2017

Stormwater Resource Plan

STORMWATER CAPTURE: A WATER SUPPLY RESOURCE

GOLETA WATER DISTRICT | 4699 Hollister Avenue, Goleta, CA 93111

MISSION

To provide an adequate supply of quality water at the most reasonable cost to the present and future customers within the Goleta Water District

GOLETA WATER DISTRICT

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Acronyms

AF	Acre Foot
AFY	Acre Foot per Year
BMP	Best Management Practice
CEQA	California Environmental Quality Act
CFS	Cubic Feet per Second
CCRB	Cachuma Conservation Release Board
CCWA	Central Coast Water Authority
CWA	Clean Water Act
DO	Dissolved Oxygen
DDW	Division of Drinking Water
DEM	Digital Elevation Model
DWR	Department of Water Resources
EMC	Event Mean Concentration
EPA	Environmental Protection Agency
ESA	Environmentally Sensitive Area
GIS	Geographic Information System
GMP	Groundwater Management Plan
IGP	Industrial General Permit (stormwater)
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
LCMWC	La Cumbre Mutual Water Company
LPRM	Load Pollutant Reduction Model
MCL	Maximum Contaminant Level
MG	Million Gallons
MPN	Most Probable Number
MS4	Municipal Separate Storm Sewer System
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System

PEAIP	Performance Effectiveness Assessment & Improvement Plan
RWMP	Regional Water Management Group
RWQCB	Regional Water Quality Control Board
SBCWA	Santa Barbara County Water Agency
SMARTS	Storm Water Multiple Application and Report Tracking System
SRP	Stormwater Resource Plan
STORMS	Strategy to Optimize Resource Management of Storm Water
SWMP	Storm Water Management Program
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TGM	Guidelines from the Ventura County Technical Guidance Manual for Stormwater Quality Control Measures
TMDL	Total Maximum Daily Load
UCSB	University of California, Santa Barbara
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WLA	Waste Load Allocation
WSMP	Water Supply Management Plan
WWTP	Waste Water Treatment Plant

Glossary of Terms

Acre Foot (AF) – the amount of water required to cover an acre one foot deep (325,851 gallons).

Acre Foot per Year (AFY) – the amount of water required to cover an acre one foot deep per year.

Adjudication – a determination of water rights for an entire stream or groundwater basin.

Alluvium – A general term for detrital deposits made by streams or river beds, flood plains, and alluvial fans. The term applies to stream deposits of recent time. It does not include sub-aqueous sediments of seas and lakes.

Aquifer – any underground formation that stores, transmits and yields water to wells and springs.

Aquifer, Confined – an aquifer that is overlain by a confining bed. The confining bed has a significantly lower hydraulic conductivity than the aquifer.

Aquifer, Unconfined – An aquifer in which there are no confining beds between the zone of saturation and the surface. There will be a water table in an unconfined aquifer. Water-table aquifer is a synonym.

Beneficial Uses of Water – Water used for the following purposes: domestic (homes, human consumption, etc.), irrigation, power (hydroelectric), municipal (water supply of a city or town), mining (hydraulic, drilling), industrial (commerce, trade, industry), fish and wildlife preservation, aquaculture (raising fish etc. for commercial purposes), recreational (boating, swimming), stock watering (for commercial livestock), water quality, frost protection (misting or spraying crops to prevent frost damage), heat control (water crops to prevent heat damage), ground water recharge, and agriculture.

Best Management Practices (BMP) – A practice which is determined to be the most effective and practicable method of preventing or reducing the amount of pollution generated by pollution sources.

California Environmental Quality Act (CEQA) – Established law of environmental protection, maintenance and enhancement.

California Water Code (CWC) – The Porter Cologne Water Quality Control Act enacted by California Legislature in 1970, containing a complete framework for the regulation of waste discharges to both surface and ground waters of the State. It further provides for the adoption of water quality control plans and the implementation of these plans by adopting waste discharge requirements for each discharge of waste that could impact the waters of the state.

Constituent – a component or attribute of waste that is detectable.

Contamination – Water quality impairment to a degree that creates a public health hazard through poisoning or through the spread of disease.

Cubic Feet per Second (cfs) – The rate of flow passing any point equal to the volume of one cubic foot of water every second. One cfs is equal to 7.48 gallons per second; 448.8 gallons per minute; 646,317 gallons per day.

Dissolved Oxygen – The oxygen dissolved in water, wastewater, or other liquid, usually expressed in milligrams per liter, parts per million or percent of saturation.

Downstream – in the direction of the current of a stream.

Effluent – Solid, liquid, or gaseous wastes that enter the environment as a by-product of human-oriented processes; or water that has undergone treatment to remove pollutants.

Endangered Species – animal populations are determined to be endangered when populations are severely depleted, as defined by the Endangered Species Act.

Environmental Impact Report – A document required by the 19670 CEQA that assesses the possible environmental effects of a project.

Ephemeral Stream – Carries water runoff only in times of rainfall and remains as a dry channel during the rest of the year.

Escherichia Coli (E. Coli) – One of the group of bacteria referred to as fecal coliforms.

Estuary – Water at the mouth of a stream that serves as mixing zones for fresh and ocean waters during a major portion of the year.

Fecal Coliform – A sub-classification of the total coliform group. Fecal coliform bacteria are primarily found in the intestinal track of humans and warm-blooded mammals.

Groundwater – The water below the land surface.

Groundwater Recharge – Refers to the addition of water within the earth that occurs naturally from infiltration of rainfall and from water flowing over the earth materials that allow water to infiltrate below the land surface.

Heavy Metals – Toxic, high-density, metallic elements such as lead, silver, mercury and arsenic.

Hydraulic Conductivity – A coefficient of proportionality describing the rate at which water can move through a permeable medium.

Impervious – Not allowing, or allowing only with great difficulty, the movement of water; impermeable.

Indicator – A species of plant, animal or bacterium whose presence is indicative of a particular environmental condition.

Infiltration – To pass, or cause (a fluid, cell, etc.) to pass, through small gaps or openings; filter.

Injection Well – Any bored, drilled or driven shaft, dug pit, or hole in the ground into which waste or fluid is discharged, and any associated subsurface appurtenances, and the depth of which is greater than the circumference of the shaft, pit, or hole.

Maximum Contaminant Level (MCL) – Enforceable drinking water standards adopted either by the California Department of Health Services or the federal EPA. It is the maximum permissible level of a contaminant in drinking water.

National Pollutant Discharge Elimination System (NPDES) Permit – Permit required for all point sources discharges of pollutants to surface waters. It has the following characteristics: issued for up to five years; provides for inspection and monitoring; requires notice to the public, the USEPA and any other affected state, provides for the protection of navigation, and mandates a pre-treatment program as necessary.

Nitrate (NO_3) – A class of chemical compounds having the form NO_3; typically formed when ammonia is degraded by microorganisms in soil or groundwater.

Nitrogen (N_2) – A gas that comprises 78% of the earth's atmosphere by volume. An essential plant nutrient.

Nonpoint Source – Diffuse discharges of waste throughout the natural environment that may be a major cause of water pollution. Difficult to pinpoint physically, but can be classified by type: urban runoff, agriculture, mining, septic tank leach fields and silviculture.

Nuisance – Anything which meets all of the following requirements (a) Is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, (b) Affects at the same time an entire community or neighborhood, or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal, (c) Occurs during, or as a result of, the treatment or disposal of wastes.

Nutrients – A nutritious ingredient (e.g. nitrogen, phosphorus, etc.).

Pathogen – Any agent, especially a microorganism (e.g. viruses or bacteria), able to cause disease.

Percolation – The flow or filtering of water or other liquids through subsurface rock or soil layers, usually continuing to groundwater.

Permeability – The ability of a natural and artificial materials to transmit fluids.

pH – A measure of the acidity or alkalinity of a substance. Waters that are too acid (low pH) or alkaline (high pH) can be unfit for animal or plant life. On the pH scale, which runs from zero to 14, a value of 7 is neutral. There is a tenfold difference between each number (if the pH drops from 7 to 6, the acidity is ten times greater).

Phosphorus (P) An element, and essential nutrient for plants and animals.

Plume – A body of contaminated groundwater flowing from a specific source. The movement of the [contaminated] groundwater is influenced by such factors as local groundwater flow patterns, the character of the aquifer in which the [contaminated] groundwater is contained, and the density [and other physical and chemical properties] of the contaminants.

Point Source – A discernible, confined and discrete conveyance such as a pipe, ditch or channel, tunnel, conduit, well container, concentrated animal feeding operation or vessel, from which pollutants are or may be discharged. Does not include agricultural stormwater discharges and return flows from irrigated agriculture.

Pollutant – Dredged spoil, solid waste, incinerator residue, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials, heat, wrecked or discarded equipment, rock, sand, cellar dirt and industrial, municipal and agricultural waste discharged into water.

Pretreatment – Removal of toxic or hazardous substances from wastewater before it is discharged into a wastewater collection, treatment and disposal system.

Priority Pollutant – Those pollutants listed by the Administrator of the USEPA in Section 307 (a) of the Clean Water Act.

Reclaimed Water (also known as Recycled Water) – water which, as a result of treatment of waste, is suitable for direct beneficial use or a controlled use that would not otherwise occur.

Regional Water Quality Control Board (RWQCB) – Any California regional water quality control board for a region as specified in Porter-Cologne Water Quality Control Act, Section 13200.

Remediation – Cleanup of a site to levels determined to be health-protective for its intended use, or protective of beneficial uses of water.

Return Flow – Applied water that drains as surface flow from irrigated lands.

Riparian – Of, adjacent to, or living on the bank watercourse (e.g. stream, river, lake, etc.).

Runoff – Rainfall or snow melt which is not absorbed by soil, evaporated, or transpired by plants, but finds its way into streams as surface flow.

Sediment - The soil, sand and minerals at the bottom of surface waters, such as streams, lakes and rivers. The term may also refer to solids that settle out of any liquid.

Stormwater – referred to also as "Storm Water," stormwater runoff is snow melt runoff and surface run off and drainage.

Suspended Solids – The small, solid particles in water or wastewater that cause a cloudy condition. Solids that either float on the surface of, or are in suspension in water or wastewater which are removable by filtering.

Total Ammonia – The combined concentrations of the unionized (NH_3) and ionized (NH_4) forms of ammonia.

Total Maximum Daily Load (TMDL) - A specific water quality attainment strategy for a water body and related impairment identified on the 303(d) list. The strategy defines specific measurable features that describe attainment of the relevant water quality standards. The strategy includes a description of the total allowable level of the pollutant(s) in question and allocation of allowable loads to individual sources or groups of sources of the pollutant(s) of concern.

Toxic Pollutant – Those pollutants or combinations of pollutants including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will, on the basis of information available, cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations, in such organism or their offspring.

Toxicity – Ability to harm human health or environment, such as injury, death or cancer. One of the criteria used to determine whether a waste is a hazardous waste (the "Toxicity Characteristic").

Tributary – Connected to another body of water.

Vector – An animal, especially an insect that transmits a disease-producing organism from a host to a non-infected animal.

Water Quality – Refers to chemical, physical, biological, radiological, and other properties and characteristics of the water.

Water Quality Control Plan (Basin Plan) – The Basin Plan defines and designates beneficial uses of waters, establishes water quality objectives to protect those uses, identifies water quality threats and outlines corrective measures to be implemented. It is used to develop discharge limits and guide Regional Board decisions on specific cases.

Watershed – The total land area that contributes water to a river, stream, lake or other body of water. Synonymous with drainage area, drainage basin, and catchment.

1.0 Executive Summary

The Goleta Water District is responsible for providing the Goleta Valley with a safe and reliable supply of water for residential, commercial, agricultural, industrial, and institutional uses. Since the early 1950s, the District has supplied water from a variety of sources, including local surface water, groundwater, and imported supplies. Future imported water supplies from distant sources are becoming more restricted and less reliable. Environmental commitments, periods of dry years, low snow pack, and judicial decisions have all contributed to significant cuts in imported supplies in recent years, and reduced reliability for future years.

California's historic 2012-2017 drought, which the County of Santa Barbara continues to experience as of this writing, has inspired creative approaches and renewed focus on alternative strategies in water management. A combination of factors – drought, population growth, increasing intensity of rainfall, and stormwater runoff pollution – creates challenges and opportunities for exploring additional water supply sources, including stormwater. Stormwater is runoff from rain or snowmelt that, instead of seeping into the ground, runs off land and hard surfaces such as rooftops and paved areas like streets and highways. Runoff from these impervious surfaces mobilizes pollutants such as oil, pesticides, sediment, trash, bacteria and metals, which ultimately flow to and adversely affect local creeks and the ocean. Stormwater policy has traditionally focused on minimizing water quality and flood control problems caused by pollution and wet weather in urbanized areas.

California's stormwater infrastructure has been designed to carry what has been historically treated as hazardous, harmful runoff water away from urbanized areas and out to the ocean as fast as possible. In light of the recent drought, the public's perception of the potential utility of stormwater is changing – from viewing it as problem to viewing it as a resource. Accordingly, new State-level strategies and plans have emerged, which identify goals for stormwater capture from a multi-benefit approach, addressing a broad spectrum of issues in water quality, flood control, habitat, and water supply.

This document serves as the Stormwater Resource Plan (Plan) for stormwater resources contained within the Goleta Water District (the District) service territory. This Plan identifies projects that recharge groundwater and/or capture stormwater for use to supplement water supply, which benefits

the District and its customers. As a steward of water resources in the Goleta Valley, the Goleta Water District promotes the economic, environmental, and social well-being of its present and future customers. Consistent with these sustainability goals and its mission, the District has undertaken this Plan to identify large, centralized stormwater capture opportunities that could augment water supply, thereby offsetting potable water demand, increasing local groundwater reserves, and, ultimately, enhancing the reliability of the District's overall water supply portfolio. Additionally, several secondary benefits resulting from the identified projects are recognized, including enhanced flood control, water quality improvements, as well as environmental benefits for the community. The infiltration projects identified in this Plan utilize natural filtration processes to reduce pollutants reaching the water table, in conjunction with the District's existing water treatment capabilities used for groundwater production. Implementing dry well and capture-reuse projects will be contingent upon verified water treatment effectiveness for the specific application.

Written in accordance with the State's SRP Guidelines and the Water Code, this Plan focuses on large-scale stormwater capture from the large drainage areas of Goleta watersheds, utilizing existing stormwater conveyance infrastructure constructed by the County of Santa Barbara. The projects identified in this Plan utilize preliminary engineered designs necessary to comply with existing flood control and water quality permitting constraints. While this Plan does not evaluate smaller scale, decentralized stormwater capture projects that may be feasible for implementation, the District recognizes the potential benefits of such projects and may explore decentralized stormwater opportunities outside the scope of this Plan.

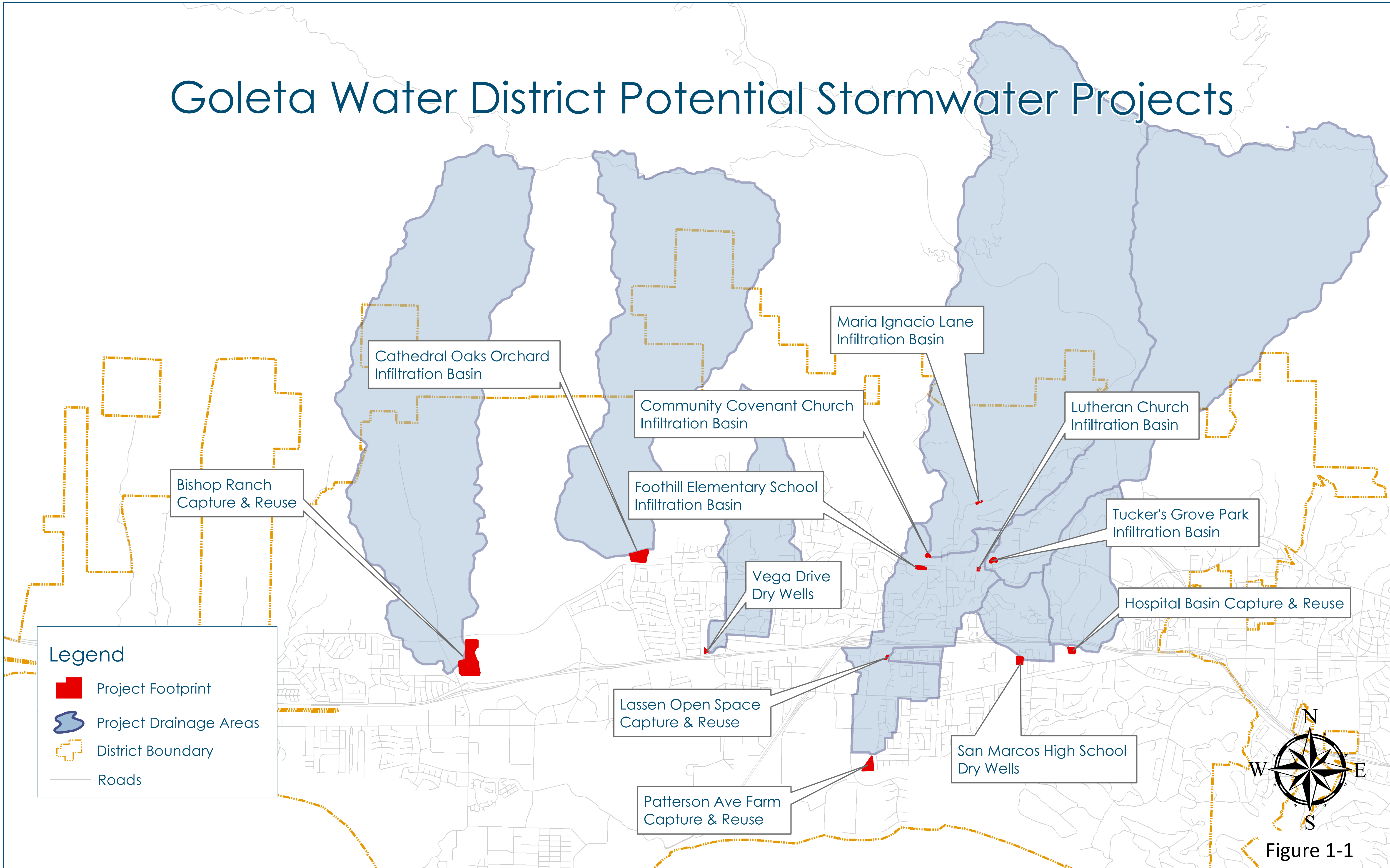
As stated by the State Water Resources Control Board (SWRCB) in its Strategy to Optimize Resource Management of Storm Water (Storm Water Strategy, STORMS), multiple barriers exist that affect the ability of water agencies to implement stormwater capture and other beneficial use projects. Stormwater capture barriers are diverse and include technical, political, legal/regulatory, and logistical issues, and may differ from region to region. Furthermore, stormwater capture projects are often hindered by concerns related to: water quality, water rights, stream and wetland ecosystem impacts, and funding. Ultimately, any implementation of the recommended projects contained in this Plan will need to undergo further review to determine whether any additional barriers to implementation exist, including economic feasibility studies.

The extensive evaluation completed by the District as part of this Plan to identify stormwater capture opportunities within the Goleta Water District showed that conceptual large-scale projects are often limited by topography and lack of sufficient land areas for recharge that would replenish the aquifers of the adjudicated portion of the Goleta Basin (where the water is needed most). These and other pertinent criteria were applied to all land within the Goleta Water District to determine the most feasible projects, which are listed in Table 1-1. Section 4 and Appendix F of this Plan discuss the analysis in detail and Section 5 compares all of the identified projects. Finally, Section 6 provides implementation recommendations. Of particular note, projects located within the jurisdiction of the Santa Barbara County Flood Control District (South Coast Flood Zone) were identified as the most feasible and having the most potential for offering multi-benefits to achieve the goals of SB 985. Accordingly, after submitting this Plan for incorporation into the Integrated Regional Water Management Plan (IRWMP) for Santa Barbara County, the District will encourage the Santa Barbara County Flood Control District to consider implementing projects that are within their responsibility and jurisdictional authority.

Table 1-1 – List of Identified Conceptual Stormwater Capture Projects

Project ID	Project Type	Potential Water Supply Volume (AF)
Maria Ygnacio Infiltration	Infiltration Basin	24
Cathedral Oaks Orchard Infiltration	Infiltration Basin	130
Foothill Elementary Infiltration	Infiltration Basin	73
Tuckers Grove Park Infiltration	Infiltration Basin	38
Lutheran Church Infiltration	Infiltration Basin	26
Community Covenant Church Infiltration	Infiltration Basin	44
Bishop Ranch Capture Reuse	Capture Reuse	660
Patterson Ave Farm Capture Reuse	Capture Reuse	410
Hospital Basin Capture Reuse	Capture Reuse	150
Lassen Open Space Capture Reuse	Capture Reuse	23
San Marcos High School Dry Wells	Dry Wells	49
Vega Drive Dry Wells	Dry Wells	94

The following map, Figure 1-1, depicts the locations of the identified projects in this Plan throughout the District's service territory.



Goleta Water District Potential Stormwater Projects
Cathedral Oaks Orchard Infiltration Basin
Community Covenant Church Infiltration Basin
Maria Ignacio Lane Infiltration Basin
Lutheran Church Infiltration Basin
Bishop Ranch Capture & Reuse
Foothill Elementary School Infiltration Basin
Tucker's Grove Park Infiltration Basin
Vega Drive Dry Wells
Hospital Basin Capture & Reuse
Lassen Open Space Capture & Reuse
San Marcos High School Dry Wells
Patterson Ave Farm Capture & Reuse
Legend
Project Footprint
Project Drainage Areas
District Boundary
Roads
N
W
E
S
Figure 1-1

2.0 Background

For a broader context of the regulatory environment and evolution of policy approaches toward stormwater management, Section 2 summarizes the regulatory background and history of stormwater management at the federal, state, and local levels, including the District's background and role in stormwater management. This section includes a summary of the statewide stormwater permitting program, and the types of permits administered, as required by the SRP Guidelines.

2.1 Goleta Water District Background

The Goleta Water District is a local government agency organized under Division 12 of the California Water Code. It was created by a vote of the people on November 17, 1944 to meet the specific water supply and distribution needs of the Goleta Valley. The federal Cachuma Project, completed in 1956, is one of three major U.S. Bureau of Reclamation projects in the region, capturing water from the Santa Ynez River Watershed. The Cachuma Dam, later renamed the Bradbury Dam, captures the highly variable seasonal streamflow from the Santa Ynez watershed between October and April that would otherwise drain to the ocean. Since the Goleta Water District receives an allocation of that Cachuma water, the District, in a sense, has been "capturing" watershed runoff for decades already.

One of the original purposes for the formation of the District was to establish a legal entity representing the Goleta Valley area to work with the City of Santa Barbara, Montecito, Summerland, Carpinteria, and Santa Ynez Water Districts. As a group, these organizations were able to enter into contracts with the Santa Barbara County Water Agency and the U.S. Bureau of Reclamation for a supply of water and repayment of the costs of construction of the Cachuma Project on the Santa Ynez River. This project was constructed to conserve waters of the Santa Ynez River for use in the Santa Ynez Valley and the South Coast area of Santa Barbara County. Water from the Cachuma Project began serving the South Coast in 1956.

The District is located in the South Coast portion of Santa Barbara County. The service area encompasses approximately 29,000 acres, and provides water service to 86,950 residents. There are more than 16,600 active municipal and industrial customer accounts and 165 agricultural accounts within the District. The District serves water to the City of Goleta, University of California, and the City of Santa Barbara Airport; the remainder of the District is located in the unincorporated County of Santa Barbara. La Cumbre Mutual Water Company, El Capitan Mutual Water Company, and several other small private water purveyors are located within the service area but manage their own supplies, facilities, and customers, and are not served by the District.

The District has multiple sources of water supply, including Cachuma Reservoir, groundwater, State Water Project (SWP) water, recycled water, and supplemental water purchases. The District's distribution system includes over 270 miles of pipelines ranging in size from two inches to 42 inches in diameter. Water from Cachuma Reservoir and the SWP is treated at the Corona Del Mar Water Treatment Plant. The District maintains 8 reservoirs ranging in capacity from 0.3 million gallons (MG) to over 6 MG with a total combined capacity of approximately 21 MG.

Within the Goleta Water District, the climate is characterized as Mediterranean Coastal. Summers are mild and dry, and winters are cool. The average temperature is 59 degrees Fahrenheit. Average rainfall is about 16 inches per year at lower elevations and 30 inches per year at the crest of the Santa Ynez range to the north. The volume of water used by Goleta Water District customers varies seasonally.

Consistent with the SRP Guidelines' requirement that the District discuss each component of the District's existing water supply portfolio, the following summaries of each supply source are provided.

Cachuma Project

The Cachuma Project delivers water to Cachuma Project Member Units for domestic, irrigation, and municipal and industrial uses. The Member Units are the Goleta Water District, the City of Santa Barbara, Montecito Water District, Carpinteria Valley Water District, and the Santa Ynez River Water Conservation District Improvement District #1. The Lake Cachuma watershed and Upper Santa Ynez River system originates in the San Rafael Mountains in the Los Padres National Forest. Lake Cachuma has an estimated capacity of 190,000 AF. The Federal government owns the Cachuma Project. The Bradbury Dam is operated by the United States Bureau of Reclamation (USBR), and the conveyance facilities are operated by the Cachuma Operation and Maintenance Board (COMB). Deliveries from the Cachuma Project to the Member Units vary from year to year depending on winter runoff, lake storage, water demand, downstream releases for fish and other water rights holders. Historically, the lake has spilled over Bradbury Dam every three years on average. When spill occurs, the District may access the excess supply without debiting its annual entitlement, which is 9,322 AFY in a normal year. Spill water is injected into the groundwater basin as part of the District's groundwater management program.

Average Cachuma deliveries over the past ten years have been 8,217 AFY. For the first time in history, the District received a 0% allocation from the Cachuma Project for the 2015-16 water year, due to the prolonged drought and historically low lake levels. Changing conditions at the lake over the last 20 years include reduced reservoir capacity due to sedimentation and increased downstream release obligations for fish and water rights holders. The Cachuma Project remains the least expensive and primary source of supply for the District during normal years, however, the District's updated WSMP analyzes multiple scenarios that could affect the impact of reduced Cachuma Project yield, including anticipated worst-case scenarios of significantly reduced Cachuma yield.

Groundwater

The Goleta Groundwater Basin is a vital and reliable ongoing source of supply, and serves as a buffer during drought and other emergencies. In 2017, storage in the Basin was approximately 35,000-40,000 AF. The District extracts groundwater from wells located in the Central and North adjudicated subbasins, with a right to produce, or extract, 2,350 AFY of the annual safe yield of the Basin, as well as surplus water stored in the Basin pursuant to the District's storage rights. The District and La Cumbre Mutual Water Company have the sole rights to store water in the Basin, per the Judgment in Wright v. Goleta Water District (1991). The District is currently pumping and treating water from nine wells, with the capacity to produce 5,000 to 6,000 AFY. Wells that are currently undergoing rehabilitation for future production will increase this capacity for added water supply reliability.

State Water Project (SWP)

In 1991, District customers voted to purchase water from the SWP. Water is delivered from the SWP via the main SWP aqueduct's Coastal Branch, which serves eight other water agencies. These agencies and the District collectively form the Central Coast Water Authority (CCWA), a California Joint Powers Agency, which was created to construct, operate and maintain the Coastal Branch facilities. The District has an entitlement of up to 7,450 AFY from the SWP, inclusive of "drought buffer" purchased in the 1990s; any allocated water that the District does not use in a given year is stored in San Luis Reservoir in Merced County. SWP deliveries are determined by the California Department of Water Resources (DWR) based on the water content in the Sierra snowpack and statewide water availability, as well as environmental constraints.

Recycled Water System

Both the Goleta West Sanitary District and the Goleta Sanitary District provide wastewater collection to customers within the District's service area. Wastewater from both the Goleta West Sanitary District and the Goleta Sanitary District is treated at the Goleta Sanitary District wastewater treatment plant (WWTP). Recycled water service within Goleta began in 1994 in response to drought conditions of the early 1990s and the Wright suit settlement. The WWTP is designed to handle a peak dry weather flow of 9 MGD. The existing recycled water system can produce up to 3 million gallons per day (MGD) (approximately 3,000 AFY) of tertiary treated water. The ability to utilize recycled water is limited by water use patterns, delivery capacity, and end-user demand. Currently, the District delivers recycled water for landscape irrigation uses as well as a minor amount for toilet flushing. Over the last 14 years the amount of recycled water produced and delivered has remained relatively constant, with minor variation due to rainfall. Demand for non-potable recycled water is not expected to dramatically increase in the future. The District completed a Potable Reuse Facilities Plan in July of 2017, which analyzed the feasibility of expanding recycled water uses within the Goleta Valley. The study identified an initial phased project, whereby the District could ultimately produce up to 1,500 AFY of highly treated water for groundwater recharge. Ahead of any potential project, the District will review the need for a pilot project in light of its long-term water supply portfolio.

Current Supply/Demand

As part of its water supply management strategy per the District's WSMP, the District modeled water supplies for an average year, a single dry year (2012), and for multiple dry years (2014-2016). The analysis determined that the District's current supplies exceed current demand under average conditions, with demand reductions and/or supplemental water purchases required only during drought periods.

The current supply and demand under the optimal water supply strategy outlined in the 2017 WSMP are shown in Table 2-1.

Table 2-1 – Current Supply/Demand Summary under Optimal Water Supply Strategy

Current Conditions	Average Year Supply (AFY)	Single Dry Year (AFY)	Multiple Dry Years (AFY)
Current Demand	13,824	14,567	14,567
Supply Sources			
Cachuma Potable & GWC	9,811	9,322	3,884
State Water	1,942	2,427	3,381
Groundwater	1,160	1,923	5,750
Recycled Water	1,061	985	985
Supplemental SWP Allocation Purchases	0	0	0
Total Supply	13,974	14,657	14,000
Total Surplus (Deficit)	*150*	*0*	*(657)*

Note: Supplies are based on the optimal water supply strategy model run. Average year supply is the mean of all "average" years determined from historical Goleta rainfall. The single dry year was 2012 (at the beginning of current drought) and the multiple dry year period was 2014-16. These results are from the WSMP model, and are not identical to the actual data from those years because Cachuma and State Water supplies from those and preceding years come from the RiverWare and State Water Project Delivery Capability Report modeling results.

2.2 Existing Regulatory Framework

With roots in federal and state legislation, environmental and water quality issues have long been a domain of California leadership and expertise. The California Water Boards have overseen stormwater quality management and regulation at the state level for more than 20 years. At the federal level, water quality legislation dates back as early as the 19th century. The first major United States law to address water pollution nation-wide was enacted in 1948 with passage of the Federal Water Pollution Control Act with the goal of reducing toxic pollutants in the waters of the nation. The Act became more commonly known as the Clean Water Act in 1972.

In the 1970s there were major notable advancements in the environmental movement, and in addressing water quality concerns specifically. The Environmental Protection Agency (EPA) and the Council on Environmental Quality (CEQ) were created, Earth Day was celebrated for the first time in 1970, and legislation was enacted to address quality of life and environment in the areas of drinking water, ocean, wastewater, gasoline, hazardous waste, and toxic substances (including cancer-causing pesticides). The National Pollutant Discharge Elimination System (NPDES) program, which now focuses on controlling toxic discharges into the nation's waters, was created in 1972 (Section 402) and later enhanced through program amendments adopted in 1977. The NPDES program was designed to be implemented as part of the Water Quality Act of 1987, through active enforcement by local jurisdictions to control water pollution from "point sources" that discharge pollutants into federal waters. The United States currently delegates NPDES permitting authority to the State of California, where it is implemented by the California EPA through State and Regional Water Boards.

Pursuant to its authority drawn from the federal Clean Water Act and the EPA, the California State Water Resources Control Board (SWRCB) requires cities, counties, and towns to regulate activities that cause pollutants to enter their storm drain systems, consistent with the NPDES program. Storm drains typically flow into creeks that have already passed through a variety of land uses, including natural, agricultural, urban and industrial, and often through more than one jurisdiction. Jurisdictions within the study area of this Plan include the Cities of Goleta and Santa Barbara, County of Santa Barbara, University of California, Santa Barbara (UCSB), and the California Department of Transportation (Caltrans).

The SWRCB administers the NPDES Program, which regulates stormwater discharges from municipal separate storm sewer systems (MS4s). MS4 permits were issued in two phases:

- Under Phase I, which started in 1990, the Regional Water Quality Control Boards adopted National Pollutant Discharge Elimination System (NPDES) stormwater permits for medium (serving between 100,000 and 250,000 people) and large (serving 250,000 or more people) municipalities. Most of these permits are issued to a group of Co-permittees encompassing an entire metropolitan area.

- Phase II began on April 30, 2003, when the SWRCB issued a statewide General Permit for the Discharge of Storm Water from Small MS4s (WQ Order No. 2003-0005-DWQ). The General Permit provides permit coverage for smaller municipalities (population less than 100,000), including non-traditional Small MS4s such as military bases, public campuses, prisons and hospital complexes that direct stormwater into discrete conveyances (point sources). The statewide Phase II Small MS4 General Permit was renewed on February 5, 2013, and became effective on July 1, 2013.

Owners and/or operators of industrial facilities require regulation of their stormwater discharge. The permit regulating industrial stormwater discharges is the NPDES General Permit for Storm Water Discharges Associated with Industrial Activities, NPDES No. CAS000001. The California State Water Resources Control Board (State Water Board) adopted this permit (also known as the Statewide Storm Water Industrial General Permit, or IGP) on April 1, 2014 as State Water Board Order No. 2014-0057-DWQ. The NPDES Permit and IGP allow industrial facilities to discharge clean stormwater to surface waters. Without the permit, it is unlawful to discharge even clean stormwater from regulated facilities. Within the Central Coast Region of California, the Central Coast Water Board administers the IGP, which went into effect on July 1, 2015. However, the State Water Board maintains the electronic reporting system for the IGP, so interaction with both the State and Central Coast Water Boards is necessary in complying with the IGP.

While federal regulations allow two permitting options for stormwater discharges (Individual Permits and General Permits), the State Water Board has elected to adopt only one statewide General Permit that applies to construction activity. Specifically, projects with discharge that disturbs one or more acres of soil are required to obtain coverage under the General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction Storm Water General Permit) Order Number 2009-0009-DWQ, amended by 2010-0014-DWQ and 2012 -0006-DWQ, NPDES Number CAS000002. Construction activity subject to this permit includes clearing, grading, excavation, or any other activity that results in a land disturbance of one acre or more.

Table 2-2 – Permittees Within Study Area*

Permittee	Permit Type	Permit Area
County of Santa Barbara	MS4	Unincorporated County Territory
City of Goleta	MS4	City Territory
Caltrans	MS4	HWYs 101, 217, 154
UCSB	MS4 (Non-Traditional)	1,923
Santa Barbara Airport	IGP	Airport, Goleta Slough

*This table does not include IGPs for individual commercial and industrial properties, with the exception of the Santa Barbara Airport (Airport). The Airport is listed because of its size and inclusion of the Goleta Slough. The District holds an IGP for activities in the Headquarters Operations Yard.

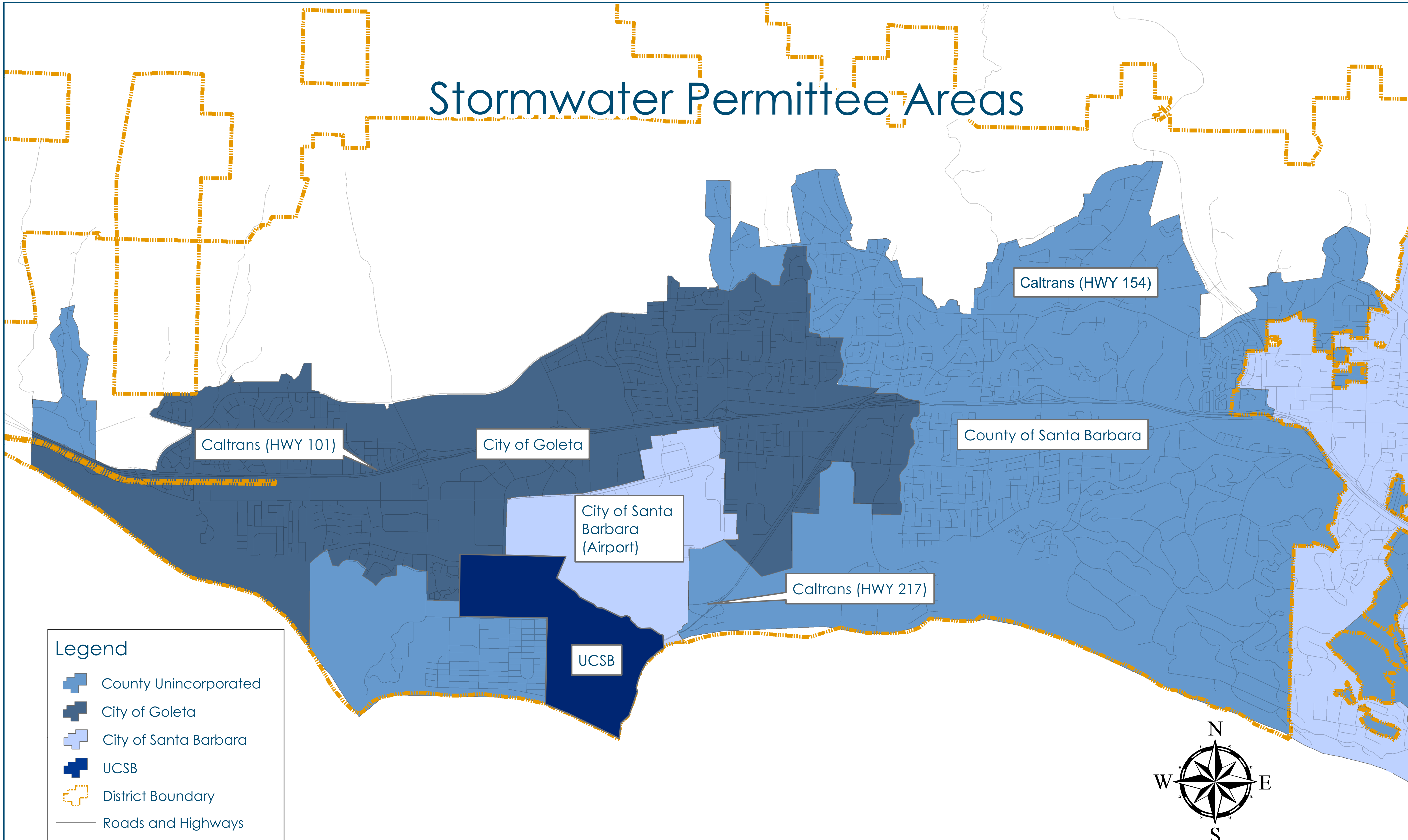

Stormwater Permittee Areas
Caltrans (HWY 154)
Caltrans (HWY 101)
City of Goleta
County of Santa Barbara
City of Santa Barbara (Airport)
Caltrans (HWY 217)
UCSB
Legend
County Unincorporated
City of Goleta
City of Santa Barbara
UCSB
District Boundary
Roads and Highways
N
W
E
S

Figure 2-1

2.3 Goleta Water District Role in Stormwater Management

Stormwater management in the District service territory is within the jurisdiction of the Santa Barbara County Department of Public Works Flood Control District, as well as the City of Goleta and the University of California Santa Barbara. The Goleta Water District manages stormwater runoff in accordance with the same state and federal regulatory regime, pursuant to its Industrial General Permit (IGP) for activities at the District's Headquarters Operations Yard, as well as its Drinking Water Discharge Permit, as further described in Section 2.3.1.

As a water supplier for approximately 87,000 people, the District implements sustainable water management practices that ensure the continued availability and reliability of water to support current and future generations of customers in the Goleta Valley. While it does not have the jurisdiction or authority to implement stormwater capture projects, the District has undertaken this Stormwater Management Plan effort to explore and promote water supply augmentation and improved water quality within its service territory. Accordingly, in the spirit of coordination and collaboration, the District intends to present the recommended projects identified in this Plan to the Santa Barbara County Flood Control and Water Conservation District as the appropriate land use and flood control entity for carrying out such projects. Notably, implementation of the recommended projects would support and enhance the District's Aquifer Storage and Recovery (ASR) program, which utilizes a series of injection wells to recharge the groundwater basin with surface water (when available) for storage and later use in dry years. Such sustainable water management optimizes the use of water supplies, helping to ensure the continued balance of supplies with the diverse demands for water resources in southern Santa Barbara County.

The State stormwater program objectives include identification and elimination of pollutant contact with stormwater by implementation of Best Management Practices (BMPs). General Permits require, at a minimum, monitoring and reporting that includes: sampling and analysis of four pollutant indicator parameters, wet and dry weather stormwater conveyance system inspections, and annual reporting. The Regional Board can recommend additional monitoring parameters based on the presence of specific pollutant sources. Sampling results and annual report information will be used to prioritize Regional Board staff education and enforcement efforts and to develop future group general permits. Compliance is measured through implementation of pollution prevention Best Management Practices, reduction in pollutant loadings, and accurate and timely report submittal.[1] (See References at the end of this report for all numbered notations.) The Statewide 2013 Phase II MS4 Permit (SWRCB, 2013) is applicable to areas within the District's stormwater resource planning area (i.e., the cities of Goleta and Santa Barbara, unincorporated areas of Santa Barbara County, and the University of California at Santa Barbara).

Against this regulatory backdrop, this Plan provides a watershed-based approach to stormwater management by identifying multi-benefit projects. One benefit, for example, involves reducing the volume of urban and/or agriculture runoff to receiving waters, thereby reducing pollutant loads while also augmenting or supplementing water supplies. The pollutant load reductions achieved by stormwater capture projects would benefit receiving water quality, thus supporting MS4 permit compliance with TMDL wasteload allocations (WLAs), and agriculture waiver entities with specific waterbody load allocations.

