# Riparian Groundwater Dependent Ecosystems Assessment

## Upper Ventura River Groundwater Basin

*prepared for*

**Upper Ventura River Groundwater Agency**
202 West El Roblar Drive
Ojai, California 93023

*prepared by*

**Rincon Consultants, Inc.**
180 North Ashwood Avenue
Ventura, California 93003

**April 2021**



RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
rinconconsultants.com

# Table of Contents



## Tables

# Figures



# Appendices

# 1 Introduction

This technical appendix to the Upper Ventura River Groundwater Agency (UVRGA) Groundwater Sustainability Plan (GSP) summarizes the process for identifying, characterizing, and assessing potential impacts to riparian groundwater dependent ecosystems (GDEs) in the Upper Ventura River Groundwater Basin (UVRGB). Importantly, this appendix identifies how groundwater management could affect (i.e., impact) riparian GDEs in the UVRGB and provides initial recommendations for establishing draft sustainability measurement criteria (SMC).

> **Groundwater Dependent Ecosystems:** *"Ecological communities of species that depend on groundwater emerging from aquifers or on groundwater occurring near the ground surface"* – SGMA. 23 CCR § 351(m)

The Sustainable Groundwater Management Act (SGMA) requires groundwater sustainability agencies (GSAs) to identify and consider GDEs and other beneficial uses of groundwater when developing their GSPs. GDEs include vegetative communities (e.g., plants) as well as both aquatic and terrestrial species (e.g., animals) that are dependent on the habitat supported by groundwater. As is the case within the UVRGB, these ecosystems can include instream and riparian habitat, as well as vegetative habitat comprised of terrestrial plant species adapted with root systems that can reliably access groundwater.

While instream and riparian habitats have various interrelated characteristics and interdependent components, this assessment focuses on riparian plant communities as well as the species that rely on plant communities. This riparian GDE assessment provides information relevant to development of sustainable management criteria (SMC) for the *groundwater level* and *groundwater storage* sustainability indicators by evaluating potential effects to these beneficial users of groundwater. Note that a separate assessment of aquatic GDEs will be conducted to support SMC development for the *depletion of interconnected surface water* sustainability indicator and will evaluate potential impacts to instream habitat and the species dependent on interconnected surface water in the UVRGB. The aquatic GDE assessment will be published under separate cover.

The following outline provides a description of each of the sections found in this appendix:

- **Section 1. Introduction.** Provides a brief introduction to riparian GDEs and an overview of this technical document.
- **Section 2. Riparian GDE Identification.** Provides a list of the riparian GDEs that occur within the UVRGB and describes the process of identifying and screening potential riparian GDEs and the grouping of "Riparian GDE units".
- **Section 3. Riparian GDE Characterization.** Provides an overview of the ecological condition of the UVRGB and a detailed summary of the ecological condition of each Riparian GDE Unit within the UVRGB, including: vegetation, beneficial uses, federally designated critical habitat, special status species, and overall ecological value.
- **Section 4. Riparian GDE Impact Analysis.** Provides an analysis of potential impacts to riparian GDEs related to changing groundwater conditions from both natural and non-natural (i.e., pumping) causes.

Note that GSP development is an iterative process, and the SMCs for GDEs in the UVRGB are subject to change based on stakeholder input, monitoring data, and forthcoming studies.

# 2 Riparian GDE Identification

This section summarizes the evaluation of riparian GDEs that have the potential to occur, and the identification of actual riparian GDEs that occur within the UVRGB. The approach for identifying riparian GDEs in the UVRGB generally followed the guidance provided by The Nature Conservancy (TNC) ("TNC GDE Guidance") (Rhode et al., 2018). A statewide dataset of potential riparian GDEs (iGDEs) was used as a starting point and compared against previous vegetation mapping, aerial imagery, basin-specific data on plant community rooting depths, and groundwater elevations to determine actual riparian GDEs present in the UVRGB. The actual riparian GDEs were grouped into "Units" based on areas with consistent vegetation and hydrology.

## 2.1 Data Used for Riparian GDE Identification

As recommended by TNC, riparian GDE identification started with spatial data of potential GDEs provided by the Natural Communities Commonly Associated with Groundwater (NCCAG) dataset (DWR 2021). The NCCAG dataset is a compilation of 48 publicly available State and Federal agency datasets that map vegetation, wetlands, springs, and seeps in California. A working group comprised of TNC, the California Department of Fish and Wildlife (CDFW) and the California Department of Water Resources (DWR) reviewed the compiled dataset. This working group also conducted a screening process to exclude vegetation and wetland types less likely to be associated with groundwater and retained vegetation types commonly associated with groundwater, based on criteria described in Klausmeyer et al., 2018. Due to uncertainty in the knowledge of when and how plants and animals depend on groundwater, the spatial database identifies ecosystems that potentially rely on groundwater. These potentially groundwater reliant ecosystems are therefore referred to as "indicators of groundwater dependent ecosystems" (iGDEs), which can also be thought of as "potential GDEs."

Additional data were accessed or developed to evaluate groundwater dependency of the potential GDEs, and ultimately identify riparian GDEs in the UVRGB. Table 1 presents the data sources used for this analysis.

**Table 1 Data Used to Identify Riparian GDEs**

| Description | Provider | How it was Used |
|---|---|---|
| NCCAG dataset | TNC, CDFW , DWR | The map provides polygons representing potential GDEs, which were used as a starting point to map GDEs. |
| Groundwater elevations and model outputs | UVRGA (GSP work in progress) | Well-specific elevation data were used to evaluate proximal depths to water and refine iGDE polygons.<br>Basin-wide groundwater elevations were modeled and data were used to further refine iGDE polygons. |
| Aerial imagery | Google Earth Pro, USDA – NAIP[1] | Aerial imagery was used for a visual analysis to manually refine iGDE polygons. |
| Vegetation maps/databases | CalVeg[2], NWI[3], VegCAMP[4], CDFW, VCPWA-WP[5], UVRGA (GSP work in progress) | Data on groundwater, vegetation communities, and hydrologic conditions within the UVRGB were used to identify and group GDEs into final GDE units. |
| Maximum rooting depths | TNC | Maximum rooting depths were defined for each iGDE and were compared to actual depth to groundwater throughout the basin to determine which communities could actually be groundwater dependent. |

[1] United States Department of Agriculture – National Agriculture Imagery Program (USDA 2021a)

[2] Classification and Assessment with Landsat of Visible Ecological Groupings, U.S. Department of Agriculture (USDA) Forest Service (USDA 2021b)

[3] National Wetlands Inventory, U.S. Fish and Wildlife Service (USFWS 2021b)

[4] Vegetation Classification and Mapping Program (CDFW 2021d)

[5] Ventura County Public Works Agency – Watershed Protection (VCPWA-WP 2021)

## 2.2 Analysis of Potential Riparian GDEs

The iGDE dataset representing potential riparian GDEs is regional in nature and it is known that it may not be consistent with basin-specific habitat and groundwater conditions. As such, TNC suggests using the iGDE dataset as a starting point for the identification and analysis of GDEs under SGMA. Determining whether an iGDE is actually a GDE requires detailed local data about land use, vegetation, habitat, groundwater levels, surface water hydrology, and geology.

The TNC GDE Guidance recommends several steps for validating the groundwater dependency of iGDEs with basin-specific local information, which were generally followed. The process refined the iGDE polygons (spatial areas representing potential riparian GDEs) using local data, site-specific information, and aerial imagery.

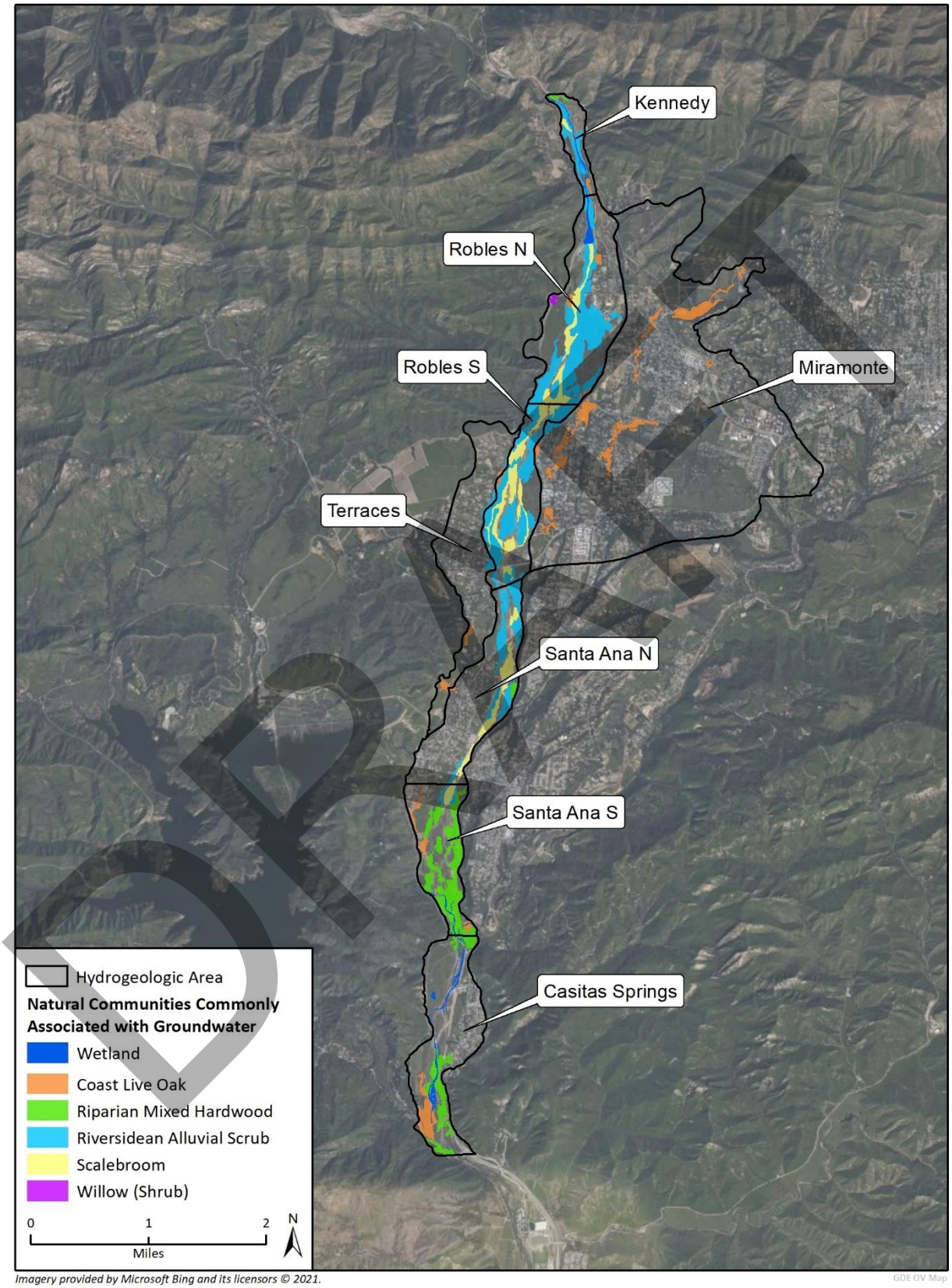
The iGDEs provided by the NCCAG dataset are separated into the following two classifications:

- Wetland features commonly associated with the surface expression of groundwater under natural, unmodified conditions, such as perennial wetlands, perennial rivers, and springs
- Vegetation types commonly associated with the sub-surface presence of groundwater (phreatophytes)

### Initial Desktop Analysis of Potential Riparian GDEs

Figure 1 depicts a map of all iGDEs within the UVRGB identified in the NCCAG dataset (DWR 2021). These iGDEs were compared with CalVEG maps and vegetation communities identified in the Ventura River Management Plan (VRMP). Experienced local botanists then conducted a visual

**Figure 1 iGDEs within the UVRGB (NCCAG Dataset)**



analysis of these iGDEs using aerial imagery dating back to 2005. Based on this desktop review, iGDEs within the UVRGB were visually assessed and refined to best reflect the potential riparian GDEs within the basin. This included adjustments to area and changing the classifications of specific iGDEs.

The resulting iGDEs included the following plant communities: Wetlands, Coast Live Oak, Riparian Mixed Hardwood, Riversidean Alluvial Scrub, and Scalebroom. These NCCAG classifications represent groupings of multiple species, and the classification name generally represents the dominant vegetation type. Vegetation and habitats associated with each of these classes within the UVRGB are discussed in detail in Appendix A.

Figure 2 presents the refined iGDE polygons that occur within the UVRGB, as well as the hydrogeologic areas within the UVRGB. Figure 2 also depicts the interconnected surface water systems outlined in Chapter 3.2.6 of the Draft GSP. The varying groundwater-surface water interconnection is evident in the distribution of vegetation communities that occur across the four identified reaches. These reaches consist of the following:

- A losing reach with intermittent groundwater-surface water interconnection in the Kennedy hydrogeologic area
- A losing reach with generally disconnected groundwater-surface water in the Robles North, Robles South, and northern Santa Ana South hydrogeologic areas
- A variably losing or gaining reach with intermittent groundwater-surface water interconnection in the Santa Ana North, Santa Ana South, and northern Casitas Springs hydrogeologic areas
- A gaining reach with generally interconnected groundwater-surface water in the Casitas Springs hydrogeologic area

## 2.3 Potential Riparian GDE Screening Methods

A cursory GIS spatial analysis of maximum rooting depths and groundwater levels was completed to assess potential riparian GDE groundwater access. Depending on results from this initial assessment, further evaluations of groundwater level and rooting depth were completed. As needed, additional analysis was conducted to verify groundwater dependency.

### Maximum Rooting Depth

A literature review was conducted to establish maximum rooting depths for the dominant species found within the NCCAG classifications of potential GDEs. Maximum rooting depths for the dominant plant species found within each potential riparian GDE were evaluated and used to represent each iGDE's maximum rooting depth (Table 2). The plant species with the deepest rooting depth was selected for the maximum rooting depth, except in the case of Riparian Mixed Hardwood, which used an average of the rooting depths.[1] The maximum rooting depth for each potential Riparian GDE polygon were added to the attribute table in GIS for spatial analysis.

[1] The average rooting depth was used for this potential GDE because *Quercus agrifolia* (Coast Live Oak) is known to comprise up to 50 percent of the community. Because this species is not as prevalent as in Coast Live Oak community, we do not use this as a max rooting depth.

