Water Scarcity in the Borrego Valley:
A Survey of Planning Interventions

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Professional Report
Submitted in partial satisfaction of the requirements for the
Master of Urban and Regional Planning
University of California, Irvine

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DATE: July 15, 2015

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List of Abbreviations

"Borrego" or "the Town"= Borrego Springs (Census Designated Place)

BSCP = Borrego Springs Community Plan

BVGB = Borrego Valley Groundwater Basin

BWC = Borrego Water Coalition

BWD = Borrego Water District

CASGEM = California Statewide Groundwater Elevation Monitoring

CDP = Census-Designated Place

CPR = Common-Pool Resource

"the County" = San Diego County

GSA = Groundwater Sustainability Agency

GSP = Groundwater Sustainability Plan

GWMP = Groundwater Management Plan

IRWMP = Integrated Regional Water Management Plan

SGMA = Sustainable Groundwater Management Act

UWMP = Urban Water Management Plan

Executive Summary

Borrego Springs is small, unincorporated desert community situated in Anza Borrego State Park, in eastern San Diego County, CA. Its only source of water is the underlying groundwater basin, which is in critical overdraft by approximately 13,000 acre-feet per year of water (Borrego Springs Community Plan, 2011). Importing water is not currently feasible, so water supply planning methods must be effective in this closed system.

With the passing of the 2014 Sustainable Groundwater Management Act (SB 1168, SB 1319, and AB 1739), new doors for groundwater planning have been opened. Public agencies are empowered to form a Groundwater Sustainability Agency (GSA) to come up with a Groundwater Sustainability Plan (GSP) for their respective basins. Under this legislation a County's General Plan must now support a basin's GSP and not be in conflict with groundwater management plans. These plans are mandatory for basins identified by the Department of Water Resource as "High" or "Medium" risk, which includes the Borrego Valley Groundwater Basin (BVGB).

The object of this report is to survey California Department of Water Resource's (DWR) accepted Groundwater Management Plans (GWMPs) for planning interventions and discuss best potential options for the Borrego Valley to address its overdraft of the BVGB. The Borrego Water District, Borrego Water Coalition, and San Diego County Department of Planning & Development Services may then apply the lessons learned from other cases to determine an optimal path forward.

For the methodology, this document categorizes planning interventions found in the GWMPs by 1) whether they are technical or behavioral in nature, and 2) whether they address the supply-side or demand-side of groundwater management. Patterns and trends in the interventions are analyzed and discussed. To further understand the relevance of various interventions for the BVGB, three case studies were selected based on their similar constraints to Borrego Valley: the Coachella Valley basin, the Paso Robles sub-basin, and the Indian Wells Valley basin.

This research finds that within wide analysis of planning interventions in GWMPs:

1) There is a notable lack of emphasis on the connection between land use and groundwater demand.

2) The structure of basin planning- with conflicting jurisdictions, multiple water districts, basin and sub-basin boundaries and plan boundaries- leave groundwater management either in conflict when it comes to implementation of any plan or with holes in oversight and enforcement to achieve the objectives of the plan.

3) Many GWMPs reassert ordinances or programs that were already in place and ineffective but often do not propose new approaches or solutions that may help address groundwater management challenges.

The case study findings show similar patterns;

- Coachella Valley shows that groundwater areas by recharge ponds recover some elevation. But when the recharge is coming from imported water that may eventually no longer be available or only available at much higher prices, this is just a stalling action. Groundwater levels elsewhere in the basin continue to fall, showing that technical solutions alone may be insufficient to curb overdraft.

- Paso Robles demonstrates that even if a basin does not initially appear to be at risk and a DWR-approved plan is in place, overdraft can still quickly become a serious issue. In this situation, having strong partnerships with the County can affect change for better or worse and a lack of County leadership can fail to produce necessary and difficult change. Also, even though Paso Robles had been importing surface water from Lake Nacimiento, groundwater elevation continued to fall, highlighting the reality that imported water is not necessarily a long-term solution.

- Indian Wells Valley has similar constraints to Borrego in that it has no import capacity. Agriculture is the largest water user in this basin but is outside the jurisdiction of the local water district. Kern County is considering re-zoning the agricultural area to enable management of all groundwater withdrawals from this basin because expanding water supply through importation appears unlikely at this time. A 2014 study by Todd engineers indicated that without imported water, the agricultural land overlying this basin will likely need to be fallowed. This situation continues to evolve.

The findings of the wide analysis of GWMPs and the in-depth case studies show that technical innovations may help marginally save water, but do not always decrease overall demand for water. Additionally, supplementing groundwater supply or importing water may meet local groundwater demand in the short-term but are not long-term solutions as without thoughtful land-use planning demand will likely exceed supply. Both literature and current state of the planning field are acknowledging this issue and calling for a greater link between land use and water availability (Janney, 2014; McKinney, 2003; UNM 2010; Hanak et. al, 2014).

Given these findings, I recommend the following to curb overdraft in the Borrego Basin: 1) Borrego Springs must advocate for San Diego County to implement local land use planning that is consistent with available water supply; 2) San Diego County should include a Water Resources Element in its General Plan, as other California jurisdictions have done to directly address and plan for water resources;

3) The Borrego Water District and the County must petition for DWR to redefine the DWR-defined Borrego Basin into sub-basins and focus management efforts on the Borrego Valley Groundwater sub-basin (BVGB), as it is the only overdrafted portion of the Borrego Basin (defined by DWR's Bulletin 118); and 4) Given its unique natural surroundings, Borrego Springs should market itself as an geotourism destination to drive the local economy in lieu of agriculture, bring in needed services, and promote a culture of conservation.[1]

I. Problem Statement

For my professional report, I will examine the current scarcity of the Borrego Valley Groundwater Basin and provide recommendations for planning interventions. Due to decades of water-intensive land uses such as agriculture and golf, the demand on the basin has exceeded the replenishment rate- a condition called "overdraft". This makes the town of Borrego Springs, an unincorporated desert community in San Diego County that relies on the basin for all its water needs, especially vulnerable to decreasing water quality and increasing costs to access and treat that water.

Recent legislation, the Sustainable Groundwater Management Act, (SGMA) has provided for the establishment of Groundwater Sustainability Agencies (GSAs) to write Groundwater Sustainability Plans (GSPs) for the sustainable management of groundwater resources. These developments have begun a new era of groundwater management in California and opened the door for a variety of innovative governance structures.

The group advocating for policies that manage the BVGB in a sustainable way on behalf of the roughly 2,700 residents of the Town is the Borrego Water Coalition

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[1] ***Geotourism*** – tourism that sustains or enhances the character of a *place* – its culture, environment, heritage, and the well-being of its resources and residents.

(BWC; “the Coalition”). The BWC is comprised of golf resort and agricultural landowners, business owners, water district board members, and non-profits that operate in the Borrego Springs area. The BWC members represent approximately eighty percent (80%) of the annual withdrawals from the BVGB. While the Coalition has no formal regulatory power, it is inclusive of many of the key stakeholders in the community, which gives weight to its policy recommendations and ensures that no undue burden is placed unfairly on specific community members. BWC requested that I conduct a survey to identify:

1) Planning interventions employed to reduce overdraft in other California communities with similar water resource issues;

2) Land use decisions the County could potentially employ to support local groundwater management efforts.

In addressing these concerns, this report will focus on the regulatory relationship between state, regional, county and local unincorporated territory in dealing with water scarcity. As can be seen in other case studies that will be examined in this report, coordinated inter-jurisdictional governance can facilitate the effective implementation and regulation of land use approaches to groundwater management.

II. Significance

Significant changes are needed to bring water resources in California into balance. While water supply throughout the state is chronically threatened due competition between various land-users, the current historic drought has made matters worse.

Scant rainfall and snowpack over the past several years has left over 80% of California in "Extreme" or "Exceptional" drought. While Northern California's precipitation since October 1st, 2014 is roughly 60% of historic averages, Southern California is in an even direr situation, where precipitation has not yet reached even 20% of normal levels (U.S. Drought Monitor). This is hugely problematic for Borrego Springs, where the sole supply of water is the Borrego Valley Groundwater Basin, which is dependent on recharge from precipitation. Without the continual supply of groundwater, the basin will not be able to continue supporting its overlying population. Other options for water supply, such as a pipeline linking the community to access Colorado River water and other sources of water in the state, have been explored but are not economically feasible. This means that if the basin is not brought into balance, the 2,700 permanent residents and more than 2,000 seasonal residents would be affected, which is particularly threatening because over half of the population is retirement-aged and homes in the town are 65.7% owner-occupied (ACS 2012). Thus, over half of the residents could also loose their collective property value, currently estimated to be worth roughly $343,174,793 dollars (San Diego Property Tax Assessment, 2013. See Sandoval, 2014).

While the lack of supply of groundwater is of major concern, it is the high demand for water in this desert town that is causing overdraft. This has strong significance for the community because it will have to reduce water consumption in order to bring the level of demand into balance with available supply. Studies commissioned by the Borrego Water District over the past three decades have produced useful information regarding the town's water demand. As the average annual natural recharge rate of the basin is approximately 5,600 acre-feet per year (AFY), and current usage is over 19,000 AFY, the result is an overdraft of approximately 13,000 AFY (Borrego Springs Community Plan, 2011).

A closer look at the cause for the high rate of annual water demand reveals that approximately 70% of water is used by the agricultural sector, 20% by golf and recreation, and 10% by residential (BSCP, 2011). This has major implications for the entire future of Borrego Springs, as agriculture in its current state appears to no longer be a sustainable land use for the town.

There is some difficulty in assessing exactly how Borrego Springs would be impacted economically if agriculture were to cease operations. In reviewing the American Community Survey (ACS) over the years with available data (2010-2013), the statistics are conflicting. In 2010 and 2011, the data shows that "Agriculture, forestry, fishing, hunting, and mining" as an industry employed zero individuals in the community. In 2012, the share of industry suddenly leaps to 13.2%, representing the second-largest industry in Borrego Springs. In 2013, the industry was the largest employer, at 15.8%. These figures combine to an average of 75 people employed by agriculture, forestry, fishing, hunting, and mining, representing 7.3% of the labor force.

The inconsistency in these figures is demonstrative of a larger demographic challenge in understanding the makeup of economies, particularly in smaller towns and cities. Because of the nature of the ACS methodology, it is possible that a town might not even sampled, leaving gaping holes in the data for employment numbers and other metrics. Additionally, the inclusion of multiple categories of employer within the same industry- for example “agriculture, forestry, fishing, hunting and mining”- can be misleading. The growth in the category in Borrego over the last two years for example, might be attributed to a growth in agriculture’s share as an employer, when it could actually be gardening or another activity doing all the hiring.

One thing that can be garnered from the ACS data is that the category of industry employers that relate to tourism (“Arts, entertainment, recreation, accommodation and food services”) has remained relatively constant, with an average of 304 people and 27.5% of the labor force represented. The number appears to have dropped in 2013, but as previously discussed, there are some limitations to the reliability of the demographic data available. This is promising for Borrego, which clearly has a foundation of services that support tourism, which could be an eco-friendly way to build the economy and replace jobs lost in agriculture. It is a significant shift for the historically agriculture-oriented Town, but could mean a positive transformation into a geotourism hub.