The District does not have any responsibility for MS4 permits. In fact, the only stormwater permitting requirements that apply to the District are related to the small amount of stormwater discharge from the administration headquarters operations yard and pipeline dewatering activities. In addition to potentially augmenting water supplies, the projects identified in this Plan could assist MS4 dischargers in complying with the following provisions of the Phase II MS4 Permit:

- Provision B, which prohibits "discharges of stormwater from the MS4 to waters of the U.S. in a manner causing or threatening to cause a condition of pollution or nuisance".
- Provision C, which requires the permittees to implement controls to reduce the discharge of pollutants from their MS4s to the Maximum Extent Practicable (MEP).
- Provision D, which states that "discharges shall not cause or contribute to an exceedance of water quality standards contained in a Statewide Water Quality Control Plan, the California Toxics Rule, or in the applicable Regional Board Basin Plan."

In summary, implementation of the projects recommended in this Plan have the potential to yield multiple benefits for the County and other MS4 permit-holders, in addition to District customers.

2.3.1 Existing Permits

The District currently holds two types of stormwater permits; one for drinking water discharge from production well sites and waterlines (i.e. flushing, leaks), and one for the District administrative headquarters site, which is considered industrial. These permits are further described below, in order to provide context for how the District fits in the regulatory regime.

Drinking Water Discharge Permit (NPDES)

The District currently holds a NPDES Permit for Drinking Water System Discharges into Waters of the U.S. under Water Quality Order 2014-0194-DWQ, NPDES NO. CAG 14001 under the new Statewide State Water Resources Control Board's General Permit. The District became a permittee of the new General Permit in January 2016. The District currently maintains twelve well sites with the potential to discharge to neighboring creeks: Airport Well, Anita Well, Berkeley Well, El Camino Well, Oak Grove Well, San Antonio Well, San Ricardo Well, San Marcos Well, Santa Barbara Corporate Well, Sierra Madre, Shirrell Well, and University Well. These wells are currently used for potable water supply or are being developed as wells for potable water supplies and require necessary discharge before water is treated and for rehabilitation. Under the same permit, the District is required to report drinking water discharges to storm drains and/or other losses via pipeline breaks, water meter leaks, flushing orders, reservoir overflows and shutdowns to the State Water Resources Control Board. The District is obligated to sample and test for specific parameters for each drinking water discharge into waters of the U.S. and report noncompliant water quality. The District is also required to report flow data including the number of discharge events greater than 50,000 gallons per day, the annual total estimated volume of discharge, and the fraction of that volume put to beneficial use or sent to land annually by June 30 each year to the State Water Resources Control Board.

Industrial General Permit

Figure 2-2 – Hospital Creek Channel Upstream of District Headquarters

The District also holds an Industrial General Permit (IGP) for its administrative headquarters property. The IGP requires the implementation of best management practices and a site-specific SWPPP to improve the quality of onsite stormwater runoff. The objectives of the District's SWPPP are (1) to identify and evaluate sources of pollutants associated with industrial activities that may affect the quality of stormwater discharges and authorized non-stormwater discharges from the site; and (2) to identify and implement site-specific BMPs to reduce or prevent pollutants associated with industrial activities in stormwater discharges and authorized non-stormwater discharges. The District's SWPPP also includes a Storm Water Monitoring Program that designates two stormwater discharge monitoring points to be sampled during permit-defined qualifying storm events. Stormwater monitoring points are located in the Operations Yard located at District Headquarters where water is discharged into an adjacent flood channel. The IGP requires the District to sample monitoring points during the first two qualifying storm events of July 1-December 30 and the first two storm events of January 1-June 30 of each reporting year. Stormwater samples sent to a certified laboratory are tested specifically for total suspended solids, oils and grease. The District performs infield measurements of pH, which is also required by the permit. The District's IGP Annual Report is submitted to SMARTS each year summarizing sampling event observation forms, monthly observation forms, lab results, BMPs, and the District's SWPPP.

2.3.2 Historical Stormwater Capture Studies

The District has studied opportunities for stormwater capture at various points over the last 30 years. During the drought of the late 1980s and early 1990s, water supplies for the south coast of Santa Barbara County reached a critically low level, prompting further efforts to identify alternative water supply sources, including stormwater capture. While many projects were identified as feasible opportunities to provide potential supply augmentation, ultimately the District did not pursue them as drought conditions eased in the early 1990s and additional supplies were acquired through the State Water Project and a newly constructed recycled water system. With increasing variability in water availability, re-evaluating prior projects that were once identified as feasible is both prudent and appropriate.

Technical analysis and documentation from previous reports were considered and integrated as appropriate into this Plan. Specifically, two previous plans provided meaningful input:

Goleta Artificial Recharge Study – Phases 1 (Data Evaluation) & 2 (Implementation Plans)

In this 1982 report, prepared for the District by David Keith Todd Consulting Engineers, Inc, methods for artificial groundwater recharge were reviewed and estimates of the quantity of water available from each stream crossing the Goleta Groundwater Basin were produced. Phase 1 of the Report summarized the availability and adequacy of hydrogeological data, and Phase 2 focused on the development of plans for groundwater recharge facilities. The study made recommendations to include artificial recharge of local streamflow in the District's groundwater management programs and to use the study as a reference document in site selection for projects. The District subsequently selected six locations on United States Forest Service and County of Santa Barbara property for enhancement of surface water percolation in creek channels using flow-retarding structures (check-dams) – two (2) on San Jose Creek and four (4) on San Antonio Creek. None of the projects proceeded past the conceptual stage, mainly due to concerns regarding potential environmental impacts from hindering flows in steelhead habitat, as well as changed water supply conditions.

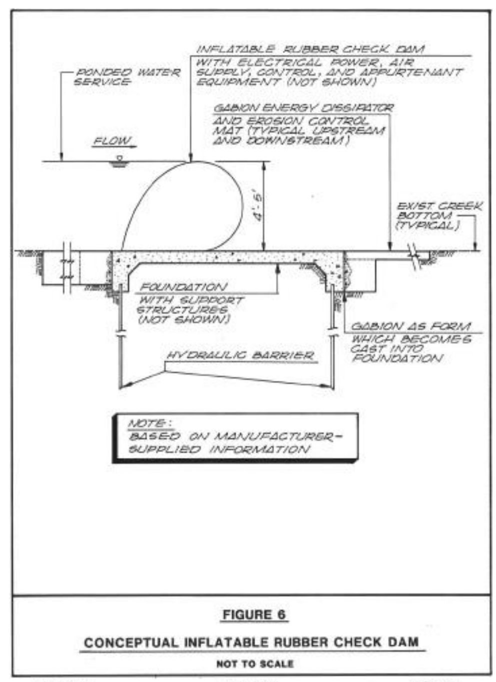


Figure 2-3 – 1988 Check Dam Project Concept

Project Development Study for Goleta Water District's Stream Bed Percolation Project

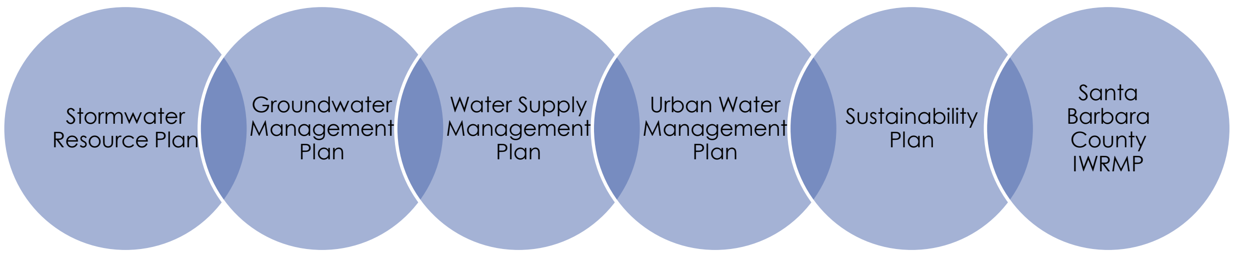
This 1988 report prepared by Flowers & Associates, Inc. built upon the findings of the Todd Study and further refined site locations, evaluated engineering design considerations, solicited jurisdictional agency comments, and defined a recommended project for check-dams to regulate stormwater flow at various locations selected by the District. The study provided concept check-dam designs and initial project cost estimates.

Recommendations were made for the District to further review the hazards of stormwater collection for recharge, and if it found that the hazards and environmental impacts were mitigable, to proceed with the project design process.

The District ultimately chose not to pursue environmental review or conceptual designs for any of the projects contemplated in the studies outlined above. As part of this Plan, in addition to formulating its own potential projects, the District re-evaluated many of these prior project concepts in light of current conditions and regulations.

2.3.3 Related Policy Documents

The District is guided by a variety of dynamic and detailed resource management plans that this Plan will relate with and inform as part of future updates.



The District's plans, particularly the Water Supply Management Plan (WSMP) recommend the conjunctive use of the Goleta Groundwater Basin, injecting surface water and alternative water supplies when available to store in the Basin, and extracting groundwater in dry years. The WSMP has a current priority of injecting spill water from Cachuma first if available, and then State Water Project water if spill water is not available. To engage in full conjunctive use, the District has a variety of options to augment supply. The WSMP identified the potential need for augmented supplies in the event surface water entitlements are further reduced, and noted that such augmented supplies could come from a variety of sources, including purchased water, groundwater augmentation with recycled water, and stormwater capture either for infiltration and recharge or offsetting potable use by capture and reuse. The plans that align with this Plan are summarized in this section.

Groundwater Management Plan

The Goleta Groundwater Basin is a critical component of the District's water supply portfolio, particularly in times of drought when surface water is in short supply. Proper management of the basin and groundwater supplies requires accurate and up-to-date information, including groundwater levels, water quality, and basin storage. To this end, the District completed a 2016 update to its Groundwater Management Plan (GMP), originally developed in 2010, to reflect current water levels and management of the basin, as wells as recommending any appropriate modifications to groundwater management strategies and operating plans under various scenarios. The GMP 2016 Update also integrates new salt and nutrient planning requirements. The District's GMP describes the physical characteristics of the Basin, reiterates adjudication and voter-passed components of groundwater management, and includes basin management strategies, including an ongoing aquifer storage and recovery program when water is available for injection. Notably, the GMP identifies stormwater capture as a potential opportunity to help recharge the basin.

Water Supply Management Plan

The Water Supply Management Plan (WSMP) formulates a water supply strategy for the District by prioritizing use of various sources of supply, evaluating the reliability of those water supplies, and evaluating scenarios for current and future demand, which is defined as 18 years from the current 2017 Plan (2035). While the primary purpose of the WSMP is to identify the optimum water supply management strategy, demand management is equally important as part of the supply/demand equation. The strategies outlined in the WSMP reflect the District's long-standing and continued commitment to long-term water efficiency as part of its strategy to preserve available water resources. Ongoing policy related to improving water efficiency throughout the District now and into the future is a key ongoing part of the District water supply management strategy. The WSMP identified potential need for long-term supply augmentation in the event the District's current surface water rights are reduced or curtailed due to environmental and regulatory mandates. Local supplies such as stormwater were included as potential supply alternatives for further evaluation.

Urban Water Management Plan

The District's Urban Water Management Plan (UWMP) provides the District and the public with a broad roadmap for its unique water supply and demand concerns, and is updated every five years consistent with California Water Code (Section 10610 et seq.). The UWMP functions as a high-level guiding document to demonstrate the District's ability to achieve its core mission, and is not intended to direct specific actions related to water supply and demand management. The District's UWMP is informed by the Groundwater Management Plan (GMP), as well as the District's recently updated Water Supply Management Plan (WSMP). These documents inform and dictate how the District will manage its diverse water supply portfolio to optimize available supplies under various conditions in light of projected demands. As such, the long-term water supply planning and reliability discussion included in the UWMP relies heavily on the extensive modeling undertaken in developing the GMP and WSMP. Taken together, these three documents serve as a critical management tool to plan for the long-term reliability of water supplies to serve the community.

Sustainability Plan

The District Sustainability Plan was adopted by the District Board of Directors in 2012 to illustrate how District's service delivery strategy and specific activities result in economic, environmental, and social benefits for current and future customers. The Sustainability Plan consolidates the District's past, present, and future efforts and activities under one common framework, highlighting sustainable outcomes that help ensure the continued availability and delivery of water to support current and future generations of customers. To effectively capture the three traditional resource management objectives – economic, environmental, and social – the Sustainability Plan presents a blueprint for aligning these objectives with the District's responsibilities as a public water utility. Any activity, including pursuing water supply alternatives, is evaluated from a sustainability perspective. Costs are a large driver in pursuing any particular water supply alternative, and the District's economic approach relies on the prudent balancing of costs and revenue. The environmental objective is achieved through enhancing resource stewardship, emergency preparedness, and risk mitigation. Social sustainability is accomplished with healthy and active public engagement, as well as keeping consistent with community values. The development and implementation of this Stormwater Resource Plan aligns with the District Sustainability Plan and addresses each of the sustainability objectives.

Santa Barbara County Integrated Regional Water Management Plan

The District is one of 30 cooperating partners in the Santa Barbara County (SBC) Integrated Regional Water Management (IRWM) process. The IRWM is a collaborative effort to identify capital projects on a regional scale that can augment the billions of dollars of existing investments made by its cooperating partners. While the Santa Barbara County Water Agency is designated as the "lead agency" for administrative purposes, the Steering Committee is the main decision making body within the IRWM. The Steering Committee, of which the District is a member, has the authority to recommend or propose actions to the Cooperating Partners, inclusive of determining IRWM Plan goals and the criteria for ranking and selecting projects that are proposed for grant funding. The IRWM Plan is a living document, updated every five years as required by the Integrated Regional Water Management Planning Act. The regional boundaries of the SBC IRWM Plan are based upon the political boundaries of the County of Santa Barbara for the management purposes of the regional group, and all watersheds within the scope of this Plan are included within the boundaries of the "South Coast Watershed" as defined in the IRWMP and further described in section 3.1 of this plan.

2.4 Existing Plans (Other Agencies/Organizations)

While not directly affecting the District's identification of feasible stormwater projects, the following plans and reports are summarized in order to highlight local organizations that have a role in stormwater management within the District's Plan study area, as required by the SRP Guidelines. These plans were prepared in accordance with federal or state requirements and/or local environmental management efforts.

Central Coast RWQCB – Water Quality Control Plan

- Required by the Porter-Cologne Act
- The Central Coastal Basin Plan (Basin Plan) is the Board's master water quality control planning document.
- The Basin Plan designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater.[2]

County of Santa Barbara (Project Clean Water) Guidance Document for Municipal Stormwater Permit

- The County's Storm Water Management Program (SWMP) was prepared in 2012 pursuant to State Water Resources Control Board Water Quality Order No. 2003-005-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit No. CAS0000004 Waste Discharge Requirements for Storm Water Discharges from Small Municipal Separate Storm Sewer Systems (General Permit).[3]
- Pursuant to the current 2013 Permit, the County now operates under the Guidance Document for Municipal Stormwater Permit 2013-2018, which is the current stormwater management program.

City of Goleta Storm Water Management Plan

- The City's SWMP is required under the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges from Small MS4s, Water Quality Order No. 2003-005-DWQ and CAS000004 (General Permit).[4]
- The Plan was approved by the Central Coast Regional Water Quality Control Board (CCRWQCB) (Water Board) on February 4, 2010.

UCSB Stormwater Management Program Guidance Document

- UCSB submitted its original Stormwater Management Plan (SWMP) in 2003 to the Central Coast Regional Water Quality Control Board (Central Coast Water Board) and implemented pollution prevention practices, even though they were not officially enrolled until 2008. On February 15, 2008, UCSB was required to enroll in the State Water Board's MS4 General Permit and to revise the existing UCSB Stormwater Management Plan, which was later adopted by the Central Coast Water Board in June of 2009.
- UCSB's Guidance Document serves as a planning tool to be used by UCSB's regulatory body, University departments, contractors, and the general public throughout the UCSB community, which includes staff, students, faculty, and visitors.[5]

Santa Barbara County Urban Runoff Treatment Control Project, 2001

- Stakeholders included Santa Barbara County, Goleta, and Santa Barbara.
- Local monitoring data was used to identify stormwater discharge that may exceed water quality standards in some of these basins and select constituents of concern.
- A database was developed to store notes, photographs, and other information from the site investigations.
- Projects were prioritized relative to resource and design constraints and the water quality objectives.[6]

Goleta Slough Area Sea Level Rise and Management Plan, 2015

- The 2015 Plan updates the first Goleta Slough Ecosystem Management Plan. The purpose of the original plan was to provide a comprehensive framework for ecosystem management and impact mitigation within the Goleta Slough Ecosystem.
- The updated plan re-evaluates the study area based on projected sea level rise, assesses vulnerability and risk to both environmental and human resources, and recommends policies and potential adaptation strategies for the Slough with input from multiple stakeholders[7]

Urban Storm Water Monitoring Plan, 2015-2018

- The goal of this monitoring effort is to characterize pollutant concentrations and loads from representative MS4 discharge locations within the County by collecting data to inform the County-wide PEAIP land use-based pollutant load model (LPRM).
- This monitoring program focuses on pollutants typically associated with wet weather MS4 discharges in key watersheds.
- The monitoring program is defined for a period of three years, at which time continuing monitoring, or revisions to this plan, will be considered.[8]

Goleta Valley Watersheds Stream Team Data Reports, 2014

- This report is based on a comparison of data collected during the 2014 Water Year (October 1, 2013—September 30, 2014) to applicable water quality standards.
- Stream Team engages volunteers in conducting monthly water quality sampling at 23 sites throughout the Goleta Valley.[9]

3.0 Goleta Watershed Study Area

Figure 3-1 – Flood of 1995 – Goleta (Photo Credit: Santa Barbara County Flood Control District)

3.1 Watershed Description

The 15 Santa Barbara County South Coast watersheds that traverse the Goleta Water District service area were analyzed using CalWater watershed designations and criteria, consistent with State guidance. A watershed is defined as the region draining into a river, river system, or other body of water. CalWater delineates California watershed boundaries at six scales, or "watershed levels," that are based on average acreage of the watershed. The watersheds analyzed in this Plan vary in size from 900 acres to 5503 acres, with a total area of 40,582 acres, or just over 63 square miles. CalWater watershed levels that most closely match the size of those watersheds, either individually or collectively, are the Planning watershed level (3,000-10,000 acres) and Super Planning watershed levels (50,000 acres). Using the Planning level designation will provide a level of detail such that patterns of stormwater and dry weather runoff can be analyzed and quantified. Additionally, the Planning level scale will also be useful to identify areas of recharge and other types of potential water capture projects, as well as allowing analysis of multiple projects within the watersheds, helping the plan achieve true watershed-based stormwater management objectives. Likewise, the Super Planning watershed level supports this comprehensive, integrated stormwater management plan that looks at a broad range of projects across multiple jurisdictional boundaries.

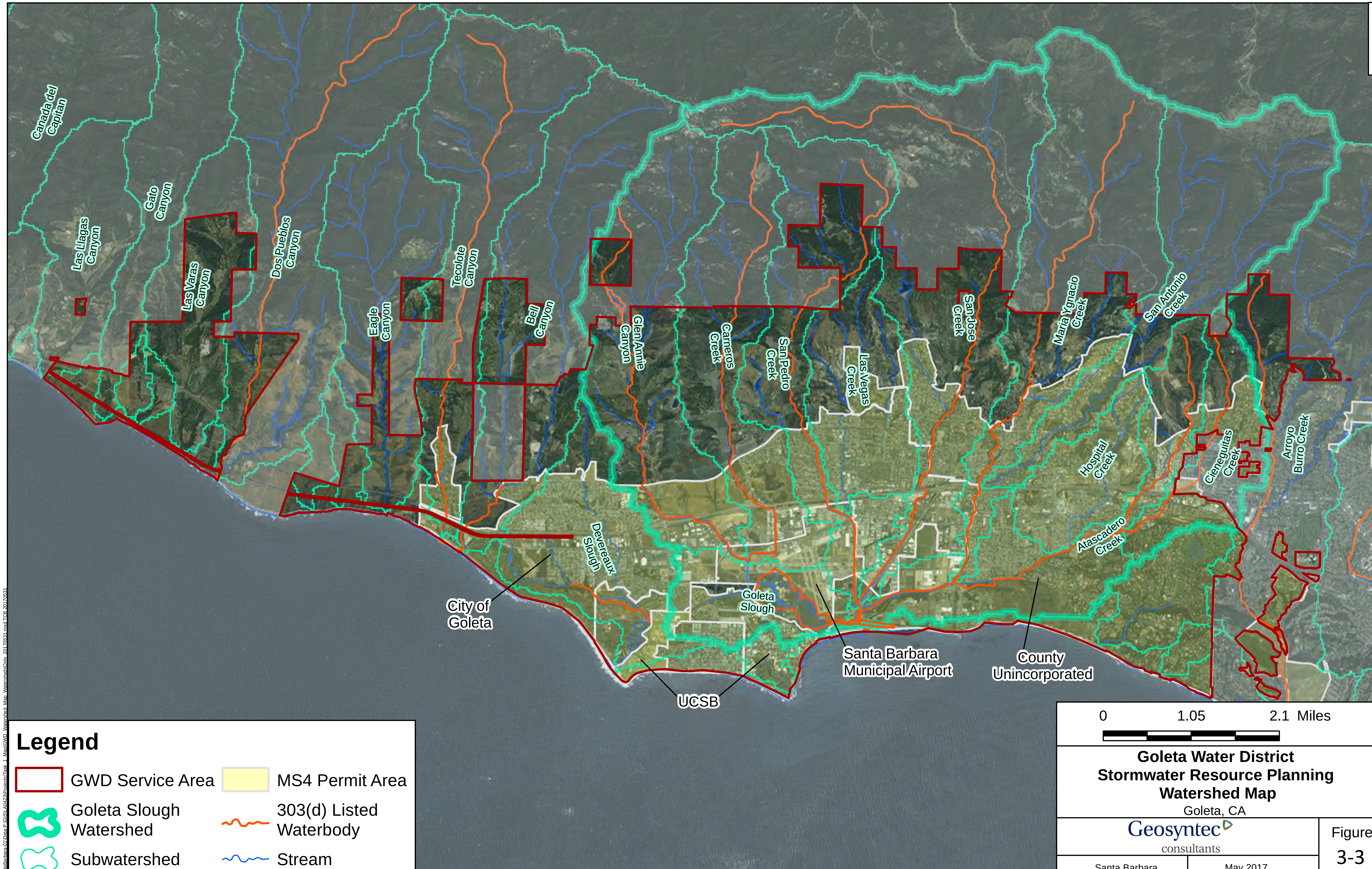
Consistent with SWRCB guidelines, this Plan explores multi-benefit stormwater capture projects within the watersheds and subwatersheds tributary to areas in the District's territorial boundaries;

Figure 3-2 – Atascadero Creek During Rain Event

the District boundary itself does not confine the watersheds described in this Plan. The smallest jurisdictional unit encompassing the watersheds and subwatersheds in this Plan is Santa Barbara County, which contains four principle watersheds – Santa Maria, San Antonio Creek, Santa Ynez River, and South Coast watersheds. All of the creeks and subwatersheds that traverse land in Goleta and unincorporated Santa Barbara County territory are in the South Coast watershed. The tributary creeks spanning Goleta Water District include Cieneguitas, Atascadero, Hospital, San Antonio, Maria Ygnacio, San Jose, Las Vegas, San Pedro, Carneros, Glen Annie, Devereaux, Ellwood, Winchester, Bell, and Tecolote. A map of the District boundary and associated watersheds is shown in Figure 3-3.

The Goleta Slough Watershed covers approximately 45 square miles and includes the drainages of seven creeks: Tecolotito, Carneros, Las Vegas/San Pedro, San Jose, Atascadero and its two major tributaries, Maria Ygnacio and San Antonio. The Goleta Slough drains a large portion of the Goleta Valley, and receives the water of most of the major creeks in the Goleta area, including the southern face of the Santa Ynez Mountains. The Goleta Slough is an area of estuary, tidal creeks, tidal marsh, and wetlands, consisting primarily of the filled and unfilled remnants of the historic inner Goleta Bay, and is a designated Environmentally Sensitive Habitat (ESA). The Slough empties into the Pacific Ocean through an intermittently closed mouth at Goleta Beach County Park just east of the UCSB campus. This Slough is one of the few coastal wetlands that remain in the State and it is important for enhancing water quality by filtering pollutants. The watershed provides recreational opportunities including bike paths, parks and bird watching, and protects wildlife habitat for endangered steelhead trout, red-legged frogs and tidewater gobies. Stream flow is the primary source of fresh water within the estuary, playing a crucial role in the physical and ecological processes in the Slough. Some estuarine species (e.g. tidewater gobies) are adapted to thrive in the brackish salinities that occur when saline seawater that enters the Slough is mixed with freshwater inflows from the watershed.[10]

Since construction of the airport, flood control has been an ongoing problem and is actively managed by the Santa Barbara County Flood Control District. Stream flows into the Slough bring both benefits and harm to the natural ecosystem. Contaminants introduced into the Slough from stream flows can compromise habitats and recreational uses. However, stream flows are a primary component of the Slough water levels and strongly influence water quality, both by reducing salinity, as well as transporting sediments from the watershed. Stream flows that reach the Slough carry sand, silt, cobbles, and other sediments, which are mostly deposited into the wetland while a small amount is washed out to sea.



Goleta Water District
Stormwater Resource Planning
Watershed Map
Goleta, CA

Figure 3-3

While the County Flood Control District's removal of sediment from the Slough reduces the risk of flooding, it also disturbs the natural process of accumulation, where sediments that are deposited during normal stream flows are eventually flushed out of the Slough mouth during larger events. Sedimentation provides nutrients and substrate that is important to the vegetation and ecosystem. This supply of sediment may potentially play a critical role in management of the Slough under future sea level rise conditions; the continual deposit of sediment through natural flows might allow the wetland to keep pace with sea level rise over time. Without sediment, tidal marshes and wetlands are at risk of drowning or converting to subtidal habitats over time as sea levels rise.[11] The sensitive balance between flood control and the natural sedimentation process is one that would need to be carefully considered for any potential stormwater capture projects included in this Plan or to be incorporated in the future.

Atascadero Creek

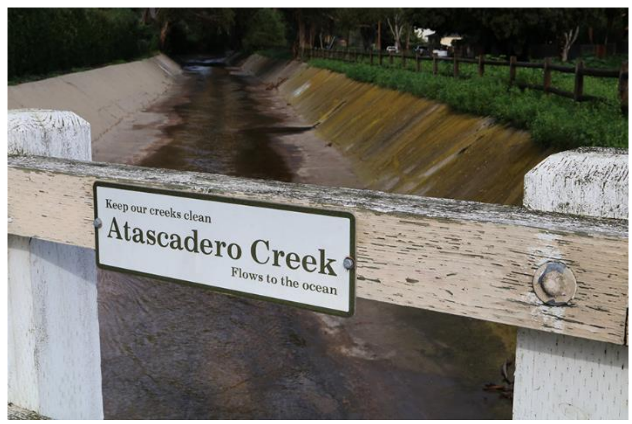


Figure 3-4 – Atascadero Creek

The Atascadero Creek watershed extends from the foothills of the Santa Ynez Mountains to the Pacific Ocean. Tributaries to Atascadero are Cieneguitas and Hospital creeks. The total length of Atascadero creek from the top of the watershed is approximately 6.3 miles before draining into Goleta Slough. The headwaters originate at an elevation of 1,060 feet on the coastal side of the mountains. The Cieneguitas watershed of 2.1 square miles, the Hospital watershed of 1.4 square miles, and the Atascadero subwatershed of 5 square miles combine for a total watershed size of 8.5 square miles. Atascadero Creek flows southwest from an area that is predominantly native Chaparral habitat with a narrow riparian zone immediately adjacent to the creek. Most of the lower three quarters of the watershed is an urban area with some agricultural land on either side of the creek. The last mile of the creek forms part of the Goleta Slough, an extensive coastal wetland, and then flows into the Pacific Ocean.

San Antonio Creek

The San Antonio Creek watershed extends from the ridgeline of the Santa Ynez Mountains to a point where it converges with Maria Ygnacio Creek just above the 101 freeway, leading ultimately to the Goleta Slough. The total length of the creek from the top of the watershed is approximately 6.1 miles before meeting Maria Ygnacio Creek. The headwaters of San Antonio Creek originate at an elevation of 3,380 feet on the ridge and drain 5 square miles. San Antonio Creek flows south-

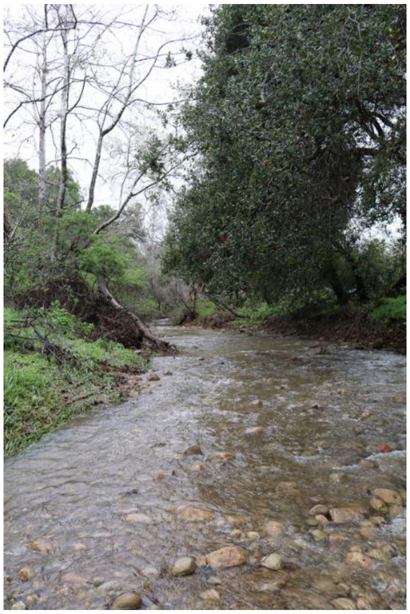


Figure 3-5 – San Antonio Creek at Tucker's Grove

southwest from an area that is predominantly native habitat at its source, through an urban area characterized by progressively increasing density.

Maria Ygnacio Creek

The Maria Ygnacio Creek watershed extends from the ridgeline of the Santa Ynez Mountains at an elevation of 3,200 feet to a point where the creek converges with Atascadero creek about 1.5 miles upstream of the Goleta Slough. The total length of the creek from the top of the watershed to the Atascadero Creek convergence is approximately 6.7 miles. The Maria Ygnacio watershed drains 6.6 square miles. Maria Ygnacio Creek flows from a predominantly native habitat area at its source, through an urban area where the density generally increases as it flows south. There is an area of orchard agriculture north of the urbanized area in unincorporated County territory and below Hollister Avenue, consisting predominantly of avocado orchards, some row crops, and horse ranches. South of Hollister, the non-urbanized land is devoted mostly to ornamental nurseries.

San Jose Creek

The San Jose Creek watershed extends from the Santa Ynez Mountains to the Pacific Ocean, encompassing all tributaries to San Jose Creek and traversing approximately 8 miles before draining into the Goleta Slough. The headwaters of San Jose Creek originate at an elevation of 2,760 feet at the coastal side of the Santa Ynez Mountains. The San Jose Creek watershed serves to drain approximately 9.5 square miles of urban, suburban, and rural land. San Jose Creek flows southward from an area that is predominantly native habitat at its source, to an area of progressively increasing urban density where it enters the Goleta Slough and Pacific Ocean.

Figure 3-6 – San Jose Creek

San Pedro Creek

The San Pedro Creek watershed extends from an area just below the top of the Santa Ynez Mountains and flows south to the Pacific Ocean. Las Vegas creek is tributary to San Pedro joining it just above Hollister Avenue. The total length of the creek from the top of its watershed is approximately 6.2 miles before draining into Goleta Slough. The headwaters of San Pedro Creek originate at an elevation of 2,760 feet on the coastal side of the mountains. The Las Vegas watershed originates at an elevation of 1,055 feet and comprises 2.1 square miles of the total San Pedro watershed of 7.1 square miles. The upper half of the watershed is predominantly native habitat, flows south through orchard agriculture, followed by an urban band. The west bank flows along the Santa Barbara Airport and into the Goleta slough.

Carneros Creek

The Carneros Creek watershed extends from an area just below the top of the Santa Ynez Mountains and flows south to the Pacific Ocean. The total length of the creek from the top of its watershed is approximately 5.3 miles. The headwaters of Carneros Creek originate at an elevation of 2,860 feet on the coastal side of the mountains, and the total Carneros watershed is 4.2 square miles. The upper third of the watershed is predominantly native habitat, the middle third is orchard agriculture, followed by an urban band, after which it joins Tecolotito creek in Goleta Slough north of the main runway of the Santa Barbara Airport.

Glen Annie/Tecolotito Creek

Glen Annie/Tecolotito Creek, just west of the Carneros watershed, is the first watershed in the Goleta Water District that completely overlies the West groundwater basin. All of the previously described watersheds have been over the North and Central groundwater basins. From the top of the watershed to Highway 101 the creek is identified as Glen Annie Creek on the U.S. Geological Service map; south of Highway 101 the same creek is identified as Tecolotito. The watershed extends from an area just below the top of the Santa Ynez Mountains and flows south to the Pacific Ocean for approximately 8.1 miles. The headwaters of Glen Annie/Tecolotito Creek originate at an elevation of 3,069 feet on the coastal side of the mountains, and the total Glen Annie/Tecolotito watershed is 8 square miles. The upper third of the watershed is predominantly native habitat; the middle third is orchard agriculture, followed by an urban band that is less than 1 mile long, after which it joins Carneros creek in Goleta Slough north of the main runway of the Santa Barbara Airport. It travels another 1.9 miles through the slough before joining Atascadero creek for a short run to the ocean.

Devereaux Creek

The headwaters of Devereaux Creek are very low by comparison with the other watersheds in the area. The creek originates at an elevation of 560 feet in the foothills of the Santa Ynez Mountains. The total length of the creek from the top of its watershed is approximately 3.7 miles, and the Devereaux watershed is 3.7 square miles. The upper one fourth of the watershed is orchard agriculture, the middle half is an urban band, followed by open space, most of which belongs to UCSB. About half of that area is Devereaux lagoon, an estuary that is intermittently open to the Pacific Ocean.

Ellwood, Winchester, and Bell Creeks

At the confluence of Ellwood and Winchester Creeks, the name changes to Bell. Ellwood Creek watershed starts at an elevation of 2680 feet at the crest of the Santa Ynez Mountains and travels 5.6 miles to its confluence with Winchester. Winchester starts at an elevation of 1885 feet and travels 3.6 miles to the confluence. Bell's highest elevation is 100 feet and it runs just under a mile before emptying into the Pacific Ocean. The orientation of all three creeks is generally North to South. Ellwood Creek watershed is 3.9 square miles. The upper half is native habitat, the lower half is orchard agriculture, and the last quarter of a mile is on the north side of a small subdivision. Winchester Creek watershed is 1.8 square miles, the upper half of which is orchard agriculture. The lower half is a mix of chaparral, coastal sage scrub and grassland with a narrow band of riparian habitat right along the creek. Bell Creek watershed is 0.5 square mile. The top two thirds flows through row crop agriculture while the lower third is a dense riparian zone bordered on the east by an oil production facility.

Tecolote Creek

The Tecolote Creek watershed extends from the top of the Santa Ynez Mountains and flows south to the Pacific Ocean. The total length of the creek is approximately 6.2 miles. The headwaters of Tecolote Creek originate at an elevation of 3,080 feet, and the watershed is 5.7 square miles. The upper half of the watershed is predominantly native habitat. The lower half is mixed orchard agriculture and a low-density subdivision that runs down to the 101 freeway. Below the freeway there is a stretch of riparian habitat about 0.2 mile long bordered on both sides by a resort, and finally the creek flows through a very small estuarine area before it goes into the ocean.

Along the corridor of all these watersheds, various factors contribute to the baseline conditions observed within the creeks. These factors include existing geology and geomorphology, vegetation/habitat types, hydrology, and human interference in the areas that are near each of the creeks.

3.2 Watershed Water Quality

Stormwater runoff can be a significant pollution source. The United States Environmental Protection Agency (U.S. EPA) estimates that at least 33% of all contamination in lakes and estuaries and 10% of all river contamination is caused by stormwater runoff. Sources of pollution include runoff from industrial facilities, construction sites, and urban municipalities.[12] Any identified stormwater project must comply with all TMDL requirements, and the following summaries are offered to provide background on pollutant limitations in the Goleta Valley watersheds, per the SRP Guidelines.

The Clean Water Act requires states, territories, and authorized tribes to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by these jurisdictions. The law requires that each jurisdiction establish priority rankings for waters on its list and develop "Total Maximum Daily Loads" (TMDLs) for these waters. A TMDL is a written plan required pursuant to Section 303(d) of the federal Clean Water Act. A TMDL describes how an impaired water body will meet water quality standards, and quantifies the maximum amount of a pollutant that a body of water can receive and still safely meet water quality standards.[13]

A TMDL contains:

- A measurable feature to describe attainment of the water quality standard(s)
- A description of required actions to remove the impairment
- An allocation of responsibility among dischargers to act in the form of actions or water quality conditions for which each discharger is responsible

The subwatersheds encompassing the District's stormwater resource planning area are shown in Figure 2-3. These subwatersheds have several applicable TMDLs and waterbodies identified on the 2012 Clean Water Section 303(d) list of impaired waterbodies, although it is important to note that the District is not assigned TMDL waste load allocations (WLAs) or load allocations (LA), nor was it identified as a source of the 303(d) impairments.

The applicable TMDL Plans within the District's study area include:

- **Bell Creek Nutrient TMDL**: approved by the Central Coast Water Board on May 30, 2013 and approved by the USEPA on August 20, 2013 (CCRWQCB, 2013). LA is assigned to agriculture only.
- **Glen Annie Canyon, Tecolotito Creek, and Carneros Creek Nitrate TMDL**: approved by the Central Coast Water Board on March 7, 2014 and approved by the USEPA on July 31, 2014 (CCRWQCB, 2013). LA is assigned to agriculture only.

The waterbodies, and the specific pollutant impairments, identified on the 303(d) list are listed in Table 3-1 below.

Table 3-1 – 303(d) Listed Waterbodies

Waterbody	303(d) Impairment
Dos Pueblos Canyon Creek	Sodium
Tecolote Creek	Chloride, sodium
Bell Creek	Pathogens (fecal coliform), nitrate, toxicity

Waterbody	303(d) Impairment
Glen Annie Canyon	Chloride, pathogens (E. coli, fecal coliform, and enterococcus), nitrate, sodium, toxicity
Devereux Creek	Pathogens (fecal coliform), low DO
Los Carneros Creek	Electrical conductivity, pathogens (E. coli and enterococcus), nitrate, pH
San Pedro Creek	Pathogens (E. coli, fecal coliform, and enterococcus), sodium, temperature, pH
San Jose Creek	Chloride, electrical conductivity, pathogens (E. coli, fecal coliform, and enterococcus), sodium, pH
Maria Ygnacio Creek	Pathogens (E. coli, fecal coliform, and enterococcus), sodium, pH
Atascadero Creek	Chloride, pathogens (E. coli, fecal coliform, and enterococcus), low DO, sodium, temperature, pH
Cieneguitas Creek	Pathogens (E. coli and enterococcus), low DO, temperature
Arroyo Burro Creek	Pathogens (E. coli and fecal coliform)
Goleta Slough/Estuary	Pathogens, priority organics

Urbanization and urban activities typically increase constituent concentrations to levels that may affect water quality. Pollutants associated with stormwater include sediment, nutrients, bacteria and viruses, oil and grease, metals, organics, pesticides, and gross pollutants (floatables). Potential sources of pollution within the Goleta Water District are listed in Table 3-2 according to land use type.

*Table 3-2 – Pollutant Sources by Land Use Type**

Land Use	Generating Site	Potential Pollutant Activities/Source	Pollutants of Concern: Groups
Residential	• Apartments • Multi-Family • Single Family, detached	• Driveway and sidewalk cleaning • Dumping and spills • Vehicle and equipment maintenance and washing • Landscape maintenance and irrigation • Septic system maintenance • Swimming pool and spa discharges • Illicit connections • Sump dewatering • Painting	• Sediment • Nutrients (P, N, NO3, NO2) • Pathogens (indicator bacteria) • Hydrocarbons (O & G, lubricants) • Pesticides • Gross pollutants (litter, trash, debris) • Toxics (organics, hazardous waste, etc.)
Commercial	• Golf Courses • Auto sales, dismantling, maintenance, and oil change shops • Gas stations • Commercial laundry and dry cleaning • Nurseries/garden centers • Restaurants • Agriculture	• Building maintenance (power washing) • Dumping and spills • Landscaping and grounds maintenance • Outdoor fluid storage • Parking lot maintenance (power washing) • Vehicle fueling, maintenance, repair, and washing • Wash down of greasy equipment and grease traps • Illicit connections • Sump dewatering • Carpeting	• Sediment • Nutrients (P, N, NO3, NO2) • Hydrocarbons (O & G, lubricants) • Pesticides • Metals • Gross pollutants (litter, trash, debris) • Detergents • Toxics (organics, hazardous waste, etc.)
Industrial	• Auto recyclers • Distribution centers • Food processing • Garbage truck washouts • Metal plating operations • Petroleum storage/refining	• All commercial activities • Industrial process water or rinse water • Loading and unloading area wash downs • Parking lot maintenance (power washing) • Outdoor material storage (fluids) • Illicit connections • Sump dewatering	• Nutrients (P, N, NO3, NO2) • Pathogens (indicator bacteria) • Hydrocarbons (O & G, lubricants) • Pesticides • Metals • Gross pollutants (litter, trash, debris) • Toxics (organics, hazardous waste, etc.)