**Figure 2 Potential Riparian GDEs, Hydrogeologic Areas, and Interconnected Surface Water Systems within the UVRGB**

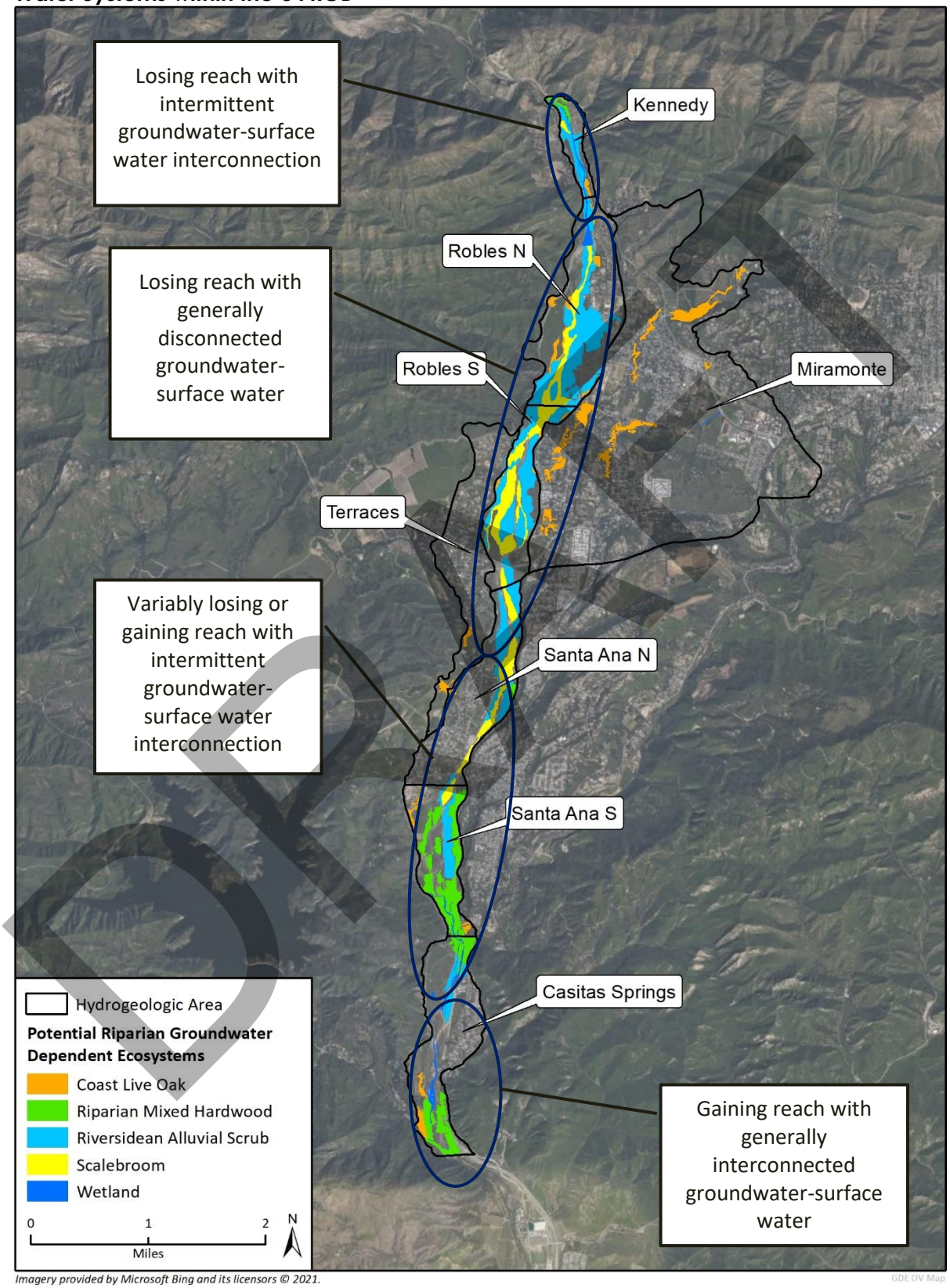


**Table 2 Maximum Rooting Depths of Potential Riparian GDEs**

| Potential Riparian GDE | Maximum Rooting Depth (feet)[1] |
|---|---|
| Coast Live Oak | 30.0 |
| Riparian Mixed Hardwood | 13.7[2] |
| Riversidean Alluvial Scrub | 5.0 |
| Wetlands | 3.0 |
| Scalebroom | 6.0 |

[1] Raw data for maximum rooting depths were referenced from GDE Rooting Depth Database (TNC 2020).
[2] Mixed Riparian Hardwood communities can consist of up to 50 percent Coast Live Oak trees. As such, this rooting depth represents the average of species known to occur in these communities.

## Groundwater Levels

Modeled groundwater levels from the UVRGA GSP numerical model provided spatially distributed depth to water (DTW) measurements throughout the basin to overlay with the iGDEs. To evaluate groundwater access for potential riparian GDEs over changing DTW conditions, varying climatic conditions were selected from the numerical model output. Water years 2005, 2010, and 2015 were selected to represent wet, average, and dry precipitation conditions, respectively.[2] Model outputs of the highest and lowest DTW conditions for each modeled year were exported to GIS for spatial analysis. This provided six hydrologic conditions that could be evaluated against plant rooting depths, corresponding with the high and low DTW value for the wet, average, and dry water years (wet-high, wet-low, average-high, average-low, dry-high, and dry-low).

## GIS Spatial Analysis of Maximum Rooting Depth and Groundwater Level

A GIS spatial analysis was conducted to intersect the maximum rooting depths associated potential riparian GDEs to the six DTW categories. Table 3 presents the criteria used to screen the potential riparian GDEs based on the results from this spatial analysis. If maximum rooting depths were always deeper than the lowest DTW condition, that potential riparian GDE was classified as likely to be groundwater dependent and groundwater dependency was verified to include the confirmed riparian GDE in the UVRGB Riparian GDE map. When maximum rooting depth was never deeper than the highest DTW conditions, that potential GDE was classified as unlikely to be groundwater dependent and was excluded from the UVRGB Riparian GDE map. If maximum rooting depth for a potential riparian GDE was deeper than any of the DTW conditions (i.e., deeper than at least one hydrologic condition), it was assumed that groundwater dependency could be possible and additional evaluation of groundwater level, maximum rooting depth, and location-specific characteristics was completed.



[2] Note that the historic time period for modeling groundwater levels was limited to 2005-2019.

**Table 3 Groundwater Dependency Likelihood Criteria for GIS Spatial Analysis**

| Groundwater Dependency Likelihood | Evaluation Criteria | Action Taken if Criteria were Met |
|---|---|---|
| Likely | Maximum rooting depth deeper than DTW for all low groundwater levels (wet-low, average-low, and dry-low hydrologic conditions) | Verify groundwater dependency to include in UVRGB Riparian GDE map |
| Possible | Maximum rooting depth deeper than DTW for any high groundwater levels (wet-high, average-high, or dry-high hydrologic conditions) | Further evaluation of groundwater level, maximum rooting depth, and location-specific characteristics to evaluate groundwater dependency |
| Unlikely | Maximum rooting depth never deeper than highest groundwater levels (wet-high, average-high, or dry-high hydrologic conditions) | Exclude from UVRGB Riparian GDE map |

### Additional Assessment

Following the GIS mapping and spatial analysis of maximum rooting depth and DTW, a desktop review was conducted to further analyze groundwater dependence for individual vegetation communities within the UVRGB. Aerial imagery of the basin was used to conduct a visual assessment of habitat features and natural characteristics, as well as topography and drainage characteristics. Potential GDEs with possible groundwater dependency based on the GIS spatial analysis were ultimately either included or excluded based on biologic understanding or included if exclusion was too difficult to determine based on available information.

## 2.4 Potential Riparian GDE Screening Results

The following presents the initial screening results of the spatial analysis, followed by the additional assessment of the groundwater dependency likelihood criteria.

### 2.4.1 GIS Spatial Analysis Results

Figure 3 presents the initial screening results of the GIS spatial analysis. Following the criteria outlined in Section 2.3, “Unlikely” groundwater dependence (represented by the red areas) indicates that no intersection of maximum rooting depth and DTW occurred. “Possible” groundwater dependence (represented by the yellow areas) indicates at least one intersection of maximum rooting depth and DTW occurred. Finally, “Likely” groundwater dependence (represented by the green areas) indicates that maximum rooting depths intersected with the DTW during all low groundwater levels.

### 2.4.2 Additional Assessment

The potential riparian GDEs meeting the “Unlikely” screening criteria (red areas in Figure 3) were comprised entirely of either Riversidean Alluvial Scrub or Scalebroom plant communities. The species in these communities are known to be well adapted to flood plains in alluvial basins, have shallow rooting depths, and are understood as an unlikely groundwater dependent community. In addition, these criteria were met primarily in the losing reaches of the Ventura River where groundwater-surface water interconnection is intermittent or disconnected. Additional assessment was conducted for the potential riparian GDEs that met the Likely and Possible GIS spatial analysis screening criteria, as presented in Figure 4.

**Figure 3 Spatial Analysis Results for Maximum Rooting Depth and Groundwater Level**

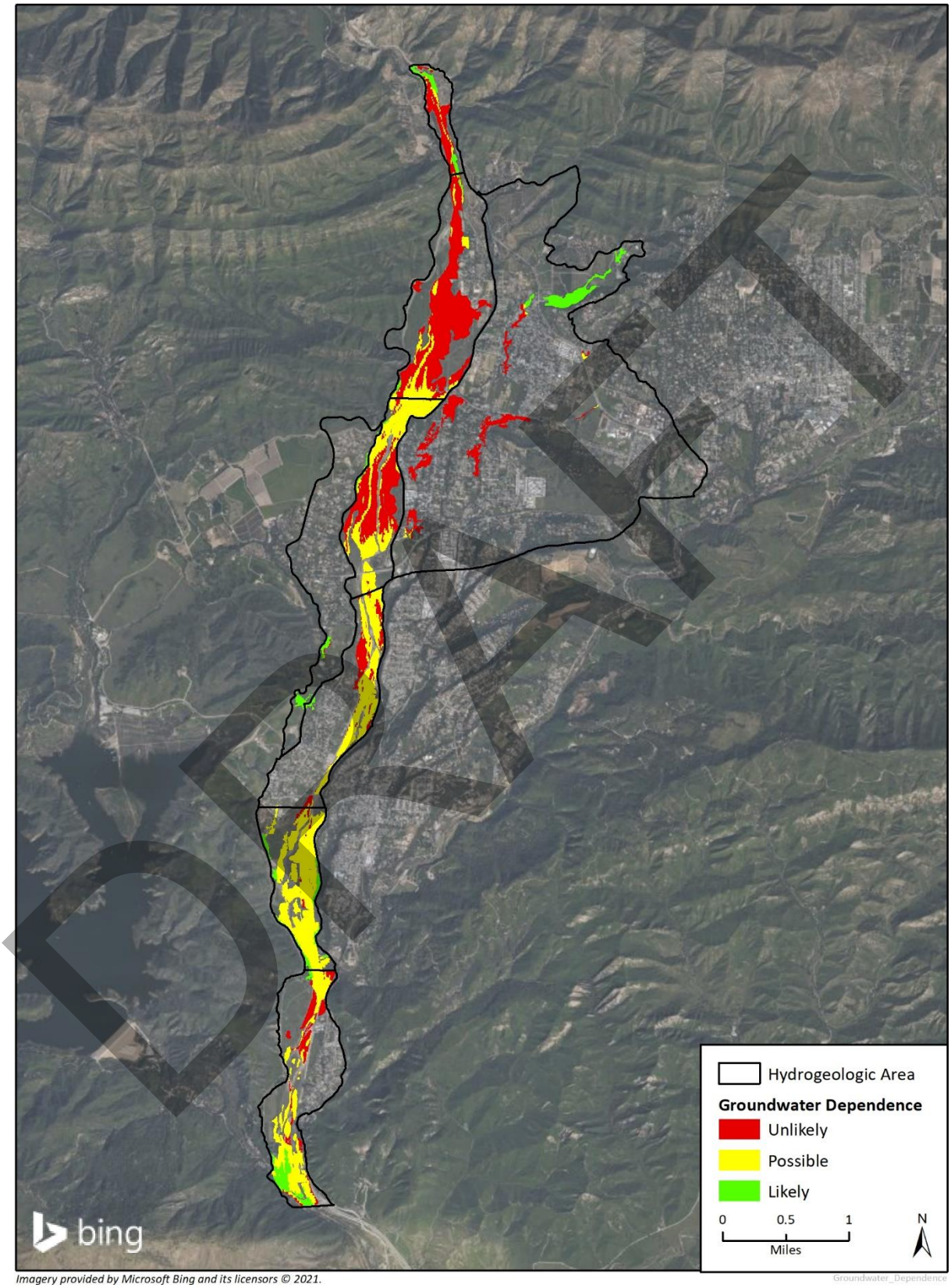
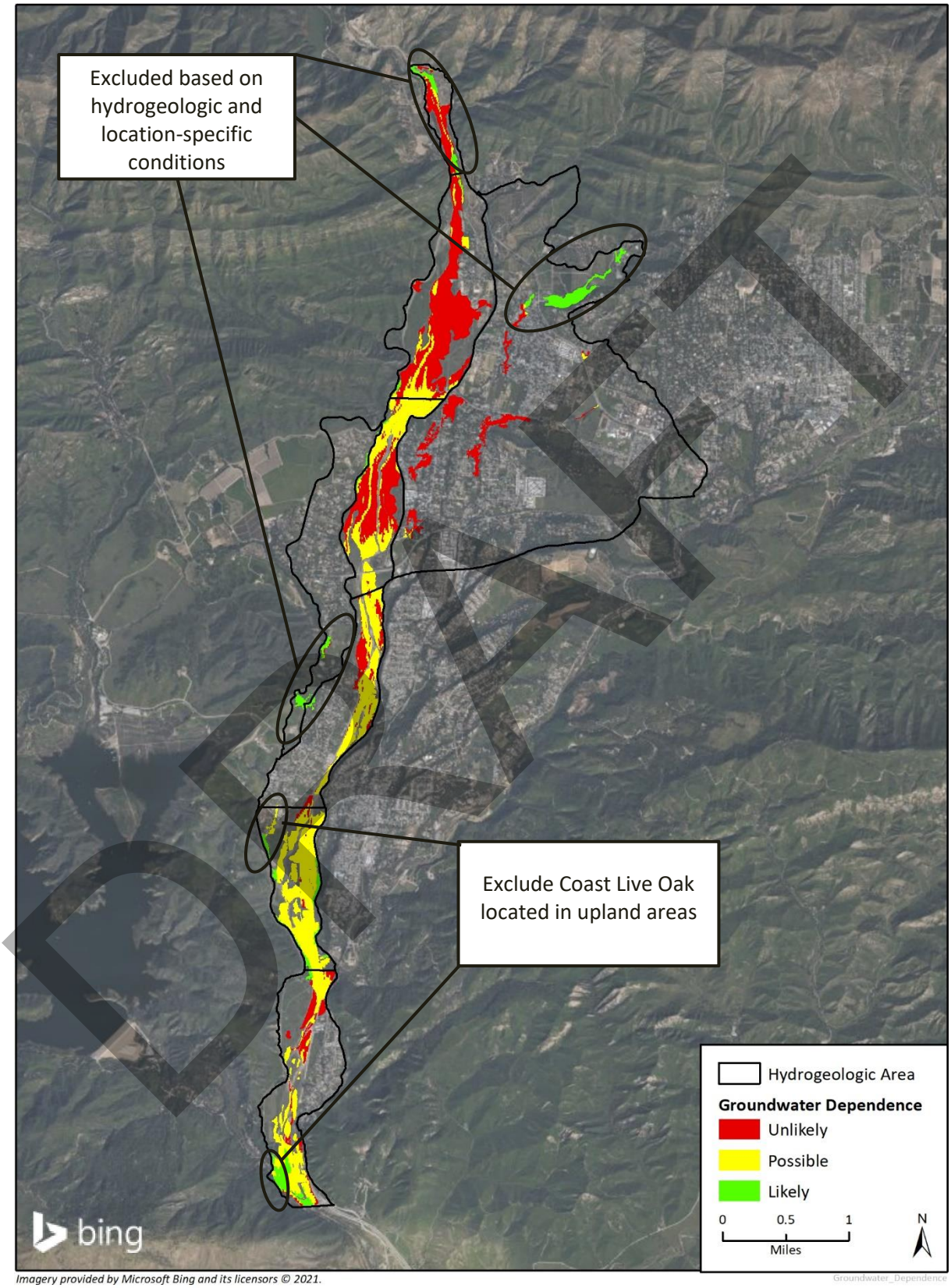


**Figure 4 Additional Assessment of Spatial Analysis**



## Assessment of Potential Riparian GDEs that Met "Likely" Screening Criteria

Potential riparian GDEs met "Likely" screening criteria in the Mira Monte, Kennedy, and Terraces hydrogeologic areas. The plant communities meeting the "Likely" screening criteria in these areas consisted of Coast Live Oak, as well as Riparian Mixed Hardwood in the Kennedy hydrogeologic area. Based on geologic formation, topography, surface water inflow, and likely influence of irrigation (in the Kennedy area), it was determined that these communities are unlikely to be dependent on the UVRGB primary aquifer.

In addition, it is unclear whether Coast Live Oak communities should be included as a riparian GDE, as the species is known to occur in upland communities with deep rooting structures for access to soil moisture. For the purposes of this assessment, this NCCAG community classification will be excluded from the UVRGB Riparian GDE map in upland areas that are outside of the riparian corridor.

