Chapter 8 Groundwater Resources

8.1 Introduction

This chapter describes the environmental setting, methods of analysis, and impact analysis for groundwater resources (including groundwater quality) that would potentially be affected by the construction and operation of the Project. Groundwater resources are defined as groundwater aquifer systems, including groundwater infrastructure (i.e., existing groundwater wells and their distribution facilities in the vicinity of the Project). The study area for groundwater resources consists of the groundwater basins and subbasins that could be directly affected by construction and operation of Project facilities. Offsite commercial facilities (including quarries) for aggregate and other materials are not included in the study area and impact analysis because they are existing, permitted facilities. Tables 8-1a and 8-1b summarize the CEQA determinations and NEPA conclusions for construction and operation impacts, respectively, between alternatives.

Table 8-1a. Summary of Construction Impacts between Alternatives

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Impact GW-1: Violation of water quality standards or waste discharge requirements or otherwise substantial degradation of groundwater quality			
No Project	NI NE	-	NI NE
Alternative 1	LTS NE	-	NI NE
Alternative 2	LTS NE	-	NI NE
Alternative 3	LTS NE	-	NI NE
Impact GW-2: Substantial decrease in groundwater supplies or substantial interference with groundwater recharge			
No Project	NI NE	-	NI NE
Alternative 1	LTS NE	-	LTS NE
Alternative 2	LTS NE	-	LTS NE
Alternative 3	LTS NE	-	LTS NE

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Impact GW-3: Conflict with or obstruct implementation of a sustainable groundwater management plan			
No Project	NI NE	-	NI NE
Alternative 1	LTS NE	-	LTS NE
Alternative 2	LTS NE	-	LTS NE
Alternative 3	LTS NE	-	LTS NE

Notes:
NI = CEQA determination of no impact
LTS = CEQA determination of less-than-significant impact
LTSM = CEQA determination of less than significant with mitigation
SU = CEQA determination of significant and unavoidable
B = NEPA conclusion of beneficial effects
NE = NEPA conclusion of no effect or no adverse effect
AE = NEPA conclusion of adverse effect
SA = NEPA conclusion of substantial adverse effect

Table 8-1b. Summary of Operation Impacts between Alternatives

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Impact GW-1: Violation of water quality standards or waste discharge requirements or otherwise substantial degradation of groundwater quality			
No Project	NI NE	-	NI NE
Alternative 1	LTS B	-	LTS B
Alternative 2	LTS B	-	LTS B
Alternative 3	LTS B	-	LTS B
Impact GW-2: Substantial decrease in groundwater supplies or substantial interference with groundwater recharge			
No Project	NI NE	-	NI NE
Alternative 1	LTS B	-	LTS B
Alternative 2	LTS B	-	LTS B

Alternative	Level of Significance Before Mitigation	Mitigation Measures	Level of Significance After Mitigation
Alternative 3	LTS B	-	LTS B
Impact GW-3: Conflict with or obstruct implementation of a sustainable groundwater management plan			
No Project	NI NE	-	NI NE
Alternative 1	LTS NE	-	LTS NE
Alternative 2	LTS NE	-	LTS NE
Alternative 3	LTS NE	-	LTS NE

Notes:
NI = CEQA determination of no impact
LTS = CEQA determination of less-than-significant impact
LTSM = CEQA determination of less than significant with mitigation
SU = CEQA determination of significant and unavoidable
B = NEPA conclusion of beneficial effects
NE = NEPA conclusion of no effect or no adverse effect
AE = NEPA conclusion of adverse effect
SA = NEPA conclusion of substantial adverse effect

8.2 Environmental Setting

This section summarizes the existing conditions for groundwater resources in the study area which consists of the Funks Creek and Antelope Creek groundwater basins, and the Red Bluff, Colusa, and Yolo Subbasins of the Sacramento Valley Groundwater Basin (Figure 8-1). Table 8-2 shows the alternative component/facility and corresponding groundwater basin or subbasin, regulatory agency, depth to basin aquifer, and total annual groundwater use. A detailed description of the existing conditions in the study area is provided in Appendix 8A, *Groundwater Resources Basin Setting*.

Table 8-2. Summary of Groundwater Resources in the Study Area

Alternative Component/Facility	Groundwater Basin or Subbasin	Regulating Agency	Groundwater Basin Depth[a] (feet bgs)	2018 Total Pumped Groundwater Use[b] (AF)	Local Groundwater Infrastructure and Use [c,d]				Groundwater Quality [c,e]	
					Well Type	Well Depth (feet bgs)	Depth to Shallow Groundwater (feet bgs)	Yield (gpm)	Specific Conductance (µS/cm)	Primary MCL Exceedances
Sites Reservoir and adjacent roads Recreation Areas	Funks Creek and Antelope Creek Basins	Glenn and Colusa Counties	100	1,038	15 Domestic 15 Stock	100 to 201	1 to 30	0 to 60	680 to 2,190	Arsenic
RBPP and TC Canal Diversion	Red Bluff Subbasin	Groundwater Sustainable Agency of Tehama County	200	76,153	32 Domestic 9 Irrigation 5 Production 3 Public Use	45 to 600	55	20 to 2,080	158 to 707	None
TRR East and West, TRR East and West Pipelines	Colusa Subbasin	Colusa Groundwater and Glenn Groundwater Authorities	200	553,700	17 Domestic 3 Irrigation	70 to 400	4 to 20	70 to 200	444 to 1,104	None
Funks Reservoir and Transition Manifold	Colusa Subbasin	Colusa Groundwater and Glenn Groundwater Authorities	200	553,700	20 Domestic 2 Stock 3 Industrial	22 to 440	15 to 207	3 to 75	–	–
SD1,2,3-Z3 Quarry 2, GG-Z3 Quarry 2, and Sites-Z3 Quarry	Colusa Subbasin	Colusa Groundwater and Glenn Groundwater Authorities	200	553,700	10 Domestic 2 Industrial	28 to 300	–	2 to 50	–	None
CBD Outlet, Sacramento River Discharge, Dunnigan Pipeline	Yolo Subbasin	Yolo Subbasin Groundwater Agency	20 to 420	327,195	20 Domestic 65 Irrigation 1 Stock 2 Industrial 2 Public Use	51 to 1,000	20 to 293	4 to 5,467	361 to 781	Total Dissolved Solids Nitrates

