City-wide interests. The evaluation considered nine separate criteria to assess how each water supply alternative compared to the existing system supply and operation as well as future infrastructure improvements. The nine criteria included:

- Unit Cost
- Drought Resiliency
- Earthquake Resiliency
- Flood Risk Mitigation
- Local Supply Benefit
- Energy Requirement
- Constructability
- Regulatory and Institutional Complexity
- Quality Consistency

The water supply evaluation provided a comprehensive assessment of various water supplies available to the City.

The evaluation showed that criteria including drought resiliency, earthquake resiliency, flood vulnerability, regulatory and institutional complexity and quality consistency remain constant between alternatives. The alternatives varied more greatly in the unit cost, drought resiliency, local supply offset, energy requirements, and constructability criteria. The study concluded that given the variability of water supply scenarios the City may potentially face and with the impending WRF Project, IPR represents the best option for supplementing the City's water supply portfolio. The study recommended the City move forward with Alternative 4A to construct the advanced treatment facilities as part of the WRF Project to produce recycled water and facilitate IPR within the Morro Valley Groundwater Basin and utilize the City's existing Brackish Groundwater Desalination Plant for treatment following groundwater extraction if needed.

Additional information on the alternatives analyzed and the evaluation process can be found in the OneWater Morro Bay Chapters 3 and 7, respectively.

4.4 Summary of Previous Studies

The City began evaluation of recycled water starting in 2016 with the FMP. The FMP evaluated the treatment costs associated with both potable and non-potable recycled water options. In order to determine the best recycled water end use, the City evaluated numerous non-potable and potable recycled water options in the WRF Plan. The treatment costs developed in the FMP were used as an input for the alternatives analysis in the WRF Plan. The alternatives analysis in the WRF Plan considered both economic and non-economic criteria to evaluate four recycled water options and ultimately recommended IPR at one of two injection locations in the City. The IPR alternative was recommended in part because it has the highest potential for potable water offset. The City then began OneWater Morro Bay to evaluate IPR along with other potable water supply options available including desalination and groundwater without augmentation. When evaluated against these other water supply options, IPR was recommended based on its drought resiliency and ability offset imported water use (i.e., SWP).

Section 5
PHASED HYDROGEOLOCICAL STUDIES

This section presents the previous hydrogeological studies performed and those needed to be completed to investigate the feasibility of pursuing an IPR option for water reuse. Ongoing hydrogeological activities are necessary to further characterize and select the preferred project area for the injection wells. GSI was contracted by the City to utilize the screening-level groundwater flow model of the Lower Morro Basin they developed in 2017 to evaluate impacts to the groundwater quantity and quality under various scenarios. In 2018, GSI was contracted to perform three phases of work, summarized in the following sections. Hydrogeological Investigation (HI) Phase 1 has been completed and the results are summarized in Section 5.1 below. HI Phase 2 is ongoing, and HI Phase 3 has yet to be fully scoped and budgeted.

5.1 Hydrogeological Investigation Phase 1

To evaluate the feasibility of recycled water injection (i.e., IPR) into the aquifer to expand the City's water supply, GSI, was retained to develop a screening-level numerical groundwater flow model of the lower portion of the Morro Valley Groundwater Basin within the City. This model was used to conduct simulations of groundwater hydraulics and flow to evaluate the feasibility of IPR and estimate the associated benefit to the City's water supply. Figure 4, shows the extent of the model area along with the City's existing production wells and seawater intake wells.

The model results were presented in the Lower Morro Valley Basin Screening-Level Groundwater Modeling for Injection Feasibility report. Additionally, a series of water quality scenarios were run using the GSI model and are summarized in the Morro Bay Water Reclamation Facility Groundwater Modeling Technical Memorandum dated April 19, 2019. See Sections 5.1.1 and 5.1.2 for a summary of both documents.

5.1.1 Lower Morro Valley Basin Screening-Level Groundwater Modeling for Injection and Feasibility

The GSI Lower Morro Valley Basin Screening-Level Groundwater Modeling for Injection Feasibility summarizes the results of the modeling effort. Within the study model, the feasibility of IPR in the lower portion of the Morro Valley Groundwater Basin was evaluated based on the following goals:

- Ability to inject 825 AFY of recycled water.
- Maximum annual production capacity of the City wells that can be sustained without the model results indicating seawater intrusion.
- Ability to satisfy Title 22 minimum response retention time requirements for the injected recycled water.