### *Kennedy Hydrogeologic Area*

The Kennedy hydrogeologic area is fed by perennial surface flow, originating upstream and flowing into the UVRGB. A Riparian Mixed Hardwood iGDE was located at the northern-most extent of the UVRGB. Based on the perennial source of surface flow, it is understood that this community is dependent on surface water, and not groundwater. A Coast Live Oak iGDE was also located in the upland area along the eastern portion of the river and continued into the North Robles hydrogeologic area. These Coast Live Oak iGDEs are located along slopes immediately downgradient orchards, suggesting that these trees receive irrigation flows collecting along the slope.

### *Terraces Hydrogeologic Area*

The Terraces hydrogeologic area consists of very thin alluvial deposits that are elevated above and separated from the principal aquifer of the Basin by bedrock. Water wells in this are believed to tap the underlying Sespe Formation (bedrock), which is not managed by the GSA. Groundwater in the thin alluvium, if any, is perched and hydraulically disconnected from the principal aquifer of the Basin. The Coast Live Oak mapped in the Terraces are located along drainage features where surface water and interflow collects, suggesting the trees are not reliant on groundwater.

### *Mira Monte Hydrogeologic Area*

The Coast Live Oaks identified in McDonald Canyon lie along the drainage of the canyon where surface water and interflow collects, suggesting the tress are not reliant on groundwater. This part of the UVRGB is underlain by thin alluvial deposits, which overlie bedrock of the Sespe Formation. Groundwater in the thin alluvium, if any, is perched on the Sespe Formation and has limited hydraulic connectivity with the principal aquifer of the Basin because it is elevated and thin. There are no water wells in McDonald Canyon and any potential future water wells would likely produce water from the Sespe Formation, which is not managed by the GSA.

### *Santa Ana South and Casitas Springs Hydrogeologic Areas*

Coast Live Oak was also observed meeting the Likely screening criteria in the Santa Ana South and Casitas Springs hydrogeologic areas, primarily located in upland areas on slopes and along drainages. These trees were located in upland areas, outside of the riparian corridor, and along slopes or drainages where surface water and interflow collects.

### Assessment of Potential Riparian GDEs that Met "Possible" Screening Criteria

Following the criteria established in Section 2.3, additional evaluation was necessary for the majority of the potential riparian GDEs. This further evaluation was especially important due to general uncertainty inherent in the use of modeled data and the use of one maximum rooting depth for each plant community. See Section 2.4.2 for detailed information about the additional evaluation.

To further investigate groundwater level and rooting depth interactions, Figure 5 was developed to present the counts of rooting depth access to groundwater. The figure displays the groundwater access counts ranging from zero to six, reflecting the six different hydrologic conditions (wet-high, wet-low, average-high, average-low, dry-high, and dry-low). As illustrated, a large portion of the potential riparian GDEs that met the Possible screening criteria were comprised of Riversidean Alluvial Scrub and Scalebroom plant communities. In addition, these potential riparian GDEs were located in the reaches understood to have generally disconnected groundwater-surface water conditions.

Importantly, Figure 5 displays that the groundwater access counts were highest (above 3 counts) in the southern Santa Ana South and southern Casitas Springs (near Foster Park) hydrogeologic areas. The potential riparian GDEs that occur in these locations were comprised mostly of Riparian Mixed Hardwood and Wetland plant communities, with minor occurrence of Riversidean Alluvial Scrub.

### Potential Riparian GDEs Excluded

Based on the information developed from the GIS spatial analysis and additional assessment, the following potential riparian GDEs were excluded from the final UVRGB Riparian GDE map:

- Scalebroom throughout the UVRGB
- Riversidean Alluvial Scrub throughout the UVRGB
- Coast Live Oak in the Mira Monte, Kennedy, and Terraces hydrogeologic area
- Coast Live Oak in the upland areas of the Santa Ana South and Casitas Springs hydrogeologic area
- Riparian Mixed Hardwood in the Kennedy hydrogeologic area

## 2.5 UVRGB GDE Units

Informed by screening results, the following riparian GDEs were determined to occur within the UVRGB: Coast Live Oak (within the riparian corridor), Riparian Mixed Hardwood, and Wetlands. Riparian GDEs occur within the southern Santa Ana South and southern Casitas Springs hydrogeologic areas. Based on the geographic, hydrologic, and ecological conditions, these riparian GDEs were grouped into two Riparian GDE Units. These are the South Santa Ana Riparian GDE Unit and the Foster Park Riparian GDE Unit. Table 4 provides a description of each Riparian GDE unit and Figure 6 depicts each unit within the UVRGB.

**Figure 5 Groundwater Access Counts of GIS Spatial Analysis**

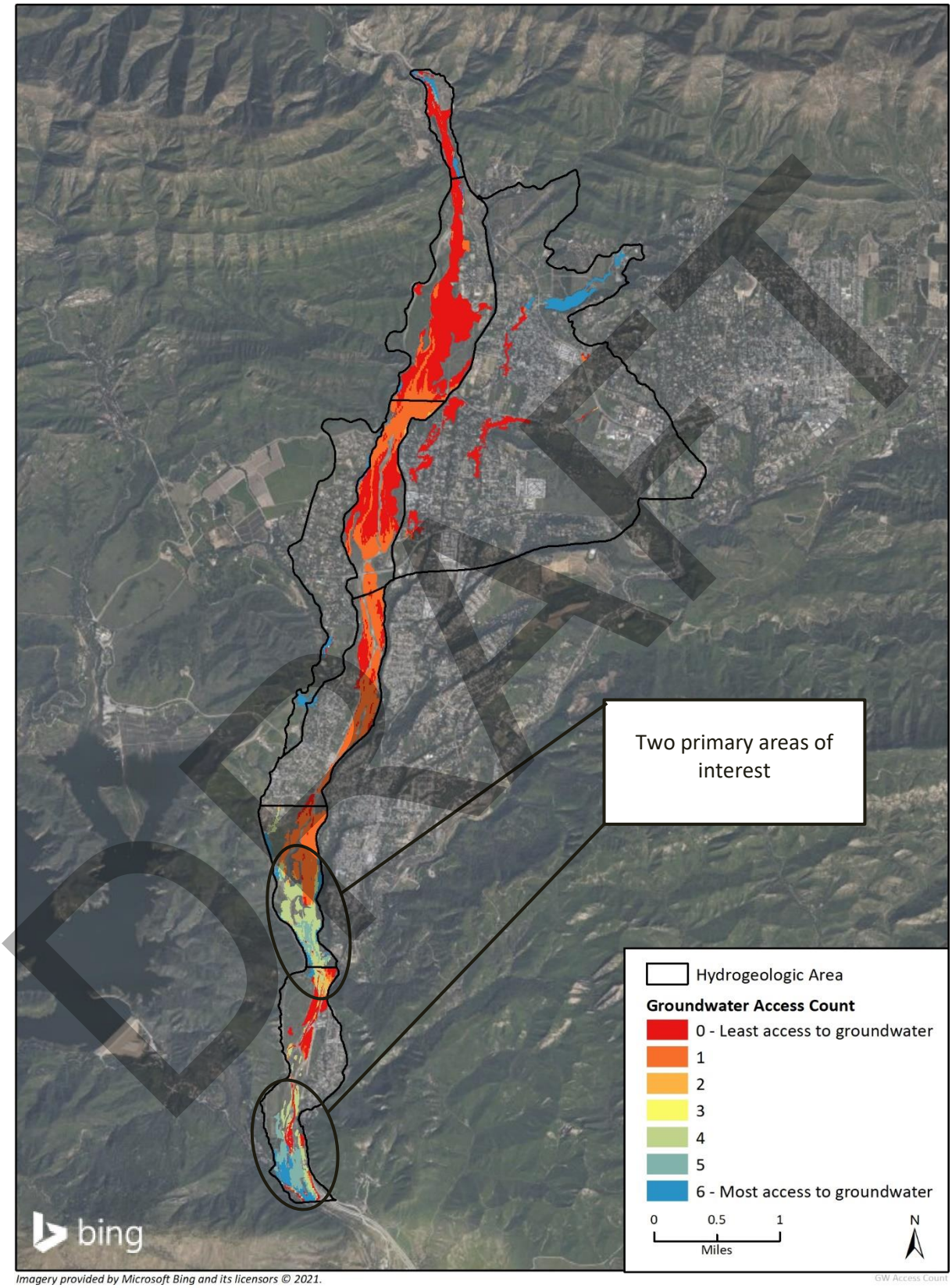


**Figure 6 UVRGB Riparian GDE Map**

**Table 4 UVRGB Riparian GDE Units**

| Riparian GDE Unit | Description |
|---|---|
| **South Santa Ana** | This Riparian GDE unit falls primarily within the southern South Santa Ana and a small area in the northern Casitas Springs hydrogeologic area. This Riparian GDE Unit occurs near a narrow reach of the Ventura River channel, southwest of Oak View and northwest of Casitas Springs. It consists primarily of Riparian Mixed Hardwood along the river channel and adjacent slopes, areas of Wetland habitat within and adjacent to the river. |
| **Foster Park** | This Riparian GDE unit lies in the southern limit of the UVRGB and the southern portion of the Casitas Springs hydrogeologic area. This Riparian GDE Unit lies southwest of Casitas Springs, north of Casitas View Road and west of Highway 33 and includes portions of Foster Park. The unit consists primarily of Riparian Mixed Hardwood in the east and south and a small portion of Coast Live Oak in the west, with several small Wetland areas scattered throughout. |

# 3 Riparian GDE Unit Characterization

This section provides an overview of the ecological condition of the UVRGB as a whole as well as the Riparian GDE Units, including an assessment of their relative ecological value. Descriptions of vegetation communities and critical habitat, as well as how these habitats are used by animals and special status species.

## 3.1 UVRGB Ecological Condition Overview

### Vegetation Communities

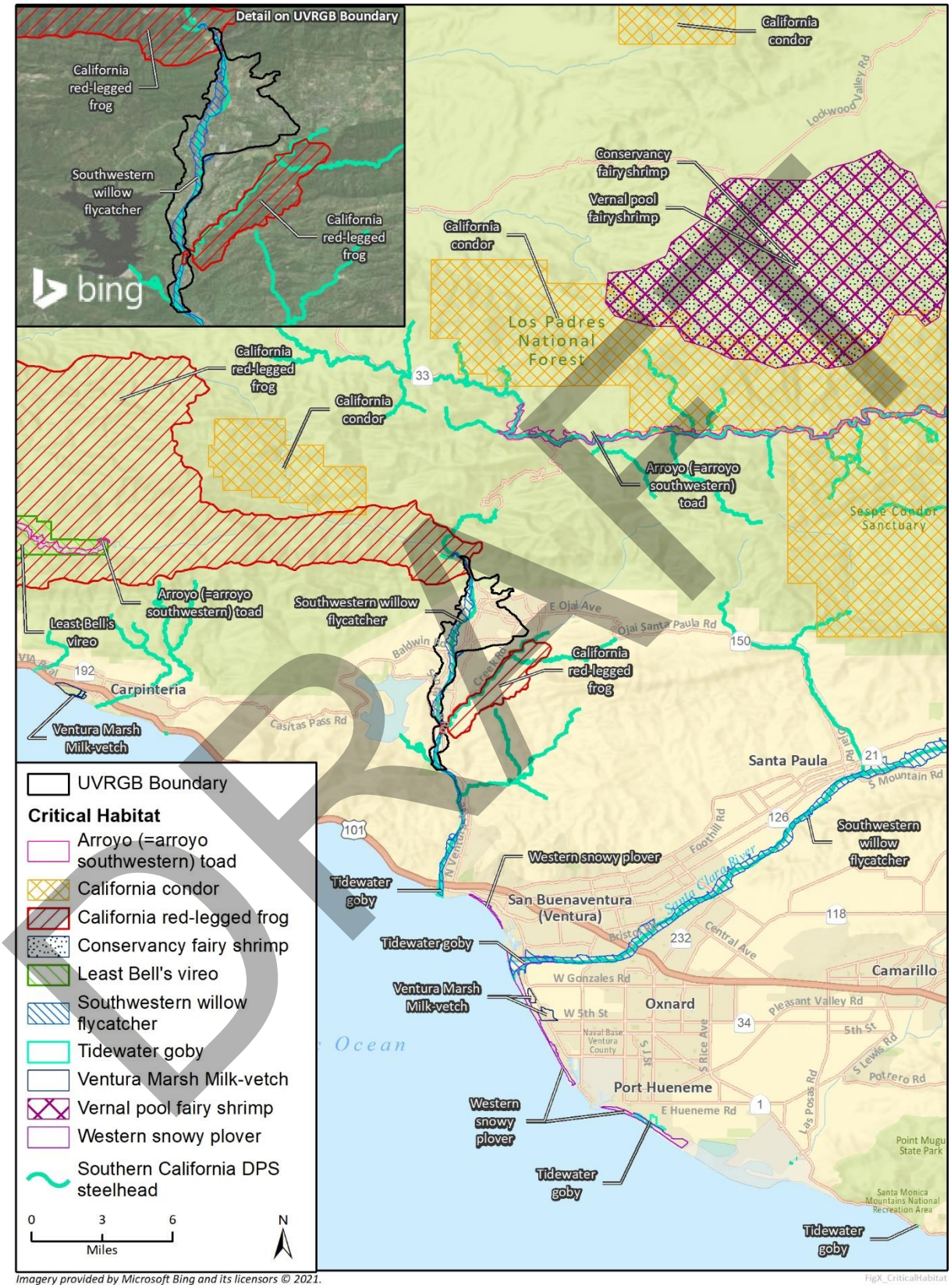
The UVRGB is home to various vegetation communities, including: Chaparral, Arroyo Willow Scrub, Coast Live Oak, Riparian Mixed Hardwood, Scalebroom, Riversidean Alluvial Scrub, and Wetlands (CDFW 2021d, CalVEG). Southern Sycamore Riparian Alder woodland, a CDFW sensitive natural community, also exists within the southern portion of the basin (CFDW 2021a). Invasive plant species, including arundo (*Arundo donax)* and sweet fennel (*Foeniculum vulgare*) occur within the Ventura River channel throughout the basin and have been documented replacing native plant species within multiple vegetation communities. Vegetation communities within the UVRGB that were identified by the NCCAG dataset as iGDEs are described in more detail in Appendix A.

### Critical Habitat

Rincon queried the U.S. Fish and Wildlife Service (USFWS) Critical Habitat Portal (USFWS 2021a) and the NOAA Critical Habitat maps (NOAA 2021) for information on federally designated critical habitat within the UVRGB. The UVRGB includes designated critical habitat for three federally listed species: southwestern willow flycatcher (*Empidonax traillii extimus*), southern California DPS steelhead (*Oncorhynchus mykiss irideus*), and California red-legged frog (*Rana draytonii*) (USFWS 2013, NOAA 2005, USFWS 2010).

A map of federally designated critical habitats within the UVRGB and surrounding area is presented as Figure 7. Critical habitat for the southwestern willow flycatcher occurs within the entire Ventura River basin, as well as the Santa Clara River basin to the south. Critical habitat for southern California DPS steelhead occurs within all estuaries and streams with connectivity to the ocean from the Santa Maria River (in southern San Luis Obispo County) south to San Mateo Creek (at the border of Orange and San Diego Counties). Within the UVRGB, critical habitat for steelhead exists within the stream channel of the Ventura River up to the ordinary high-water mark (OHWM) from the ocean upstream to impassable barriers. A large expanse of critical habitat for the California red-legged frog exists northwest of the UVRGB and overlaps with the northernmost portion of the basin. Critical habitat for the species also exists within San Antonio Creek to the east and overlaps with the UVRGB at the confluence of San Antonio Creek and the Ventura River (Figure 7).

