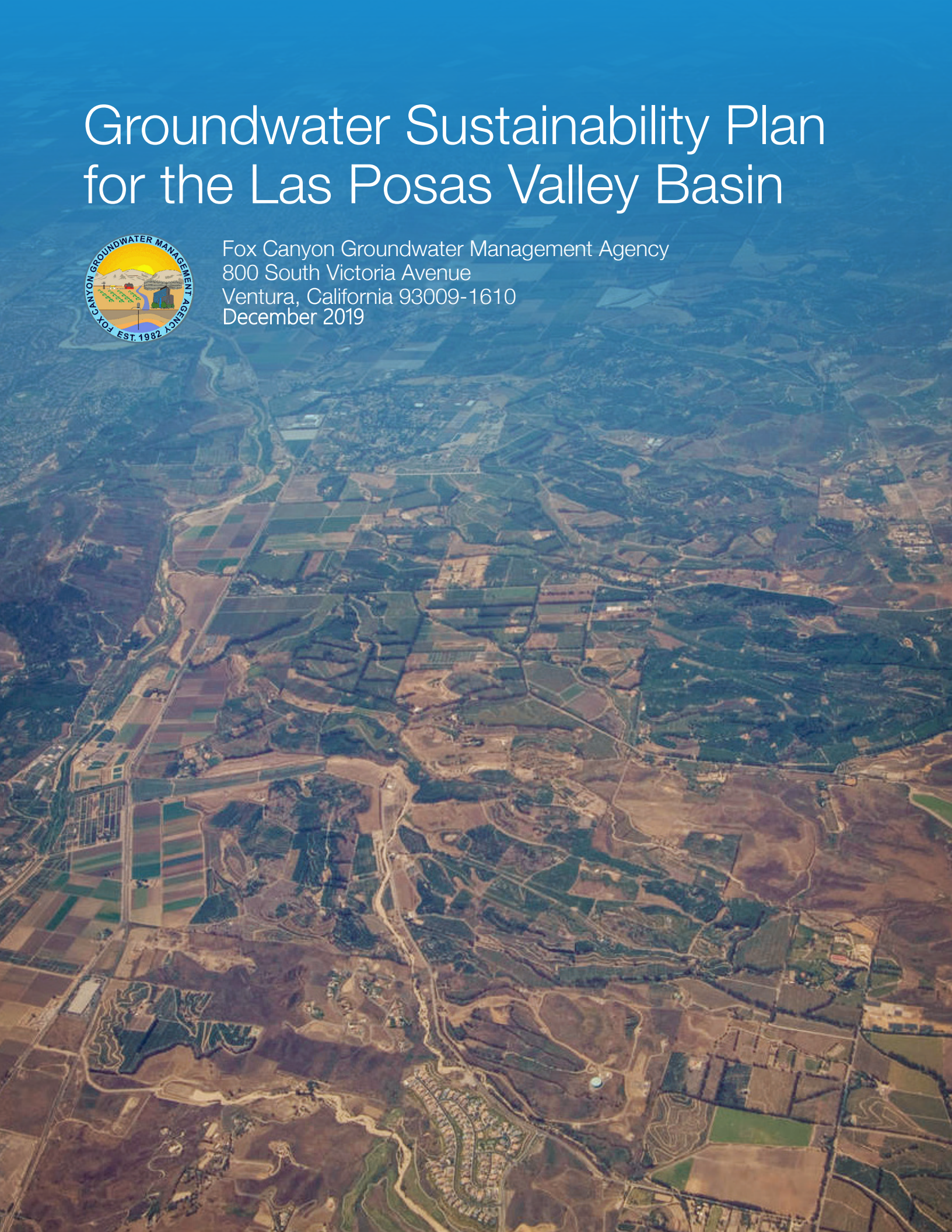
Groundwater Sustainability Plan for the Las Posas Valley Basin

Fox Canyon Groundwater Management Agency
800 South Victoria Avenue
Ventura, California 93009-1610
December 2019



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Board of Directors
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Subject: Groundwater Sustainability Plan for the Las Posas Valley Basin

Dear Board of Directors:

Dudek is pleased to submit this Groundwater Sustainability Plan (GSP) for the Las Posas Valley Basin to the Fox Canyon Groundwater Management Agency. This GSP was prepared this in accordance with California Code of Regulations, Title 23. Water, Division 2. Department of Water Resources, Chapter 1.5. Groundwater Management, Subchapter 2. Groundwater Sustainability Plans.

Respectfully Submitted,

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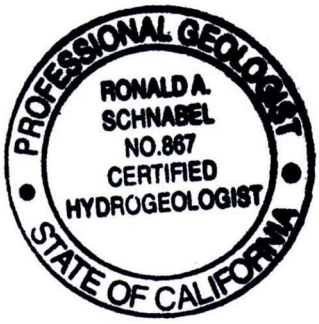