The BWC has been proactively taking steps to address this water supply uncertainty, which ultimately may have significant implications for other water-stressed communities in the state as well. Because much of the legislation regarding regulation of groundwater in California (discussed further in the Background section of this report) has been passed just this year, the structure of governance is still in flux. Many questions about the exact parameters for basin management are still unanswered, particularly for basins that straddle multiple jurisdictions. As the Borrego Basin is currently defined by the CA Department of Water Resources, it underlies the local agencies not only of the Borrego Water District and other unincorporated territory of San Diego County, but also part of Imperial County, as well as land governed by the CA Department of Parks and Recreation (DWR Bulletin 118, 2003) and the US Bureau of Land Management. However, only the northwestern portion of the Borrego Basin underlying the town of Borrego Springs (the BVGB) is currently relevant to management strategies being explored, so redefining this sub-basin area with the DWR is an important step in beginning to address the overdraft. Because the BWC has been proactive about considering potential governance structures and reaching out to relevant agencies, the outcome of the BWC's management models might serve as an example for other multi-jurisdictional basins. In addition to evaluating the most effective governance structures for their basin, the BWC has come up with a robust set of policy recommendations that will be a guide map for future groundwater management, which could also have significant influence on other communities dealing with overdraft.

III. Deliverables and Goals

A Matrix of Planning Methods

Several decades of research commissioned by the Borrego Water District have shown that the land use patterns in Borrego Springs are not consistent with sustainable levels of groundwater extraction. As the Town is part of unincorporated San Diego County, land use decisions in Borrego Springs are subject to the ultimate approval or rejection of the County Board of Supervisors, via the Department of Planning and Development Services. The current Borrego Springs Community Plan was adopted by the County in August 2011 and includes several Specific Plans for land use areas that are water-intensive.

These Specific Plan areas are supportive of an overall focus on improving Borrego's viability as a geotourism destination. Key to sustaining all the other areas is the cornerstone Borrego Valley Farmlands (BVF) plan, which addresses the transition of agricultural land away from thirsty citrus crops. While this is the formally adopted plan for the BVF, The Borrego Water Coalition has recommended that the fallowing of irrigated cropland be expanded if necessary to support water conservation. In addition, BWC recommends a moratorium on all new golf and agricultural development in Borrego Springs. These land use decisions might potentially achieve much toward the end of bringing the groundwater basin back into balance, but it would require cooperation from both agricultural landowners and the County.

Given the situation, a variety of planning interventions will likely be necessary. In this capacity, I will conduct an exhaustive survey of Groundwater Management Plans (GWMPs) from various groundwater-supplied communities in order to assess planning interventions made and their effect on water levels. These interventions will be organized in a matrix and categorized by 1) whether they focus on boosting supply or reducing demand, and 2) if they are technical or behavioral in nature. This deliverable will be a decision-support tool for the BWC and Borrego Water District as they move throughout the process of creating a groundwater sustainability plan. The goal is to ensure that all land use decisions will be made with as much information as possible, and that they will provide the best possible outcomes for Borrego Springs and its residents.

IV. Background and Context

A Brief History of Groundwater Law in California

Groundwater law in California has a complicated and highly contentious history. Without getting too much into the minutia of every legal action in the field, it is important to review a few key developments to illuminate how water law effects groundwater planning. The most influential of all water law in the state of California revolves around water rights. Common law default is that an owner of land has the right to use any water for beneficial use that runs over (riparian right) or under (overlying right) his or her property. This underlying assumption is the source of much controversy in a state with historical periods of serious drought (Blomquist, 1992). Appropriative rights, another system of water rights adopted in 1872, assigned right to a specified quantity of use based on tenure. The balance between these two types of rights- riparian/overlying and appropriative- through a series of legal cases resulting in the following fundamental agreements (Blomquist, 1992):

1) Landowners have the right to “reasonable” use (for beneficial purpose) of water on or under their land.
2) Overlying owners have equal, proportionate (“correlative”) rights and all would reduce use during water shortage.

3) Water left over in the basin after overlying owners used their reasonable amount is available for “appropriators”.

4) Appropriators’ rights are in accordance with seniority- those who came to an area first have first rights to reasonable use, and are the last to reduce usage in a shortage.

While this structure seems intuitive, the delicate balance between these two rights are complicated by a third system- prescriptive rights- that were commonly known as “squatter’s rights” wherein longtime adverse users of a water source with no formal claim developed a right to that use. The institutionalization of prescriptive rights began to happen through adjudication in the 1930s. In some cases, the resulting agreements between combinations of rights-holders were long lasting and effective- overdraft rates were reduced and maintained (Blomquist, 1992). In other cases, a lack of coherent data and understanding led to governance structures that failed to correct the problem.

The 2014 Sustainable Groundwater Management Act

Although previous groundwater legislation in California has some provisions for how water rights are distributed in the case of a shortage, the historic drought has placed additional stress on watersheds, necessitating new legislation. The California legislature responded this year by passing a wealth of new legislation mandating stricter management of California’s groundwater resources. Three California state bills, SB 1168, SB 1319, and AB 1739, comprise the Sustainable Groundwater Management Act (SGMA), which was signed into law on September 16, 2014 by Governor Brown.

Previously, groundwater management was enabled but not enforced. Local water management authorities could write a Groundwater Management Plan (GWMP), but needed the blessing of the local planning agency for it to be enacted. With the passing of SGMA, public agencies are empowered to form a Groundwater Sustainability Agency (GSA) to develop a Groundwater Sustainability Plan (GSP) for their respective basins, so long as it is consistent with the local General Plan. The GSP is mandatory if the basin is classified as high- or medium-priority by the DWR California Statewide Groundwater Elevation Monitoring program (Pavley and Dickinson, 2014).

A GSA would be empowered under SGMA to actively pass and enforce regulations, something which local basin authorities under a GWMP were not empowered to do (California Water Code, Section 10753.8). While the Act empowers the GSA, it also obligates the agency to collect data, monitor water use and write the GSP. The GSP is two-fold, first it is a policy and planning document, composed of data on historical trends, groundwater levels and quality, projected future supply and demand, and spatial mapping. Second, it is a timeline with specific milestones to bring the basin to sustainable extraction levels within 20 years of the plan implementation (Pavley and Dickinson, 2014). If there are any objections to the adopted GSP, the GSA would be the agency vulnerable to lawsuit. There will likely be a number of legal cases regarding the forthcoming GSPs, as these plans are comprehensive and will likely require local fees to pay for the various elements of both the planning and implementation stages.

As natural resources exist independent of political boundaries, many basins in the state straddle multiple jurisdictions, and the SGMA provides for a variety of governance structures so those jurisdictions can work together. Local jurisdictions who register as GSAs will be able to create a formal agreement to work conjunctively on a single sustainability plan for the basin in question, or to each create a plan for their respective area of the basin, so long as said plans use the same methodology. This governance situation will be a crucial component of Borrego's strategy, because their basin as defined by CA Department of Water Resources Bulletin 118 incorporates land underlying Imperial County, the Department of Parks and Recreation, the BLM and other San Diego County territory. Partnering with the right agencies or choosing to write their own groundwater sustainability plan could significantly affect the extent to which they can self-determine their water future.

Borrego Springs: The Town, The Coalition

Nestled in a beautiful, secluded desert valley, the Town of Borrego Springs has deep historical roots in its natural environment. Native American tribes were active throughout the area thousands of years ago, and early Spanish explorers traversed the mountainous terrain, naming the area "Borrego" for its rare and striking big-horned sheep (BSCP, 2011). Settlers began farming in the Town in the early 1900s, supported by the readily available groundwater. Agriculture grew in importance as alfalfa, grapes, cotton, ornamental plants, and citrus were harvested a-plenty over the years. When California officially formed the 600,000 acre Anza-Borrego State

Park in 1932, the Town truly became an oasis in the desert, surrounded on all sides by protected wilderness.

Borrego Springs retains the character of a small frontier-style town today. Only 2,700 residents live in the Town full-time, with another 2,000 arriving seasonally. This leaves a population density of about 58 people per square mile over the 42.5 square-mile community (BSCP, 2011). With such a small population, the Town cannot sustain a few importance services, such as a hospital. This would be an important inclusion if possible because a third of the population is over 65 years old (ACS, 2012). Another large demographic group is the Hispanic or Latino community, which makes up 34.5% of the population of Borrego. People in the Town are fairly financially sound with the median income at $44,199, just below the mean income of $52,749 (ACS, 2012). Over 43.3% collect social security, but this is likely because of a slightly older population. Because of the demographics of the Town, it has the feel of a smaller Palm Springs and could be a similarly comfortable retirement community, but it must address its water supply to make residents feel secure in settling there.

It became evident to the community as early as 1982 that the Borrego Valley Groundwater Basin was at risk. This was the year that San Diego County commissioned a study to assess the status of the basin for development of a groundwater management plan (USGS, 1982). The research studied hydrologic and geologic characteristics of the basin, and found that in the 40 years preceding the study, water use exceeded recharge by 330,000 total acre-feet. These findings spurred many studies over the next three decades, all confirming the basin's overdraft. The BWD sought to compile the results of all the decades of data to create a groundwater management plan, which it formally adopted in 2002. The plan has since seen several iterations and would have been translated into a GWMP when the legislation enabled it in 2013, but because it is a CASGEM medium-priority basin, it will need to serve as a foundation for the more exhaustive GSP.

To increase community participation in this process, the CA Department of Water Resources brought together key stakeholders from the Town to form the Borrego Water Coalition. These stakeholders included representatives from various agriculture, golf and recreation, non-profit and public sectors, and were guided by Dorian Fougères, a professional mediator with the Center for Collaborative Policy. In January 2014, after the first round of groundwater legislation was passed, the newly formed BWC met to begin the process of forming a set of policy recommendations on which future plans could be built. The three most salient of these ten recommendations are: 1) the reduction of 70% in groundwater withdrawals within a 20 year period (from a baseline calculated for each owner); 4) the development of funding mechanisms to support the process of reductions; and 6) the establishment of an agreement with San Diego County to facilitate the development of a GSP (Borrego Water Coalition, 2014). The first recommendation is in line with the SGMA-mandated timeline, which also requires reaching a sustainable yield in 20 years from implementation of the GSP. Because the local agency involved is the Borrego Water District, and land use planning is under the umbrella of the San Diego County Department of Planning & Development Services, implementation of many of these policy recommendation will require County participation.

The Role of San Diego County

Because Borrego Springs is part of the unincorporated territory of San Diego County, the County is a major determinant in what happens in Borrego. Historically, while the County has been supportive of Borrego's efforts to bring its basin into balance, it has not condoned the means by which the Town has sought to achieve that balance. A sticking point in discussions between the County and the Town is the question of what restrictions ought to be placed on developments in Borrego Springs in order to curb excess water consumption. Two such restrictions in consideration by the Coalition include a moratorium on new development permits for agriculture and golf resorts and a stricter application of water credit policy. The County however, is hesitant to discriminate against types of land use because it does not want to make development burdensome (BWC Meeting, 09/10/14). This interplay is demonstrative of the difficult position the County, a jurisdiction representing a wide variety of constituents, finds itself in when trying to address local planning issues such as groundwater management.