Land Use	Generating Site	Potential Pollutant Activities/Source	Pollutants of Concern: Groups
Institutional	• Churches • Corporate campuses • Hospitals • Schools	• Building maintenance (power washing) • Dumping and spills • Landscaping and grounds care (irrigation) • Parking lot maintenance (power washing) • Vehicle washing • Wash down of greasy equipment and grease traps • Illicit connections • Sump dewatering	• Sediment • Pathogens (indicator bacteria) • Hydrocarbons (O & G, lubricants) • Pesticides • Gross pollutants (litter, trash, debris) • Detergents • Toxics (organics, hazardous waste, etc.)
Municipal	• Airports • Landfills • Maintenance depots • Municipal fleet storage • Public works yards • Streets and highways	• Building maintenance (power washing) • Dumping and spills • Landscaping and grounds care (irrigation runoff) • Outdoor fluid storage • Parking lot maintenance (power washing) • Road maintenance • Spill prevention and response • Vehicle fueling, maintenance, repair, and washing • Illicit connections	• Sediment • Nutrients (P, N, NO3, NO2) • Hydrocarbons (O & G, lubricants) • Pesticides • Metals • Gross pollutants (litter, trash, debris) • Toxics (organics, hazardous waste, etc.) • Detergents
Other	• Mobile • Parks • Multi-use detention basins and detention/recharge basins • Construction sites	• Vehicle accidents • Mobile car wash and auto detailers, painters, power washers, pet washers, and food vendors • New development and redevelopment • Operations and maintenance	• Sediment • Pathogens (indicator bacteria) • Hydrocarbons (O & G, lubricants) • Metals • Gross pollutants (litter, trash, debris) • Detergents • Toxics (organics, hazardous waste, etc.)

* Adapted from the City of Goleta Stormwater Management Plan, 2010.

3.3 Goleta Groundwater Basin

3.3.1 Boundaries

The Goleta Groundwater Basin is a critical water supply resource for the Goleta Valley. The basin is generally divided into three subbasins: the Central subbasin, where the majority of the extractions occur; the West subbasin, which is generally shallower and has the least amount of extraction; and the North subbasin. The various studies on the Goleta Basin and subbasins disagree on the exact boundary of each subbasin. Some of the boundaries coincide with faults that are mapped at the surface or are inferred from hydrogeologic evidence such as large differences in groundwater elevations on each side of the "fault." Other boundaries are defined by the thinning edges of water-bearing strata against bedrock highs and upstream valleys. Because of the differences in interpretations of this evidence, basin and subbasin boundaries have been drawn differently.

There are some Basin boundaries that all studies agree upon. The southern boundary of the Goleta Groundwater Basin is defined by the trace of the More Ranch Fault, where consolidated rocks of Tertiary age are uplifted along the south side of the fault and form a hydrologic barrier between the ocean and the water-bearing deposits of the ground-water basin. The exact location of the More Ranch Fault's boundaries has been disputed between studies; for the purposes of this Plan, the location of the fault (and, therefore, the southern boundary of the groundwater basin) is taken from the latest U.S. Geological Survey (USGS) mapping.

The eastern boundary of the Goleta Groundwater Basin has historically been defined as the location of the Modoc Fault. The Modoc Fault has been considered to be a hydrologic barrier, although the USGS suggested that along the eastern boundary near its southern juncture with the More Ranch fault, groundwater discharges freely from the adjacent Foothill Groundwater Basin on the east into the Goleta Groundwater Basin.

3.3.2 Recharge

As discussed in the District's Groundwater Management Plan, the Goleta Groundwater Basin is recharged by Cieneguitas, Atascadero, San Antonio, Maria Ygnacio, San Jose, Las Vegas, San Pedro, Carneros, and Glen Annie/Tecolotito creeks. The lower reaches of these creeks are intermittent where they flow across permeable sediments of the North subbasin which is an active area of groundwater recharge. Remaining creek flow runs off into the Pacific Ocean with relatively minor recharge of more fine-grained shallow sediments in the Central and West subbasins.

The majority of useable groundwater in storage in the Basin is present within the Central subbasin. The major sources of recharge to the Basin, aside from injection by the District, are infiltration from rainfall, percolation from streambeds, deep percolation of irrigation waters, and leakage from the adjacent (largely upslope) consolidated rocks. Recharge from surface sources can only occur if the sediments between the ground surface and the aquifer can transmit water downward. If, instead, there is a clay layer or other less-transmissive layer above the basin aquifers (a "confining layer"), then downward percolation is largely eliminated. Instead, these areas of the aquifer that are below confining layers must receive their recharge by horizontal flow within the aquifer from other areas where confining layers are absent.

In the Goleta Groundwater Basin, confining layers occur in the seaward portion of the basin. One of the areas where there is little or no communication of surface waters and aquifer waters is around the tidal channels that make up much of the seaward portion of the basin. The confining layer serves as a natural barrier to seawater intrusion. There has been disagreement among researchers as to how far the coastal confining layers extend inland. Prior investigators such as Upson considered much of the area south of Cathedral Oaks Blvd. to the ocean as having confined conditions. This effectively eliminates much of the area of the basin from recharge by percolation from overlying sources. Upson estimated that an average of about 3,100 AFY of rainfall and stream infiltration reach the aquifer. In contrast, Evenson (1962) and other investigators considered the confined area to be much smaller, increasing the area for direct recharge from surface sources.

In relation to groundwater recharge, the Goleta Groundwater Basin watershed may be divided into three types of area: 1) runoff, 2) unconfined or recharge, and 3) confined subareas. The runoff area is underlain by rock which transmits very little if any water to the Quaternary deposits of the groundwater basin. The confined part of the groundwater basin is believed to have a layer of impermeable or semi – permeable sediments near the ground surface which hinders the downward percolation of surface water. The distribution of these areas is critical because groundwater recharge from the ground surface primarily occurs within the unconfined area. The size, location, and performance of any proposed recharge facilities will depend upon the confined or unconfined nature of the land overlying the groundwater basin.

Much of the Central subbasin is likely under confined conditions. For the subbasin to receive recharge from the adjacent North subbasin (which is largely unconfined), the fault(s) separating the subbasins must be "leaky" – that is, only a partial barrier to groundwater flow, allowing some groundwater to flow thorough the fault plane into the Central subbasin. Most of the undeveloped area in the Central subbasin is in the northern part of the subbasin and overlies the unconfined recharge area defined by prior researchers. In developed urban areas, most precipitation is captured by storm sewers, city streets, and buildings, thus preventing significant infiltration of rain. The precipitation that does infiltrate in unpaved urban areas recharges the shallow aquifer and the amount is likely minimal. However, for individual homeowners or other property owners, private diversion efforts could be the source of useful on-site landscape irrigation water.

Irrigation-return flow is another source of recharge, primarily to the shallow aquifer. This is water not consumptively used by the plants during irrigation of landscaping in the residential areas, of agricultural fields, and of large grass fields. As noted earlier, irrigation-return flow from water applied in areas outside the recharge area recharges the shallow aquifer but probably does not reach the deep aquifer.

3.3.3 Injection

Injection by the District, called "artificial recharge" into the Basin, is surplus water injected into wells perforated primarily in the deep aquifer. The source of water injected by the District is historically spill water from Lake Cachuma. The District's recent rehabilitation of its well facilities included a special retrofit of its wells for use as dual-purpose injection-extraction wells (commonly referred to as "Aquifer Storage and Recovery," or "ASR" wells) to maximize injection capacity. These actions were undertaken to maximize conjunctive use potential of the basin and Lake Cachuma. Water that is injected during wet years is available for use in dry years when surface water supplies are reduced. In this way, the surface and groundwater supplies are used "conjunctively". Conjunctive use operations allow a more efficient use of both surface and groundwater supplies. Over the last 20 years, the District has injected 7,129 AF, or 446 AFY on an average annual basis.

3.3.4 Basin Water Quality

Water quality has historically been considered fair in the Central subbasin, although chloride concentrations in the past were somewhat elevated in portions of the West and North subbasins (up to about 200 mg/L). Although below the drinking water standard, irrigation water with chloride at that concentration can harm salt-sensitive crops. From 1980 to 2000, a period for which there is a significant amount of data on groundwater quality, chloride concentrations in the Central subbasin were generally less than the approximate 150 mg/L level that could affect salt-sensitive crops and well below the drinking water standard of 500 mg/L. However, portions of the North and West subbasins had chloride concentrations above the drinking water standard. Historical nitrate levels were significantly below the drinking water standard except in three wells; this is surprising, given the rural agricultural heritage of the land overlying the basin (agricultural fertilizers, concentrations of ranch animals, and septic systems are the largest sources of nitrate in many basins). Both sulfate and total dissolved solids (TDS) were above the secondary drinking water standards in many wells in the West subbasin. Iron and manganese have historically been a problem in the basin, with most wells in all subbasins having a maximum recorded concentration above the secondary drinking water standards.

Today, there are few water quality issues in the North and Central subbasins. Chloride concentrations in the Central subbasin generally reached their maximum in the late 1980s and early 1990s, decreasing after that time, as discussed in the District's GMP. This period of poorer groundwater quality coincides with the period of heaviest pumping from the basin. Injection of lower-chloride Cachuma spill water likely also contributed to better-quality groundwater.

There are a number of spills and leaks of contaminants at the ground surface overlying some areas of the Basin, mainly near the Santa Barbara Airport and old industrial facilities nearby. The agency responsible for enforcing the cleanup of most of these sites is the State Water Resources Control Board, through the local Regional Water Quality Control Board. The Regional Board tracks each of these sites, approves remediation plans, and eventually determines when the site is remediated and the case is closed. For the roughly 175 sites in this Goleta-Santa Barbara area, their current status is:

- 50% have been remediated and the case is closed;
- 20% are currently being remediated;
- 25% are currently being assessed for possible remediation; and
- 5% are currently being monitored for verification of contamination.

These spills and leaks are only threats to groundwater quality in areas of the basin where there are no confining layers separating the aquifers from the surface soils. However, in the recharge areas of the basin, contaminants may move freely from the ground surface to the aquifer. The majority of recharge areas are generally in the foothills to the north of the majority of the spills. As discussed below, this Plan tracked known areas of poorer water quality and considered these sites in identifying feasible parcels for recharge and capture projects.

4.0 Stormwater Capture Project Siting Analysis and Costs

To fulfill State requirements for identification and prioritization of multiple benefit stormwater capture projects, the District retained services from Geosyntec Consultants, Inc., to assist with technical analysis, including identification and conceptual planning of potential multi-benefit stormwater and dry weather project opportunities within the District's service area. The process to identify potential projects included screening land parcels for implementation feasibility, and then selecting the most effective project type and required design parameters. The District utilized general screening parameters for each type of stormwater concept project, and then applied specific screening parameters based upon each project type to further narrow down and conceptualize identified projects for potential implementation. Conceptual projects were then modeled to quantify their expected average annual water supply augmentation volume and pollutant load reduction benefits. These projects were then scored and prioritized based on their ability to provide multiple benefits and likelihood of successful implementation, per the Water Code and SRP Guidelines.

The conceptual designs included in this Plan include engineered solutions required for maximum water supply benefits. The scope of this Plan is to capture stormwater flows on a large scale for purposes of augmenting water supply and offering other multiple benefits, consistent with the District's role and purpose as a public water supply agency. Capturing stormwater on a large scale, as the projects identified in this Plan are designed, requires engineered capture and treatment structures in order to handle the volume of stormwater runoff from large areas within MS4 permittee jurisdictions. The addition of natural, vegetative infiltration techniques in further design work for these projects has the potential to bring down the cost of construction and implementation, while also assisting MS4 permittees with their water quality objectives. Where feasible, principles of low impact design will be incorporated into final project designs for each of the projects identified in this Plan. These principles can include promotion of bioswales and vegetative filtration corridors where feasible, as well as other types of low-impact construction that can utilize the land's more natural topography. The District will advocate for the inclusion of low-impact design principles in project designs to be implemented by jurisdictional agencies such as the County of Santa Barbara to potentially reduce costs and increase environmental benefits.

The following explains the process used to prioritize parcels, and the screening parameters used for all stormwater capture sites before specific parameters were applied for each specific type of project. Sections 4.1-4.3 describe the concepts behind each project type identified in this Plan, as well as the specific screening parameters for each project type that were applied step-by-step to determine optimal sites for stormwater capture in the District.

Parcel Prioritization Process – All Projects

Areas suitable for structural stormwater project implementation (i.e., they lack constraints that limit stormwater project implementation feasibility) were identified by filtering out constraints. The Geographic Information Systems (GIS)-based screening process starts with all parcels in the District's service area, then removes areas based on implementation constraints, and ends with a subset of "potential implementation parcels" that contain "usable area" for project implementation. However, additional site specific feasibility assessment would be required at all sites.

To identify the potential implementation parcels for the three project types (infiltration-based, dry wells, and capture and reuse storage tanks), a series of project-specific constraints were applied in the District's service area. The following series of maps illustrate how each constraint was applied and the resulting elimination of usable area and potential implementation parcels.

The potential implementation parcels were then compiled into an Excel file to enable sorting and prioritizing by:

- Size of usable area (and size of reuse parcel);
- Land use type (and land use of reuse parcel);
- Ownership (and ownership of reuse parcel);
- Distance from water source; and
- Type of water sources.

The potential implementation parcel Excel file, as well as GIS files for spatial viewing, were then evaluated to select parcels for project modeling. The parcel prioritization maps present several informational layers, including:

- Potential Implementation Parcels
- Remaining "Usable" Area within the Parcels
- Area of the unique constraint (one map for each constraint)

Each map only shows information applicable within the District's service area, as defined by the red boundary line. The area to be eliminated as a result of the constraint listed on the map is illustrated in orange with hatching. The remaining usable area, that is still considered potentially suitable for project implementation, is shown in green. The remaining usable area shown within each map is based on the constraint applied in the current map, in addition to the constraints applied in all previous maps. Additionally, the full parcel outlines are shown (in yellow) for parcels that had at least 0.5 acres (or 0.2 acres for dry wells) of usable area remaining within the parcel. The number of parcels remaining that are still considered for project implementation are also presented on each map.

It is important to note that the number of parcels eliminated by each constraint will differ based on the order that the constraints are applied, but the order will not affect the final number of potential implementation parcels and usable areas remaining at the completion of the process. The constraint that is applied last in the process will likely only eliminate a few parcels, even if the constraint covers a large portion of the District's service area, because there are likely not a large number of parcels remaining at the last step in the process.

The only exception to this random order is that the constraint that usable area must be within 100 ft (or 500 ft for infiltration projects) of a storm drain pipe or channel must be applied last. This constraint was applied last, for each project type, because the final usable area needed to be located within the designated distance from the storm drain or waterbody source. For capture and reuse projects, the constraint that the usable area must be within 500 feet of a potential reuse parcel was also applied as the last step. Only a small portion of the usable area needs to be within 500 feet of a potential reuse parcel, which is applied so that the stored volume in a capture and reuse storage tank does not need to be transferred unreasonable distances to be used as irrigation or for other purposes.

All parcels located within the District's service area (Figure 4-1) were first screened based on their designated land use (Figure 4-2). Out of all parcels within the District's service area, only the parcels with the following land uses were considered to be a potential parcel for project implementation:

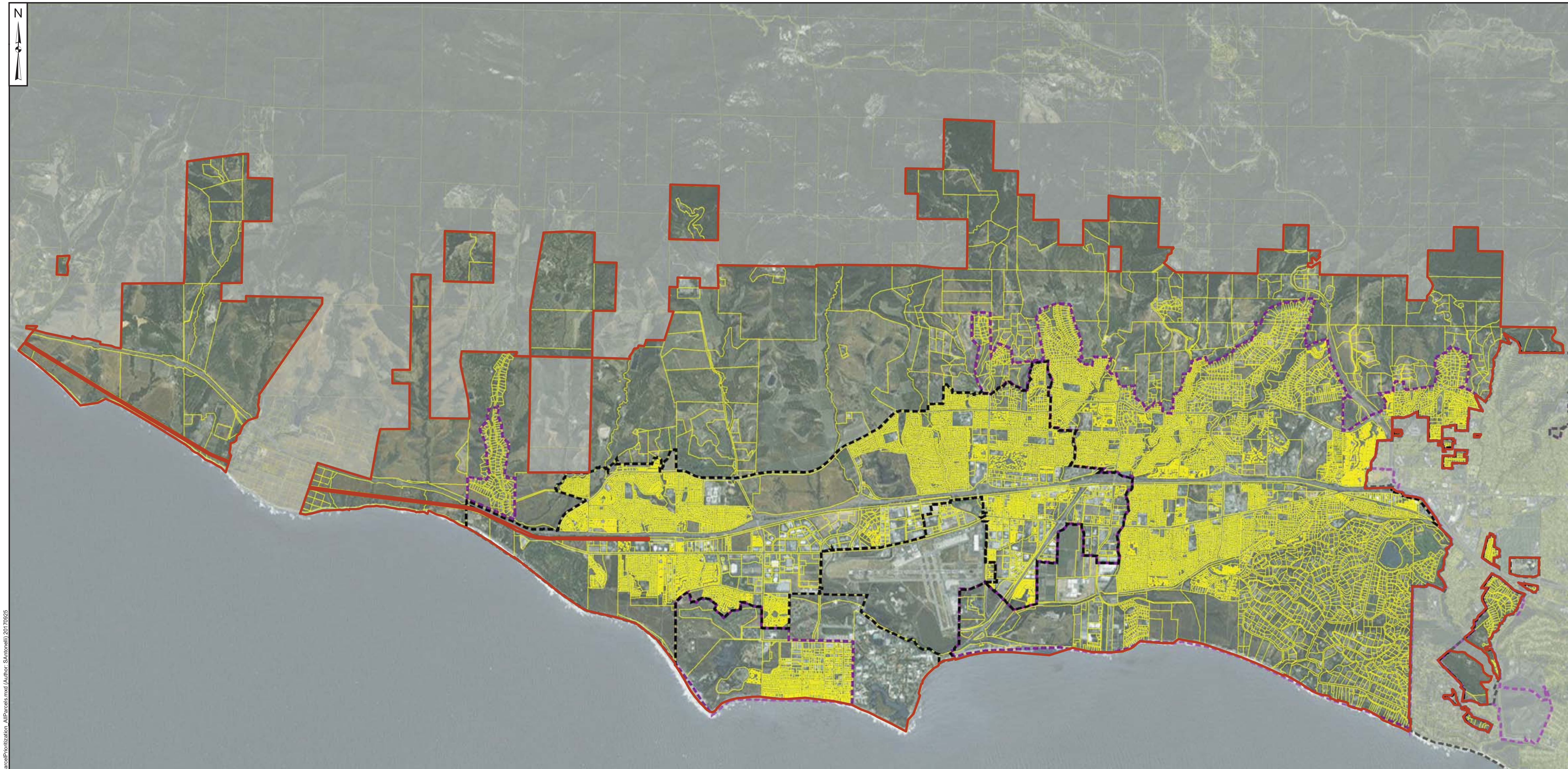
- Churches
- Schools
- Public agency properties
- Agricultural parcels

After the first step of determining potential implementation parcels based on land use, the entire area within each of these parcels was designated as usable area since no additional constraints had been applied prior to this step. Figure 4-3 through Figure 4-6 then show the remaining four constraints that were applied for all three project types, including:

- **Water wells**: eliminated areas within 100 feet of a water well[*]
- **Lakes**: eliminated areas within 300 feet of a lake
- **Environmentally sensitive areas**: eliminated all environmentally sensitive areas
- **Slope**: eliminated areas with greater than ten percent slopes[*]

The specific parameters and project-specific screening for each project type is discussed further in subsections 4.1.2, 4.2.2, and 4.3.2.

[*] Design standards referenced in: *Ventura County Technical Guidance Manual for Stormwater Quality Control Measures*. Geosyntec Consultants and Larry Walker Associates (LWA), 2011.



Legend

- GWD Service Area
- Parcel
- City Boundary
- County Unincorporated MS4 Area Boundary

Constraints Applied (All 3 Project Types)*:

*No constraints shown on this map

Parcels: **21,548**

0 1 2 Miles

All Parcels in the GWD Service Area

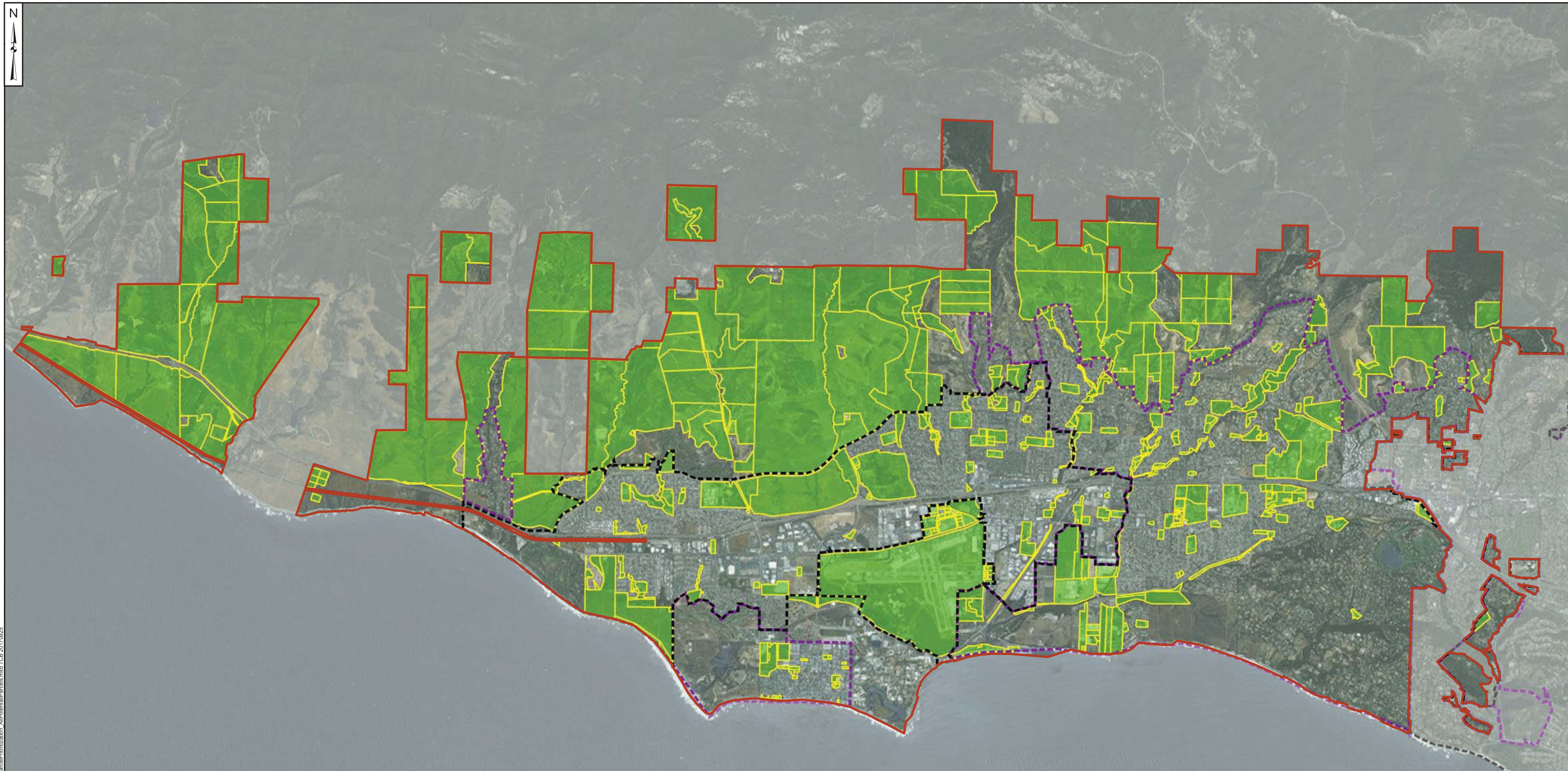
Goleta Water District Stormwater Resource Plan

Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-1



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- City Boundary
- County Unincorporated MS4 Area Boundary

Constraints Applied (All 3 Project Types):

1. Eliminate privately-owned parcels (except for churches and agriculture parcels)

Parcels: **21,548**

Parcels remaining**: **466**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

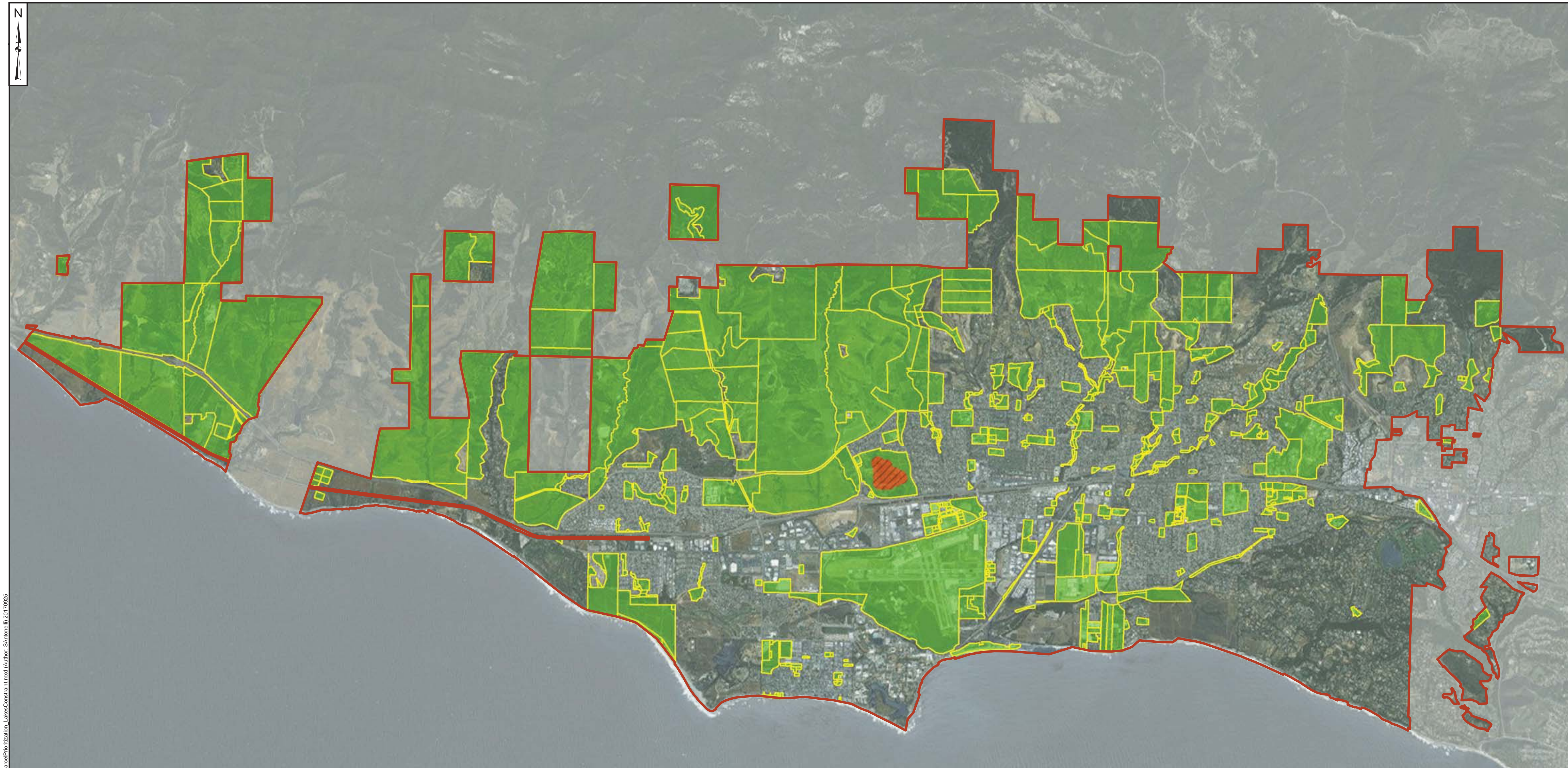
Potential Implementation Parcels

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-2



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Within 300 ft of a Lake

Constraints Applied (All 3 Project Types)*:

1. Eliminate privately-owned parcels
2. **Eliminate areas within 300 ft of a lake**

Parcels: **21,548**

Parcels remaining**: **466**

**With at least 0.5 acres of "usable" area remaining

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

0 1 2 Miles

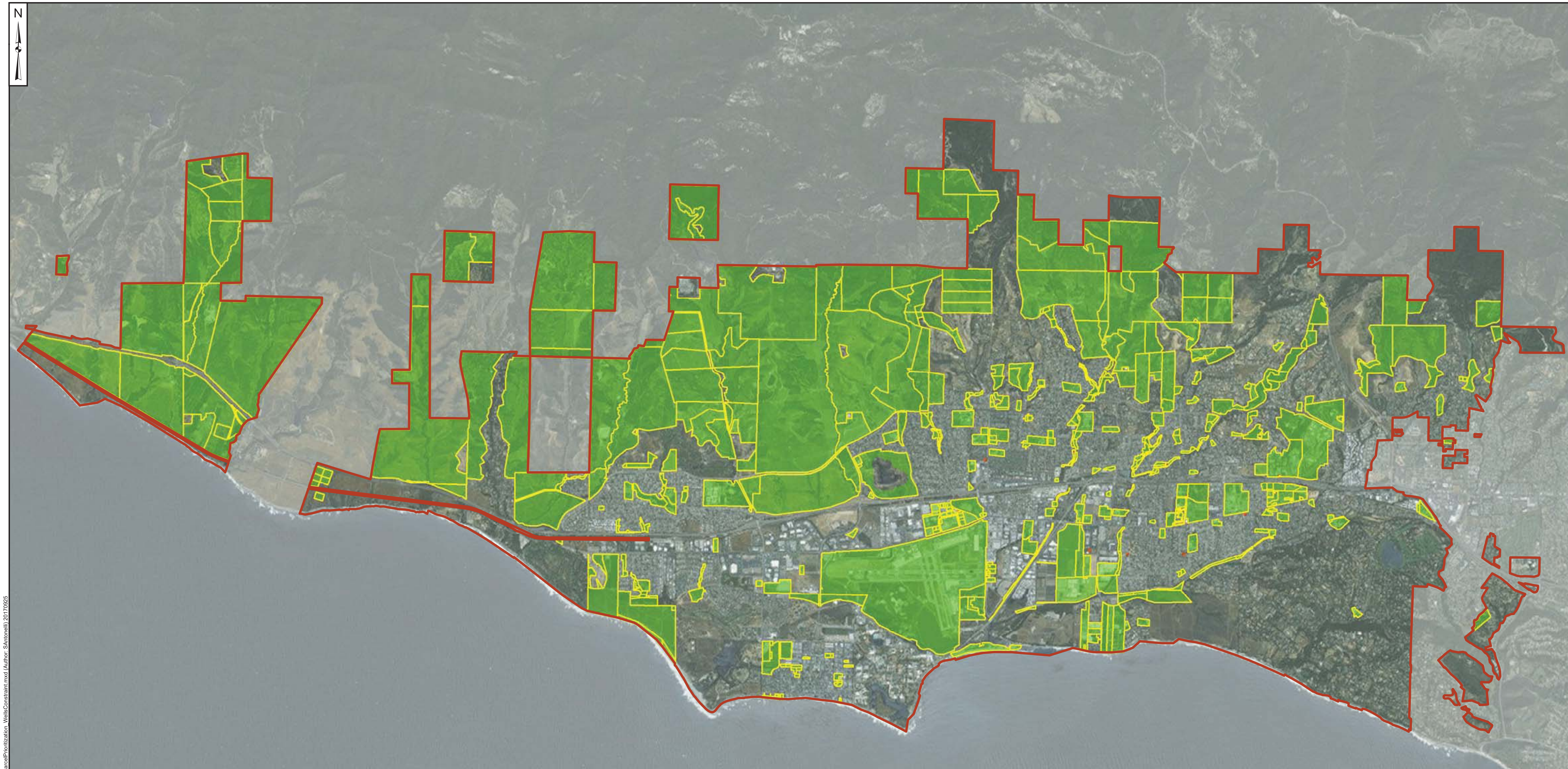
Areas Eliminated by Lakes

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Figure 4-3

Santa Barbara | September 2017



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Within 100 ft of a Water Well

Constraints Applied (All 3 Project Types)*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. **Eliminate areas within 100 ft of a water well**

Parcels: **21,548**

Parcels remaining**: **466**

**With at least 0.5 acres of "usable" area remaining

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

0 1 2 Miles

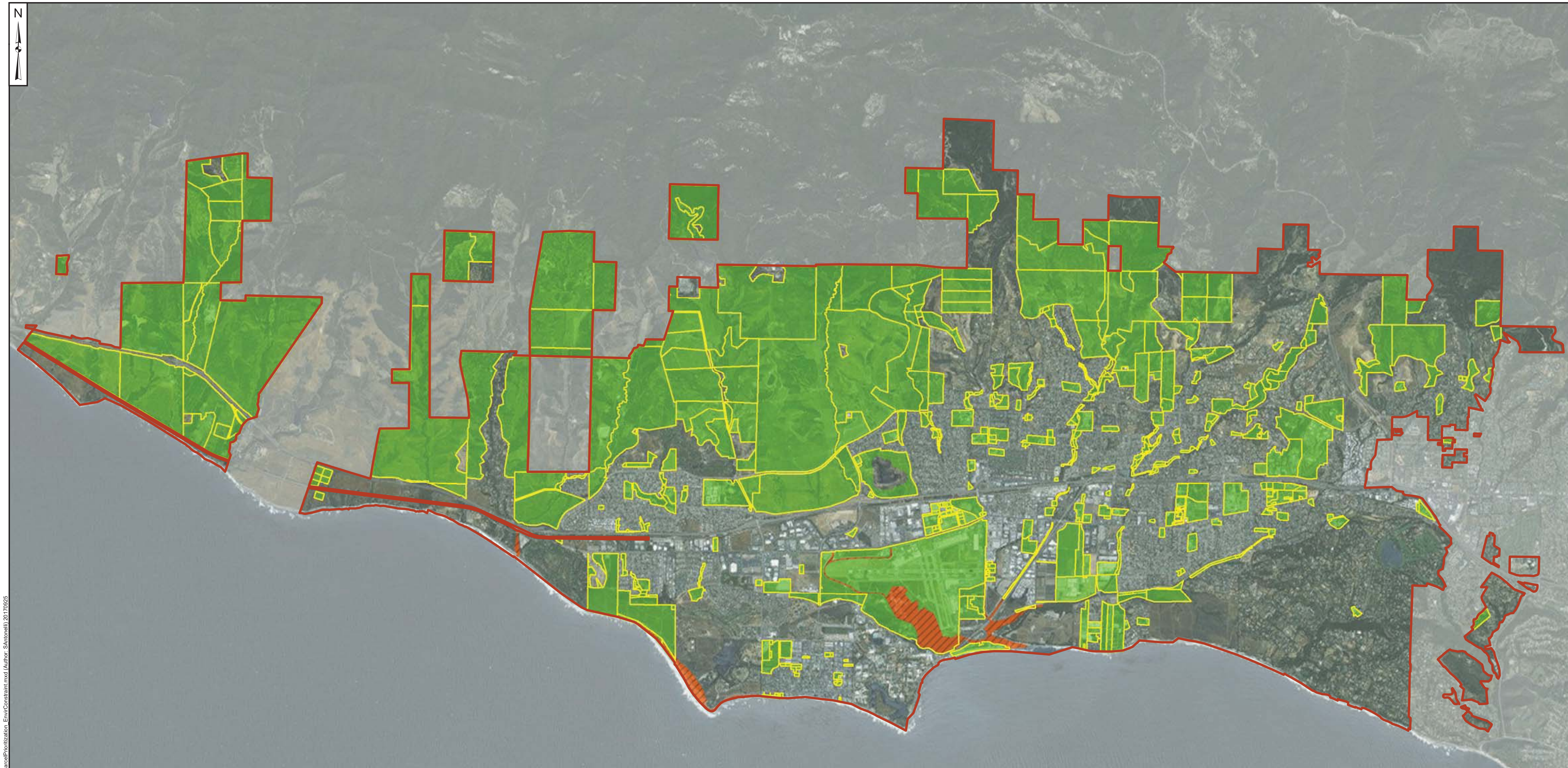
Areas Eliminated by Water Well

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-4



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Environmentally Sensitive Area

Constraints applied (All 3 Project Types)*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. **Eliminate environmentally sensitive areas**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **464**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

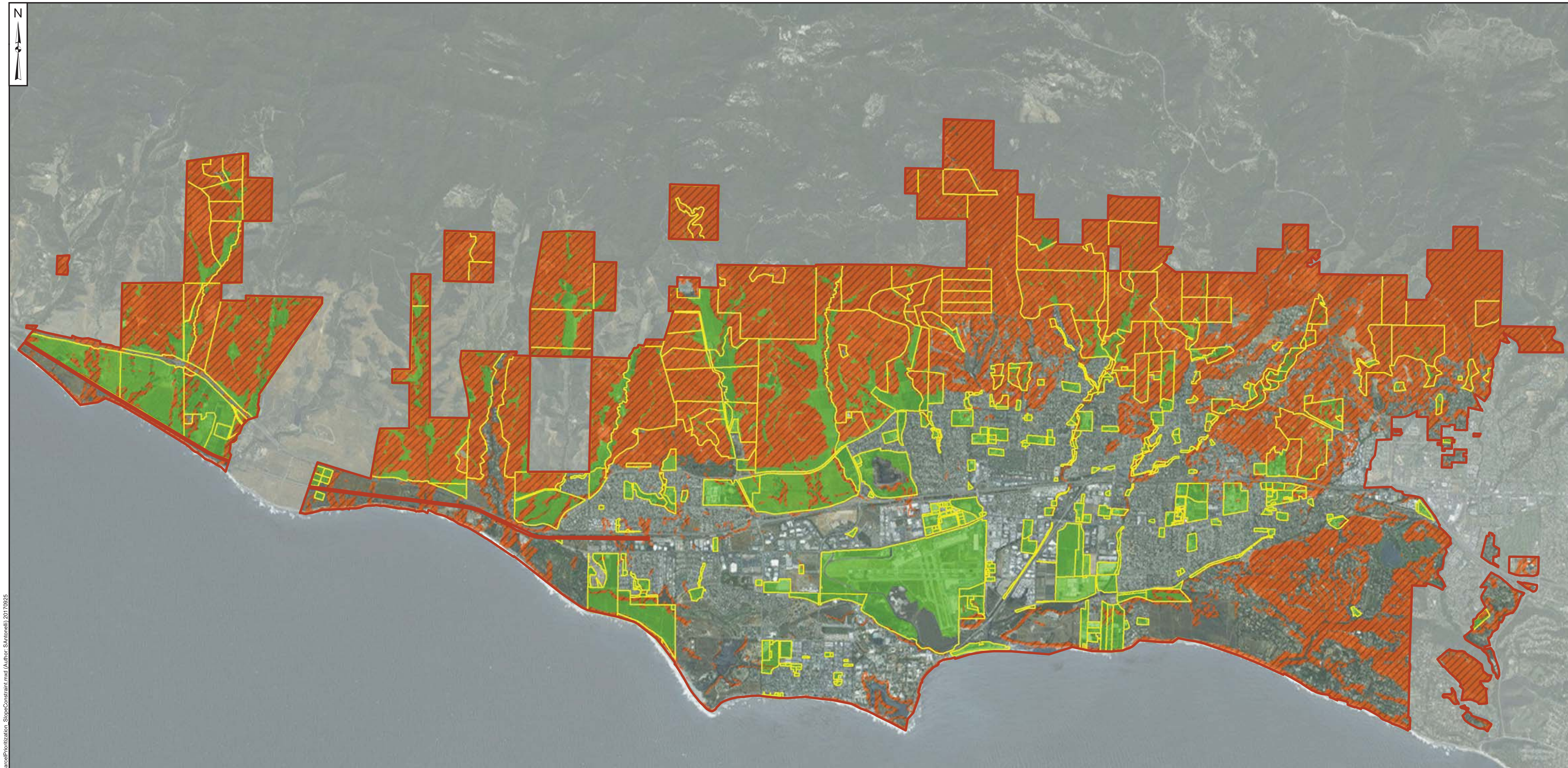
Areas Eliminated by Environmental Sensitivity

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-5



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Greater than 10% Slope

Constraints applied (All 3 Project Types)*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas

5. Eliminate areas with greater than 10% slope

Remaining constraints are specific to BMP type

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **412**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

Areas Eliminated by Slope

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-6

4.1 Infiltration-based Projects

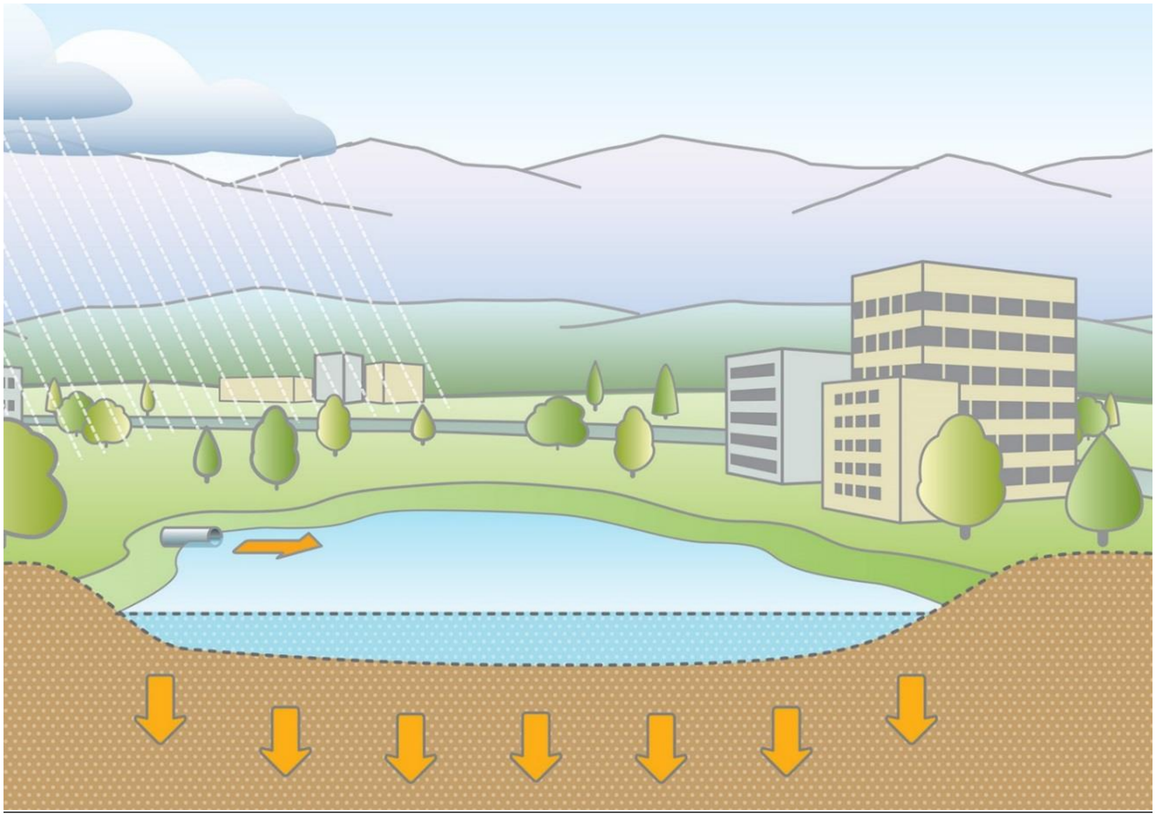


Figure 4-7 – Schematic Drawing of Infiltration Basin Project

4.1.1 Concept and Description

Infiltration basin projects are designed to divert flow from nearby creeks to areas with available land and optimal soil type for recharge of groundwater. An infiltration basin is a natural or constructed impoundment that captures, temporarily stores and infiltrates the design volume of water. Drawdown of this stored runoff occurs through infiltration into the surrounding naturally permeable soil. Water that is stored but not infiltrated must leave the project, typically through an outlet, within the required drawdown time.