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
ADF	average daily flow
AEA	Annual Efficiency Allocation
AF	acre-feet
AFY	acre-feet per year
ASR	Aquifer Storage and Recovery
AWMP	Agricultural Water Management Plan
BCM	Basin Characterization Model
BMO	Basin Management Objective
cfs	cubic feet per second
CIMIS	California Irrigation Management Information System
CMWD	Calleguas Municipal Water District
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ELP	East Las Posas Subbasin
ELPMA	East Las Posas Management Area
EMSA	Eastern Management Sub-Area
FCA	Fox Canyon Aquifer
FCGMA	Fox Canyon Groundwater Management Agency
GCA	Grimes Canyon Aquifer
GDE	groundwater-dependent ecosystem
GREAT	Groundwater Recovery Enhancement and Treatment
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
IE	irrigation efficiency
LAS	Lower Aquifer System
LPGMP	Las Posas Basin-Specific Groundwater Management Plan
LPUG	Las Posas Users Group
LPV	Las Posas Valley
LPVB	Las Posas Valley Basin
LWA	Larry Walker & Associates
mgd	million gallons per day
mg/L	milligrams per liter
MWD	Metropolitan Water District of Southern California
MWTP	Moorpark Wastewater Treatment Plant
PVB	Pleasant Valley Basin
SCAG	Southern California Association of Governments
SGMA	Sustainable Groundwater Management Act
SR	State Route
SVWQCP	Simi Valley Water Quality Control Plant
SWP	State Water Project
TAG	Technical Advisory Group
UAS	Upper Aquifer System

Acronym/Abbreviation	Definition
UWCD	United Water Conservation District
UWMPA	Urban Water Management Planning Act
VCWD	Ventura County Waterworks District
VCWPD	Ventura County Watershed Protection District
WLP	West Las Posas Subbasin
WLPMA	West Las Posas Management Area
WMSA	Western Management Sub-Area
WQCP	Water Quality Control Plant
WQO	Water Quality Objective

EXECUTIVE SUMMARY

The Fox Canyon Groundwater Management Agency (FCGMA, or the Agency), has developed this Groundwater Sustainability Plan (GSP) for the Las Posas Valley Basin (LPVB; DWR Basin 4-008) in compliance with the 2014 Sustainable Groundwater Management Act (SGMA) (California Water Code, Section 10720 et seq.). FCGMA is one of three Groundwater Sustainability Agencies (GSAs) in the LPVB. The other two GSAs are the Camrosa Water District GSA–Las Posas Valley and the Las Posas Valley Outlying Areas GSA. This GSP is the sole GSP prepared for the LPVB, and covers the entire LPVB, including all areas of the LPVB outside of FCGMA's jurisdiction. The purpose of this GSP is to define the conditions under which the groundwater resources of the entire LPVB, which support agricultural, municipal and industrial, and environmental uses, will be managed sustainably in the future.

Although the California Department of Water Resources (DWR) has defined the LPVB as a single groundwater basin, the western and eastern parts of the basin are hydraulically separated from each other by the Somis Fault, a geologic feature that inhibits groundwater flow across it. As a result, groundwater conditions on the west side of the fault in the Fox Canyon Aquifer and Grimes Canyon Aquifer, two primary aquifers in the LPVB, differ from conditions on the east side of the fault. Furthermore, the Epworth Gravels Aquifer, located on the east side of the fault is hydrologically separated from the Fox Canyon Aquifer and Grimes Canyon Aquifer. Hydrologic differences in the controls on, and responses to, both recharge and groundwater production necessitate the definition of three separate management areas in the LPVB. These three management areas are the West Las Posas Management Area (WLPMA), the East Las Posas Management Area (ELPMA), and the Epworth Gravels Management Area. The hydrologic conditions, sustainable yield, and sustainability criteria are discussed and defined by management area throughout this GSP.

Historical groundwater production in the LPVB has resulted in chronic declines in groundwater levels and loss of groundwater in storage in parts of each of the three management areas. In the WLPMA, the average rate of groundwater production between 2015 and 2017 was approximately 14,000 acre-feet per year (AFY). In the ELPMA and the Epworth Gravels Management Area, the average rate of groundwater production between 2015 and 2017 was approximately 20,500 AFY and 1,500 AFY, respectively. Numerical groundwater simulations indicate that if these production rates were carried into the future, groundwater elevations in each of the management areas of the LPVB would not recover during multi-year cycles of drought and recovery.

In order to determine the sustainable yield of each management area, combinations of projects and management actions were explored to estimate the rate of groundwater production that would prevent chronic declines in groundwater elevation and ongoing loss of groundwater storage in the future. Additionally, in the WLPMA, the numerical groundwater model simulations were used to

assess the influence of groundwater conditions on the adjacent Oxnard Subbasin. In the ELPMA, numerical groundwater simulations were also used to assess zones of the Fox Canyon Aquifer that are most prone to conversion from confined to unconfined conditions.[1] The rate of groundwater production that avoids chronic water level declines, loss of storage, potential land subsidence, and impacts to adjacent basins is referred to as the sustainable yield for each management area.

With the currently available projects and management actions, the sustainable yield of the WLPMA is approximately 12,500 AFY, with an uncertainty estimate of ±1,200 AFY (Table ES-1). In the ELPMA, the total sustainable yield (including the Epworth Gravels Management Area) is estimated to be 17,800 AFY ±2,300 AFY. For the Epworth Gravels Management Area only, the sustainable yield is estimated to be approximately 1,300 AFY. Except for the Epworth Gravels Management Area, both the historical (1985–2015) and recent (2015–2017) groundwater production rates exceeded the upper end of the future sustainable yield estimates (Table ES-1).