While the Borrego basin is first-priority, it is not the only groundwater source in the county that is in overdraft. Four other basins are also in the CASGEM medium-priority category and need serious planning interventions. This creates a dilemma for the Planning and Development Services department, which is responsible for groundwater management in San Diego County. BWC's policy recommendations suggest that it would explore a partnership with the County for the purpose of co-authoring a GSP for the BVGB (BWC Policy Recommendation #6).

To complicate matters further, the Borrego Basin underlies Imperial County, BLM land and CA State Parks and Recreation lands as well (DWR Bulletin 118). This means San Diego County must thoughtfully evaluate which of the three options for structuring a GSP for the BVGB will be most effective (AB-1739, Chapter 6, 10727(b)):

1) One GSP for one Basin managed by one GSA;
2) One GSP for one Basin managed by multiple GSAs; or
3) Multiple GSPs for one Basin managed by multiple GSAs.

These options are all feasible for the Borrego Basin, and while the Borrego Water District is investigating the prospect of multiple GSAs for the BVGB, the advantage of operating as a separate GSA within the BVGB sub-basin is that both they and the County can avoid a lengthy and expensive CEQA process necessary in forming a Joint Powers Agreement (JPA) or coordinating efforts across more complicated multi-jurisdictional lines required for the Borrego Basin.

It might seem at first glance that any option that allows the BWD to have the biggest hand in the writing of the GSP for its basin would be acceptable. But forming an alliance with the County and each sharing GSA roles may increase the opportunity for coordinated land use authorities and groundwater management authorities to address the overdraft of the BVGB. Also helpful could be the new legislation under the recently passed Proposition 1, which has made available billions of dollars for water conservation, or previous funding under Proposition 84, which set aside over $1.25 billion for water security alone (CA Natural Resources Agency, 2014). The Coalition recommends a combination approach, wherein both public and private funding are employed in support of its conservation goals. Water credits are a way to raise the private level of contribution and the BWD is presently in the process of revising its existing policy for its water credit to comply with the BWC's reduction program recommendations (BWD, 2015). When credits are issued, they can be traded as an asset and exchanged between parties, allowing farm owners to find a way outside of replanting to sustain losses. In order to evaluate the effectiveness of various types of governance structures and funding vehicles, it is essential to review other groundwater management case studies.

V. Knowledge Base:

Common-Pool Resource Management

The issue at hand for the sustainability of the Borrego Valley Groundwater Basin is primarily practical in nature- how to protect the resource over the long-term from economic exploitation and environmental degradation and optimally use it at the same time for the economic and social well-being of the Borrego community during both the short and long-terms. There is a wealth of theory in the field of common-pool resource management that allows us to consider the how various cooperative approaches can improve the longevity of an extractive natural resource. One of the most influential thinkers in this field is Elinor Ostrom, who has both helped to define common-pool resource problems, and observed their dynamics in wide variety of situations. In order to define a natural resource as "common-pool", it must satisfy two requirements: 1) it is subtractable, meaning that is can be depleted, and 2) it is non-excludable, meaning that it is not possible to prevent people from using the resource (Ostrom, 1987). Solutions to CPR dilemmas focus on usually one of the two defining characteristics (Gardner et al. 1990): provision (stock of the resource) and appropriation (flow of the resource). Provision is a question of supply-side management, techniques such as reducing impervious surfaces and protecting topsoil to allow for increased rain and runoff infiltration. While increasing supply can support overdraft reduction, as we have discussed, the biggest improvements can be seen from decreasing demand. Therefore appropriation-oriented approaches will be most effective in planning for groundwater sustainability in the Borrego Valley groundwater basin.

In structuring solutions to CPR dilemmas, there are several key characteristics that have proven effective. The most prominent works defining these requirements are co-authored by Pinkerton and Weinstein, and separately by Ostrom (Stein and Edwards, 1999). Pinkerton & Weinstein (1995) found that accountability, effectiveness, representativeness and adaptability were the essential criteria of any CPR plan. These four characteristics are similar to, though less complex than, the design principles of robust CPR management systems observed by Ostrom (1990);

1. Clearly defined boundaries
2. Congruence between allocation and access rules and local conditions
3. User's ability to modify the operational rules through collective-choice arrangements
4. Monitoring of management system
5. Graduated sanctions
6. Conflict resolution mechanisms
7. Management rights of resource users are not challenged by external agents.

Ostrom's observations are characterized by a focus on simple CPRs, meaning that they have one resource to be dealt with at a time, such as groundwater in a basin.

The characteristics from Pinkerton and Weinstein's work as well as Ostrom's provide guidance for elements of Borrego's future GSP. The process by which the BWC came together satisfies many of Pinkerton and Weinstein's criteria of accountability, effectiveness, representativeness and adaptability. The BWC is accountable to the residents of Borrego Springs. They are effective because they set out to produce specific, collaborative policy recommendations and they have done so. They are representative, having been brought together by the DWR from various sectors of the community. The only criterion that is left to determine is their adaptability. As the water district moves forward with plans to form a GSA with the County, the BWC will need to adapt to this new formal arrangement in order to ensure that it continues to be relevant as an entity, and that its recommendations continue to inform the planning process and the GSP itself. Ostrom's requirements for robust CPR management systems could be helpful in guiding that transition, and will be discussed in further detail within the planning method matrix.

Literature in Pursuit of Groundwater Sustainability: Everything but a Plan

The primary concern of the Borrego Water Coalition (BWC) is the manner in which the water use is reduced. Because the BWC is composed of a variety of influential stakeholders with diverse interests and needs, reduction methods have to be politically feasible in nature. To address this concern, this literature review focuses on case studies to garner lessons learned from experience. It becomes clear from the literature that while research has been conducted on some legal and technical aspects of groundwater management, less attention has been paid explicitly to the planning interventions that have been implemented. This question of implementation is a gap in the literature that the Borrego Valley study will hopefully be able to address.

Cases of successful groundwater management often incorporate a variety of techniques that are tailored to the situation. In perhaps the definitive book of case studies in groundwater management, *Dividing the Waters: Governing Groundwater in Southern California,* Blomquist offers an enlightening perspective on the development of legislation of water use in California. Reviewing the history of riparian, appropriative, correlative, and prescriptive water rights, he is able to delineate some of the potential for overuse when multiple types of rights can be conflicting. Blomquist furthers this insight by discussing case studies in eight of Southern California's premier groundwater basins: Raymond Basin, West Basin, Central Basin, Main San Gabriel Basin, The San Fernando Valley, The Mojave River Basin, Orange County Basin, and China Basin. To evaluate the effectiveness of the strategies employed by the acting agencies, Blomquist takes into account overarching lessons from the basins, several of which are particularly salient for the Borrego Valley Basin:

1. Collaboration works. Often, polycentric management allows for varied inputs and expertise that can be applied to problems as they arise.

2. Applying lessons learned saves resources. Several basins in the study had similar enough attributes that they could apply governance techniques crafted by other basin management.

3. Having a clear grasp of the science is crucial. Without sufficient Information based on solid analysis and science, governance will be ineffective or impossible.

4. The emphasis solely on supply-side management can be effective in the short term, but might only delay and not cease entirely, the need to reduce demand.

Other case studies substantiate Blomquist's findings by employing the lessons learned in a technical capacity. One is in Pajaro Valley, where scientific information has informed engineering solutions such as recycled water treatment, recharge basins, infiltration or injection of recycled water, agricultural efficiency and land fallowing. The Pajaro Valley case study also employs some non-technical management strategies that echo the same lessons Blomquist uncovered, such as polycentric governance, improving stakeholder participation and focusing on time- and cost-effective approaches.

Cases outside of California do not offer as much insight about governance structures, but can give significant direction for logistic steps in groundwater conservation. In a comparative case study paper on basins in Spain and Australia, Ross and Martinez-Santos found several shared features of successful management strategies that worked for both countries that offer new insight for application to the Borrego Valley:

1. A reasonable time period for transition was crucial to reaching financial agreements and reducing entitlements.
2. Investment of public funds to promote the development of technologies and governance for sustainable basin withdrawal led to higher overall success in overdraft resolution.

In the Ross and Martinez-Santos paper, they highlight the significance of public funding, an issue which is also critical for the Borrego Valley case, as several

Coalition members have made it clear that their support for collaborative policy recommendations will be withdrawn if a source of public funding is not made available.

In New Zealand, Lowry et al. emphasize the need for adaptive management, a somewhat vague recommendation that is found throughout the literature (such as in Blomquist; Ross and Martinez-Santos). Their research is clear about how a lack of coherent national groundwater management objectives is problematic for regional implementation of groundwater management strategies. It also highlights that validated scientific knowledge available at a national level could improve the effectiveness of local negotiations for demand reduction. The term "adaptive management" used by Lowry et al. is often associated integrated water management, but there are a wide variety of principles implied by those terms. Various techniques employed within the umbrella of integrated water management will be explored in depth as part of the planning method matrix.

While the current literature derived from case studies is clear on lessons learned, the major gap left for researchers to fill is understanding how political will and stakeholder willingness can be crafted to execute those lessons. In *Managing California's Water: From Conflict to Resolution,* Hanak highlights the need for all levels of governance to have consistent information, both vertically and horizontally, which will enable collaboration among and between various actors. For instance, the state water department, regional planning body, and local stakeholders (water district, agricultural owners, non-profits, etc.) can more effectively negotiate and implement strategies if they are operating from the same scientific, legal and regulatory assumptions. While Hanak addresses other key areas of the field whose improvement would facilitate successful groundwater management, the focus on having consistent information is key to the Borrego Valley study, as the lack of agreement between the local, county and state levels of governance partially results from differing understandings of planning tools and techniques. Nelson expounds on that concept, highlighting that once all levels of governance are on the same page about the contributing research, and have subsequently developed a feasible plan, the effective implementation of those plans remains to be seen. She also emphasizes that changing state legislation will have a huge effect on how local programs are implemented, and the process will need to be carefully observed to understand what the implications are on a local basin level.

Following from the initial literature review, the next steps in this study will necessarily be to find more information on the specific techniques of groundwater overdraft reduction that the basins used. This information might be available in local public documents. In particular, as most groundwater studies (with the exception of Blomquist's work) are focused on the technical or engineering methodology used, more research on successful planning methods is needed. This literature review justifies the creation of a planning-method matrix, which should help fill the knowledge gap with planning approaches to groundwater overdraft reduction.