Table Notes:
a = California Department of Water Resources 2020a
b = California Department of Water Resources 2019
c = based on a 1-mile radius from Alternative Component/Facility
d = California Department of Water Resources 2020b
e = California Water Boards 2020
f = No data
AF = acre-feet
bgs = below ground surface
gpm = gallons per minute
MCL = Maximum Contaminant Level
µS/cm = microsiemens per centimeter

8.3 Methods of Analysis

Data, published reports, and modeling results, and best professional judgement were used to identify and evaluate the potential impacts on groundwater resources from Project implementation. The groundwater quality impact analysis focuses on Project construction and operation activities which could substantially degrade groundwater quality. The impact analysis also considers potential violations of groundwater quality standards and evaluates wastewater discharge effects that may occur from Project construction and operations. The BMPs described in Appendix 2D, *Best Management Practices,* are incorporated into the analysis of potential Project construction and operation impacts on groundwater resources. BMPs in the Project Stormwater Pollution Prevention Plan (SWPPP), would entail discharging groundwater onto suitable land where it would infiltrate back into the water table; testing groundwater if contamination is suspected; and treating or settling groundwater prior to land or surface water discharge to reduce sedimentation. Project facilities would comply with applicable design standards and building codes. Impacts associated with accidental spills and releases of hazardous materials, which could affect groundwater quality, are discussed in Chapter 27, *Public Health and Environmental Hazards*.

8.3.1. Construction

Construction activities, such as dewatering and groundwater use, would potentially affect groundwater resources. Dewatering would occur during excavation for Sites Reservoir, quarrying, GCID system upgrades, road construction and improvements, pipeline and transition manifold installation, and Funks Reservoir dredging. Groundwater would be required for uses such as moisture conditioning of fill materials, batching concrete, grouting, and dust suppression for haul roads, stockpiles, disposal areas, quarries, and borrow areas. The potential impacts of construction-related dewatering on groundwater resources are evaluated qualitatively based on the number and location of wells that may be affected by construction activities. The potential impacts of groundwater use during Project construction were evaluated qualitatively and quantitatively. Groundwater use for construction was assumed to be up to 100,000 gallons per day for 365 days a year. This assumption provides a conservative evaluation of construction impacts on groundwater in the study area because actual use is likely to be less than this total volume.

8.3.2. Operation

Operations would potentially affect groundwater resources by altering groundwater quality, groundwater recharge, groundwater/surface water interaction, and groundwater flow direction and volume. The potential impacts on groundwater resources from operation of the Project were analyzed using publicly available data, modeling results, and operation practices (Appendix 8B, *Groundwater Modeling*).

Potential variations in groundwater flow direction were evaluated to determine if Project operations would result in the migration of lower quality groundwater into areas of higher quality groundwater. Existing groundwater quality conditions were compared to existing surface water quality to determine infiltration effects from Project conveyance systems and reservoirs.

Surface water and groundwater systems are connected within the Sacramento Valley Groundwater Basin and are highly variable spatially and temporally. In general, the Sacramento and Feather Rivers act as drains and are recharged by groundwater throughout most of the year, except for areas of depressed groundwater elevations attributable to groundwater pumping (inducing leakage from the rivers) and localized recharge to the groundwater system. Project operations would change current surface water management and could affect groundwater/surface water interaction.

A CalSim II surface water routing model and Central Valley Hydrologic Model (CVHM) were used to determine potential impacts on groundwater resources from Project operations. The CalSim II model determined how much water would need to be diverted to fill and maintain Sites Reservoir assuming a reservoir capacity of 1.8 MAF. This CalSim II simulation was then used as input to the CVHM groundwater model to ascertain changes to groundwater/surface water interaction at the TC Canal and GCID Main Canal diversions from operations over the life of the Project. The CVHM model utilized historical groundwater conditions from April 1961 through September 2003 for the simulation. The CVHM model results presented changes in groundwater levels at 4.2 years, 24.8 years, and 39.2 years near the points of diversion as well as roughly 12 miles downgradient. Changes to surface and groundwater exchange at the TC Canal and GCID Main Canal diversions over the life of the Project (from start of operations to 40 years later) were also simulated and included in model results (Appendix 8B, *Groundwater Modeling*).

Though modeled Project operations were based on a 1.8-MAF reservoir capacity, groundwater modeling results used to evaluate effects on groundwater resources are valid. First, the incremental groundwater effects associated with the Project operations as simulated for the 1.8-MAF reservoir model run are unlikely to be greatly affected by changes in hydrological baseline conditions. Second, the models used represent a beyond-worst-case condition for evaluating effects on groundwater/surface water interaction because Alternatives 1, 2, and 3 have smaller reservoir sizes and would require less water supply (1.8 MAF as compared to 1.5 or 1.3 MAF).

A $SACFEM_{2013}$ model was used to determine the potential impacts of long-term reservoir seepage on groundwater levels near Sites Reservoir. The model assumed a reservoir capacity of 1.8 MAF with an associated seepage rate of 2,150 gallons per minute, and that the reservoir was filled to the maximum capacity over the life of the Project. The analysis compared groundwater levels from the modeled 1.8-MAF reservoir capacity seepage against baseline conditions over 17 years (Water Year 1970 to Water Year 1985; Figure 10A-1 in Appendix 8B). This modeled reservoir size and seepage rate would be greater than those conditions under Alternatives 1, 2, and 3 since these alternatives would have reservoir capacity of 1.5 MAF or 1.3 MAF. Therefore, the model represents a beyond-worst-case condition for evaluating seepage effects on groundwater levels near Sites Reservoir from Project operations.