Table ES-1
Sustainable Yield Estimates

Period	Management Area	Sustainable Yield (AFY)	Approximate Average Pumping During the Period (AFY)
Historical 1985 to 2015 (based on GSP Regulation Section 354.18[b][5])	WLPMA	10,000 to 11,000	15,400
	ELPMA	17,000 to 19,000	19,800
	Epworth Gravels	About 1,300	1,300
Average groundwater pumping during the 2015–2017 period using a simulated 1930 to 1969 climate period and the 2070 DWR climate change data (based on preventing significant and unreasonable affects for one or more of the six sustainability indicators)	WLPMA	11,300 to 13,700	14,000
	Total ELPMA	15,500 to 20,100	20,500
	Epworth Gravels	1,300 to 1,340	1,500

Notes: AFY = acre-feet per year; DWR = California Department of Water Resources; ELPMA = East Las Posas Management Area; GSP = Groundwater Sustainability Plan; WLPMA = West Las Posas Management Area.

Adoption of this GSP represents the first step in achieving groundwater sustainability within the LPVB, as required by SGMA. SGMA requires that groundwater in each of the management areas of the LPVB be managed sustainably within 20 years of adoption of the GSP. SGMA also requires that this GSP be evaluated at a minimum of every 5 years after adoption. As part of the 5-year evaluation process, the sustainable yield will be refined and adjusted. These refinements will be based on new data, additional studies undertaken to fill data gaps, and groundwater modeling. Refinements and adjustments will also be made to the minimum threshold groundwater levels developed to avoid undesirable results, the measurable objective groundwater levels that account

[1] A confined aquifer is saturated with water that is under pressure, so that when it is penetrated by a well, the water level in the well rises above the top of the aquifer. An unconfined aquifer is an aquifer whose upper water surface is at atmospheric pressure and below the top of the aquifer.

for the need to continue groundwater production during drought cycles and the associated interim milestones to help gauge progress toward sustainability over the next 20 years.

The required 5-year evaluations will also examine both new water supply projects, and the potential impacts of extractions rates on groundwater elevations and sustainability in the LPVB. Additional modeling is recommended during the 5-year update process to understand how changes in pumping and additional new water supply projects can increase the overall sustainable yield of the different management areas of the LPVB. As this understanding improves, projects to support increases in the overall sustainable yield can be developed.

ES.1 INTRODUCTION

The LPVB is an alluvial groundwater basin located in Ventura County, California. The climate is typical of coastal Southern California, with average daily temperatures ranging generally from 54°F to 84°F in summer and from 40°F to 74°F in winter. The Las Posas Valley ranges in elevation from approximately 100 feet above mean sea level in the southwest to more than 1,500 feet above mean sea level in the northeast. The primary surface water drainage in the Las Posas Valley is Arroyo Las Posas, which is named Arroyo Simi in the easternmost portion of the Las Posas Valley.[2] Land use overlying the LPVB is divided between agricultural and urban uses, with agricultural use covering approximately 51% of the land within the Las Posas Valley, and residential and urban use covering approximately 23% of the land. The remaining 26% is open space. DWR has designated the LPVB as a high-priority groundwater basin.

The majority of the LPVB is within the jurisdiction of the FCGMA, an independent special district, formed by the California Legislature in 1982, to manage and protect the aquifers within its jurisdiction for the common benefit of the public and all groundwater users. Extractors within FCGMA jurisdiction are subject to the Agency's GSPs, ordinances, and policies created for the sustainable management of groundwater management actions.

FCGMA is one of three groundwater sustainability agencies (GSAs) that have jurisdiction over portions of the LPVB. FCGMA is the GSA for the area of the LPVB that falls within its jurisdiction. The Camrosa Water District GSA–Las Posas Valley is the GSA for the portion of the Camrosa Water District Service area in the Las Posas Valley, and the Las Posas Outlying Areas GSA is the GSA for portions of the LPVB not within FCGMA or Camrosa Water District jurisdiction. This FCGMA GSP is the sole GSP prepared for the LPVB, and covers the entire LPVB, including all areas of the LPVB outside of FCGMA's jurisdiction.

[2] For simplicity, the name *Arroyo Simi–Las Posas* is used in this GSP to denote the entire reach of the two arroyos in the ELPMA.

Public participation and stakeholder feedback have played a critical role in the development of this GSP. FCGMA maintains a list of stakeholders interested in the GSP process, known as the *List of Interested Parties*. A monthly newsletter, meeting notices, and notices of GSP documents available for review were sent electronically to those on the List of Interested Parties. Public workshops were held to inform stakeholders and the general public on the contents of the GSP and to solicit feedback on that content. To further facilitate stakeholder understanding, the FCGMA Board of Directors (Board) approved release of a preliminary draft GSP for public comment in November 2017. Additionally, the FCGMA Board formed a Technical Advisory Group, which held public meetings throughout the GSP development process, beginning in July 2015, and updates on the development of the GSP were given at meetings of the FCGMA Board, beginning in April 2015. All FCGMA Board meetings, Technical Advisory Group meetings, Board-appointed committee meetings, and Board special workshops were noticed in accordance with the Brown Act, and opportunities for public comment were provided at all FCGMA Board meetings, Technical Advisory Group meetings, Board-appointed committee meetings, and workshops.

