APPENDIX G

Nature Conservancy GDE Tech Memo

Technical Memorandum - DRAFT
Assessment of Groundwater Dependent Ecosystems for the Las Posas Valley Basin Groundwater Sustainability Plan

INTRODUCTION

The assessment of groundwater dependent ecosystems (GDEs) is one element of Groundwater Sustainability Plans, as required by the California Sustainable Groundwater Management Act (SGMA). The Fox Canyon Groundwater Management Agency's Technical Advisory Group (TAG) for the development of its Groundwater Sustainability Plans formed an ad hoc committee, comprised TAG members from The Nature Conservancy, United Water Conservation District, and Calleguas Municipal Water District, to support this assessment for the Fox Canyon Groundwater Sustainability Plans. The assessment coincided with development of a statewide GDE Guidance Framework to address GDEs under SGMA (Rohde et al., 2017). Thus, the assessment also served to both aid in the development of the guidance framework and serve as a case study of the utility of the guidance framework. The seven steps of the GDE Guidance Framework are addressed.

I. Identification of GDEs

One groundwater dependent ecosystem (GDE) unit was identified in the Las Posas Valley groundwater basin. The Arroyo Simi - Las Posas GDE is defined by dominant surface water feature, which is hydrologically connected to the shallow aquifer (Figure 1). The primary source of water to both the Arroyo and to the shallow aquifer is discharges from the Simi Valley Water Quality Control Plant, dewatering wells operated by the City of Simi Valley, and discharges from the Moorpark Water Treatment Plant percolation ponds adjacent to Arroyo Las Posas. The former two sources are external to the groundwater basin. The non-native water is also a primary source of poor water quality (high total dissolved solids, chloride, and sulfate). Currently, there is little pumping of the shallow aquifer; however, downward flow of groundwater from the shallow aquifer into deeper units of the basin is an

important source of recharge to the primary pumping zones. The feasibility of pumping and desalting shallow aquifer groundwater is being evaluated by several entities within the basin.

The GDE unit was identified using the statewide potential GDE map (pGDE v0.3.1, TNC, 2017)) and groundtruthed using local information to confirm the potential hydrologic connection to groundwater, as described in The Nature Conservancy's GDE Guidance Framework (Rohde et al., 2017). The statewide map (Figure 2) of potential GDEs is based on best available statewide data on phreatophytic vegetation (i.e., vegetation known to use groundwater) (US NBVC, 2013; US FS, 2014) and wetlands identified in the National Wetland Inventory Inventory (US FWS, 2016).

The statewide potential GDE map was groundtruthed using aerial photos, local knowledge, and field verification as described below. The verified potential GDE map is presented in Figure 3. Because the statewide map relies of vegetative surveys conducted over multiple years, some of the mapped vegetation have undergone residential housing and agricultural development since the survey date; these removed areas are noted on the map as "cultivated" or "developed". Several agricultural drainage channels and ephemeral natural drainages were also removed. No potential GDE areas were added based on local knowledge.

The hydrologic connection to groundwater of the potential GDEs was first assessed using an initial screening worksheet (Worksheet 1). As discussed in Section 2.2.4, two areas had been identified as having shallow unconfined aquifers: the shallow alluvial aquifer underlying Arroyo Las Posas and Arroyo Simi and the Fairview Area Unconfined aquifer (included as part of the Epworth Gravels aquifer in the Groundwater Sustainability Plan) (see Figure 4). The statewide mapping identified potential phreatophytic vegetation along the numerous ephemeral drainages along the northern side of Las Posas Valley. These areas outside these identified shallow aquifers were excluded from further consideration. It is assumed that these phyreatophytic vegetation areas are most likely supported during dry summer periods by agricultural runoff, shallow perched groundwater, and/or residential development outdoor water use. The depth to groundwater in the Fairview Area/Epworth Gravels aquifer exceeds 150 feet below ground surface (bgs) (see Figure 5).

Arroyo Simi - Las Posas GDE

One GDE unit was identified in the Las Posas Valley Basin defined by the Arroyo Las Posas and Arroyo Simi watercourses with Arroyo Simi flowing into the Arroyo Las Posas near Hitch Boulevard downstream of the city of Moorpark. It is comprised of approximately 305 acres of southern riparian scrub/southern willow scrub, 105 acres of riparian mixed hardwood, and 127 acres of non-native vegetation (TNC, 2017).

Nearly 420 acres are classified as wetlands by the National Wetlands Inventory (USFWS, 2016), which includes riparian habitat in the 100-year floodplain (Wildscape Restoration, 2015). Seventy-six percent of the vegetation in this GDE is considered native vegetation (TNC, 2016). Riparian vegetation types in the eastern portion of the GDE along Arroyo Simi known as Virginia Colony include arroyo willow, laurel sumac, blue elderberry, coast live oak, mulefat, red willow, scalebroom scrub and western sycamore – Fremont cottonwood woodlands (VCWPD and Aspen Environmental Group, 2013a). Riparian vegetation present on the Arroyo Simi occurs primarily near surface or subsurface perennial water (VCWPD and Aspen Environmental Group, 2013b). Non-native eucalyptus and giant reed (Arundo donax) also occur within the GDE. Giant reed densities vary from less than one percent to more than 75 percent cover throughout Arroyo Simi and Arroyo Las Posas, with the majority of the area consisting of less than 49 percent giant reed cover (Wildscape Restoration, 2015).

The GDE supports the state- and federally-listed endangered least Bell's vireo (Vireo bellii pusillus) in both Arroyo Las Posas and Arroyo Simi (CDFW, 2017). In the Virginia Colony area[1], the state-listed endangered northwestern willow flycatcher (Empidonax traillii brewsteri), likely transient individuals, were detected in a survey in 2011, and the federally threatened and California species of special concern California gnatcatcher (Polioptila californica californica) is resident in the GDE (VCWPD and Aspen Environmental Group, 2013b). One hundred and three species of common and sensitive birds were identified on the Virginia Colony area on the eastern portion of the GDE during surveys completed in 2011 (VCWPD and Aspen Environmental Group, 2013b). The native arroyo chub (Gila orcuttii) is found in Arroyo Simi (CDFW, 2017) as well as the southwestern pond turtle (Actinemys pallida) and the San Diego desert woodrat (Neotoma lepida intermedia), all California species of Special Concern (Padre Associates, 2009).

The Basin Plan (RWQCB, 2014) for Arroyo Las Posas and Arroyo Simi lists the following beneficial uses: groundwater recharge (GWR), warm freshwater habitat (WARM), cold freshwater habitat (COLD) (potential), Wildlife Habitat (WILD) and Freshwater Replenishment (FRESH). Additionally, Rare, Threatened, or Endangered Species (RARE) beneficial use is listed for Arroyo Simi (east of Hitch Road).
The Arroyo Simi - Las Posas GDE ranges from natural channel consisting of riparian woodland/wetland habitat (Caltrans 1987) to a confined channel rip-rapped on the sides with a soft bottom that is maintained in a largely vegetation-free state by the Ventura County Watershed Protection District (Bonfiglio Allen, 2017). In the natural areas of the stream channels, the active channel generally supports a dense canopy

[1] The Virginia Colony area is located inside the California Department of Water Resources basin boundary, but outside of the Fox Canyon Groundwater Management Area jurisdiction.

of vegetation, although winter storm events can scour the active channel and mid- to lower terraces, leaving some areas free of vegetation for extended periods of time (VCWPD and Aspen Environmental Group, 2013).

Critical habitat for the coastal California gnatcatcher is adjacent to and present in portions of the easternmost portion of the GDE. This unit of critical habitat includes the only known breeding population of coastal California gnatcatchers in Ventura County (USFWS, 2007). Habitat for the least Bell's vireo is extensive throughout the GDE (VCWPD and Aspen Environmental Group, 2013b). An inventory of ecological assets is listed in Worksheet 2.

Historically, the Arroyo Simi - Las Posas was an ephemeral stream with flashy flows from winter storm events and no flows during dry summers. Since the 1960s, the arroyo has become a perennial stream with the addition of non-native water sources. Currently, dry weather surface water flow in Arroyo Simi - Las Posas is composed of groundwater, municipal wastewater, urban non-storm water discharges, and agricultural runoff. The Simi Valley Water Quality Control Plant discharges an average of 9,527 acre-feet per year to the Arroyo Simi upstream of the eastern basin boundary (Todd Groundwater, 2016). The Moorpark Wastewater Treatment Plant (MWTP) discharges primarily to percolation ponds near the Arroyo Las Posas, downstream of the city of Moorpark. Because the Arroyo Las Posas is a gaining stream in this area, most of the MWTP percolation becomes surface water. Direct discharges to the Arroyo Las Posas from the Moorpark treatment plant occur during extremely wet periods (Larry Walker Associates 2007). The City of Simi Valley operates a number of dewatering wells near the western end of the city to dewater the Simi Valley Basin. The dewatering operations discharges an estimated 1,700 acre-feet per year (AFY) to Arroyo Simi (TODD Groundwater 2016). This water is discharged to the Arroyo Simi upstream of Madera Road east of the basin boundary (Todd Groundwater 2016). The water treatment plant and dewatering discharges provide a constant base flow in Arroyo Simi - Las Posas. Baseflow, defined by monthly minimum, average daily flow ranges between 6 and 30 cfs at Stations 841/841A in the middle of the gaining reach (see Table 1-2, Las Posas Valley Basin Groundwater Sustainability Plan, 2017).

Two field studies in 2011 and 2012 monitored and characterized the interconnection of surface water and groundwater in the Arroyo Simi-Las Posas under baseflow conditions (LWA, 2012 and 2013). The studies characterize the Arroyo Simi as a losing reach from upstream of the basin boundary just downstream of the Simi Valley WWTP to approximately Leta Yancy Road in Moorpark, a gaining reach to approximately a mile downstream of the Moorpark WWTP and a losing reach extending into the Pleasant Valley groundwater basin (see Figure 6). Perennial flow generally ends near the boundary of the Las Posas Valley and Pleasant Valley basins.

Visual observation during the recent drought years in 2014 and 2015 has confirmed the upstream retreat of the Arroyo Las Posas throughout the year (LWA, 2015 and 2016). Figure 7 presents the stream terminus as it recedes approximately one mile upstream from the basin boundary during summer 2014, and moves back downstream by winter 2014. The stream terminus locations for 2015 was in the same spatial range as 2014, but fluctuated up and downstream from month to month in 2015.

Significant diurnal fluctuations were observed in the surface water flow data (LWA, 2012). This periodic signal indicates the water consumption of the riparian vegetation. In particular, non-native plants such as giant reed are considered to have high water consumption, much more than the native vegetation (Cal-IPC, 2011). As described in Section 2.2.4 (Las Posas Valley Basin Groundwater Sustainability Plan, 2017), the shallow aquifer that underlies the arroyo floodplain (see extent of shallow aquifer in Figure 6) has been continuously recharged from the WWTP and Simi Valley dewatering discharges since the 1960s. Much of this recharge flows downward into the underlying confined aquifers. The shallow groundwater levels have risen and stabilized since the mid 1980s (see Figures 8 - 10). The figures provide another view of the gaining and losing reaches and interconnection of the shallow groundwater and surface water. The figures present the estimated depths to groundwater in the GDE, based on interpolation of water elevation data from representative wells along the arroyo to reference point locations within the GDE. In general, groundwater levels have been relatively constant for 30 years since the mid-1980s. Groundwater levels generally vary less than 15 feet for wells with longer time records, although variations up to 30 feet of variation are also observed. There is quite a range of depths across the GDE. Near the easternmost well at the basin boundary, 02N19W03A01S, the estimated depth to groundwater averages 3 feet bgs, with a 3.5-foot variation in depth for quarterly measurements for 1972-1991. Near the second easternmost well, 02N19W09E01S, the estimated depth to groundwater is approximately 15 feet bgs, and only a one-foot variation in depth for the daily measurements for 2015-2016. Moving downstream in the transition zone between the losing and gaining reaches, the depths to groundwater based on wells 02N19W08G03S and 02N19W08H02S average 13 feet bgs and exhibit larger variations of approximately 15 feet across the 1985 to 2010 period. The depths based on well 02N19W08H02S for the most recent years of quarterly data (2006 to 2010) are also constant around 8 feet bgs with only a 2-foot seasonal variation. Wells 02N19W07K04S and 02N19W07G01S in the gaining reach are constant at approximately 5 ft bgs for 2015. In the gaining reach by the Moorpark WWTP ponds, the depths to groundwater are estimated between 14 to 23 feet bgs in 02N20W12MMW1 above the WWTP ponds, and between ground surface and 12.5 feet adjacent and downgradient of the ponds in 02N20W12MMW2 and 02N20W12MMW3, based on data between 2000 and 2015. The depths to groundwater in the losing

reach near well 02N20W16A04S range between 22 and 47 feet bgs for the years 1992 to 1999. The depths to groundwater near well 02N20W09Q08S range between 5 and 10 feet bgs for the two years of data (2015 – 2016), higher than expected. The depths to groundwater at well 02N20W17J06S, located near the Las Posas Valley – Pleasant Valley groundwater basin boundary, range between 45 and 85 feet and decrease 40 feet across the two years of data (2015 – 2016). In this losing reach of Arroyo Las Posas, between the upstream location near well 02N20W09Q08S well 02N20W17J06S the depths to the shallow aquifer increase to depths much greater than 30 feet, the riparian vegetation is unlikely to utilize groundwater to sustain growth during the dry season.