The $SACFEM_{2013}$ model was also used to assess the potential impacts on groundwater recharge within the TRR East complex from seepage. TRR East and West would be constructed using a liner system to prevent seepage; the liner may reduce surface water infiltration and could affect groundwater recharge in the area. The model determined average hydrological conditions using Water Year 2005 that were utilized to estimate existing deep percolation from precipitation within TRR East (Sites Project Authority and Bureau of Reclamation 2017). Impacts to groundwater recharge from the TRR West liner were qualitatively analyzed using the Water Year 2005 annual precipitation to determine possible changes at the local and landscape scale.

8.3.2.1. Implementation of the Sustainable Groundwater Management Act

Project construction, operation, and maintenance may affect the implementation of the Sustainable Groundwater Management Act (SGMA) by conflicting or impeding with local Groundwater Sustainability Plans (GSPs). Counties which have medium or high priority groundwater basins, as designated under the SGMA, are required to draft a GSP with the goal of having a sustainable groundwater aquifer within 20 years after plan adoption and implementation (further details regarding SGMA are contained in Appendix 4A, *Regulatory Requirements*). The Colusa and Yolo Subbasins have been designated as high priority and are regulated by the Colusa Groundwater Authority (CGA), Glenn Groundwater Authority, and the Yolo County Flood Control and Water Conservation District (FCWCD) while Red Bluff Basin is designated as a medium priority subbasin and regulated by Groundwater Sustainable Agency of Tehama County. These county agencies are currently drafting their GSPs that would be submitted to the California Department of Water Resources for review by January 2022. At the time of preparation of this RDEIR/SDEIS, these GSPs were in the initial study and planning phases, and the potential Project effects on individual GSPs could not be evaluated. Therefore, this analysis compares the Project effects on the overarching SGMA goals, as well as current county Groundwater Management Plans (GWMPs) and Basin Management Objectives (BMOs), which would be superseded by adopted GSPs. The GWMPs and BMOs reviewed include:

- Coordinated Assembly Bill 3030 Groundwater Management Plan (Antone et al. 2012)
- BMO for Groundwater Surface Elevations in Glenn County, California (Glenn County Water Advisory Committee 2001)
- BMO Method of Groundwater Basin Management (Dudley 2000)
- Colusa Basin Watershed Management Plan (Fahey 2012)
- Groundwater Management Plan (Yolo County Flood Control and Water Conservation District 2006)

8.3.3. Thresholds of Significance

An impact on groundwater resources (including groundwater quality) would be considered significant if the Project would:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade groundwater quality.

- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the Project may impede sustainable groundwater management of the basin.
- Conflict with or obstruct implementation of a sustainable groundwater management plan.

8.4 Impact Analysis and Mitigation Measures

Impact GW-1: Violation of water quality standards or waste discharge requirements or otherwise substantial degradation of groundwater quality.

No Project

Existing conditions and the future No Project Alternative were assumed to be similar given the rural nature of the study area and limited potential for growth and development in Glenn and Colusa counties over the life of the Project. As a result, it is anticipated that the No Project Alternative would not entail material changes in groundwater conditions as compared to existing conditions.

Under the No Project Alternative, the operations of the existing TC Canal, RBPP, and GCID Main Canal would continue. These facilities have not been shown to degrade or otherwise adversely affect groundwater within the Sacramento Valley Groundwater Basin. In addition, there is no known water quality contamination in the study area.

Significance Determination

The No Project Alternative would not result in a violation of water quality standards or waste discharge requirements or otherwise substantial degradation of water quality because no new facilities would be constructed and operated. There would be no impact.

Alternatives 1, 2, and 3

Many of the Project facilities are included in Alternatives 1, 2, and 3. These facilities would involve the same types of construction methods and operation activities and would largely result in the same potential construction and operation impacts related to groundwater quality. The potential construction and operation impacts discussed below pertain to all Project alternatives unless otherwise stated.

Construction

The footprint of Alternatives 1 and 3 would differ from that of Alternative 2; but construction means and methods would be the same between these alternatives, resulting in the same effects related to groundwater quality.

Dewatering

Temporary dewatering would be required during construction for a variety of activities (e.g., during quarrying, installation of the Dunnigan Pipeline). Dewatering would not change the permeability of the ground surface where construction activities would occur. Therefore, dewatering would not affect groundwater quality during construction.

Temporary dewatering would be required for construction of the two TRR East or TRR West pipelines and two Funks pipelines leading to the I/O tunnel. In addition, dewatering would be required for the tunnel between the main reservoir and extension reservoir of TRR West. Pipes used to transport water during construction of the TRR East or West may be buried several feet below ground at heavily trafficked intersections and require temporary dewatering. There is one groundwater well within 1 mile of these facilities with a Primary Maximum Containment Level exceedance for arsenic and there is a low probability of arsenic affecting groundwater quality in the study area (California Water Boards 2020). An onsite water treatment facility, including a settling basin, would be located near the I/O Works. Treated water would then be used for dust suppression or discharged into Funks Creek. Groundwater discharged to surface waterbodies would comply with RWQCB Order No. 5-00-175. Groundwater encountered in other areas during dewatering would be stored onsite in bermed areas or Baker tanks as needed. Potential contamination of groundwater from dewatering would be avoided through the implementation of BMPs. Based on the lack of extensive, documented groundwater contamination near the TRR East and West pipelines, I/O Works, and Funks PGP, as well as the use of BMPs, dewatering during construction of these facilities would not result in a violation of water quality standards or waste discharge requirements or otherwise substantial degrade groundwater quality.

Funks Reservoir dredged to design capacity. Groundwater quality would not be adversely affected due to reduced seepage and percolation from the drained reservoir because this is a temporary activity and soil permeability is low in the area.