ES.2 SUMMARY OF BASIN SETTING AND CONDITIONS

Hydrogeologic Background

DWR defines three water-bearing formations in the LPVB: alluvium, the San Pedro Formation, and the Santa Barbara Formation. Geologic differences between the WLPMA and the ELPMA have resulted in different names being assigned to the hydrostratigraphic units associated with these three water-bearing formations in each management area. In the WLPMA, the alluvium is referred to as the shallow alluvial system to reflect the hydrologic connection between the WLPMA and the Upper Aquifer System of the Oxnard Subbasin to the west. Underlying the shallow alluvial system in the WLPMA, the San Pedro Formation has been divided into two hydrostratigraphic units: the upper San Pedro Formation and, underlying that, the Fox Canyon Aquifer. The Fox Canyon Aquifer is a principal aquifer in the WLPMA. The Grimes Canyon Aquifer in the upper Santa Barbara Formation, which underlies the Fox Canyon Aquifer, is the deepest aquifer in the WLPMA.

In the ELPMA, the alluvium is referred to as the Shallow Alluvial Aquifer, and is constrained to an area adjacent to Arroyo Simi–Las Posas. The San Pedro Formation is divided into three hydrostratigraphic units in the ELPMA: the Epworth Gravels Aquifer, the upper San Pedro Formation, and the Fox Canyon Aquifer. The extent of the Epworth Gravels Aquifer is approximately 1,600 acres (2.5 square miles) located 2 to 3 miles north-northwest of Moorpark in the ELPMA. Because the Epworth Gravels Aquifer is limited in extent and is hydrologically disconnected from the Fox Canyon Aquifer, the Epworth Gravels Aquifer has been designated as a separate management area in this GSP. The upper San Pedro Formation underlies the Shallow Alluvial Aquifer where it is present, and underlies the Epworth Gravels Aquifer, where it is present in the ELPMA. The upper San Pedro Formation is not a primary aquifer, but rather serves as a reservoir of stored water that through time

has been slowly leaking into the Fox Canyon Aquifer below. The Fox Canyon Aquifer is a primary aquifer in the ELPMA. Underlying the Fox Canyon Aquifer is the Grimes Canyon Aquifer in the upper Santa Barbara Formation, which is the deepest aquifer in the ELPMA.

Extensive geologic folding and faulting in the LPVB have resulted in large differences in the thickness, elevation, and exposure of the subsurface aquifers. In general, the Fox Canyon Aquifer is confined, except where it crops out on the northern and southern margins of the basin, and in the vicinity of Moorpark, where a subsurface fold has thinned and lifted the Fox Canyon Aquifer. This fold is known as the Moorpark anticline. In these areas, declining groundwater elevations would result in larger portions of the Fox Canyon Aquifer becoming unconfined.

Historical Groundwater Conditions

Groundwater elevations and flow directions have varied historically in the different management areas of the LPVB. In the WLPMA, groundwater elevations in wells adjacent to the Oxnard Subbasin are influenced by surface water diversions of the Santa Clara River, which are directed to spreading basins in the Forebay area of the Oxnard Subbasin by the United Water Conservation District (UWCD). When UWCD has been able to divert river water to its recharge basins, groundwater elevations have risen in wells in the western parts of the WLPMA. The influence of UWCD recharge operations is not clear in historical water level records from wells farther east in the WLPMA. In this area, chronic declines in groundwater levels caused by groundwater production have been observed historically. These chronic declines were offset by in-lieu surface water deliveries between 1995 and 2008.

In the Epworth Gravels Management Area, chronic groundwater level declines were observed between 1930 and 1990. Water level declines in this management area caused property owners to drill deeper wells, which penetrated the Fox Canyon Aquifer. As groundwater production shifted from the Epworth Gravels Aquifer to the Fox Canyon Aquifer in this area, groundwater elevations began to recover in the Epworth Gravels Aquifer. With the onset of the drought that began in 2011, groundwater elevations in the Epworth Gravels Aquifer began to decline again.

In the ELPMA chronic groundwater level declines were observed prior to 1970. In 1970, upstream wastewater treatment plant and shallow dewatering well discharges began reaching the ELPMA and converted Arroyo Simi–Las Posas from an ephemeral stream to a perennial stream. The perennial flow in the Arroyo provided recharge to the underlying groundwater aquifers. This recharge caused water levels to recover in areas of the ELPMA adjacent to Arroyo Simi–Las Posas, while groundwater levels have continuously declined throughout the northern ELPMA, which does not receive recharge from Arroyo Simi–Las Posas. The volume of perennial surface water flows that reach the ELPMA has declined over the past decade, and water levels adjacent to Arroyo Simi–Las Posas have stabilized or declined in recent years in response to the combined effects of the diminished recharge and the drought that began in 2011.

As the ELPMA began to receive additional recharge from perennial flows in Arroyo Simi–Las Posas, groundwater concentrations of total dissolved solids (TDS) began to increase. Increased concentrations of TDS have been observed in both the Shallow Alluvial Aquifer and the Fox Canyon Aquifer.

Increased surface water flow and infiltration along Arroyo Simi–Las Posas also resulted in the establishment of riparian vegetation, along the banks of the arroyo. This riparian vegetation, which is dominated by non-native Arundo (*Arundo donax*), has been identified as a potential groundwater-dependent ecosystem. Within the boundaries of the ELPMA, water from Arroyo Simi–Las Posas percolates into the underlying sediments to recharge the groundwater. This indicates that the riparian habitat along Arroyo Simi–Las Posas may rely on soil moisture from percolating surface water, rather than groundwater. As surface flows and recharge decrease in Arroyo Simi–Las Posas, groundwater elevations and soil moisture content in the vicinity of the potential groundwater-dependent ecosystem are anticipated to decline. These declines may impact the health of the riparian vegetation.