As described above, the ecohydrology of the Arroyo Simi-Las Posas GDE is complex. There are uncertainties both spatially and temporally variability aspects that limit the understanding and accuracy of this assessment. In general, the gaining and losing reaches based on the surface water monitoring locations are corroborated by the depth to groundwater data. There are some wells whose data conflict with the general interpretation, such as 02N20W12MMW1 or 02N20W09Q08S, whose depths to groundwater are substantially different than surrounding wells. One limitation is that the wells used to estimate groundwater levels in the GDE are approximated based on wells outside the GDE. Better understanding of the hydrology in this vicinity would aid in determining the impacts of decreasing groundwater levels on the riparian habitat. The degree to which the vegetation is reliant on groundwater versus unsaturated soil water is also uncertain. Comparisons between satellite imagery and groundwater data provide some potentially conflicting evidence. The widest riparian corridor, approximately 500 feet wide, is located in the western losing reach, where the depth to groundwater from well 02N20W09Q08S is estimated to be less than 10 feet bgs. Review of recent satellite imagery at corresponding dates in 2015 and 2016 indicate the vegetation is drying out and going into senescence[2] (Google Earth, 2017). Satellite imagery also show consistently green vegetation in other areas that have deeper groundwater levels. Potential water sources could be coming from tributary drainages that have agricultural or residential runoff.

II. Determination of Potential Effects on GDEs

SGMA requires agencies to describe current or future potential significant and unreasonable effects on the GDEs (a beneficial use of groundwater) that may occur or are occurring with respect to the six SGMA undesirable results. Following The Nature Conservancy's GDE Guidance Framework (Rohde et al., 2017), this step uses

[2] Water-stress induced plant senescence (process of aging) is caused by the xylem cavitation, which leads to drying out of plant tissue. The process is visually observed as leaf loss, then branch mortality, then full canopy die-back to full plant mortality.

groundwater elevations as the basic hydrologic indicator to observe changes in groundwater conditions to help define whether potential effects from undesirable results are occurring or may occur. The undesirable results that relate to GDEs are: chronic lowering of groundwater levels, degraded water quality, and depletions of interconnected surface water. This step assumes that if there are little-to-no changes in groundwater conditions from baseline conditions then the corresponding undesirable result will have little-to-no impact on a GDE. The step also includes an assessment of risk to gauge the likelihood that adverse impacts to GDEs are occurring or may occur under future conditions.

The Arroyo Simi – Las Posas GDE unit has a complex gaining/losing interconnected surface water and groundwater, with marginal water quality, and primary sources of water coming from out-of-basin WWTP discharges and groundwater dewatering discharges, and in-basin WWTP discharges. The Arroyo Simi – Las Posas GDE unit has representative depth to groundwater data in the vicinity of the GDE units, surface water-groundwater field assessment. As shown in Figures 7 - 9, the depth to groundwater data show a relatively constant interannual trend for these GDE units. The specific depths to groundwater for different reaches are discussed above in Section I and the baseline averages and ranges are listed in Worksheet 3, although there is a range of time periods available for the different wells. The overall depth to groundwater data indicate little-to-no changes in in groundwater conditions from baseline conditions, which then correspond to little-to-no impact on the GDEs. This is not surprising, given that stabilizing presence of the external water sources and the limited groundwater utilization of the shallow aquifer for water supply purposes due to its marginal water quality.

The water quality of Arroyo Simi – Las Posas and the interconnected shallow groundwater has been impacted by the water quality of the non-native source waters. The high chloride, sulfate and TDS levels have resulted in surface water and groundwater RWQCB water quality objectives for Arroyo Simi -Las Posas, and the shallow aquifer. The Calleguas Creek Watershed Salts TMDL (LWA, 2007) notes that chloride are may have an impact on the environmental beneficial use of warm water aquatic habitat in the Arroyo Las Posas, but the primary beneficial uses being impacted are agricultural irrigation and groundwater recharge. Given the limited recognition of any ecological impacts, water quality is not considered further as a factor for evaluating the GDE.

Following the GDE Guidance Framework, if there is little-to-no impact to the GDE under current conditions, then one assesses whether there may be risk for future adverse impacts (in the next five years or longer). There is currently limited pumping in the shallow aquifer. The feasibility of pumping and desalting shallow aquifer groundwater is being evaluated by several entities within the basin, which, if

implemented, could impact the GDE. Projects that reduce water consumption (e.g. giant reed removal) or increase storm water recharge are also being evaluated by several entities, which, if implemented, could have a beneficial impact to the GDE. Reduced flows from external water sources is expected to have the greatest impact on the GDE. Reductions in wastewater flows on the order of 20-30 percent have occurred over the last ten years. Plans for up to 50 percent additional wastewater recycling of the Simi Valley Water Quality Control Plant are anticipated, along with potable use of the Simi Valley shallow groundwater dewatering flows. Given that these external water sources are the primary source of the high groundwater levels of the shallow aquifer, and resulted in the connectivity of the Arroyo Simi-Las Posas and the establishment of the GDE, this potential change is likely to have an adverse impact on the GDE. Thus, the Arroyo Simi - Las Posas GDE unit would considered to be at medium risk[3] of any adverse impact due to these planned projects.

III. Consideration of GDEs When Determining the Basin's Sustainability Goal

The consideration of the Arroyo Simi – Las Posas GDE in the Las Posas Valley Groundwater Sustainability Plan is complex, given the historical source of the shallow groundwater that support the GDE are primarily out-of-basin Simi Valley wastewater and groundwater dewatering flows and the recognition that those external water sources are likely to diminish as more demands to recycle that water use are met.

A proposed management solution is that under circumstances where external constraints result in impacts to GDEs, the groundwater sustainability agency would not be obligated to address those impacts, particularly if it is at the expense of other beneficial users. The groundwater sustainability agency would only be obligated to address impacts to the GDE caused by groundwater conditions under the jurisdiction of the groundwater sustainability agency that cause undesirable results.

IV. Consideration of GDEs in Setting Minimum Thresholds

To Be Determined

V. Consideration of GDEs in Setting Measurable Objectives

[3] The GDE Guidance Framework defines three risk levels: high risk for current adverse impacts to GDEs; medium risk for future changes that will likely cause future adverse impacts; and low risk for no known impacts under current and future conditions. Impacts are defined as conditions outside the baseline average and range.

To Be Determined

VI. Incorporation of GDEs into the Basin's Monitoring

Placeholder language: We recommend monitoring of the depth to groundwater for the GDE to continue a record of baseline conditions and to assess whether changes occur in the future. Better understanding of the hydrology in this vicinity would aid in determining the impacts of decreasing groundwater levels on the riparian habitat. We also recommend that biological indicators be included in the monitoring program. In particular, an assessment of the NDVI data would potentially support a better understanding of the riparian vegetation dependency on surface water and/or groundwater. Lastly, we recommend additional surface water gauges.

VII. Identification of Projects and Management Actions to Maintain or Enhance Conditions in GDEs

There are several water management projects currently under evaluation that have the co-benefit of enhancing GDE conditions. One potential project is giant reed (arundo) removal, which is estimated to consume six times more water than native vegetation (Cal-IPC, 2011); the water savings and the restoration of native habitat is a beneficial project for both needs that has potential for accessing bond funding (e.g., Proposition 1) that also require a demonstration of environmental benefits. Another potential project would increase storm water recharge along the Arroyo Simi. [Placeholder language: Need more information to state what benefits are to GDEs.]

References

References:

Bonfiglio Allen, A. 2017. Personal communication L. Riege. February 9, 2017.

California Department of Fish & Wildlife (CDFW). 2017. California Natural Diversity Database (CNDDB), Rarefind, Version 3.1.1. Heritage section, CDFW, Sacramento.

California Department of Transportation (Caltrans). 1987. Proposed Freeway Connection from the end of Route 23 at New Los Angeles Avenue to the end of Route

118, 0.3 mile east of College View Avenue in the City of Moorpark. Draft Environmental Impact Statement. July 15, 1987.

California Invasive Plant Council (Cal-IPC). 2011. Arundo donax Distribution and Impact Report. March 2011.

California Regional Water Quality Control Board – Los Angeles (RWQCB). 2014. Water Quality Control Plan, Los Angeles Region, Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties. Adopted September 11, 2014.

Dudek. 2017. Las Posas Valley Basin Groundwater Sustainability Plan. Draft in Progress.

Larry Walker Associates. 2007. Calleguas Creek Watershed Management Plan, Calleguas Creek Watershed Boron, Chloride, TDS and Sulfate TMDL, Public Review Technical Report, April 2007.

Larry Walker Associates, 2012. Phase I Study: Surface Flow and Groundwater Recharge in Arroyo Las Posas. Prepared for Calleguas Municipal Water District, January 15, 2012.

Larry Walker Associates. 2013. DRAFT Data Report for the Phase II Program for Long-Term Monitoring of Flow and Recharge in Arroyo Las Posas. Prepared by for Calleguas Municipal Water District, August 12, 2013.

Larry Walker Associates. 2015. Results of Water Quality Sampling Events and Tracking of the Surface Flow Terminus in Arroyo Simi/Las Posas. Prepared by for Calleguas Municipal Water District, May 1, 2015.

Larry Walker Associates. 2016. Results of Water Quality Sampling Events and Tracking of the Surface Flow Terminus in Arroyo Simi/Las Posas for 2015. Prepared by for Calleguas Municipal Water District, July 7, 2016.

Padre Associates, Inc. 2009. Virginia Colony Regional Detention Basin Site Biological Survey Report. Prepared for the Ventura County Watershed Protection District. October 2009.

Rohde, M.M., S. Matsumoto, S. Liu, J. Howard, L. Riege, E. Remson. 2017. Addressing Groundwater Dependent Ecosystems under the Sustainable Groundwater Management Act: Guidance for Preparing Groundwater Sustainability Plans. The Nature Conservancy, San Francisco.

Stillwater Sciences. 2016a. United Water Conservation District Multiple Species Habitat Conservation Plan Study: Effects of Freeman Diversion on Riparian Vegetation in the Santa Clara River. Prepared by Stillwater Sciences, Berkeley, California for United Water Conservation District, Santa Paula, California.

The Nature Conservancy (TNC). 2017. Potential Groundwater Dependent Ecosystems for the Fox Canyon Groundwater Management Agency, Version 0.3.1. San Francisco, California.

Todd Groundwater. 2016. Simi Valley Basin - Characterization and Groundwater Supply Assessment. March 2016.

US Fish and Wildlife Service (USFWS). 2007. Revised Designation of Critical Habitat for the Coastal California Gnatcatcher (Polioptila californica); Final Rule. December 19. Federal Register Vol. 72, No. 243.

US Fish and Wildlife Service. 2016. National Wetlands Inventory, v2, California Wetlands. Accessed May 2016.

US Naval Base Ventura County (US NBVC). 2013. Vegetation Classification and Mapping, Naval Base Ventura County, Point Mugu, California. Digital vegetation map managed through VegCAMP. Accessed January 2016.
US Forest Service (US FS). 2014. Existing Vegetation South Coast, 2002-2010, v2 [ESRI File Geodatabase]. MeClellan, CA. Accessed June 2016.

Ventura County Watershed Protection District (VCWPD) and Aspen Environmental Group. 2013a. Draft Preliminary Jurisdictional Waters/Wetlands Delineation Report for the Virginia Colony Detention Basin Project. March 2013.

Ventura County Watershed Protection District (VCWPD) and Aspen Environmental Group. 2013b. Least Bell's Vireo, Southwestern Willow Flycatcher and California Gnatcatcher Survey Report for the Virginia Colony Detention Basin Project. March 2013.

Wildscape Restoration. 2015. Arundo Removal Feasibility and Water Savings Study. Report prepared for the Ventura County Water and Sanitation Department. January 2015.

Worksheet 1: Assess a GDE's Connection to Groundwater

For each pGDE unit, use the following questions to assess whether the pGDE unit is connected to groundwater.