The model simulates groundwater flow in the Lower Morro Valley Groundwater basin below "the Narrows," which extends from the Narrows, to the west and southwest to the ocean and south to the Embarcadero.

Two possible IPR layouts were evaluated:

- Scenarios 1A (utilizing 5 extraction wells) and 1B (utilizing 6 extraction wells) evaluated recycled water injection upgradient (east) of the City's existing wells, near the Narrows.
- Scenarios 2A (utilizing 4 extraction wells) and 2B (utilizing 5 extraction wells) evaluated recycled water injection cross-/downgradient (south) of the City's existing wells.

The screening-level model results indicated that:

- It is likely feasible for the aquifer to accept the recycled water available for injection (825 AFY).
- A minimum of four injection wells would likely be needed to achieve the desired recycled water injection capacity.
- Depending on the injection well locations, up to approximately 1,200 AFY of groundwater could potentially be produced for potable supply without the model indicating seawater intrusion would occur.
- The 2-month minimum subsurface recycled water response retention time required under Title 22 will likely be met.

Based on the screening evaluation, the study recommended the following tasks:

- Conduct a preliminary consultation with the Division of Drinking Water (DDW) regarding permitting considerations.
- Implement a pilot injection program. The pilot program would consist of constructing a pilot injection well and monitoring wells, baseline groundwater monitoring, and long-term injection pilot tests. The purpose of the pilot program would be to validate the screening modeling results and provide a design basis for the full-scale project and permitting.

Additional information regarding the groundwater modeling effort of the lower portion of the Morro Valley Groundwater Basin can be found in the Lower Morro Valley Basin Screening-Level Groundwater Modeling for Injection Feasibility Report.

5.1.2 Morro Bay Water Reclamation Facility Groundwater Modeling Technical Memorandum

A series of water quality scenarios were run using the 2017 Screening Level Morro Bay groundwater model as prepared by GSI to assist in the evaluation of installing injection wells in the lower Morro Valley Groundwater Basin as part of an IPR project.

Three specific issues were identified for analysis using the model. These included:

- An evaluation of the ability of the City to pump their full groundwater allotment of 581 AFY without inducing sea water intrusion from the coast.
- An evaluation of the impact of injection into the aquifer proposed as part of the IPR project on the concentrations of nitrates that migrate from upgradient to the groundwater in City wells.
- An evaluation of the impact on the water quality in City wells from the injection into the aquifer proposed as part of the IPR project on the concentrations of total dissolved solids (TDS) that migrate from the coast, and to evaluate two separate injection well layouts to determine their potential impact on elevated TDS concentrations due to sea water intrusion.

The results of the modeling scenarios showed that:

- 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 injection.
- The bedrock "ridge" in the area of City wells MB-1 and MB-2 results in separate flow paths supplying the High School wells and the Highway 1 wells, and provides a degree of separation in the lower portion of the aquifer between the area of the high school wells and the Highway 1 well field.
- The model displayed adequate calibration for historically observed nitrate and TDS concentrations.
- Predictive nitrate scenarios indicate that all wells have significantly lower nitrate concentrations under either injection well configuration. MB-3 experiences the greatest reduction in nitrates using the Narrows injection well configuration. The remaining Highway 1 wells experience a greater nitrate reduction from the Southside injection well configuration.
- Predictive scenarios indicate that both the Narrows and the Southside injection well layouts prevent sea water intrusion in predictive scenarios.
- The injection and extraction activities proposed would lower the nitrate levels in the Morro Valley Groundwater Basin to less than the primary MCL (Figure 6).
- The Southside injection well configuration results in slightly lower TDS concentrations in the Highway 1 wells than the Narrows configuration. The Southside well locations lie between the well field and the ocean, and so may provide a greater barrier to intrusion events (Figure 5).

Additional information on the water quality scenarios performed can be found in the April 19, 2019 Technical Memorandum regarding the Morro bay Water Reclamation Facility Groundwater Modeling.