Water Budget

The water budget for the management areas of the LPVB provides an accounting and assessment of the annual volume of groundwater and surface water entering (i.e., inflow) and leaving (i.e., outflow) each management area. This enables an accounting of the cumulative change in groundwater in storage over time. Two numerical groundwater models were developed to calculate the water budget for the different management areas in the LPVB. Calleguas Municipal Water District (CMWD) developed the "Groundwater Flow Model of the East and South Las Posas Sub-Basins," a MODFLOW numerical groundwater flow model, for the ELPMA and the Epworth Gravels Management Area. UWCD developed the "Ventura Regional Groundwater Flow Model," a MODFLOW numerical groundwater flow model, for the WLPMA, the Oxnard Subbasin, the Mound Basin, and the Pleasant Valley Basin, which are in hydraulic communication with each other. A peer review study of each groundwater model was conducted for this GSP.

The historical groundwater budget for the WLPMA is based on the UWCD model, which had a historical base period from 1985 through 2015. During average conditions, which are defined as water years in which the precipitation was between 75% and 150% of the average annual precipitation, the net change in groundwater storage for the Shallow Aquifer System was an increase of 292 AFY. In the upper San Pedro Formation, Fox Canyon Aquifer, and Grimes Canyon Aquifer, the net change in groundwater storage was a decrease of approximately 263 AFY. Groundwater pumping during these years averaged 1,346 AFY in the Shallow Aquifer System, and 13,274 AFY in the upper San Pedro Formation, Fox Canyon Aquifer, and Grimes Canyon Aquifer, combined. Between 1995 and 2007, CMWD delivered in-lieu water to the WLPMA, which has kept groundwater levels and storage from declining further. As of 2015, CMWD had stored 25,192 AF of water in the WLPMA through in-lieu deliveries. Groundwater levels and storage would be lower if CMWD cumulative storage had not occurred.

During average conditions, the net change in groundwater storage for the Epworth Gravels Aquifer was an increase of 184 AFY. Groundwater pumping during these years averaged 1,203 AFY. The increase in storage during average years reflects the rising water levels in the aquifer that occurred after property owners drilled wells into the Fox Canyon Aquifer, and reduced production from the Epworth Gravels Aquifer.

During average conditions, the net change in groundwater storage for the ELPMA was an increase of 4,638 AFY. Groundwater pumping averaged 17,283 AFY during average conditions. The increase in storage primarily reflects the rising water levels in the management area that occurred since 1970, as perennial flow in Arroyo Simi–Las Posas began to recharge the management area. It also reflects CMWD in-lieu water deliveries, and Aquifer Storage and Recovery Project injections, which have kept groundwater levels and storage from declining. As of 2015, CMWD had stored 11,398 AF of water in the ELPMA through in-lieu deliveries and Aquifer Storage and Recovery Project injections. Groundwater levels and storage would be lower if CMWD cumulative storage had not occurred.

Projected Water Budget and Sustainable Yield

Several numerical groundwater model scenarios were developed for this GSP to assess the future sustainable yield of the management areas of the LPVB. Each future scenario covered a 50-year timeframe, from 2020 to 2069. The UWCD model was used to assess the future sustainable yield of the WLPMA, and the CMWD model was used to assess the future sustainable yield of the ELPMA and the Epworth Gravels Management Area.

Two scenarios in the WLPMA continued the 2015–2017 average groundwater extraction rate throughout the 50-year model period. The results of each of these scenarios indicated that continuing the 2015–2017 extraction rate would contribute to net seawater intrusion in the Oxnard Subbasin, which is hydrologically connected to the WLPMA. In three additional scenarios, the groundwater production rate was decreased gradually over the first 20 years in the WLPMA, Oxnard Subbasin, and Pleasant Valley Basin. These model scenarios indicated that reduced groundwater production can eliminate net seawater intrusion in the Oxnard Subbasin over periods of drought and recovery and may result in higher groundwater elevations in the WLPMA. Increasing groundwater elevations across the management area in the three scenarios indicate that the modeled groundwater production rates in the WLPMA during these scenarios were likely lower than the sustainable groundwater production rate. Based on the suite of model scenarios, the sustainable yield of the WLPMA was calculated to be approximately 12,500 AFY, with an uncertainty of ±1,200 AFY.

In two numerical groundwater model scenarios for the ELPMA and the Epworth Gravels Management Area, the 2015–2017 average groundwater extraction rate was continued throughout the 50-year model period. The results of each of these scenarios indicated that there would be chronic declines in groundwater levels and associated loss of storage in the Epworth Gravels Management Area at the 2015–2017 average groundwater production rate. In the ELPMA, chronic declines in groundwater level and loss of storage were also predicted at the 2015–2017 average production rate. However, a smaller loss of storage was predicted for the scenario in which surface water flow was maintained in Arroyo Simi–Las Posas than for the scenario in which surface water flow was decreased.

Three additional scenarios were developed for the ELPMA and the Epworth Gravels Management Area. In one scenario, groundwater production was reduced and flow in Arroyo Simi–Las Posas was maintained. In the other two scenarios, groundwater production was reduced and flow in Arroyo Simi–Las Posas was also reduced. Based on the suite of model scenarios, the sustainable yield of the ELPMA was estimated to be 17,800 AFY ± 2,300 AFY. In the Epworth Gravels Management Area, the sustainable yield is estimated to be approximately 1,300 AFY.