	Arroyo Simi -Las Posas	Fairview Area Unconfined Aquifer	Areas outside delineated shallow unconfined aquifers
	Yes/No/ Insufficient Data	**Yes/No/ Insufficient Data**	**Yes/No/ Insufficient Data**
General Questions for all Environments			
Is the pGDE underlain by a shallow unconfined or perched aquifer that has been delineated as being part of a Bulletin 118 principal aquifer in the basin?	Yes	No	No
Is the depth to groundwater under the pGDE less than 30 feet?	Yes	No	No
Is the pGDE located in an area known to discharge groundwater (e.g. springs/seeps)?	Yes	No	No
If you answer Yes to any of the above questions, then you likely have a GDE. Stop here. *If you selected No, Insufficient Data, or cannot confidently answer any of the above questions then move onto below questions to infer groundwater dependency.*			
River/Stream Environment			
Is the pGDE located in a portion of a river or stream that is likely a gaining reach?	Yes		
Are water temperatures around the pGDE relatively constant over time, indicating a potential for gaining conditions?			
Are there stable/permanent natural flows detected by stream gauges near the pGDE, indicating a potential for gaining conditions?	Yes (Note: non-native flows)		
Is there still water or flows around the pGDE during summer months?	Yes		
Wetland/Lake Environment			
Is the level of water around the pGDE maintained during extended dry periods without surface water inflow or management?			
Coastal/Estuarine Environment			
For estuarine pGDEs, does the salinity drop below that of seawater in the absence of surface water inputs (e.g. surface runoff or stormwater)?			
Are the isohaline contour lines of the saline wedge relatively constant under a pGDE?			
Is the location of the pGDE consistently associated with known areas of groundwater discharge (e.g. springs or seeps) in terrestrial and/or coastal environments?			
Terrestrial Environment			
Does vegetation in the pGDE remain green and physiologically active during extended dry periods of the year?	Yes		
Does the pGDE have higher evapotranspiration (ET) rates in summer months compared to other nearby vegetation unlikely to be dependent on groundwater?			
If you answered Yes to any of the questions within a specific environment, then you likely have a GDE. If you selected No to all of the questions then you likely do not have a GDE. If you selected Insufficient Data to all of the questions then assume you have a GDE until sufficient data is collected {Refer to Appendix II and Step 6 of the GDE Guidance Framework (Rohde et al., 2017)}.			

Worksheet 2: Ecological Asset Inventory

Ecological Assets	Arroyo Simi - Las Posas
List any locally important, special status, rare, threatened, or endangered plants or animals supported by the GDE	state & federally listed endangered least Bell's vireo, arroyo chub, federally listed threatened and state species of concern California coastal gnatcatcher
Describe whether the GDE provides important or critical habitat for native species (Source- CH, 2016)	California coastal gnatcatcher (Virginia Colony area)
Describe whether any portion of the GDE is a recognized wetland (Sources- NWI, 2016; pGDE, 2016)	417 acres
Describe whether any portion of the GDE part of a protected area, locally-important conservation or wildlife corridor plan (Source: CPAD, 2016)	Open Space: City of Moorpark Arroyo Vista Community Park, 0.8 acres
List any environmental beneficial uses designated in the RWQCB Basin Plan for the surface water found in the groundwater basin	Reach 7 (Downstream of Hitch Road): GWR, WARM, COLD (Potentially), WILD, FRESH Reach 6 (Upstream of Hitch Road): GWR (Intermittent), FRESH (Intermittent), WARM, WILD, RARE
Is the GDE area comprised of > 30% native vegetation? (Source- pGDE, 2016)	yes - 76%

Sources:
CPAD: Greeninfo Network. 2016. California Protected Area Network, 2016b. Oakland, California. http://www.calands.org/.
NWI: US Fish and Wildlife Service. 2016. National Wetlands Inventory, v2, California Wetlands. Accessed May 2016.
CH: U.S. Fish and Wildlife Service, Endangered Species Program, ECOS Joint Development Team. 2016. Critical Habitat Polygons and Lines. Accessed from https://ecos.fws.gov/ecp/report/table/critical-habitat.html in December 2016.
pGDE: The Nature Conservancy, California Department of Fish and Wildlife, California Department of Water Resources. 2017. Potential Groundwater Dependent Ecosystems Database, v0.3.1.

Worksheet 3: Summary of Potential Effects on GDEs

GDE Unit:	**Arroyo Simi - Las Posas**

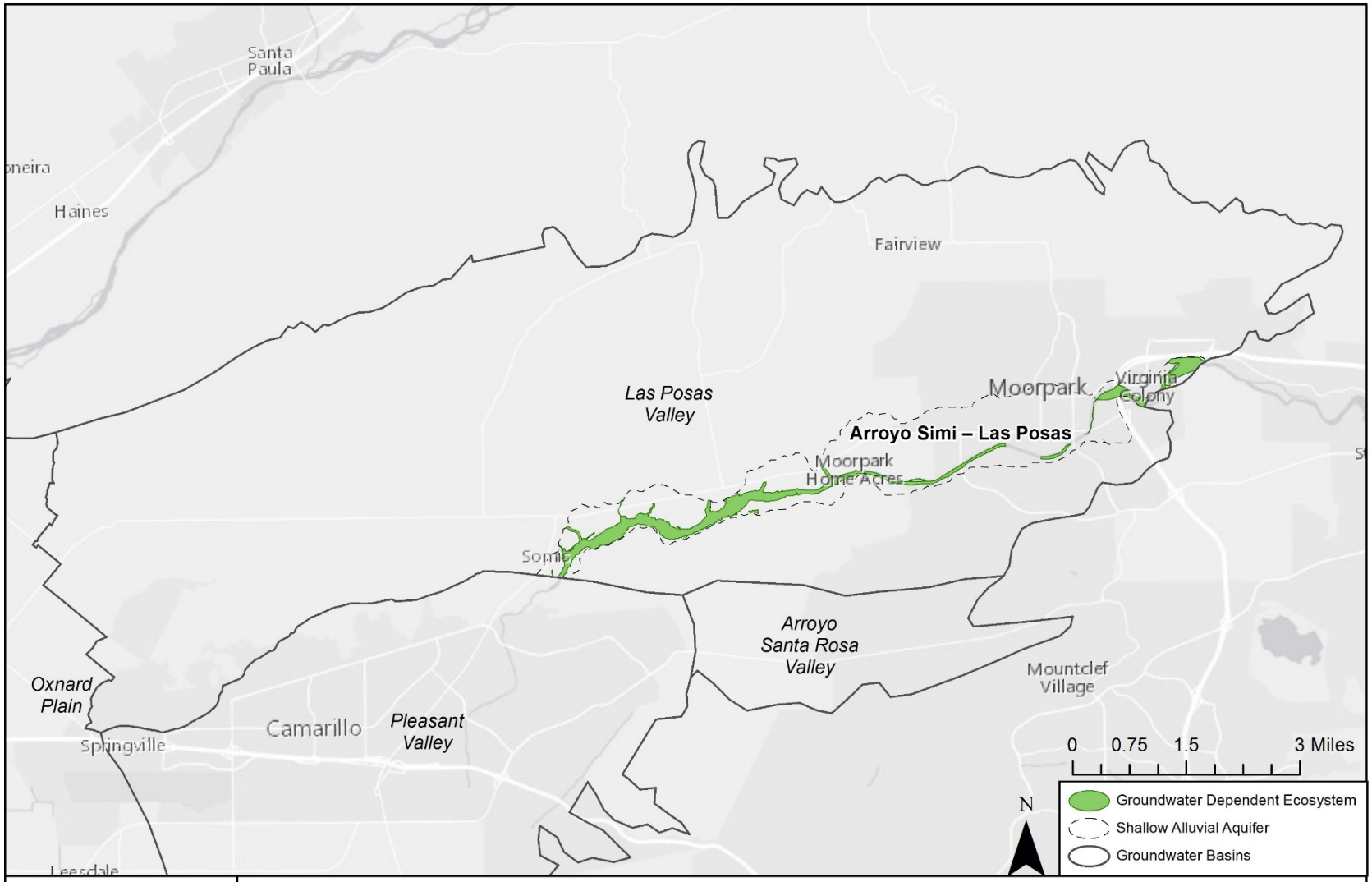
Ecological Assets (Step 1.2.B):

Species Present	**Environmental Beneficial Uses**
[ ] Locally-important	[ ] Aquaculture
[X] Special Status	[X] Cold Freshwater Habitat (Potentially)
[ ] Rare	[ ] Estuarine Habitat
[X] Threatened	[ ] Inland Saline Water Habitat
[X] Endangered	[ ] Marine Habitat
	[ ] Migration of Aquatic Organisms
Habitat	[ ] Preservation of Biological Habitats of Special Significance
	[ ] Special Biological Significance
[ ] Critical Habitat	[X] Rare, Threatened, or Endangered Species (East of Hitch Rd)
[X] Recognized Wetland	[ ] Spawning, Reproduction, and/or Early Development
[ ] Part of a Protected Area	[X] Warm Freshwater Habitat
[ ] Part of locally-important conservation plan	[X] Wildlife Habitat
[ ] Part of a wildlife corridor plan	[X] Other: Groundwater Recharge
	[X] Other: Freshwater Replenishment

Undesirable Results	Lowering Groundwater Levels	Lowering Groundwater Levels	Lowering Groundwater Levels/Surface Water Depletion	Lowering Groundwater Levels/Surface Water Depletion	Lowering Groundwater Levels
Corresponding Sustainability Indicator	Groundwater elevation	Groundwater elevation	Groundwater elevation	Groundwater elevation	Groundwater elevation
Hydrologic Indicator (Step 2.1)	Depth to groundwater	Depth to groundwater	Depth to groundwater	Depth to groundwater	Depth to groundwater
Area	Virginia Colony (Eastern Boundary to RR track)	Losing Reach (RR track to Arroyo Vista Community Park)	Gaining Reach (Arroyo Vista Community Park to Santa Rosa Drive)	Gaining Reach (Santa Rosa Drive to Moor Park WWTP Ponds)	Losing Reach (Balcom Canyon Road to La Cumbra Road)
Baseline Average (Step 2.2A)	02N19W03A001S: 577 ft MSL At well: 6.1 ft bgs At GDE RP: 3 ft bgs	02N19W09E01: 485 ft MSL At well: 20 ft bgs At GDE RP: 15 ft bgs	02N19W07K04 (2015-2016) Average: 433 ft MSL At well: 12 ft bgs At GDE RP: 7 ft bgs Range: 0 ft 02N19W07G01 (2014-2016) Average: 436 ft MSL At well: 16 ft bgs At GDE RP: 4 ft bgs	02N20W12MMW1 (1996-2015) Average: 370 ft MSL At well: 21 ft bgs At GDE RP: 20 ft bgs 02N20W12MMW2 (1996-2012) Average: 333 ft MSL At well: 24 ft bgs At GDE RP: 6.5 ft bgs 02N20W12MMW3 (1996-2012) Average: 345.6 ft MSL At well: 41 ft bgs At GDE RP: 6 ft bgs	02N20W09Q08 (2014-2016) Average: 272 ft MSL At well: 38 ft bgs At GDE RP: 3 ft bgs 02N20W16A004S (1992-1999) Average: 252 ft MSL At well: 33 ft bgs At GDE RP: 28 ft bgs
Baseline Range (Step 2.2A)	02N19W03A001S Range: 3.5 ft 574.9 -578.4 ft MSL	02N19W09E01 Range: 16 ft (based on 02N19W08G003S & 02N19W08H002S) 479 -495 ft MSL	0 ft range for 2015-2016	02N20W12MMW1 (1996-2015) Range: 9 ft 367-376 ft MSL 02N20W12MMW2 (1996-2012) Range: 12 ft 328-340 ft MSL 02N20W12MMW3 (1996-2012) Range: 14.5 ft 337.5-352 ft MSL	02N20W09Q08 Range: 5 ft 270-275 ft MSL 02N20W16A004S Range: 12 ft 246-258 ft MSL
Description of Adverse Impacts to GDE (Step 2.3)					
Risk to Changing Groundwater Conditions (Step 2.2.C)					
Risk to Changing Groundwater Conditions (Step 2.2C)	*Medium Risk*	*Medium Risk*	*Medium Risk*	*Medium Risk*	*Medium Risk*

Notes:

Other Undesirable Results (Reduction of Groundwater Storage, Seawater Intrusion, Degraded Water Quality, Land Subsidence) are not considered for the GDE.
Wells located outside GDE have elevation data adjusted for ground surface elevation within riparian habitat