Abandoned Wells or Septic Systems

There are approximately 26 wells, 10 existing plugged natural gas wells, and numerous septic systems located in the Sites Reservoir inundation area. There are approximately 20 groundwater wells and one plugged dry natural gas well within a 1-mile radius of the TRR East and West, and their associated pipelines. Because natural gas wells are dry and previously plugged, there would be no effect on groundwater quality. Other water wells, septic systems, test wells, or boreholes may also be along or adjacent to other Project facilities. There has been no reported groundwater contamination as a result of septic systems in the study area (Appendix 27A, *Environmental Records Search*). All well types, boreholes, and septic systems would be located, identified, and decommissioned before or during construction to avoid possible groundwater contamination in accordance with the BMPs. The decommissioning requirements described in the BMPs would reduce the potential for contamination of groundwater to occur because the well boreholes would be filled with impermeable materials to preventing cross-contamination in accordance with county groundwater authority requirements. With the implementation of well-decommissioning BMPs and on the basis of a lack of reported contamination from septic systems, groundwater quality would not be degraded or result in a violation of groundwater quality standards due to abandoned wells or septic systems in the study area.

Concrete Batch Plants and Onsite Water Treatment Plants

Three concrete batch plants that would be used to construct the I/O Works, main dams and saddle dams, diversions, and emergency release structures and would require groundwater use during operations. Due to the variable water quality in the Antelope Creek and Funks Creek Basins, groundwater would be treated at onsite water treatment plants prior to use for mixing concrete. The treatment would improve the groundwater quality, and the water used for concrete production would not be discharged back into the environment. Therefore, groundwater treated at the onsite water treatment plants and used for concrete mixing would not violate water quality standards or otherwise degrade groundwater quality during construction.

Operation

Reservoirs

Despite the grouting of the underlying rock formations, some water would leak from the inundation area and potentially affect groundwater quality in nearby areas. Alternative 2 would have a slightly less potential for this to occur when compared to Alternatives 1 and 3 because it has a smaller inundation area. Surface water from the Sacramento River, which would be used to fill the Sites Reservoir, has an electrical conductivity (EC) averaging 130 microsiemens per centimeter (µS/cm). Though this salinity could increase due to evapoconcentration, local creek discharges, and Salt Pond seeps it should remain well below the current EC for groundwater quality of 680 to 2,190 µS/cm in the Sites Reservoir footprint. The weight of the reservoir could force additional percolation of surface water into the reservoir soils, resulting in higher quality surface water seeping into the reservoir floor and the shallow groundwater layer. This surface water would then alter the shallow groundwater chemistry in and immediately adjacent to the reservoir by reducing salinity.

Because Alternatives 1 and 3 have a larger surface water capacity than Alternative 2, these alternatives would allow potentially more fresh water in and adjacent to the Sites Reservoir. Alternatives 1 and 3 would result in more water weight on the reservoir floor than Alternative 2, which would cause more groundwater percolation and greater changes, or improvements, to shallow groundwater quality. The model results show minor changes to the extent of groundwater flow, which would result in minimal groundwater freshening that would be primarily contained along the eastern margin of the Sites Reservoir.

The TRR East and West would both be constructed with an ultraviolet-resistant polyvinylchloride or high-density polyethylene liner to minimize seepage over the reservoir footprint. Therefore, there would be no to very minimal interaction between the existing groundwater table and reservoir surface water resulting in a low likelihood that groundwater quality would be degraded or that water quality standards would be violated due to seepage in the TRR East or TRR West complex.

Salt Pond

A saline seep is present approximately 4 miles north of the community of Sites near the Salt Lake Fault. The saline seep, Salt Pond, is within the inundation area. Based on the geology and topography of the inundation area, surface water would percolate into the shallow aquifer under the reservoir floor, formed from alluvial deposits, and then flow to the west. Due to saline density the saline seep would stay near the bottom of the reservoir floor where it would mix with fresh water close to the Golden Gate Dam. Mixing with surface water would increase during periods of inflow from the bottom outlet of the I/O tower. Based on modeling (assumed a maximum 1.8-MAF reservoir capacity during the wettest simulated Water Year), groundwater elevation would increase along the western margin of the reservoir but would not result in any difference in the discharge area when compared to existing conditions. Some fresh water would dilute the saline water column within or near the Salt Pond, improving water quality somewhat within that column as compared to the baseline. Groundwater would move laterally and be discharged in the same area as existing conditions (Appendix 8B, *Groundwater Modeling*). As mentioned above, groundwater near Sites Reservoir has higher salinity than reservoir surface water and as such the inundation area would not result in increasing salinity or decreasing groundwater quality.

Wastewater Collection or Disposal Systems

An onsite wastewater disposal system, which would include a septic tank or other alternative system, would be installed at the administration building. The septic system would be sited and designed to avoid harmful contamination. The onsite wastewater disposal system at the Funks PGP maintenance and storage building would not result in a violation of wastewater discharge requirements or otherwise substantial degrade groundwater quality.

Vault toilets would be installed at all the recreation areas. These vault toilets would not include a leach field and would not dispose of wastewater on site. This wastewater would be pumped and transported offsite for treatment at a licensed facility and so would not result in a detrimental effect to groundwater resources or a violation of waste discharge requirements.

Recreation Areas

During operation of recreation areas, increased vehicle traffic and use of the recreation areas by recreationists could introduce contaminants (e.g., fuels, oils, and herbicides) which could enter the environment and subsequently compromise groundwater quality. Potential contamination of groundwater from hazardous materials via this route would be low due to the depth of the groundwater aquifer within the basin (100 feet below ground surface [bgs]). Therefore, increased vehicle traffic or use of recreation areas would not degrade groundwater quality or result in a violation of water quality standards.

