Identification, Monitoring and Assessment of Groundwater Dependent Ecosystems in the Eastside Subbasin

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Prepared for the Salinas Valley Basin Groundwater Sustainability Agency

Prepared by the Central Coast Wetlands Group

Introduction

The Sustainable Groundwater Management Act (SGMA) requires all beneficial users, including Groundwater Dependent Ecosystems (GDEs), must be considered during development and implementation of Groundwater Sustainability Plans (Water Code § 10723.2). SGMA requires all GDEs within a groundwater basin be identified, monitored and assessed to ensure there are no adverse impacts to these systems due to groundwater conditions.

Identification of Potential Groundwater Dependent Ecosystems

The process for identifying and mapping potential GDEs in the Salinas Valley Basin, including the Eastside Subbasin, was developed with guidance from documents developed by The Nature Conservancy (TNC) (Rhode et al. 2018, Rhode et al. 2020), TNC staff and San Francisco Estuary Institute (SFEI) staff with subject matter expertise, and Dr. Melissa Rhode. Additionally, this process was developed with feedback from local stakeholders as part of the Salinas Valley Basin Groundwater Sustainability Agency (SVBGSA) convened Groundwater Dependent Ecosystem Working Group, which met seven times between July 2023 - April 2024.

Identification and mapping of potential GDEs in the Eastside Subbasin was part of a larger identification process for identifying potential GDEs in the Salinas Valley Basin and included a desktop review and analysis of groundwater and habitat datasets.

There are inherent uncertainties in the identification of GDEs due to the difficulty of directly measuring an ecosystem's reliance on groundwater. While there are methods for directly measuring the extent to which vegetation and waterbodies are reliant on groundwater, these methods are highly resource intensive and are not considered a reasonable or necessary approach by subject matter experts. This process instead relied on proxy measures based on the best available science and groundwater and habitat mapping data. If these datasets are updated, so should the identification and mapping of potential GDEs in this subbasin. Due to the inherent uncertainties, this process aimed to err on the side of being more inclusive in the mapping and identification of potential GDEs.

Additionally, the goal of this identification and mapping process was not to identify every plant and waterbody dependent on groundwater but rather ensure there was adequate identification of GDEs across the Eastside Subbasin. This approach takes the perspective that if there are no adverse impacts to identified GDEs, then any additional ecosystems missed in the process will also be protected under SVBGSA management activities and decisions. Subject matter experts consulted in the development of this identification process support this perspective and encourage spending enough resources on identification and mapping to get adequate coverage while spending more focus and resources on monitoring and assessment to protect potential GDEs from adverse impacts.

Monitoring and Assessment of Groundwater Dependent Ecosystems

The objective of GDE monitoring and assessment is to detect when the condition of a GDE is declining, where further decline would be expected to result in long-term adverse impacts to the ecosystem. When such declines in condition are detected, the GDE must be flagged for further investigation into the root cause of the decline to determine if it is related to groundwater management activities. For the purposes of GDE monitoring in the Salinas Valley, ecosystem condition is primarily defined through vegetation health and vigor since this metric can be most readily tied to groundwater conditions. If groundwater

levels are lowered below a depth that vegetation roots can access, a decline in vegetation vigor due to the loss of the water source would be an expected result and defined as an adverse impact.

The monitoring and assessment protocol for GDEs in the Salinas Valley was developed with guidance from documents developed by TNC (Rhode et al. 2018, Rhode et al. 2020), TNC staff and SFEI staff with subject matter expertise, and Dr. Melissa Rhode. Additionally, as with the identification of potential GDEs in the Salinas Valley, this monitoring protocol was developed with feedback from local stakeholders as part of the SVBGSA Groundwater Dependent Ecosystem Working Group.

Two-pronged Approach

This GDE monitoring methodology uses a two-pronged approach to maximize efficiencies of cost and labor while ensuring GDEs are adequately monitored and assessed to effectively detect adverse impacts. Monitoring includes a desktop-based component and a field-based component. It is recommended that the desktop-based monitoring is conducted annually for all mapped potential GDEs while the field-based monitoring is conducted once every five years at a subset of mapped potential GDEs. Detailed procedures for both monitoring components are described in the following sections, as is application of this monitoring methodology to potential GDEs identified in the Eastside Subbasin to establish baseline conditions. As will become clear, while both monitoring components are reasonable and useful tools for monitoring and assessing GDEs, neither can directly relate declining ecosystem condition to decreasing groundwater levels. Making this direct causal connection to groundwater management would need to be a subsequent hydrogeological analysis to investigate groundwater level trends in the area around the GDE. Therefore, all GDEs in the report are described as “potential” GDEs. However, it is important to make informed inference between any declines in GDE condition and groundwater levels wherever possible. To that end this protocol also includes considerations for siting additional shallow water table monitoring wells, appropriate for monitoring groundwater at a depth the roots of groundwater dependent vegetation can reach, to be added to the existing monitoring well network.