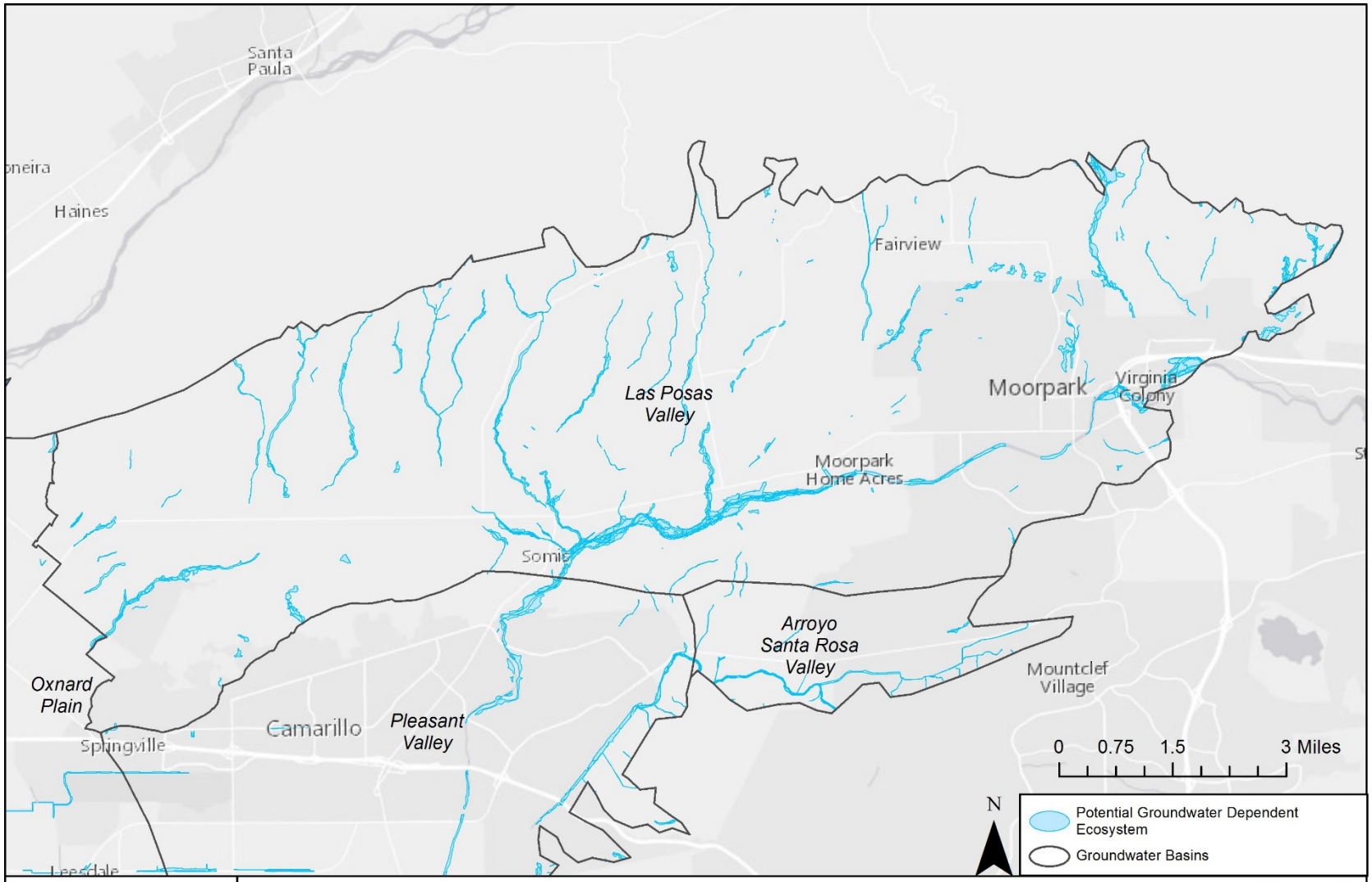
The Nature Conservancy

Source: pGDE-2016, NWI- 2016, CalVeg- 2014, VegCamp- 2015.

Figure 1
Groundwater Dependent Ecosystem (GDE) units identified in the Las Posas Valley Groundwater Basin

Assessment of Groundwater Dependent Ecosystems for the Las Posas Valley Basin Groundwater Sustainability Plan – DRAFT

May 1, 2017. N:\Projects\Groundwater\sites\VenturaCounty\mxds\pGDEs_FoxCanyon_MappingChanges_Cori_LasPosas.mxd

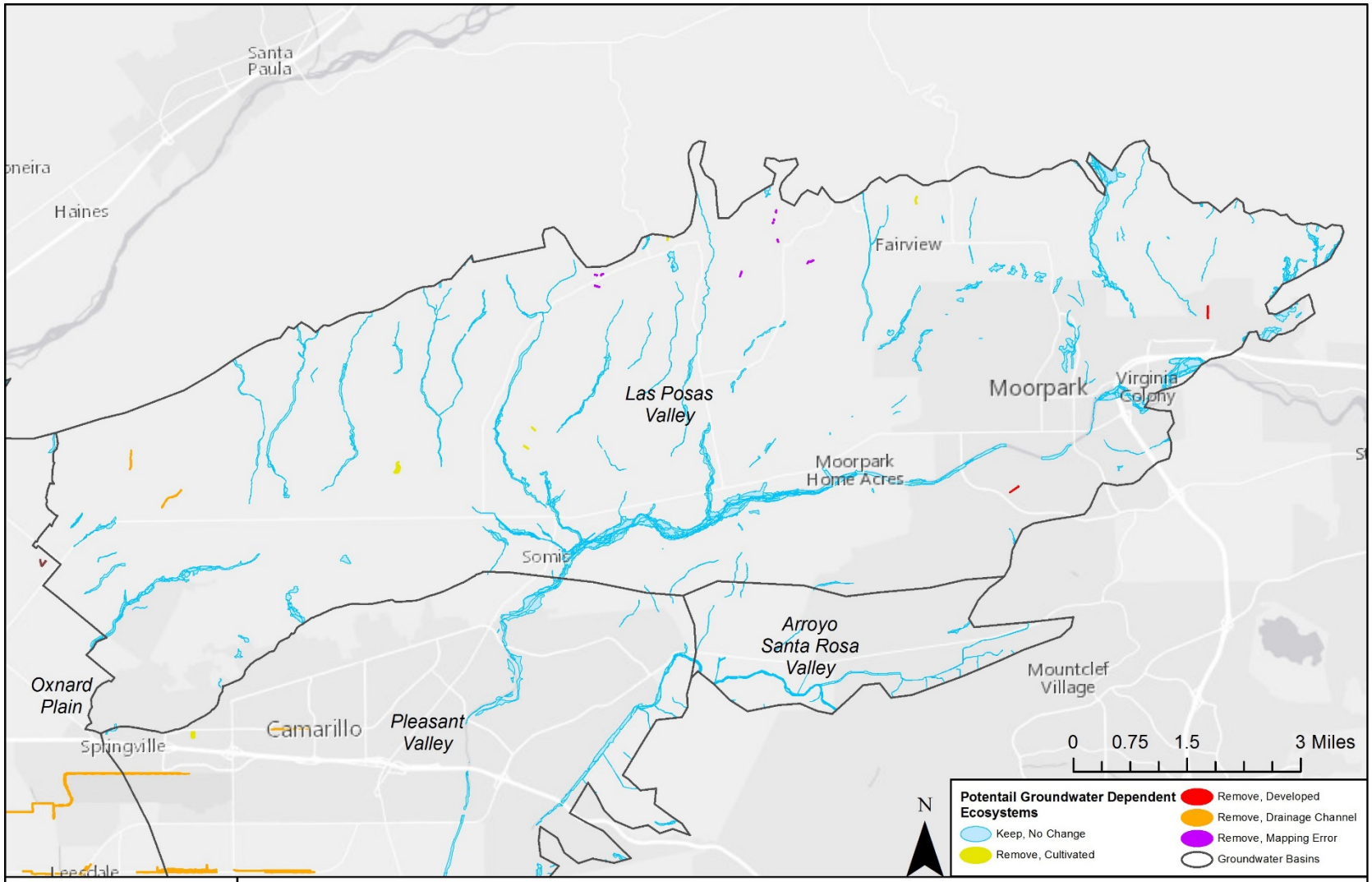


The Nature Conservancy

Source: pGDE-2016, NWI- 2016, CalVeg- 2014, VegCamp- 2015.

Figure 2
Statewide Potential Groundwater Dependent Ecosystem (GDE) Mapping of Las Posas Valley Groundwater Basin

May 1, 2017. N:\Projects\Groundwater\sites\VenturaCounty\mxds\pGDEs_FoxCanyon_MappingChanges_Cori_LasPosas.mxd

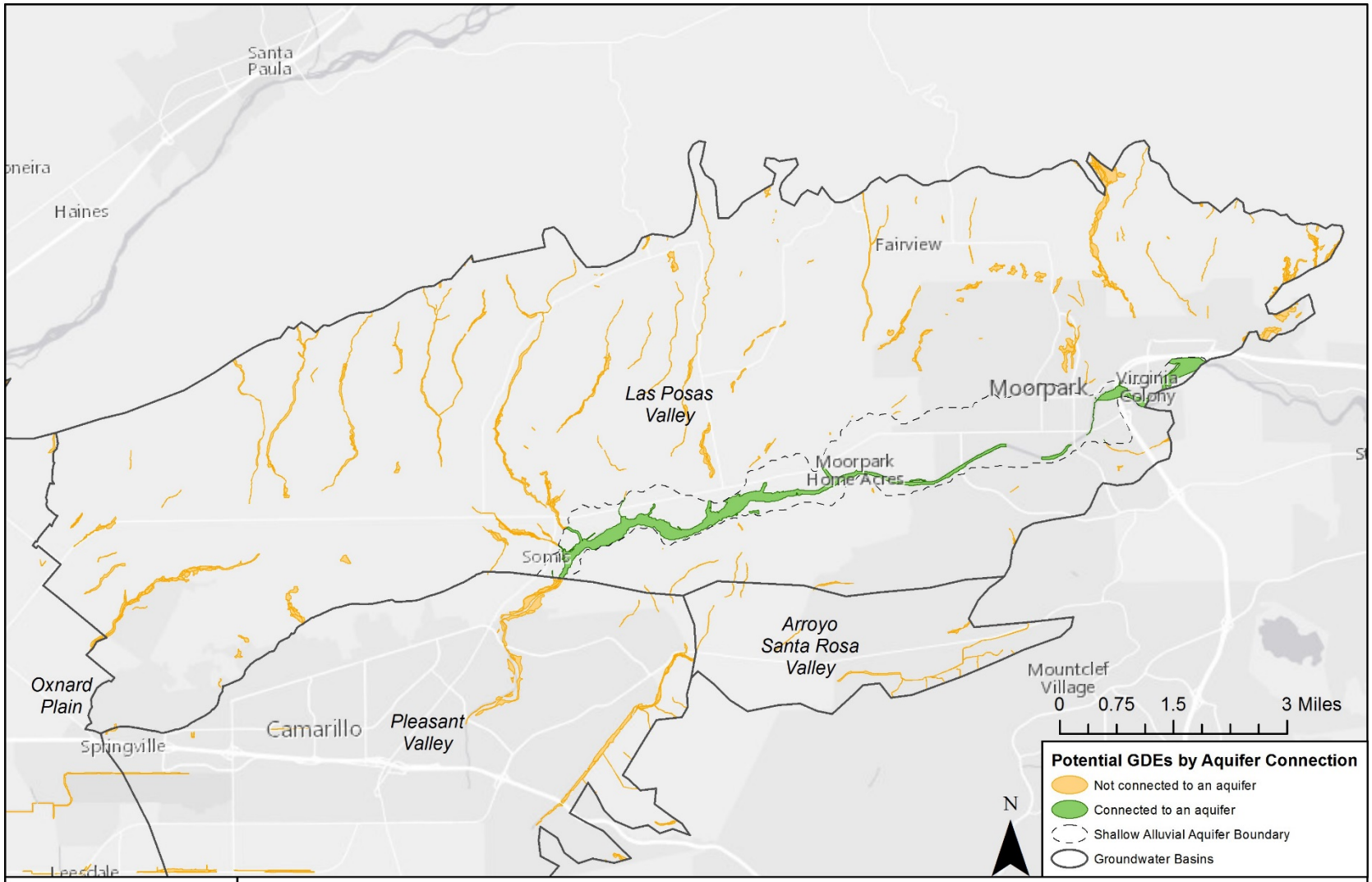


The Nature Conservancy

Source: pGDE-2016, NWI- 2016, CalVeg- 2014, VegCamp- 2015.

Figure 3
Groundtruthing of Potential Groundwater Dependent Ecosystems (GDE) in Las Posas Valley Groundwater Basin

May 1, 2017. N:\Projects\Groundwater\sites\VenturaCounty\mxds\pGDEs_FoxCanyon_MappingChanges_Cori_LasPosas.mxd



The Nature Conservancy

Source: pGDE-2016, NWI- 2016, CalVeg- 2014, VegCamp- 2015.