VI. Method Analysis

A Matrix of Planning Methods

The goal of this report is a deliverable matrix of planning methods that help inform land use decisions for Borrego's future GSP. That matrix is composed of a survey of land use among a sample of cities addressing groundwater management, and will divide relevant interventions by column categories: 1) Technical Interventions and 2) Behavioral Interventions, then further into sub categories of 1) Supply-Side Interventions and 2) Demand-Side Interventions. Each row represents a sub-basin, which are grouped into basins and ordered north-south within a DWR Hydrologic Region. For the purposes of this research document, a "demand-side" intervention is defined by its decrease of overall water demand, not just in demand for un-recycled water. Some technical interventions may marginally slow demand for the highest quality, "fresh" groundwater, but because they do not slow demand for water overall, they are not categorized here as demand-side interventions.

It is important here to take a moment to discuss the role of market and regulatory structures in the selection of these case variables. Water management operates differently than other resource management (such as energy) because of the structure of water rights as well as water's role as a basic need. In economic interactions, supply and demand adjust freely in relationship to one another, creating a self-regulating market that responds to scarcity with prices that increase. However, the pre-existence of water rights means that the true cost of the resource is not reflected in the price, which inhibits the ability of the market to achieve self-regulation (Olmstead, 2010). Additionally, the role of water as an essential public good means that there is a strong political resistance to applying economically congruent pricing to water resources; the perception that this basic need will be regulated can create public fear and backlash, especially in times of scarcity (Krause et al. 2003; Olmstead and Stavins, 2007).

Active management of the water source- the groundwater basin- becomes necessary to compensate for this market failure. In this case, the interventions applied fall neither squarely into the "market" or "government" category. The approaches almost always include some combination of private and regulatory involvement (Ostrom et al. 2012). One example is the construction of wastewater treatment facilities, which requires not only private investment or participation (such as the contribution of land, capital or wastewater itself) but also public oversight and management (such as effective zoning and coordination between landowners). For this reason, the interventions in this report are categorized as either "technical" or behavioral" instead of "market" versus "government". I believe this delineation is more effective because it enables direct analysis of the management solutions applied, rather than reinforcing the idea that market and government act separately from one another. Interventions can then be looked at for their relative merits or defects, and the roles that the private and public sector need to play can be assessed.

I will extract these interventions from the available Groundwater Management Plans for all California State Groundwater Elevation Monitoring (CASGEM) program high- and medium-priority basins in order to populate the spreadsheet. Established in 2009, the object of CASGEM is to spur "regular and systematic" monitoring of alluvial groundwater basins at a local level (DWR, 2014). Selecting from the CASGEM-prioritized basins narrows California's 515 basins into the 127 that account for 96% of the state's groundwater use and 88% of the population that overlies a groundwater basin (DWR, 2014). The water supplies of these basins are most at-risk, so the corresponding agencies are more likely to have groundwater plans in place to address that risk.

The intervention matrix provides an overall sense of what interventions are being applied to high/medium priority basins throughout the state and how common each of these interventions are. The results of the wide analysis, however, need to be supplemented by in-depth looks into several Groundwater Management Plans in order to determine what types of interventions are most applicable for Borrego Springs.

In order to ensure that the interventions examined are from cases that share the same types of constraints as Borrego, I undertook a systematic selection process. The constraints considered in narrowing cases were:

A) Whether other water sources are available.
B) Whether land uses of overlying the basin are of a water-intensive nature.

These constraints posed the following questions about the basins for comparison:

- Is groundwater the only or primary water source?
- Does the basin share Borrego's geography or climate?
- How high is the level of land use stress?
- Can basin objectives be accomplished without land-use interventions?

I found that these questions could be represented by the following factors, whether the basin was:

1. Situated on the coast or inland?
2. Underlying agriculture or golf?
3. Had been adjudicated or remained unmanaged?
4. Supplemental water available from imported or surface water supply?

Factor 1 (Coastal/Inland) clarifies the type of climate patterns likely to occur, establishes if desalination is an option in the area and sheds light on whether saltwater intrusion is an issue of concern. Factor 2 (Agriculture/Golf) establishes if water-intensive land uses are overlying the basin. Factor 3 (Adjudicated/Unmanaged) illuminates if the types of interventions employed are limited by pre-existing legal resolutions. And Factor 4 (Imported/Surface Water) determines if other sources of water outside the basin are available.

These factors are called "Basin Relevance Factors" for the purposes of this study and in the matrix are assigned either a "1" if the constraint is shared by the Borrego Valley Groundwater Basin or a "0" if it is not. These Basin Relevance Factors are useful in determining the best candidates for the in-depth qualitative review, as they narrow the basins to those that share the most traits with the BVGB.

In-Depth Case Studies

The in-depth case studies are an opportunity to see if the interventions currently being employed to curb groundwater overdraft will be relevant for Borrego Springs. Having a qualitative such review of the selected GWMP documents in the context of their basins and communities should give deeper insight into possibilities for change. Additionally, it provides opportunity to measure the effect of the interventions on any adverse condition or overdraft- helping to illuminate the most effective techniques. In evaluating the case studies, the major considerations are:

1. Is there also an Integrated Regional Water Management Plan/ Urban

Water Management Plan in place for the area overlying the basin?

2. Does the local General Plan[s] address water as part of the Land Use, Conservation or optional Water Element?
3. How long have interventions been in place?

Because of the lack of actual groundwater elevation data publically available, to help determine the potential effectiveness of chosen interventions I noted whether the basin in question was able to prevent or curb overdraft subsequent to the implementation of its GWMP. Additionally, I consulted literature to see the results of similar interventions in other cases. While examining both the literature on the intervention as well as the actual change over time in groundwater elevation cannot give absolute clarity on the effectiveness of applied interventions, it can help illuminate trends.

Analysis of Method Effectiveness

The methods employed to catalog and understand the various planning interventions discussed in this report went through many iterations. Initially, I sought to use the Land Use Elements from General Plans of the jurisdictions overlying each basin to assess interventions. However, I found the LU elements to be very limited. Not only were many of them highly outdated because of the lack of a state standard for how often they must be updated, but others failed to mention anything about water at all. I sought next to consider the Conservation Element, but found they, too, faced the same limitations. An article published by the Stanford University forum, *Water in the West*, pointed me toward considering the optional Water Element included by 96 jurisdictions in California as the basis of my analysis.

While I believe that these documents have a lot of potential to connect land use decision-making with groundwater planning [see Summary section], at present there is significant variation in the detail and structure of those Water Elements, and groundwater is not always at the forefront of their focus (Janney, 2014).

Given the lack of suitable documentation from within planning departments, I selected the Groundwater Management Plan as the vehicle for the research. The GWMP is tailored to specifically address groundwater interventions and has the highest level of congruence with basin boundaries of other document types (such as the Water Element, Integrated Regional Water Management Plan or Urban Water Management Plan). There are some jurisdictional complications [see Discussion Section], that can decrease the effectiveness of the GWMP as a tool, but it is the most applicable document currently available as it bears the most resemblance to the forthcoming Groundwater Sustainability Plan.

Using the GWMP to populate the matrix was ultimately effective, though there were several basins missing plans and a few basins that had multiple, conflicting plans [see Findings Section]. The additional application of Basin Relevance Factors helped to select relevant cases for comparison, which both contextualized planning interventions and gave insight into their utility. Overall the methodology was effective, but could be improved given more complete information.

VII. Findings

The findings from the wide analysis of CASGEM high- and medium- priority basins suggest that the Groundwater Management Plans are more focused on technical means of increasing overall water supply than means of decreasing overall demand for water. The interventions offered were very similar to one another and few plans had any innovative approaches to prevent or curb overdraft. Notably, very few other GWM plans (only SJ19, SJ12, and CR3) recommended land fallowing as a potential solution [See Case Study section for expansion on CR3- Coachella Valley Water District GWMP].

Table 1 (page 27) displays a listing the categories of interventions proposed. As evident from Table 1, the types of solutions proposed are woefully out of balance. There are many technical interventions meant to augment supply to keep up with current demand. Behavioral interventions tended to focus on reducing overall demand to adjust to limited supplies. Both types of solutions will be needed to address the many difficulties facing groundwater basins in California, however, from reading the GWMPs, it becomes clear that unless serious demand management measures are in place, the increasing demand for groundwater will lead to overdraft in most basins. The findings in the section following expand upon this observation (*Note: the GWMPs were evaluated for interventions specifically dealing with overdraft. While many basins deal with issues of saltwater intrusion or groundwater quality, Borrego's primary goal is to reduce overdraft. Therefore interventions were screened for their applicability to this particular goal)*.

Planning Interventions			
TECHNICAL		BEHAVIORAL	
supply side	demand side	supply side	demand side
monitoring	water conservation via efficient technology (eg fixtures/irrigation)	interagency cooperation	public education
artifical recharge		recharge area protection	water conservation via reduction of excess use or waste
wastewater reclamation		conjunctive use	limits on exportation
water banking		incentives to connect to municipal supply	limits on new wells
water storage			conservation pricing
water recycling			
balancing well locations			
desalination			
increase imported water			

Table 1

General Findings

1) Lack of Land Use Emphasis:

Initially, in setting out to complete this research, I thought to examine the land use elements of the general plans for jurisdictions overlaying groundwater basins. But while reading those documents, it became clear that water was often not addressed at all. This was the first indication that the field of urban and regional planning is missing a major link to the causes of groundwater overdraft.

In switching the base document of the study to the GWMP, I have found the same pattern- consistently, there is a complete lack of emphasis placed on tailoring the land use of a county, city or census-designated place to the availability of water resources in the area. The only stipulation in the California Water Code requiring linkage between land use and water resources is CWC § 10750: "Review of land use plans and coordination with land use planning agencies to assess activities that create reasonable risk of groundwater contamination". This acknowledges that source pollutants can arise from ill-planned locations for certain land uses, such as the situating of a gas station directly next to a riverbed that percolates into the groundwater below. However, it fails to recognize the key connection between the "thirstiness" of certain land uses and how they may need to be limited or excluded entirely from an area's allowable land uses.

This is particularly problematic for areas that have golf, seasonal tourism or agriculture as a major component of the economy. Golf courses can be managed by regulating that drought-tolerant landscaping and tertiary recycled water be used for irrigation. Seasonal tourism is somewhat harder because pools, water parks, amusement parks and potable water all must be of a certain quality. With both golf courses and tourism, land use practices can at least marginally reduce water demands by limiting the number of new construction golf courses, pools, etc. This is often an unpopular stance, but can be effective.

Because of its prevalence in the state and its extreme water demands, agriculture is the most important consideration for many regions overlying groundwater basins. The level of complexity in terms of jurisdiction over planning for this groundwater is particularly apparent in the Central Valley; although there are only 3 basins (Redding Area, Sacramento Valley and San Joaquin) in the valley, there are over 85 Groundwater Management Plans for that area. As these plans are only for dictating groundwater planning, the competition for surface water is another layer of contention between competing farmers, corporations, municipalities and residents.

Some plans may go as far as explicitly acknowledging the link between land use patterns and increase in water demand [See plans SR-3, SC-6, and CR-3], even though the proposed interventions are incongruous with that observation- they fail to propose alternative land use strategies. Others are quick to state that the goal of the plan is to secure an adequate supply to maintain current land uses [See plans NL-3, NC-3], which is a sort of recognition that the current land uses will require increasing water supply. A few plans explicitly state that their modeling indicates that even once all proposed projects are operational, there will still be an overdraft [See plans CR-3, CC-6]. These few plans mentioned have some indication of the connection between land use and groundwater consumption, but it is a far cry from sincerely incorporating land use planning to bring basins into balance.