CEQA Significance Determination and Mitigation Measures

Groundwater degradation from contaminates during dewatering would be unlikely due to depth to the groundwater aquifer within the study area. Abandoned wells would be decommissioned as described in the BMPs. There are no documented reports of contamination from septic tanks. An onsite water treatment facility would be utilized during dewatering for the I/O Works. Three onsite water treatment plants would be operated alongside concrete batch plants. These treatment plants would improve groundwater prior to use in mixing concrete. Groundwater quality standards would be met through implementation of SWPPP BMPs. Groundwater which could be discharged to surface waterbodies would be compliant with RWQCB Order No. 5-00-175. There would be a less-than-significant impact on groundwater quality or violation of water quality standards during construction for Alternative 1, 2, or 3.

Sacramento River fresh water would alter the shallow groundwater chemistry in and immediately adjacent to the reservoir by reducing salinity, resulting in a less-than-significant impact from Alternative 1, 2, or 3. Alternative 1 or 3 would have a greater impact as compared to Alternative 2 because these two alternatives have larger reservoir capacities. Because TRR East and TRR West would both have a liner to prevent groundwater/surface water interaction, they would have a less-than-significant impact on groundwater quality from Alternatives 1, 2, and 3.

Due to saline density of the Salt Pond, saline water would stay near the bottom of the reservoir floor where it would mix with fresh water close to the Golden Gate Dam. This fresh water would dilute the saline water column, improving water quality. Therefore, Alternatives 1, 2, and 3 would have a less-than-significant impact on groundwater quality when compared to existing conditions.

Administration building wastewater disposal systems would not contaminate groundwater and would be in compliance with county regulations. Wastewater from vault toilets in recreation areas would be pumped and treated offsite at a licensed facility. Hazardous materials from increased traffic and use of recreation areas would be unlikely to reach the basin aquifer. Therefore, operation of these facilities under Alternative 1, 2, or 3 would not result in wastewater discharge violation and would have a less-than-significant impact on groundwater quality.

NEPA Conclusion

Construction and operation effects under Alternatives 1, 2, and 3 would be the same as those described above for CEQA. The effects of construction would not be adverse and the effects of operation would be beneficial.

Impact GW-2: Substantial decrease in groundwater supplies or substantial interference with groundwater recharge that would impede sustainable groundwater management of the basin.

No Project

Under the No Project Alternative, the operations of the existing TC Canal, RBPP, and GCID Main Canal would continue. These facilities have been shown to act as a source of groundwater recharge within the Sacramento Valley Groundwater Basin that would continue under the No Project Alternative.

Significance Determination

The No Project Alternative would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge that would impede sustainable groundwater management of the groundwater basins and subbasins because no new facilities would be constructed and operated. There would be no impact.

Alternatives 1, 2, and 3

The footprint of Alternatives 1 and 3 would differ from that of Alternative 2, but construction means and methods would be the same between these alternatives, resulting in the same effects related to groundwater elevation or flow direction. The construction impacts discussed below pertain to Alternatives 1, 2, and 3 unless otherwise stated.

Construction

Groundwater Use

The average volume of construction water required for the Sites Reservoir complex, including adjacent roads and recreation areas, is estimated to be 750,000 to 1,000,000 gallons per day and would be supplied from existing groundwater wells over a period of 4 years. This required daily construction use within the reservoir would be less than 15% of the 2018 groundwater pumped for total groundwater use within Antelope and Funks Creek Basins (Table 8-2). Over time, the water used during construction would be replaced. Groundwater recharge would come from the surface water in the inundation area infiltrating into the floor of the reservoir; surface water infiltration from runoff in nearby creeks such as Grapevine Creek, Funks Creek, and Antelope Creek; and from precipitation. Therefore, use of groundwater for the construction of the Sites

Reservoir complex would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge in these basins.

Construction of the Dunnigan Pipeline would require 20,000 to 30,000 gallons of water per day from existing wells or dewatering efforts. The required daily construction use would be less than 1% of the 2018 groundwater pumped for total groundwater use within the Yolo County Subbasin (Table 8-2). The use of groundwater for the construction of the Dunnigan Pipeline would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge in this subbasin. Water used for pipeline compression and dust control during construction of conveyance facilities would be supplied from the GCID Main Canal and would not affect groundwater.

Dewatering and Redirected Surface Water

Temporary dewatering would be required during construction and could affect the surrounding groundwater levels. Dewatering practices would include BMP measures discussed in GW-1.

Some of the GCID Main Canal would be dewatered during siphon improvements. This construction would occur during the regularly scheduled annual maintenance period for the canal and would not adversely affect groundwater flow directions or quality. Construction of the new GCID Main Canal head gate would not require temporary dewatering (Appendix 2C, *Construction Means, Methods, and Assumptions*). The GCID Main Canal system upgrades would have no impact on groundwater supplies or recharge when compared to existing conditions.

The flow of Stone Corral and Funks Creeks would be temporarily redirected and reduced during construction of the main dams. The redirection of creek flows and stormwater management may result in a minor reduction of groundwater recharge (due to potentially altering the volume infiltration of surface water and potentially changing groundwater flow directions), but not at a rate that would affect surface water infiltration into groundwater aquifers or significantly change the existing deep percolation.

Dredging Funks Reservoir would require dewatering that would result in a short-term reduction in groundwater levels and recharge in the nearby area. There are 25 wells located within 1 mile of Funks Reservoir with depths between 22 to 440 feet bgs and depths to water between 15 to 207 feet bgs. Temporary dewatering during construction would not affect these wells because the average well depth and total depth to water would be able to compensate for any reduction in nearby groundwater levels. Dewatering required to dredge Funks Reservoir would not result in a substantial decrease in groundwater levels or substantial interference with groundwater recharge.