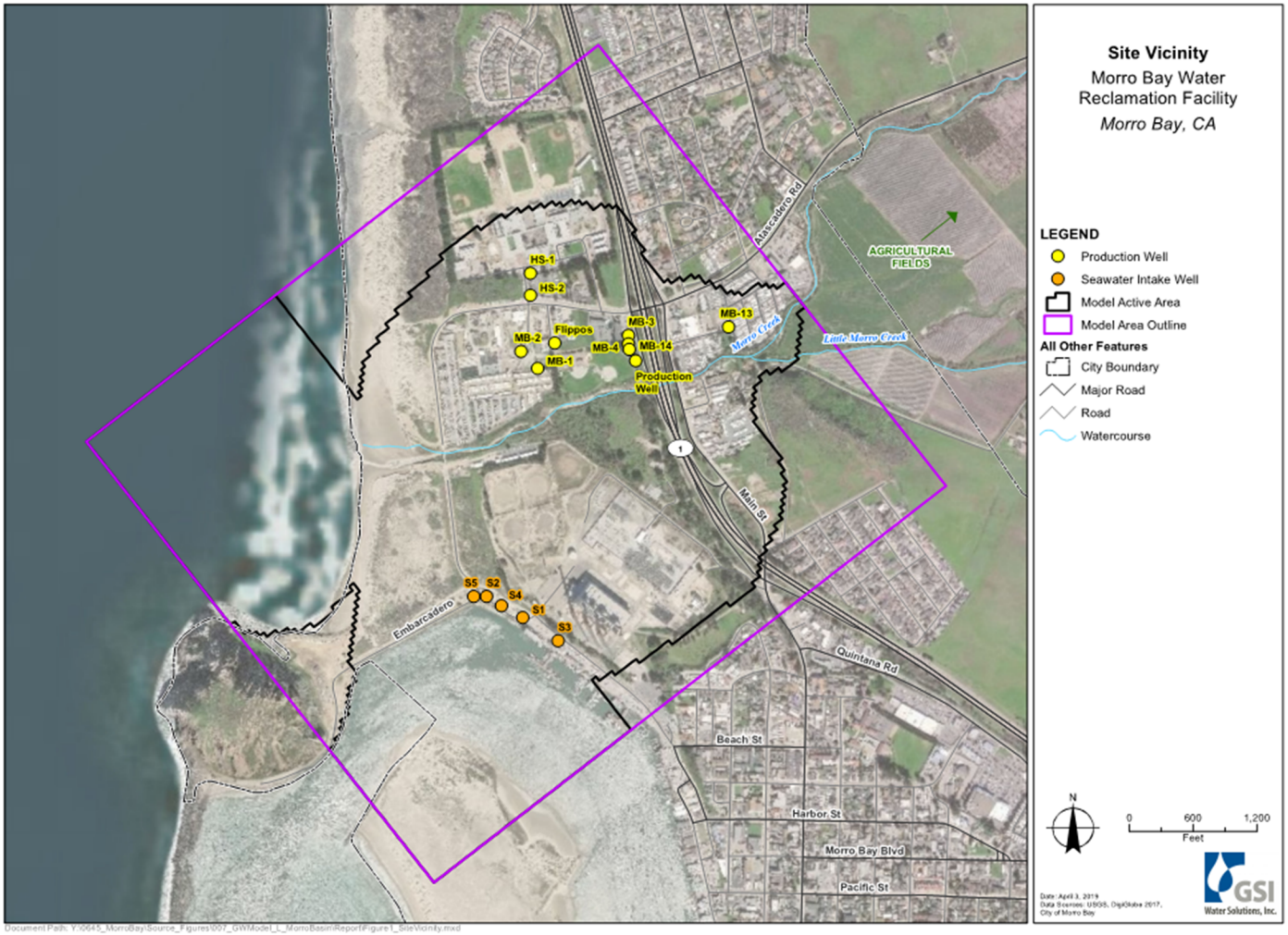

Figure 4 GSI Hydrogeological Model Area

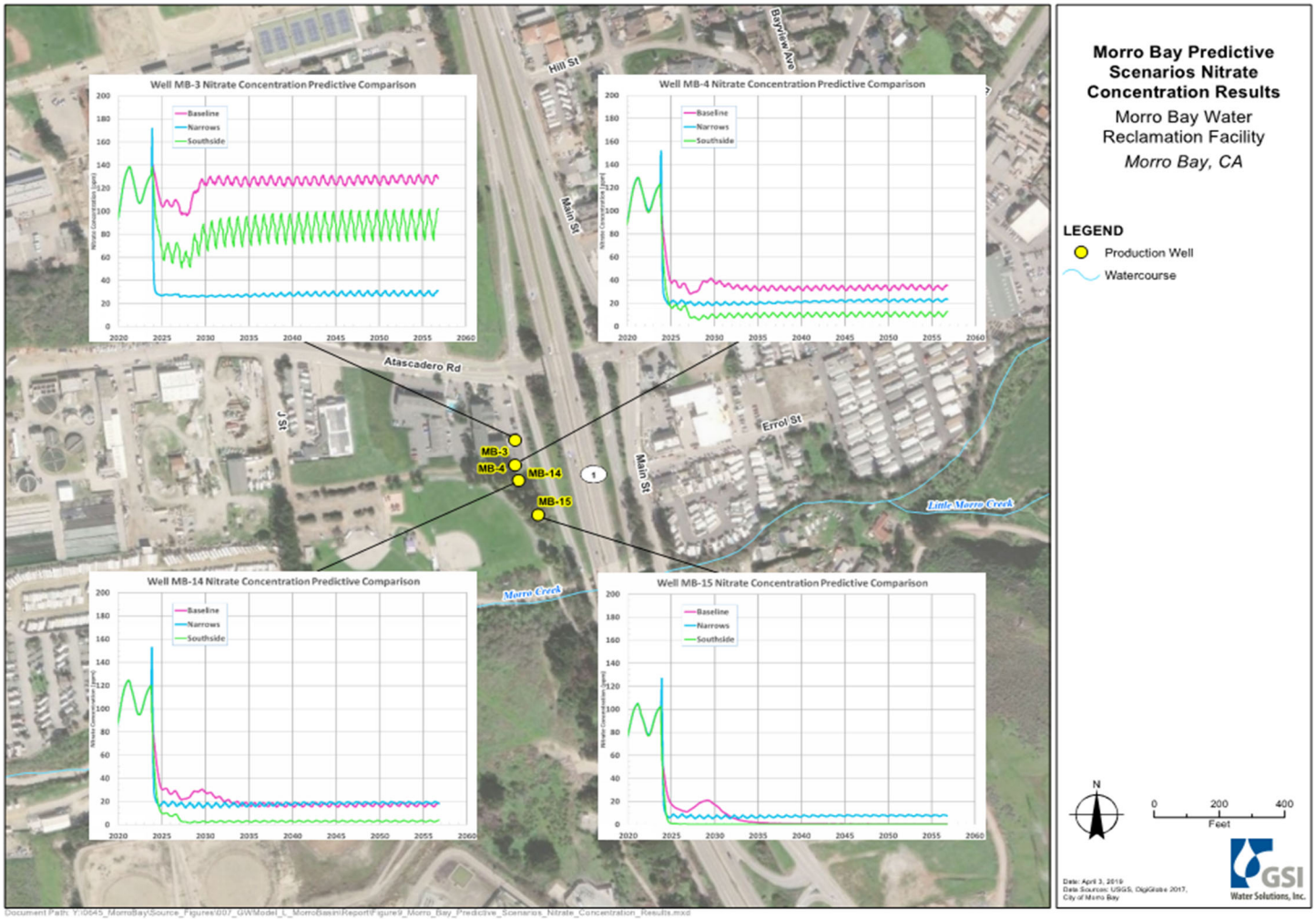

Figure 5 Predictive nitrate concentrations in existing production wells (adapted from the Morro Bay Water Reclamation Facility Groundwater Modelling Technical Memorandum, GSI 2018).