2) Structure of Basin Planning Leaves Management Gaps:

More clarity is needed about the jurisdictional boundaries of management for groundwater basins. Because there are many types of jurisdictions- water districts, irrigation districts, counties, cities, census-designated places, state parks, etc.- overlying each basin or sub-basin, the Groundwater Management Plan suffers as a vehicle for effective change. Many of the GWMPs only overly part of the basin, but it is unclear because those plans could refer to the basin in different terms than what is official with the Department of Water Resources. For example, basin 4-07 Arroyo Santa Rosa Valley is not listed as having a GWMP according to the DWR. However, a plan has been written for the same area by the Camrosa District under the basin name “Santa Rosa”. Nowhere in the document is the DWR code for the basin listed. This is unfortunately not an isolated incident, and could lead to confusion for all levels of basin management- for the DWR, for the city or county involved, for adjacent sub-basin managers trying to understand what is being done basin-wide, and for academics or consultants monitoring the situation. This lack of consistency can obscure real patterns of groundwater use and lead to poor management decisions.

Another danger is that many at-risk basins are overlooked because of the boundaries of water districts or other jurisdictions. Overall, 41 basins were missing a GWMP. For example, the Metropolitan Water District of Los Angeles covers the Coastal Plain of Los Angeles (4-11.01 through 4-11.04), and the Western Municipal Water District covers some of Upper Santa Ana Valley basin (sub-basins 8-02.03 and 8-02.06) but because of the limited operational boundaries of both agencies, the basins between- representing the remainder of the Upper Santa Ana Valley and San Fernando Valley, Raymond and San Gabriel Valley (4-11, 4-23 and 4-13)- are not currently covered by any GWMP.

In cases of adjacent basins such as these, the land use patterns are likely to be consistent across the GWMP-covered and uncovered basins. This means that when management strategies and regulations are made for a GWMP basin, demand is likely to shift to the adjacent unregulated basin. Those basins, having no GWMP, would be especially vulnerable to overdraft resulting from that increased use. One example is Antelope Valley (6-44), which has no plan but straddles Kern, Los Angeles and San Bernardino counties. Multiple unincorporated towns overly this CASGEM high-priority basin but it remains uncovered by a GWMP [See Figure 1 below].

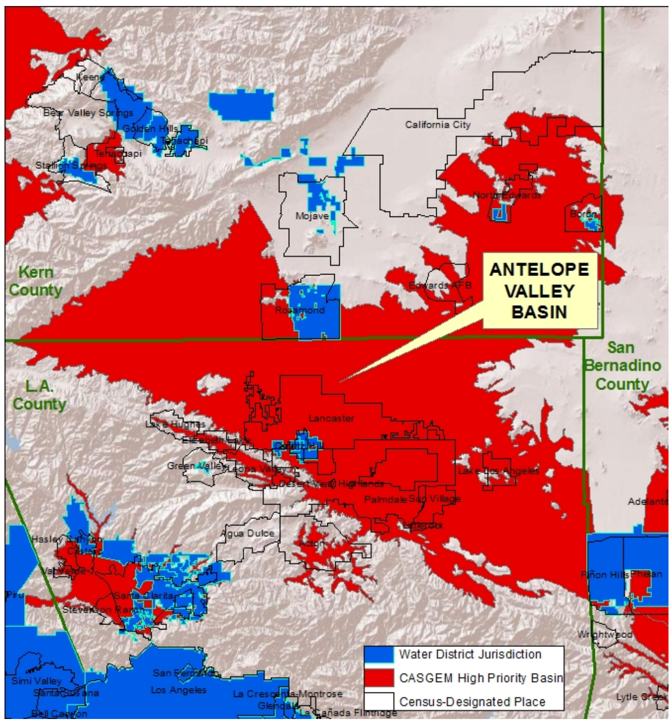

Figure 1

In Figure 1, it is evident that the management complications for this basin alone could be enormous. Several towns and cities with growing populations- such as Lancaster and Palmdale- could be competing for the groundwater, and with districts only empowered to regulate the portion of the basin underlying their jurisdiction, no basin-wide regulatory consistency is seen.

The opposite problem can exist as well. Instead of having no regulation above a basin, there can be too many conflicting parties regulating the same space. Such is the case for the thirsty Central Valley, where even up to 11 different GWMPs have been written for one sub-basin (San Joaquin Valley 5-22.14). Other jurisdictional complications that were observed include:

- Water Districts that only overly part of the basin
- Counties that only overly part of the basin
- Cities or Census-Designated Places that only overly part of the basin
- Water Districts that overly multiple jurisdictions (counties, cities, etc.)
- Counties, Cities or CDPs that overly multiple basins
- Water Districts that overly multiple basins
- GWMPs that overly multiple basins
- GWMPs that overly multiple jurisdictions
- GWMPs that overly only part/parts of a basin or sub-basin

Because of the many players involved in each basin's management, it becomes increasingly difficult to enact meaningful change to curb or prevent overdraft. Additionally, as GWMPs exist on a basin basis they are therefore more complicated as the resulting interventions- land use and technical- must be enacted in various jurisdictional environments simultaneously (for example, different land use planning in each side of two counties that share a groundwater basin). Here, some state solution might eventually be needed to bring the DWR boundaries in line with the jurisdictional boundaries, or vice-versa.

3) Ultimately most GWMPs are "Business as Usual":

The main conclusion to be drawn from this wide study of the CASGEM high- and medium-priority basins' GWMPs is that the policies, regulations and interventions being suggested to address problematic patterns are not introducing anything new. In many cases, a Basin Management Objective will begin with the phrase "Continue to_" indicating that no change has been made. This is concerning because it has the flavor of lip service, where the intention is to sound busy and effective but in reality the level of effort remains static. A few of the interventions suggested are already part of California Water Code, such as regulation of well construction and repair and the CA Water Conservation in Landscaping Act of 1990, and have been in place sometimes for decades. The plans are also replete with filler language- terms such as "Interagency Cooperation", "Stakeholder involvement", and "Public Education and Outreach". While these concepts are important components of any public agency effort, little substantial detail or plans for improvement are put in place by many of the plans. This finding has particular relevance, as the new wave of groundwater legislation could have real power to shape the future of California's water landscape, or, if real thought and detail are again neglected, it could just be more of the same.

VIII: Case Studies

In designing their future Groundwater Sustainability Plan, Borrego Springs can take lessons from what has gone into some of the precursor Groundwater Management Plans. Particularly, those cases that share similar constraints can offer guidance for what interventions have or have not been effective. Toward this end, each CASGEM high- or medium-priority basin was given a Basin Relevance Factor, representing its total comparability with the Borrego Valley Groundwater Basin, 0 being the lowest and 4 being the highest. From the basins ranking a 3 or higher, I chose three cases based on a combination of their data availability, geographical circumstances, any unique approaches implemented toward managing overdraft, or valuable lessons learned. The three basins determined to be most relevant for Borrego were: 1) Coachella Valley (all sub-basins), 2) Paso Robles (Salinas Valley sub-basin 3-04.06) and 3) Indian Wells Valley (6-54). Following is a detailed analysis of each case.

COACHELLA VALLEY GROUNDWATER BASIN

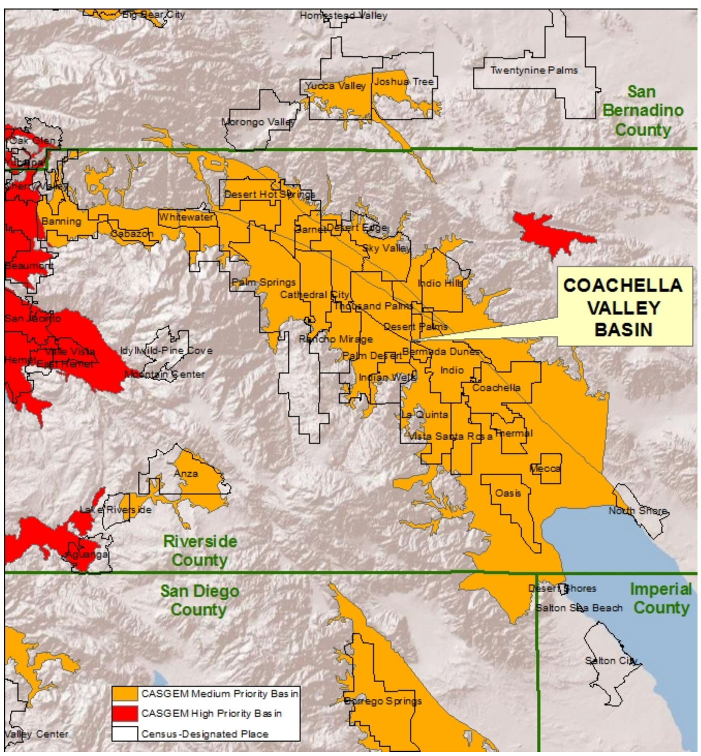

Figure 2

1) Basin Basics:

The basin is located in central Riverside County, slightly extending into San Bernardino, San Diego and Imperial counties. Bordered to the south by the Salton

Sea, it is composed of 4 sub-basins: Indio (7-21.01), Mission Creek (7-21.02), Desert Hot Springs (7-21.03) and San Gorgonio Pass (7-21.04). Situated just an hour north of Borrego Springs, the Coachella Valley experiences the same extreme summer heat and dry conditions, with an average of only 3 inches of rain annually (CVWD website).

The main managing agency for the basin is the Coachella Valley Water District (CVWD), thought Desert Water Agency (DWA) is also a distributor. There are several growing cities overlying the basin with Palm Springs, Palm Desert, Rancho Mirage and La Quinta among the largest of them. The valley is overseen by the regional government body, Coachella Valley Association of Governments, which coordinates planning action between the various jurisdictions. Because of the extreme importance of water in the area, the valley also has the Coachella Valley Regional Water Management Group, tasked with producing an Integrated Regional Water Management Plan. The agencies involved are the:

- City of Coachella/Coachella Water Authority
- Coachella Valley Water District
- Desert Water Agency
- City of Indio/Indio Water Authority
- Mission Springs Water District

In addition to the IWRMP, the region has two Urban Water Management Plans, one produced by the CVWD and the other from the DWA, and a Groundwater Management Plan from CVWD. These documents collectively govern water resources within the entire region above the Coachella Valley basin. This governance is ever-important, as this once-sleepy desert valley now has a total population of 346,518 (U.S. Census, 2010), not counting seasonal visitors.

The major industries in the valley are tourism, golf and agriculture, all of which require a large, steady supply of water. In addition to seasonal tourism (including the famous Coachella music festival), and countless golf courses throughout the valley, there are 72,800 irrigated acres of agriculture. These land uses have contributed to an overdraft of 136,700 AFY, most of which is located outside of the CVWD jurisdiction; the portion inside CVWD's control is overdrafted by 35,621 AFY (City of Palm Desert General Plan, 2004). Because the largest source of water is from the groundwater basin, the GWMP produced by CVWD is critical.