Identification and Mapping of Potential GDEs

State and local habitat mapping datasets were filtered to identify where ecosystems potentially dependent on groundwater are located. Local habitat datasets were used to where available to supplement statewide habitat datasets. The only available local habitat mapping dataset in the Salinas Valley was for the Elkhorn Slough Watershed in the 180/400-Foot Aquifer Subbasin, so no local datasets are described in this report. Groundwater elevation and ground surface elevation data were used to determine how deep the groundwater table was in relation to the ground surface. This depth to groundwater table was layered with the habitat datasets to identify locations where the groundwater table was reasonably high enough to expect the above ecosystem above to be able to access groundwater as one of its water sources.

Datasets

The desktop-based process of identifying and mapping potential GDEs in the Eastside Subbasin used local groundwater elevation data, ground surface elevation data, state habitat mapping datasets, and TNC guidance on the rooting depth of plant species known to be groundwater dependent.

Habitat Data

Natural Communities Commonly Associate with Groundwater

The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset is a compilation of phreatophytic vegetation, regularly flooded natural wetlands and riverine areas, and seeps and springs identified from 48 publicly available state and federal agency datasets. This dataset does not account for local groundwater elevations and areas identified in the dataset are considered potentially dependent on groundwater. Two potential GDE types are identified in NCCAG, wetlands and terrestrial vegetation (Figure 1). This dataset was developed by a working group comprised of staff from Department of Water Resources, California Department of Fish and Wildlife, and The Nature Conservancy (Klausmeyer et al. 2018). GDE subject matter experts recommend using NCCAG as a starting point for identifying potential GDEs within groundwater subbasins and modifying the dataset based on local habitat and groundwater data.

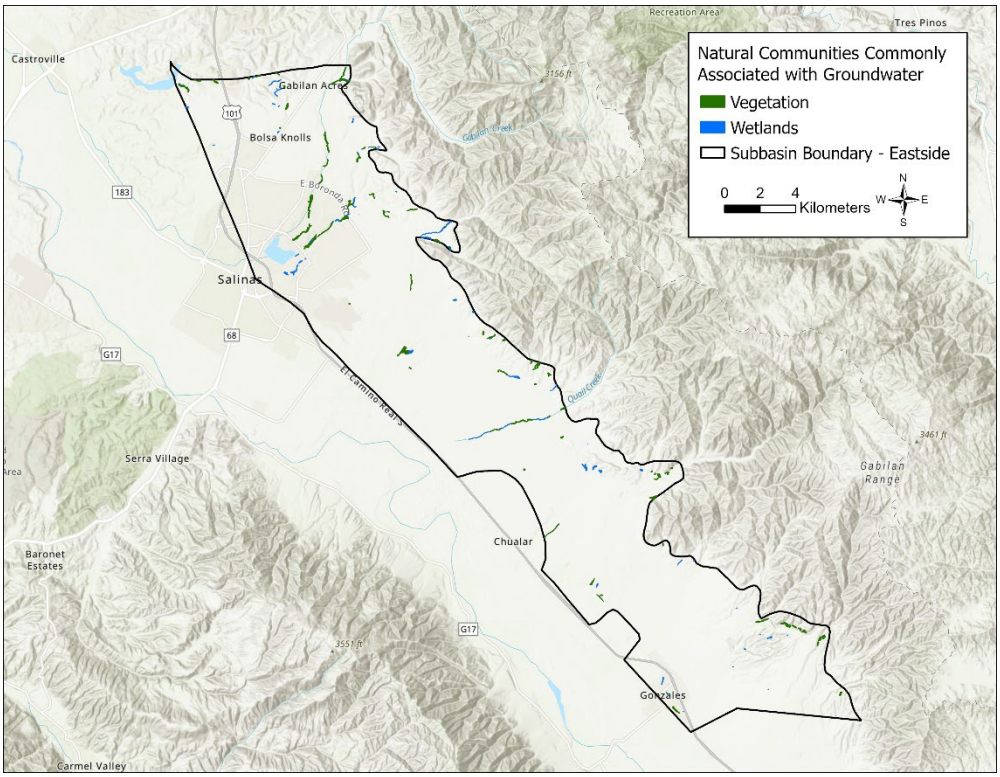

Figure 1. Natural Communities Commonly Associated with Groundwater dataset focused on the Eastside Subbasin (Klausmeyer et al. 2018).