In the case of a constructed basin, the impoundment is created by excavation or embankment. Infiltration basins are more commonly used for drainage areas of 5 to 50 acres. Typical depths range from 2 to 6 feet, including bounce (submerged vegetation) in the basin. The sizing is to control stormwater volumes at the regional or development scale, as opposed to bioretention basins (rain gardens) that are designed at the site scale. Typical dimensions range from 1,000 square feet up to an acre. Infiltration basins are commonly constructed with plant species that can tolerate and thrive in this unique growing environment. Design parameter assumptions for infiltration basin projects include:

- **Pretreatment**: assumed to occupy 25 percent of the available area
- **Drawdown time**: 48 hours (limited for vector control purposes)
- **Infiltration rate**: Based on the site-specific hydrologic soil group (1.0 in/hr for hydrologic soil group A and 0.5 in/hr for hydrologic soil group B)
- **Footprint Area**: Determined by space available for the BMP
- **Depth**: Governed by the drawdown time and infiltration rate
- **Side slope**: 3:1
- **Freeboard Depth**: 1 ft

A conceptual project design for an infiltration basin project is included as Appendix B.

4.1.2 Screening Parameters

As described in the introduction to Section 4.0, the general criteria below were applied first in the parcel filtering process:

- **Parcel ownership**: eliminated privately owned parcels, except for agricultural and church parcels
- **Water wells**: eliminated areas within 100 feet of a water well
- **Lakes**: eliminated areas within 300 feet of a lake
- **Environmentally sensitive areas**: eliminated all environmentally sensitive areas
- **Slope**: eliminated areas with greater than ten percent slopes

The following criteria were then used to identify and remove parcels infeasible for infiltration-based project implementation:

- **Soils**: eliminated areas within hydrologic soil groups C and D, which have low permeability
- **Groundwater liquefaction**: eliminated areas classified as "high" groundwater liquefaction
- **Recharge areas**: eliminated areas outside a recharge zone (as defined in the Groundwater Management Plan[14]
- **Groundwater basin**: eliminated areas outside the North or Central subbasins
- **Storm Drains or channels**: eliminated parcels that were not located within 500 feet of a storm drain pipe or channel or waterbody (parcels in closer proximity [i.e., within 100 feet] to a storm drain pipe/channel were prioritized)

Figure 4-9 through Figure 4-13 show the remaining constraints that were unique to the infiltration-based BMPs. These constraints are also listed in Figure 4-8, which illustrates the reduction in usable area (and potential parcels for BMP implementation) that occurs as the parcel prioritization process was executed. The constraints applicable to infiltration-based projects eliminated 21,534 parcels, with 14 parcels consisting of usable areas remaining.

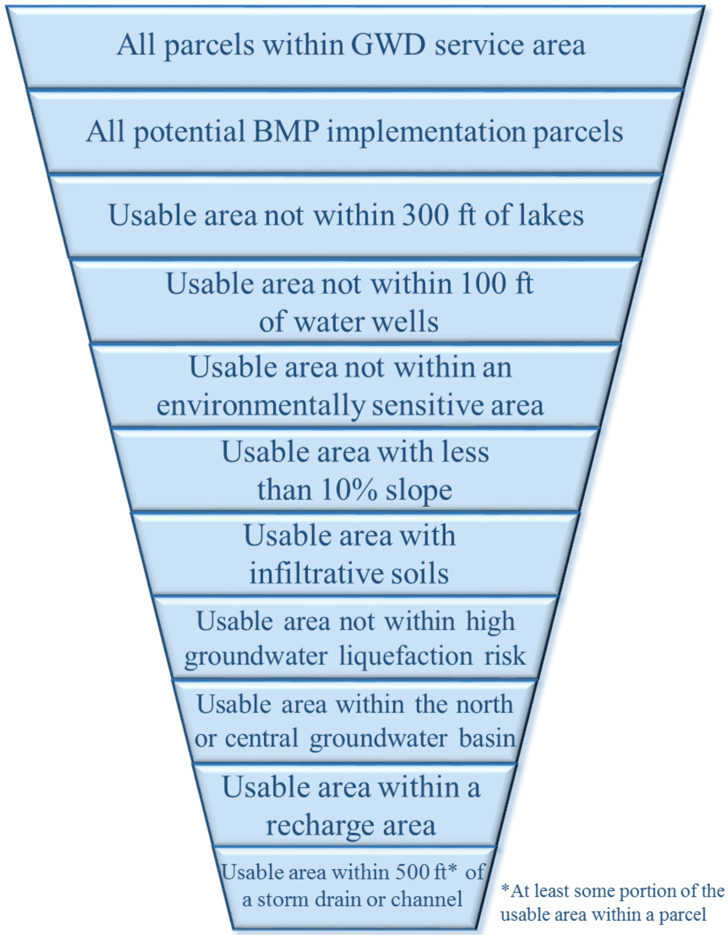
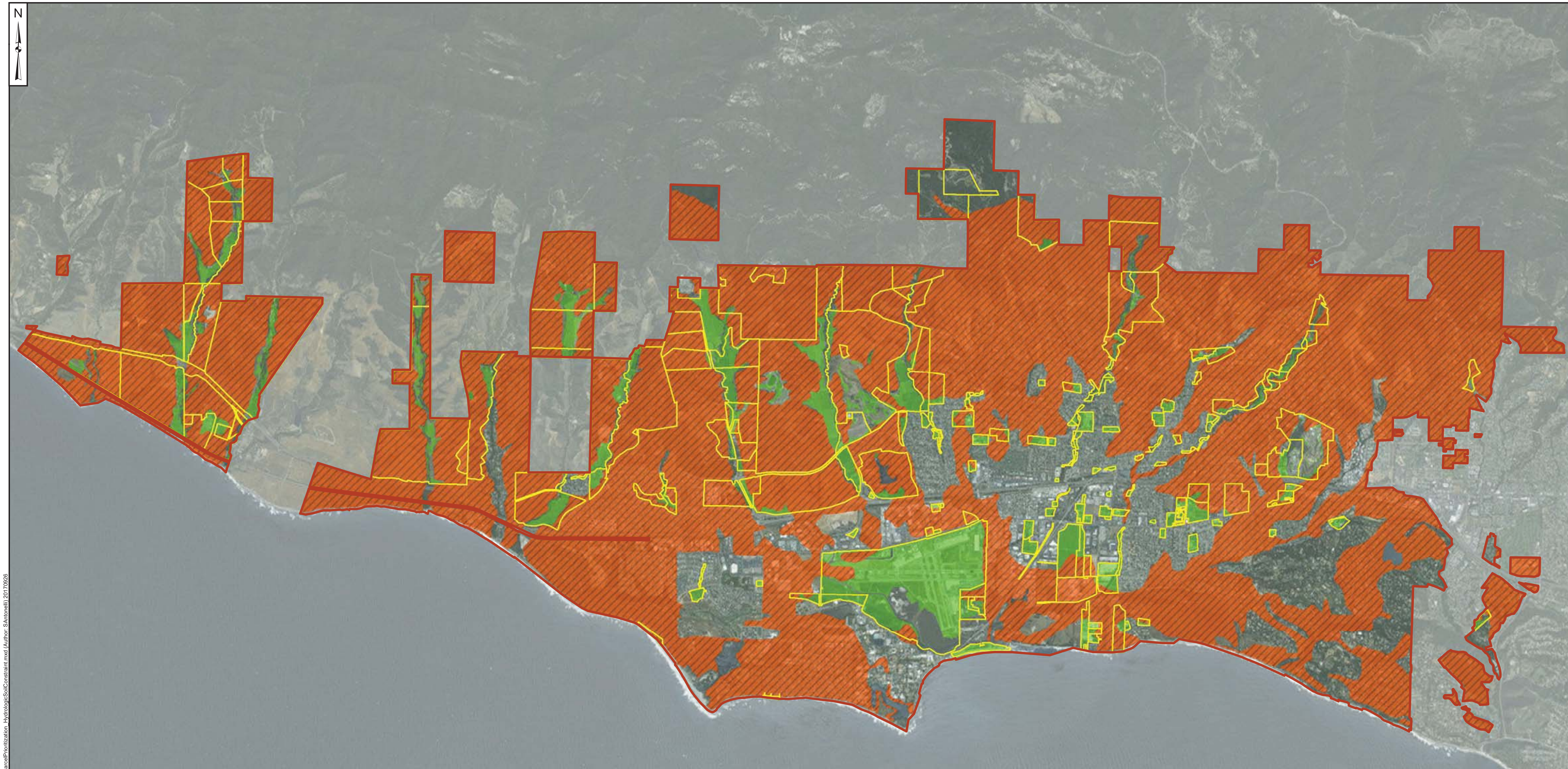


Figure 4-8. Parcel Prioritization Overview for Infiltration-based BMPs

In order to provide further screening, parcels with less than half an acre of area available (area left within a given parcel after all constraints were applied) were also eliminated, since stormwater project implementation may not be feasible given such a small amount of usable land. The District then selected parcels from the list of remaining parcels for infiltration-based projects to be conceptually developed. Future site-specific field testing may result in additional sites identified for infiltration opportunities.



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Hydrologic Soils Groups C and D

Infiltration-based Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. **Eliminate areas within hydrologic soil groups C and D**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**
Parcels remaining**: **201**

**With at least 0.5 acres of "usabl e" area remaining

0 1 2 Miles

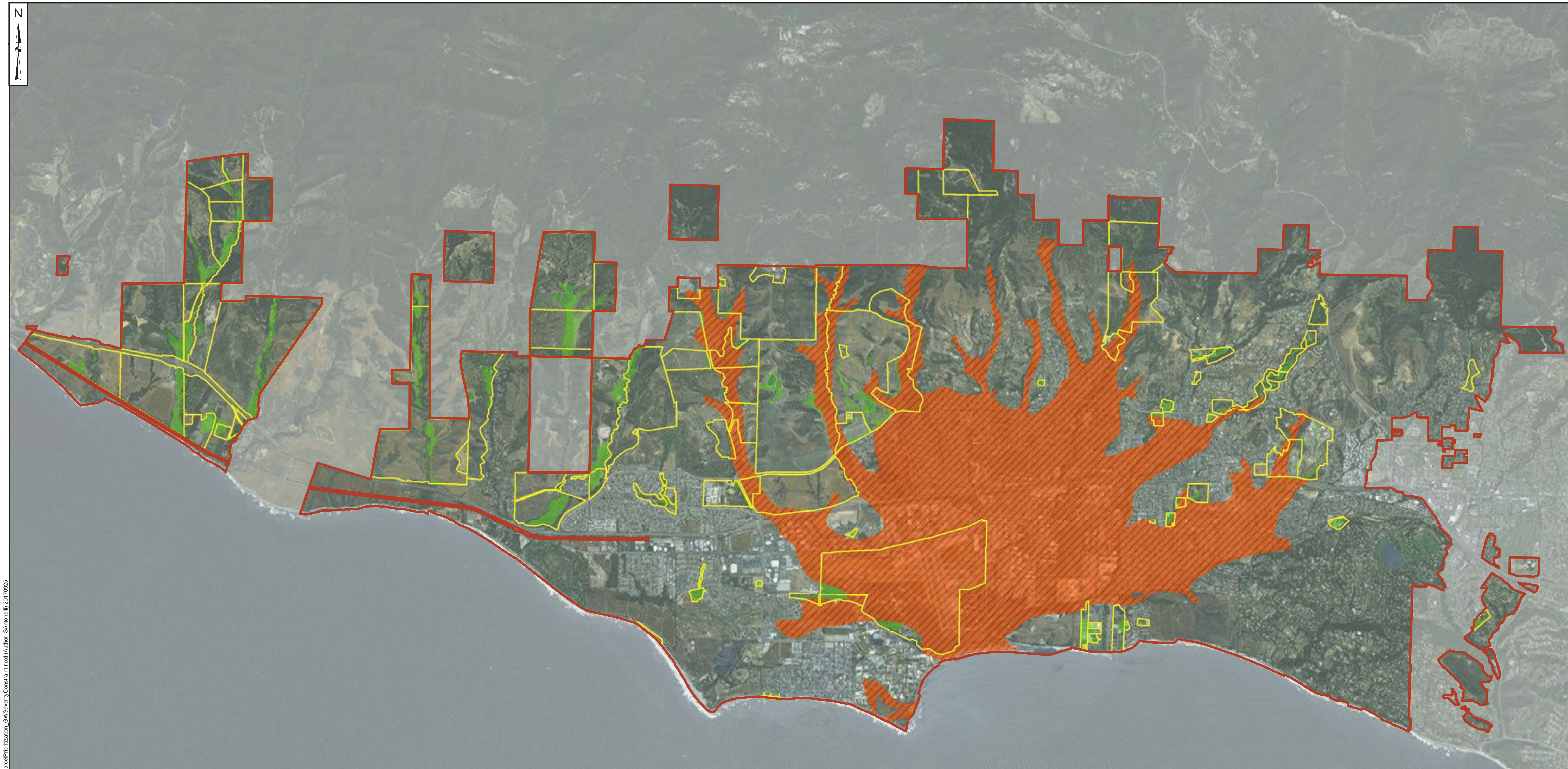
Areas Eliminated by Hydrologic Soils

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-9



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- High Liquefaction

Infiltration-based Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas within hydrologic soil groups C and D
7. **Eliminate areas classified as "high" liquefaction**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **100**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

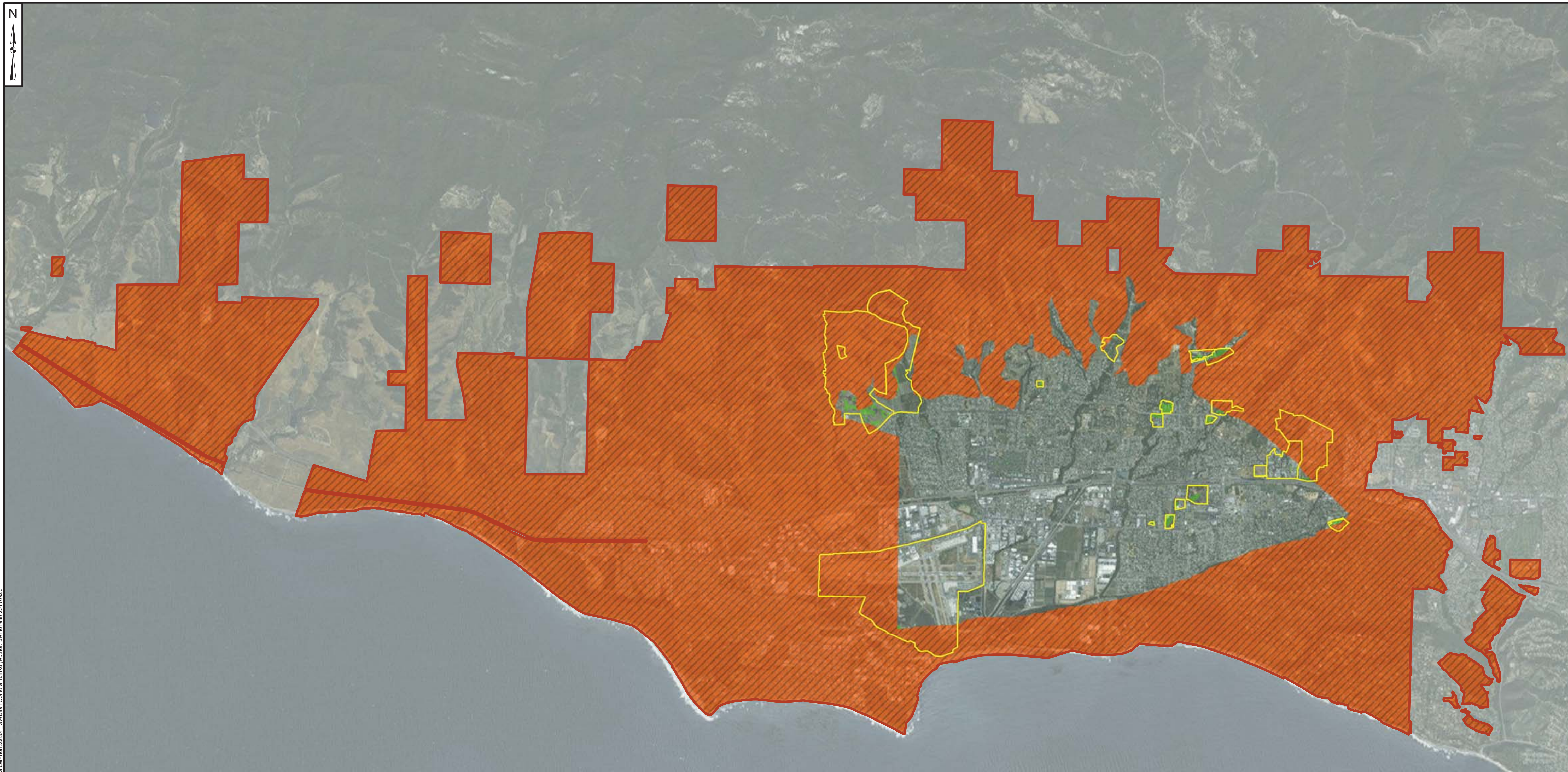
Areas Eliminated by Liquefaction

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-10



Legend

- GWD Service
- Potential Implementation Parcel
- Remaining "Usable" Area
- Outside North or Central Groundwater Basin

Infiltration-based Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas within hydrologic soil groups C and D
7. Eliminate areas classified as "high" groundwater liquefaction
8. **Eliminate areas outside the north or central groundwater basin**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **21**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

Areas Eliminated by Groundwater Basin

Goleta Water District Stormwater Resource Plan

Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-11

Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Outside a Recharge Zone

<u>Infiltration-based Project Constraints Applied*:</u>

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas within hydrologic soil groups C and D
7. Eliminate areas classified as "high" groundwater liquefaction
8. Eliminate areas outside the north or central groundwater basin
9. **Eliminate areas outside a recharge zone**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **14**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

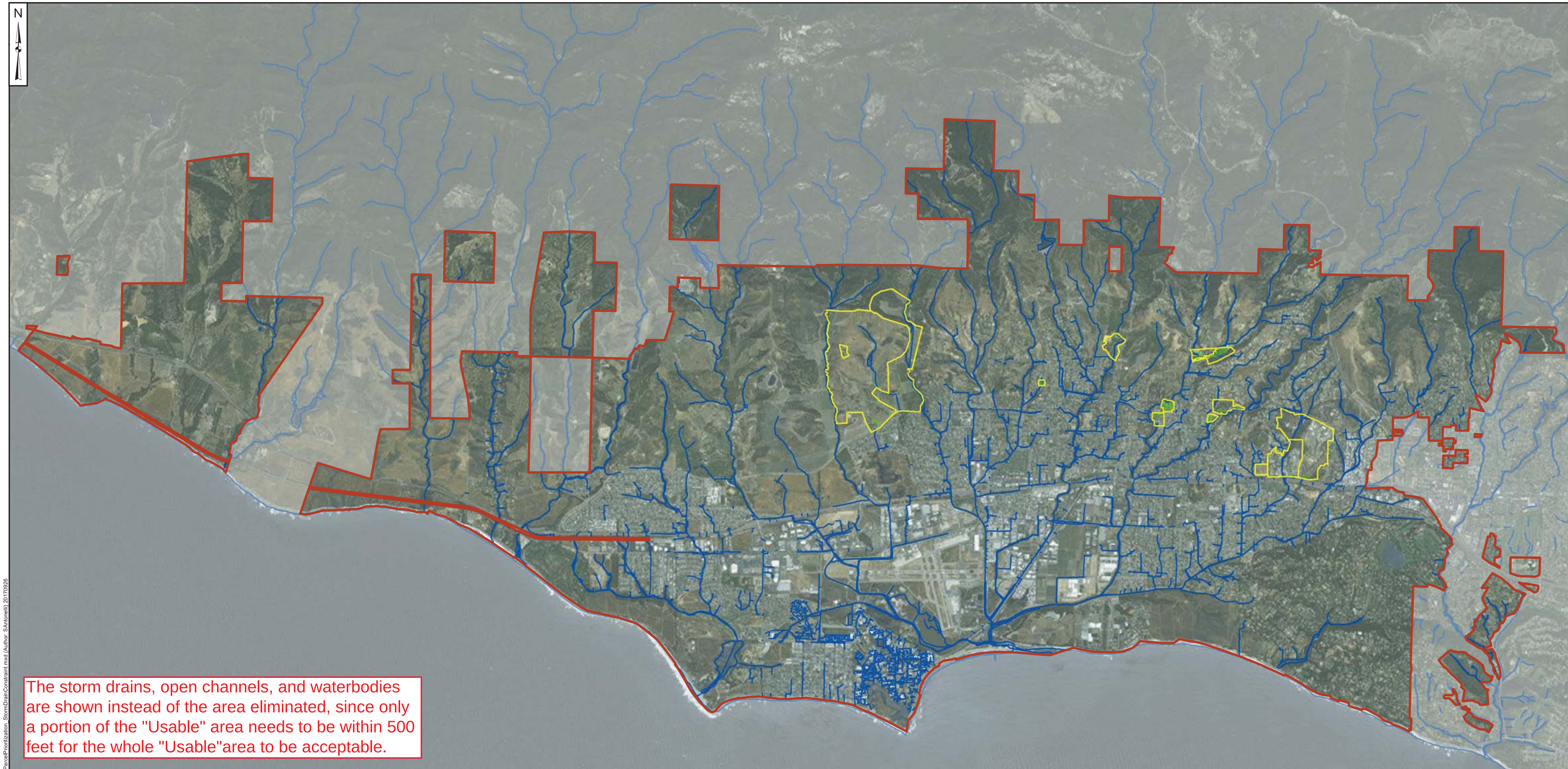
Areas Eliminated by Recharge Zone

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-12



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Storm Drain, Open Channel, or Waterbody

Infiltration-based Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas within hydrologic soil groups C and D
7. Eliminate areas classified as "high" liquefaction
8. Eliminate areas outside the north or central groundwater basin
9. Eliminate areas outside a recharge zone
10. **Eliminate parcels that were not located within 500 feet of a storm drain pipe or channel or waterbody**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **14**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

Potential Infiltration Parcels Proximate to Water Sources

Goleta Water District Stormwater Resource Plan

Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-13

4.1.3 Conceptual Projects

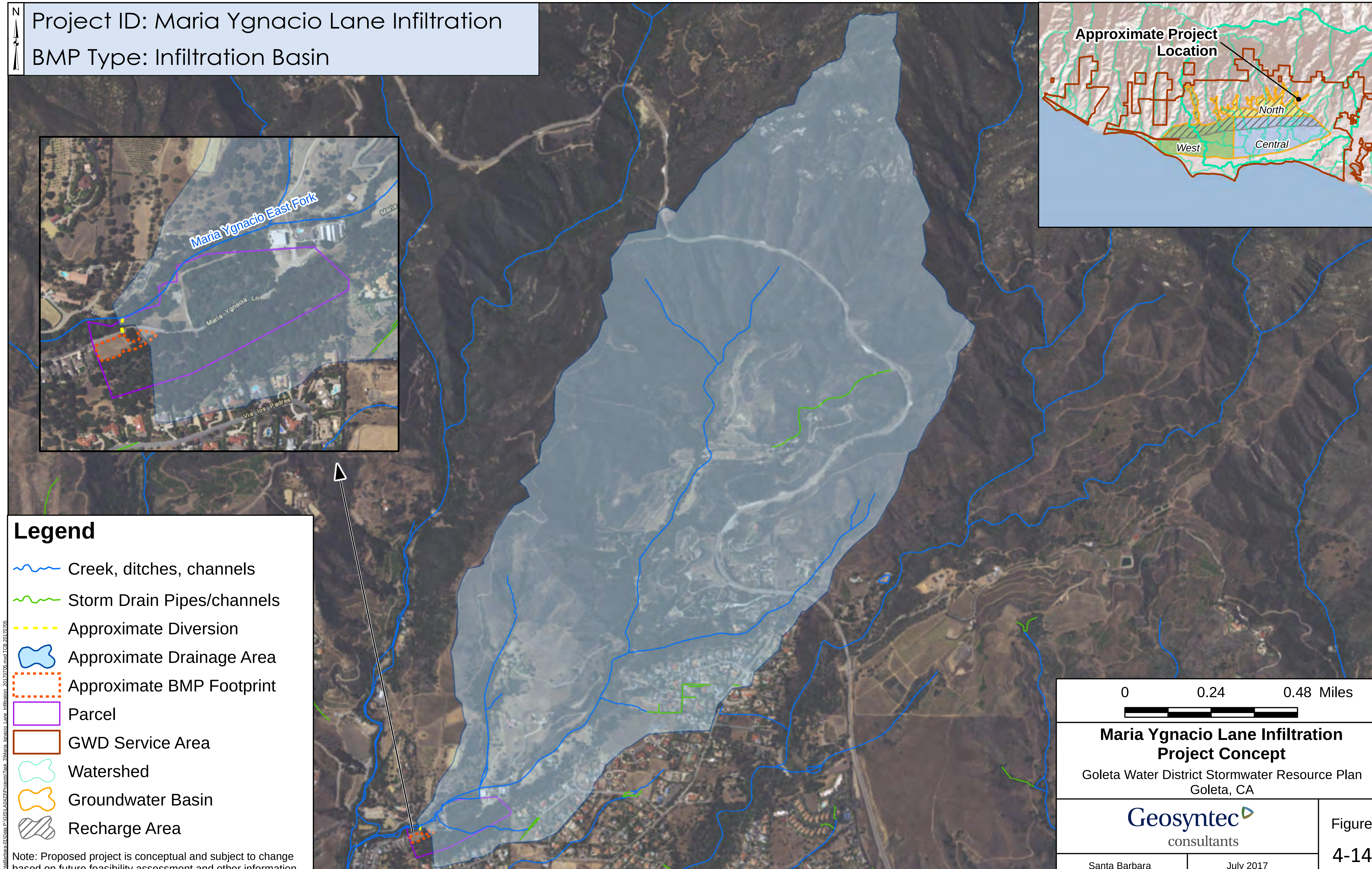
4.1.3.A Maria Ygnacio Infiltration Project

A parcel located adjacent to Maria Ygnacio Lane was identified as a potential location for an infiltration basin project. The parcel is owned by the County Flood Control and Water Conservation District and will treat flow from East Fork Maria Ygnacio Creek. The project was sized for the maximum footprint available on the parcel, avoiding large trees and dense vegetation. This project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.16 acre(ac)
- **Approximate Footprint Area**: 0.49 ac
- **Drainage Area**: 1,108 ac
- **Imperviousness of drainage area**: 14%
- **Infiltration Rate**: 1.0 inch per hour (in/hr)
- **Depth**: 4.0 feet (ft)
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 81,000 cubic feet (cu ft)
- **Expected average annual capture efficiency**: 9.0%
- **Potential site constraints**: a small portion of the proposed footprint has high slopes
- **Groundwater basin**: North
- **Land uses treated**: open space (59%), single-family residential (33%), transportation (4.8%), and agriculture (3.3%)
- **Potential Water Supply Volume in Modeled Storm Year**: 24 AFY

Preliminary cost estimate: Infiltration project construction and O&M costs are based upon observed costs for similarly sized projects in Los Angeles County (eg. Ballona watershed) and cost analyses prepared by the City of Santa Maria in its Stormwater Resource Plan functional equivalent. The estimated capital cost is approximately $3.42 million. Project estimates include $1.12 million for engineering and design, permits, and CEQA analysis; $900,000 for construction administration and support; and $1.4 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Utilizing a standardized 25-year amortization schedule for capital projects,[*], the amortized capital component would be approximately $136,800 per year. Annual O&M costs are estimated at approximately $100,000 per year for oversight, monitoring, and maintenance. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $10,815.

[*] Assumes a 25-year useful life for all components of the project, and assumes all costs incurred are eligible for capitalization. The amortization numbers do not include capitalized interest costs. Amortization is calculated using mid-year convention.



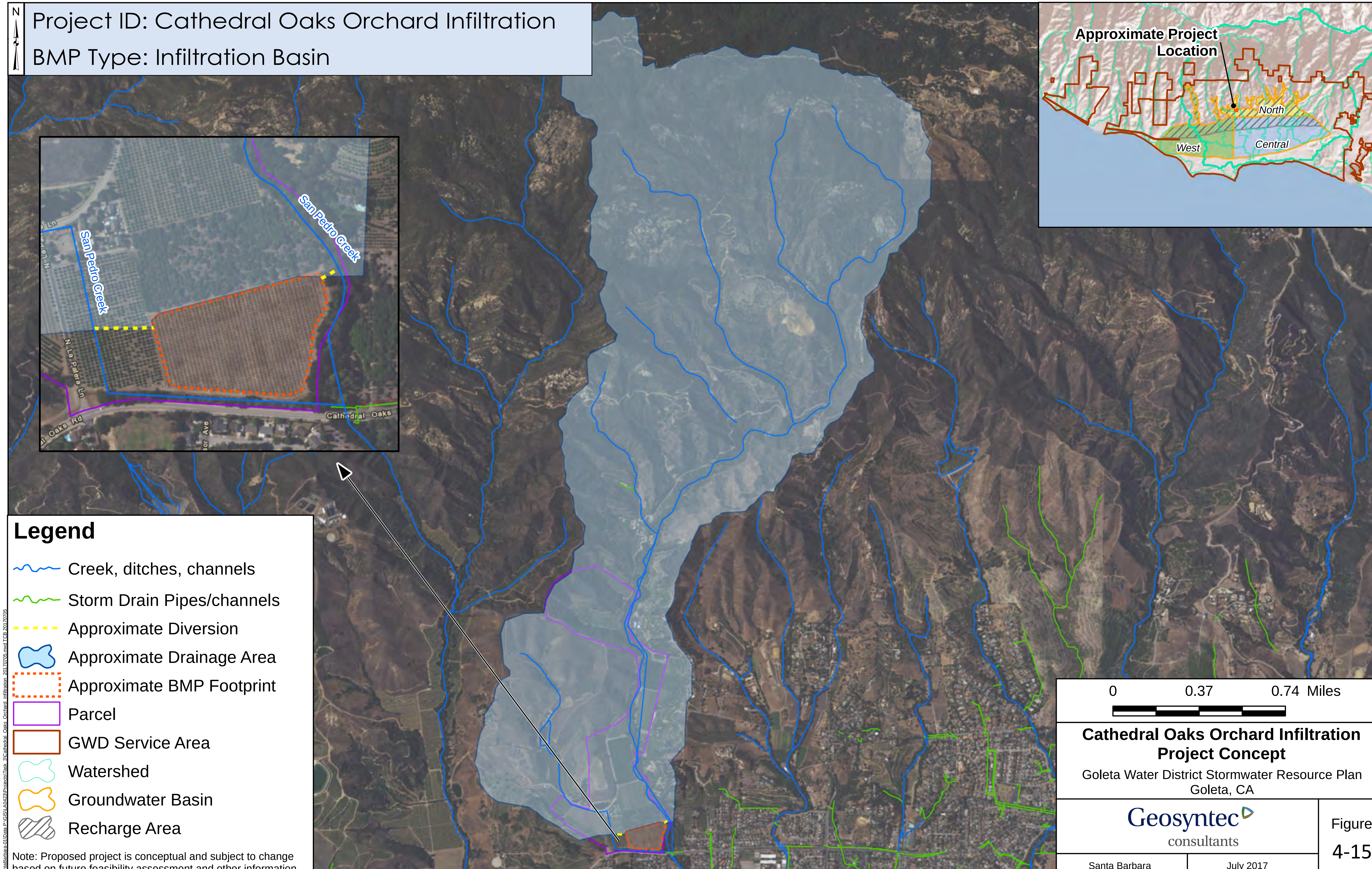
N
Project ID: Maria Ygnacio Lane Infiltration
BMP Type: Infiltration Basin
Maria Ygnacio East Fork
Maria Ygnacio Ln
Maria Ygnacio Ln
Via Los Padres
Approximate Project Location
North
West
Central
Legend
Creek, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0 0.24 0.48 Miles
Maria Ygnacio Lane Infiltration Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec consultants
Figure 4-14
Santa Barbara
July 2017

4.1.3.B Cathedral Oaks Orchard Infiltration Project

An opportunity to implement an infiltration basin was identified at an agricultural (orchards) parcel off Cathedral Oaks Road, which is privately owned. The project could divert water from two separate portions of San Pedro Creek. The proposed infiltration basin was sized based on the maximum footprint available on the southeastern plot of the agricultural fields (could potentially be expanded to include adjacent agricultural plots within the parcel in order to increase the expected capture efficiency). The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 2.3 ac
- **Approximate Footprint Area**: 7.0 ac
- **Drainage Area**: 2,191 ac
- **Imperviousness of drainage area**: 3.4%
- **Infiltration Rate**: 0.5 in /hr
- **Depth**: 2.0 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 600,000 cu ft
- **Expected average annual capture efficiency**: 45%
- **Potential site constraints**: the proposed footprint is located in a "high" liquefaction area
- **Groundwater basin**: North
- **Land uses treated**: open space (52%), agriculture (44%) single-family residential (4.1%), and transportation (0.37%)
- **Potential Water Supply Volume in Modeled Storm Year**: 130 AFY

Preliminary cost estimate: The estimated capital cost is approximately $6 million. Project estimates include $1.9 million for engineering and design, permits, and CEQA analysis; $1.9 million for construction administration and support; and $2.2 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $240,000 per year. Annual O&M costs are estimated at approximately $200,000. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $4,334.


Project ID: Cathedral Oaks Orchard Infiltration
BMP Type: Infiltration Basin
N
San Pedro Creek
San Pedro Creek
N La Patera Ln
Cathedral Oaks
Oaks Rd
Approximate Project Location
North
West
Central
Legend
Creek, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0
0.37
0.74 Miles
Cathedral Oaks Orchard Infiltration Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec consultants
Santa Barbara
July 2017
Figure
4-15

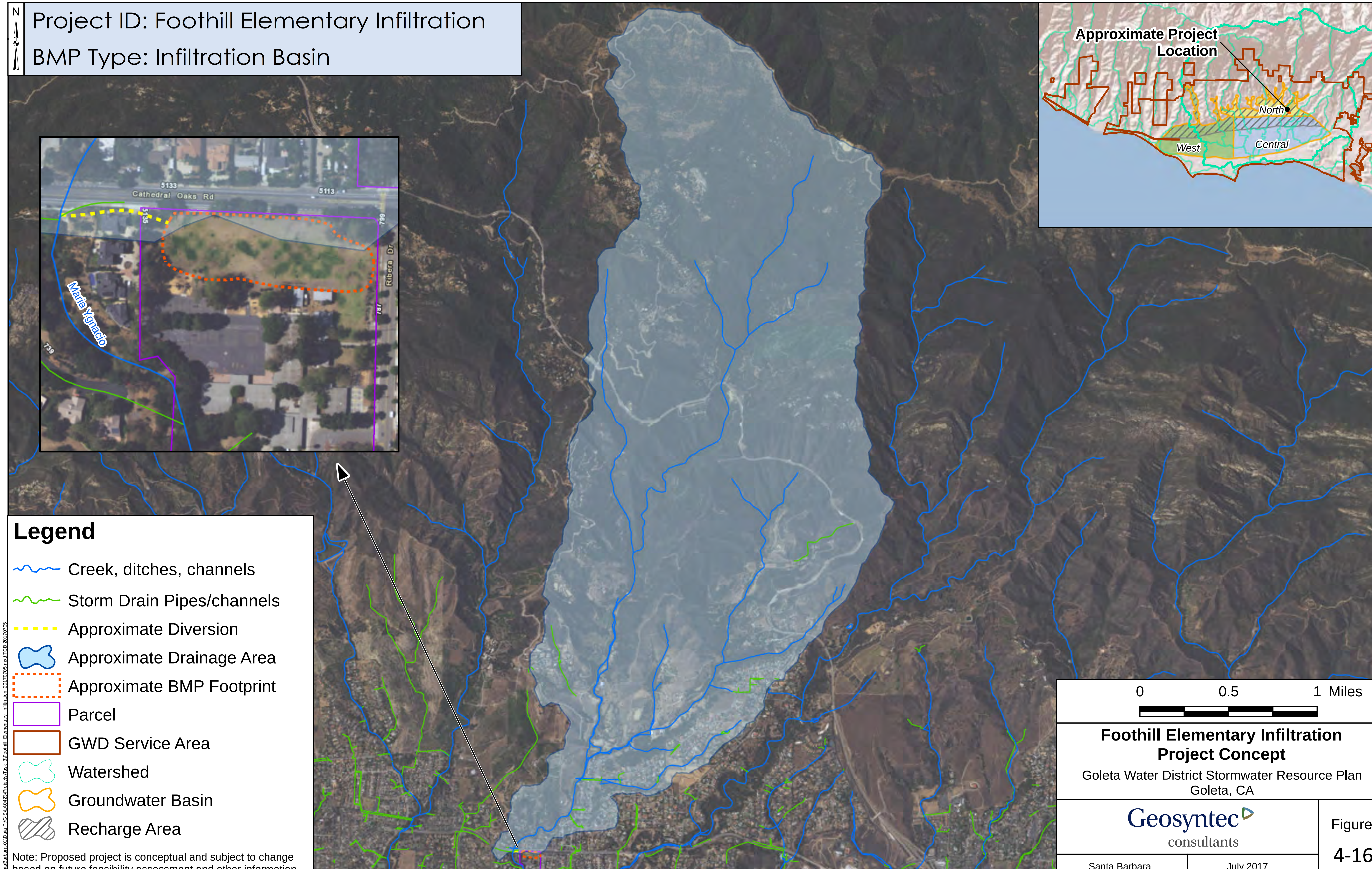
4.1.3.C Foothill Elementary Infiltration Project

An opportunity to implement an infiltration basin was identified at Foothill Elementary, which is owned by the Goleta Union School District and located within the County Unincorporated area north of Goleta. The project would divert flow from Maria Ygnacio Creek. The proposed infiltration basin will only occupy the undeveloped portions of the school yard, avoiding the sports courts, parking lots, and other paved areas. The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.5 ac
- **Approximate Footprint Area**: 1.5 ac
- **Drainage Area**: 3,958 ac
- **Imperviousness of drainage area**: 11%
- **Infiltration Rate**: 1.0 in /hr
- **Depth**: 4.0 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 253,000 cu ft
- **Expected average annual capture efficiency**: 9.0%
- **Groundwater basin**: North
- **Land uses treated**: open space (63%), single-family residential (25%), agriculture (7.5%), transportation (3.4%), and others (0.30%)
- **Potential Water Supply Volume in Modeled Storm Year**: 73 AFY

Preliminary cost estimate: The estimated capital cost is approximately $2.92 million. Project estimates include $1.12 million for engineering and design, permits, and CEQA analysis; $700,000 for construction administration and support; and $1.1 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $116,800 per year, with annual O&M costs of approximately $100,000. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $3,918.

Project ID: Foothill Elementary Infiltration
BMP Type: Infiltration Basin



Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.