Construction of TRR East and West, TRR East and West pipelines, pipelines to convey water during TRR East and West construction, the transition manifold, and Dunnigan Pipeline, as well as quarrying associated with dam construction, may require dewatering. Under Alternatives 1 and 3, construction of the TRR East embankment, TRR East PGP, and the TRR East electrical substation would require excavation between 40 to 50 feet bgs. Under Alternative 2, TRR West would be excavated to a depth between 20 to 60 feet bgs, with a maximum depth of 120 feet near the TRR West PGP on the western side of the reservoir. TRR West PGP and electrical substation would also require excavation between 40 to 50 feet bgs. Under all three alternatives, the pipelines and transition manifold would be installed approximately 6 feet bgs.

Three quarries located to the east of Sites Reservoir and two within the inundation area would be excavated to access aggregate material for dam construction. Quarries can disrupt the existing movement of surface water/groundwater exchange by interrupting the natural water recharge. In addition, groundwater flow can also be disrupted as quarry dewatering lowers the water table and changes groundwater flow direction (Green et al. 2003:216, Ekmekci 1990:4). After construction, quarries outside the inundation area would be decommissioned and graded to have positive drainage to quarry bottoms and so would act as a recharge area upon construction completion.

BMPs require groundwater encountered during any excavation be stored onsite in bermed areas or Baker tanks before being discharged onto suitable land where it would infiltrate back into the water table. Encountered groundwater may also be utilized for dust suppression or moisture conditioning of embankment fill materials. Temporary dewatering during construction would not affect local groundwater wells (Table 8-2) because the average well depth and total depth to water would compensate for any localized reduction in groundwater levels. Alternative 2 would require more dewatering over a larger area during installation of the Dunnigan Pipeline compared to Alternatives 1 and 3 (10 miles versus 4 miles). Based on the typical depth to groundwater for local infrastructure wells along the Dunnigan Pipeline alignment and the temporary nature of dewatering, the installation of the pipeline would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge.

Operation

Project operation would differ under Alternatives 1, 2, and 3; but the differences in water deliveries would largely have the same effects on groundwater resources under all Alternatives. Therefore, the operation impacts discussed below pertain to Alternatives 1, 2, and 3 unless otherwise stated.

Sacramento River Diversion, Conveyance to Regulating Reservoirs, and Conveyance to Sacramento River

The timing and magnitude of changes at the two points of diversion on the Sacramento River vary between the alternatives but generally include periods of increased diversion flow during winter months to fill or maintain Sites Reservoir.

Model-simulated Sacramento River groundwater elevations were almost identical to baseline conditions. The largest decrease in groundwater elevation near the RBPP and GCID Main Canal head gate was 2.5 feet, with average annual volumetric differences in groundwater exchange 12 miles downgradient in the TC Canal and GCID Main Canal of 0.22% and 2.3%, respectively (Appendix 8B, *Groundwater Modeling*; Figure 10A-10). Because diversions required to operate the Sites Reservoir under Alternatives 1, 2, and 3 would be less than those needed for a 1.8-MAF reservoir capacity, the effects on groundwater elevation and groundwater/surface water interaction would be minimal. In addition, diversions would occur during high-flow events when excess surface water is available and would have minimal interference with groundwater recharge.

Alternative 2 would have the least effect on groundwater levels, as well as groundwater/surface water interaction, because it would require the least water to fill and maintain the Sites Reservoir (1.3 MAF as compared to 1.5 MAF under Alternatives 1 and 3). Alternative 3 would affect groundwater level and groundwater/surface water interaction the most due to increased filling and releases during operation.

Model-simulated groundwater/surface water interaction downstream of diversions indicated that the largest change in groundwater recharge was up to 3 cubic feet per second 10 miles downstream from the RBPP 20 years from the start of operations. After this spike, groundwater recharge matched existing conditions along the 12 miles of the TC Canal over the life of the Project (approximately 40 years). Groundwater recharge 12 miles downgradient from the GCID Main Canal head gate remained largely the same as existing conditions over the 40 years simulated (Appendix 8B; Figure 10A-11). Because water diversions required to operate the Sites Reservoir under Alternatives 1, 2, and 3 would be less than that needed for the 1.8-MAF reservoir capacity, the effects on groundwater recharge for these alternatives would be less than was modeled. Therefore, Project-related diversions would not substantially interfere with groundwater recharge.

Alternative 2 would have the least effect on groundwater recharge because it would involve the lowest volume of water to fill and maintain Sites Reservoir (1.3 MAF as compared to 1.5 MAF under Alternatives 1 and 3). Alternative 3 would have the greatest effect on groundwater recharge due to increased exchanges during operation.

Pipeline operation could affect the surrounding groundwater levels due to pipeline seepage along the I/O tunnels, TRR East and TRR West pipelines, Funks pipelines, and Dunnigan Pipeline. The I/O tunnels would be constructed using pre-excavation grouting to reduce groundwater flow into the tunnels. These two tunnels would be lined with concrete to prevent seepage between the transition manifold and the I/O tower and would not change groundwater levels or flow direction. Construction of these tunnels would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge.

The TRR East and TRR West pipelines, Funks pipelines, and Dunnigan Pipeline would be constructed using a large diameter welded steel pipe to prevent or minimize seepage between the perspective pipeline inlets and outlets (Rude pers. comm.). There would be no change in groundwater levels or flow direction associated with these pipelines and their installation would not result in a substantial increase in groundwater supplies or substantial interference with groundwater recharge. Based on the length of Dunnigan Pipeline under Alternative 2, there is a greater possibility for increases in groundwater levels compared to Alternative 1 or 3.