**Figure 7 Federally Designated Critical Habitats within the UVRGB and Region**



### Sensitive Natural Communities

CDFW maintains a list of sensitive communities that are known to have generally been reduced from their historic levels statewide and are therefore a priority for conservation. Riparian types comprise a large portion of these sensitive communities as a result of water resources development and other land uses. Two groundwater dependent sensitive natural communities occur within the UVRGB: Southern California Steelhead Stream and Southern Sycamore Alder Riparian Woodland (*Alnus rhombifolia -Platanus racemosa*). Note that the statewide CDFW datasets use obsolete vegetation nomenclature that are not comparable to current vegetation lists. While additional investigation into these communities to "crosswalk" that data to current nomenclature was considered, the key takeaway is that sensitive resources occur throughout the UVRGB and within the GDEs. Further, additional sensitive natural communities that are not groundwater dependent are likely to occur throughout the UVRGB.

### Special status Species

Fourteen special status plant species were evaluated for their potential to occur within the UVRGB based on database queries (CDFW 2021a, CNPS 2021) and local knowledge. Of these, five are not expected to occur, and nine have some potential to occur within the basin. Twelve special status fish and wildlife species were evaluated for the potential to occur within the UVRGB based on database queries (CDFW 2021a) and local knowledge. Of these, nine have some potential to occur within the basin and six are known to be present within the basin. Appendix B provides a complete list of special status species evaluated, as well as the criteria used to evaluate potential for special status species to occur, as well as their potential dependency on groundwater.

## 3.2 Ecological Assessment of South Santa Ana Riparian GDE Unit

The South Santa Ana Riparian GDE Unit consists primarily of riparian mixed hardwood along the river channel and adjacent slopes and areas of wetland habitat within and adjacent to the Ventura River (Figure 6). The unit contains federally designated critical habitat for the southwestern willow flycatcher, California red-legged frog, and southern California DPS steelhead (Figure 7).

Nine special status fish and wildlife species are known or have potential to occur within the unit. One sensitive natural community occurs within the South Santa Ana GDE Riparian Unit: Southern California Steelhead Stream.[3] There are no special status plant species with potential to occur within the Unit. Table 5 lists each of these species and communities, as well as their status, potential to occur, and riparian GDE association.

Aquatic species rely on both instream and riparian habitats and are therefore identified in this Riparian GDE Assessment. However, a separate assessment of aquatic GDEs is being conducted to support SMC development for the *depletion of interconnected surface water* sustainability indicator. This assessment will evaluate potential impacts to instream habitat and the aquatic species dependent on interconnected surface water in the UVRGB.

[3] Note that Southern California Steelhead Stream is not a plant community. Rather, it is an overlay CDFW used to include steelhead habitat in the statewide database.

**Table 5 Special status Wildlife Species and Sensitive Natural Communities with Potential to Occur Within the South Santa Ana Riparian GDE Unit**

| Scientific Name<br>Common Name | Status:<br>Fed/State ESA<br>CDFW | Potential to Occur[1] | Riparian GDE Association[1] |
|---|---|---|---|
| **Wildlife** | | | |
| *Actinemys pallida (Emys marmorata)*<br>Southwestern pond turtle[2] | None/None<br>SSC | Present | Direct |
| *Empidonax traillii extimus*<br>Southwestern willow flycatcher | FE/SE | May Occur | Indirect |
| *Entosphenus tridentatus*<br>Pacific lamprey[2] | None/None<br>SSC | Present | Direct |
| *Gila orcutti*<br>Arroyo chub[2] | None/None<br>SSC | Present (non-native) | Direct |
| *Oncorhynchus mykiss irideus* pop. 10<br>Southern California DPS steelhead[2] | FE/None | Present | Direct |
| *Rana draytonii*<br>California red-legged frog[2] | FT/None<br>SSC | Present | Direct |
| *Setophaga petechia*<br>Yellow warbler | None/None<br>SSC | Likely to Occur | Indirect |
| *Thamnophis hammondii*<br>Two-striped gartersnake[2] | None/None<br>SSC | Present | Direct |
| *Vireo bellii pusillus*<br>Least Bell's vireo | FE/SE | Likely to Occur | Indirect |
| **Sensitive Natural Communities** | | | |
| Southern California Steelhead Stream[2] | – | Present | Direct |

[1] Appendix B presents criteria for assessing species' potential to occur and riparian GDE association.

[2] Note that potential impacts to aquatic species will be evaluated as part of a separate aquatic GDE assessment.

Fed = Federal
ESA = Endangered Species Act
CDFW = California Department of Fish and Wildlife
FE = Federally Endangered
FT = Federally Threatened
SSC= CDFW Species of Special Concern
SE = State Endangered
ST = State Threatened
SCE = State Candidate Endangered

## South Santa Ana Riparian GDE Unit Ecological Value

The South Santa Ana GDE Unit was determined to have high ecological value based on the following characteristics:

- Contains federally designated critical habitat for the California red-legged frog, the southwestern willow flycatcher, and southern California DPS steelhead,
- Provides habitat for a relatively large number of special status species (Table 5),
- Contains mixed riparian hardwood, coast live oak, and wetland vegetation communities, which support a large number of native terrestrial and aquatic wildlife species, and
- Located along a reach of the Ventura River with generally perennial flows discharged from groundwater.

# 3.3 Ecological Assessment of the Foster Park Riparian GDE Unit

The Foster Park Riparian GDE Unit consists primarily of riparian mixed hardwood in the east and south and coast live oak in the north and west, with several small wetland areas scattered throughout (Figure 6). The unit contains federally designated critical habitat for the southwestern willow flycatcher and southern California DPS steelhead (Figure 7).

Nine special status terrestrial and aquatic wildlife species are known or have potential to occur within the unit. There are no special status plant species with potential to occur within the Foster Park GDE Unit. Table 6 lists each of these species, as well as their status, potential to occur within the GDE unit, and GDE association.

**Table 6 Special status Wildlife Species and Sensitive Natural Communities with Potential to Occur Within the Foster Park Riparian GDE Unit**

| *Scientific Name*<br>Common Name | Status:<br>Fed/State ESA<br>CDFW | Potential to Occur[1] | Riparian GDE Association[1] |
|---|---|---|---|
| **Wildlife** | | | |
| *Actinemys pallida (Emys marmorata)*<br>Southwestern pond turtle[2] | None/None<br>SSC | Present | Direct |
| *Empidonax traillii extimus*<br>Southwestern willow flycatcher | FE/SE | May Occur | Indirect |
| *Entosphenus tridentatus*<br>Pacific lamprey[2] | None/None<br>SSC | Present | Direct |
| *Gila orcutti*<br>Arroyo chub[2] | None/None<br>SSC | Present (non-native) | Direct |
| *Oncorhynchus mykiss irideus*<br>Southern California DPS steelhead[2] | FE/None | Present | Direct |
| *Rana draytonii*<br>California red-legged frog[2] | FT/None<br>SSC | Present | Direct |
| *Setophaga petechia*<br>Yellow warbler | None/None<br>SSC | Likely to Occur | Indirect |
| *Thamnophis hammondii*<br>Two-striped gartersnake[2] | None/None<br>SSC | Present | Direct |
| *Vireo bellii pusillus*<br>Least Bell's vireo | FE/SE | Likely to Occur | Indirect |
| **Sensitive Natural Communities** | | | |
| Southern California Steelhead Stream[2] | | Present | Direct |
| *Platanus racemosa*<br>Southern Sycamore Alder Riparian Woodland | | Present | Direct |

[1] Appendix B presents criteria for assessing species' potential to occur and riparian GDE association.

[2] Note that potential impacts to aquatic species will be evaluated as part of a separate aquatic GDE assessment.

Fed = Federal FE = Federally Endangered FT = Federally Threatened

ESA = Endangered Species Act SSC= CDFW Species of Special Concern SE = State Endangered

CDFW = California Department of Fish and Wildlife

## Foster Park Riparian GDE Unit Ecological Value

The Foster Park GDE Unit was determined to have high ecological value based on the following characteristics:

- Contains federally designated critical habitat for the southwestern willow flycatcher and southern California DPS steelhead,
- Provides habitat for a relatively large number of special status species (Table 6),
- Contains mixed riparian hardwood, coast live oak, and wetland vegetation communities, which support a large number of native terrestrial and aquatic wildlife species, and
- Located along a gaining reach of the Ventura River with perennial flows discharged from groundwater.

# 4 Riparian GDE Impact Analysis

The applicable SGMA sustainability indicators for assessing potential effects to riparian GDEs in the UVRGB are "Lowering of Groundwater Levels" and "Reduction of Storage." Following TNC guidance, groundwater level data and two satellite-derived vegetation indices were used to analyze the potential effects to each Riparian GDE Unit caused by changing groundwater conditions. First, the susceptibility of each Riparian GDE Unit was assessed, and then the potential impacts (i.e., effects) caused by changing groundwater conditions were evaluated.

## 4.1 Susceptibility to Changing Groundwater Conditions

Historical groundwater level data from two groundwater monitoring wells located north and south of the South Santa Ana Riparian GDE Unit, and one groundwater monitoring well located within the Foster Park Riparian GDE Unit were used for this analysis (Figure 8).[4] Normalized Difference Vegetation Index (NDVI) and Normalized Difference Moisture Index (NDMI) were used to assess the relative health of the vegetation communities within the Riparian GDE Units.

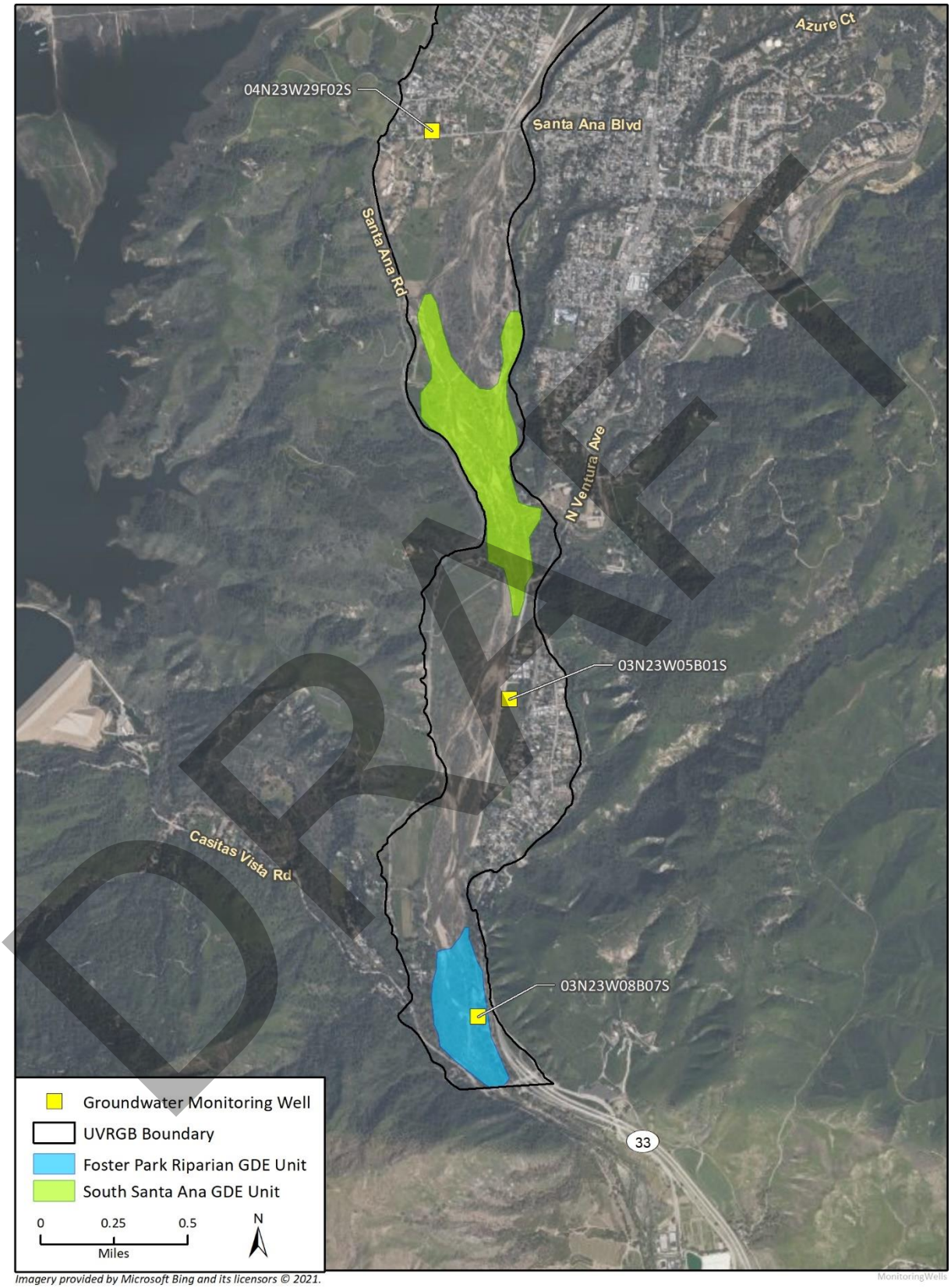
NDVI provides an estimate of vegetation greenness, while NDMI estimates vegetation moisture, and these indices are correlated with vegetative growth (e.g., increasing values indicated increasing growth and decreasing values indicate decreasing growth). Both values are generated from surface reflectance corrected multispectral Landsat imagery corresponding to the period of July 9 to September 7 of each year, which represents the period when GDE species are most likely to use groundwater (Klausmeyer et al. 2019). NDVI and NDMI data from 1985 to 2018 were downloaded for specific GDE areas within the UVRGB from the TNC GDE Pulse website (TNC 2018). The data are provided according to iGDE polygons. The average NDVI and NDMI values for the areas overlapping with each Riparian GDE Unit were calculated and are presented in the following figures. Additional figures for all NDVI and NDMI data are presented in Appendix C.

While these indices do not provide a definitive indication that other components of the ecosystem are thriving or under stress, they provide a reasonable first-order check on the connection between groundwater and the vegetation that compose the ecosystem. Previous work has shown that decreases in vegetation vigor are correlated to decreases in remote sensing metrics such as NDVI (e.g., Huntington et al. 2016) and that decreases in vegetation health often correlate with decreases in overall ecosystem health. NDVI and NDMI values can serve as a general indicator of ecosystem health, though they do not allow for differentiation between vegetation types, including differentiation between native and invasive species. Thus, visual analysis is necessary to confirm that NDVI and NDMI values represent canopy health/vegetation vigor of the same native plant species within a community over time, and that major species composition shifts have not occurred. Aerial imagery of each GDE Unit within the UVRGB was analyzed to confirm that the predominant plant species were consistent from 1985 to 2018.



[4] No groundwater monitoring sites are located within the South Santa Ana Riparian GDE Unit. This is a data gap that will be addressed during GSP implementation.

**Figure 8 Riparian GDE Units and nearby Groundwater Monitoring Wells**



## South Santa Ana Riparian GDE Unit Susceptibility

Figure 9 depicts the trends in groundwater level and average NDVI and NDMI values for the South Santa Ana Riparian GDE Unit from 1985 through 2018. DTW from a static reference point was measured quarterly at wells both north and south of the South Santa Ana GDE Unit (Figure 6). While DTW varied widely at these groundwater monitoring wells (from a high of 7.5 feet in February 1998 to a low of 62.7 feet in December 2013), it's important to understand that these wells do not reflect the actual DTW within the South Santa Ana GDE Unit, but rather provide insight to the changing groundwater conditions.[5] Nonetheless, these groundwater levels provide an indication of the relative seasonal and interannual groundwater level trends expected in the GDE unit. Annual rainfall during 1998 was the highest on record (49.20 inches) since 1906 (VRWC 2021). A period of drought occurred between 2012 and 2016, during which time groundwater levels did not rise above 20 feet below ground level. The lowered DTW to 62.7 feet below ground level in December 2013 marks the lowest groundwater level at that location since 1972. Following periods of heavier rainfall in early 2017, groundwater levels rebounded rapidly to pre-drought levels.