Local Habitat Datasets

If available in the future, local habitat datasets can be added to the GDE identification process to supplement and enhance the initial set of ecosystems potentially dependent on groundwater under consideration in the Eastside Subbasin.

Elevation Data

2019 Fall Groundwater Elevation Contours

Monterey County Water Resources Agency (MCWRA) conducts a groundwater elevation monitoring program in the Salinas Valley and provided the groundwater elevation contour data used for this

identification and mapping effort. These data are for all wells monitored by MCWRA, almost all of which are deep irrigation wells in which water levels often differ from the true water table elevation near the ground surface. There are too few true shallow monitoring wells to allow contouring over the full extent of the Subbasin, so the global water-level data set was used as a proxy, recognizing its inherent limitations and potential bias. Fall groundwater elevation contour data from 2019 was used to identify potential groundwater dependent ecosystems in the Eastside Subbasin (Figure 2). This was a conservative approach, including the broadest number of potential GDEs in initial identification because 2019 was a wet year with high groundwater elevations post 2014 when SGMA took effect. The fall groundwater elevation contours are developed from measurements taken from mid-November to December after the end of the irrigation season and before seasonal recharge from winter precipitation increases groundwater levels.

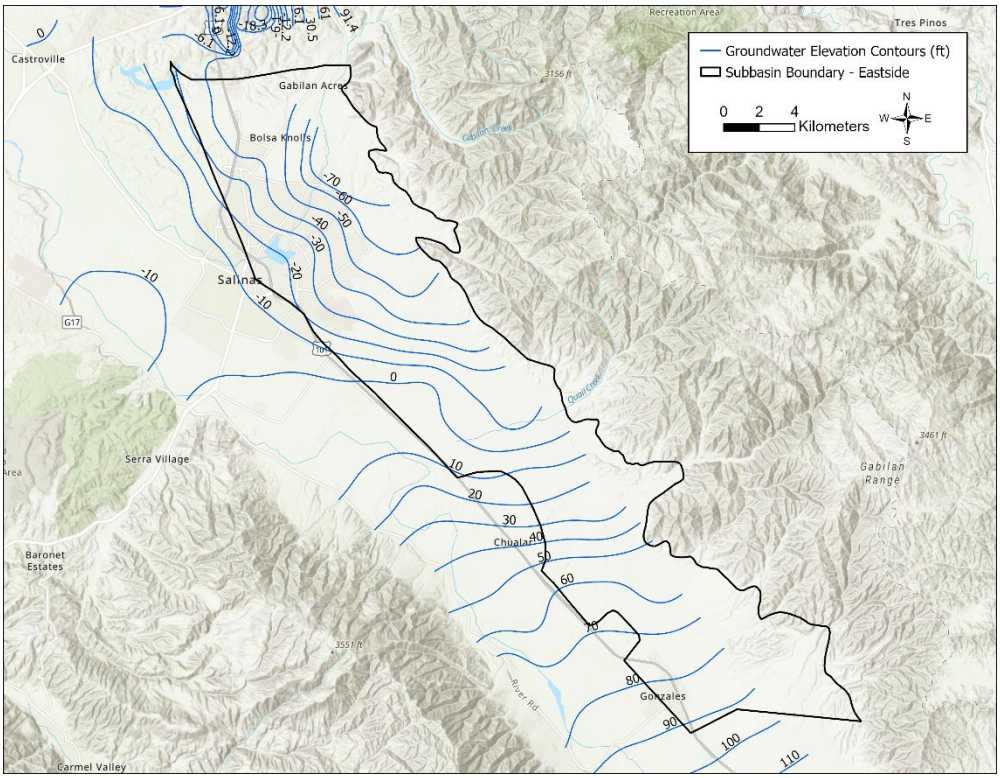

Figure 2. Groundwater elevation contours (feet) based on Fall 2019 MCWRA monitoring.