It is anticipated that the analysis for the 5-year update to the GSP will focus on developing new water supply projects, as well as examining the potential impacts of differential extractions on the water levels in the management areas of the LPVB. In the WLPMA, additional groundwater modeling will be needed to better constrain the sustainable yield over the next 5 years. In the ELPMA, additional modeling is recommended to understand how changes in pumping patterns and the addition of new water supply projects may influence the area of Fox Canyon Aquifer that would convert from confined to unconfined conditions and increase the overall sustainable yield of the management area. As this understanding improves, targeted projects and management actions can be developed to support increases in the overall sustainable yield in each management area.

ES.3 OVERVIEW OF SUSTAINABILITY CRITERIA

The primary sustainability goal in the LPVB is to maintain a sufficient volume of groundwater in storage in each management area so that there is no significant and unreasonable decline in groundwater elevation or storage over wet and dry climatic cycles. Further, groundwater levels in the WLPMA should be maintained at elevations that are high enough to not inhibit the ability of the Oxnard Subbasin to prevent net landward migration of the saline water impact front after 2040.[3]

[3] Sources of water high in chloride in the Oxnard Subbasin include modern seawater as well as non-marine brines and connate water in fine-grained sediments. Therefore, the area of the Subbasin impacted by concentrations of chloride greater than 500 milligrams per liter is referred to as the "saline water impact area," rather than the "seawater intrusion impact area," to reflect all the potential sources of chloride to the aquifers in this area.

Under SGMA, undesirable results occur when the effects caused by groundwater conditions occurring throughout the management area cause significant and unreasonable impacts to any of the six sustainability indicators:

- Chronic lowering of groundwater levels
- Reduction of groundwater storage
- Seawater intrusion
- Degraded water quality
- Land subsidence
- Depletions of interconnected surface water

Of the six sustainability indicators, chronic lowering of groundwater levels, reduction of groundwater storage, degraded water quality, and land subsidence are applicable to the LPVB when groundwater production exceeds the sustainable yield. The LPVB does not experience direct seawater intrusion, although groundwater elevations in the WLPMA can influence the ability of the Oxnard Subbasin to prevent seawater intrusion. Depletion of interconnected surface water is not occurring within the LPVB. Minimum thresholds and measurable objectives, which are quantitative metrics of groundwater conditions in the LPVB, were established for the sustainability indicators determined to be a current and/or potential future undesirable result. Separate minimum thresholds and measurable objectives were developed for each management area in the LPVB. Groundwater elevations were used as a proxy for other sustainability indicators in establishing the minimum thresholds and measurable objectives.

West Las Posas Management Area

The measurable objective groundwater levels for the WLPMA differ geographically, based on the extent of influence of surface water spreading on observed groundwater levels in the management area. In the western part of the WLPMA, where UWCD surface water spreading influences groundwater elevations, the measurable objective water level is the groundwater level to which the Fox Canyon Aquifer has recovered historically. In the eastern WLPMA, the measurable objective groundwater elevation is the elevation that represents half of the total recovery in the historical record. The measurable objective groundwater levels in the WLPMA are at least 20 feet higher than the minimum threshold groundwater levels, thereby allowing for operational flexibility in the management area. To allow for operational flexibility during drought periods, groundwater levels in the WLPMA are allowed to fall below the measurable objective as long as the periods during which groundwater elevations are below the measurable objective are offset by periods when the groundwater elevations are higher than the measurable objective.

The minimum threshold groundwater levels for the WLPMA also differ geographically, based on proximity to the Oxnard Subbasin. In the western part of the WLPMA, the minimum threshold is based on the lowest simulated groundwater elevation after 2040 for the model scenario in which the 2015–2017 average production rate was continued throughout the 50-year model simulation, and projects were implemented. For the eastern part of the WLPMA, the minimum threshold is based on the average low historical groundwater elevations in the early 1990s, before in-lieu surface water deliveries to the WLPMA began. These elevations were selected because the groundwater levels in the eastern part of the WLPMA recovered, with the aid of in-lieu surface water deliveries, from the historical low levels in the early 1990s. These minimum thresholds are anticipated to maintain or improve the beneficial uses of the WLPMA by preventing chronic lowering of groundwater levels. This allows for long-term use of groundwater supplies in the WLPMA without ongoing loss of storage.

Although exceedance of a minimum threshold at any given well in the WLPMA may indicate an undesirable result is occurring, a single exceedance is not necessarily sufficient to indicate management-area-wide conditions are causing undesirable results. To define the conditions under which undesirable results will occur in the WLPMA, two criteria were developed. The WLPMA would be determined to be experiencing an undesirable result if:

- In any single monitoring event, groundwater levels in three of five identified representative monitoring wells, referred to as *key wells*, are below their respective minimum thresholds.
- The groundwater level in any individual key well is below the minimum threshold for either three consecutive monitoring events or three of five consecutive monitoring events, which occur in the spring and fall of each year.

East Las Posas Management Area

In the ELPMA, the measurable objective groundwater elevations were selected based on the historical groundwater level record and the groundwater model simulations that result in stable groundwater elevations after 2040. The measurable objective is the groundwater level at which observed declines in groundwater elevation would cease if gradual reductions in groundwater production are implemented between 2020 and 2040. The measurable objective groundwater elevation is lower than the 2015 groundwater elevation in each of the representative monitoring wells (key wells), in the ELPMA. These measurable objectives reflect the anticipated future declines in groundwater elevation that will result from a gradual reduction in groundwater production to the sustainable groundwater production rate over the next 20 years and the potential for further reductions in recharge to the ELPMA from Arroyo Simi–Las Posas.