Reservoirs

A portion of the water retained in the Sites Reservoir under operating conditions would infiltrate into the subsurface materials, acting as new sources of recharge to the underlying groundwater system (as described above in Impact GW-1). In the nearby Colusa Subbasin, additional groundwater recharge would be beneficial during dry periods when groundwater levels are generally low but could adversely affect adjacent land uses in the study area that are susceptible to seepage in wetter years when groundwater levels are generally higher. Modeling showed that simulated groundwater levels would begin to increase as compared to baseline levels. In most years, the reservoir seepage inflow to groundwater would provide a benefit in terms of additional shallow groundwater. During critical drought years, groundwater levels were projected to be between 30 to 20 feet higher along the western margin of the Colusa Subbasin immediately adjacent to Site Reservoir, with the highest groundwater elevation modeled near Funks Creek. This increase was reduced to a 5-foot gain or less just 4 miles to the east near TRR East (Appendix 8B, *Groundwater Modeling*; Figure 10-3A). During Extremely Wet Water Years, groundwater levels were modeled to be from 1 to 25 feet higher along the western margin of the Colusa Subbasin immediately adjacent to Site Reservoir with the highest groundwater elevation modeled near Funks Creek (Appendix 8B; Figure 10-3B). Similar to the Critically Dry Water Years, the 2017 model simulation showed that expanded areas of higher groundwater elevations would be limited. Extremely Wet Water Years did result in additional discharge to streams and/or low-lying areas as compared to Normal or Dry Water Years. Finally, simulated hydrographs indicated even during Wet Water Years, groundwater levels were still forecast to be approximately 10 feet bgs near Funks Creek with little chance of flooding orchard land, though still higher than existing conditions (Appendix 8B; Figure 10-8B). Changes to nearby groundwater levels from Sites Reservoir seepage under Alternatives 1, 2, and 3 would be less than those modeled for the 1.8-MAF capacity but would still result in changes to groundwater levels and recharge as compared to existing conditions. Under Alternatives 1, 2, and 3 groundwater levels along the western margin of the Colusa Subbasin, especially near Funks Creek during Extremely Wet Water Years, may increase in the local shallow groundwater aquifer. Alternatives 1 and 3 would have a greater recharge potential in that aquifer when compared to Alternative 2 because they have a larger reservoir capacity (1.5 MAF as compared to 1.3 MAF). In addition, Alternative 1 would have a greater recharge potential in the shallow groundwater aquifer as compared to Alternative 3 because more water would be consistently stored in the reservoir during Alternative 1 operations (Alternative 3 operations would have a more reservoir fluctuation). Operation of Sites Reservoir would increase shallow groundwater levels abutting the inundation area, resulting in a slight increase in groundwater supplies and recharge when compared to existing conditions.

Conversion of irrigated agriculture to the lined TRR East would result in temporary lowering of groundwater levels in the proximity of TRR East due to the reduction in deep percolation from precipitation and seepage from irrigation canals. The estimated deep percolation from precipitation alone over the TRR East footprint, under average hydrologic conditions (Water Year 2005), was estimated at approximately 225 AF per year. This represents less than 0.1% of the average deep percolation within the Colusa Subbasin (400,700 AF per year) based on the average hydrologic conditions included in the 2017 model (Sites Project Authority and Bureau of Reclamation 2017). In addition, there is no irrigated agriculture in the TRR West footprint and it is on flat lands or sloping foothills. Natural groundwater recharge is primarily driven from precipitation events, approximately19.36 inches near Colusa (Water Year 2005). This precipitation represents a lower volume and less constant rate of water than seepage from irrigation canals near the TRR East footprint. The relative magnitude of the loss of groundwater recharge for TRR East and TRR West would be minimal compared to conditions in the subbasin, and operation of TRR East or TRR West would not result in a substantial decrease in groundwater supplies or substantial interference with groundwater recharge.

Recreation Areas and Roads

Under Alternatives 1, 2, and 3, the Project would add 46 miles of paved and unpaved roads. Alternative 2 would involve an additional 30 miles of paved roads for the realigned portion of Huffmaster Road and new South Road. These new roads could slightly diminish groundwater recharge but not to an extent that would affect existing uses of nearby wells because the increase of hard surface areas is negligible when compared to the surrounding permeable area. In addition, these roads would not be located in a high groundwater recharge area (The Nature Conservancy 2020).

Groundwater would not be used as a potable water source in the recreation areas. Therefore, operation activities associated with the recreation areas would result in similar groundwater conditions as the existing baseline.

Stone Corral Creek and Funks Creek

Flows would be maintained downstream of the dams and the creeks would continue to infiltrate as they currently do because releases would be made from the reservoir to these creeks.

CEQA Significance Determination and Mitigation Measures

Total required groundwater use for construction of Sites Reservoir and Dunnigan Pipeline over the life of the Project would be between 1% to 15% of the total annual groundwater use within the basin or subbasin and would result in a less-than-significant reduction in groundwater supply.

Based on the average well depth and total depth to water of local well infrastructure, nearby wells would be able to compensate for reductions in groundwater levels associated with dewatering during construction. Water diverted from Stone and Funks Creeks during construction would remain in the same watershed, resulting in minimal to no change in deep percolation or recharge within the basin. In addition, changes in groundwater levels or recharge would be minimized through use of BMPs (see Impact GW-1). Alternative 1, 2, or 3 would result in a less-than-significant impact on groundwater levels and recharge in the study area.

Pipeline operation could affect the surrounding groundwater levels due to seepage under Alternative 1, 2, or 3. Based on the length of the Dunnigan Pipeline under Alternative 2, there is a greater chance for increases to groundwater levels as compared to Alternative 1 or 3. All pipelines would be constructed using materials to effectively prevent or minimize pipeline seepage, resulting in a less-than-significant impact on groundwater levels.

All diversions would primarily take place during high flows when excess surface water would be available. In addition, modeling has shown little to no effects on existing groundwater recharge due to diversions. Effects on groundwater recharge would be the greatest under Alternative 3, then Alternative 1, and the lowest under Alternative 2. Based on high-flow conditions and modeling, diversions would have a less-than-significant impact on groundwater recharge or supplies under Alternative 1, 2, or 3.