Digital Elevation Model (DEM) Ground Surface Elevation

A digital elevation model (DEM) is a representation of the bare ground (excluding surface objects such as trees and buildings) topographic surface of the Earth. The DEM used for this identification and mapping effort was developed by the U.S. Geological Survey (USGS) at a 30-meter resolution (USGS 2024) (Figure 3). The DEM data describes the ground surface elevation in relation to sea-level.

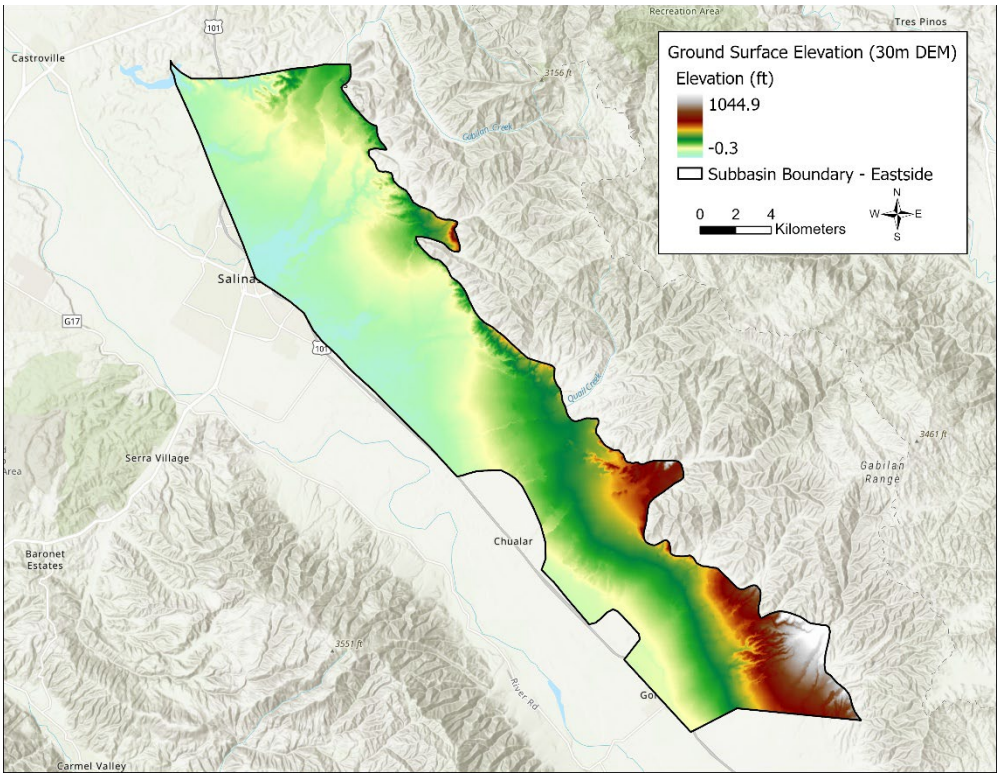

Figure 3. Digital Elevation Model (DEM) ground surface elevation (feet) in the Eastside Subbasin (USGS 2024).

Verification of Ecosystem Connection to Groundwater

To determine if the starting set of ecosystems potentially dependent on groundwater, based on local and state habitat mapping datasets (Figure 1), are GDEs, it is necessary to determine how deep the groundwater table is below the ground surface. If the groundwater table is 200 ft below the ground surface, it is highly unlikely that groundwater is able to support the vegetation or wetland above it. However, if the groundwater table is 5 ft below the ground surface, it is highly likely that groundwater is able to support the above vegetation or wetland. Areas above the current known extent of the Salinas Valley Aquitard are excluded from consideration because the shallow area above the aquitard is not a principle aquifer (Figure 4).