2) Local Land Use Planning and Groundwater:

Because of the significance of water for the Coachella Valley, many of its cities- including Desert Hot Springs, Cathedral City, Rancho Mirage, Palm Desert, Indian Wells, and La Quinta- have produced an optional Water Resources Element (WRE) along with their General Plan. While the purpose of this document is to incorporate water resources into local land use planning, it does that in Coachella only somewhat successfully. Although one would expect that the WREs show increased focus on the role of land use for groundwater conservation, the interventions indicated in the WREs do not substantially differ from those in the GWMP.

The City of Palm Desert General Plan incorporates mostly technical solutions into its WRE. These solutions include a Groundwater Replenishment Program, wherein water borrowed from the Metropolitan Water District of Southern California is to be banked and paid back in contracted water from the State Water Project. The most interesting thing about this program is that it could potentially mean fallowing some land in exchange for lower water rates. MWD has a similar program in place in the Palo Verde Irrigation district under which the farmers refrain from irrigating 7-28% of the valley lands annually, during which time the land is taken out of production, and rotated every 5 years (MWD, 2013). While the specific arrangements regarding the agreement with Coachella Valley were not in place at the time of the GWMP (CVWD GWMP, 2010), even the prospect of at least partial land fallowing is highly unique throughout GWMPs in California.

Other standard aspects of the City of Palm Desert Water Resources Element include artificial recharge, increased use of recycled water (including tertiary treated water), and wastewater reclamation. There is a section on water conservation, but it simply reiterates support for and implementation of efficient landscaping and fixtures ordinances, in addition to offering audits for farms, golf courses, and homeowners' associations to identify water waste. For future interventions, the city will consider refining water budgets and giving further incentives for conservation. The City of Palm Desert's Land Use Element makes no mention of water.

Among other cities in the valley, City of Rancho Mirage's General Plan (2005) only mentions that the grading ordinance should protect natural resources and open space including water resources. In the City of La Quinta General Plan (2013), the Water Resources chapter of the Natural Resource element acknowledges the link between land use development patterns, lot coverage and stormwater runoff within the planning area, but its Land Use Element also has zero mention of water. The City of Palm Springs Land Use Element (2007) also does not mention water in connection with land use, but its Conservation Element mentions the typical water-smart landscaping and design, retrofit, recycling, and water efficiency though financial incentives (Section RC9.2).

The Coachella Valley Water District's 2010 UWMP is another effort to curb overdraft that misses the mark. Many of the same technical interventions are proposed, though there is a remarkable concession toward the power of land use in groundwater consumption. Section ES-5.1.1 notes that urban development in the area has been more efficient than expected because of landscaping and plumbing code requirements. Given that this type of development has come primarily from conversion of agricultural land to residential, the water demand projection for 2045 will be 64500 AFY less than originally thought (CVWD UWMP, 2010). Given continued conversion of lands, the rate will slow further. But demand uncertainty still exists as new golf courses are being built since there is no moratorium currently in place.

3) Lessons Learned:

While the Groundwater Management Plan document reflects efforts made to curb overdraft, currently groundwater levels are still not stabilized, with water levels continuing to fall by over 100 acre-feet, especially in the areas of Palm Desert and Rancho Mirage near the golf courses. The only areas that have stabilized since 2010 are those directly above groundwater recharge ponds, near Palm Springs and Rancho Mirage (James, 2013).

While the improvement in areas near recharge ponds would seem a testament to that technology, the increase coincides with the arrival of the MWD water from the Colorado River that percolates now to the aquifer. That water banking will eventually have to be paid back, even if fallowing in the interim helps save some groundwater, so the valley is living on borrowed time. Additionally, the Agua Caliente Band of Cahuilla Indians are now suing CVWD and DWA for allowing levels to drop, claiming rights to a portion of the threatened groundwater supply (James, 2013).

The GWMP put forth by Coachella Valley Water District is a noble step toward improving conditions, and whether because of conversion of land toward residential units or the recession, by 2009, agricultural water use was down 9.9% and golf course use was down 14% (CVWD GWMP, 2010). Hopefully this is a positive trend that can continue, despite a lack of applied land use planning for water conservation implemented by the cities and water districts in Coachella Valley.

PASO ROBLES GROUNDWATER BASIN

1) Basin Basics:

Nestled in the temperate hills of the Central Coast, the Paso Robles aquifer (3-04.06) is actually a sub-basin of the Salinas Valley groundwater Basin. It straddles the line between Monterey and San Luis Obispo Counties, though because the majority of population overlying the basin is in San Luis Obispo, the agencies within that county are most involved in the Paso Robles basin management. Though most of the basin is technically under the San Luis Obispo County jurisdiction [See Figure 3], it is the City of Paso Robles and the San Luis Obispo County Flood Control and Water

Conservation District (SLOFC&WCD or "Water District") that authored the GWMP for the basin (City of Paso Robles, 2011. DWR plan "CC-9").

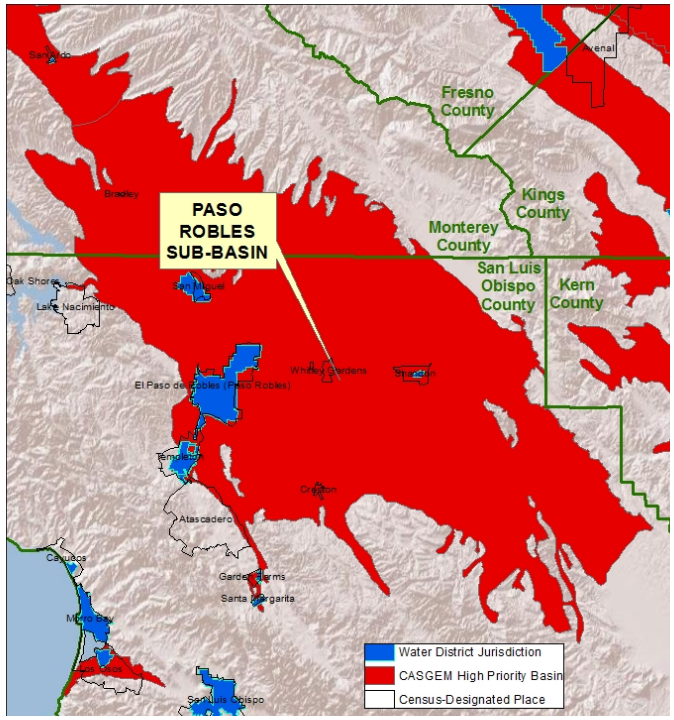

Figure 3

The population of the largest city (Paso Robles) overlying the basin is estimated at 30,857 (American Community Survey, 2013). Additionally, the basin serves 29% of the population of San Luis Obispo County (Paso Robles GWMP, 2011) - adding an additional 80,168 people to the groundwater users (ACS, 2013). This increasing pressure on the basin is exacerbated by the rapidly growing agricultural industry- as of 2011, agriculture accounted for 67% of groundwater use (Paso Robles GWMP).

What is most unique about the Paso Robles case is the speed with which the overdraft crisis precipitated; at the time the GWMP was written, the basin was not in overdraft, but within two years over 100 groundwater users' wells had gone dry (Janney, 2014). In the CASGEM prioritization process, DWR identified Paso Robles as the highest level of concern, and an Urgency Ordinance was issued in 2013 banning any new housing development or irrigated agriculture unless the water use was offset by an equal amount of conservation (Sneed, 2015). While this ordinance stalled the crisis, the basin remains in jeopardy and the Water District is seeking out supplemental sources of water.

2) Local Land Use Planning and Groundwater:

While the Paso Robles GWMP is a seemingly well put-together document, it suffers from the same errors made in most other GWMPs- a focus on technical interventions that may only have marginal results. The plan lists all the buzzwords: recharge, recycled water, efficient irrigation, conjunctive use, storage, banking, monitoring, public education, incentivized water conservation and demand management- though the latter is not discussed in detail.

An examination of the General Plans of the major jurisdictions overlying the basin- City of Paso Robles and County of San Luis Obispo- reveals a lack of planning for water resources. Neither the city nor county include the optional Water Resources Element into their general plans, even though water is a threatened resource in the area. Additionally, the Land Use Elements of those general plans do not mention water. San Luis Obispo County's General Plan does include an Agriculture Element, but as far as water planning goes, it only references increasing irrigation efficiency. An update is currently underway to the County General Plan, which will hopefully include more focus on water planning (SLO County website, Planning Department).

The Paso Robles Urban Water Management Plan also offers little direction for bringing the basin back into balance. Also produced by the City of Paso Robles, at the same time as the GWMP (2010), it reflects a similar outlook. The plan acknowledges that the basin will reach its perennial yield within the next few years, but does not perceive the imminent overdraft or plan for it, even though Todd Engineers, who authored the plan, citied the basin as having a LOS III (Level of Severity III)- the highest level of concern for depletion of groundwater (Paso Robles UWMP, 2011). But again, the interventions remain standard and technical and no proactive approach is put in place to stall the impending crisis.

3) Lessons Learned:

The major lesson learned in this case study is clearly that a document detailing problems and potential solutions is not enough- real action must be taken. For Paso Robles, that action did not come until after over a hundred residents had their wells dry up in the summer of 2013 (Janney, 2014). The Urgency Ordinance requiring that all new development (residential or agricultural) be offset by equal water conservation helped to stall the decline in groundwater elevation. However, when it was time for the San Luis Obispo board of supervisors to vote on a replacement measure, they did not. This means that as of August 2015, unregulated development and pumping can resume unimpeded (Sneed, 2015). This failure of governance highlights a few major lessons:

a) Partnership at the County level is crucial.

Having a strong support for groundwater conservation efforts at the County level is essential because for most basins, the County has jurisdiction over at least part of the area and will need to enact legislation. In San Luis Obispo, the county itself actually should have a GWMP in place, as the city of Paso Robles and the Water District cover only a small fraction of the land overlying Paso Robles Basin. There is a strong local lobby land rights, PRIOR (Paso Robles Imperiled Overlying Rights), but overdraft eventually effects everyone so the County needed to come up with a solution. Instead, the San Luis Obispo Supervisors have consistently avoided difficult decisions, letting overdraft worsen (Sneed, 2015). A solution had been proposed to replace the urgency ordinance upon its expiration which would have banned new agricultural plantings in areas with at-risk groundwater elevation unless it was offset by an equal amount of water conservation- but lack of support by the Supervisors led to a lack of any plan whatsoever (Sneed, 2015).

b) The DWR has not set clear, consistent standards.

The Department of Water Resources is clearly overburdened, with 515 groundwater basins in the State to contend with, over 127 of which are currently imperiled. However, the level of oversight for individual GWMPs is not sufficient. Using Paso Robles as only one example, the basin plan was read and approved, but it still caused rapid declines in groundwater. Given that the Department desires to see as much local control of the basins as possible, some type of consistent expectation for the content and implementation of groundwater plans needs to be in place. This is especially true given the upcoming wave of Groundwater Sustainability Plans that will need to be even more stringent to achieve basin balance in multiple regions.

c) Supplementing is not a long-term solution.