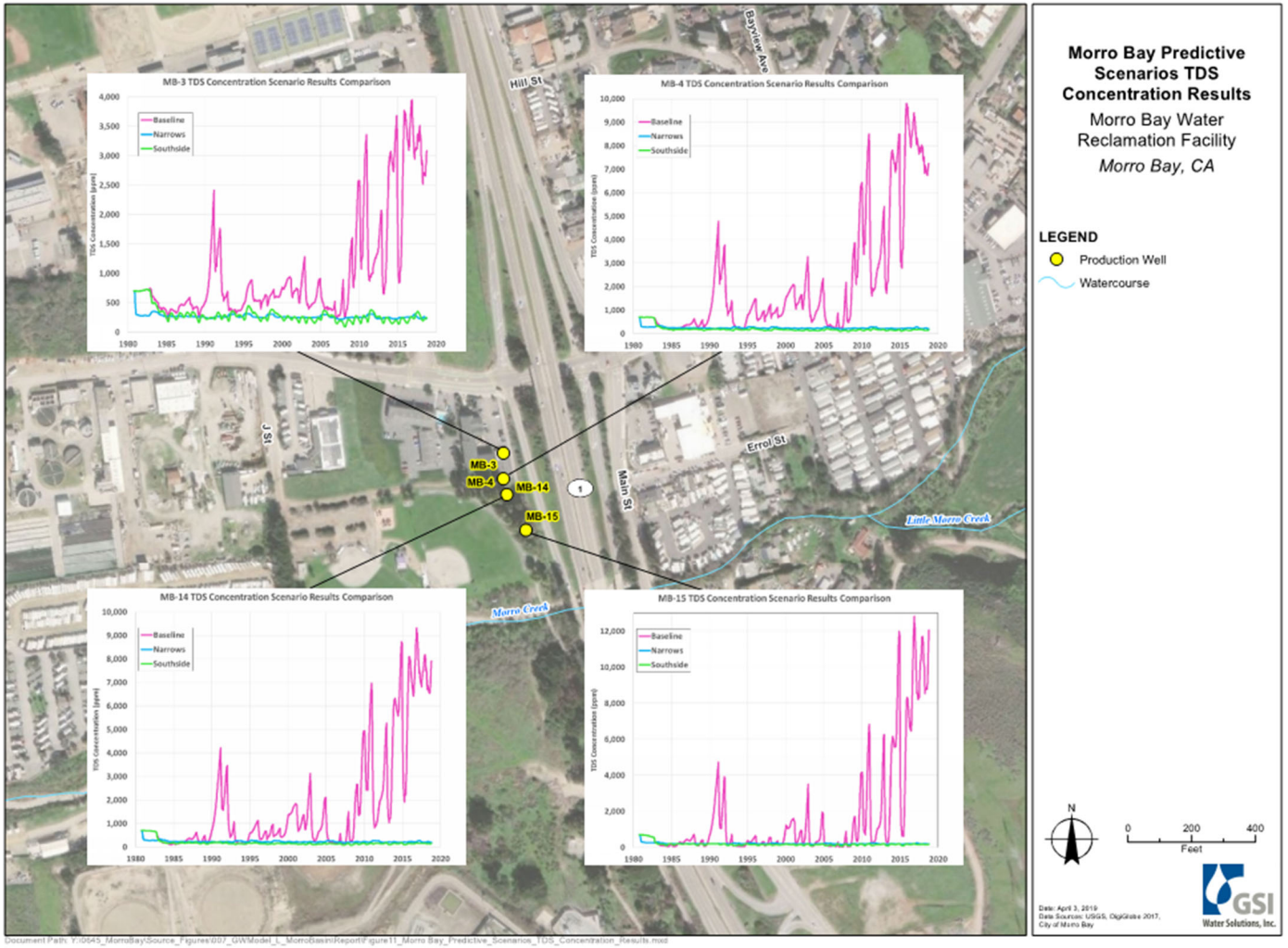

Figure 6 Predictive TDS concentrations in existing production wells (adapted from the Morro Bay Water Reclamation Facility Groundwater Modelling Technical Memorandum, GSI 2018).

5.2 Hydrogeological Investigation Phase 2

HI Phase 2 consists of pilot injection testing to more accurately assess potential injection rates that could be achieved. This will allow for calculation of expected injection rates and travel time, and thereby help determine the number and location of injection well needed to meet the goals of the project. The tasks in HI Phase 2 include:

- Select the preferred injection location.
- Conduct pilot injection testing.
- Update the groundwater model.
- Utilize the updated groundwater model to confirm the travel time for permitting with DDW.
- Utilize the updated groundwater model to complete a clogging analysis for the injection wells.
- Investigate effects of sea level rise and seawater intrusion.

Phase 2 efforts are currently ongoing. GSI has completed the characterization of the east injection location based on pump testing performed at an existing well on Errol Street. The City has been working GSI to develop the plan for characterization of the west injection area. The current plan is to utilize an existing well owned by the Morro Bay Mutual Water Company (MBMWC) owned by Vistra Energy (Vistra). Once the City receives the final CDP, construction of a piezometer and pumping and injection testing will be completed for the MBMWC well. It is anticipated that Phase 2 of the planned hydrogeological work will be completed by the end of 2019.

5.2.1 Sea Level Rise Investigation

The downtown area of Morro Bay lies above predicted sea level rise, significant areas along Morro Strand Beach, Morro Bay High School, the Dynegy Power Plant, the length of the Morro Bay State Park, and sections of Baywood-Los Osos will be highly vulnerable to coastal flooding, erosion, and salt-water infiltration. This is especially critical in the area around the outlet of Morro Creek. Most at risk will be coastal roads and bridges, the Moro Bay – Cayucos Wastewater Treatment Plant, wetlands and habitat in the South Bay, as well as docks and marinas throughout the bay.