The minimum threshold groundwater levels in the ELPMA, which vary geographically, are based on a review of the historical groundwater elevation data, incorporation of potential projects, and

an analysis of the projected future declines in groundwater elevation and storage under multiple future groundwater production scenarios. For wells that are adjacent to Arroyo Simi–Las Posas and are, generally, south and west of the Moorpark Anticline, the minimum thresholds are based on the historical low groundwater elevation. For the remaining wells, the minimum threshold is based on the groundwater level that limits reduction in storage to less than 20% relative to the estimated 2015 groundwater storage volume in areas of the ELPMA where the Fox Canyon Aquifer may convert from being confined to unconfined. Conversion of the Fox Canyon Aquifer from confined to unconfined conditions is most likely to occur on the flanks of the Moorpark and Long Canyon anticlines, and on the northern and southern margins of the ELPMA where the Fox Canyon Aquifer crops out. Continued production at the 2015–2017 rates has the potential to cause these areas of the ELPMA to lose more than 30% of the available groundwater storage. Limiting the long-term loss of storage to no more than 20% in these areas of the ELPMA was determined to be a reasonable approach by the FCGMA Board to avoid significant and unreasonable loss of supply. The selected minimum thresholds are anticipated to maintain the future beneficial uses of the ELPMA by preventing chronic lowering of groundwater levels, ongoing loss of storage, and increased areas of unconfined conditions in the Fox Canyon Aquifer after 2040.

Although exceedance of a minimum threshold at any given well in the ELPMA may indicate an undesirable result is occurring, a single exceedance is not necessarily sufficient to indicate management-area-wide conditions are causing undesirable results. To define the conditions under which undesirable results will occur in the ELPMA, two criteria were developed. The ELPMA would be determined to be experiencing an undesirable result if:

- In any single monitoring event, groundwater levels in 5 of 15 identified key wells are below their respective minimum thresholds.
- The groundwater level in any individual key well is below the minimum threshold for either three consecutive monitoring events or three of five consecutive monitoring events, which occur in the spring and fall of each year.

Epworth Gravels Management Area

In the Epworth Gravels Management Area, the measurable objective groundwater elevation was selected based on the historical groundwater level record and the groundwater model simulations that result in stable groundwater elevations after 2040. Groundwater elevations have been below the measurable objective groundwater elevation historically, but have been above the measurable objective since 2005.

The minimum threshold groundwater level in the Epworth Gravels Management Area was selected as the groundwater level that limits reduction in storage to less than 20% relative to the estimated 2015 groundwater storage volume. Limiting the long-term loss of storage to no more than 20% in

in this management area was determined to be a reasonable approach by the FCGMA Board to avoid significant and unreasonable loss of supply. The selected minimum threshold is anticipated to maintain the future beneficial uses of the Epworth Gravels Management Area by preventing chronic lowering of groundwater levels and ongoing loss of storage after 2040.

One well was selected as a key well in the Epworth Gravels Management Area. The definition of undesirable results for the Epworth Gravels Management Area is based on the time over which this well may exceed the minimum threshold. Under this definition, the Epworth Gravels Management Area would be determined to be experiencing an undesirable result if the groundwater level in the key well were below the minimum threshold for either three consecutive monitoring events or in three of five consecutive monitoring events. Monitoring events are scheduled to occur in the spring and fall of each year.

ES.4 OVERVIEW OF THE BASIN MONITORING NETWORK

The overall objective of the monitoring network in the LPVB is to track and monitor parameters that demonstrate progress toward meeting the sustainability goals. In order to accomplish this objective, the monitoring network in the LPVB must be capable of the following:

- Monitoring changes in groundwater conditions (in six sustainability indicator categories)
- Monitoring progress toward minimum thresholds and measurable objectives
- Quantifying annual changes in groundwater budget components

The existing network of groundwater wells includes both monitoring wells and production wells. This network is capable of delineating the groundwater conditions in the different management areas of the LPVB and has been used for this purpose in the past. The current groundwater well network will be used to monitor groundwater conditions moving forward, in order to continue to assess long term trends in groundwater elevation and groundwater quality in the LPVB.

In both the WLPMA and the ELPMA, monitoring can be improved in the future by coordination of monitoring schedules to ensure that groundwater monitoring activities occur over a 2-week window during the key reporting periods and mid-March and mid-October. Additionally, as funding becomes available, pressure transducers should be added to wells in the groundwater monitoring network. Pressure transducer records provide the high-temporal-resolution data that allows for a better understanding of water level dynamics in the wells related to groundwater production, groundwater management activities, and climatic influence.

In the ELPMA, the monitoring network can also be improved by adding a monitoring well screened in the Grimes Canyon Aquifer, and a well screened in the Shallow Alluvial Aquifer. The monitoring well screened in the Shallow Alluvial Aquifer should be placed within the boundaries

of the potential groundwater-dependent ecosystem to assist with understanding the potential connectivity between groundwater and the potential groundwater-dependent ecosystem.

In the future, to the extent possible, additional dedicated monitoring wells will be incorporated into the existing monitoring network. These wells will provide information on groundwater conditions in geographic locations where data gaps have been identified, or where a dedicated monitoring well would better represent conditions in the aquifers than a production well currently used for monitoring.