Figure 4

Evaluation of Hydrologic Connection of Potential Groundwater Dependent Ecosystems (GDE) in Las Posas Valley Groundwater Basin

May 1, 2017. N:\Projects\Groundwater\sites\VenturaCounty\mxds\pGDEs_FoxCanyon_MappingChanges_Cori_LasPosas.mxd

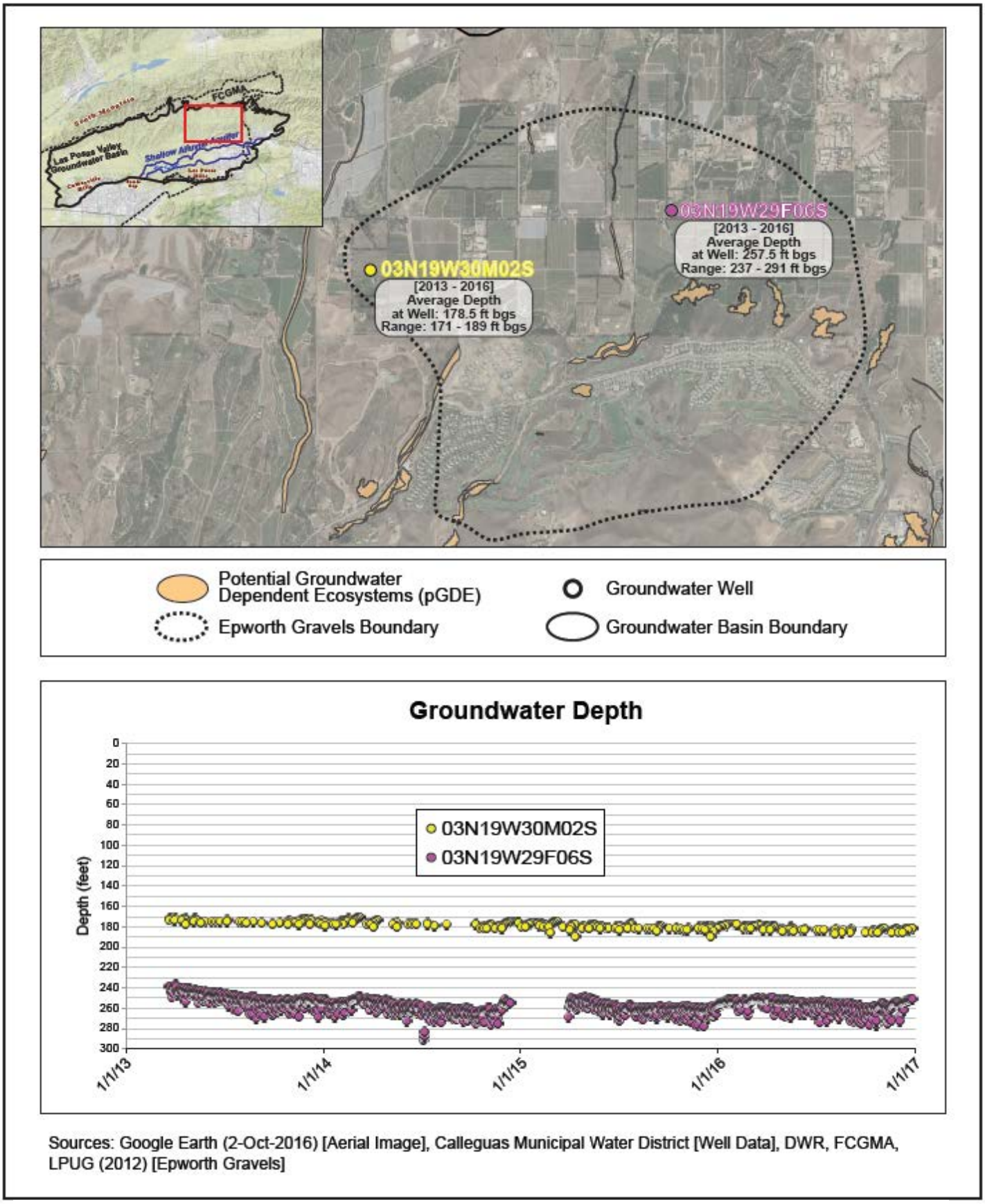
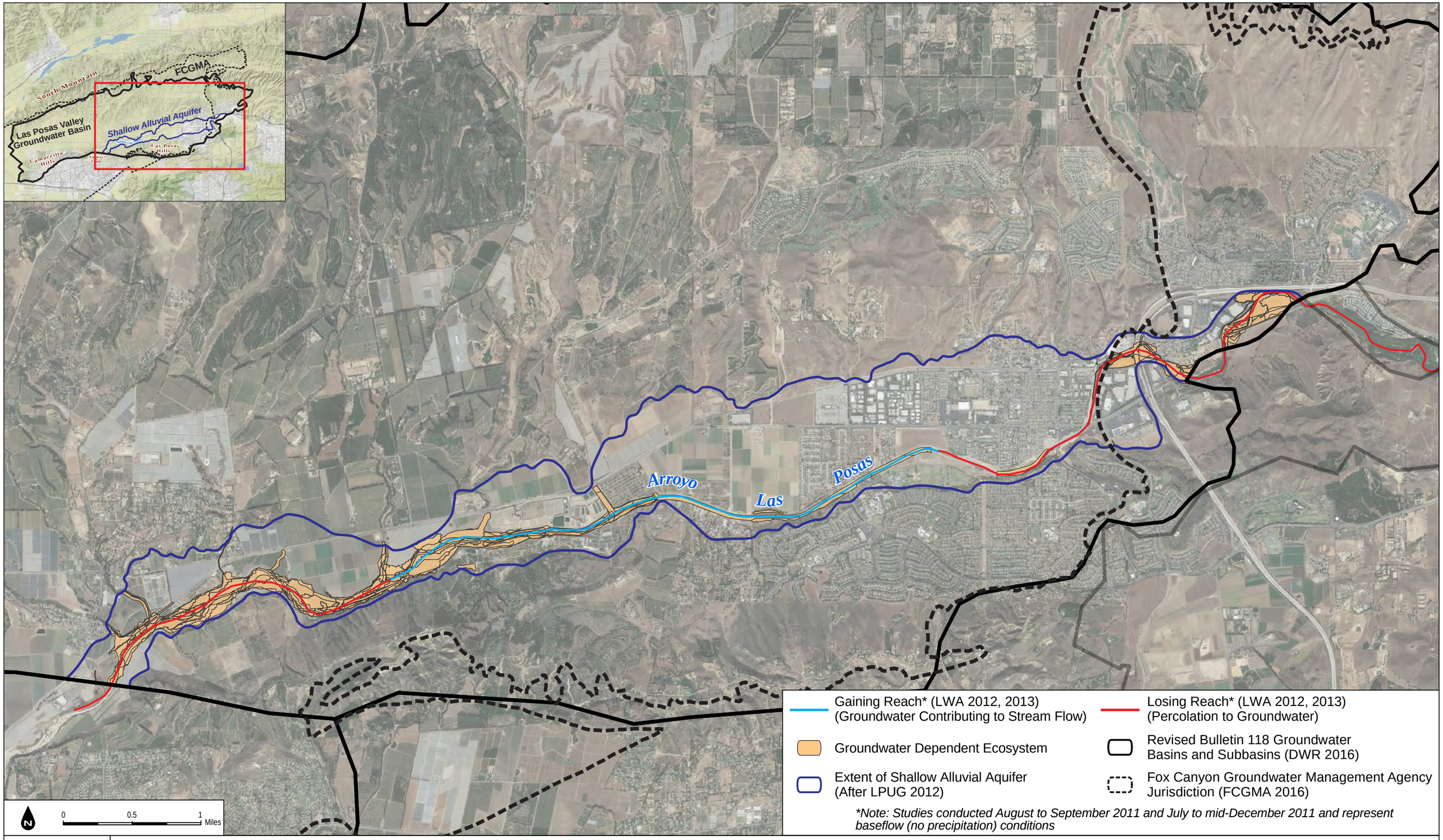


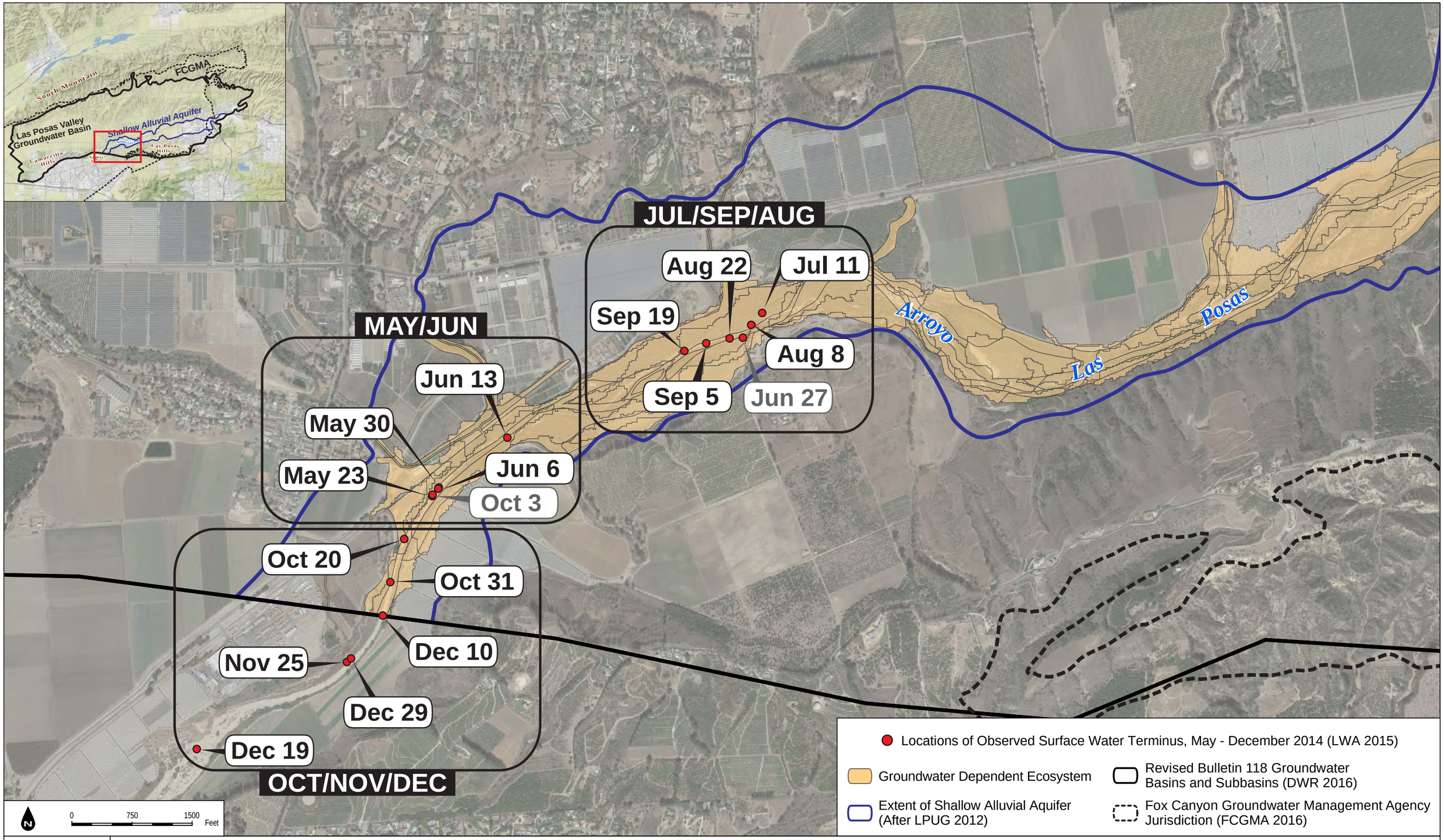
Figure 5. Depth to Groundwater in the Epsworth Gravels.