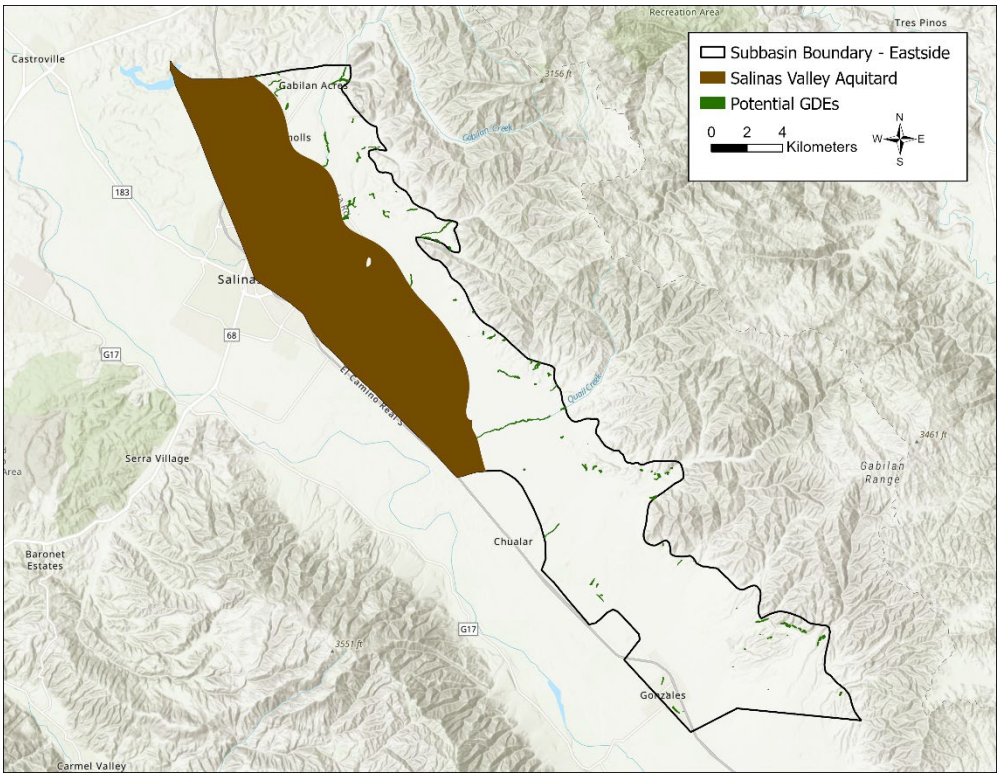

Figure 4. Set of ecosystems potentially dependent on groundwater, based on state habitat mapping datasets. Areas above the current known extent of the Salinas Valley Aquitard are excluded from consideration because it is not a principle aquifer.

To determine the depth from the surface down to the groundwater table across the Eastside Subbasin, the groundwater elevation (groundwater contours) was subtracted from the ground surface elevation (DEM). However, to complete this subtraction, the groundwater contours, which are provided by MCWRA as topographic lines, had to be turned into a continuous surface to ensure there was a groundwater elevation measurement for every point in the Subbasin. This was accomplished using the Inverse Distance Weighting (IDW) interpolation method to estimate missing data and turn the contours into a continuous surface (Figure 5). Once this layer was created it was subtracted from the ground surface elevation (DEM) to create a complete depth to groundwater map (Figure 6).

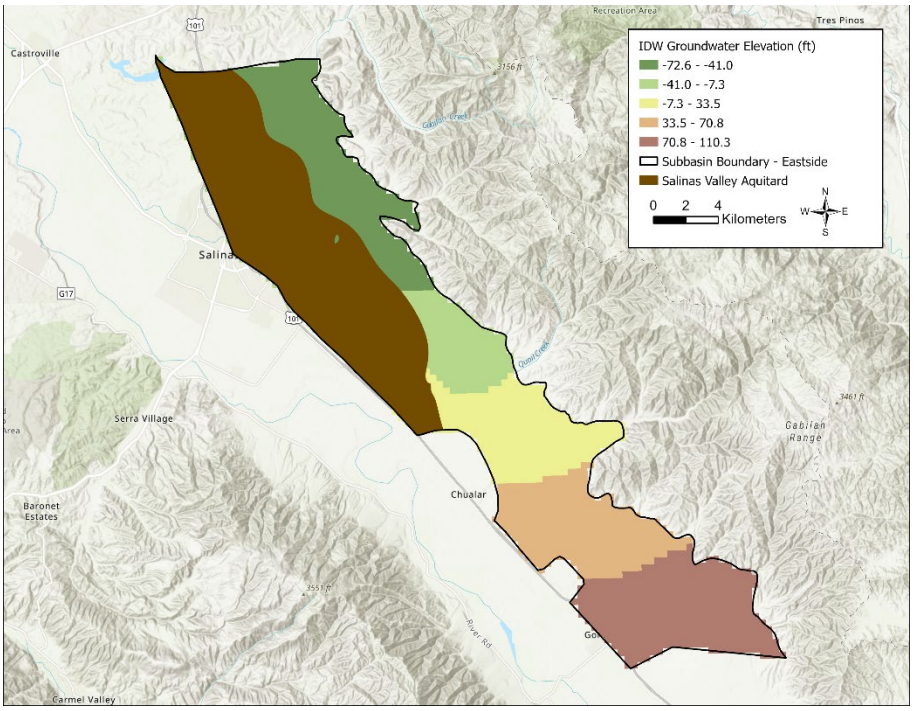

Figure 5. Continuous surface of groundwater elevations. Fall 2019 Shallow Groundwater Contour data provided by MCWRA was interpolated using Inverse Distance Weighting (IDW) to create the continuous surface of groundwater elevations.