Perhaps the most salient take-away from the Paso Robles example is that supplementing groundwater does not prevent groundwater levels from declining. Even given increased supply of 17,500 AFY of water from Lake Nacimiento, which arrived in 2011 (at the time of the GWM plan completion), groundwater levels continued to drop. The cost of this project was an astounding $176 million and it took 40 years to complete (City of Paso Robles website, 2015). Investments like these are being made all over the state at enormous cost to residents and, in cases like Paso Robles, they ultimately fail to prevent groundwater depletion. Human development is very thirsty, and when given supplemental water, we will drink it up and ask for more.

INDIAN WELLS VALLEY GROUNDWATER BASIN

1) Basin Basics:

Indian Wells Valley (basin 6-54) was the only aquifer with a Basin Relevance Factor of 4, signifying that it had all the same constraints as Borrego Valley- being inland, having agriculture or golf, being adjudicated, and lacking in surface or imported water. Being relatively small, with a population of approximately 31,120 (Indian Wells Valley UWMP, 2011), and having a desert climate with summer temperatures above 100 degrees Fahrenheit, it is too small to negotiate expensive shares of imported water and too hot and dry to have available surface water. Given that the basin is in "critical" overdraft and pumping is three to five times greater than basin yield (Todd Engineers, 2014), this creates a situation in which the interventions applied must be effective, as there are is no possible "Plan B" available.

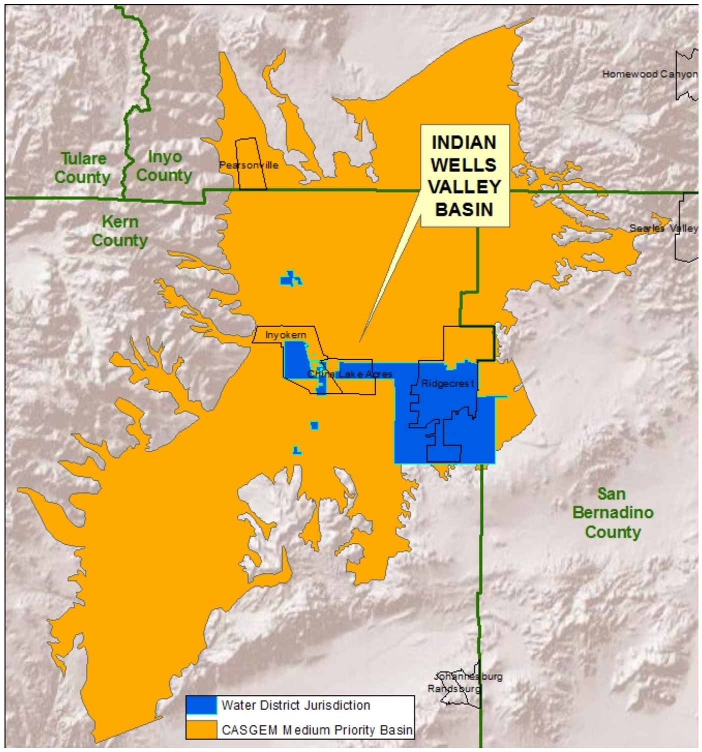

Figure 4

Figure 4 [above] shows that most of the basin is not currently being serviced by a water district. This is particularly problematic, because there is currently not a full GWMP in place, but only a cooperative agreement from the major parties in the area to write one. All that currently dictates water planning in the area is the Indian Wells Valley Water District's UWMP. The district is made up of mostly residential customers, whose water consumption within the district jurisdiction accounts for 78% of all water use (IWV UWMP, 2011). However, a study by Todd Groundwater shows that most of the total water consumption in the basin is agricultural- just outside the boundaries of the water district (Bodine, 2014).

2) Local Land Use Planning and Groundwater:

The GWMP for Indian Wells Valley is incomplete in its current format, reflecting a lack of prior planning for groundwater resources. However, a benefit to the smaller size of the area is that multiple signatories are party to the plan (IWV GWMP, 2006). These parties include:

- Naval Weapons Station, China Lake
- Kern County Water Agency
- City of Ridgecrest
- Inyokern Community Services District
- Indian Wells Valley Water
- Searles Valley Minerals
- Eastern Kern County Resources Conservation District
- Indian Wells Valley Airport
- Bureau of Land Management
- Quist Farms
- County of Kern, CA.

Though the plan has a limited scope in its current incarnation, the commitment to interagency cooperation by the above parties is an encouraging sign for future cooperation. These parties make several agreements to stall overdraft, including limiting additional large-scale pumping in threatened areas, in addition to developing capacity for basin management, water reuse, monitoring network, and water conservation and education programs. While these are some of the same suggestions made in other GWMPs, here the plan is too introductory to critique, as no real interventions or modes of implementation have yet been proposed. Because the GWMP is not yet complete, the three existing documents guiding groundwater management in the area are the Indian Wells Valley Water District UWMP, and the General Plans for the City of Ridgecrest and the County of Kern.

The Urban Water Management Plan is limited in its capacity to completely address water resource protection because the service area of the Water District is limited and the agricultural area is outside that service area. However, the plan's contents reflect an awareness of the need to have contingency plans in place for water shortage, and does set allotment methods for that shortage. The methods include phased stages of graduated intensity for when various types of consumption reduction would begin (IWV UWMP, page 51). Outside of this important component, the plan mostly discusses research and rollout for technical solutions such as recycled water, reclamation, demand management, etc.

The City of Ridgecrest's General Plan addresses water throughout the Land Use and Open Space and Conservation Element. This is one of the only land use elements to expressly consider the impact of development on the overall availability of water, and not just the availability of water on for development-oriented goals (LU-10.13. City of Ridgecrest General Plan, 2009). The element affirms that the city will adopt the goals of the UWMP, and will investigate various technical methods of conservation support, such as: recycled water, wastewater reclamation, efficient fixtures, xeriscaping, and reduction of impervious surface. However, despite the inclusion of water-saving methods, the city is planning to build aquatics complex and golf course by 2028, in addition to promoting golf-oriented residential (LU-2.10). These future land uses, however beneficial to the community, are inconsistent with the critical condition of groundwater in the valley.

The Kern County General Plan covers too large an area to be of practical application to land use planning in areas overlying Indian Wells Valley. It currently does not have a specific plan for the area, but is researching zoning changes to support reduction in overdraft (Bodine, 2014.) The counties of San Bernardino, Inyo, Tulare counties also overlap the basin but it is a marginal area and there are no census-designated places in those counties overlying the Indian Wells Valley Basin, so their land use policies are less relevant to this case.

3) Lessons Learned:

The still-evolving case of Indian Wells Valley groundwater basin is highly relevant to Borrego Spring's situation. Currently having no ability to import water and relying solely on groundwater, the overlying population must be highly innovative with overdraft interventions. An excellent and thorough report by Todd Engineers for the Kern County Department of Planning found that without water importation, the population overlying the basin could not maintain its current land uses. Further investigation of this statement shows that agricultural water could represent 130,000 AFY in groundwater usage out of a total 165,000 AFY throughout the basin. If Kern County and other relevant planning bodies operating in the basin decided not to import water, it would mean fallowing agricultural land and rezoning (Todd Engineers, 2014. page 45). Given that imported water will be very expensive and might not be available at all, Kern County must engage with the community as well as the City of Ridgecrest to create a Specific Plan for the area (none is currently in place) that will determine a path for the water-stressed population to regain basin balance and re-envision their community's future.

IX. Discussion

The findings in both the wide analysis of the CASGEM high- and medium-priority basin Groundwater Management Plans and the in-depth case studies of Coachella Valley, Paso Robles, and Indian Wells Valley point to the resounding conclusion that technical, supply-side interventions are insufficient to bring over-drafted basins back into balance. From the wide analysis, we can see that even though the average plan has been in place since 2005 and fewer than a fifth of the plans were updated after 2010 (calculated from dates on DWR website), the basins were not categorized by CASGEM until 2014, in that time not one of the plans managed to either prevent to curb overdraft. If well monitoring data were made publically available, it would help to understand the trend with more precision. However, it stands to reason that interventions that have not worked yet for GWM plan in place since 1990, will not work for the plan just now implementing them. The definition of insanity is doing the same thing over and over again while expecting different results (quote: Albert Einstein).

There is a wealth of research supporting the claim that in order to effectively address groundwater sustainability, technological innovation is not enough, land use changes must be made. *Water in the West,* a periodical by Stanford University is a highly relevant and thoughtful series on water management in California. In September 2013, the forum had a meeting with lead scientists, lawyers, consultants, NGOs, academics, land use planners and basin managers. The resulting consensus was that development in an area should be tailored to water availability, and this should be accomplished by requiring all general plans in the state to include a water element with specific linkage between land use and water use (Janney, 2014). As novel as this approach might seem, it is hardly a new idea. Among a number of articles citing the need for greater connection between land use and groundwater management (McKinney, 2003; UNM, 2010; Hanak et. al. 2014; Hanson, 2010)., the Environmental Law Institute in conjunction with the American Planning Association and other organizations held a conference as early as February 2003 exploring land use and water consumption, titled "Wet Growth: Should Water Law Control Land Use?". New legislation in the form of the Sustainable Groundwater Management Act of 2014

mandating Groundwater Sustainability Plans finally requires a link between land use and groundwater quantity (Staples, 2014). But given the history of avoiding the confrontational choices behind land use planning for groundwater conservation, the battle is likely to have just begun.

X. Recommendations

1) Borrego Springs must advocate for San Diego County to implement local land use planning that is consistent with water supply.

From the results of the Groundwater Management Plan analysis and the case studies, it is clear that the current technical interventions in the field groundwater management are inadequate without corresponding land use changes. This reality, coupled with the inability of the town to import water, indicate that San Diego County and Borrego Springs should evaluate what land uses the town can sustain.

Given that agricultural land accounts for 70% of Borrego's groundwater use, the simplest solution would be to fallow the land, if a reasonable strategy can be devised for agricultural landowners to cease production and be equitably compensated. The Groundwater Sustainability Plan that is to be written over the next few years should include a distinct focus on demand-side planning interventions as part of land use planning for groundwater sustainability. Some supply-side techniques- such as recycled water treatment, greywater use, and basin infiltration and injection- should be also considered so long as they are time and cost efficient for Borrego.

2) San Diego County should include a Water Element in its General Plan.

A review of both literature and policy (LU Element, Conservation Elements, UWMP) documents displays the intense focus on technical solutions to avoiding or reducing groundwater overdraft. This indicates a strong bias toward supply-side management measures and may not be the best approach in general for water conservation, in particular for Borrego Springs. However, because Borrego is an unincorporated town, San Diego County must take the lead to officially link land use and water resource management. The Borrego Water Coalition should consider advocating this position with the County to secure the Borrego Valley's groundwater sustainability.

3) The Borrego Water District and San Diego County should petition for the Department of Water Resource to re-define the Borrego Basin as defined in DWR's Bulletin 118 into sub-basins.