ES.5 PROJECTS AND MANAGEMENT ACTIONS

Future projects and management actions have been identified to address potential impacts to beneficial uses and users of groundwater in the management areas of the LPVB resulting from groundwater production in excess of the current sustainable yield. Three projects were included in this GSP. One project applies to the WLPMA and two projects apply to the ELPMA. No projects were proposed for the Epworth Gravels Management Area. The projects that are included in this GSP were suggested by stakeholders and reviewed by the FCGMA Board. The inclusion of these projects does not constitute a commitment by the FCGMA Board to construct or fund them, but rather signals that the projects were sufficiently detailed to be included in groundwater modeling efforts that examined the quantitative impacts of the projects on groundwater elevations and the sustainable yield of the LPVB. Projects included in the GSP or any amendment thereof that increase the available supply of groundwater are necessary to meet the sustainability goal for the basin in a manner that avoids adverse impacts to beneficial uses and users of groundwater within the basin.

Project No. 1 – Purchase of Imported Water from CMWD

The Purchase of Imported Water from CMWD for Basin Replenishment Project would supply imported water to the eastern part of the WLPMA in lieu of groundwater production. This project would reduce production from discrete wells in the WLPMA by 1,762 AFY. Numerical groundwater model scenarios suggest that this project will assist with water level recovery in the WLPMA. Furthermore, historical deliveries of imported water in lieu of groundwater production have resulted in groundwater elevation recoveries in the eastern WLPMA. Therefore, this project is anticipated to have a direct impact on groundwater elevations and could be used to help maintain elevations above the minimum thresholds.

Project No. 2 – Arroyo Simi–Las Posas Arundo Removal

The Arroyo Simi–Las Posas Arundo Removal Project consists of removing the invasive plant species Arundo from approximately 324 acres of land along the Arroyo Simi–Las Posas corridor. Arundo would be replaced with native riparian plant species, which are estimated to consume

approximately 6 to 25 AFY per acre less water than Arundo. If all of the Arundo is removed, this project could result in up to an additional 2,680 AFY of recharge to the ELPMA. This project is anticipated to have a positive impact on groundwater recharge, as well as a positive impact on the health of riparian habitat along Arroyo Simi–Las Posas.

By increasing surface water flow in Arroyo Simi–Las Posas and decreasing evapotranspiration losses from invasive species that currently line the Arroyo Simi–Las Posas, the ELPMA is anticipated to receive more recharge along Arroyo Simi–Las Posas. Although this recharge alone is insufficient to maintain groundwater elevations at or above the measurable objectives throughout the ELPMA at the 2015–2017 average groundwater production rate, it will lessen groundwater pumping reductions necessary to maintain groundwater elevations close to the measurable objectives groundwater levels. This project is anticipated to have a positive impact on groundwater recharge, as well as a positive impact on the health of riparian habitat along Arroyo Simi–Las Posas.

Project No. 3 – Arroyo Simi–Las Posas Water Acquisition

The Arroyo Simi–Las Posas Water Acquisition Project would involve the purchase of recycled water and discharged groundwater from the City of Simi Valley. In return, Simi Valley would commit to continuing to discharge the purchased water from its shallow dewatering wells or the Simi Valley Water Quality Control Plant to Arroyo Simi–Las Posas for downstream recharge to the LPVB. Simi Valley has indicated that 3,000 AFY of recycled water would be available from the Simi Valley Water Quality Control Plant and 1,700 AFY would be available from the dewatering wells. However, due to the riparian use of the water along the Arroyo Simi–Las Posas, an estimated 1,000 to 2,500 AFY of the water may be lost due to plant uptake and evaporation, leaving 2,200 to 3,700 AFY available as surface flow and recharge to the ELPMA.

This project is anticipated to have a direct impact on groundwater elevations and could be used to help maintain elevations above the minimum thresholds throughout much, but not all, of the ELPMA. Although perennial surface water flow has provided recharge to the ELPMA, this flow is also thought to be the primary source of rising TDS concentrations observed in the groundwater adjacent to Arroyo Simi–Las Posas since the 1990s. Consequently, if this project is pursued further, the water quality of the surface water flows will have to be investigated further and addressed in the feasibility study.

Management Action No. 1 – Reduction in Groundwater Production

The primary management action proposed under this GSP is Reduction in Groundwater Production from the LPVB. FCGMA has had the authority to monitor and regulate groundwater production in the LPVB since 1983. The FCGMA Board has established extraction allocations for each extraction facility and has used its authority to reduce groundwater production from the LPVB in the past, and will continue to control groundwater production as a GSA for the LPVB.

In the WLPMA, the estimated long-term rate of groundwater production that will prevent chronic declines in groundwater levels, loss of storage, and subsidence due to groundwater withdrawal and will also allow the prevention of seawater intrusion in the Oxnard Subbasin is approximately 12,500 AFY, with an estimated uncertainty of approximately ±1,200 AFY. The difference between the estimated sustainable yield and the average 2015–2017 production rate is 1,500 AFY. In the ELPMA, the sustainable yield is estimated to be 17,800 AFY ± 2,300 AFY. The average 2015–2017 groundwater production rate was approximately 20,500 AFY. In the Epworth Gravels Management Area, the sustainable yield is estimated to be approximately 1,300 AFY. The average 2015–2017 groundwater production rate was approximately 1,500 AFY.

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