In Phase 2 of the ongoing hydrogeological analysis, GSI will incorporate sea level rise into their model in order to evaluate the impacts of sea level rise on seawater intrusion. Sea level rise estimates from to sources have been previously considered by the City. In 2014, Rincon Consultants, Inc. completed the Final Climate Action Plan Morro Bay. In 2018, Moffatt & Nichol prepared the Sea Level Rise Adaptation Strategy Report.

The Final Climate Action Plan utilized sea level rise estimates from a statewide study conducted in 2009, which projected that sea level could rise 12 to 16 inches above current levels by 2050 (Cal-Apart 2010). The study found that by the end of the century, sea levels are projected to rise 3.3 to 4.6 feet (23 to 55 inches) above current levels (Rincon, 2014).

The Sea Level Rise Adaptation Strategy Report used SLR projections from the 2012 study "Sea Level Rise for the Coasts of California, Oregon, and Washington" conducted by the National Research Council (NRC). This study estimated sea levels to rise between 4.8 to 24 inches by 2050 and between 1.5 to 5.5 feet (18 to 66 inches) by 2100.

Table 4 summarizes the projected sea level rise estimates from each of these reports.

Table 4 Projected Sea Level Rise for Years 2050 and 2100

Source	SLR in 2050 (inches)	SLR in 2100 (inches)
Final Climate Action Plan Morro Bay	12 - 16	23 - 55
Sea Level Rise Adaptation Strategy Report – 2012 NRC[1] estimate	4.8 - 24	18 - 66

Notes:
(1) National Research Council
(2) Ocean Protection Council Science Advisory Team

A new scientific study cited in the Sea Level Rise Adaptation Strategy Report titled "Rising Seas in California – An Update on Sea-Level Rise Science" (OPC-SAT2017) for the State of California suggests the potential for higher sea level rise projections than NRC 2012 by the year 2100 and beyond timescales. These new sea level rise projections were given probabilities of occurrence by years 2030, 2050, and 2100. The OPC-SAT (2017) and NRC (2012) sea level rise projections are compared in Figure 7. It is important to note that OPC-SAT (2017) probabilities do not include the more recent extreme ice loss scenario from the DeConto and Pollard (2016) study and therefore the probabilities are potentially underestimated, though the degree by which the probabilities may be underestimated is currently unknown.