NDVI and NDMI values fluctuate over time and generally decrease with decreasing DTW. During drought conditions that occurred between 2012 and 2016, NDVI and NDMI values showed a persistent decline. However, these values also rebounded as DTW increased again in 2017. Analysis of aerial imagery confirmed a decrease in vegetative growth during this recent period of severe drought, followed by a resurgence of growth and canopy health in subsequent years with more rain.

## Foster Park Riparian GDE Unit Susceptibility

Figure 10 depicts trends in groundwater levels and average NDVI and NDMI values for the Foster Park Riparian GDE unit from 1985 through 2018. DTW from a static reference point was measured quarterly at a well within the Foster Park Riparian GDE Unit (Figure 6). DTW varied from a high of 6.80 feet in February 1998 to a low of 29.6 feet in February 1991. During the recent drought period, DTW values lowered to 23.1 feet in February 2013 and 24.2 feet in December 2014. Following periods of heavier rainfall in early 2017, groundwater levels rebounded to almost pre-drought levels.

NDVI and NDMI values fluctuate over time and generally decrease with decreasing DTW. While a general increasing trend of NDVI and NDMI was observed for the Foster Park Riparian GDE Unit, the potential cause is currently unclear, but could be related to influences of past floods or management actions in Foster Park. Figure 9 presents a photo series beginning in 2004 and ending in 2019. This figure depicts vegetation removal and subsequent revegetation following flood events that occurred in 2005. Following a period of increasing index values from 2006 to 2012, NDVI and NDMI values declined during recent drought conditions, but then increased again in 2017 following a water year with moderate precipitation. Similar to the South Santa Ana Riparian GDE Unit, analysis of aerial imagery confirmed a decrease of vegetative growth during this recent period of severe drought, followed by rebounding growth and canopy cover in subsequent years with more rain.



[5] UVRGA understands this is a data gap and plans to develop a monitoring well network that includes a groundwater monitoring well in the South Santa Ana Riparian GDE Unit.

**Figure 9 Groundwater Level Compared to Average NDVI and NDMI for the South Santa Ana Riparian GDE Unit (1985 to 2018)**

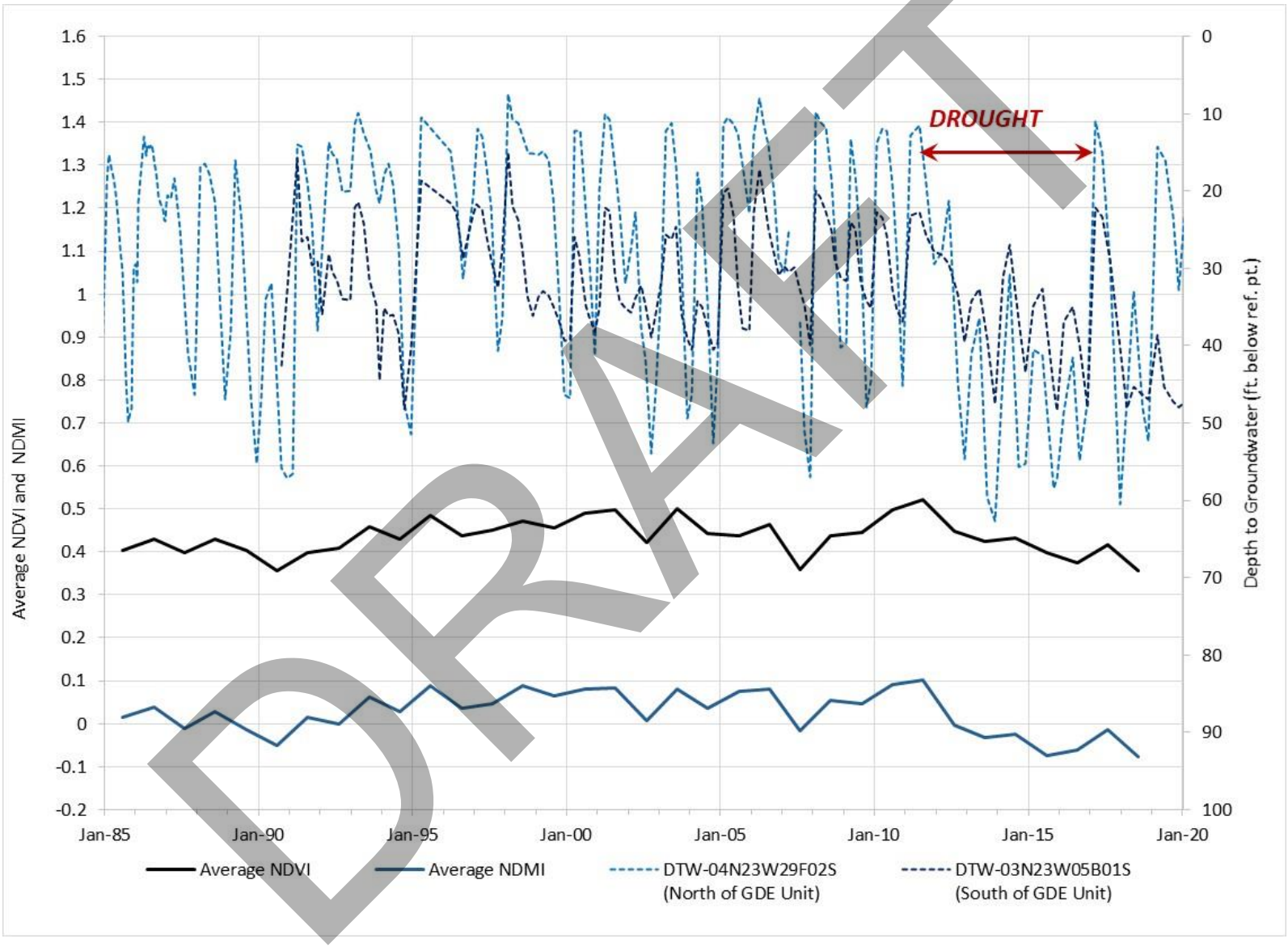


**Figure 10 Groundwater Level Compared to Average NDVI and NDMI for the Foster Park Riparian GDE Unit (1985 to 2018)**

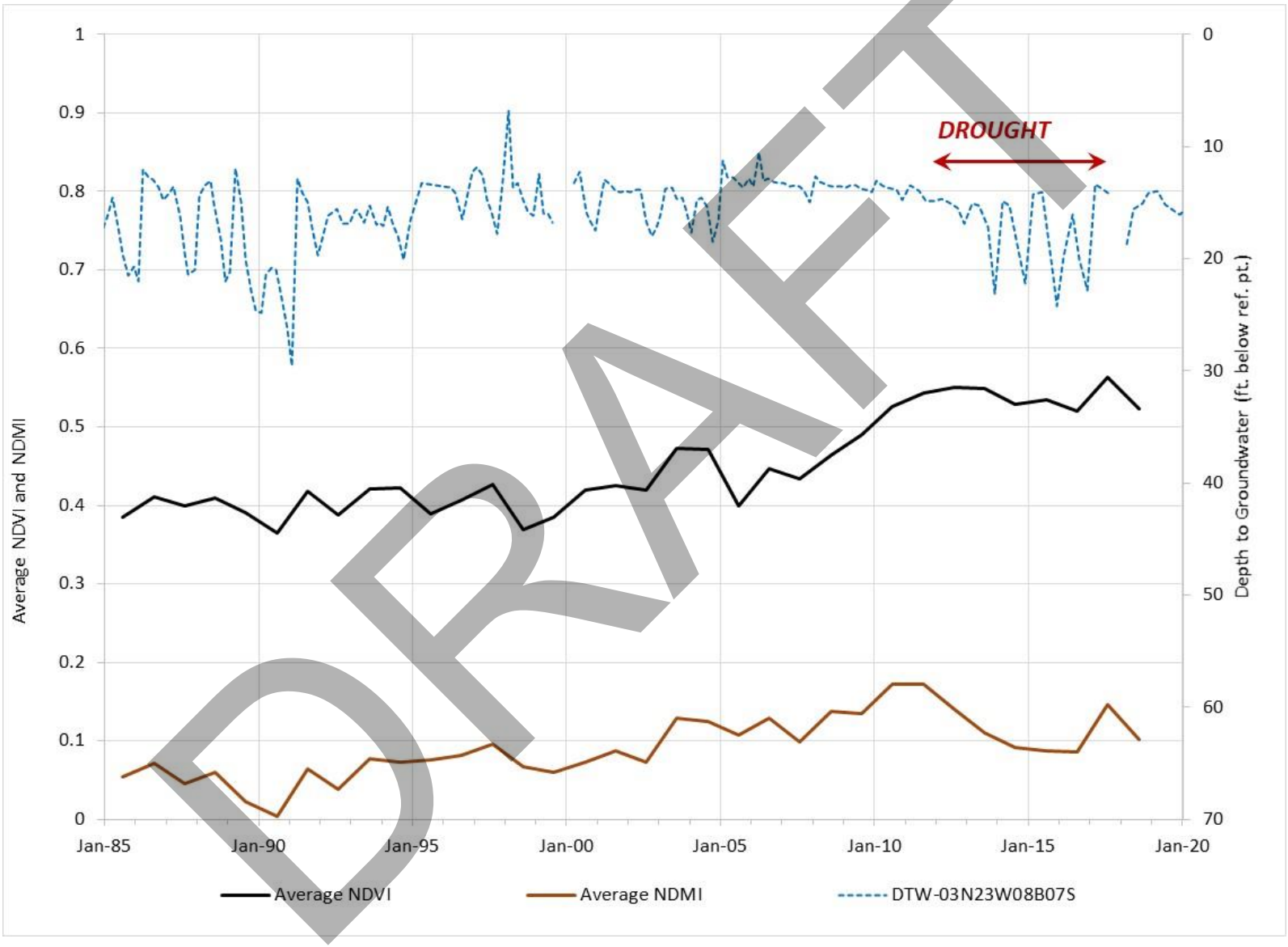
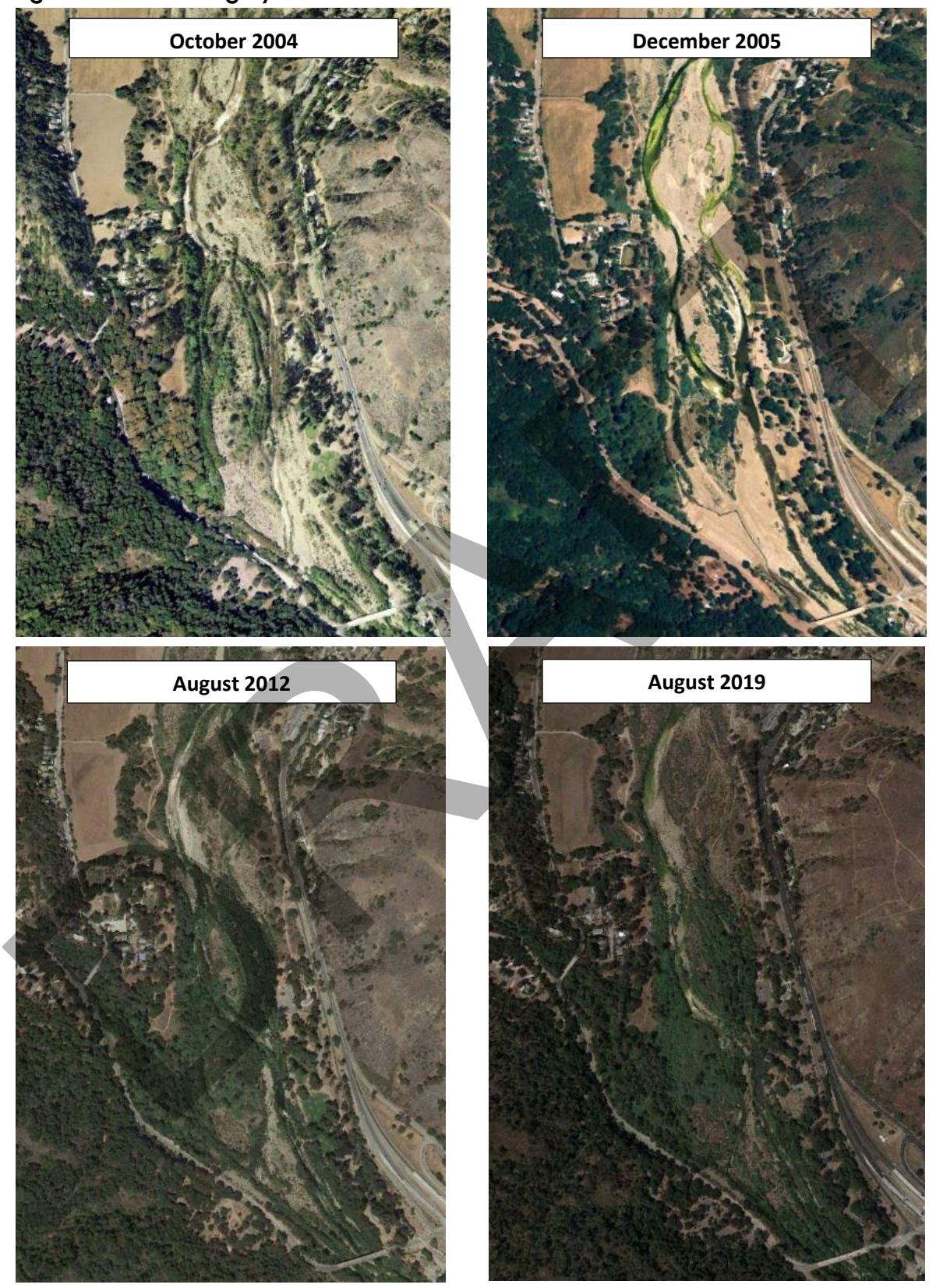


**Figure 11 Aerial Imagery of Foster Park GDE Unit between 2004 and 2019**



## 4.2 Potential Effects Caused by Changing Groundwater Conditions

Historic hydrologic conditions within the Riparian GDE Units indicate that groundwater levels are directly connected to climatic conditions and that groundwater recharge occurs following periods of rain. Based on NDVI and NDMI data, vegetative health of the communities within each Riparian GDE Unit are correlated to groundwater levels and decrease during periods of drought but rebound upon the return of relatively moderate precipitation. Based on these data, it appears that naturally occurring periods of low groundwater levels do have a negative impact on these groundwater dependent vegetation communities, but that these impacts are not permanent or prolonged. A visual analysis of the recent drought period between 2012 through 2017 confirms that the species in these vegetation communities rebound with no noticeable changes in density or composition.

Therefore, it appears that pumping is likely not the cause of impacts in the historic data, but that it is instead closely related to the varying hydrologic conditions. Based on this assessment, no permanent or prolonged impacts to GDEs within this unit are anticipated if climatic, hydrologic, and pumping conditions remain generally consistent with past trends. If groundwater levels were to remain chronically low for an extended period of time (beyond that seen in the historic dataset), pumping within the basin could exacerbate the stress on these communities and could potentially cause permanent or prolonged impacts to the GDEs. As such, ongoing monitoring of groundwater levels and vegetative health within these important ecosystems should be considered in the required 5-year GSP assessment.

# 5 References

Allen, M.A. 2015. Steelhead population and habitat assessment in the Ventura River/Matilija creek Basin 2006-2012, final report. Prepared for the Surfrider Foundation and California Department of Fish and wildlife. Prepared by Mark Allen, Normandeau and Associates, Inc.

Baldwin, B.G. (Ed.), D.H. Goldman (Ed.), D. J. Keil (Ed.), R. Patterson (Ed.), T. J. Rosatti (Ed.), D. H. Wilken (Ed.). 2012. The Jepson Manual: Vascular Plants of California, Second Edition, Thoroughly Revised and Expanded. University of California Press. Berkeley, California.

Bowers, N., R. Bowers, & K. Kaufman. 2004. Mammals of North America.

Calflora. 2021. Information on wild California plants for conservation, education, and appreciation. Berkeley, CA. Available at: www.calflora.org. Accessed March 2021.

California Department of Fish and Wildlife (CDFW). 2015. Arroyo Chub (*Gila orcutti*). Fish Species of Special Concern Accounts, 3rd Edition.