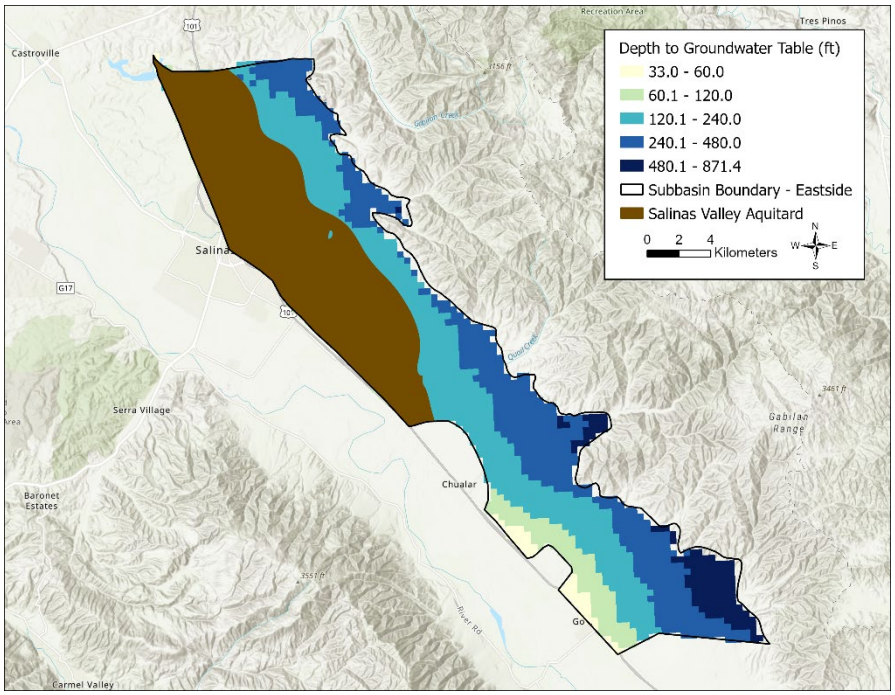

Figure 6. Distance from the ground surface to the groundwater table, or depth to groundwater table (feet).

With depth to groundwater table data for the entire Subbasin, the starting set of habitat data can be overlayed to determine where the groundwater table is reasonably high enough to support the above ecosystems. Guidance developed by subject matter experts at The Nature Conservancy was consulted to determine how close to the surface the groundwater table is to be reasonably assumed a water source for the above ecosystem (Rhode et al. 2018). Based on this guidance, if the groundwater table is greater than 30 feet below the ground surface, the ecosystem at the surface is likely not reliant on groundwater. This is because most vegetation does not have roots deep enough to reach the water table below 30 feet. Oak trees are an exception to this generalized rule, as oak trees have been shown to have roots that reach up to 80 feet below the ground surface (Howard 1992). For this reason, in areas mapped as having oak trees as the dominant plant species, the depth to groundwater cutoff for including the ecosystem as a potential GDE was 80 feet. For all other areas the cutoff was 30 feet. Figure 7 shows the resulting map of potential groundwater dependent ecosystems in the Eastside Subbasin, of which there are none.