Foothill Elementary Infiltration Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Figure 4-16

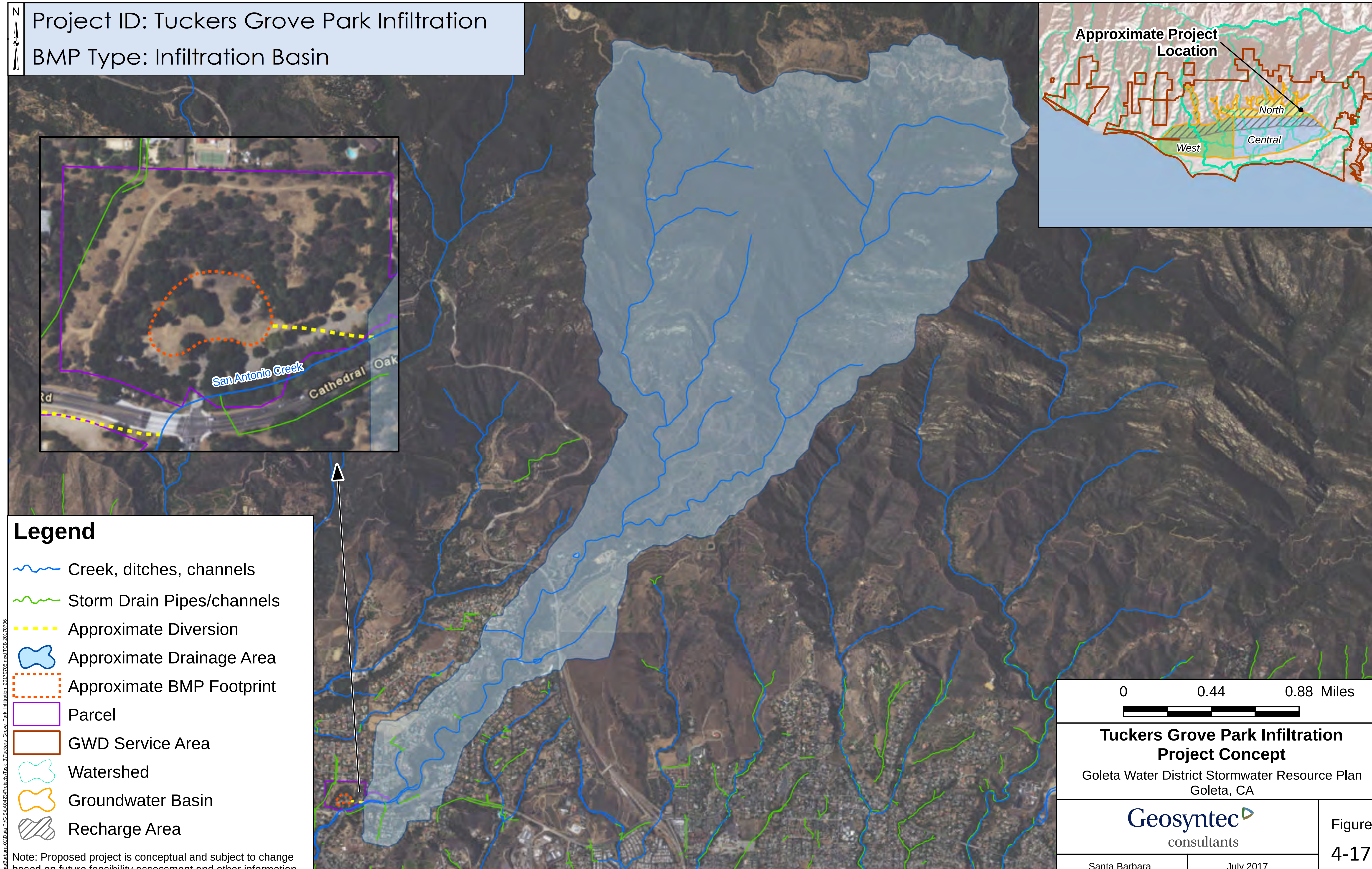
Santa Barbara | July 2017

4.1.3.D Tucker's Grove Park Infiltration Project

An opportunity to implement an infiltration basin was identified at Tucker's Grove Park, which is owned by the County of Santa Barbara and located within the County Unincorporated area north-east of Goleta. The proposed project will divert flow from San Antonio Creek and will only occupy the central portion of the park located adjacent to the western parking lot. The infiltration basin was sized based on the maximum footprint available, avoiding the most densely vegetated areas. The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.44 ac
- **Approximate Footprint Area**: 1.3 ac
- **Drainage Area**: 2,909 ac
- **Imperviousness of drainage area**: 5.4%
- **Infiltration Rate**: 0.5 in /hr
- **Depth**: 2.0 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 112,000 cu ft
- **Expected average annual capture efficiency**: 8.3%
- **Potential site constraints**: The footprint is on the eastern boundary of the north groundwater basin (based on available information), so further investigation is needed to confirm that this project would contribute to groundwater recharge in the northern basin.
- **Groundwater basin**: North
- **Land uses treated**: open space (88%), single-family residential (8.7%), transportation (1.8%), agriculture (0.73%), and others (0.52%)
- **Potential Water Supply Volume in Modeled Storm Year**: 38 AFY

Preliminary cost estimate: The estimated capital cost is approximately $3.42 million. Project estimates include $1.12 million for engineering and design, permits, and CEQA analysis; $900,000 for construction administration and support; and $1.4 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $136,800 per year, plus annual O&M costs of $100,000 per year. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $7,181.

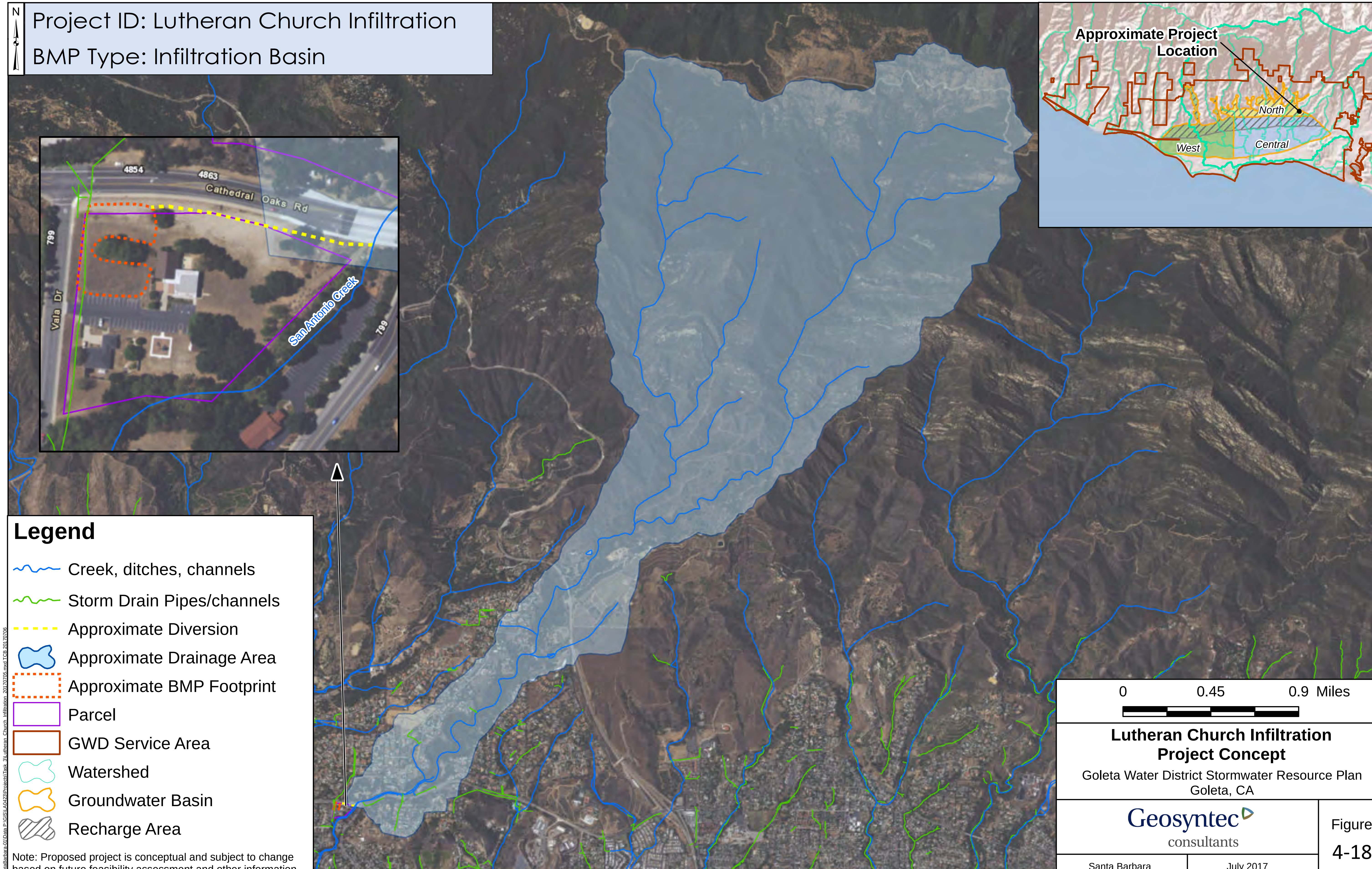

Project ID: Tuckers Grove Park Infiltration
BMP Type: Infiltration Basin
N
San Antonio Creek
Cathedral Oak
Rd
Approximate Project Location
North
Central
West
Legend
Creek, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0 0.44 0.88 Miles
Tuckers Grove Park Infiltration Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec consultants
Figure 4-17
Santa Barbara
July 2017

4.1.3.E Lutheran Church Infiltration Project

Our Redeemer Evangelical Lutheran Church, located adjacent to Cathedral Oaks Road, was identified for implementation of an infiltration basin. This parcel is located within the County Unincorporated area north-east of Goleta. This project would divert flow from San Antonio Creek. The proposed infiltration basin will only occupy the undeveloped area in the portion of the parcel west of the church (and north of the parking lot), as the eastern portion of the parcel has non-infiltrative soils and heavy vegetation/trees. The infiltration basin was sized based on the maximum footprint available in areas of infiltrative soils, while avoiding large trees on the parcel. The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.12 ac
- **Approximate Footprint Area**: 0.35 ac
- **Drainage Area**: 2,944 ac
- **Imperviousness of drainage area**: 5.7%
- **Infiltration Rate**: 1.0 in /hr
- **Depth**: 4.0 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 59,000 cu ft
- **Expected average annual capture efficiency**: 5.5%
- **Potential site constraints**: large trees in the northwestern portion of the parcel
- **Groundwater basin**: North
- **Land uses treated**: open space (88%), single-family residential (9.1%), transportation (2.0%), agriculture (0.72%), and others (0.52%)
- **Potential Water Supply Volume in Modeled Storm Year**: 26 AFY

Preliminary cost estimate: The estimated capital cost is approximately $3.42 million. Project estimates include $1.12 million for engineering and design, permits, and CEQA analysis; $900,000 for construction administration and support; and $1.4 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $136,800 per year, with annual O&M costs of $100,000. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $10,056.



Lutheran Church Infiltration Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | July 2017

Figure 4-18

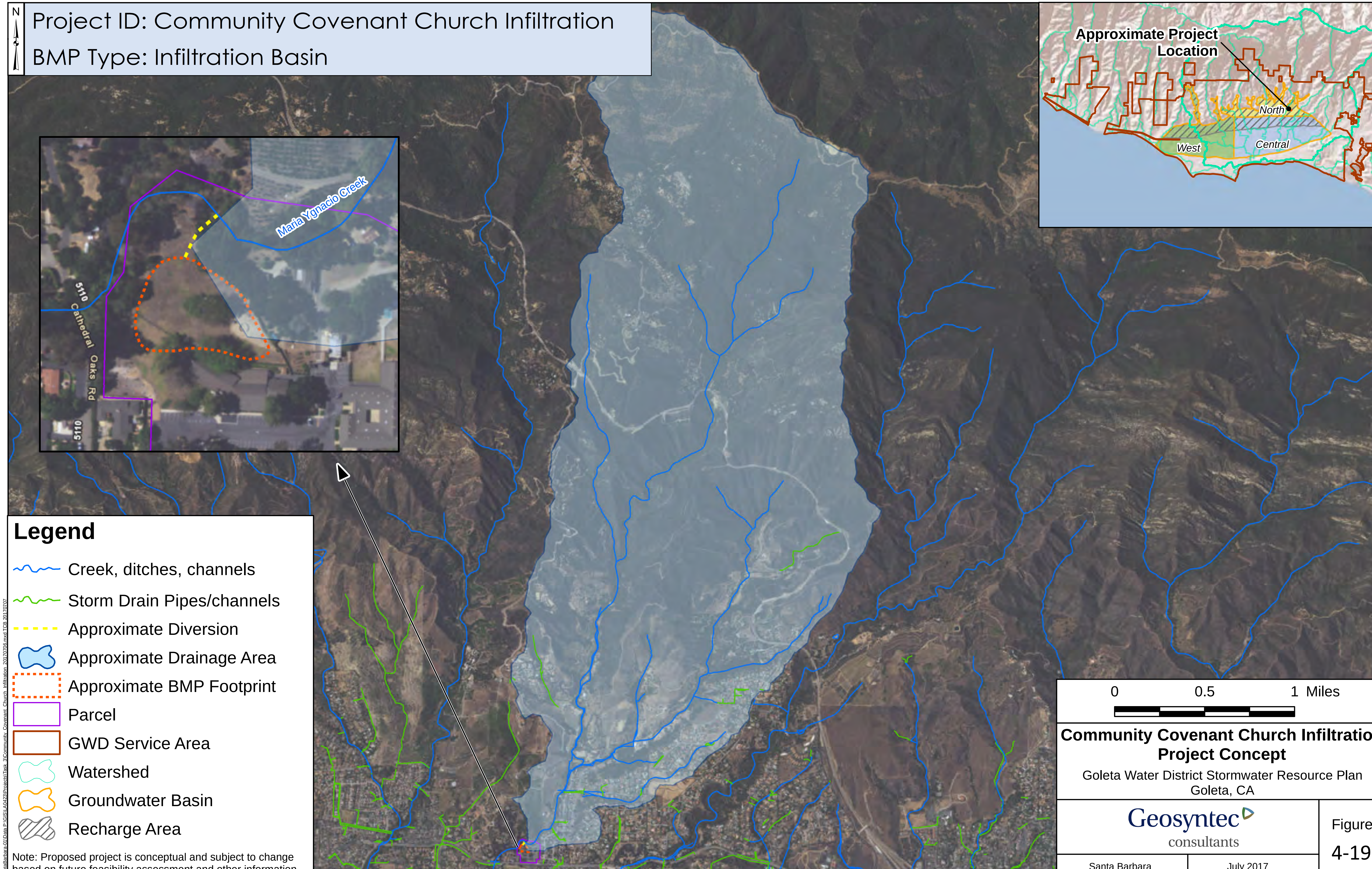
4.1.3.F Community Covenant Church Infiltration Project

Community Covenant Church of Goleta, adjacent to Cathedral Oaks Road, was identified as an opportunity for an infiltration basin. The project would divert flow from Maria Ygnacio Creek and the proposed infiltration basin was sized based on the maximum footprint available in the undeveloped northwestern portion of the parcel, avoiding large trees. The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.23 ac
- **Approximate Footprint Area**: 0.68 ac
- **Drainage Area**: 3,906 ac
- **Imperviousness of drainage area**: 11%
- **Infiltration Rate**: 1.0 in /hr
- **Depth**: 4.0 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 115,000 cu ft
- **Expected average annual capture efficiency**: 5.6%
- **Groundwater basin**: North
- **Land uses treated**: open space (64%), single-family residential (25%), agriculture (7.3%), transportation (3.3%), and others (0.17%)
- **Potential Water Supply Volume in Modeled Storm Year**: 44 AFY

Preliminary cost estimate: The estimated capital cost is approximately $3.12 million. Project estimates include $1.12 million for engineering and design, permits, and CEQA analysis; $900,000 for construction administration and support; and $1 million for mobilization, excavation, fill and soil export, and diversion structures and pipes. Annual O&M costs are estimated at approximately $50,000-$100,000. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $124,800 per year, with estimated O&M costs of $100,000. The cost for groundwater extraction set forth in the District's 2017 Water Supply Management Plan, inclusive of fixed and variable costs, equate to $949 per AF extracted. Including of all of the above components, the total annual cost per AF for this project is approximately $6,058.

Project ID: Community Covenant Church Infiltration
BMP Type: Infiltration Basin



Legend

- Creek, ditches, channels
- Storm Drain Pipes/channels
- Approximate Diversion
- Approximate Drainage Area
- Approximate BMP Footprint
- Parcel
- GWD Service Area
- Watershed
- Groundwater Basin
- Recharge Area

Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.

Community Covenant Church Infiltration Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | July 2017

Figure 4-19

4.2 Capture and Reuse Projects

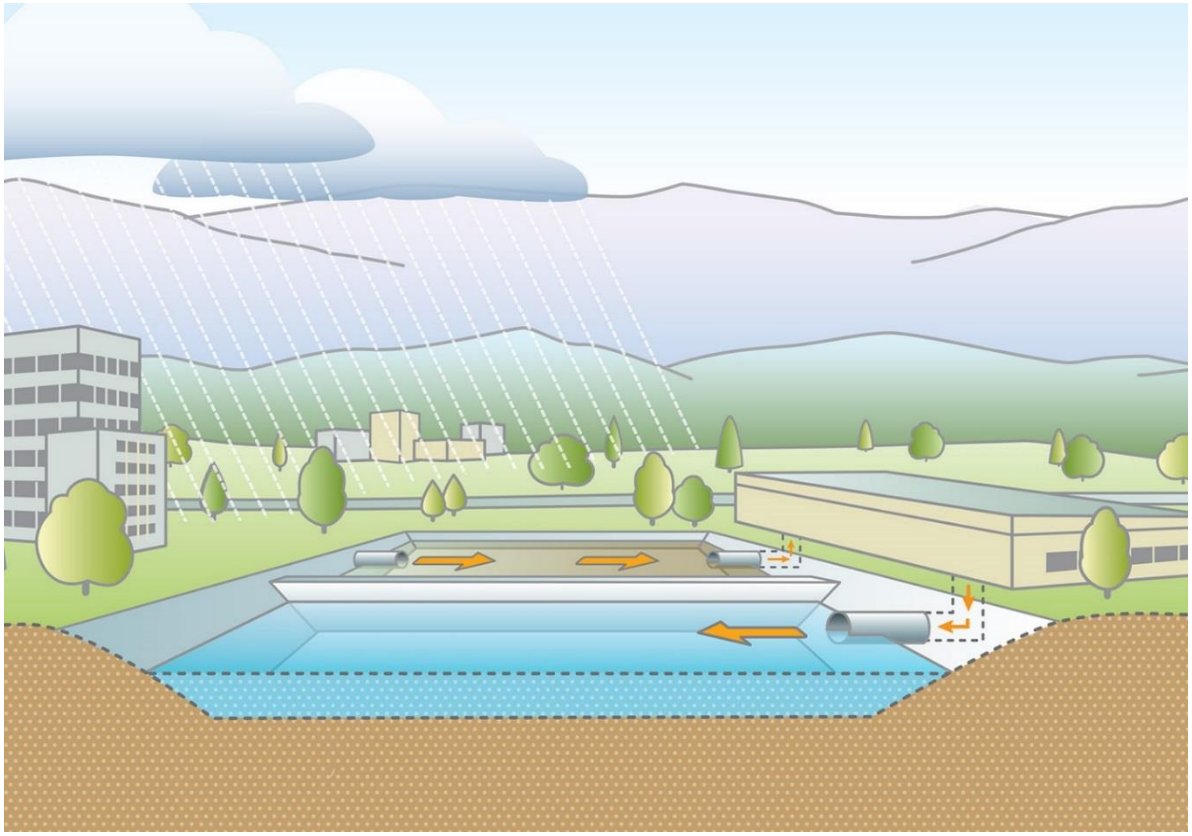


Figure 4-20 – Schematic Drawing of Capture and Reuse Project

4.2.1 Concept and Description

Stormwater Capture and Reuse projects, also known as "rainwater harvesting," use a subsurface storage tank to capture flow from nearby creeks and storm drain systems to use for irrigation on site or at feasible locations nearby. The projects can be implemented on a variety of scales, from individual parcels to regional scales, and in a variety of contexts, from ultra-urban settings to new development. The scale and complexity of any harvest and use project depends on several factors, including source water quality, intended application, and water quality regulations. Design parameter assumptions for Capture and Reuse projects include:

- **Pretreatment**: assumed to occupy 25 percent of the available area
- **Footprint Area:** determined by space available for the BMP
- **Depth**: 3 - 13 ft[15]
- **Freeboard**: 1 ft

For capture and reuse projects that will store water for irrigation purposes, it will be necessary to treat captured water to a high standard. Santa Barbara County reuse criteria have not been established for stormwater, but the Los Angeles Department of County Health (LADPH) has adopted reuse guidelines that require treatment to Title 22 standards for stormwater reuse as irrigation, which would require relatively high cost disinfection pretreatment (potentially making such projects impractical from a cost-benefit perspective).

A conceptual project design for a Capture and Reuse project is included as Appendix C.

4.2.2 Screening Parameters

To identify parcels suitable for capture and reuse projects, parcels that could potentially benefit from reuse of captured water as irrigation were first identified, which included:

- University of California Santa Barbara (UCSB)
- Golf courses
- Parks and open spaces
- Cemeteries
- Schools

As described in the introduction to Section 4.0, the general criteria below were then screened:

- **Parcel ownership**: eliminated privately owned parcels, except for agricultural and church parcels
- **Water wells**: eliminated areas within 100 feet of a water well
- **Lakes**: eliminated areas within 300 feet of a lake
- **Environmentally sensitive areas**: eliminated all environmentally sensitive areas
- **Slope**: eliminated areas with greater than ten percent slopes

The following specific criteria were then used in the parcel prioritization process to identify and remove parcels infeasible for infiltration-based project implementation:

- **Recycled Water Use**: eliminated parcels already utilizing District recycled water
- **Near a potential reuse parcel**: eliminated parcels located outside a 500 foot radius of a potential reuse parcel
- **Storm Drains or channels**: eliminated parcels that were not located within 100 feet of a storm drain pipe or channel or waterbody

Figure 4-22 and Figure 4-23 show the remaining constraints, following what was presented in Figure 4-6, that were unique to the capture and reuse storage tank projects. These constraints are also listed in Figure 4-21, which illustrates the reduction in usable area (and potential parcels for BMP implementation) that occurs as the parcel prioritization process was executed. The constraints applicable to capture and reuse storage tank projects eliminated 21,397 parcels, with 151 parcels consisting of usable areas remaining.

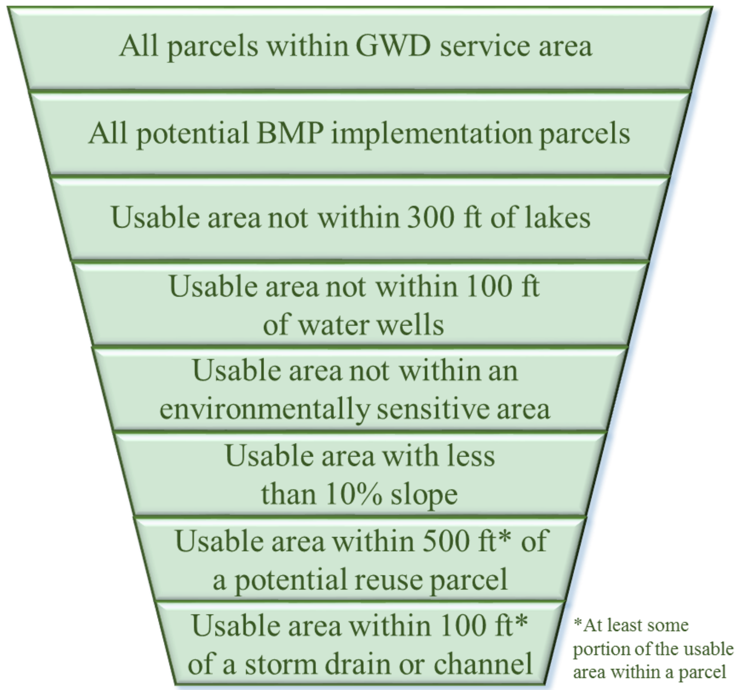
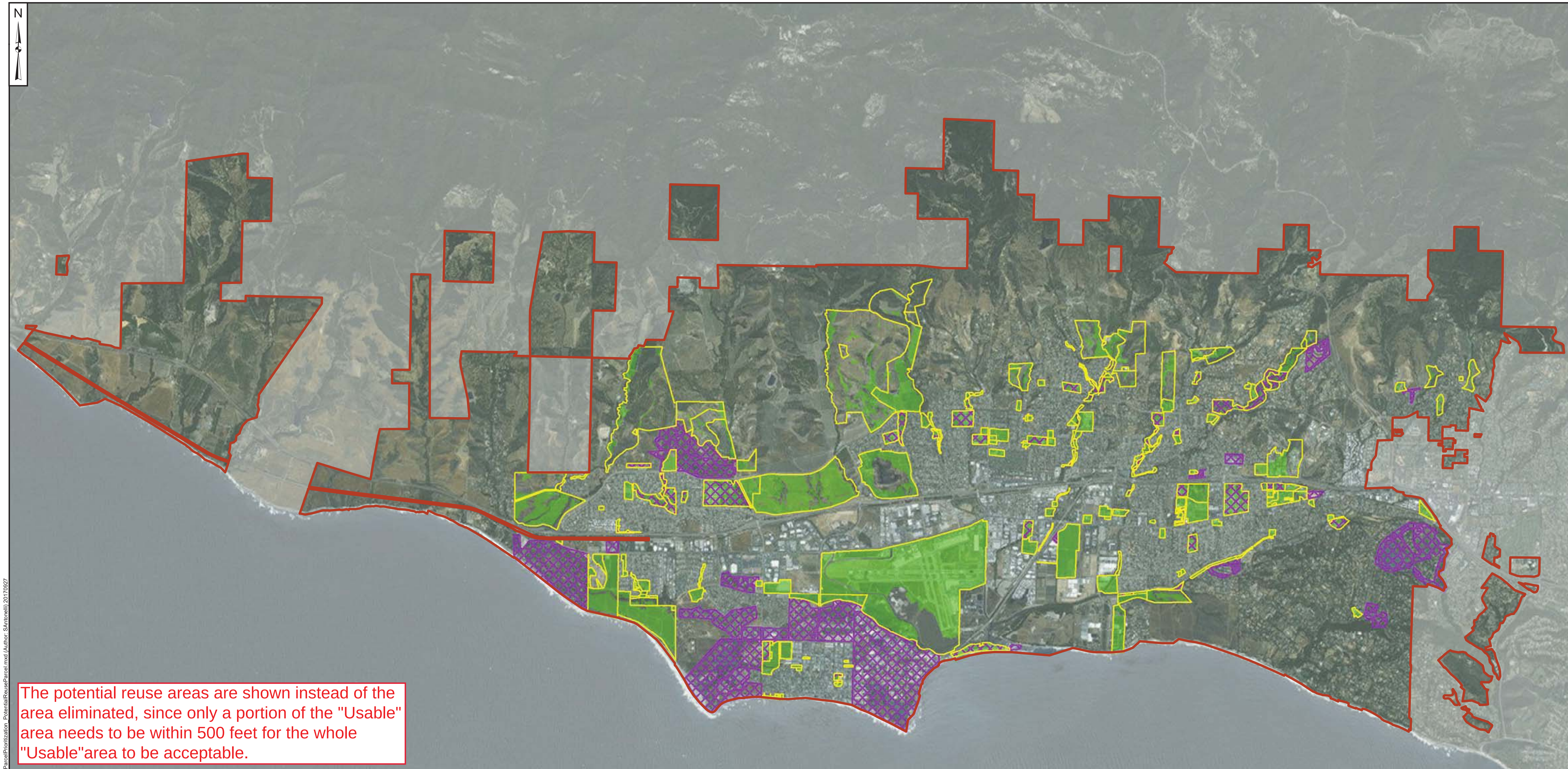


Figure 4-21. Parcel Prioritization Overview for Capture and Reuse Storage Tanks

Similar to the process for identifying potential infiltration project locations, parcels with less than half an acre of area available for implementation (area left within a given parcel after all constraints were applied) were eliminated. In addition, parcels identified with a reuse area (i.e., the parcel where captured water would be applied as irrigation) less than two acres in size were also eliminated since the demand for irrigation would likely not be sufficient to justify the capital expenditure of the capture and reuse project. The District then selected parcels from the list of remaining parcels for capture and reuse projects to be conceptually developed. Future site-specific field testing may result in additional sites identified for capture and reuse opportunities.



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Parcel that could potentially benefit from reuse+

+Includes University of California Santa Barbara parcels, golf courses, parks, cemeteries, and schools with at least 2 acres.

Capture and Use Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. **Eliminate areas located further than 500 ft from a potential reuse area**

Parcels: **21,548**
Parcels remaining**: **216**

**With at least 0.5 acres of "usable" area remaining

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

0 1 2 Miles

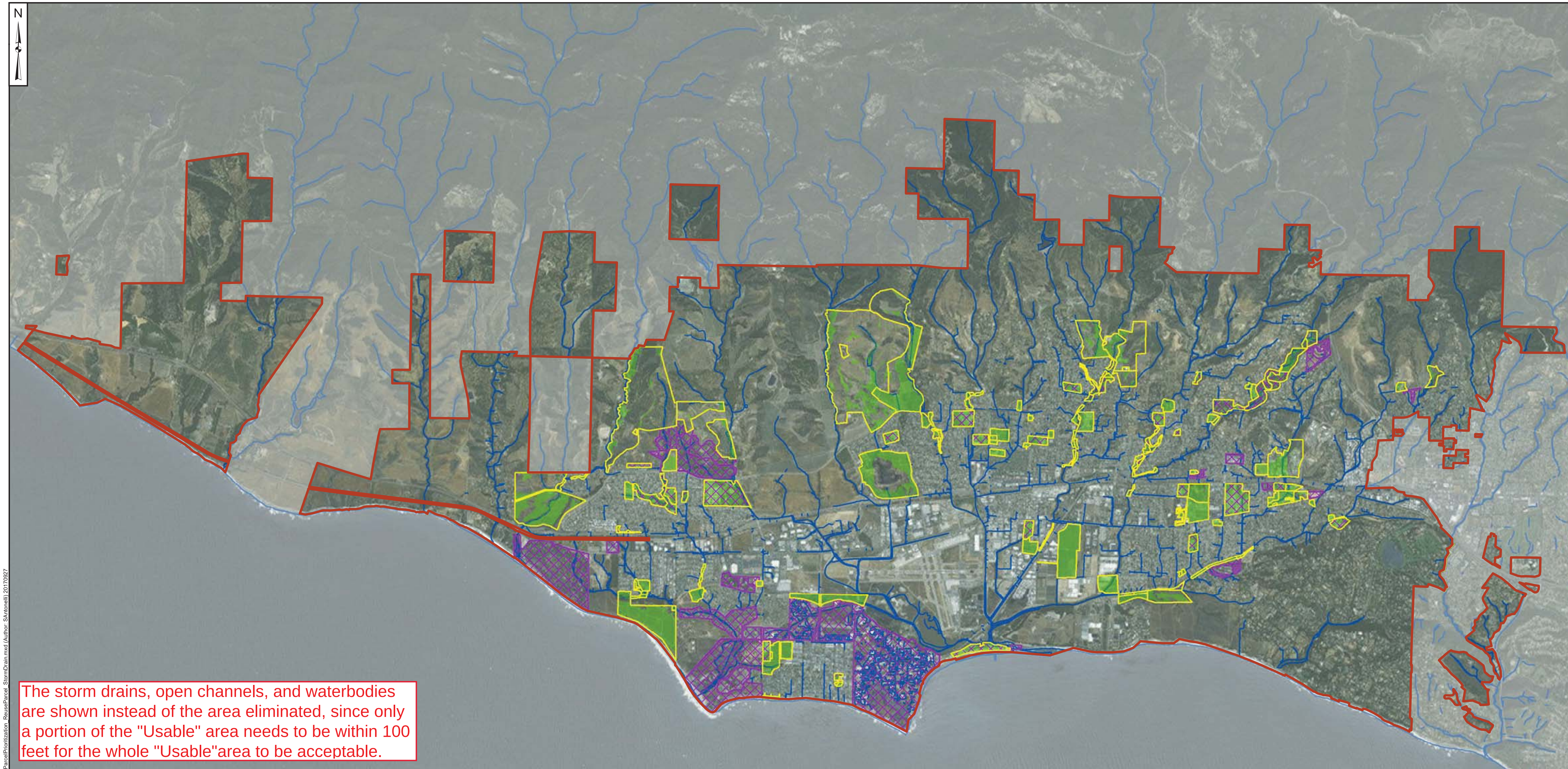
Potential Reuse Parcels

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-22



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Parcel that could potentially benefit from reuse
- Storm Drain, Open Channel, or Waterbody

Capture and Use Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas located further than 500 ft from a potential reuse area
7. **Eliminate parcels that were not located within 100 ft of a storm drain pipe or channel or waterbody**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **151**

**With at least 0.5 acres of "usable" area remaining

0 1 2 Miles

Potential Reuse Parcels Proximate to Water Sources

Goleta Water District Stormwater Resource Plan

Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-23

4.2.3 Conceptual Projects

4.2.3.A Bishop Ranch Capture Reuse Project

An opportunity to implement a rainwater harvesting system (a capture reuse subsurface storage tank) was identified at Bishop Ranch, a large privately-owned, undeveloped parcel that was previously used for agriculture. This parcel is located within the City of Goleta adjacent to Dos Pueblos Senior High School (across Glen Annie Road), which contains numerous baseball fields and a football field. A subsurface storage tank could provide the irrigation for these sports fields, in place of the recycled water currently serving the fields. Alternatively, captured stormwater could be used for agricultural irrigation on surrounding nearby parcels. Any additional water use above the needs of the fields and agricultural uses could be piped into the District's distribution system after full package treatment.

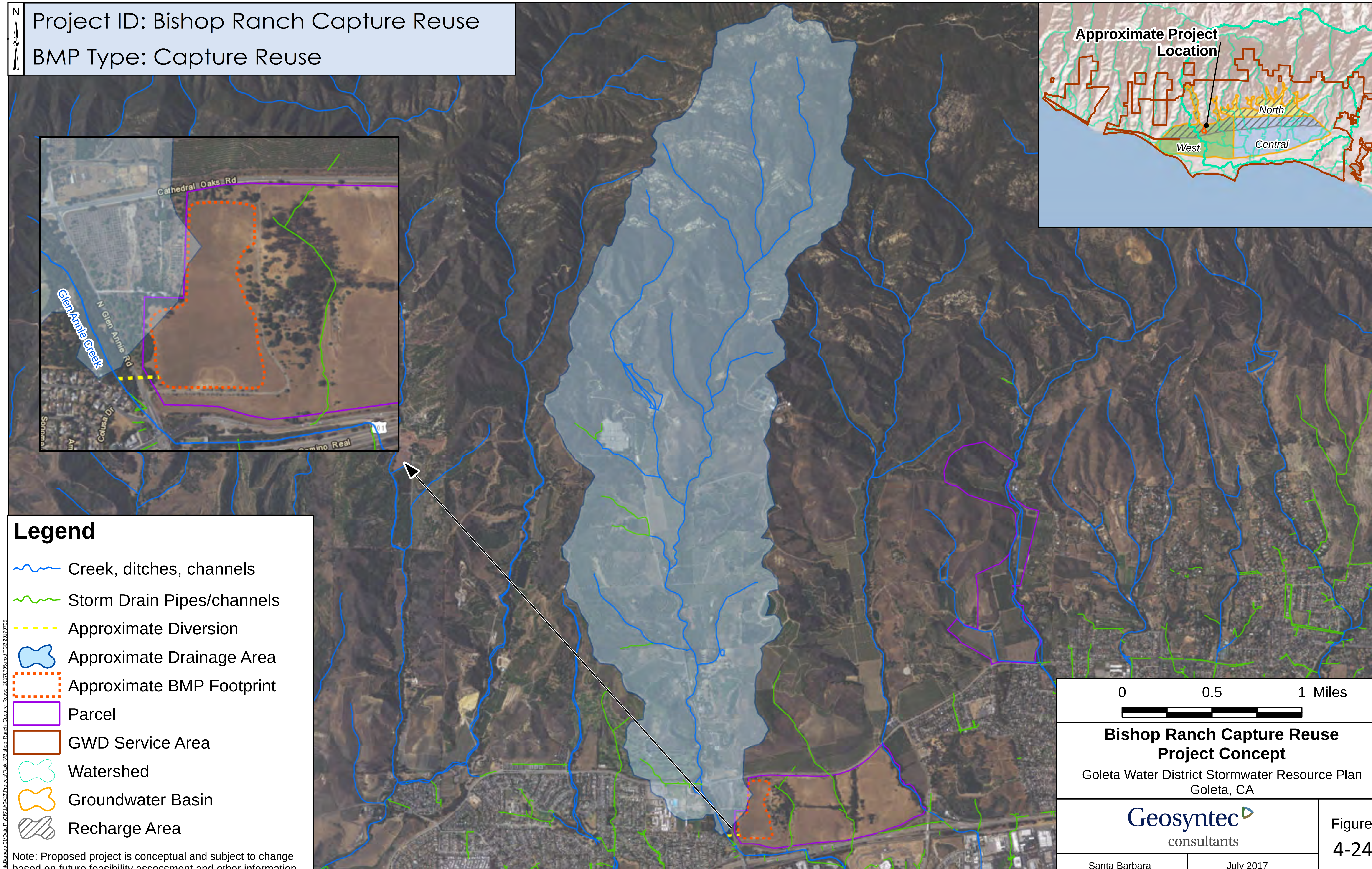
The project will divert flow from Glen Annie Creek. The tank was sized to the maximum footprint available on the western portion of the parcel, without disturbing any roads or larges trees/dense vegetation. Implementation of a subsurface storage system will not interfere with the existing or planned use of the footprint area (e.g., parks, ball fields, etc.). This project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 6.8 ac
- **Approximate Footprint Area**: 20 ac
- **Drainage Area**: 2,815 ac
- **Imperviousness of drainage area**: 5.5%
- **Tank Depth***: 13 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 11,600,000 cu ft
- **Expected average annual capture efficiency**: >100%
- **Groundwater basin**: West
- **Land uses treated**: open space (57%), agriculture (38%), industrial (2.3%), single-family residential (1.2%), education (1.2%), and transportation (0.86%)
- **Potential Water Supply Volume in Modeled Storm Year**: 660 AFY

Preliminary cost estimate: Construction costs are estimated at $12 million, which include the necessary water treatment packages in order to treat and use the water. The project estimate also includes an additional $1.72 million in engineering, CEQA-related services, and permitting and design services, for a total of $13.72 million. Note that as a privately held property site, substantial additional costs may be incurred to secure the necessary access rights to utilize the property. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the

* Further investigation of groundwater elevation levels in this area should be conducted to determine if the maximum tank depth of 13 ft is feasible.

amortized capital component would be approximately $564,800 per year. With annual O&M costs of approximately $1 million to operate the facility and treatment package, the total annual cost per AF is $2,371.


Project ID: Bishop Ranch Capture Reuse
BMP Type: Capture Reuse
N
Approximate Project Location
North
West
Central
Cathedral Oaks Rd
Glen Annie Creek
N Glen Annie Rd
Colusa Dr
Camino Real
Legend
Creek, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0
0.5
1 Miles
Bishop Ranch Capture Reuse
Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec
consultants
Figure
4-24
Santa Barbara
July 2017

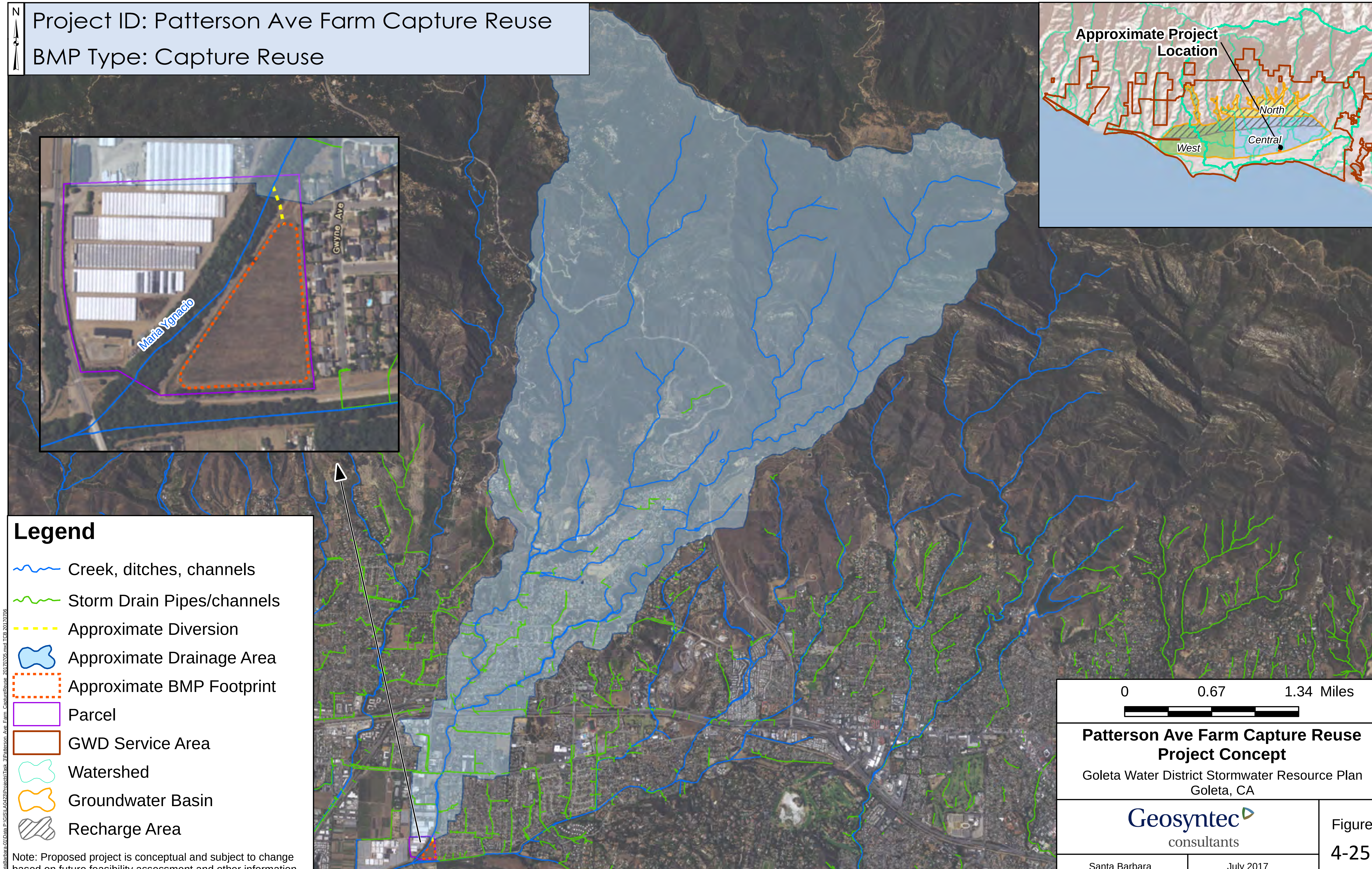
4.2.3.B Patterson Ave Farm Capture Reuse Project

An opportunity to implement a rainwater harvesting system (a capture reuse subsurface storage tank) was identified at a privately-owned parcel east of Patterson Avenue, near Atascadero Creek. The parcel is currently used for agriculture (nurseries and greenhouses) and is located within the County Unincorporated area between Santa Barbara and Goleta. The project will capture flow from Maria Ygnacio Creek, and the captured water can then be used to irrigate the nurseries, greenhouses, or open space area. This project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 1.3 ac
- **Approximate Footprint Area**: 4.0 ac
- **Drainage Area**: 7,651 ac
- **Imperviousness of drainage area**: 14%
- **Tank Depth***: 13 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 2,300,000 cu ft
- **Expected average annual capture efficiency**: 15%
- **Groundwater basin**: Central
- **Land uses treated**: open space (67%), single-family residential (21%), transportation (4.6%), agriculture (4.5%), and others (3.0%)
- **Potential Water Supply Volume in Modeled Storm Year**: 410 AFY

Preliminary cost estimate: Construction costs are estimated at $4.9 million, which include the necessary water treatment packages in order to treat and use the water. The project estimate also includes an additional $500,000 in engineering, CEQA-related services, and permitting and design services, for a total of $5.4 million. Note that as a privately held property site, substantial additional costs may be incurred to secure the necessary access rights to utilize the property. O&M costs are estimated at approximately $1 million per year to monitor the project and run the package treatment plant. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $216,000 per year. The total annual cost per AF is approximately $2,965.