SOURCE: DWR; Ventura County; FCGMA; Las Posas Users Group (2012) Las Posas Basin-Specific Groundwater Management Plan; Larry Walker Associates (2012) Phase I Study: Surface Flow and Groundwater Recharge in Arroyo Las Posas; Larry Walker Associates (2013) DRAFT Data Report for the Phase II Program for Long-term Monitoring of Flow and Recharge in Arroyo Las Posas

FIGURE 6

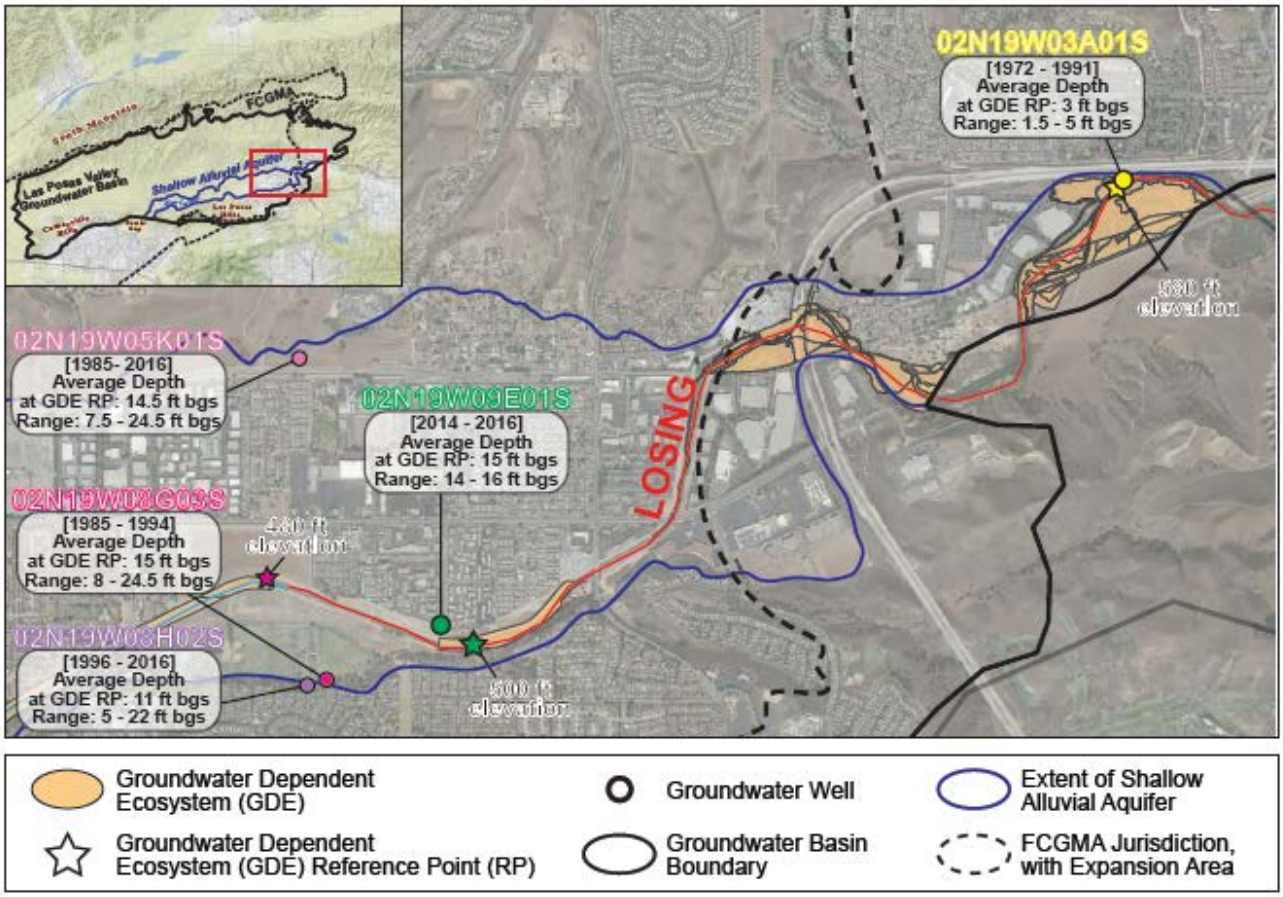
Gaining and Losing Reaches of Arroyo Simi-Las Posas

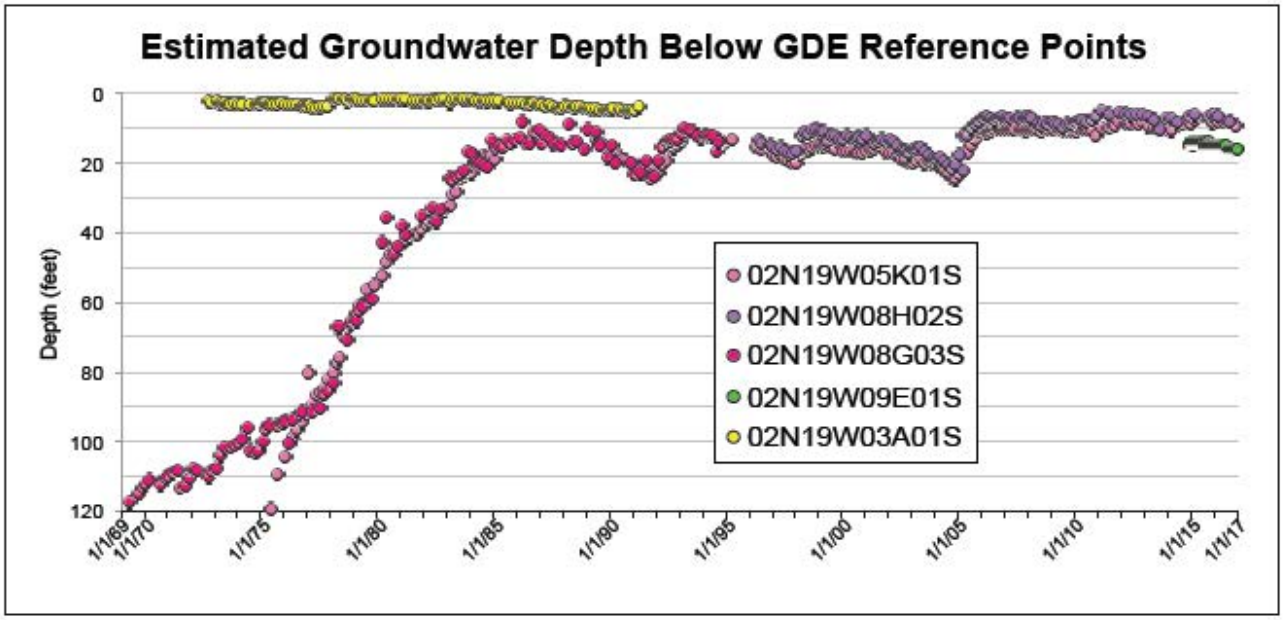


SOURCE: DWR; Ventura County; FCGMA; Las Posas Users Group (2012) Las Posas Basin-Specific Groundwater Management Plan; Larry Walker Associates (2015) Results of Water Quality Sampling Events and Tracking of the Surface Flow Terminus in Arroyo Simi/Las Posas

FIGURE 7

Extent of Arroyo Simi-Las Posas Perennial Stream





Sources: Google Earth (2-Oct-2016) [Aerial Image], DWR Water Data Library [-5K1, -8H2, -8G3, -3A1 Well Data], Ventura County/ CMWD [-9E1 Well Data], DWR, FCGMA, LPUG (2012) [Shallow Aquifer], LWA (2012, 2013) [Gaining/Losing Reaches]

Figure 8. Depth to groundwater in the eastern losing reach of the Arroyo Simi- Las Posas GDE.

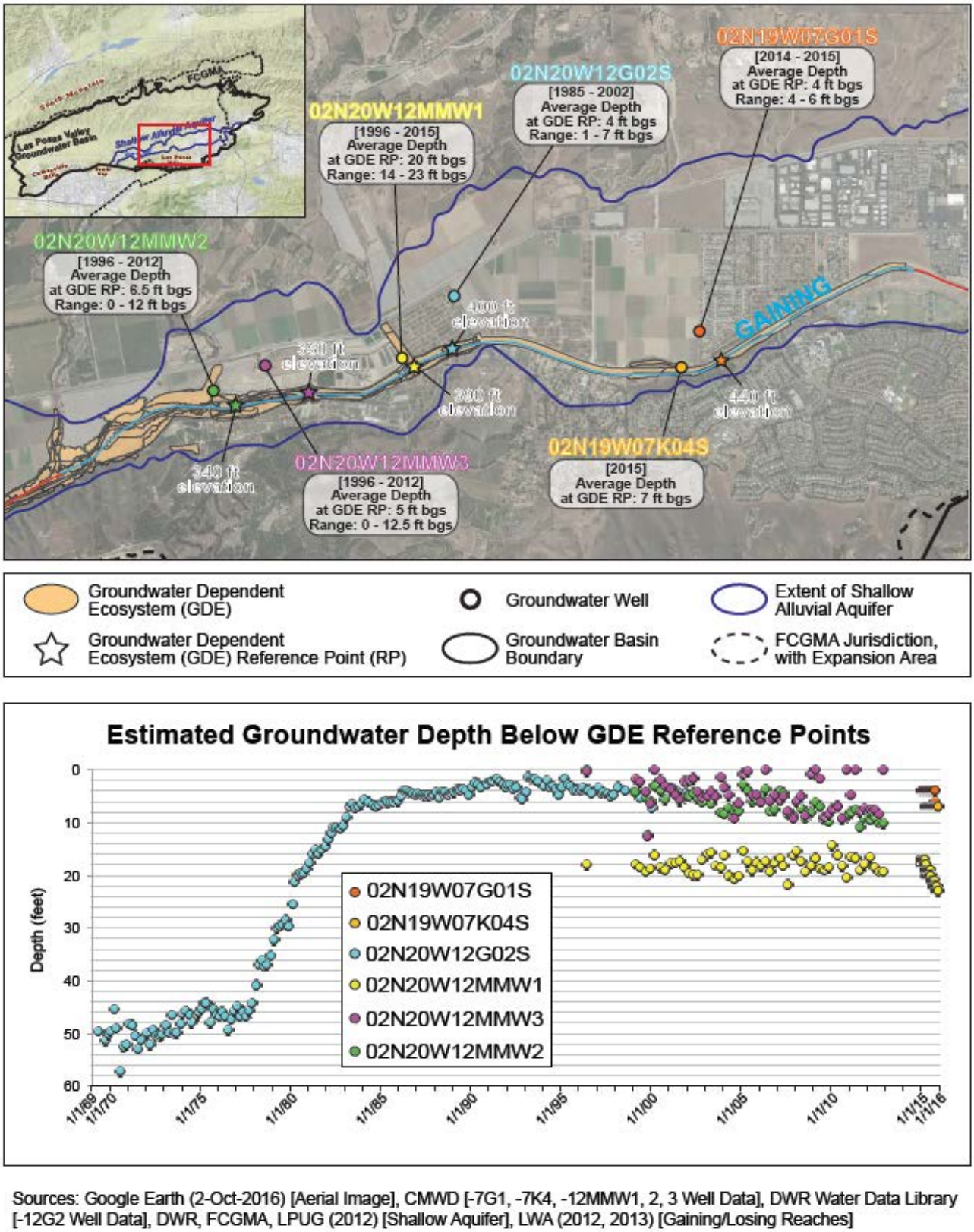


Figure 9. Depth to groundwater in the central gaining reach of the Arroyo Simi- Las Posas GDE.