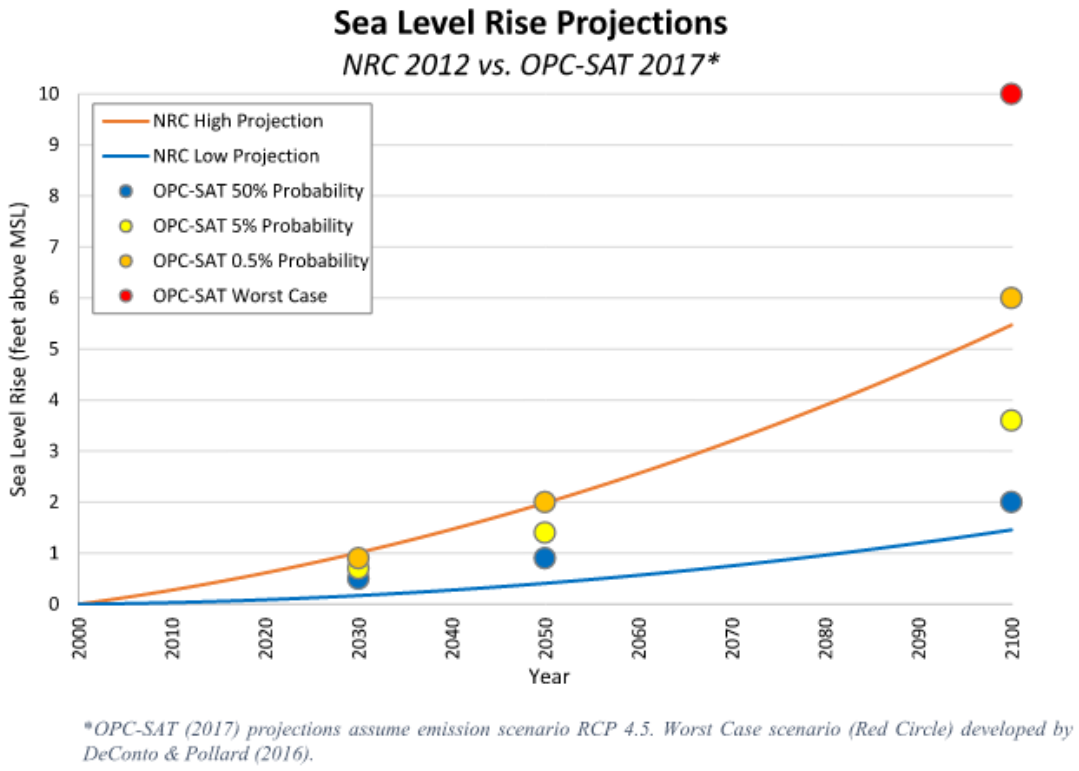

Figure 7 Sea Level Rise Projections – A Comparison of Best Available Science (adapted from the Morro Bay SLR Adaptation Report, Moffatt & Nichol, 2018).

As part of the Phase 2 hydrogeological studies, GSI will update the model to include seal level rise projections from one of the scenarios previously discussed. The selection of the final sea level rise scenario will be selected by the City in the next few months.

5.2.2 Seawater Intrusion Investigation

In January 2017, GSI conducted seawater intrusion monitoring during full-scale testing of the City's five seawater wells. As part of the Phase 2 work, GSI will perform additional seawater intrusion monitoring as part of the characterization and testing of East and West areas. To collect important pre-project baseline groundwater level and quality data, pressure transducers capable of recording water level, temperature, and electrical conductivity devices will be installed in each of the five wells.

Data has been collected since 2018 at regular intervals and collection will continue through 2022. This data will provide water level data and tidal water level influence information. Tidal water level information will be compiled from published water level data from a nearby National Oceanic and Atmospheric Administration (NOAA) gauge to determine whether observed changes in groundwater levels are influenced by tidal effects. Changes in electrical conductivity, an indication of changing salinity, are also measured and recorded by the transducers.

5.3 Hydrogeological Investigation Phase 3

At this time, HI Phase 3 of the hydrogeological work has not been fully scoped. Following the completion of HI Phase 2, the City will negotiate with GSI to finalize the HI Phase 3 scope of work. The components of HI Phase 3 will include:

- Development of the final basis of design for the injection wells.
- Additional permitting support.

HI Phase 3 of the hydrogeological work will be completed in the spring of 2020.

Section 6
RECYCLED WATER FACILITIES IMPLEMENTATION

To further refine and implement the recommended WRF Project, the City will need to address the following:

- Complete the ongoing hydrogeological study to determine siting for injection wells.
- Update groundwater modeling.
- Develop the Title 22 Engineering Report.
- Develop final design documents for the Recycled Water Facilities including the injection wells.
- Continue public outreach activities with the local community.
- Obtain permits and clearances from applicable regulatory agencies such as RWQCB and DDW.
- Review any existing City water ordinances and update as necessary.
- Construct the recommended project.

6.1 Preliminary Design

6.1.1 Water Reclamation Facility

On August 30, 2019, the City received the 60 percent plans and specifications for the WRF. The WRF is being delivered via a design-build process by a joint venture of Filanc and Black & Veatch (FBV). The 60-percent design submittal is based on the Basis of Design Report prepared by FBV in May 2019. The WRF will utilize three processes to meet the virus, *Giardia*, and *Cryptosporidium* log reduction requirements required by the DDW. These processes are:

- Membrane Bioreactor (MBR).
- Reverse Osmosis (RO).
- Ultraviolet advanced Oxidation Process (UV AOP).

Based on the overall efficiency of the treatment processes coupled with the anticipated raw wastewater flows to the WRF, the City will have the ability to inject 825 AFY into the Lower Morro Valley Groundwater Basin.

6.1.2 Recycled Water Facilities

The Recycled Water Facilities include the injection wells that will inject purified water into the Lower Morro Valley Groundwater Basin located wither east or west of Highway 1. Based on the preliminary hydrogeological work completed by GSI, the preliminary design criteria for the wells is summarized in Table 5.