* Further investigation of groundwater elevation levels in this area should be conducted to determine if the maximum tank depth of 13 ft is feasible.



N
Project ID: Patterson Ave Farm Capture Reuse
BMP Type: Capture Reuse
Approximate Project Location
North
Central
West
Gwyne Ave
Maria Ygnacio
Legend
Creek, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0
0.67
1.34 Miles
Patterson Ave Farm Capture Reuse Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec consultants
Figure
4-25
Santa Barbara
July 2017

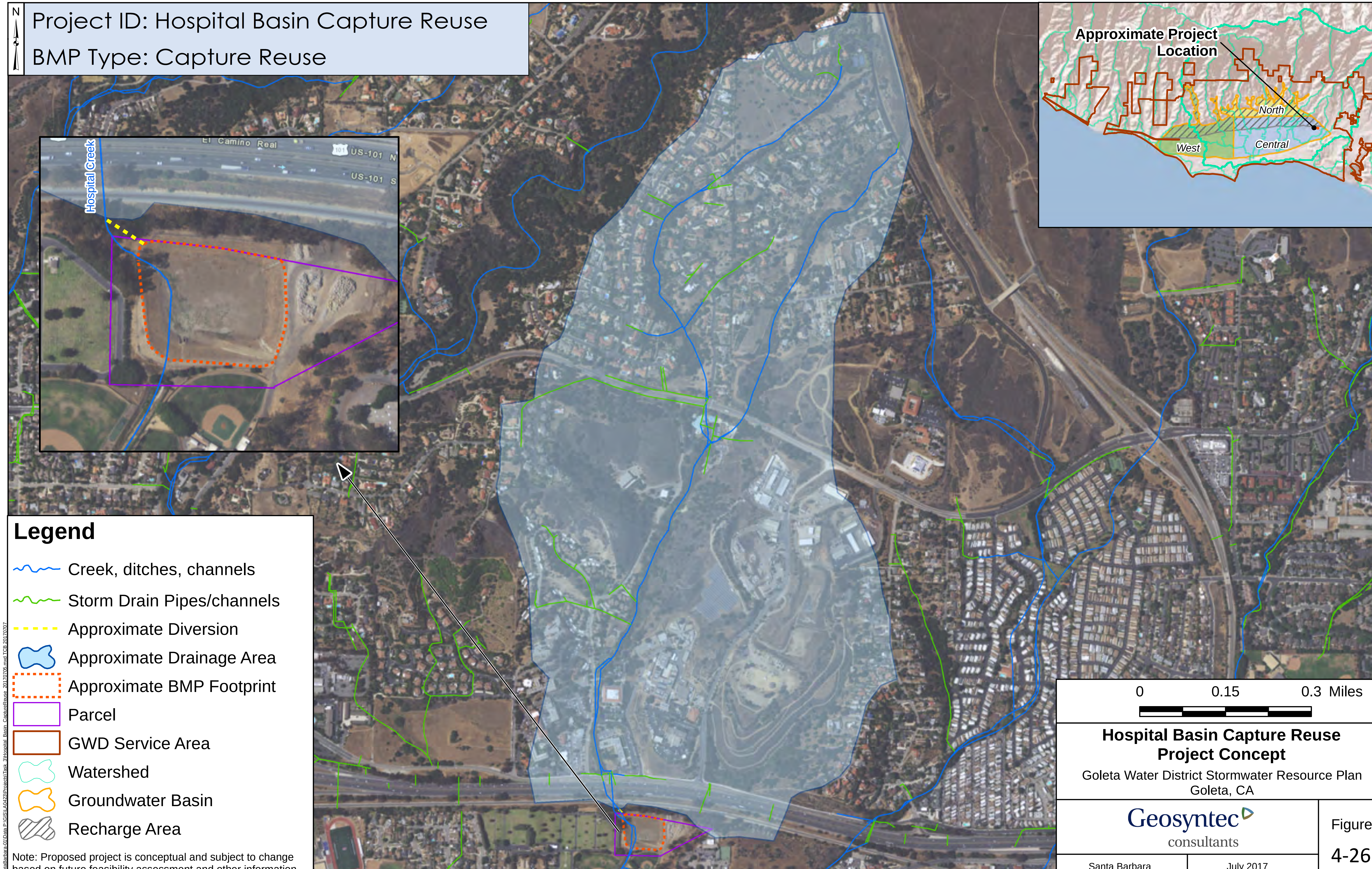
4.2.3.C Hospital Basin Capture Reuse Project

An opportunity to implement a rainwater harvesting system (a capture reuse subsurface storage tank) was identified at a large parcel owned by the County of Santa Barbara (located within the County Unincorporated area east of Goleta), located just south of the US-101 and adjacent to the Goleta Cemetery. There is currently a detention basin constructed on the parcel. This parcel is located adjacent to George "Ben" Page Youth Center, which has several baseball fields. A subsurface storage tank is proposed to provide irrigation for these sports fields and/or the Goleta Cemetery.
The project will divert flow from Hospital Creek. The tank was sized to the maximum footprint available on the parcel, without disturbing any larges trees. This project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.61 ac
- **Approximate Footprint Area**: 1.8 ac
- **Drainage Area**: 455 ac
- **Imperviousness of drainage area**: 69%
- **Tank Depth**[*]: 13 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 1,000,000 cu ft
- **Expected average annual capture efficiency**: 30%
- **Groundwater basin**: Central
- **Land uses treated**: commercial (44%), single-family residential (29%), transportation (11%), open space (6.3%), multi-family residential (7.7%), industrial (1.7%), and agriculture (0.80%)
- **Potential Water Supply Volume in Modeled Storm Year**: 150 AFY

Preliminary cost estimate: Construction costs are estimated at $6 million, which include the necessary water treatment packages in order to treat and use the water. The project estimate also includes an additional $500,000 in engineering, CEQA-related services, and permitting and design services, for a total of $6.5 million. Annual O&M costs are estimated at approximately $1 million. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $260,000 per year, for a total annual cost per AF of approximately $8,400.

[*] Further investigation of groundwater elevation levels in this area should be conducted to determine if the maximum tank depth of 13 ft is feasible.



Hospital Basin Capture Reuse Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Figure 4-26

4.2.3.D Lassen Open Space Capture Reuse Project

An open space area slightly east of South Patterson Avenue and directly west of Lassen Drive was identified for an opportunity to implement a rainwater harvesting system (a capture reuse subsurface storage tank). The parcel is owned by the County of Santa Barbara and is located within the County Unincorporated area of east of Goleta. There is a 30-inch reinforced concrete pipe (RCP) storm drain that drains a residential area to the east of the parcel. The tank was sized to the maximum footprint available on the parcel, without disturbing any larges trees/dense vegetation. This project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.13 ac
- **Approximate Footprint Area**: 0.40 ac
- **Drainage Area**: 39 ac
- **Imperviousness of drainage area**: 56%
- **Tank Depth**: 13 ft
- **Freeboard Depth**: 1.0 ft
- **Storage Volume**: 224,000 cu ft
- **Expected average annual capture efficiency**: 66%
- **Groundwater basin**: Central
- **Land uses treated**: single-family residential (71%), transportation (26%), industrial (3.7%), and open space (0.24%)
- **Potential Water Supply Volume in Modeled Storm Year**: 23 AFY

Preliminary cost estimate: Construction costs are estimated at $2.9 million, which include the necessary water treatment packages in order to treat and use the water. The project estimate also requires an additional $500,000 in engineering, CEQA-related services, and permitting and design services, for a total of $3.4 million. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $116,000 per year. Estimated O&M costs are approximately $500,000, for a total annual cost per AF of $26,782.

Project ID: Lassen Open Space Capture Reuse

BMP Type: Capture Reuse

Legend

- Creek, ditches, channels
- Storm Drain Pipes/channels
- Approximate Diversion
- Approximate Drainage Area
- Approximate BMP Footprint
- Parcel
- GWD Service Area
- Watershed
- Groundwater Basin
- Recharge Area

Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.

Lassen Open Space Capture Reuse Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | July 2017

Figure 4-27

4.3 Dry Well Projects

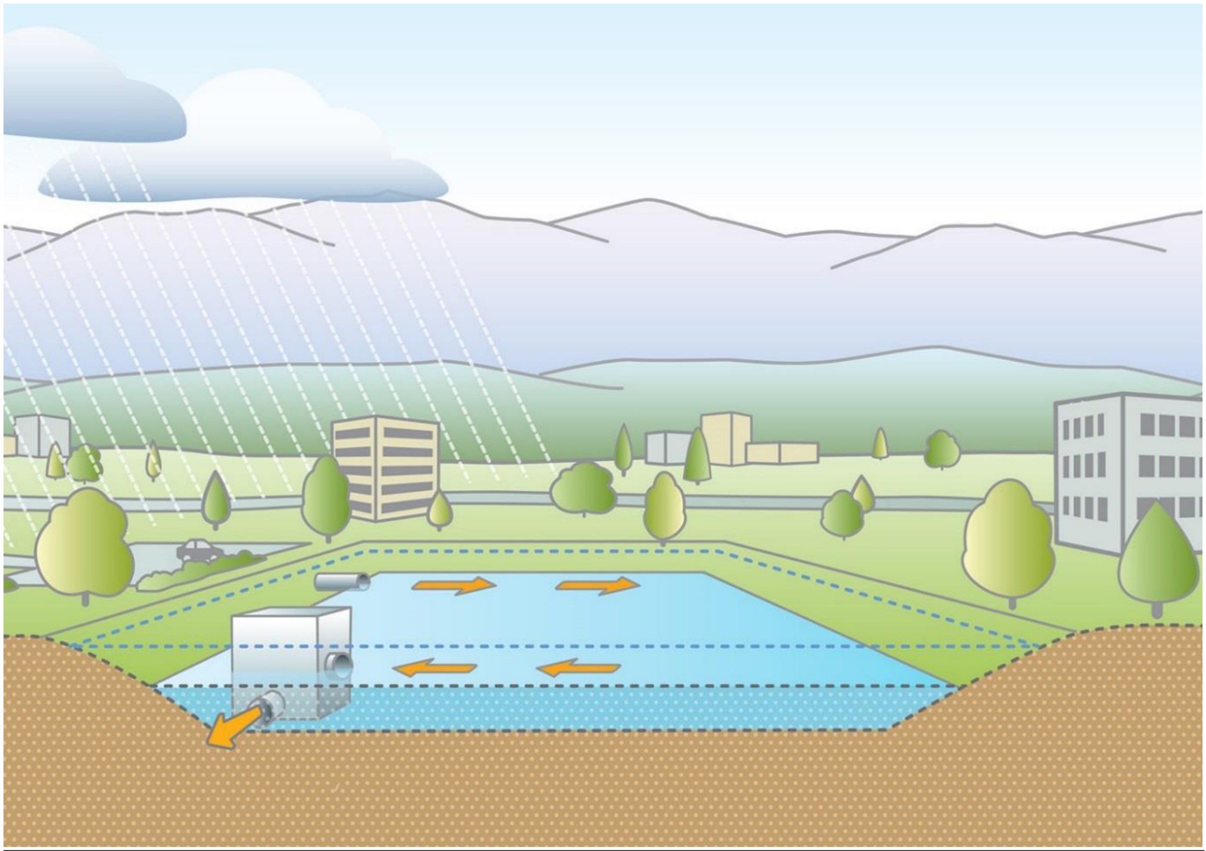


Figure 4-28 – Schematic Drawing of Dry Well Project

4.3.1 Concept and Description

Dry well projects are designed using gravity-fed excavated pits lined with perforated casing and backfilled with gravels or stone, allowing water to penetrate layers of soil with poor infiltration. Dry wells, also known as underground injection control (UIC) systems, and are subject to the EPA's UIC regulations. Dry wells are stormwater infiltration devices typically constructed of a pipe approximately 3 feet wide and 20 to 50 feet deep, containing perforation at various locations along the pipe and/or at the bottom. A dry well is considered a "Class V injection well" by the US EPA, which is defined as a potential conduit for non-hazardous fluids that is deeper than it is wide.

Dry wells are appropriate for parcels where surface soil infiltration may be poor, but deep soil infiltration may be better, and there is substantial depth to groundwater. Subsurface infiltration rates were not available during this screening. Therefore, infiltration testing should be performed to verify that subsurface infiltration rates are sufficient. In California, county environmental management departments such as the Santa Barbara County Environmental Health Services regulate wells that supply drinking water, including dry wells. It is currently the responsibility of county environmental management departments to implement dry well standards as the US EPA does not have design standards for dry wells, so local agencies use their best professional judgment to manage them prudently. EPA Region 9 has a program in place for the registration of all injection wells which may apply to stormwater dry wells; EPA Region 9 is in the process of developing a specific permitting process for dry wells, therefore permitting considerations should be incorporated into dry well planning efforts.

Because drywells can be clogged and tend to risk concentrating pollutants in one place, pollution and sediment control practices are used to protect them in design. The design elements include a proactive monitoring program to review risk of siltation and buildup, with removal. This maintenance is factored into the ongoing O&M costs of maintaining the dry well. Observation wells are part of the designs, and an observation well not only provides the necessary access to the dry well, but also provides a conduit through which pumping of stored runoff can be accomplished in case of slowed infiltration. The Santa Barbara Stormwater BMP Guidance Manual requires a typical observation well consisting of a slotted PVC well screen, 4 to 6 inches in diameter, capped with a lockable, above-ground lid.

Dry wells can be used in a variety of situations, but are especially useful in areas of the Basin with clay soils to help facilitate the movement of stormwater runoff below the constricting clay layers. They are a stormwater best management practice (BMP) to infiltrate water into the ground to reduce runoff; are relatively easy to construct; and require little land area. Dry wells can be used in conjunction with low impact development (LID) practices to help infiltrate and retain, filter, or slowly release stormwater at a given site, similar to bioswales. Numerous designs have been used; some includes pretreatment features such as vegetated swales and sedimentation basins that help trap sediment and other pollutants. These features help to minimize clogging in the dry well as well as reducing contaminates released into the subsurface. Design parameter assumptions for dry well projects include:

- **Pretreatment**: assumed to occupy 25 percent of the available area
- **Drawdown time**: maximum of 12 hours
- **Depth**: maximum depth possible that meets the following constraints:
    - minimum of 10 ft above seasonal high groundwater level[*]

[*] Historical groundwater data were investigated from the District Groundwater Management Plan (GSI Water Solutions, Inc., 2016), in addition to the GeoTracker Groundwater Ambient Monitoring and Assessment Program (GAMA) online database. If a project location was in close proximity to a well with hydrograph data in the Groundwater Management Plan, groundwater elevation data from approximately 1940 to 2016, as presented in the hydrographs, were used. If a project location was not in close proximity to a well with hydrograph data in the Groundwater Management Plan, a nearby well was selected from the GeoTracker GAMA database, which generally contained only recent data from approximately 2011 through 2016. For both sources, an estimate of the 75th percentile groundwater elevation from all available data was used as a close approximation of the seasonal high groundwater level for an average year. For all dry well projects, further investigation of groundwater elevation data should be conducted to assess project feasibility.

  - minimum of 10 ft below an impermeable layer[**]
  - within layers of adequate subsurface infiltration[***]
- **Media**: assumed to be gravel media (porosity = 0.35)
- **Spacing between dry wells**: minimum of 100 ft (spacing may be closer if the interdependency of multiple wells in close proximity has been evaluated to determine the reliable long-term dry well capacity)
- **Design flowrate**: 0.25 cfs[****] (based on information provided by Torrent Resources, 2017)
- **Diameter**: assumed to be 6 ft (based on information provided by Torrent Resources, 2017)

A conceptual project design for a capture/reuse project is included as Appendix D.

4.3.2 Screening Parameters

As described in the introduction to Section 4.0, the general criteria below were screened first:

- **Parcel ownership**: eliminated privately owned parcels, except for agricultural and church parcels
- **Water wells**: eliminated areas within 100 feet of a water well
- **Lakes**: eliminated areas within 300 feet of a lake
- **Environmentally sensitive areas**: eliminated all environmentally sensitive areas
- **Slope**: eliminated areas with greater than ten percent slopes

The following specific criteria were then used in the parcel prioritization process to identify and remove parcels infeasible for infiltration-based project implementation:

- **Groundwater liquefaction**: eliminated areas classified as "high" groundwater liquefaction
- **Groundwater basin**: eliminated areas outside the North, Central or West subbasins (as defined in the Groundwater Management Plan)
- **Storm Drains or channels**: eliminated parcels that were not located within 100 feet of a storm drain pipe or channel or waterbody

[**] Boring logs for wells near the proposed project locations, from the GeoTracker GAMA database, were used to characterize the approximate depth of the confining layers, if applicable. For all dry well projects, further investigation of confining layers should be conducted to assess project feasibility.
[***] Subsurface infiltration rates were not available during development of project concepts. It is assumed that subsurface infiltration rates are adequate at the dry well depths determined by the aforementioned criteria. However, subsurface infiltration rates at the proposed locations for dry wells should be investigated to confirm that subsurface infiltration rates are adequate.
[****] This design flowrate is based on the design rate of up to 0.25 cfs for the pretreatment settling chamber, which is the limiting factor, according to Torrent Resources.

Figure 4-30 through Figure 4-32 show the remaining constraints, following what was presented in Figure 4-6, which were unique to the dry well projects. These constraints are also listed in Figure 4-29, which illustrates the reduction in usable area (and potential parcels for project implementation) that occurs as the parcel prioritization process was executed. The constraints applicable to dry well projects eliminated 21,451 parcels, with 97 parcels consisting of usable areas remaining.

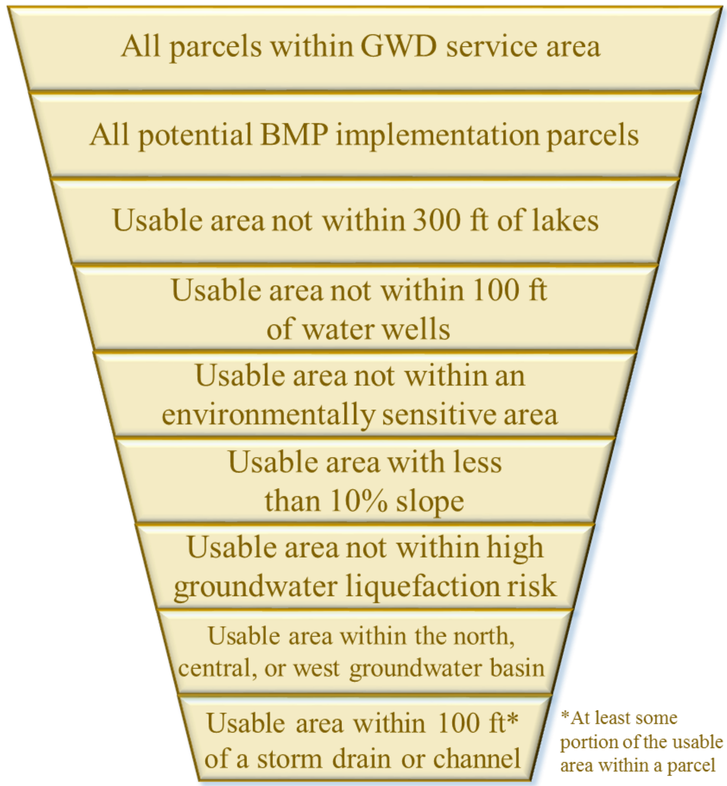
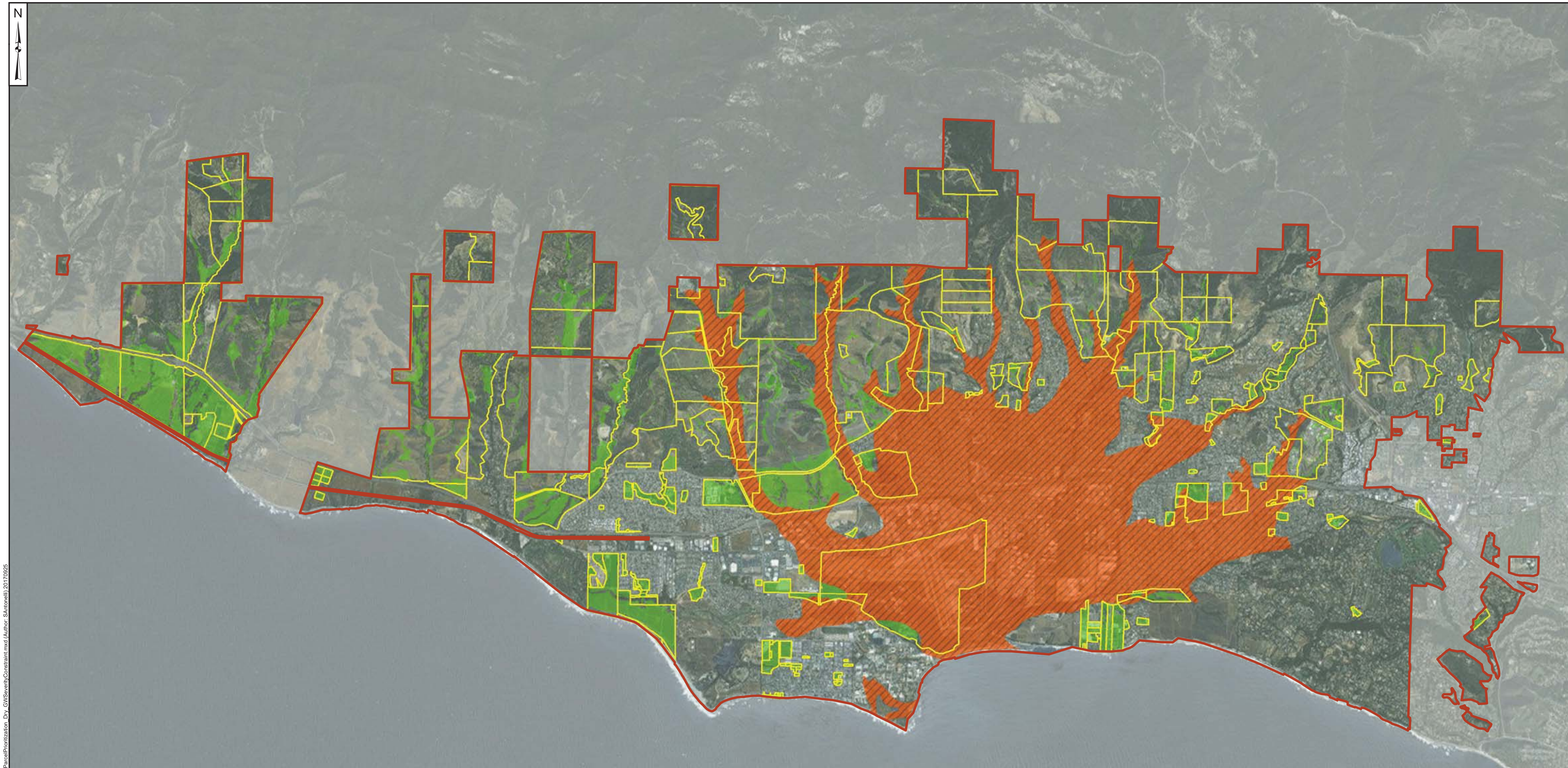


Figure 4-29. Parcel Prioritization Overview for Dry Wells

In order to further screen the remaining parcels that met the aforementioned criteria, parcels with less than 0.2 acres of area available for implementation (area left within a given parcel after all constraints were applied) were also eliminated. The District then selected parcels from the list of remaining parcels for dry well projects to be conceptually developed. A brief investigation of typical groundwater depths and confining layers underlying these identified projects was also performed to assess parcel suitability.



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- High Groundwater Liquefaction

Dry Well Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. **Eliminate areas classified as "high" liquefaction**

Parcels: **21,548**

Parcels remaining**: **247**

**With at least 0.2 acres of "usable" area remaining

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

0 1 2 Miles

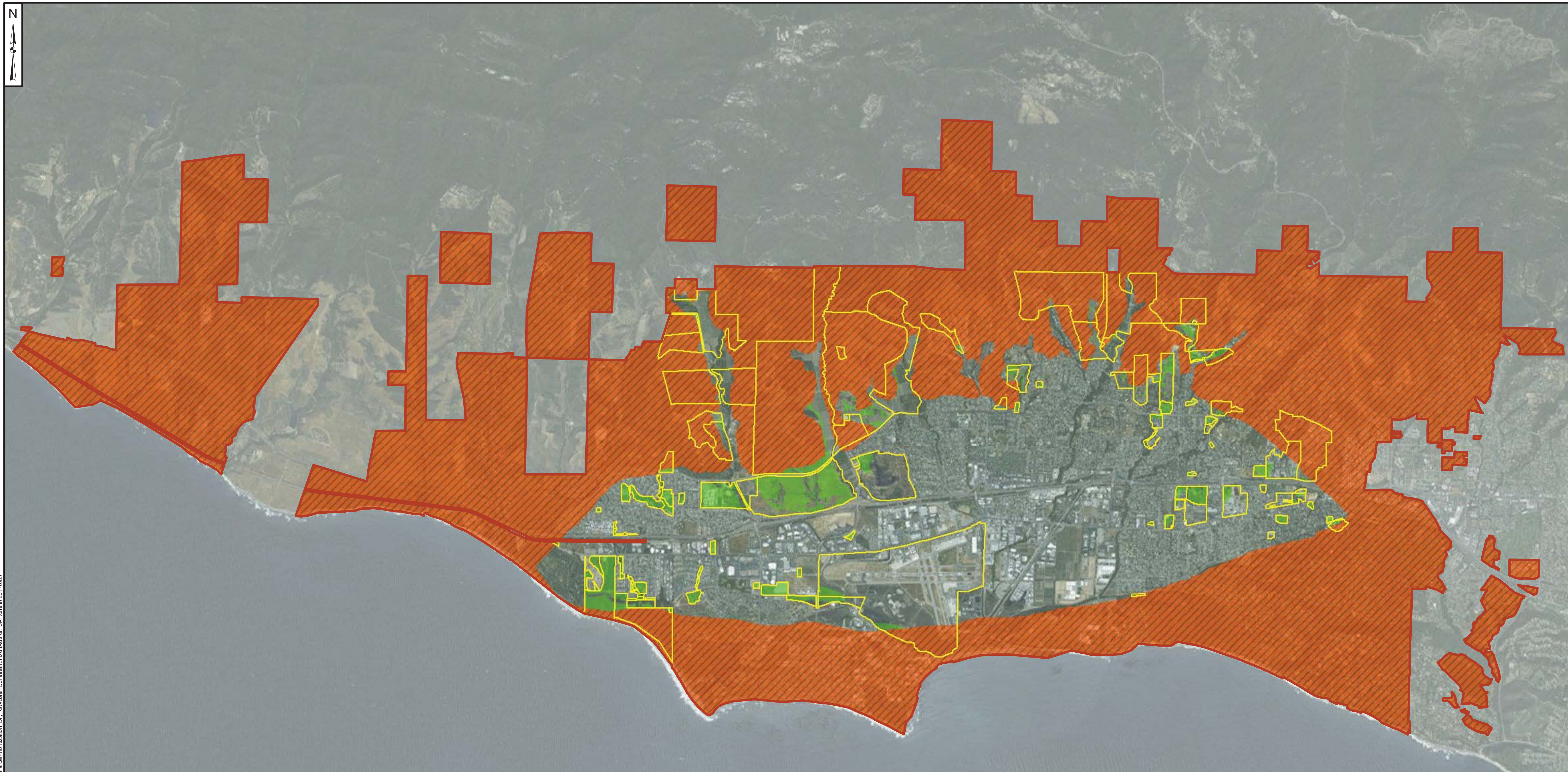
Areas Eliminated by Liquefaction

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-30



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Outside North, Central, and West Groundwater Basin

Dry Well Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas classified as "high" liquefaction
7. **Eliminate areas outside the north, central, or west groundwater basin**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map.

Parcels: **21,548**

Parcels remaining**: **107**

**With at least 0.2 acres of "usable" area remaining

0 1 2 Miles

Areas Eliminated by Groundwater Basin

Goleta Water District Stormwater Resource Plan

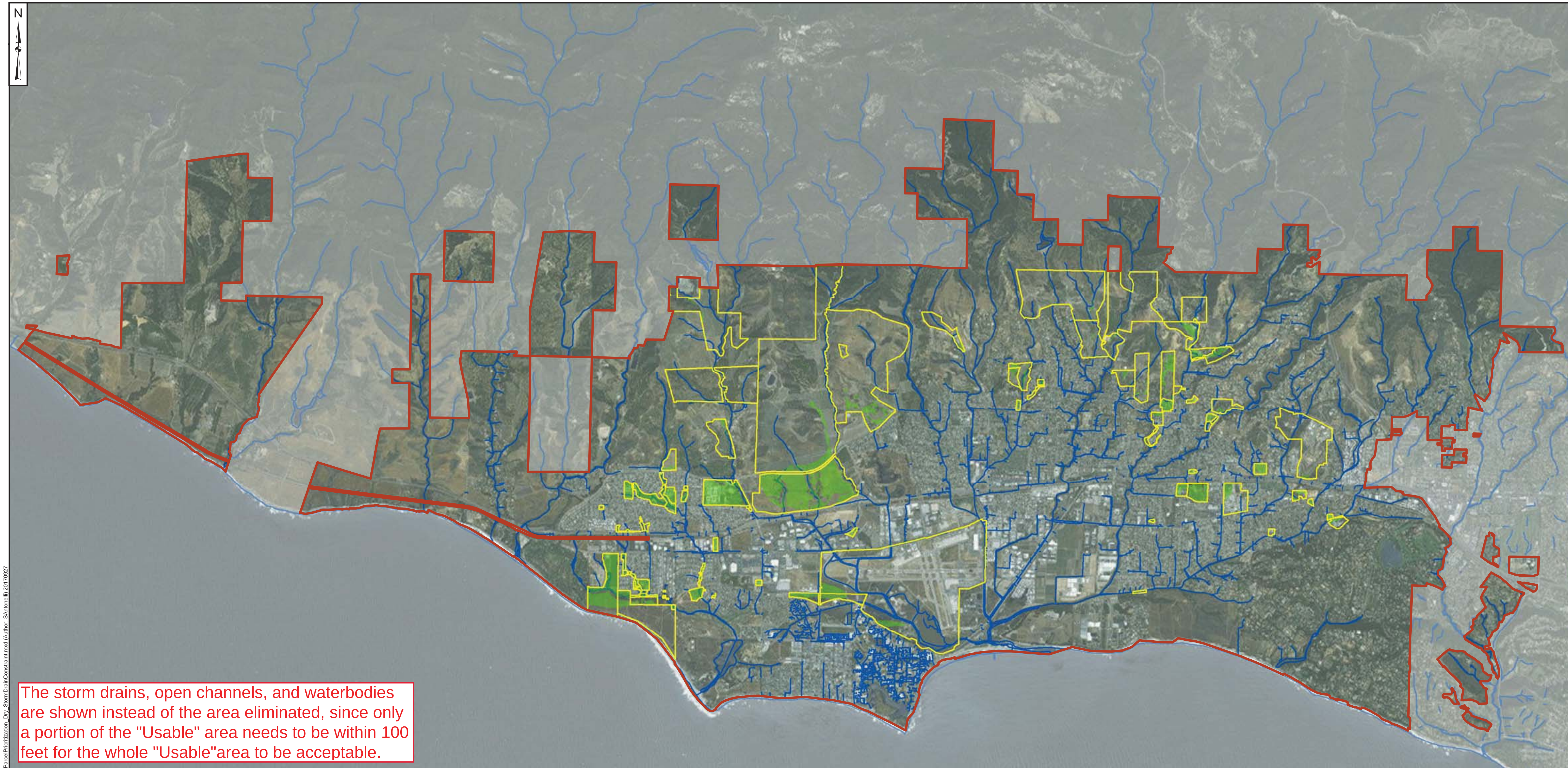
Goleta, CA

Geosyntec consultants

Santa Barbara

September 2017

Figure 4-31



Legend

- GWD Service Area
- Potential Implementation Parcel
- Remaining "Usable" Area
- Storm Drain, Open Channel, or Waterbody

Dry Well Project Constraints Applied*:

1. Eliminate privately-owned parcels
2. Eliminate areas within 300 ft of a lake
3. Eliminate areas within 100 ft of a water well
4. Eliminate environmentally sensitive areas
5. Eliminate areas with greater than 10% slope
6. Eliminate areas classified as "high" liquefaction
7. Eliminate areas outside the north, central, or west groundwater basin
8. **Eliminate parcels that were not located within 100 feet of a storm drain pipe or channel or waterbody**

*Constraints listed in black text have been applied to the prioritization, but only the constraint listed in larger **bold** text is being displayed on this map..

Parcels: **21,548**

Parcels remaining**: **97**

**With at least 0.2 acres of "usable" area remaining

0 1 2 Miles

Potential Dry Well Parcels Proximate to Water Sources

Goleta Water District Stormwater Resource Plan

Goleta, CA

Geosyntec consultants

Santa Barbara | September 2017

Figure 4-32

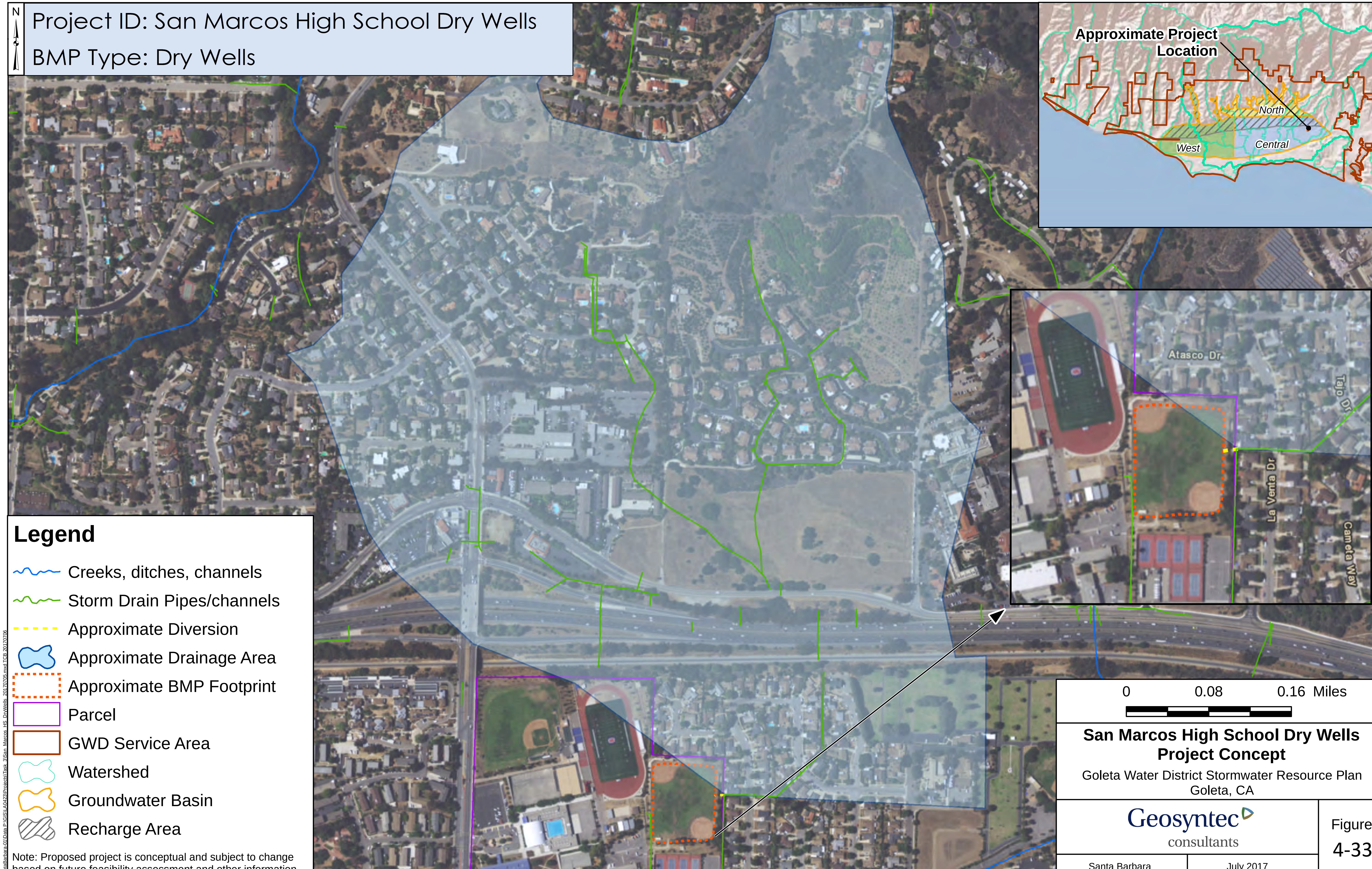
4.3.3 Conceptual Projects

4.3.3.A San Marcos High School Dry Wells Project

San Marcos High School, part of the Santa Barbara School District, was identified for implementation of dry wells. This parcel is located within the County Unincorporated area east of Goleta. The project will divert flow from a storm drain that drains a residential area directly east of the school, in addition to a large area north of the US-101. The proposed dry wells will only occupy the portion of the school property that is currently a baseball field (to be placed around the perimeter of the fields to reduce the number of manholes on the fields). The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.70 ac
- **Approximate Footprint Area**: 2.1 ac
- **Drainage Area**: 230 ac
- **Imperviousness of drainage area**: 60%
- **Depth**: 45 ft (based on an estimated seasonal high groundwater level of 55 ft below ground surface and an estimated confining layer depth of 20.5 ft below ground surface; further verification of groundwater levels, confining layers, and subsurface infiltration rates is needed to determine project feasibility).
- **Diameter**: 6.0 ft
- **Approximate number of dry wells**: 12
- **Storage Volume (of all dry wells)**: 5,300 cu ft
- **Potential site constraints**: the proposed footprint is located in a "high" liquefaction area
- **Expected average annual capture efficiency**: 22%
- **Groundwater basin**: Central
- **Land uses treated**: single-family residential (39%), transportation (18%), multi-family residential (13%), education (9.1%), industrial (8.5%), commercial (5.0%), open space (4.3%), and agriculture (3.6%)
- **Potential Water Supply Volume in Modeled Storm Year**: 49 AFY

Preliminary cost estimate: Dry well construction costs can range from $4-$9 per cubic foot of storage volume, with costs varying depending on design configuration, location, soils, and material availability. Annual maintenance costs have been reported to be around 5 to 10% of capital costs. Based upon similarly engineered dry wells evaluated in Elk Grove, California and Los Angeles County, construction estimates range between $500,000-$600,000, with approximately $100,000-$200,000 in permitting and design costs. Annual O&M costs are estimated at $60,000 per year. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $92,000 per year, for a total annual cost per AF of approximately $1,877.