Inundation in previously unsaturated areas would result in higher groundwater in the shallow aquifer along the western margins of the Colusa Subbasin (in the immediate vicinity of the Sites Reservoir). Groundwater levels and recharge potential would increase the most under Alternative 1, which would consistently store the most surface water. Alternative 2 would result in the lowest change in potential recharge or groundwater levels when compared to existing conditions. Increased shallow groundwater levels and recharge would be limited and not result in inundation to local orchards. Therefore, Alternative 1, 2, or 3 would have a less-than-significant impact on groundwater recharge and supply.

Reduced infiltration from the TRR East, TRR West, roads, and recreation areas would not be considered a significant change when compared the surrounding landscape and so Alternative 1, 2, or 3 would have a less-than-significant impact on groundwater recharge.

Discharges would continue to be made to Stone Corral Creek and Funks Creek under operating conditions; therefore, operation of Alternative 1, 2, or 3 would have less-than-significant impacts on groundwater recharge through these creeks.

<u>*NEPA Conclusion*</u>

Construction and operation effects on groundwater supplies and groundwater recharge under Alternative 1, 2, or 3 would be the same as described above for CEQA. The construction effects would not be adverse, and the operation effects would be beneficial. Surface water from Sites Reservoir has the potential to improve nearby shallow groundwater aquifer levels.

Impact GW-3: Conflict with or obstruct implementation of a sustainable groundwater management plan.

No Project

Under the No Project Alternative, the operations of the existing TC Canal, RBPP, and GCID Main Canal would continue. The operations of these facilities do not conflict with or obstruct the implementation of a sustainable groundwater management plan (e.g., county GSP).

Significance Determination

The No Project Alternative would not conflict with or obstruct the implementation of a sustainable groundwater management plan. There would be no impact.

Alternatives 1, 2, and 3

Current county GWMPs and BMOs would be superseded by GSPs adopted by local groundwater authorities. These GSPs would be developed at the basin and subbasin levels and would contain measures to facilitate the achievement of the overall goals of the SGMA. This section discusses likely GSP measures that may be affected by the implementation of Alternative 1, 2 or 3. Construction and operation would similarly affect possible GSP measures, and the potential construction and operation impacts discussed below pertain to all Project alternatives unless otherwise stated.

Construction

Construction activities would result in no to less-than-significant impacts on groundwater resources throughout the study area (see Impacts GW-1 and GW-2) during the 6-year construction period. Construction would not conflict with or impede GSPs developed by county groundwater authorities.

Operation

Operation could affect GSPs through changing the surface water management practice in the Sacramento Valley Groundwater Basin by increased diversions from the Sacramento River and storage of up to 1.5 MAF at Sites Reservoir. Under Alternatives 1 and 2, water would be released from Sites Reservoir for use by storage partners during Dry to Critically Dry Water Years. Releases under Alternative 3 are likely to be more frequent. Operations are unlikely to affect groundwater levels, flows, or water quality (see Impacts GW-1 and GW-2) so they would not impede or conflict with the overarching SGMA goals. Project facilities would not impede the installation or use of groundwater monitoring wells, which is a likely GSP measure.

Alternative 1, 2, or 3 would increase diversions from the Sacramento River. Because GSPs are in the initial stages of development, the surface water requirements for MAR areas are unknown. Project facilities are largely not in areas identified as excellent recharge areas by the CGA and operation would not conflict with current or future MAR projects (The Nature Conservancy 2020). Diversions would be highest under Alternative 3, then Alternative 1, with Alternative 2 having the lowest diversions from the Sacramento River. Diversions would not significantly reduce recharge or groundwater levels (Impact GW-2) and would therefore not impede likely GSP measures for sustainable groundwater levels.

Operation would improve water supply and reliability by creating additional surface water storage to be used by SWP and CVP contractors. This increased water storage aligns with existing county GWMPs and BMOs and likely goals in future GSPs. Alternatives 1 and 3 would provide more surface water storage than Alternative 2. Under Alternative 3, the reservoir exchanges would increase and Sites Reservoir would typically be below full capacity. The operation under Alternative 3 would also result in less seepage as compared to Alternative 1, reducing the beneficial effects on nearby groundwater levels.

Alternative 1, 2, or 3 would provide a more reliable surface water supply for agricultural use, lowering dependency on groundwater pumping for crop irrigation in the Sacramento Valley and the San Joaquin Valley. For example, under Alternatives 1, 2, and 3, Colusa County could release up to 10 TAF per year directly to the TC Canal which would then count towards groundwater replenishment (Appendix 8B, *Groundwater Modeling*). Surface water use could increase deep percolation that would subsequently increase groundwater storage and improve groundwater quality because surface water has been shown to have better water quality than groundwater, especially in the San Joaquin Valley. This increase in groundwater storage could also reduce land subsidence and disconnections from surface water. The increased surface water use for agriculture would also decrease dependency on micro-irrigation systems which rely on groundwater pumping and have been shown to result in little to no groundwater recharge and a buildup of salt in the upper layers of the soil profile, both due to lack of deep percolation (Fahey 2012). All surface water use would be downstream from Sites Reservoir and this benefit would not be applicable to the Groundwater Sustainable Agency of Tehama County GSP.

CEQA Significance Determination and Mitigation Measures

Construction and operation under Alternative 1, 2, or 3 would not conflict with or obstruct implementation of GSPs. Construction and operation would not result in a violation of water quality standards or waste discharge requirements or otherwise substantial degradation of groundwater quality (Impact GW-1). There would be no substantial decrease in groundwater supplies or interference with groundwater recharge (Impact GW-2). Operation would improve surface water reliability and increase its use, which would reduce groundwater pumping in the Sacramento Valley Groundwater Basin and San Joaquin Valley. Alternative 1, 2, or 3 would have a less-than-significant impact on GSP implementation.

NEPA Conclusion

Construction and operation effects under Alternative 1, 2, or 3 would be the same as described above for CEQA. The construction and operation of Alterative 1, 2, or 3 would have beneficial to not adverse effects on GSP implementation.

8.5 References

8.5.1. Printed References

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8.5.2. Personal Communications

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