____. 2020. California Natural Communities List. Biogeographic Data Branch, California Natural Diversity Database. September 2020.

____. 2021a. California Natural Diversity Database (CNDDB), Rarefind V. Accessed March 2021.

____. 2021b. Special Animals List. Biogeographic Data Branch, California Natural Diversity Database. February 2021.

____. 2021c. Special Vascular Plants, Bryophytes, and Lichens List. Biogeographic Data Branch, California Natural Diversity Database. January 2021.

____. 2021d. Vegetation Classification and Mapping Program (VegCAMP). Accessed March 2021.

California Native Plant Society. 2021. Inventory of Rare and Endangered Plants. V.7-08c-Interim 8-22-02. Updated online and accessed via: www.rareplants.cnps.org. Accessed March 2021.

Cornell Lab of Ornithology. 2021a. eBird: An online database of bird distribution and abundance. eBird, Ithaca, New York. Available at: http://www.ebird.org. Accessed March 2021.

____. 2021b. All About Birds. Online Guide. Updated online and accessed at: https://www.allaboutbirds.org/. Accessed March 2021.

County of Ventura. 2006. Guide to Native and Invasive Streamside Plants: Restoring Riparian Habitats in Ventura County and along the Santa Clara River in Los Angeles County. May.

Cowardin, L., Carter, V., Golet, F., and LaRoe, E. 1979. Classification of Wetlands and Deepwater Habitats of the United States. Prepared for the US Department of the Interior, Fish and Wildlife Service.

Department of Water Resources (DWR), California. 2021. GIS files. Natural Communities Commonly Associated with Groundwater (NCCAG), Vegetation. Available at: https://gis.water.ca.gov/app/NCDatasetViewer/#.

Ferren, W., P. Fiedler, and R. Liedy. 1995. Wetlands of the Central and Southern California Coast and Coastal Watersheds: A Methodology for their Classification and Description. Prepared for the U.S. Environmental Protection Agency, Region 9. February 6, 1995.

Hanes, T.L., R.D. Friesen, and K.Keane. 1988. Alluvial Scrub Vegetation in Coastal Southern California. USDA Forest Service Gen.Tech Rep. PSW-110.

Holland, Robert F. 1986. Preliminary Descriptions of the Terrestrial Natural Communities of California. California Department of Fish and Wildlife, Nongame Heritage Program. 156 pgs.

Huntington, J., McGwire, K., Morton, C., Snyder, K., Peterson, S., Erickson, T., Niswonger, R., Carroll, R., Smith, G. and Allen, R., 2016. Assessing the role of climate and resource management on groundwater dependent ecosystem changes in arid environments with the Landsat archive. Remote sensing of Environment, 185, pp.186-197.

Klausmeyer, K., J. Howard, T. Keeler-Wolf, K. Davis-Fadtke, R. Hull, and A. Lyons. 2018. Mapping Indicators of Groundwater Dependent Ecosystems. California: Methods Report.

Moore, M.R. 1980. Factors influencing the survival of juvenile steelhead rainbow trout in the Ventura River, California. M.S. Thesis, Humboldt State University, Arcata, California. 82 pp.

Nafis, G. 2021. California Herps-A Guide to the Amphibians and Reptiles of California. Updated online and accessed via: http://www.californiaherps.com. Accessed March 2021.

National Oceanic and Atmospheric Administration (NOAA). 2005. Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California. Federal Register Vol. 70, No. 170. Available at: https://www.govinfo.gov/content/pkg/FR-2005-09-02/pdf/05-16389.pdf

____.2021. Critical Habitat- Salmon and Steelhead (all West Coast). Maps and GIS Data. Available at: https://www.fisheries.noaa.gov/resource/map/critical-habitat-salmon-and-steelhead-all-west-coast.

Rincon Consultants, Inc. 2020. Biological Resources Assessment for the Foster Park Fish Passage Improvement Project: Phase 1 Subterranean Diversion Notch.

Riverside-Corona Resource Conservation District (RCRCD). 2018. Lepidospartum Squamatum (A.Gray) A. Gray. October 19. Available at https://www.rcrcd.org/plant-profiles

Rohde, M. M., S. Matsumoto, J. Howard, S. Liu, L. Riege, and E. J. Remson. 2018. Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco, California.

Rohde, M.M., B. Seapy, R. Rogers, and X. Castañeda (editors). 2019. Critical Species LookBook: A compendium of California's threatened and endangered species for sustainable groundwater management. The Nature Conservancy, San Francisco, California.

Sawyer, J. O., T. Keeler-Wolf, and J.M. Evens. 2009. A Manual of California Vegetation, Second Edition. California Native Plant Society, Sacramento, California.

State of California. 2014. Sustainable Groundwater Management Act. California Legislature Water Code. Part 2.74. 10720-10737.8.

Stebbins, R. C. 2003. A Field Guide to Western Reptiles and Amphibians. 2nd ed. Houghton-Mifflin Company. Boston, Massachusetts.

Stillwater Sciences. 2021. Assessment of Groundwater Dependent Ecosystems for the Fillmore and Piru Basins Groundwater Sustainability Plan. Technical Appendix. Prepared by Stillwater

Sciences, Berkeley, California for Fillmore and Piru Basins Groundwater Sustainability Agency, Fillmore, California.

Swift, C.C. and S.R. Howard. 2009. Current Status and Distribution of the Pacific Lamprey South of Point Conception, Coastal Southern California, USA. American Fisheries Society Symposium. 72:269-278.

The Nature Conservancy (TNC). 2018. GDE Pulse. Online Database of NDVI and NDMI values by groundwater basin. Available at: https://gde.codefornature.org/#/home.

____.2019. Identifying GDEs Under SGMA, Best Practices for Using the NC Dataset. July.

____.2020. Groundwater Resource Hub: GDE Rooting Depths Database. Available at: https://groundwaterresourcehub.org/sgma-tools/gde-rooting-depthsdatabase-for-gdes.

United States Department of Agriculture (USDA), Forest Service. 2009. Vegetation Descriptions, South Coast and Montane Ecological Province, CALVEG Zone 7. March 30.

____.2021a. National Agriculture Imagery Program (NAIP). Available at: https://www.fsa.usda.gov/programs-and-services/aerial-photography/imagery-programs/naip-imagery. Accessed March 2021.

____.2021b. Forest Service. Classification and Assessment with Landsat of Visible Ecological Groupings (CalVEG). Available at: https://www.fs.usda.gov/detail/r5/landmanagement/resourcemanagement/?cid=stelprdb5347192. Accessed March 2021.

United States Fish and Wildlife Service (USFWS). 2010. Revised Designation of Critical Habitat for California Red-legged Frog. Federal Register. Vol. 75, No. 51. Available at: https://www.govinfo.gov/content/pkg/FR-2010-03-17/pdf/2010-4656.pdf#page=2

____.2013. Designation of Critical Habitat for Southwestern Willow Flycatcher, Final Rule. Federal Register. Vol. 78, No. 2. Available at: https://www.fws.gov/nevada/protected_species/birds/documents/swwf/1-02-13_SWWF_FR_Critial_Habitat.pdf

____.2021a. Critical Habitat Portal. Available at: https://ecos.fws.gov/ecp/report/table/critical-habitat.html. Accessed March 2021.

____.2021b. National Wetlands Inventory (NWI). Available at: https://www.fws.gov/wetlands/data/mapper.html. Accessed March 2021.

Ventura County Public Works Agency - Watershed Protection (VCPWA-WP). 2021. Available at: https://www.vcpublicworks.org/wp/ventura-river/

Ventura River Watershed Council (VRWC). 2015. Ventura River Watershed Council Ventura River Watershed Management Plan. March.

____.2021. VRWC Website. Available at: http://venturawatershed.org/#.

*This page intentionally left blank.*

# Appendix A

Communities Identified as iGDEs in the UVRGB

# Communities Identified as iGDEs in the UVRGB

The Natural Communities Commonly Associated with Groundwater (NCCAG) dataset identifies multiple iGDEs within the UVRGB (DWR 2021). Most of these iGDEs exist along the mainstem of the Ventura River floodplain. However, there are a number of areas with mapped Coast Live Oak outside of the floodplain in the Mira Monte/Meiners Oaks Area. Scalebroom, Riparian Mixed Hardwood and Riverside Alluvial Scrub communities occupy a significant portion of the Ventura River floodplain with Scalebroom and Riversidean Alluvial Scrub predominantly in the northern portion of the basin floodplain and Riparian Mixed Hardwood and Coast Live Oak in the southern portion of the basin floodplain. NCCAG wetland classifications are located from the Kennedy Area to just upstream of the Robles diversion in the Kennedy and Robles areas and in the Santa Ana and Casitas Springs areas downstream of the San Antonio Creek confluence (Figure 1).

Coast live oaks within the basin are found on the banks of small streams, on high terraces away from active channels, on erosional deposits along the margins of canyon bottoms, and on the lower slopes of canyon sides (VRWC 2015). Coast live oak (*Quercus agrifolia*) is considered the most fire-resistant California tree oak (USDA 2009) yet does not tolerate extended flooding (VRWC 2015). It has evergreen leaves, thick bark and an ability to sprout from the trunk and roots, given its food reserves stored in an extensive root system (USDA 2009). Other common trees, shrubs, and vines associated with this NCCAG classification may include arroyo willow, Fremont cottonwood, valley oak, California sycamore, bigleaf maple, California bay, Mexican elder-berry, mulefat, Pacific blackberry, gooseberry, snowberry, poison oak, California sagebrush, coyote brush, horsetails, and mugwort (VRWC 2015). Reported maximum rooting depths for the coast live oak ranged from 24 to 35 feet (TNC 2020).

Riparian Mixed Hardwood communities exist in the southern portions of the Ventura River floodplain (Santa Ana and Casitas Springs Hydrogeologic Areas). Riparian Mixed Hardwood is found along perennial and intermittent streams in areas that are less frequently and less intensely disturbed by flood events than areas dominated by riparian scrub. With less scouring and flooding, the trees in this habitat have more of a chance to mature (VRWC 2015). The hardwood communities can vary from a few meters in width in narrow passageways confined by geographic features at higher elevations to much broader extents in areas where non-seasonal streams flow out of the mountains and onto flat grasslands (VRWC 2015). The species mixture includes any combination of native obligate or facultative riparian hardwoods. The Riparian Mixed Hardwood this NCCAG classification can include white alder (*Alnus rhombifolia*), willow (*Salix spp.*), California sycamore (*Platanus racemosa*), fremont or black cottonwood (*Populus fremontii, P. balsamifera ssp. trichocarpa*), bigleaf maple (*Acer macrophyllum*), coast live oak (*Quercus agrifolia*), California bay (*Umbellularia californica*), and dogwood (*Cornus spp.*). A variety of riparian shrubs and perennial species may be included in this NCCAG classification, such as California wildrose (*Rosa californica*), mugwort (*Artemisia douglasiana*), *Baccharis spp.*, *Rubus spp.*, *Ribes spp.*, etc. (USDA 2009). Riparian corridors in the Ventura River Watershed support two general riparian woodland types: cottonwood-willow-sycamore and coast live oak (VRWC 2015). Apart from Coast live oak a few of this category's primary plant species (willow, fremont cottonwood, and black cottonwood) had rooting depth information in the GDE Database (TNC 2020), with ranges from 1 to 7 ft.

Scalebroom germinates and establishes after flood events and therefore the size and distribution of scalebroom along a stream channel can be used to understand flooding history in local areas (VCRC 2015). It is a many-branched shrub that can grow up to 10 feet tall but is typically around 5 feet. It

gets its name from its small leaves which form a scale-like skin, looking like part of green stems (County of Ventura 2006). Scalebroom plays an essential ecosystem role, producing abundant small yellow aromatic flowers in the fall that feed a wide variety of insects. This supports the food chain during the dry fall months and extended droughts (VRWC 2015). Roots of the scalebroom can be extensive laterally and vary in root depth, sometimes extending to the water table (County of Ventura, 2006). Roots may be deep in fluvial deposits (RCRCD 2018). Despite these general statements about root depth, specific rooting depth values were not identified for scalebroom (TNC, 2020). Species that may also be found in the Scalebroom CALVEG class include brittlebrush (*Encelia farinosa*), creosote bush (*Larrea tridentata*), chaparral yucca (*Y. whipplei*), rabbitbrush (*Chrysothamnus nauseosus*) and big sagebrush (*Artemisia tridentata*). Riparian hardwoods such as Fremont cottonwood (*Populus fremontii*) and desert willow (Chilopsis linearis) may occur on or adjacent to these sites (USDA 2009). No information about scalebroom rooting depth is provided in the GDE Rooting Depths Database (TNC 2020). However, other species associated with this NCCAG classification (brittlebrush, creosote bush, chaparral yucca, rabbitbrush, and big sagebrush) have reported maximum rooting depths in the range of 2 to 18 feet, with an average of approximately 6 feet (TNC 2020).

Riversidean Alluvial Scrub habitats are found in alluvial fans and dry washes with flood patterns. Scalebroom is also generally regarded as an indicator for this alliance (Hanes *et al.* 1989). The history of ground disturbance can play a significant contribution in the mixture of vegetation species. In addition to scalebroom, other species included in the Riversidian Alluvial Scrub CALVEG alliance are: California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), white sage (*Salvia apiana*), and *Encelia spp., Opuntia spp.*, chaparral yucca (*Yucca whipplei*), *Rhus spp.*, and California juniper (*Juniperus californica*) (USDA, 2009). As mentioned above, no information about scalebroom rooting depth is provided in the GDE Rooting Depths Database. However, the other species associated with this NCCAG classification (California buckwheat, chaparral yucca, and white sage) have reported rooting depths ranging from 2 to 5 feet (TNC 2020).

Wetlands occur where water saturation is the dominant factor influencing the nature of soil development and the types of plant and animal communities in the soil and on its surface (Cowardin et al., 1979; VRWC 2015). Agencies have different official definitions for wetlands, but all variations include the three following elements: (1) hydrology – water is at or above the soil surface for a sufficient period of time annually to influence plant types and soil chemistry, (2) hydric soils – soils that are wet of sufficient duration throughout the year to develop low-oxygen conditions, and (3) hydrophytic plants – plants are adapted to saturated soil conditions (County of Ventura 2006; VRWC 2015). Wetlands also naturally filter the water, allowing suspended sediments to drop out of the water column and for uptake of pollutants by plants and soils. They are also some of the most biologically productive natural ecosystems in the world. The shallow water and vegetation provide diverse habitats for fish and wildlife (VRWC 2015). Most of the wetlands in the UVRGB are in-channel riverine wetlands, shown in blue in Figure 1 as the NCCAG wetland classification in the Ventura River. The Ventura River and its tributaries and drainages support miles of riverine wetlands. Riverine wetlands include the “active channel” that contains flows under non-flood conditions. Since storm flows often rip out vegetation in the active channel, riverine wetlands are characterized by non-persistent vegetation that reflects this unstable environment (Ferren et al., 1995; VRWC 2015). Within the Ventura River mainstem, the riverine wetland substrate in the channel centers transitions from bedrock and large boulders in the upper reaches to mixed cobbles and gravel in the middle reaches to patchy boulders, cobbles, gravel, mud, and sand in the downstream reaches (Ferren et al. 1995; VRWC 2015). The Ventura reaches in the northern

(Kennedy Area) and southern (Casitas Springs) portion of the UVRGB that are more perennial in nature support more plant diversity than intermittent or ephemeral reaches (Robles Area and parts of Santa Ana Area). Active channels of most intermittent reaches are devoid of vegetation while perennial reaches can support a variety of herbs, and floating and submerged vegetation. Common herbaceous plants in riverine wetlands include dotted water smartweed, willow-herb, water parsnip, water primrose, iris-leafed rush, water speedwell, and California bulrush. Submerged and floating aquatic plants include leafy pondweed, fennel pondweed, horned pondweed, duckweed, duckweed fern, water cress, and green algae, which grow in slow-flowing channels (VRWC, 2015). Note, that in the Kennedy Area the Ventura River is intermittently connected to the groundwater system and is typically losing to it (Figure 2). Hence, iGDE wetlands mapped in the Kennedy Area are likely more dependent on surface water and their connection to groundwater is uncertain.