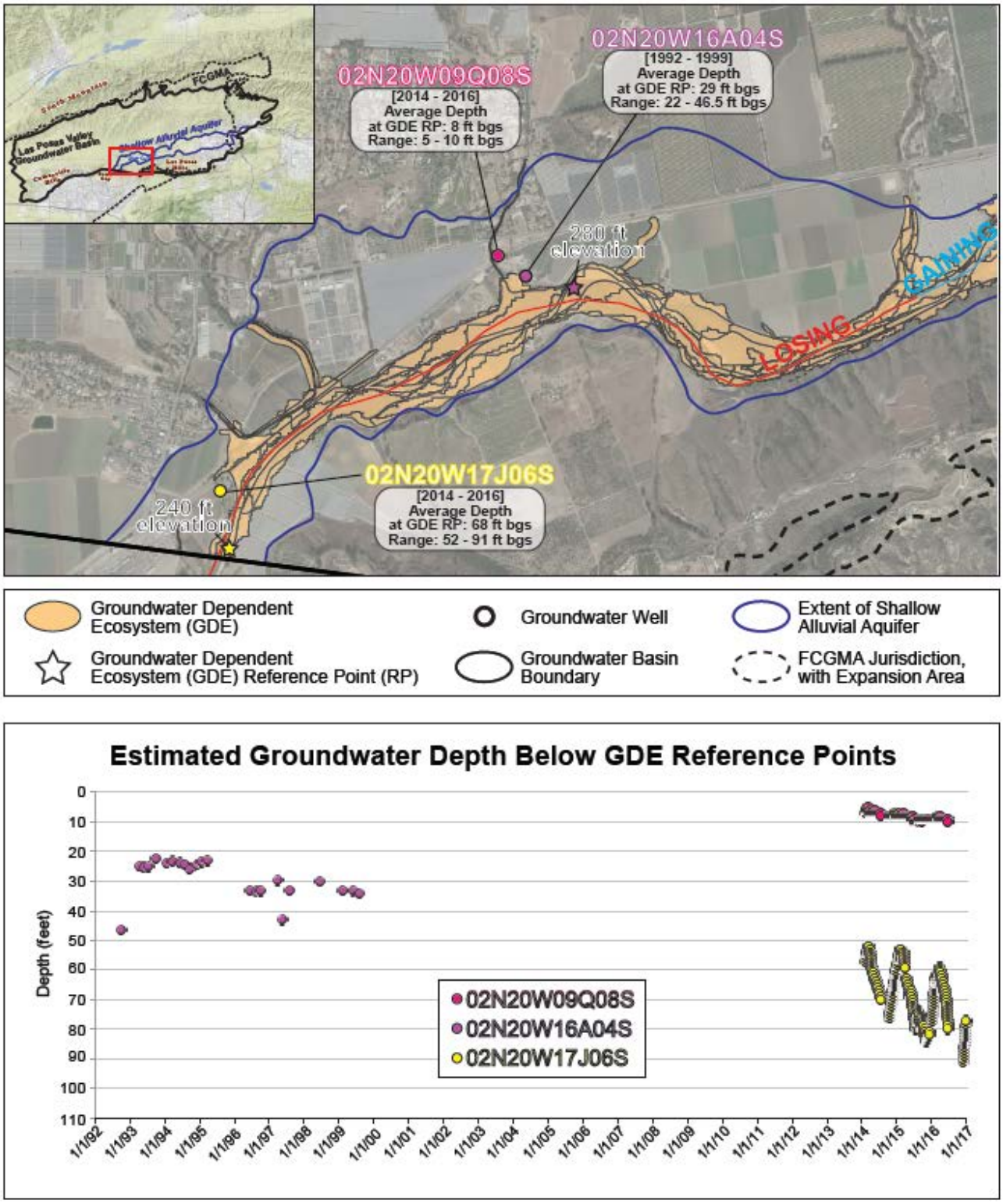
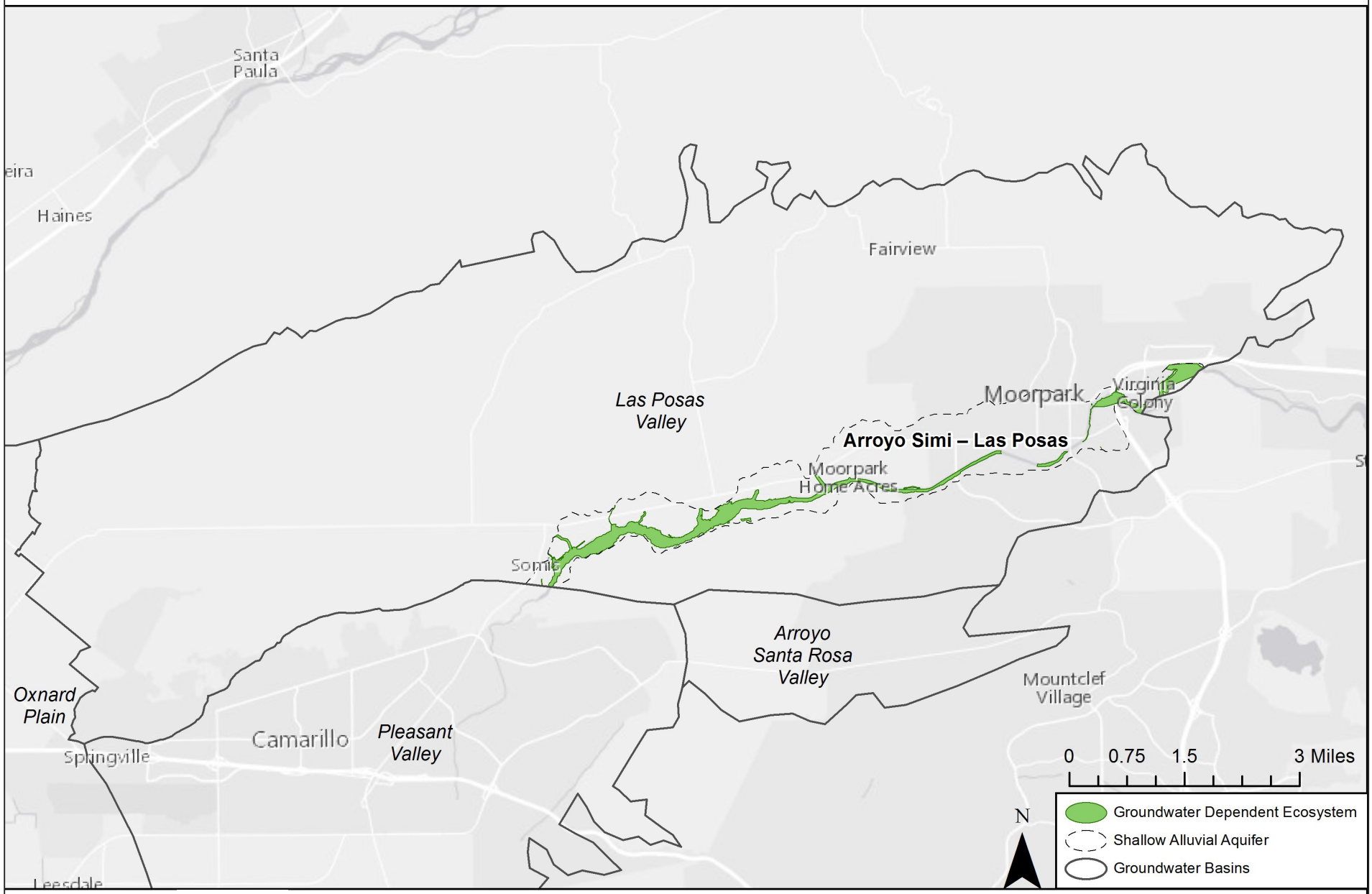


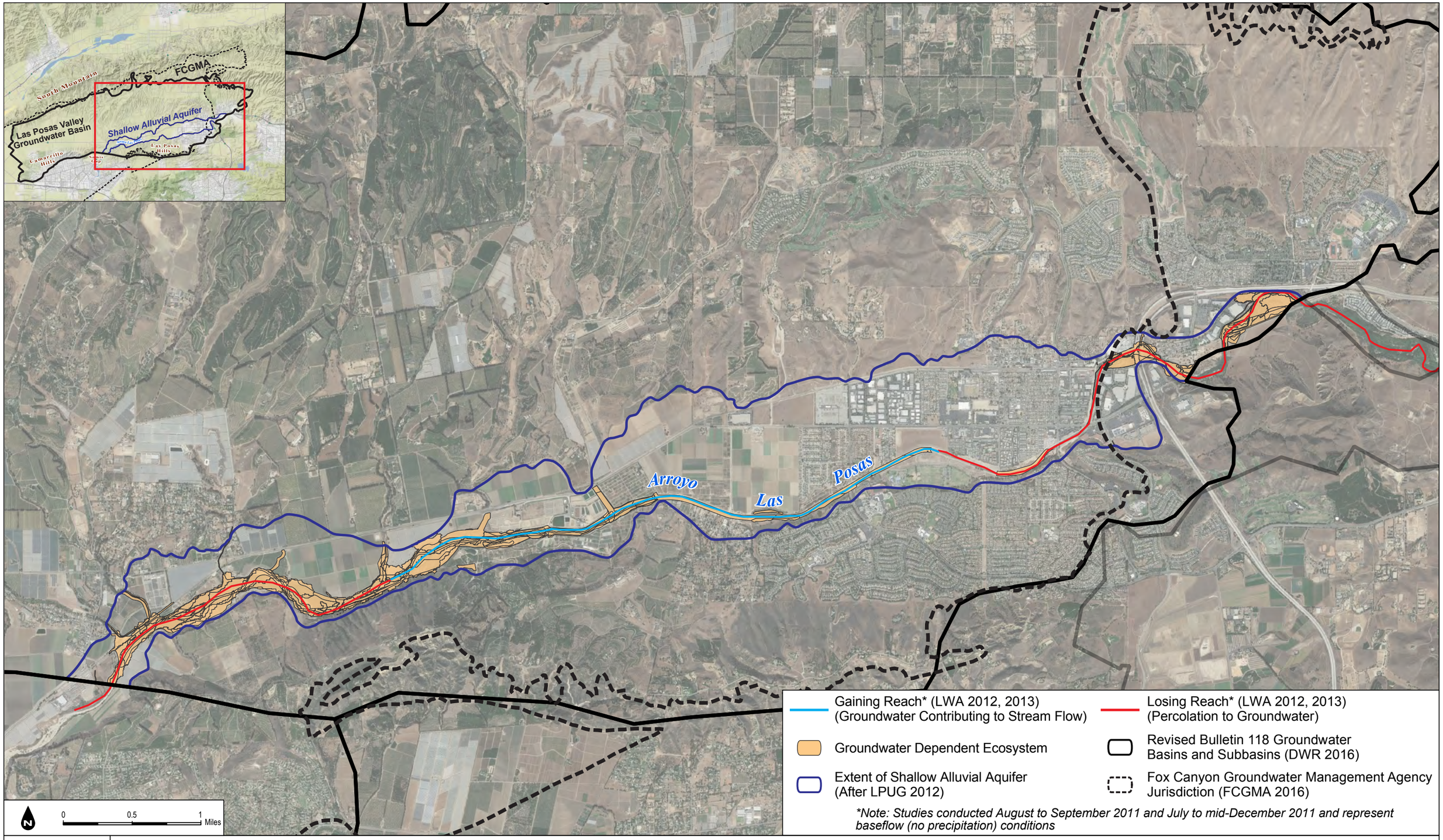
Figure 10. Depth to groundwater in the western losing gaining reach of the Arroyo Simi-Las Posas GDE.



DUDEK

FIGURE 2-38

Potential Groundwater Dependent Ecosystem: Arroyo Las Posas

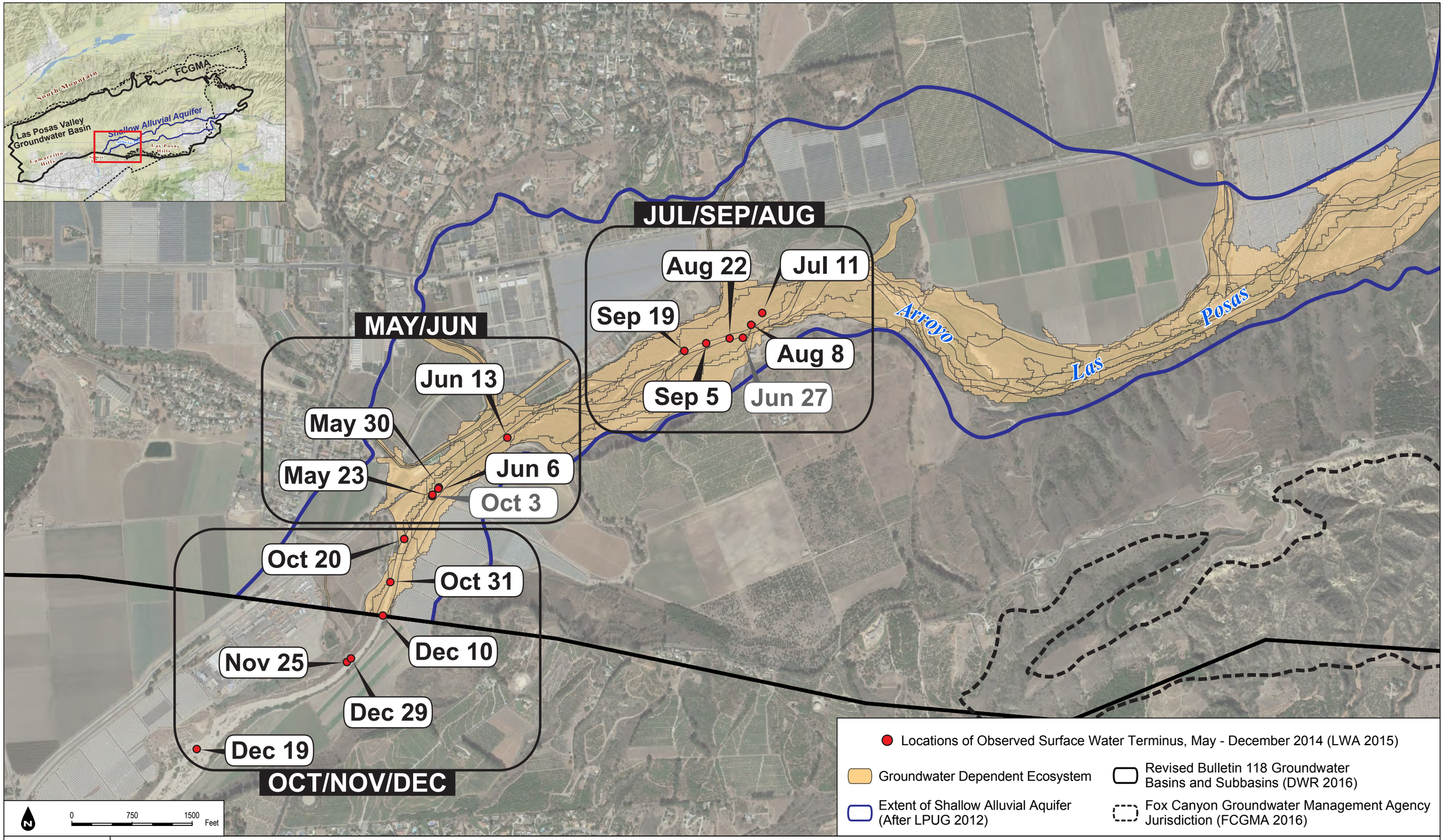


SOURCE: DWR; Ventura County; FCGMA; Las Posas Users Group (2012) Las Posas Basin-Specific Groundwater Management Plan; Larry Walker Associates (2012) Phase I Study: Surface Flow and Groundwater Recharge in Arroyo Las Posas; Larry Walker Associates (2013) DRAFT Data Report for the Phase II Program for Long-term Monitoring of Flow and Recharge in Arroyo Las Posas