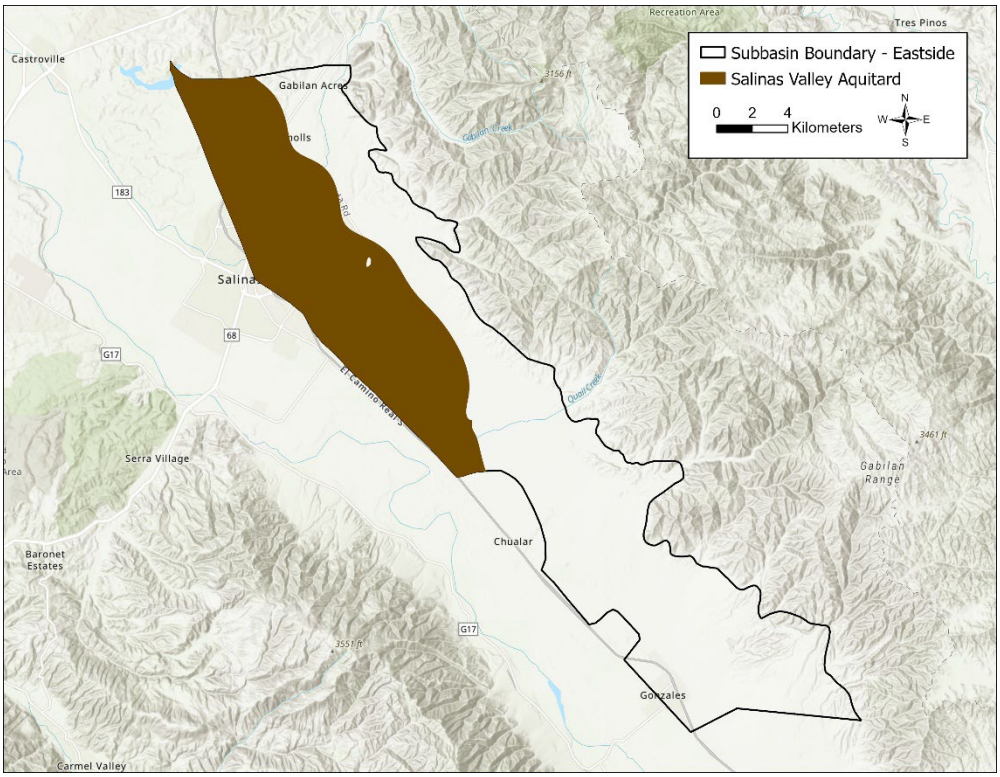

Figure 7. No GDEs were identified within the Eastside Subbasin.

Inherent Uncertainty and an Iterative Process

There are inherent uncertainties in the identification of GDEs due to the difficulty of directly measuring an ecosystem's reliance on groundwater. The process relies on the best available data and guidance from subject matter experts to develop a map of ecosystems reasonably assumed to be dependent on groundwater as one of their water sources. This identification process does not result in a perfectly accurate map of GDEs. However, it does result in a representative and characteristic map of GDEs in the Eastside Subbasin. Subject matter experts consider this a sufficient level of identification from which the SVBGSA can fulfill the GDE monitoring and assessment requirements under SGMA to ensure no adverse

impacts to GDEs. This process should be considered iterative and subject to updates if additional guidance from the California Department of Water Resources becomes available, or updates to groundwater and/or habitat datasets become available.

Removing large areas of irrigated vegetation (crops or landscaping)

While the goal of this identification and mapping process is not to identify every plant and waterbody dependent on groundwater but ensure adequate identification of GDEs across the whole subbasin, one exception to modifying the starting habitat datasets is to correct any large mapping inaccuracies. This includes any large areas of irrigated vegetation such as acreage in agricultural production or large areas of landscaping. Due to the lack of GDEs identified in this subbasin, no visual confirmation or desktop-based monitoring was performed.

Adding areas of ecological importance

In acknowledgment of the inherent uncertainty of GDE identification, the Groundwater Dependent Ecosystem Working Group decided to allow for the inclusion of areas in the habitat datasets deemed as ecologically important in the set of potential GDEs even if these ecologically important areas were not identified as a potential GDE through the process outlined here. This allows for ecologically important areas to be monitored for adverse impacts should they be identified as potential GDEs in the future through the iterative identification process.

Examples of areas of ecological importance that could be considered for inclusion in the set of potential GDEs may include, but are not limited to, areas identified as drought refugia, areas known to contain threatened and endangered species or areas identified as critical habitat for any of these species. Drought refugia are areas of habitat that stay wet and/or green for longer than their surroundings. By staying wet and green for longer these refugia continue to provide quality habitat for species when the surrounding areas have become too dry to be suitable habitat, thus providing a resource for maintaining sensitive species' populations through periods of drought. The *Groundwater Dependent Ecosystem Monitoring and Assessment Protocol for the Salinas Valley Basin* describes resources that could be utilized to identify areas of ecological importance for inclusion in the set of potential GDEs.

As of June 2026, this option has not been exercised in the identification of potential GDEs in the Eastside Subbasin.

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