*This page intentionally left blank.*

# Appendix B

Evaluation Criteria and List of Special Status Species with Potential to Occur in the UVRGB

# Evaluation Criteria and List of Special Status Species with Potential to Occur in the UVRGB

For the purposes of this document, special status species are defined as those:

- listed, proposed, or candidates for listing as endangered or threatened under the federal Endangered Species Act (ESA) or the California Endangered Species Act (CESA);
- designated by the CDFW as a Species of Special Concern (SSC) or Watchlist Species (WL);
- designated by the CDFW as Fully Protected (FP) under the California Fish and Game Code (Sections 3511, 4700, 5050, and 5515);
- included on CDFW's most recent Special Vascular Plants, Bryophytes, and Lichens List (CDFW 2021c) with a California Rare Plant Rank (CRPR) of 1 or 2.
- protected by the Migratory Bird Treaty Act (MBTA) or California Fish and Game Code Section 3503.

## Data Sources

Rincon queried the following databases for information on special status species and sensitive natural communities with documented occurrences within the UVRGB:

- California Department of Fish and Wildlife (CDFW) California Natural Diversity Database (CNDDB, CDFW 2021a)
- California Native Plant Society Online Inventory of Rare and Endangered Plants of California (CNPS 2021)
- Calflora Database (Calflora 2021)
- eBird Online Database of Bird Distribution and Abundance (Cornell Lab of Ornithology 2021a)
- California Freshwater Species Database (TNC 2020)
- VegCAMP (CDFW 2021d)

Rincon also reviewed the following sources for additional information on special status species and sensitive natural communities with potential to occur within the UVRGB:

- CDFW Special Animals List (CDFW 2021b)
- CDFW Special Vascular Plants, Bryophytes, and Lichens List (CDFW 2021c)
- CDFW Natural Communities List (CDFW 2020)
- All About Birds Online Bird Guide (Cornell Lab of Ornithology 2021b)
- A Manual of California Vegetation, Second Edition, California Native Plant Society (Sawyer et al. 2009)
- Biological Resources Assessment for the Foster Park Fish Passage Improvement Project: Phase 1 Subterranean Diversion Notch (Rincon 2020)

# Evaluation Criteria

The following criteria were used to evaluate potential for special status species to occur, as well as their potential dependency on groundwater.

- **Present.** The species has been observed by a qualified local biologist within the UVRGB within the past five years and/or has a documented occurrence within the basin within the past five years.
- **Likely to Occur.** Suitable habitat is present within the UVRGB and there are documented occurrences within the basin (or nearby locations with similar habitat) within the past ten years.
- **May Occur.** Some suitable habitat currently exists within the basin and/or there are documented occurrences in the vicinity within the past twenty years.
- **Unlikely to Occur.** Only marginally suitable habitat for the species exists within the basin and/or there are no documented occurrences of the species within basin in the past thirty years.
- **Not Expected.** No suitable habitat for the species exists within the basin, the species is considered extirpated in the region, and/or there are no documented occurrences of the species within the basin in the past thirty years.

Special status plant species were classified as either **likely** or **unlikely** to depend on groundwater, and therefore be associated with a GDE, based on habitat and water requirements, current distribution within the UVRGB and/or the location of documented occurrences within the basin, and depth to water data within areas of documented occurrences.

Wildlife and fish species were evaluated for potential groundwater dependence based on determinations from the Critical Species Lookbook (Rohde et al. 2019) and by evaluating known habitat preferences, life histories, and diets. Species GDE associations were assigned one of three categories:

- **Direct.** Species directly dependent on groundwater for some or all water needs(e.g., juvenile steelhead in dry season).
- **Indirect.** Species dependent upon other species that rely on groundwater for some or all water needs (e.g., riparian birds).
- **No known reliance on groundwater.**

## Special status Species with Potential to Occur within the UVRGB

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| **Plants** | | | | | |
| *Astragalus didymocarpus* var. *milesianus* Miles' milk-vetch | None/None 1B.2 | Not Expected | Annual herb. 50-385 m elevation. Occurs in coastal scrub with clay soils. Blooms Mar-Jun. There are two occurrences of the species documented in the CNDDB, one in 1945 along Casitas Road, and one of an unknown date in the Ojai Area (CDFW 2021a). There are no occurrences of the species within the UVRGB documented by Calflora. The UVRGB does not contain suitable coastal scrub habitat. | Unlikely | None |
| *Astragalus pycnostachyus* var. *lanosissimus* Ventura Marsh milk-vetch | FE/SE 1B.1 | Not Expected | Perennial herb. 1-35 m elevation. Occurs in Marshes and swamps, coastal dunes, coastal scrub. Within reach of high tide or protected by barrier beaches, more rarely near seeps on sandy bluffs. Blooms Jul-Oct. There is one occurrence of the species documented within the UVRGB in the CNDDB (CDFW 2021a). This occurrence was documented in 1987 and CDFW considers the species "possibly extirpated" in the region. There are no occurrences of the species documented within the UVRGB by Calflora. This is a beach-dwelling species and no suitable habitat exists within the UVRGB. | Unlikely | None |
| *Calochortus fimbriatus* Late-flowered mariposa lily | None/None 1B.3 | Likely to Occur | Perennial bulbiferous herb. 270-1435 m. Occurs chaparral, cismontane woodland, and riparian woodland in dry, open areas on serpentine soils. Blooms Jun-Aug. There is one occurrence of the species within the UVRGB documented in the CNDDB in 1946 near Kennedy Canyon in the Santa Ynez Mountains. There are two occurrences of the species documented by Calflora within the basin, one in 1915 and one in 2019. Both of these occurrences are in the Mira Monte area, west of Highway 33 and northeast of Casitas Lake (Calflora 2021). | Unlikely | None |
| *Fritillaria ojaiensis* Ojai fritillary | None/None 1B.2 | May Occur | Perennial bulbiferous herb. 225-998 m. Occurs in broadleaf upland mesic forest, chaparral, cismontane woodland, and lower montane coniferous forest in rocky soil. Blooms Feb- May. Some suitable chaparral habitat exists within the basin and there are several documented occurrences of the species upland of the UVRGB. However, there are no documented occurrences of the species within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| *Horkelia cuneata* var. *puberula* Mesa horkelia | None/None 1B.1 | Likely to Occur | Perennial herb. 15-1645 m. elevation. Occurs in chaparral, cismontane woodland, and coastal scrub in sandy or gravelly sites. Blooms Feb-Sep. There is one occurrence within the UVRGB documented in 1935 (CDFW 2021a). There are two occurrences of the species within the UVRGB documented by Calflora. One was documented in 1944 along the eastern bank of the river just south of Highway 150. The second occurrence was documented in 2008 in the Mira Monte region in the northeastern portion of the basin (Calflora 2021). | Unlikely | None |
| *Imperata brevifolia* California satintail | None/None 2B.1 | May Occur | Perennial rhizomatous herb. 0-1215 m. elevation. Occurs in chaparral, coastal scrub, Mojavean desert scrub, meadows, alkali seeps, and mesic riparian scrub. Blooms Sep-May. Some suitable habitat for the species exists within the UVRGB, but there are no documented occurrences within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |
| *Lasthenia glabrata* ssp. *Hypoleuca* Coulter's goldfields | None/None 1B.1 | May Occur | Annual herb. 1-1400 m. elevation. Occurs in coastal salt marshes, playas, valley and foothill grassland, and vernal pools. Typically in alkaline soils in playas, sinks, and grasslands. Blooms Feb-June. There is limited suitable habitat for the species within the UVRGB, but there are no documented occurrences within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |
| *Layia heterotricha* pale-yellow layia | None/None 1B.1 | May Occur | Annual herb. 300-1705 m. elevation. Occurs in cismontane woodland, coastal scrub, pinyon and juniper woodland, and valley and foothill grassland. Typically in alkaline or clay soils. Blooms Mar-Jun. There is limited suitable habitat for the species within the UVRGB, but there are no documented occurrences within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| *Monardella hypoleuca* ssp. *hypoleuca* White-veined monardella | None/None 1B.3 | Unlikely to Occur | Perennial herb. 50-1280 m. Occurs in chaparral and cismontane woodland on dry slopes. 50-1280 m. Blooms Apr-Nov. There is one occurrence of the species documented in the CNDDB within the UVRGB (CDFW 2021a). This occurrence was documented in 1969 in Foster Park, south of Casitas Springs in the southwestern corner of the UVRGB. Calflora documents two additional occurrences of the species within the basin. One in 1895 within the Ventura River channel in the Mira Monte area, and the other in Ojai in 1937 (Calflora 2021). | Unlikely | None |
| *Navarretia ojaiensis* Ojai navarretia | None/None 1B.1 | Present | Annual herb. 275-620 m. elevation. Occurs in openings in chaparral and coastal scrub, and in valley and foothill grasslands. Blooms May-Jul. There is suitable habitat for the species within the basin and there is one occurrence of the species documented within the UVRGB in 2013, in the Miramonte area (Calflora 2021). | Unlikely | None |
| *Navarretia peninsularis* Baja navarretia | None/None 1B.2 | Not Expected | Annual herb. 1400-2300 m. Occurs in openings in chaparral, as well as lower montane coniferous forest, meadows and seeps, yellow pine forest, and pinyon and juniper woodlands. Blooms May-Aug. The typical elevation range of the species is higher than the UVRGB and there are no documented occurrences of the species within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |
| *Nolina cismontana* Chaparral nolina | None/None 1B.2 | Not Expected | Perennial evergreen shrub. 140-1275 m. elevation. Occurs in chaparral and coastal scrub in sandstone or gabbro. Blooms Mar-Jul. There is some suitable habitat for the species within the UVRGB, but there are no documented occurrences within the basin (CDFW 2021a, Calflora 2021). | Unlikely | None |
| *Sagittaria sanfordii* Sanford's arrowhead | None/None 1B.2 | Not Expected | Perennial rhizomatous herb. 0-650 m. elevation. Occurs in marshes and swamps. Blooms May-Nov. There are three historical occurrences of the species documented within the UVRGB (in 1945, 1947, 1979; Calflora 2021). However, these occurrences were in habitat that has now been developed. | Unlikely | None |

| *Scientific Name*<br>Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| *Sidalcea neomexicana*<br>Salt spring checkerbloom | None/None<br>2B.2 | Unlikely to Occur | Perennial herb. 3-2380 m. Occurs in alkali springs and marshes, playas, chaparral, coastal scrub, lower montane coniferous forest, and Mojavean desert scrub. Blooms Mar-Jun. There is one occurrence of the species documented within the UVRGB (CDFW 2021a). This occurrence was documented in 1962 in Oak View, just east of Highway 33. There are no occurrences of the species documented within the basin by Calflora. Suitable habitat for the species is very limited within the basin. | Unlikely | None |
| **Invertebrates** | | | | | |
| *Bombus crotchii*<br>Crotch bumble bee | None/SCE | Not Expected | Occurs in coastal California east to the Sierra-Cascade crest and south into Mexico. Food plant genera include: *Antirrhinum, Phacelia, Clarkia, Dendromecon, Eschscholzia,* and *Eriogonum.* One occurrence of the species is documented in the CNDDB from 1892. Food genera within the basin are very limited. | No known dependence on groundwater. | None |
| **Fish** | | | | | |
| *Entosphenus tridentatus*<br>Pacific lamprey | None/None<br>SSC | Present | Occurs in freshwater systems and requires adequate flows for migration, suitable substrate (i.e., gravels) for spawning, and adequate cover for pre-spawning holding. Juveniles (called ammocoetes) spend an extended period of time (between four and ten years) rearing while burrowed in sediments filter feeding on organic material and require suitable cover, flow, foraging conditions, and cool temperatures. Juvenile migrant (called macropthalmia) emigration (i.e., outmigration to the ocean) requires water conditions suitable for migration (i.e., water velocity and water depth, dissolved oxygen levels within the surface water, and water temperature suitable for passage). Pacific lamprey ammocoetes were observed in the lower Ventura River in 2005 (Howard and Swift 2009). Migration (both upstream and downstream) could occur in all surface water reaches of the UVRGB. | Direct | Santa Ana South, Foster Park |

| *Scientific Name*<br>Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| *Gila orcutti*<br>Arroyo chub | None/None<br>SSC<br>Non-Native to Ventura River | Present | Native to streams from Malibu Creek to San Luis Rey River basin. Introduced into streams in Santa Clara, Ventura, Santa Ynez, Mojave & San Diego river basins. Inhabits slow water stream sections with mud or sand bottoms. Feeds heavily on aquatic vegetation and associated invertebrates. Known to be common and widely distributed in some of the streams in which it was introduced, including the Ventura River (CDFW 2015). While this fish is a SSC, the Ventura River is not part of its native range. | Direct | Santa Ana South, Foster Park |
| *Oncorhynchus mykiss irideus* pop. 10<br>Southern California DPS steelhead | FE/None | Present | Occurs in freshwater systems and require adequate water conditions suitable for migration (i.e., flow, dissolved oxygen levels within the surface water, and water temperature suitable for passage) and suitable substrate (i.e., gravels) for spawning. Juvenile *O. mykiss* require suitable cover, flow, foraging conditions, and cool temperatures for rearing. Juvenile emigration (i.e., outmigration to the ocean) requires water conditions suitable for migration. The Ventura River basin historically supported an abundant steelhead population (Moore 1980). Habitat within the basin has declined due to the construction of multiple dams, but the species is still known to occur within the Ventura River, and multiple life stages of the species were observed throughout the basin during surveys conducted from 2006-2012 (Allen et al. 2015). | Direct | South Santa Ana, Foster Park |

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| **Amphibians** | | | | | |
| *Rana draytonii* California red-legged frog | FT/None SSC | Present | Occurs in lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11-20 weeks of permanent water for larval development. Must have access to estivation habitat. There are 35 occurrences of the species documented in the CNDDB within the UVRGB. Two occurrences of the species are documented in the CNDDB within the UVRGB, one in 2016 and one in 2017. These occurrences were documented along San Antonio Creek from its confluences with the Ventura River to 0.6 miles upstream, and within the Ventura River north of Highway 33 at Casitas Vista Road. Juvenile California red-legged frogs were relocated approximately 0.50 mile downstream of Foster Park in 2017 (Rincon 2020). | Direct | South Santa Ana, Foster Park |
| **Reptiles** | | | | | |
| *Actinemys pallida (Emys marmorata)* Southwestern pond turtle | None/None SSC | Present | Occurs in ponds, lakes, rivers, streams, creeks, marshes, and irrigation ditches with basking sites. Feeds on aquatic plants, invertebrates, worms, frog and salamander eggs and larvae, crayfish, and occasionally frogs and fish. Relies on surface water that may be supported by groundwater (Rhode et al. 2019). There are three occurrences of the species documented within the UVRGB from 2016. These occurrences were documented along the Ventura River near Casitas Springs and in the northwestern portion of the basin just southeast of the Matilija Dam (CDFW 2021a). This species is present within the UVRGB. | Direct | South Santa Ana, Foster Park |
| *Thamnophis hammondii* Two-striped gartersnake | None/None SSC | Present | Highly aquatic snake species. Found in or near permanent fresh water, often along streams with rocky beds and riparian vegetation. Prey includes fish, fish eggs, tadpoles, newt larvae, small frogs and toads, leeches, and earthworms. There are three occurrences of the species documented within the UVRGB. These occurrences were documented in 2013, 2016 and 2018 along the Ventura River in the vicinity of Casitas Springs (CDFW 2021a). The species is present within the UVRGB. | Direct | South Santa Ana, Foster Park |