KEAR GROUNDWATER

FIGURE 6

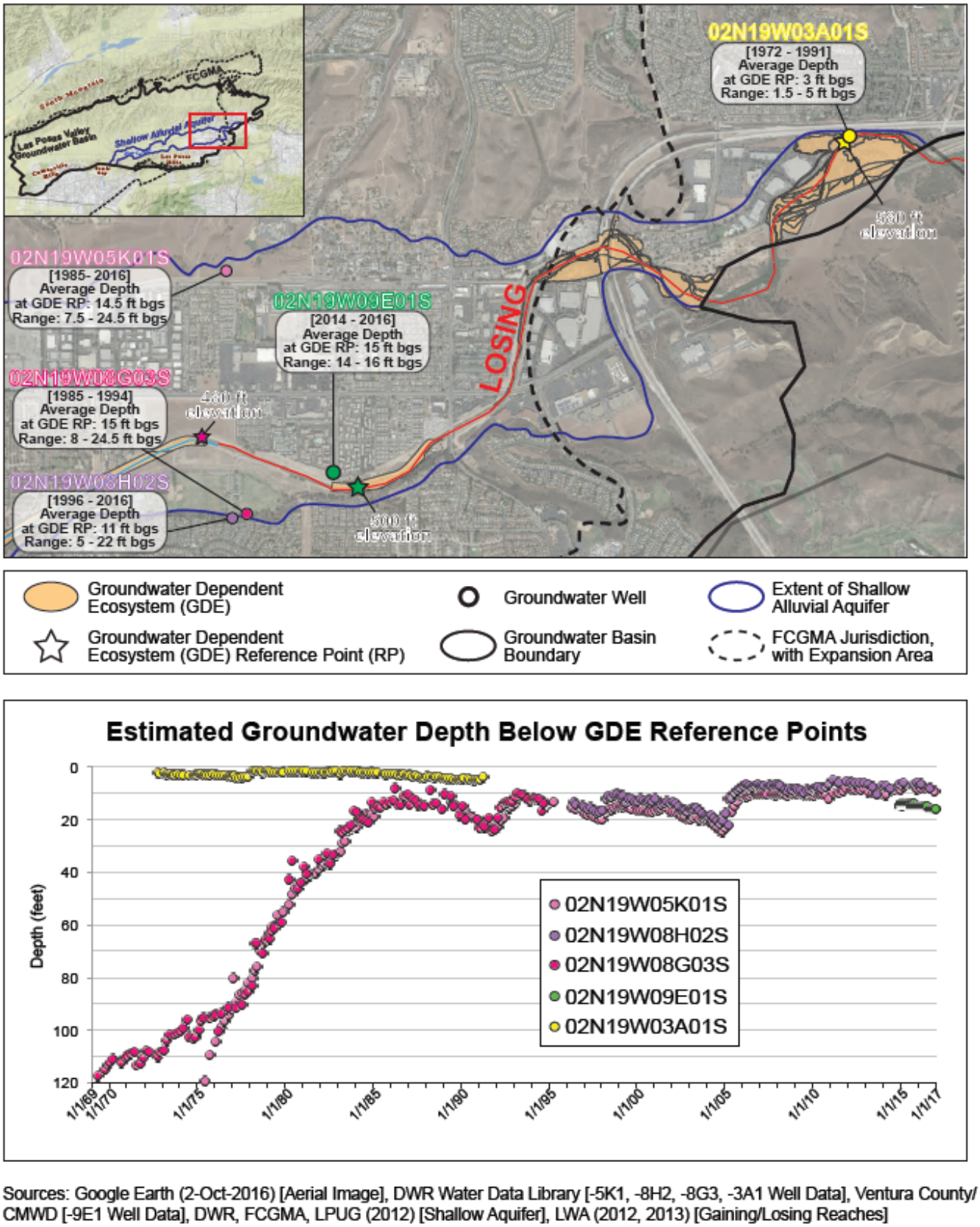
Gaining and Losing Reaches of Arroyo Simi-Las Posas



SOURCE: DWR; Ventura County; FCGMA; Las Posas Users Group (2012) Las Posas Basin-Specific Groundwater Management Plan; Larry Walker Associates (2015) Results of Water Quality Sampling Events and Tracking of the Surface Flow Terminus in Arroyo Simi/Las Posas

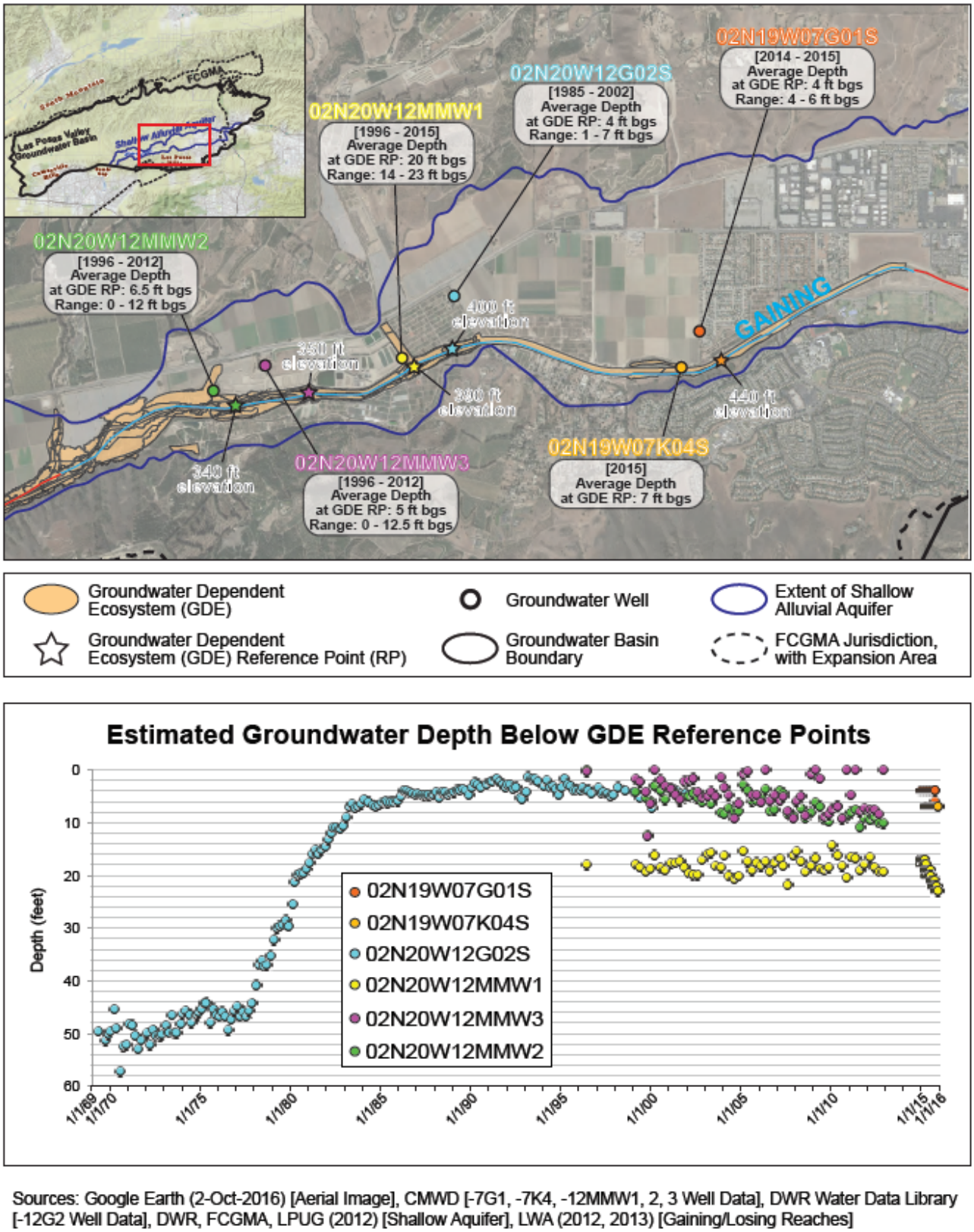
FIGURE 7

Extent of Arroyo Simi-Las Posas Perennial Stream



Sources: Google Earth (2-Oct-2016) [Aerial Image], DWR Water Data Library [-5K1, -8H2, -8G3, -3A1 Well Data], Ventura County/ CMWD [-9E1 Well Data], DWR, FCGMA, LPUG (2012) [Shallow Aquifer], LWA (2012, 2013) [Gaining/Losing Reaches]

Figure 4. Depth to groundwater in the eastern losing reach of the Arroyo Simi- Las Posas GDE.



Sources: Google Earth (2-Oct-2016) [Aerial Image], CMWD [-7G1, -7K4, -12MMW1, 2, 3 Well Data], DWR Water Data Library [-12G2 Well Data], DWR, FCGMA, LPUG (2012) [Shallow Aquifer], LWA (2012, 2013) [Gaining/Losing Reaches]

Figure 5. Depth to groundwater in the central gaining reach of the Arroyo Simi- Las Posas GDE.

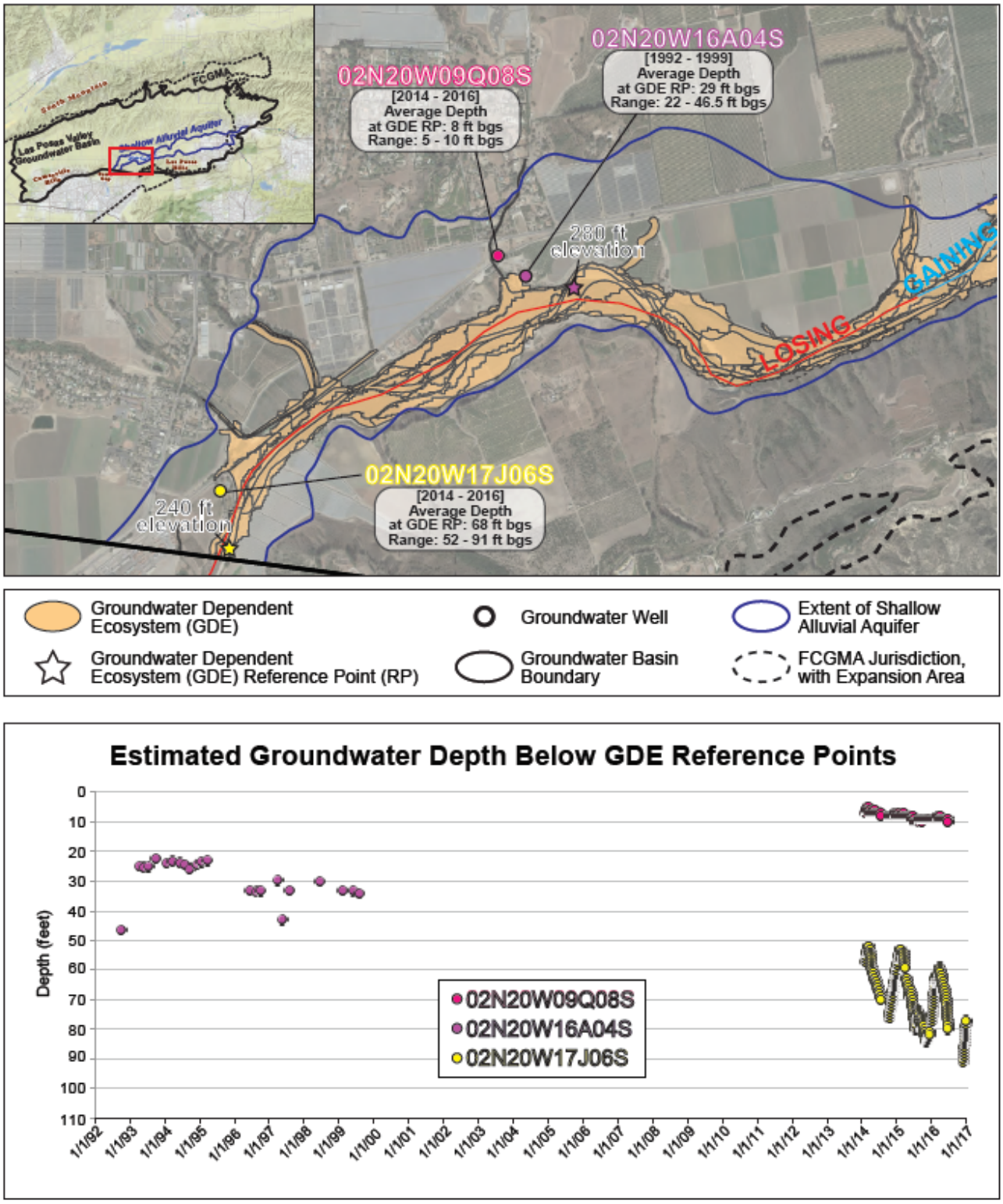


Figure 6 Depth to groundwater in the western losing gaining reach of the Arroyo Simi-Las Posas GDE.