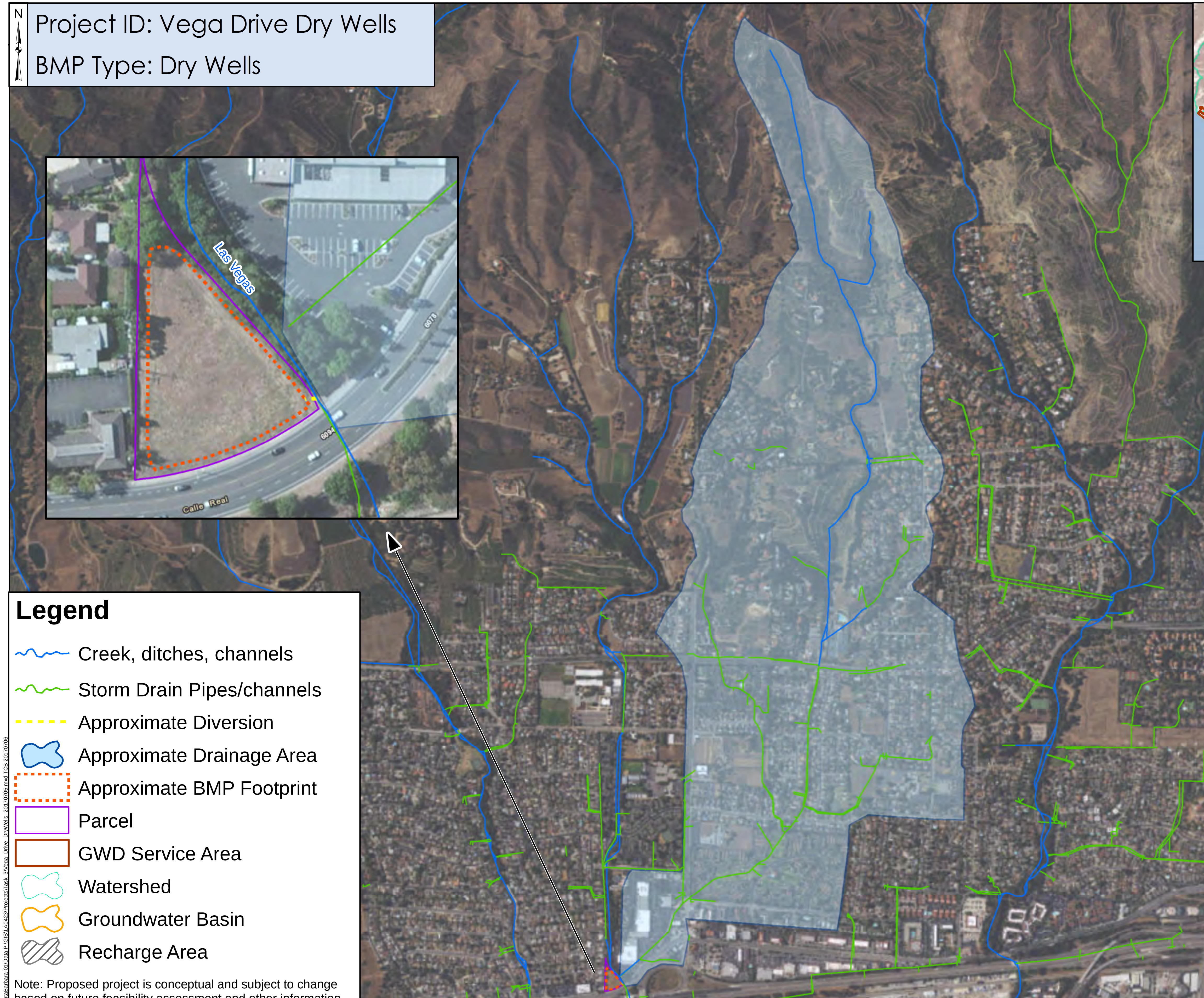
Project ID: San Marcos High School Dry Wells
BMP Type: Dry Wells
N
Approximate Project Location
North
West
Central
Atasco Dr
Tajo Dr
La Venta Dr
Cameta Way
Legend
Creeks, ditches, channels
Storm Drain Pipes/channels
Approximate Diversion
Approximate Drainage Area
Approximate BMP Footprint
Parcel
GWD Service Area
Watershed
Groundwater Basin
Recharge Area
Note: Proposed project is conceptual and subject to change based on future feasibility assessment and other information.
0 0.08 0.16 Miles
San Marcos High School Dry Wells
Project Concept
Goleta Water District Stormwater Resource Plan
Goleta, CA
Geosyntec consultants
Figure
4-33
Santa Barbara
July 2017

4.3.3.B Vega Drive Dry Wells Project

An undeveloped parcel directly north of Calle Real and east of Vega Drive was identified for implementation of dry wells. This parcel is owned by the County of Santa Barbara Flood Control and Water Conservation District and is located within the City of Goleta. The project will divert flow from a storm drain that drains a large mixed use area, and the proposed dry wells were sized to the maximum footprint available on the parcel. The project includes the following design parameters and assumptions:

- **Approximate Pretreatment Footprint Area**: 0.19 ac
- **Approximate Footprint Area**: 0.58 ac
- **Drainage Area**: 659 ac
- **Imperviousness of drainage area**: 40%
- **Depth**: 30 ft (based on an estimated seasonal high groundwater level of 40 ft below ground surface; further verification of groundwater levels and subsurface infiltration rates is needed to determine project feasibility).
- **Diameter**: 6.0 ft
- **Approximate number of dry wells**: 4
- **Storage Volume (of all dry wells)**: 1,200 cu ft
- **Potential site constraints**: the proposed footprint is located in a "high" liquefaction area, therefore additional seismic analysis will be required to determine project feasibility.
- **Expected average annual capture efficiency**: 20%
- **Groundwater basin**: Central
- **Land uses treated**: single-family residential (49%), agriculture (16%), transportation (11%), education (7.0%), multi-family residential (6.6%), open space (6.5%), commercial (3.5%), and others (0.06%)
- **Potential Water Supply Volume in Modeled Storm Year**: 94 AFY

Preliminary cost estimate: Construction estimates range between $100,000-200,000, with approximately $100,000-$200,000 in permitting and design costs. Annual O&M costs are estimated at 60,000 per year. Utilizing a 25-year amortization schedule for capital projects, in accordance with District practice, the amortized capital component would be approximately $16,000 per year, for a total annual cost per AF of approximately $808.



Vega Drive Dry Wells Project Concept

Goleta Water District Stormwater Resource Plan
Goleta, CA

Geosyntec consultants

Santa Barbara | July 2017

Figure 4-34

4.4 Estimated Project Costs

Table 4-1 below summarizes the potential water supply volume and preliminary cost per AF of supply. As noted above, the projected costs may be revised during the specific design phase based upon design parameters and implementation of low-impact design principles at each site. Below the potential projects, existing District sources, normal water supply volume, and production costs are included for comparison.

Table 4-1 - Cost Summary Table for Potential Projects and Other District Sources

Project ID	Potential Water Supply Volume (AFY)	Estimated Capital Cost	Amortized Cost Per AF
Maria Ygnacio Infiltration Basin	24	$3.42 M	$10,800
Cathedral Oaks Orchard Infiltration Basin	130	$6 M	$4,300
Foothill Elementary Infiltration Basin	73	$2.92 M	$3,900
Tuckers Grove Park Infiltration Basin	38	$3.42 M	$7,200
Lutheran Church Infiltration Basin	26	$3.42 M	$10,100
Community Covenant Church Infiltration Basin	44	$3.12 M	$6,100
Bishop Ranch Capture & Reuse	660	$12 M	$2,400
Patterson Ave Farm Capture & Reuse	410	$4.9 M	$3,000
Hospital Basin Capture & Reuse	150	$6 M	$8,400
Lassen Open Space Capture & Reuse	23	$2.9 M	$26,800
San Marcos High School Dry Wells	49	$800,000	$1,900
Vega Drive Dry Wells	94	$400,000	$800

For comparison purposes, the following summarizes the District's current total costs (capital and variable) for its water supply portfolio, as well as a recently studied groundwater augmentation pilot project:

Table 4-2 – Water Supply Costs

Supply Source	Water Supply Volume (AFY)	Cost Per AF
Cachuma Potable	9,322	$927*
Groundwater	2,350	$949*
State Water – Table A	4,500	$3,469*
Recycled Water	3,000	$2,473*
Potable Reuse**	4,620	$1,980

* Combined fixed and variable costs from the 2017 Water Supply Management Plan (Goleta Water District, 2017)
** Based on the recommended project per the 2017 Draft Potable Reuse Study (Goleta Water District, 2017)

* Combined fixed and variable costs from the 2017 Water Supply Management Plan (Goleta Water District, 2017)
** Based on the recommended project per the 2017 Draft Potable Reuse Study (Goleta Water District, 2017)

5.0 Comparison of Stormwater Projects

In order to compare the identified projects with quantifiable multi-benefit scores, as required by the SRP Guidelines, the District evaluated the potential water supply volume and costs, as well as the quantified water quality and flood control advantages associated with each project. Water supply and water quality benefits were quantified for each project by estimating average annual stormwater runoff volumes[***] and associated pollutant loads that would be captured by the proposed projects. The Load, Prioritization, and Reduction (LPR) model developed by Geosyntec Consultants for use in Santa Barbara County was used to model the identified projects. The steps to perform this quantification included:

1. Determining drainage areas for each proposed project;
2. Synthesizing spatial data in GIS to determine necessary modeling inputs for each conceptual project drainage area, including imperviousness (determined by land use), soil type, and size of the drainage area;
3. Combining runoff coefficients (determined by drainage area characteristics) with historical meteorological data to estimate average annual runoff volumes generated in each project drainage area (using the Rational Method);
4. Combining land use-specific baseline runoff volumes with land use pollutant-specific event mean concentrations (EMCs) to calculate average annual baseline pollutant loads;
5. Determining conceptual designs for each project based on conceptual design parameters for each project type and available area/site constraints;
6. Using the information gathered in the previous steps along with capture efficiency nomographs provided in the TGM, to determine the percent of the total annual runoff volume draining to the project that the project is capable of treating/managing (percent capture); and
7. Using the percent capture values to determine the quantity of runoff volume and pollutant load captured by each project during an average annual year to estimate the average annual water supply augmentation volume and pollutant load reduced by each project.

Results for both the baseline runoff volume and pollutant loads, as well as anticipated water supply augmentation volumes and reductions in pollutant loads resulting from implementation of the projects, in addition to modeling details and relevant assumptions, are presented in Appendix F, and summarized in the following table:

[***] Dry weather water quality benefits may also be expected but are not estimated here.

Table 5-1 – Average Annual Pollutant Load Reductions and Water Supply Volume (or groundwater recharge)

Project ID	Volume	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.	Potential Water Supply Volume
	cu ft	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	10^12 MPN	ac-ft
Maria Ignacio Lane Infiltration	1,600,000	16,000	42	31	37	160	220	1.1	2.4	0.86	6.4	10	3.8	24
Cathedral Oaks Orchard Infiltration	8,400,000	290,000	810	360	430	8,200	2,000	6.1	27	8.2	20	76	29	130
Foothill Elementary Infiltration	4,900,000	63,000	160	110	130	950	720	3.2	8.0	2.8	18	31	12	73
Bishop Ranch Capture Reuse	29,000,000	820,000	2,200	1,000	1,300	21,000	6,100	22	82	25	180	350	97	660
Patterson Ave Farm Capture Reuse	18,000,000	200,000	510	350	450	2,300	2,500	13	29	10	96	150	40	410
Hospital Basin Capture Reuse	6,600,000	35,000	170	130	360	320	1,200	5.7	12	4.5	56	85	14	150
Lassen Open Space Capture Reuse	990,000	6,900	32	26	28	48	160	1.2	2.0	0.67	7.9	12	2.9	23
Tuckers Grove Park Infiltration	2,500,000	30,000	42	32	38	200	250	1.0	2.8	0.91	8.5	12	3.1	38
Lutheran Church Infiltration	1,700,000	20,000	29	22	26	140	170	0.71	1.9	0.63	5.9	8.0	2.2	26
Community Covenant Church Infiltration	3,000,000	38,000	98	63	75	570	430	1.9	4.8	1.7	11	19	7.1	44
San Marcos High School Dry Wells	2,100,000	15,000	62	48	70	160	330	2.2	4.0	1.3	20	28	6.5	49
Vega Drive Dry Wells	4,100,000	37,000	150	100	140	630	680	3.9	7.7	2.6	23	39	13	94

5.1 Multi-Benefit Analysis

As required by California Water Code Section 10562(e) and the SRP Guidelines, this Plan must use "measureable factors to identify, quantify and prioritize potential stormwater and dry weather runoff capture projects." Projects were evaluated based on their potential to achieve multiple benefits in the five benefit categories identified by the SRP Guidelines listed in Table 5-2. The purpose of the evaluation is not to rank the projects with respect to implementation priority, but to identify those projects that will achieve multiple benefits and are likely to be constructed and maintained, which would therefore qualify them for funding. Benefit categories include water quality, water supply, flood management, as well as environmental and community benefits. Projects that achieve multiple benefits support a watershed-based approach to treating stormwater and dry weather runoff as a resource rather than an environmental nuisance or flood hazard. The SRP guidelines identify main benefits in each benefit category and additional benefits to inform project selection and design. Projects implemented in accordance with the SRP are required to address at least two main benefits and as many additional benefits as feasible for each project.

Table 5-2 – Stormwater Management Benefits (Table 4 in the SRP Guidelines)

Benefit Category	Main Benefit	Additional Benefit
Water Quality	• Increased infiltration and/or treatment of runoff	• Nonpoint source pollution control • Reestablished natural water drainage and treatment
Water Supply	• Water supply reliability • Conjunctive use	• Water conservation
Flood Management	• Decreased flood risk by reducing runoff rate and/or volume	• Reduced sanitary sewer overflows
Environmental	• Environmental and habitat protection • Increased urban green space	• Reduced energy use, greenhouse gas emissions, or provides a carbon sink • Reestablishment of natural hydrograph • Water temperature improvements
Community	• Employment opportunities provided • Public education	• Enhance and/or create recreational and public use areas

The approach for assessing multiple benefits consists of quantification of multiple benefits to determine scores for each benefit criteria. Quantitative results from conceptual design and modeling were used to calculate quantitative benefit scores, in accordance with the SRP Guidelines. These scores based on quantitative metrics were used to calculate quantitative benefit scores for water quality, water supply, and flood control. All of the projects identified have potential environmental and community benefits, such as reduced energy use, increased urban green space, recreational enhancements, and employment opportunities. These qualitative aspects of a project must be considered as part of any decision of whether to implement a particular project. This approach is consistent with the American Society of Civil Engineers (ASCE) award-winning Los Angeles Countywide BMP prioritization methodology, and methodologies utilized in the Ventura County SRP. The following summarizes the quantitative method for each component of the multi-benefit analysis.

Water Supply

The Water Supply benefit category weighs the extent to which the project maximizes infiltration, supplements groundwater, or reuses captured stormwater or dry weather runoff. The score is calculated based on quantitative metric of benefit multiplied by a qualitative multiplier describing the effectiveness of the project at meeting that metric.

- **Quantitative metric**: potential water supply volume (AFY)
- **Qualitative score**:
    - 0 = no infiltration or planned reuse
    - 2.5 = improved water efficiency through implementation of drought tolerant vegetation and/or removal of high water need vegetation
    - 5= potential reuse of infiltrated water that is captured/treated or capture reuse project

Water Quality

The Water Quality benefit category addresses the potential for the project to advance water quality priorities. The score for this category is calculated based on a quantitative metric of this benefit multiplied by a qualitative pollutant multiplier.

- **Quantitative metric**: pollutant load reduction (lb/year or 10^{12} MPN/year for fecal coliform) is used to calculate a weighted score for each project based on qualitative watershed specific water quality priorities.
- **Quantitative pollutant priority weights**:

    3 = TMDL Pollutants
    2 = 303(d) pollutants
    1 = all other pollutants

The District created quantitative water quality benefit scores for each individual pollutant, which were combined with priority pollutant weights (based on TMDL or 303(d) listed pollutants) to determine the water quality weighted benefit score, as shown in the following table:

Table 5-3 – Water Quality Benefit Scores

Pollutant Weights (TMDL = 3, 303(d) = 2, others = 1)											
TSS	TP	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
1	1	3	1	1	1	2	1	1	2	1	3

Flood Management

The Flood Management benefit evaluates the effectiveness of the project in minimizing runoff and discharge. The score is calculated based on quantitative metric of benefit multiplied by a qualitative multiplier describing the effectiveness of the project at meeting that metric.

- **Quantitative metric**: runoff volume captured[20] (cu-ft/yr)
- **Qualitative score**:
    - 0 = no flooding problem known to occur locally
    - 2.5 = minor flooding issues known to occur locally
    - 5 = major flooding issues known to occur locally

Environmental and Community Benefits

The SWRP Guidelines encourage examination of as many benefits as feasible. While not as easily quantifiable, the projects identified all provide potential environmental and community benefits. Specific environmental benefits include habitat protection and improvement, as all are located near a water body and could enhance or restore existing habitat; increased urban green space; and increased water supply through infiltration or capture reuse. Furthermore, projects would reduce energy used for importing water, thus reducing greenhouse gases.

Regarding potential community benefits, the SWRP Guidelines look to the creation of employment opportunities as a main community benefit. As each project requires operation and maintenance, the projects create potential employment opportunities. The second main benefit in this category is public education, which is satisfied if the project includes signage or other opportunities to educate the public about stormwater and water quality, water supply, environmental protection, or other aspects of the project. Added community benefits beyond employment and public education opportunities include whether or not the project implementation will engage the community, and whether or not the project is located in an existing public space and could provide aesthetic benefits. All of the projects identified satisfy these criteria.

5.2 Summary Comparison of Multi-Benefit Concept Projects

After comparing the multi-benefit scores associated with each project, as well as estimated costs per AF of supply and potential institutional barriers to implementation, the recommended multi-benefit projects are the Maria Ygnacio Infiltration Project, Tuckers Grove Infiltration Project, , Hospital Basin Capture and Reuse Project, Lassen Open Space Capture and Reuse Project, and the Vega Drive Dry Wells Project. These projects all score highly in multi-benefits for flood control, water quality, and water supply, while having the benefit of being located on public land owned by the County. While some of the costs per AF of water supply are comparably higher than some of the larger projects on privately owned land, the total capital costs of these projects are lower and may be reduced further, depending upon final engineered designs.

Table 5-4 contains the calculated multi-benefit scores for each project for water supply, water quality, and flood management. The scores provided in the table were calculated using the scoring methodology outlined above.

*Table 5-4 – Quantitative Scores for Modeled Projects**

Project ID	Quantitative Pollutant Water Quality Score												Benefit Scores			Multi-Benefit Index
	TSS	TP	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Coliform	Water Quality (weighted)	Water Supply	Flood Management	
Maria Ygnacio Lane Infiltration Basin	1.3	1.2	1.2	0.4	0.8	0.6	0.9	1.0	0.5	1.4	0.6	0.7	0.92	0.8	0.48	0.71
Cathedral Oaks Orchard Infiltration Basin	5.0	5.0	5.0	4.8	5.0	5.0	5.0	5.0	5.0	4.3	4.5	5.0	4.9	4.3	2.5	3.8
Foothill Elementary Infiltration Basin	5.0	4.7	4.2	1.4	5.0	1.8	2.6	3.3	1.7	3.9	1.8	2.1	3.2	2.4	1.5	2.3
Tuckers Grove Park Infiltration Basin	2.4	1.2	1.2	0.4	1.1	0.6	0.8	1.2	0.6	1.8	0.7	0.5	1.0	1.3	0.74	0.98
Lutheran Church Infiltration Basin	1.6	0.9	0.8	0.3	0.7	0.4	0.6	0.8	0.4	1.3	0.5	0.4	0.72	0.87	0.51	0.67
Community Covenant Church Infiltration Basin	3.0	2.9	2.4	0.8	3.0	1.1	1.6	2.0	1.0	2.4	1.1	1.2	1.9	1.5	0.89	1.4
Bishop Ranch Capture Reuse	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5	4.0
Patterson Ave Farm Capture Reuse	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	2.5	4.0
Hospital Basin Capture Reuse	2.8	5.0	5.0	4.0	1.7	3.0	4.7	5.0	2.7	5.0	5.0	2.4	3.9	5.0	2.0	3.4
Lassen Open Space Capture Reuse	0.5	0.9	1.0	0.3	0.3	0.4	1.0	0.8	0.4	1.7	0.7	0.5	0.79	0.77	0.29	0.6
San Marcos High School Dry Wells	1.2	1.8	1.8	0.8	0.8	0.8	1.8	1.7	0.8	4.3	1.6	1.1	1.7	1.6	0.63	1.3
Vega Drive Dry Wells	2.9	4.4	3.8	1.6	3.3	1.7	3.2	3.2	1.6	5.0	2.3	2.2	3.1	3.1	1.2	2.4

*Shading from light blue to dark blue indicates low to high values

Infiltration Project Recommendations

For infiltration projects, the highest scoring projects are the Cathedral Oaks Orchard Infiltration, and the Foothill Elementary Infiltration projects. The Cathedral Oaks project would be sited on privately controlled lands, which may present significant barriers to implementation absent a willing landowner. Further, as noted above, the proposed footprint is in a "high" soil liquefaction area, which may stress any constructed infiltration basin.

While the Lutheran Church Infiltration Project scores higher, given the high cost associated with the project, potential site constraints from large trees in the northwestern portion of the parcel, and the need to acquire an easement from a semi-private landowner, it is not recommended for near-term implementation. The next highest scoring infiltration projects are the Tuckers Grove Park Infiltration Project, and the Maria Ygnacio Infiltration Project. Since both projects are on land already within the control of County Flood Control and both have relatively minimal site constraints, both projects offer a unique opportunity for the County to implement projects that have relatively high benefits to water supply and quality, as well as flood management.

Capture and Reuse Project Recommendations

For capture and reuse projects, the Bishop Ranch and Patterson Ave Farm projects score the highest in terms of water supply and other benefits, since there is currently relatively minimal management of such lands in terms of flood management and water quality control. Acknowledging the constraint of private land ownership, the next highest projects identified are the Hospital Basin (score of 3.4) and Lassen Open Space (score of 0.6) capture and reuse projects, which are both on sites owned and operated by County Flood Control, and were identified as having the least amount of site construction constraints. In particular, the Hospital Basin project scores very highly on water supply benefits and water quality, and the Lassen Open Space project as conceptually designed would have minimal impact on the surrounding neighborhood and dense vegetation, while simultaneously improving water quality and flood control in the area.

Dry Well Project Recommendations

Finally, of the two identified dry well projects, the Vega Drive Dry Wells Project has the better score (2.4), with the added advantage that the project is relatively economical, in addition to higher water supply and quality benefits. Further, since the San Marcos High School project identified has a footprint located in a "high" soil liquefaction area, there are potential risks associated with construction of a dry well in an area where soil pressure may impact the well and affect water quality in the area. Accordingly, the Vega Drive project offers superior water supply and water quality benefits.

6.0 Implementation of Recommended Projects

Given the fact that all of the recommended projects are located within the jurisdiction of the County of Santa Barbara, the District will submit this Plan to the County for incorporation into its County-wide Stormwater Resources Plan (currently underway). The intent is to ensure consistency among planning documents. The District will share project-related information, including the specific concept designs for each identified project, and results of the pollutant load modeling, runoff modeling, and quantification of flood control, water quality, and water supply benefits. With this information, the District and the County can work collaboratively to identify potential funding sources to execute projects and opportunities for community engagement.

As identified in Santa Barbara County's Storm Water Resource Plan Grant Application work plan, the County will conduct an outreach effort as part of its Storm Water Resource Plan implementation. The outreach effort will include community presentations, distribution of information about the County's SRP and proposed projects, as well as solicitation of feedback through website advertising and email lists. Via a public roundtable discussion, the County will consult stakeholders regarding potential projects identified in their plan, in order to improve feasibility and benefits of project implementation. The recommended projects in the Goleta Water District's Stormwater Resource Plan will be integrated and included within that discussion framework. Involving stakeholders in the County's assessment of feasible projects will help develop the collaborative partnerships required for plan implementation and long-term maintenance of constructed projects across the county. The County will also consult stakeholders during project completion to discuss land ownership and acquisition, operation and maintenance responsibilities, and the community education and outreach required for each project.

Environmental injustice will be addressed by ensuring that all people have fair treatment and equal access to meaningful involvement in the process of developing the plan, prioritizing and siting potential projects, and benefiting from projects implemented.

As provided in the above referenced Santa Barbara County work plan for the County-wide Storm Water Resource plan, the County will coordinate with cooperating entities to identify funding strategies. A schedule for obtaining available funds will be developed to ensure the long term success of the County Plan once implemented. The County will identify and develop an implementation plan including necessary milestones, partnership formation, decision support tools, and data collection required for plan implementation and performance tracking. The tools and schedules will be included in the County's final Storm Water Resource Plan.

According to the Santa Barbara County Storm Water Resource Plan Grant Application work plan, the County plans to identify a funding strategy as part of 'Implementation Strategy and Schedule' project phase, scheduled to occur between June 2017 and November 2017. In addition to the

Proposition 1 Round 2 grant funding source, the District has identified additional potential sources, outlined below.

Santa Barbara County Funds

The Flood Control District received a fund balance increase of $2.1 million in 2017, for a total fund balance of $68.2 million as of June 30, 2017, according to the County's current Comprehensive Annual Financial Report (CAFR). This increase in fund balance is primarily due to lower than expected expenditures on providing flood protection and water conservation for projects having come in under-budget. According to a Board Inquiry Form dated June 10, 2013, the Flood Control District fund balance is a roll-up of 12 different funds, 10 of which are individual flood zones. Funds in each individual flood zone are not used for purposes outside of each flood zone boundary. The "South Coast Flood Zone" encompasses the study area of this Plan, and was allocated an additional $5.8 million of distributed property taxes in FY 2016-17, according to the County's FY 2016-17 Property Tax Highlights.

SB 231

California Senate Bill 231, introduced in February 2017, amends the Proposition 218 Omnibus Act to include a specific definition of "sewer" fees, which are exempt from voter approval. State law has long recognized that the term "sewer" includes services for the management of stormwater. Although "sewer" has been defined in the Public Utilities Code since 1970, Proposition 218 does not include a definition for sewer and has been legally challenged on that basis. The amendment clarifies that "sewer" include stormwater conveyance systems, consistent with the Public Utilities Code. SB 231 clarifies that under state law, cities and counties can assess property-related fees for projects that help clean up stormwater discharge under the MS4 permitting program.

The Governor approved SB 231 on October 6, 2017.

SB 5

Senate Bill 5 would enact the California Drought, Water, Parks, Climate, Coastal Protection, and Outdoor Access for All Act of 2018 (the Act), subject to voter approval in the November 2018 election. The Act, if approved by the voters, would provide for the issuance of $3.5 billion in General Obligation bonds to finance water, park, climate change preparedness, coastal protection, and outdoor access projects. This bill would provide $100 million in competitive grants for multi-benefit urban projects that address flooding, stormwater capture and reuse, and other specified activities.

The Governor approved SB 5 October 15, 2017.

References

[1] Central Coast Basin Plan (2016). Central Coast Regional Water Quality Control Board.
[2] Water Quality Control Plan for the Central Coastal Basin (p. 1-1). (2016). Central Coast Regional Water Quality Control Board.
[3] County of Santa Barbara Storm Water Management Program (2012). County of Santa Barbara - Water Resources Division.
[4] City of Goleta Storm Water Management Plan Annual Report (2013). City of Goleta.
[5] University of California, Santa Barbara Stormwater Management Program Guidance Document. (2014). UCSB.
[6] Santa Barbara County Urban Runoff Treatment Control Project – Candidate Site Assessment and Preliminary Recommendations (2001). Geosyntec Consultants, Project Clean Water.
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[10] Goleta Slough Area Sea Level Rise and Management Plan, 2015
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[14] Groundwater Management Plan (2016). Goleta Groundwater Basin 2016 Update. Prepared by GSI Water Solutions, Inc., for Goleta Water District.
[15] Contech Engineered Solutions (2016). http://www.conteches.com/products/stormwater-management/detention-and-infiltration/con-span-detention-system.

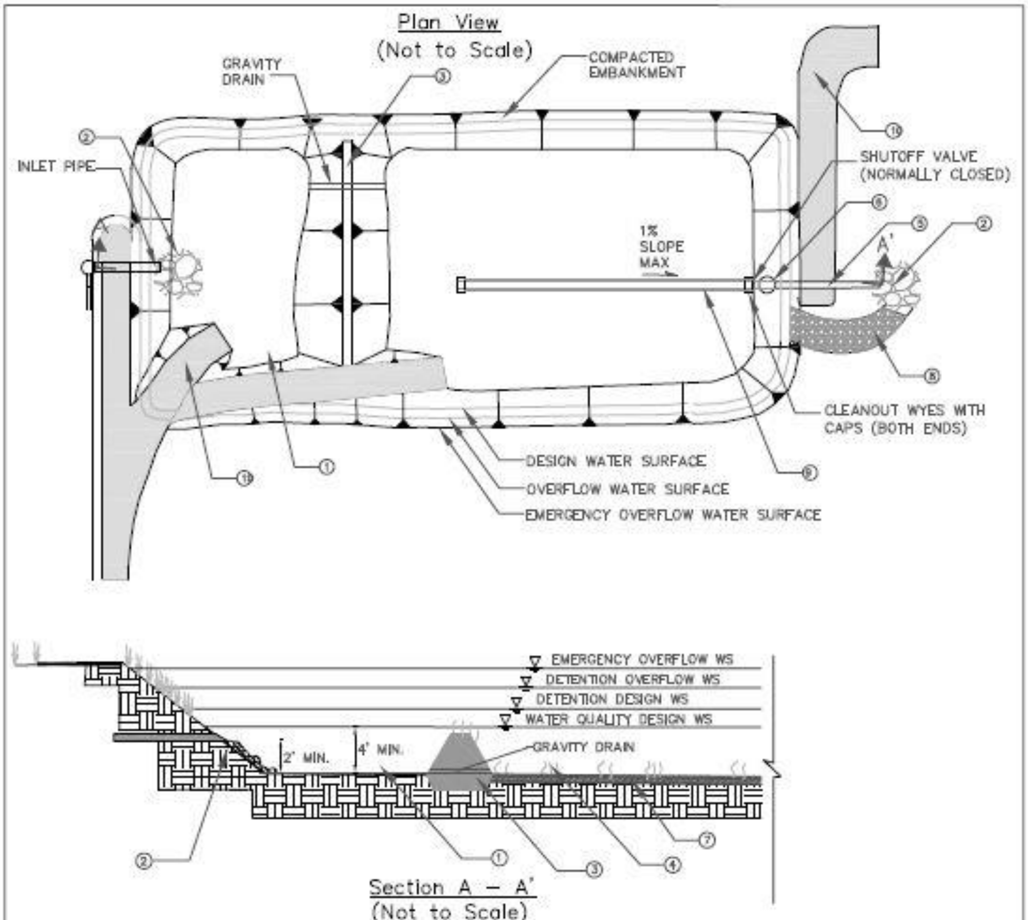
Appendix A – Checklist and Self-Certification

Guideline Element & Water Code Section(s)	Requirement/Recommendation	Reference (Section)
Watershed Identification (Guidelines Section VI.A) 10565(c) 10562(b)(1) 10565(c)	Plan identifies watershed and subwatershed(s) for stormwater resource planning.	3.1
	Plan is developed on a watershed basis, using boundaries as delineated by USGS, CalWater, USGS Hydrologic Unit designations, or an applicable integrated regional water management group, and includes a description and boundary map of each applicable watershed and sub-watershed.	3.1
	Plan includes an explanation of why the watershed(s) and sub-watershed(s) are appropriate for stormwater management with a multiple-benefit watershed approach.	3.1
	Plan describes the water quality priorities within the watershed based on, at a minimum, applicable TMDLs and consideration of water body-pollutant combinations listed on the State's Clean Water Act Section 303(d) list of water quality limited segments.	3.2
	Plan describes the general quality and identification of surface and groundwater resources within the watershed.	3.1, 3.3
	Plan describes the local entity or entities that provide potable water supplies and the estimated volume of potable water provided by the water suppliers.	2.1
Water Quality Compliance (Guidelines Section V) 10562(d)(7) 10562(b)(5) 10562(b)(6)	Plan identifies activities that generate or contribute to the pollution of stormwater or dry weather runoff, or that impair the effective beneficial use of stormwater or dry weather runoff.	3.2
	Plan describes how it is consistent with and assists in, compliance with total maximum daily load implementation plans and applicable national pollutant discharge elimination system permits.	3.2
	Plan identifies applicable permits and describes how it meets all applicable waste discharge permit requirements.	2.3, 3.2

Organization, Coordination, Collaboration (Guidelines Section VI.B) 10565(a) 10562(b)(4)	Local agencies and nongovernmental organizations were consulted in Plan development.	6.0
	Community participation was provided for in Plan development.	6.0
	Plan includes description of the existing integrated regional water management group(s) implementing an integrated regional water management plan.	2.3.3
	Plan includes identification of nonprofit organizations working on stormwater and dry weather resource planning or management in the watershed.	Appendix G
Quantitative Methods (Guidelines Section VI.C)	Plan includes an integrated metrics-based analysis to demonstrate that the Plan's proposed stormwater and dry weather capture projects and programs will satisfy the Plan's identified water management objectives and multiple benefits.	Appendix F
Identification and Prioritization of Projects (Guidelines Section VI.D) 10562(d)(1) 10562(d)(2) 10562(d)(3) 10562(d)(4) 10562(d)(5) 10562(b)(8) 10562(b)(2)	Plan identifies opportunities to augment local water supply through groundwater recharge or storage for beneficial use of stormwater and dry weather runoff.	4.1-4.3
	Plan identifies opportunities for source control for both pollution and dry weather runoff volume, onsite and local infiltration, and use of stormwater and dry weather runoff.	4.1-4.3
	Plan identifies projects that reestablish natural water drainage treatment and infiltration systems, or mimic natural system functions to the maximum extent feasible.	4.1
	Plan identifies opportunities to develop, restore, or enhance habitat and open space through stormwater and dry weather runoff management, including wetlands, riverside habitats, parkways, and parks.	4.1-4.3
	Plan identifies opportunities to use existing publicly owned lands and easements to capture, clean, store, and use stormwater and dry weather runoff either onsite or offsite	4.0
	Plan uses appropriate quantitative methods for prioritization of projects using a metrics-based and integrated evaluation and analysis of multiple benefits.	4.0, Appendix F
Implementation Strategy and	Plan projects and programs are identified to ensure the effective implementation of the stormwater resource plan pursuant to this part and achieve multiple benefits.	6.0

Schedule (Guidelines Section VI.E) 10562(d)(8) 10562(b)(7)	The Plan identifies the development of appropriate decision support tools and the data necessary to use the decision support tools.	5.1
	The Plan will be submitted to the applicable IRWM Group for incorporation into the IRWM Plan.	1.0
Education, Outreach, and Participation (Guidelines Section VI.F) 10562(b)(4)	Community participation is provided for in Plan implementation.	6.0
	Plan describes public education and public participation opportunities to engage the public when considering major technical and policy issues related to the development and implementation.	6.0
	Plan describes mechanisms to engage communities in project design and implementation.	6.0

Appendix B – Infiltration Basin Concept*



NOTES:

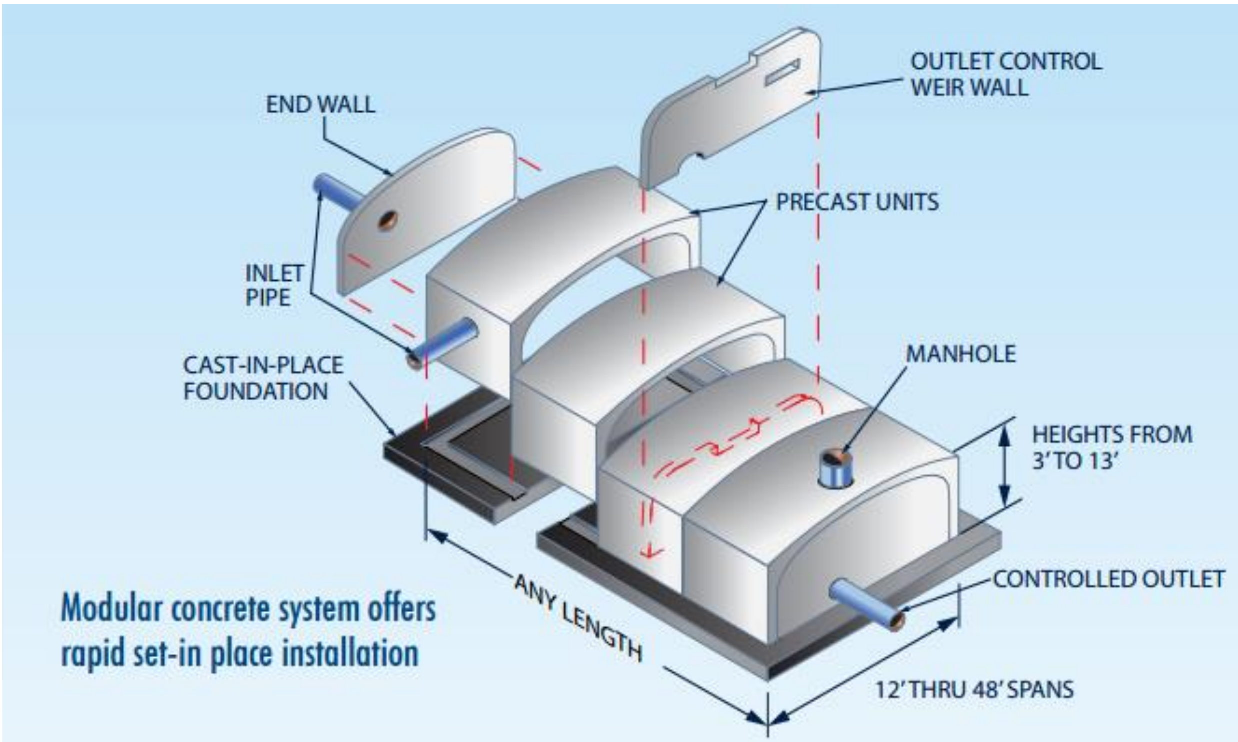
1. UPSTREAM PRETREATMENT SHALL BE PROVIDED. SEDIMENT FOREBAY WITH VOLUME EQUAL TO 25% OF TOTAL INFILTRATION BASIN VOLUME MAY BE USED IN LIEU OF UPSTREAM PRETREATMENT. DEPTH SHALL BE 4' MIN TO 8' MAX PLUS AN ADDITIONAL 1 FOOT MIN SEDIMENT STORAGE DEPTH.
2. RIP RAP APRON OR OTHER ENERGY DISSIPATION.
3. EXTEND EARTHEN BERM ACROSS ENTIRE WIDTH OF THE INFILTRATION BASIN.
4. INFILTRATION BASIN BOTTOM AND SIDE SLOPES SHALL BE PLANTED WITH DROUGHT TOLERANT VEGETATION. DEEP ROOTED VEGETATION PREFERRED FOR BASIN BOTTOM. NO TOPSOIL SHALL BE ADDED TO INFILTRATION BASIN BED.
5. SIZE OUTLET PIPE TO PASS 100–YEAR PEAK FLOW FOR ON–LINE INFILTRATION BASINS AND WATER QUALITY PEAK FLOW FOR OFF–LINE INFILTRATION BASINS.
6. WATER QUALITY OUTLET STRUCTURE. SEE FIGURE 7–2 AND FIGURE 7–3 FOR DETAILS.
7. OVER EXCAVATE BASIN BOTTOM 1 FOOT. RE–PLACE EXCAVATED MATERIAL UNIFORMLY WITHOUT COMPACTION. AMENDING EXCAVATED MATERIAL WITH 2" – 4" OF COARSE SAND IS RECOMMENDED FOR SOILS WITH BORDER LINE INFILTRATION CAPACITY.
8. INSTALL EMERGENCY OVERFLOW SPILLWAY AS NEEDED. SEE FIGURE 2–4 FOR DETAILS
9. INSTALL OPTIONAL 6" MINIMUM DIAMETER PERFORATED PIPE UNDERDRAIN. INSTALL AT 0.5% MINIMUM SLOPE.
10. MAINTENANCE RAMP SHOULD PROVIDE ACCESS TO BOTH THE FIRST CELL AND MAIN BASIN.