Table 5 Preliminary Injection Well Design Criteria

Criteria	Unit	Value
Number	-	4
Depth (Approximate)	feet	50
Capacity (Total)	AFY	825
Capacity (Each)	gpm	130

6.2 Potable Reuse Permitting

The potable reuse permitting process began with a meeting with DDW on January 25, 2019. The City has an upcoming meeting planned with DDW in October 2019 to discuss the permitting process including the process selection and proposed log reduction strategy proposed for the MBR, RO, and UV AOP processes. The City is currently preparing the Title 22 Engineering Report for DDW and the Report of Waste Discharge (ROWD) for the RWQCB. It is anticipated that these reports will be submitted in June 2020. While most of the information is available to complete these documents, the remaining hydrogeological work must be completed

6.3 Schedule

The following schedule in Figure 8 includes the recycled water planning work that has already been completed by the City including the remaining implementation tasks necessary to start groundwater injection by the end of 2022.

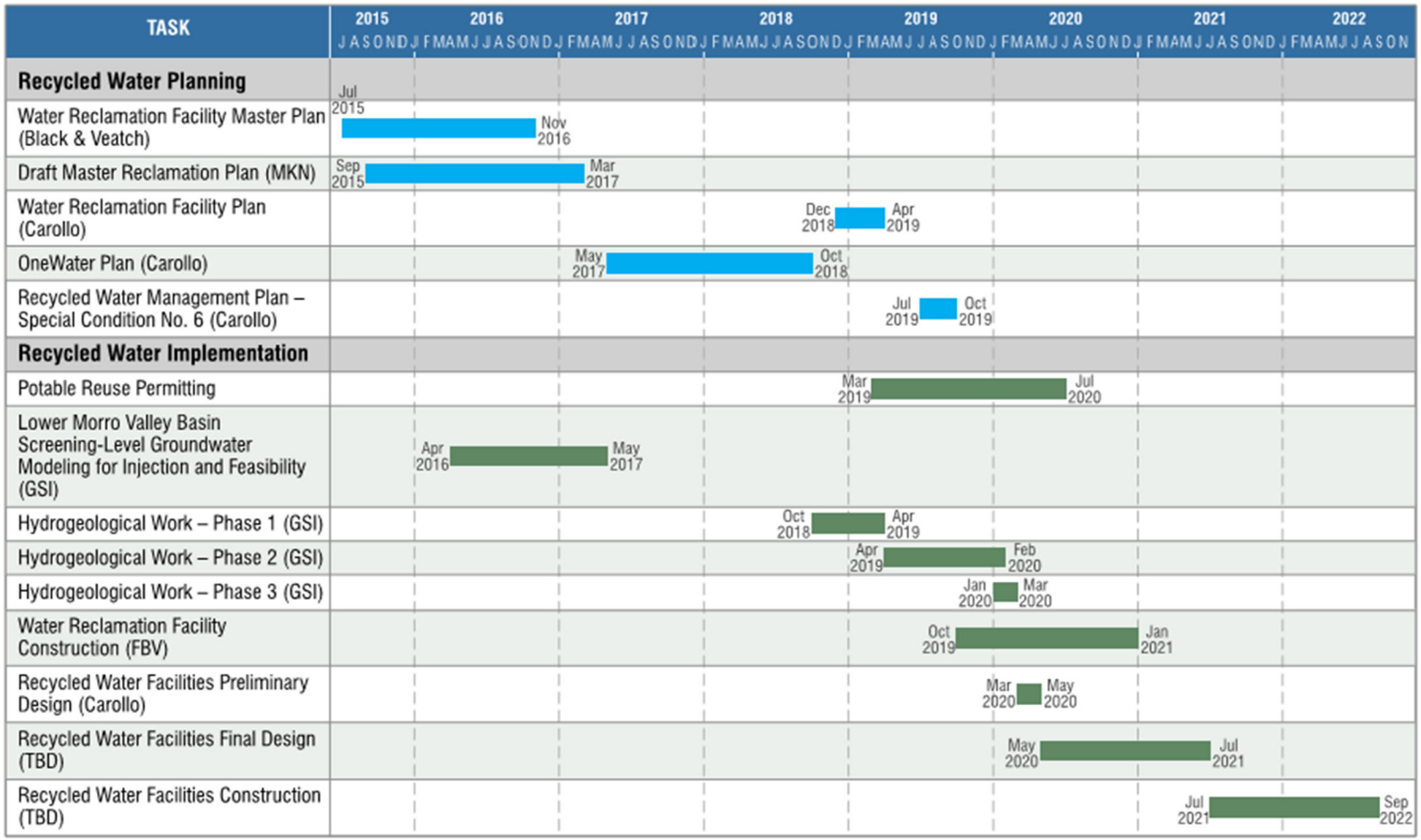

Figure 8 Recycled Water Implementation Schedule