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| *Empidonax traillii extimus* Southwestern willow flycatcher | FE/SE | May Occur | Occurs in dense brushy thickets within riparian woodland often dominated by willows and/or alder, near permanent standing water. Reliant on groundwater-dependent riparian vegetation, including for nest sites that are typically located near slow-moving streams, or side channels and marshes with standing water and/or wet soils (Rohde et al. 2019). Feeds on insects, fruits, and berries. There are no documented occurrences of the species within the UVRGB (CDFW 2021a, Cornell Lab of Ornithology 2021a. However, there is one documented observation of the species near Foster Park in April 2010 (Ryan 2010). The species is also known to occur in similar habitat within 10 miles of the UVRGB during summer months. | Indirect | South Santa Ana, Foster Park |
| *Setophaga petechia* Yellow warbler | None/None SSC | Likely to Occur | Inhabits riparian plant associations in close proximity to water. Also nests in montane shrubbery in open conifer forests in Cascades and Sierra Nevada. Frequently found nesting and foraging in willow shrubs and thickets, and in other riparian plants including cottonwoods, sycamores, ash, and alders. There are multiple observations of the species documented within the UVRGB in eBird (Cornell Lab of Ornithology 2021a). The species was also detected multiple times within the basin in 2010 (Ryan 2010). | Indirect | South Santa Ana, Foster Park |
| *Vireo bellii pusillus* Least Bell's vireo | FE/SE | Likely to Occur | Nests in dense vegetative cover of riparian areas; often nests in willow or mulefat; forages in dense, stratified canopy. This species relies on groundwater-dependent vegetation in riparian areas, particularly during breeding periods (Rohde et al. 2019). Eats insects, fruits, and berries. There is once occurrence of the species from 1919 documented within the UVRGB (CDFW 2021a) and one occurrence documented in eBird in 2018 (Cornell Lab of Ornithology 2021a). Another occurrence of the species was documented near Foster Park in May 2010 (Ryan 2010). | Indirect | South Santa Ana, Foster Park |

| *Scientific Name* Common Name | Status | Potential to Occur within UVRGB | Habitat Requirements and Documented Occurrences within the UVRGB | GDE Association | GDE Unit |
|---|---|---|---|---|---|
| **Mammals** | | | | | |
| *Chaetodipus californicus femoralis* Dulzura pocket mouse | None/None SSC | Not Expected | Inhabit a variety of habitats including coastal scrub, chaparral & grassland (primarily in San Diego County). Attracted to grass-chaparral edges. One male and one female were collected within the northeastern portion of the UVRGB near Meiner's Oaks at an unknown date. Another female was collected near Weldon Canyon at an unknown date (CDFW 2021a). There are no other documented occurrences of the species within the basin. | No known dependence on groundwater. | None |
| *Eumops perotis californicus* Western mastiff bat | None/None SSC | Not Expected | Occurs in open, semi-arid to arid habitats, including coniferous and deciduous woodlands, coastal scrub, grasslands, and chaparral. Roosts in crevices in cliff faces and caves, and buildings. Roosts typically occur high above ground. One occurrence of the species was documented in 1907 near Weldon. | No known dependence on groundwater. | None |

FE = Federally Endangered
FT = Federally Threatened
SSC= CDFW Species of Special Concern
SE = State Endangered
ST = State Threatened
SCE = State Candidate Endangered

**CRPR (California Rare Plant Rank)**
1A=Presumed Extinct in California
1B=Rare, Threatened, or Endangered in California and elsewhere
2A=Plants presumed extirpated in California, but more common elsewhere
2B=Plants Rare, Threatened, or Endangered in California, but more common elsewhere

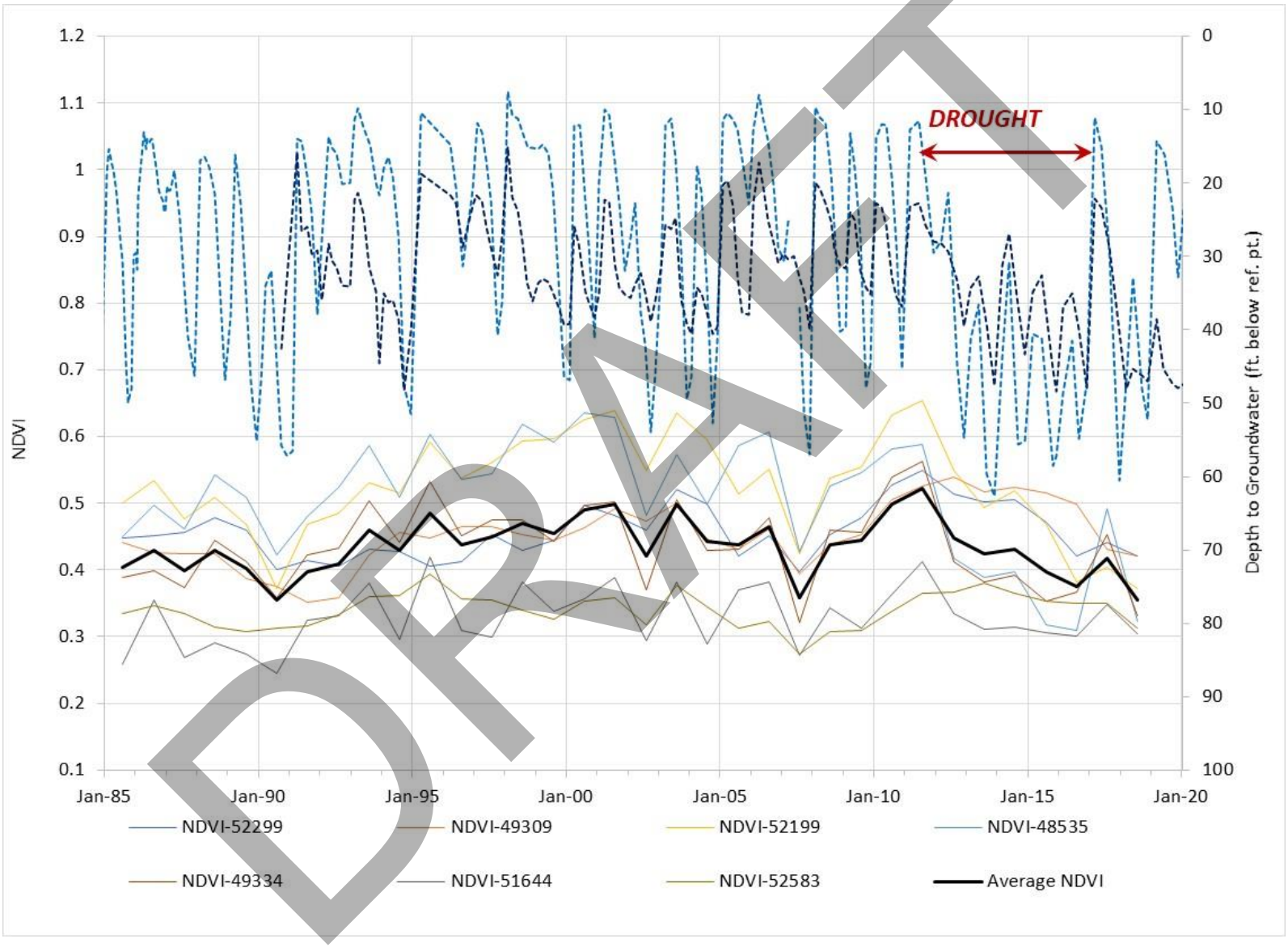
**CRPR Threat Code Extension**
.1=Seriously endangered in California (over 80% of occurrences threatened/high degree and immediacy of threat)
.2=Fairly endangered in California (20-80% occurrences threatened)
.3=Not very endangered in California (<20% of occurrences threatened)

**CDFW Rare**
G1 or S1 = Critically Imperiled Globally or Subnationally (state)
G2 or S2 = Imperiled Globally or Subnationally (state)
G3 or S3 = Vulnerable to extirpation or extinction Globally or Subnationally (state)
G4/5 or S4/5 = Apparently secure, common and abundant
GNR/SNR= Globally or Subnationally (state) not ranked

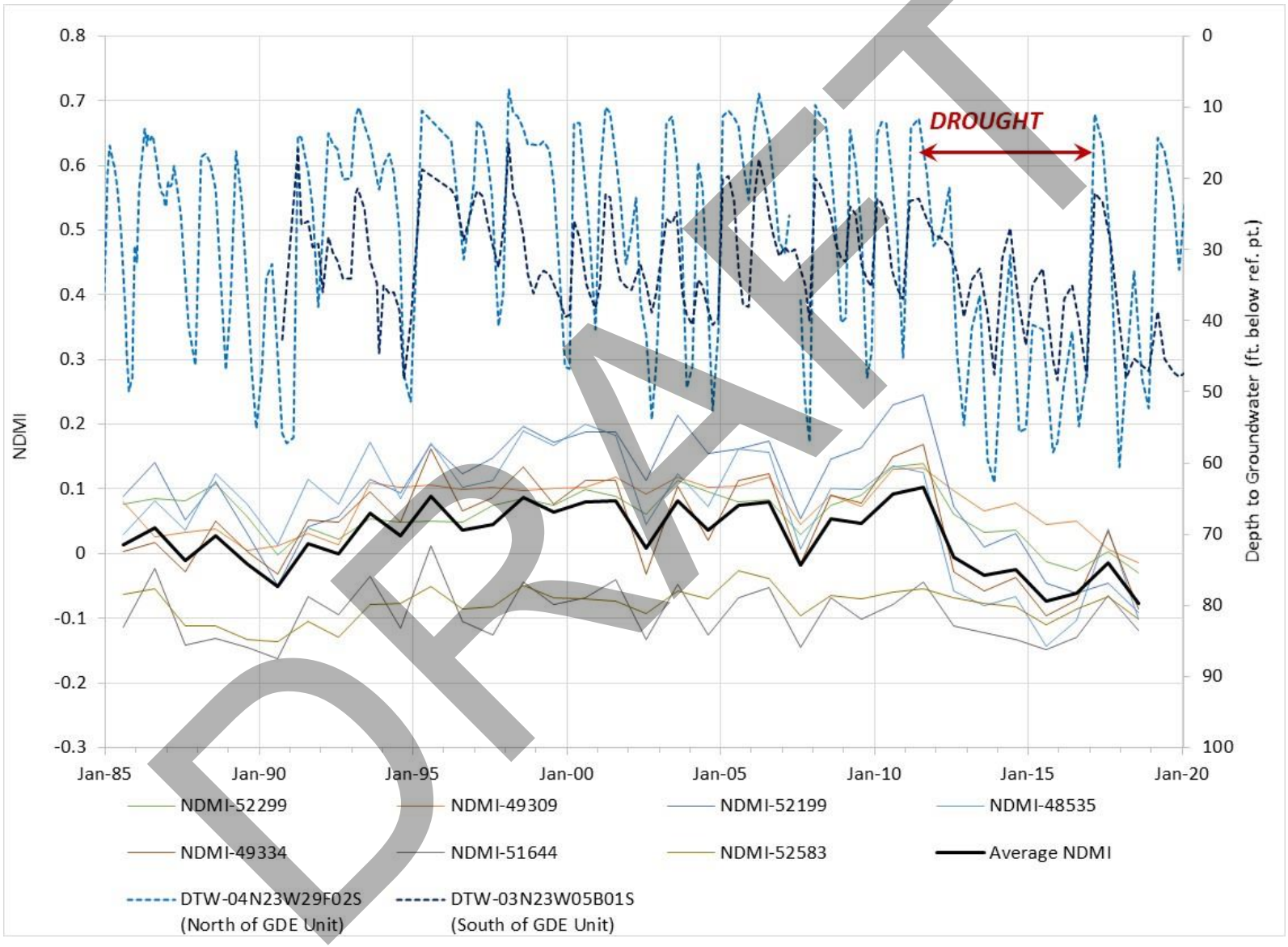
# Appendix C

NDVI, NDMI, and Groundwater Level Data for each Riparian GDE Unit

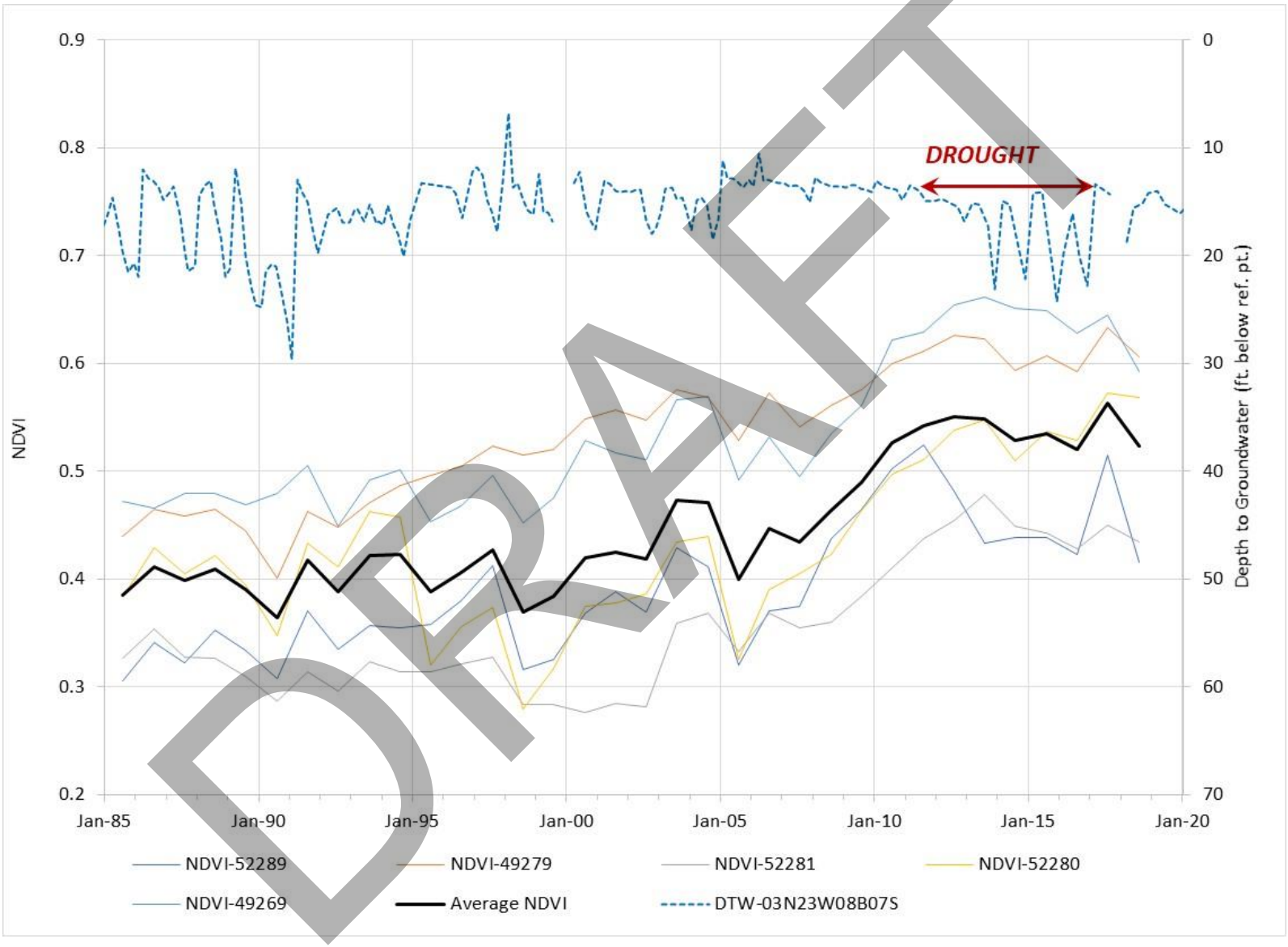
**Groundwater Level Compared to NDVI for the South Santa Ana Riparian GDE Unit (1985 to 2018)**



**Groundwater Level Compared to NDMI for the South Santa Ana Riparian GDE Unit (1985 to 2018)**



**Groundwater Level Compared to NDVI for the Foster Park Riparian GDE Unit (1985 to 2018)**



**Groundwater Level Compared to NDMI for the Foster Park Riparian GDE Unit (1985 to 2018)**