Geosyntec consultants

Figure 6-2: Infiltration Basin

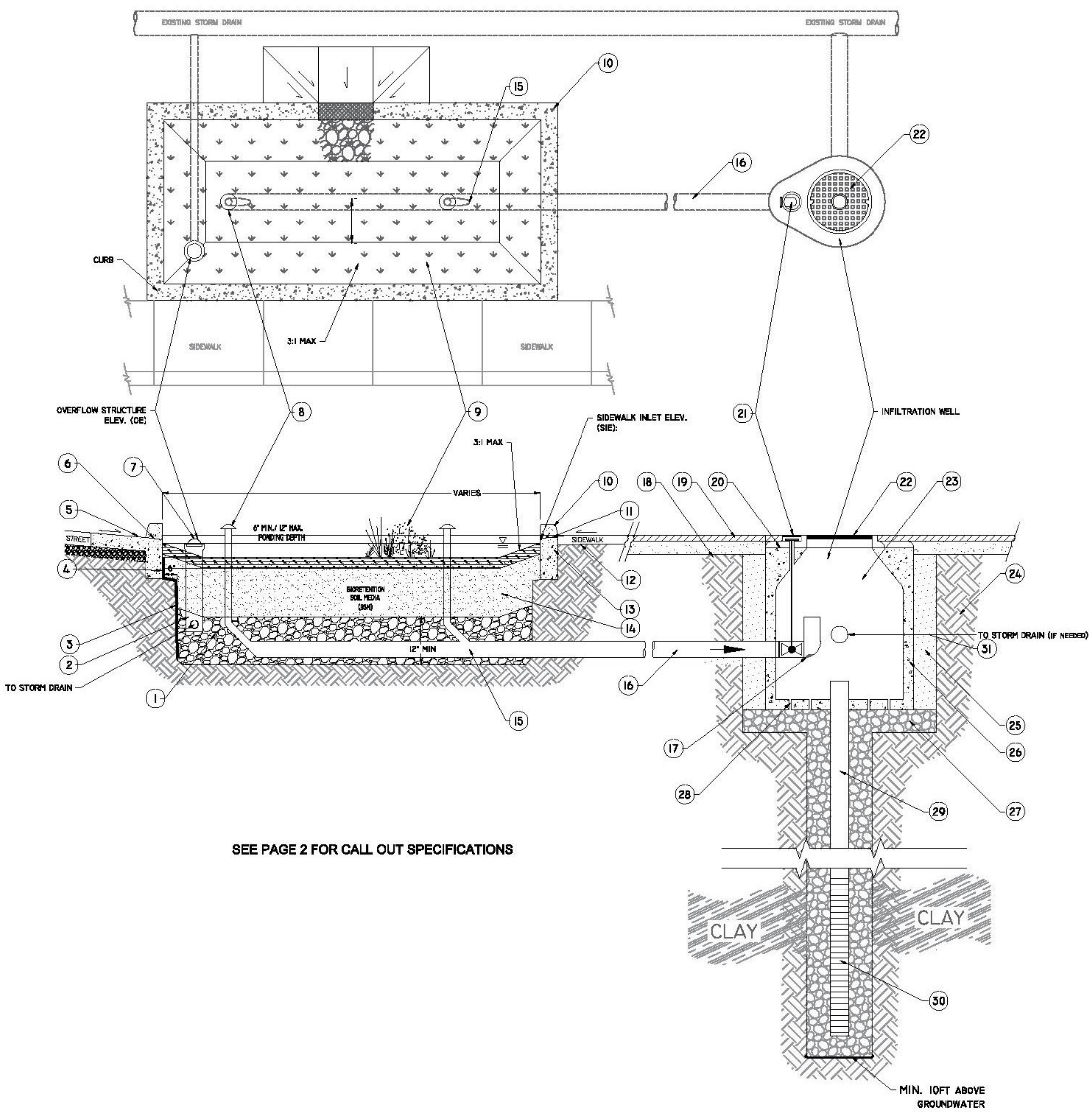
*Geosyntec Consultants and LWA, 2011

Appendix C – Subsurface Storage Tank for Capture & Reuse Projects*



*Contech Engineered Solutions, 2016

Appendix D – Dry Wells Concept*



LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

DRYWELL STORMWATER BMP

(sloped sided, no on-street parking, sidewalk, underdrain, control vault outside of BMP)

Municipality
Department Name

Detail number

XX

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*Geosyntec Consultants, 2015

SPECIFICATIONS

1. 12” DEEP OPEN GRADED WASHED STONE (TYPICALLY 3/4” TO 1-1/2” (ASTM #4 STONE) OR 1” TO 2” (ASTM #3 STONE).
2. BRIDGING LAYER(S) PER LIDI BIORETENTION TECHNICAL SPECIFICATIONS (BTS). DO NOT USE FILTER FABRIC BETWEEN BSM AND AGGREGATE. DO NOT USE FILTER FABRIC BETWEEN BIOFILTER SOIL MATERIAL (BSM) AND AGGREGATE.
3. 30 ML LINER MAY BE REQUIRED TO AVOID LATERAL INFILTRATION BELOW STREET; SUBJECT TO GEOTECHNICAL RECOMMENDATIONS.
4. MAINTAIN 6” MINIMUM BENCH OF NATIVE SOIL FOR SUPPORT OF ADJACENT SIDEWALK/ROAD (TYPICAL).
5. CURB AND GUTTER DETAIL 110.
6. CURB INLET DETAIL 120, GUTTER INLET ELEV (GIE). LOCATE ENERGY DISSIPATION COBBLE PADS AS SPECIFIED IN INLET DETAILS.
7. OVERFLOW STRUCTURE REQUIRED FOR IN-LINE SYSTEMS WITHOUT OVERFLOW BYPASS, DETAIL 140.
8. MAINTENANCE PIPES - 4” MIN. DIA. VERTICAL PVC PIPES CONNECTED TO UNDERDRAIN. PLACED AT START AND 3 FEET BEFORE END OF UNDERDRAIN. REQUIRES DIRECTIONAL SWEEP BEND. THREADED AND CAPPED
9. VEGETATION - PLANT SELECTION AND MULCH (OPTIONAL) PER BIORETENTION TECHNICAL SPECIFICATIONS.
10. 4” MIN. EXPOSED WALL HEIGHT
11. SIDEWALK DRAINAGE NOTCH 1” LOWER THAN SIDEWALK, SLOPED TO FACILITY
12. SEE PLANS FOR SIDEWALK RESTORATION
13. DEEP CURB DETAIL
14. BIORETENTION SOIL MEDIA (BSM). SPECIFICATION PER BIORETENTION TECHNICAL SPECIFICATIONS (BTS). SPECIFICATION SHOULD AVOID COMPOST OR OTHER MATERIAL KNOWN TO LEACH NUTRIENTS.
15. UNDERDRAIN, MIN. 4” DIA. PVC SDR 35 PERFORATED PIPE OR LARGER AS NEEDED TO CONVEY PEAK TREATED FLOWRATE WITH MINIMAL HEAD LOSS, SEE CONSTRUCTION NOTES.
16. 8” INLET PIPE OR OTHER.
17. LOW FLOW ORIFICE. (SEE DESIGN NOTE 11).
18. STABILIZED BACKFILL - TWO-SACK SLURRY MIX.
19. SIDEWALK PER MUNICIPAL STANDARDS.
20. COMPACTED BASE MATERIAL.
21. ACCESS HATCH WITH SHUT OF VALVE SWITCH. CONNECTED TO SHUT OF VALVE IN INLET PIPE.
22. MAINTENANCE HOLE COS TYPE 204-204 MH A OR B. ¾” I.D. MIN OBSERVATION PORT.
23. MANHOLE CONE - MODIFIED FLAT BOTTOM.
24. EXISTING SOILS. (SEE CONSTRUCTION NOTE 4, 8).
25. COMPACTED BACKFILL
26. PRE-CAST OR INSITU CAST CONTROL VAULT (SEE DESIGN NOTE 8)
27. ROCK - WASHED, SIZED BETWEEN 3/8” AND 1-1/2"
28. PERFORATED BASE OF CONTROL VAULT
29. DRILLED SHAFT WITH 6” WELDED STEEL OR THREADED PVC CASING (SEE DESIGN NOTE 13 & CONSTRUCTION NOTE 7,8)
30. 6 - 8” O.D. WELDED WIRE STAINLESS STEEL WELL SCREEN OR THREADED PVC SLOTTED SCREEN. SCREEN LENGTH + LENGTH + SLOT WIDTH TO BE DETERMINED IN ACCORDANCE WITH LOCAL CONSTRAINTS .I.E. DISTANCE BETWEEN CLAY LAYER AND MIN. 10FT ABOVE SEASONAL HIGH GROUNDWATER LEVEL
31. PVC STORMDRAIN CONNECTOR PIPE. SAME DIAMETER AS INFLOW PIPE TO CONTROL VAULT.

DESIGN NOTES

1. ADDITIONAL DESIGN GUIDANCE FOR BIOFILTRATION SYSTEM PROVIDED IN LIDI BIORETENTION TECHNICAL SPECIFICATIONS (BTS) DOCUMENT.
2. BOTTOM WIDTH - PROVIDE 2 FT MINIMUM FLAT BREGENALL
3. OTTOM WITH A MAX 3:1 SLOPE FOR SURFACE FINISHING WITHIN BIOFILTRATION SYSTEM
4. IF CALTRANS CLASS 2 PERMEABLE IS NOT AVAILABLE, SUBSTITUTE CLASS 3 PERMEABLE WITH AN OVERLYING 3” DEEP LAYER OF ¾” (NO. 4) OPEN-GRADED AGGREGATE.
5. PROVIDE SPOT ELEVATIONS AT INLETS ON CIVIL PLANS (FE, OE, GIE, SIE). SEE DETAIL 120.
6. EDGE CONDITION WILL VARY FOR NEW AND RETROFIT PROJECTS. CURB, WALL, AND SIDEWALK DETAILS MAY BE MODIFIED FOR PROJECT BY CIVIL AND GEOTECHNICAL ENGINEERS.
7. PROVIDE MONITORING WELL IN EACH FACILITY, PER BIORETENTION TECHNICAL SPECIFICATIONS.
8. LONGITUDINAL SLOPE 6% WITH CHECK DAMS.
9. IF CHECK DAMS ARE NEEDED, SEE CONCRETE CHECK DAM DETAIL 121.
10. VARIATIONS IN DRY WELL DESIGN SHOULD BE MADE TO ACCOMMODATE STORAGE VOLUME DESIGN AND TO SUIT LOCAL CONDITIONS AND CONSTRAINTS.
11. IN AREAS WITHOUT A STORMDRAIN, THE SYSTEM SHOULD ONLY BE CONSTRUCTED WHERE THE MAINTENANCE HOLE SURFACE INVERT IS ABOVE THE BIOFILTER OVERFLOW ELEVATION.
12. ALTERNATIVE VAULT LOCATIONS POSSIBLE INCLUDING WITHIN THE BIOFILTER FOOTPRINT.
13. VALVE CAN BE MOVED TO THE BIOFILTER IF DESIRED. REQUIRES STRUCTURAL SUPPORT.
14. ALTERNATIVE PRODUCTS SUCH AS VENDOR-SUPPLIED DRY WELL PRODUCTS MAY BE USED AS A SUBSTITUTE PROVIDED THAT THE ALTERNATIVE PRODUCT IS EQUAL.

LOW IMPACT DEVELOPMENT STORMWATER MANAGEMENT STANDARD DETAILS

DRYWELL STORMWATER BMP

(sloped sided, no on-street parking, sidewalk, underdrain, control vault outside of BMP)

Municipality
Department Name

Detail number

XX

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Appendix E – Land Use Imperviousness and EMC Groups

Land Use Description	EMC Land Use	Imperviousness (%)
APARTMENTS, 5 OR MORE UNITS	Multi-family Residential	74
AUDITORIUMS, STADIUMS	Commercial	91
AUTO SALES, REPAIR, STORAGE, CAR WASH, ETC	Commercial	91
BANKS, S&LS	Commercial	91
BEACHES, SAND DUNES	Open Space	1
BED AND BREAKFAST	Multi-family Residential	74
BOWLING ALLEYS	Commercial	91
CAMPS, CABINS	Open Space	1
CHURCHES, RECTORY	Education	82
CLUBS, LODGE HALLS	Education	47
COLLEGES	Education	47
COMMERCIAL (MISC)	Commercial	91
COMMERCIAL AND OFFICE CONDOS,PUDS	Commercial	91
CONDOS,COMMUNITY APT PROJS	Multi-family Residential	86
DANCE HALLS	Commercial	91
DAY CARE	Education	68
DEPARTMENT STORES	Commercial	95
DRIVE-IN THEATRES	Commercial	91
DRY FARMS (MISC)	Open Space	1
FIELD CROPS, DRY	Open Space	1
FIELD CROPS-IRRIGATED	Agriculture	2
FLOWERS	Agriculture	2
GOLF COURSES	Open Space	3

HEAVY INDUSTRY	Industrial	90
HIGHWAYS AND STREETS	Transportation	91
HORSES	Agriculture	42
HOSPITALS	Commercial	74
HOTELS	Multi-family Residential	96
Industrial	Industrial	90
INDUSTRIAL CONDOS,PUDS	Industrial	80
INDUSTRIAL, MISC	Industrial	80
INSTITUTIONAL (MISC)	Education	82
IRRIGATED FARMS, MISC	Agriculture	2
LIGHT MANUFACTURING	Industrial	80
LUMBER YARDS, MILLS	Industrial	91
MISCELLANEOUS	Open Space	2
MIXED USE-COMMERCIAL/RESIDENTIAL	Commercial	82
MOBILE HOME PARKS	Multi-family Residential	74
MOBILE HOMES	Multi-family Residential	74
MORTUARIES,CEMETERIES,MAUSOLEUMS	Education	10
Multi-family Residential	Multi-family Residential	74
NURSERIES,GREENHOUSES	Agriculture	15
OFFICE BUILDINGS, MULTI-STORY	Commercial	91
OFFICE BUILDINGS, SINGLE STORY	Commercial	91
Open Space	Open Space	1
OPEN STORAGE, BULK PLANT	Commercial	40
ORCHARDS	Agriculture	2
ORCHARDS, IRRIGATED	Agriculture	2
OTHER FOOD PROCESSING, BAKERIES	Commercial	91
PACKING PLANTS	Industrial	91

PARKING LOTS	Transportation	91
PARKS	Open Space	1
PASTURE OF GRAZING, DRY	Open Space	1
PASTURE-IRRIGATED	Agriculture	2
PETROLEUM AND GAS	Industrial	91
PIPELINES,CANALS	Water	100
POULTRY	Agriculture	2
PROFESSIONAL BUILDINGS	Commercial	91
PUBLIC BLDGS,FIREHOUSES,MUSEUMS,POST OFFICES,ETC	Commercial	91
RACE TRACKS, RIDING STABLES	Agriculture	42
RANCHO ESTATES (RURAL HOME SITES)	Single-family Residential	12
RECREATION	Education	10
RECREATIONAL OPEN (MISC)	Open Space	1
RESIDENTIAL INCOME, 2-4 UNITS	Multi-family Residential	74
REST HOMES	Education	80
RESTAURANTS,BARS	Commercial	91
RETAIL STORES, SINGLE STORY	Commercial	96
RIGHTS OF WAY,SEWER,LAND FILLS,ETC	Open Space	1
RIVERS AND LAKES	Water	100
SCHOOLS	Education	82
SERVICE STATIONS	Commercial	91
SHOPPING CENTERS (NEIGHBORHOOD)	Commercial	91
SHOPPING CENTERS (REGIONAL)	Commercial	95
SINGLE FAMILY RESIDENCE	Single-family Residential	42
STORE AND OFFICE COMBINATION	Commercial	91
SUPERMARKETS	Commercial	91
TRANSPORTATION*	Transportation	91

TREE FARMS	Agriculture	2
TRUCK CROPS-IRRIGATED	Agriculture	2
UTILITY,WATER COMPANY	Industrial	91
VACANT	Open Space	1
VINES AND BUSH FRUIT-IRRIGATED	Agriculture	2
WAREHOUSING	Industrial	91
WASTE	Industrial	96
WATER RIGHTS, PUMPS	Industrial	91
WHOLESALE LAUNDRY	Commercial	91

* The parcel data file excludes roads. Therefore, gaps in the file were manually filled in using aerial imagery with either transportation land use or the adjacent land use. Transportation land use includes freeways, highways, streets with more than two lanes in each direction, arterial roads, etc. (i.e., high and moderate density roadways). Smaller secondary roadways with lighter traffic, such as collector roads, alleys, residential streets, etc. (i.e., low density roadways), are not identified as transportation and are instead identified with the adjacent land uses. The methodology used to quantify runoff pollutant concentrations in the LPR model utilizes stormwater quality monitoring data from homogenous land use sampling sites that include roads (e.g., single family residential and commercial land use sites represent runoff predominantly from residential/commercial parcels and their adjacent secondary roads, while the transportation land use sites represent runoff predominantly from freeways/highways and other high traffic, major roadways [LACDPW, 2000]). Therefore, land use characterization for application of the LPR model characterizes land uses similarly (i.e., does not characterize secondary roads into the transportation land use category).

Appendix F - Project Modeling

Water supply and water quality benefits were quantified for each project by estimating average annual stormwater runoff volumes[***] and associated pollutant loads that would be captured by the proposed projects. The Load, Prioritization, and Reduction (LPR) model developed by Geosyntec Consultants for use in Santa Barbara County was used to model the identified projects. The steps to perform this quantification included:

1. Determining drainage areas for each proposed project;
2. Synthesizing spatial data in GIS to determine necessary modeling inputs for each conceptual project drainage area, including imperviousness (determined by land use), soil type, and size of the drainage area;
3. Combining runoff coefficients (determined by drainage area characteristics) with historical meteorological data to estimate average annual runoff volumes generated in each project drainage area (using the Rational Method);
4. Combining land use-specific baseline runoff volumes with land use pollutant-specific event mean concentrations (EMCs) to calculate average annual baseline pollutant loads;
5. Determining conceptual designs for each project based on conceptual design parameters for each BMP type (outlined in Sections 4.1.1, 4.2.1, and 4.3.1) and available area/site constraints;
6. Using the information gathered in the previous steps along with capture efficiency nomographs provided in the TGM, to determine the percent of the total annual runoff volume draining to the project that the project is capable of treating/managing (percent capture); and
7. Using the percent capture values to determine the quantity of runoff volume and pollutant load captured by each project during an average annual year to estimate the average annual water supply augmentation volume and pollutant load reduced by each project.

Results for both the baseline runoff volume and pollutant loads, as well as anticipated water supply augmentation volumes and reductions in pollutant loads resulting from implementation of the projects are presented in the following sections, in addition to modeling details and relevant assumptions.

F.1 "Modelable" Pollutants

12 pollutants were identified for modeling based on Santa Barbara County TMDL priorities and pollutants considered "modelable." The term "modelable" is defined here to mean that there are current and sufficient land use EMC data available to support modeling analysis. This is the case for

[***] Dry weather water quality benefits may also be expected but are not estimated here.

the following pollutant categories: (1) indicator bacteria (fecal coliform), (2) nutrients, (3) metals, and (4) total suspended solids. The specific modelable pollutants are listed below in Table F-1.

Table F-1 – Modelable Pollutants

Category	Pollutant	Abbreviation
Indicator Bacteria	Fecal Coliform	Fecal Col.
Nutrients	Total Phosphorus	Tot P
	Ammonia	NH3
	Nitrate	NO3
	Total Kjeldahl Nitrogen	TKN
	Dissolved Phosphorus	Diss P
Metals	Total Copper	Diss Cu
	Total Lead	Tot Pb
	Total Zinc	Tot Zn
	Dissolved Copper	Diss Cu
	Dissolved Zinc	Diss Zn
Sediment	Total Suspended Solids (TSS)	TSS

F.2 Baseline Runoff Volume and Pollutant Loads

Historical meteorological data were used to determine representative average annual rainfall for all projects and were combined with runoff coefficients, determined by the land use imperviousness and soil types, to determine predicted annual runoff volumes for each project drainage area. Estimated runoff volumes were then used with land use average EMCs for applicable land use-pollutant combinations to calculate predicted annual pollutant loads. This process resulted in an estimate of baseline runoff volumes and pollutant loads from each project drainage area prior to BMP treatment, which is a critical input to estimating the load reduction as a result of the proposed BMPs. The following subsections describe this process in detail.

Geographic Information System (GIS) Spatial Datasets

The GIS-based spatial datasets shown in Table F-2 were acquired for the District service area and were used to characterize each project's drainage area land uses, imperviousness, and hydrologic soil group(s). The necessary datasets were analyzed within drainage areas, utilizing GIS tools, for integration in the LPR model, as described in the following sections.

Table F-2 – GIS Datasets Used for Model Input

Dataset Description	Dataset Format
Drainage Area Boundaries	Vector (poly)
Land Use	Vector (poly)
Soils	Vector (poly)
Digital Elevation Model[1]	Raster
Streams[1]	Vector (line)
Storm Drains[1]	Vector (line)

[1] Not required for model calculations, but were used to aid in delineating project drainage areas and were used to improve visual output in GIS.

Drainage Area Land Use, Imperviousness, and Soils

As previously described, project drainage areas were delineated using waterbody and storm drain spatial files and a DEM. Percent imperviousness, which describes the portion of the given area that is characterized as impervious (such that runoff is not able to infiltrate), is an important parameter used to characterize the drainage areas and is determined by land use descriptions. To calculate the average imperviousness of the drainage area to each project, the 2011 parcel spatial file for Santa Barbara County, which contained categories with unique land use classifications, was referenced. Imperviousness can vary significantly among general land uses, so using the most detailed (i.e., highly descriptive) land use dataset accounts for the variation in land use and imperviousness and provides results more representative of the area. Percent imperviousness was assigned to each unique land use descriptor and is based on typical values for detailed land uses obtained from local hydrology manuals.[*]

The parcel file contained land use descriptors that are more detailed than those land uses that have EMC data available. For purposes of modeling pollutant loads, the land use descriptions were consolidated into the following nine EMC land use groups: single-family residential, multi-family residential, transportation, vacant (open space), commercial, industrial, agriculture, education, and water.

Appendix E shows how percent imperviousness values and EMC land use groups were initially assigned to the parcel dataset land use designations; these assignments served as a starting point and adjustments were made to imperviousness and EMC land use groups based on visual observation of aerial imagery and/or local knowledge of the area. After a value for imperviousness was assigned to each unique land use classification, an area-weighted imperviousness was determined for each project's drainage area.

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[*] Ventura County and Los Angeles County Hydrology Manuals (VCWPD, 2010 and LACDPW, 2006), which were used as defaults in the Structural BMP Prioritization and Analysis Tool (SBPAT) (Geosyntec, 2012).

The GIS soil dataset was acquired from a Soil Survey Geographic Database (SSURGO) database from the Natural Resources Conservation Service (United States Department of Agriculture). The soil data is characterized by hydrologic soil groups (A, B, C, or D), which for the purposes of modeling, defines the runoff potential of each soil type. Hydrologic soil group A is defined by a high saturated hydraulic conductivity (i.e., high infiltration potential) and therefore has low runoff potential. Alternatively, hydrologic soil group D has high runoff potential and low saturated hydraulic conductivity. Soil and land use data were used as input parameters into the LPR Model, as described in the following section.

F.3 Load Pollutant Reduction (LPR) Model

Overall Methodology

The LPR model uses the Rational Method to estimate the average annual runoff volume generated, using the drainage area characterization (land use, imperviousness, and soils), runoff coefficients, and precipitation data described in the subsequent sections. The equation for the Rational Method is shown in Equation 1.[1]

(1)

$$Q = \sum_{x} \frac{P}{12} \times C_x \times A_x$$

Where:
Q = runoff volume (AF)
P = rainfall depth (in)
C_x = runoff coefficient
A_x = drainage area (ac)
x = each unique land use and soil type combination

Since runoff coefficients are determined using an empirical formula that does not account for all site-specific conditions, the LPR model allows modeled runoff volumes to be adjusted based on calibration results. The calibration process compares the annual discharge volumes calculated by the LPR model to streamflow gage observed annual discharge volumes within the study area. This multiplier is used to adjust the runoff volumes reported by the LPR model, which are then used with pollutant EMCs, representing the mean concentration of a pollutant expected in stormwater runoff, to determine average annual pollutant loadings.

Runoff Coefficients

In order to estimate runoff volumes from the project drainage areas, the LPR model first calculates representative runoff coefficients. A runoff coefficient is a dimensionless coefficient that defines the ratio of runoff volume to the amount of precipitation received. For example, a runoff coefficient of 0.6 translates to 60 percent of the rainfall volume running off the land as overland flow. Runoff coefficients are larger for areas that have low infiltration and high runoff potential (i.e., more developed areas with less infiltration soils) and runoff coefficients are smaller for areas with high infiltration and lower runoff potential (i.e., permeable land with flat slopes). Runoff coefficients include the composite effect of watershed variables such as infiltration, ground slope, ground cover, surface and depression storage, antecedent precipitation and soil moisture, and shape of the drainage basin.[2]

The LPR model calculates a runoff coefficient for each unique land use (and associated imperviousness) and soil group combination for the project drainage area. Equation 2 is used to calculate a runoff coefficient (C) by accounting for the effects of development, using the pervious runoff coefficient based on soil type and the amount of impervious area (Geosyntec Consultants and LWA, 2011). The 0.95 in Equation 2 accounts for the general assumption that no development is completely impervious and also accounts for initial abstraction losses in developed areas.

(2)

$$C = 0.95 \times IMP + C_p \times (1 - IMP)$$

Where,
C = runoff coefficient (equals 0.95 for impervious surfaces)
IMP = imperviousness (fraction)
C_p = pervious runoff coefficient, determined based on soil type (see Table F-3)

Table F-3 – Pervious Runoff Coefficients*

Hydrologic Soil Group	C_p
D	0.15
C	0.10
B	0.05
A	0

*Geosyntec Consultants and LWA, 2011

In areas where the SSURGO database does not provide a hydrologic soil group, the average pervious runoff coefficient of the four soil groups was used.

Precipitation

Historical precipitation data, used to determine the average annual rainfall depth over the available Period of Record (POR), is the only meteorological component required in the LPR model. A rainfall station was selected that is in close proximity and contains at least 30 years of data in the POR, so that it provides a reasonable representation of the historic range of precipitation appropriate for the area. A large POR will include both small rainfall events that occur commonly, in addition to large events that are more infrequent.

The Goleta Fire Station #14 rainfall station was selected to characterize the District's service area. Historical rainfall data were used to determine the total annual rainfall depth for each water year (typically September to August) in the POR at the selected rainfall station. The average annual rainfall depth (calculated from the total water year depths over the POR) was then used for all calculations in the LPR model. Snowmelt, groundwater baseflow, and evaporation are not taken into account to simplify the model and because these components are not expected to be significant.

Historical rainfall data for Santa Barbara County was downloaded from the County of Santa Barbara Public Works Department.[3] Table F-4 shows the rainfall information for the District's service area, based on the Goleta Fire Station #14 rainfall station.

Table F-4 – Selected Rainfall Station Information

Rainfall Station	Station #	Annual Precipitation Depth (inches)				Period of Record (years)
		Average	Median	Min	Max	
Goleta Fire Station #14	440	18.5	16.5	6.9	47.9	74

Hydrologic Calibration

Atascadero Creek was selected for use in the model calibration (USGS Site # 11120000). The selected streamflow gauge is in the Goleta Slough watershed, a predominately urban drainage area, with nearly 30 years of data. The recursive digital filter (ephemeral) method was used to determine (and remove) baseflow, based on site-specific conditions and guidance from the "Web-based Hydrograph Analysis Tool."[4] This comparison was conducted for years with greater than 4,000 AF of measured streamflow, which minimized error while also analyzing an adequate number of years (12). The resulting factor was determined to be 1.03.

Land Use Event Mean Concentration (EMCs)

Once the average annual runoff volume for the project drainage areas were calculated (as outlined in the previous sections), the LPR model uses pollutant EMCs to determine average annual pollutant loadings. An EMC is the mean concentration of a pollutant found in storm runoff and is typically based on compositing flow weighted samples over a runoff event. The land use EMCs used in the LPR model were taken from Los Angeles region SBPAT values which include data from Los Angeles County, Ventura County, and Southern California Coastal Water Research Project (SCCWRP) Los Angeles region land use data. These data have been used in multiple TMDL Implementation Plans, Watershed Management Plans (WMPs), and Enhanced Watershed Management Plans (EWMPs). Select EMC values shown for fecal coliform were modified for Ventura County for use in the Draft Santa Clara River Bacteria TMDL Implementation Plan.[5] The SBPAT User's Guide contains additional detail on the datasets from which the default values were derived (Geosyntec, 2012). The proposed EMC values for use in the model, including their data sources, are summarized in Table F-5. These values are log distributed statistics that are shown here in arithmetic space for ease of review (i.e., they are converted from log space values). The number of samples used to develop the EMC dataset from each data source are shown in Table F-6.

Table F-5 – EMCs for Pollutant Modeling – Arithmetic Estimates of the Lognormal Means

Land Use	Pollutants											
	TSS mg/L	Tot P mg/L	Diss P mg/L	NH3 mg/L	NO3 mg/L	TKN mg/L	Diss Cu ug/L	Tot Cu ug/L	Tot Pb ug/L	Diss Zn ug/L	Tot Zn ug/L	Fecal Col.* #/100mL
Single-Family Residential	124.2	0.40	0.32	0.49	0.78	2.96	9.4	18.7	11.3	27.5	71.9	15,600
Commercial	67.0	0.40	0.29	1.21	0.55	3.44	12.3	31.4	12.4	153.4	237.1	5,510
Industrial	219.2	0.39	0.26	0.60	0.87	2.87	15.2	34.5	16.4	422.1	537.4	18,700
Education (Municipal)	99.6	0.30	0.26	0.40	0.61	1.71	12.2	19.9	3.6	75.4	117.6	11,800**
Transportation	77.8	0.68	0.56	0.37	0.74	1.84	32.4	52.2	9.2	222.0	292.9	1,680
Multi-Family Residential	39.9	0.23	0.20	0.50	1.51	1.80	7.4	12.1	4.5	77.5	125.1	11,800***
Agriculture (row crop)	999.2	3.34	1.41	1.65	34.40	7.32	22.5	100.1	30.2	40.1	274.8	24,800
Vacant / Open Space	216.6	0.12	0.09	0.11	1.17	0.96	0.6	10.6	3.0	28.1	26.3	484

Blue	Based on 1996-2000 data for Los Angeles County land use sites (LACDPW, 2000).
Grey	Based on Ventura County MS4 EMCs (Ventura County, 2003).
Green	Based on 2000-2005 SCCWRP Los Angeles region land use data (SCCWRP, 2007).
Yellow	Based on Ventura County MS4 monitoring data (County of Ventura, 2015).
Orange	Based on samples collected from the Arroyo Sequit reference watershed in western Los Angeles County, or 11 samples collected between December 2004 and April 2006. Data were used by the Los Angeles Regional Board for multiple bacteria TMDLs and are taken from (SCCWRP, 2005) and (SCCWRP 2007).

* Where original data were for *E. coli*, values were divided by 0.85 to adjust to fecal coliform.

** Multi-Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

*** The fecal coliform EMC for the multi-family residential land use is based on SCCWRP dataset for "high-density residential."

Table F-6 – Number of Data Points for Land Use EMC Data

Land Use	Pollutants											
	TSS	Tot P	Diss P	NH3	NO 3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.[a]
Single-Family Residential	41	42	42	44	43	46	48	48	48	48	48	34
Commercial	31	32	33	33	33	36	40	40	40	40	40	14
Industrial	53	55	56	57	56	57	61	61	61	61	61	35
Education (Municipal)	51	49	49	52	51	51	54	54	54	54	54	N/A[b]
Transportation	75	71	71	74	75	75	77	77	77	77	77	2
Multi-Family Residential	45	38	38	46	46	50	54	54	54	54	54	7
Agriculture (row crop)	20	18	18	21	19	17	18	21	21	21	21	23
Vacant / Open Space	48	46	44	48	50	50	52	52	57	52	52	11

Blue	Based on 1996-2000 data for Los Angeles County land use sites[6]
Gray	Based on Ventura County MS4 EMCs (Ventura County, 2003)
Green	Based on 2000-2005 SCCWRP Los Angeles region land use data[7]
Yellow	Based on Ventura County MS4 monitoring data (County of Ventura, 2015).
Orange	Based on samples collected from the Arroyo Sequit reference watershed in western Los Angeles County, or 11 samples collected between December 2004 and April 2006. Data were used by the Los Angeles Regional Board for multiple bacteria TMDLs and are taken from (SCCWRP, 2005)[8] and (SCCWRP 2007).

[a] Where original data were for *E. coli*, values were divided by 0.85 to adjust to fecal coliform.
[b] Multi-Family Residential EMC used since educational land use site not available in the SCCWRP fecal coliform dataset.

The estimated annual runoff volumes and the land use EMCs were used to develop the baseline scenario to assess the current pollutant loadings in the project drainage areas, with no BMPs, for the modelable pollutants. Specifically, the estimated runoff volumes were multiplied by the land use EMC concentrations, resulting in a baseline load. These baseline runoff volume and pollutant loads for the modeled project's drainage areas are shown in in the following table.

Table F-7 – Average Annual Baseline Runoff Volume and Pollutant Loads for each Project

Project ID	Annual Baseline Loads												
	Volume	TSS	Tot P	Diss P	NH3	NO3	TKN	Diss Cu	Tot Cu	Tot Pb	Diss Zn	Tot Zn	Fecal Col.
	cu ft	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	lb	10^12 MPN
Maria Ignacio Lane Infiltration	18,000,000	180,000	460	340	410	1,700	2,400	12	26	9.5	71	110	42
Cathedral Oaks Orchard Infiltration	19,000,000	640,000	1,800	810	960	18,000	4,600	14	60	18	45	170	65
Foothill Elementary Infiltration	54,000,000	700,000	1,800	1,200	1,400	11,000	8,000	36	89	31	200	350	130
Bishop Ranch Capture Reuse	29,000,000	820,000	2,200	1,000	1,300	21,000	6,100	22	82	25	180	350	97
Patterson Ave Farm Capture Reuse	120,000,000	1,300,000	3,300	2,300	2,900	15,000	16,000	82	190	63	620	940	260
Hospital Basin Capture Reuse	22,000,000	120,000	580	440	1,200	1,100	4,100	19	41	15	190	280	48
Lassen Open Space Capture Reuse	1,500,000	10,000	48	39	42	72	240	1.8	3.1	1.0	12	17	4.4
Tuckers Grove Park Infiltration	31,000,000	360,000	510	390	460	2,500	3,000	12	34	11	100	140	37
Lutheran Church Infiltration	32,000,000	370,000	540	410	480	2,500	3,100	13	36	12	110	150	40
Community Covenant Church Infiltration	53,000,000	690,000	1,700	1,100	1,300	10,000	7,700	34	86	30	190	340	130
San Marcos High School Dry Wells	9,900,000	70,000	290	220	330	730	1,500	10	19	6.1	91	130	30
Vega Drive Dry Wells	20,000,000	180,000	730	510	710	3,100	3,400	19	38	13	120	190	65

F.4 Anticipated Pollutant Load Reductions and Water Supply Volumes

Anticipated pollutant load reductions and water supply augmentation achieved by the projects are determined by calculating the difference between the baseline runoff volume and pollutant loads and the predicted effluent volume and pollutant loads. In order to estimate these reductions, the average annual percent volume captured for each of the proposed modeled projects was needed. Projects are typically designed in such a way that the runoff volume that drains to the project, but exceeds the storage capacity, is routed around the project and receives no treatment (e.g., overflow, bypass) or in some cases where the project is on-line and overflow occurs, minimal treatment (assumed to be zero in this modeling effort).

For infiltration-based projects, the percent capture represents the percentage of annual runoff from the drainage area that will be captured and infiltrated. It is then assumed that all of the captured runoff volume and pollutant load is reduced due to infiltration or evapotranspiration. For the subsurface storage tanks, the annual percent capture represents the percentage of annual runoff from the drainage area that will be captured and stored for reuse purposes. The percentage of runoff volume infiltrated, evapotranspired, or irrigated by these projects also represents the percentage of pollutant loading that is removed as a result of project implementation.

To approximate the percent capture of the conceptual projects identified, nomographs from the TGM were used. The nomographs[*] (Figure F-1) show the expected long-term average annual percent volume capture (shown as capture efficiency) of a project with varying drawdown times (i.e., the total duration required to fully drain the project's storage volume) from six to 240 hours and design volumes (shown as design storm depth). The nomographs demonstrate that the overall percent capture decreases with increasing drawdown times and decreasing design volumes (represented by design storm).

For infiltration basin projects, the drawdown time for all projects was assumed to be 48 hours, based on design guidance in the TGM, and capture and reuse subsurface storage tanks were assumed to have a drawdown time of 240 hours.[**] As previously mentioned, dry wells were assumed to have a design flowrate of 0.25 cfs (based on information from Torrent Resources).[9] The drawdown time of all dry well projects was calculated based on this design flowrate and the approximate storage volume of the dry well. All resulting drawdown times were less than six hours; therefore, six hours was assumed for all dry wells based on the availability of data in the nomographs, which results in a

[*] Developed using long-term continuous simulation performed in SWMM using precipitation and ET records representative of mountainous regions (Ojai-Stewart Canyon Precipitation Gauge, Matilja ET Station – average rainfall of 20.56 inches per year [http://www.vcwatershed.net/hydrodata/php/getstation.php?siteid=165#top])

[**] The intended purpose of the subsurface storage tanks is to capture and store waster during periods of wet weather, and then used the stored volume to provide irrigation during periods of dry weather. The actual tank drawdown time will vary based on storage capacity and irrigation demand. However, it is assumed that the tanks will provide irrigation demand over a period longer than 240 hours (10 days). Therefore, 240 hours was used based on data availability in the nomographs.

conservative estimate of percent capture compared to the estimated drawdown time of the proposed dry wells.

The design storm used in the nomographs was estimated for each project based on a methodology outlined in the TGM, using the Urban Runoff Quality Management (URQM) approach. This method approximated design storm depths that the project is able to treat based on available area and basic design parameters. The drainage area size and average imperviousness of the project drainage area were used as project-specific inputs for this calculation, which estimates the maximized stormwater quality captured volume using regression equations.* The estimated design storm depth and drawdown time for each project was used to determine an approximate capture efficiency, or percent capture, for each project.

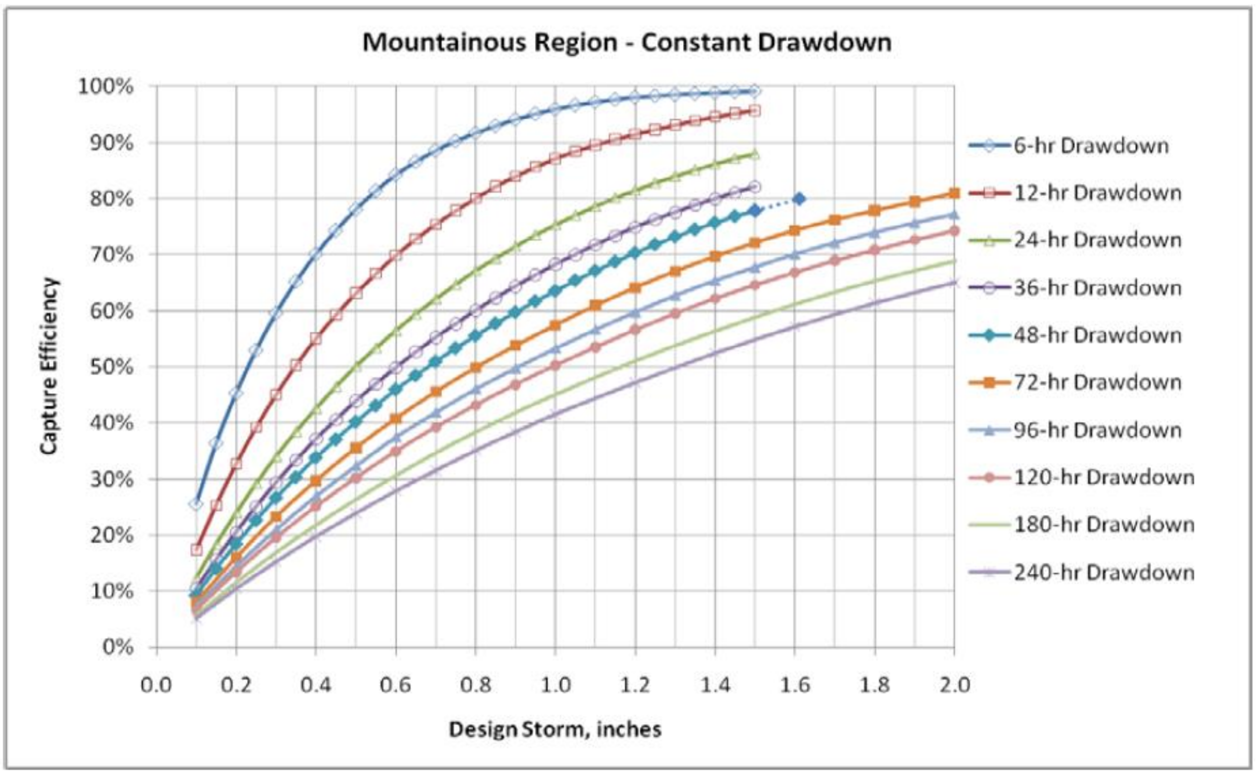

Figure F-1 – Percent Capture Nomograph (Geosyntec Consultants and LWA, 2011)

As previously described, the entire captured volume is assumed to be infiltrated or stored by the conceptual project. The infiltrated volume for infiltration-based projects was multiplied by an adjustment factor to compute a potential groundwater recharge volume to represent potential water supply benefits. This value is based on a modeling analysis of groundwater recharge performed by

* Regression equations included regression constants from the least-square analysis based on a 12, 24, or 48 hour drawdown time. For purposes of this calculation, the volume capture ratio coefficients were used and a 48 hour drawdown time was assumed for infiltration basins and capture reuse BMPs, while 12 hours was assumed for dry wells. These values vary from the drawdown times used to determine capture efficiency with the nomographs for dry wells and subsurface storage tanks due to availability of data using the regression constants.

Munévar and Mariño (in the Central California region), which showed that on average approximately 65 percent of infiltrated water reaches the water table and is therefore available for water supply.[10] Therefore, the potential water supply volume provided by infiltration basin projects was calculated to be 65 percent of the estimated captured (or reduced) runoff volume. Because dry wells are infiltrating directly to groundwater, it was assumed that 100 percent of the captured volume for dry wells is available for water supply. In addition, 100 percent of the captured volume for capture and reuse projects was assumed to be available for (non-potable) water supply, since the stored volume is used for irrigation purposes.

Appendix G – Local Non-Governmental Organizations

While not relevant to identification or implementation to feasible stormwater projects, the SRP Guidelines require identification of local nongovernmental organizations, since they can provide potential expertise in project planning and design; assistance in developing effective collaborative approaches and engaging communities; and in-kind support and private funding. The table below lists a sample of nongovernmental organizations within the District who have been involved in stormwater resource-related issues at one point or another:

Table G-1 – Non-governmental Organizations

Organization	Activities
Environmental Defense Center (EDC)	• Provides legal counsel no other nonprofit organizations. • In the area of clean water, EDC serves as a watchdog to ensure the health of local watersheds. • Participates in volunteer watershed cleanups.
Health the Ocean (HTO)	• Focuses on preventing ocean pollution. • Lobbies for increased street sweeping and enforcement to prevent illegal dumping into creeks and storm drains. • Plays an active role in the development of stormwater permits.
Land Trust for Santa Barbara County	• Acquires and protects land with natural, agricultural, scenic, recreational, and/or historical significance. • Involved in conservation efforts at the Goleta Slough, the Modoc Preserve, the Coronado Butterfly Preserve, Fairview Gardens, More Mesa, and the South Parcel Nature Park at UCSB.
Santa Barbara Channelkeeper	• Advocates for clean water and aquatic habitats. • Engages in the public policy process, including participating in the development of local Stormwater Management Plans. • Trains and educates volunteers as part of their "Stream Team" program, conducting monthly water quality monitoring in several creeks throughout the South Coast.

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