The wide analysis of Groundwater Management Plans demonstrated that when multiple jurisdictions are involved in the planning for a basin, it can lead to confused priorities and conflicting goals. In the Central Valley, for example, sub-basins have many GWMPs each and some advocate land use and water resource planning integration, while others are focused on maintaining water rights and still others are simply implementing as many technological stalls as possible.

For the community of Borrego Springs, having as much local control over its water future is advisable. Officially re-defining the sub-basin will support clarity of management efforts, whether this is accomplished by the Borrego Water District or with the County.

4) Borrego Springs should consider marketing itself an geotourism destination.

While some types of seasonal tourism can create increased demand for water (such as it has for parts of Coachella Valley), geotourism specifically promotes low-impact travel. Because of its raw natural beauty, unique location in the center of Anza-Borrego State Park, and proximity to other burgeoning tourism destination towns such as Julian and Ramona, Borrego Springs is an easy candidate for a worldwide destination for the increasingly-conscientious traveler. Promoting geotourism in the area will also help bring much-needed services into town.

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Appendix A: Planning Intervention Matrix

Region	Basins North-South	Basin Relevance Factors: Coastal/ Inland	Agriculture /Golf	Adjudicated/ Unmanaged	Imported /Surface Water	Basin Total Relevance	Interventions: Technical & Engineering: supply side	Technical & Engineering: demand side	Behavioral & Planning: supply side	Behavioral & Planning: demand side	Other Comments
NORTH COAST	1-01 SMITH RIVER PLAIN (NOT AVAILABLE)										
	1-02.01 KLAMATH RIVER VALLEY (NC3)	1	1	1	0	3	multi-party monitoring, study of recharge and storage	-	permit for well changes	improve public understanding of how agriculutre uses wells and irrigation, permit for groundwater export	Introductory plan mostly seeming to affirm legal rights and cite need for further study. However, there was a "Demand-side Management" section about improving agricultural efficiency practices that could reduce water use.
	1-02.02 KLAMATH RIVER VALLEY (NC3)	1	1	1	0	3					
	1-03 BUTTE VALLEY (NC3)	1	1	1	0	3					
	1-04 SHASTA VALLEY (NC3)	1	1	1	0	3					
	1-05 SCOTT RIVER VALLEY (NC3)	1	1	1	0	3					
	1-10 EEL RIVER VALLEY (NOT AVAILABLE)										
	1-52 UKIAH VALLEY (NOT AVAILABLE)										
	1-55.03 SANTA ROSA VALLEY (NOT AVAILABLE. SWA responsibility?)										
	1-55.01 SANTA ROSA VALLEY										
	1-55.02 SANTA ROSA VALLEY										
NORTH LAHONTAN	5-04 BIG VALLEY (NL2)	1	1	1	0	3	monitoring	-	well ordinance ordinances in place	include Natural Resource Element in general plan	GWMP reads like a science report. Focus is on geological features.
	5-12.01 SIERRA VALLEY (NOT AVAILABLE)										
	5-12.02 SIERRA VALLEY (NOT AVAILABLE)										
	6-67 MARTIS VALLEY (NL3)	1	1	1	0	3	monitoring, evaluate need for interventions consider recharge, storage, water recycling (map GW recharge zones)	-	-	consider water conservation, continue public education	First goal is to manage groundwater to maintain established and planned uses (no land use changes). Business as usual with well ordinance. Tahoe/Truckee surface water settlement in place.
	6-05.01 TAHOE VALLEY (NOT AVAILABLE)										
	6-05.02 TAHOE VALLEY										
	6-05.03 TAHOE VALLEY										
	6-07 ANTELOPE VALLEY (NOT AVAILABLE)										
SACRAMENTO RIVER	5-06.01 REDDING AREA (SR26 and SR1)	1	1	1	0	3	(SR-1) monitoring (SR-26) monitoring	-	(SR-1) interagency cooperation, conjunctive use, well ordinance (SR-26) conjunctive use, well ordinance	(SR-1) stakeholder cooperation and public outreach. (SR-26) public information and education. (SR-26) export limitations	(SR-1) Only serves agricultural users [no municipal or industrial users]. GW use is "minimal" at present but expected to increase. No mention of water recycling (pg 2-7 has brief mention of "re-diversion and resuse" but it is referring to a right to charge). Claims to not be in overdraft. (SR-26) No mention of recycling, reclamation, storage, banking, spreading basins, injection, or any other technical intervention. Claims to not be in overdraft.
	5-06.02 REDDING AREA (SR26)	1	1	1	0	3					
	5-06.06 REDDING AREA (SR26)	1	1	1	0	3					
	5-06.03 REDDING AREA (SR26 and SR1)	1	1	1	0	3					
	5-06.05 REDDING AREA (SR26)	1	1	1	0	3					
	5-06.04 REDDING AREA (SR26 and SR1)	1	1	1	0	3					
	5-21.66 SACRAMENTO VALLEY (SR7/SR27/SR1	1	1	1	0	3	monitoring, artificial recharge, balancing wells, increase imported/surface water use, water storage, wastewater reclamation, water banking	efficient irrigation, landscaping, fixtures	conjunctive use, interagency cooperation, recharge area protection	public education, water waste prohibition, limits on exportation	**(SR9)** Some discussion of storage. **(SR29)** Issue of concern- protection of private groundwater rights. No current plans to tax groundwater use. [Many of the plans seem to indicate that most of the cropland is irrigated by surface water- perhaps its availability reduces the pressure to conserve GW]. **(SR3)** Ag demand 71% of water demand in Butte County, with conveyance loss 2nd at 15%. Demand decreased with water conservation, Ag land conversion, and crop idling. **(SR29)** Ag land predominant in Sutter County. **(SR3)** Increased ag efficiency. Butte County resource protection ordinances [stating that the board does not intend to regulate use of GW]. **(SR2)** Knows of no overdraft conditions; encourages GW replenishment [common thread in irrigation district plans]. Any discussion of fallowing centers around water transfer programs **(SR 14, 18, 20, 23, 24, 30)**. A few plans did note that fallowing had been used successfully at some point, generally before imported water became heavilty relied-upon **(SR10, 28)**. Plans in this region, especially those written by irrigation districts, were especially careful to be explicit that extractions would not be reduced except under emergency circumstances (though little or no detail was given about what might constitute an emergency).
	5-21.65 SACRAMENTO VALLEY (SR24)	1	1	1	0	3					
	5-21.67 SACRAMENTO VALLEY (SR35/SR8/SR5	1	1	1	0	3					
	5-21.68 SACRAMENTO VALLEY (SR35)	1	1	1	0	3					
	5-21.64 SACRAMENTO VALLEY (SR25/SR18/SR	1	1	1	0	3					
	5-21.61 SACRAMENTO VALLEY (SR36)	1	1	1	0	3					
	5-21.62 SACRAMENTO VALLEY (SR29/SR30/SR	1	1	1	0	3					
	5-21.60 SACRAMENTO VALLEY (SR3 and SR36)	1	1	1	0	3					
	5-21.59 SACRAMENTO VALLEY (SR3/SR32/SR2	1	1	1	0	3					
	5-21.58 SACRAMENTO VALLEY (SR9/SR32/SR3	1	1	1	0	3					
	5-21.52 SACRAMENTO VALLEY (SR9/SR37/SR19/SR13/SR17/SR14/SR 10/SR20/SR34)	1	1	1	0	3					
	5-21.51 SACRAMENTO VALLEY (SR31 and SR14	1	1	1	0	3					
	5-21.57 SACRAMENTO VALLEY (SR31 and SR3)	1	1	1	0	3					
	5-21.56 SACRAMENTO VALLEY (SR31)	1	1	1	0	3					
	5-21.55 SACRAMENTO VALLEY (SR31)	1	1	1	0	3					
	5-21.54 SACRAMENTO VALLEY (SR31)	1	1	1	0	3					
	5-21.53 SACRAMENTO VALLEY (SR31)	1	1	1	0	3					
	5-21.50 SACRAMENTO VALLEY (SR31 and SR11	1	1	1	0	3					
	5-64 BEAR VALLEY (SR9)	1	1	1	0	3					
	5-14 SCOTTS VALLEY (SR15)	1	1	1	0	3	monitoring	-	interagency cooperation, stakeholder participation, recharge area protection, well policy, conjunctive use	-	Section 2.2 identifies GW as main source of Ag irrigation (Big Valley most Ag in county). Section 2.5 "Agricultural Water Demand by Groundwater Basin (clearly an emphasis/at least awareness of LU-GW connection). Conservation and water recycling not mentioned.
	5-15 BIG VALLEY (SR15)	1	1	1	0	3					
SAN FRANCISCO BAY	2-02.03 NAPA-SONOMA VALLEY (NOT AVAILABLE- Napa Jurisdiction)										
	2-02.02 NAPA-SONOMA VALLEY (SF2)	0	1	1	0	2	monitoring, water import, recycling, wastewater treatment, conjunctive use, recharge/injection, storage, banking	efficient fixtures, residential retrofit, landscape programs	well ordinance	public education,conservation pricing, conservation coordinator, water waste prohibition, landscape incentives, smart irrigation rebate	No mention of fallowing or land use.
	2-02.01 NAPA-SONOMA VALLEY (NOT AVAILABLE- Napa Jurisdiction)										
	2-01 PETALUMA VALLEY (NOT AVAILABLE. SWA responsibility?)										
	2-10 LIVERMORE VALLEY (SF3)	1	1	1	0	3	monitoring, import, recycling, wastewater reclamation, recharge/injection, storage	efficient fixtures	conjunctive use, well ordinance	-	No mention of public education. A lot of focus on monitoring and recharge techniques. Little emphasis on conservation (outside some small mention of efficient fixtures)
	2-9.02 SANTA CLARA VALLEY (SF1)	0	1	1	0	2	managed/in-lieu recharge, backup supply/storage, stormwater management, recycled water irrigation, water monitoring/accounting	efficient fixtures	interagency coordination, conjunctive use	public outreach, water conservation incentives, well ordinance program	Conserve and manage water for beneficial and purposes, including spreading, storing, retaining, and groundwater recharge. Protect, save, store, recycle, distribute, transfer, exchange, manage, and conserve water. (Pg 4-1)
	2-9.03 SANTA CLARA VALLEY (SF1)	0	1	1	0	2					
	2-9.01 SANTA CLARA VALLEY (SF1)	0	1	1	0	2					
	2-9.04 SANTA CLARA VALLEY (SF1)	0	1	1	0	2					
SAN JOAQUIN	5-22.05 SAN JOAQUIN VALLEY (SJ2)	1	1	1	0	3	monitoring, artificial recharge, balancing wells, increase imported/surface water use, water storage, wastewater reclamation, water banking	efficient irrigation, landscaping, fixtures	conjunctive use, interagency cooperation, recharge area protection	public education, water waste prohibition, limits on exportation, **fallowing/water transfers/low-water crops/limiting pump extections	**(SJ20)** South basin supplies 93 percent of total agricultural and urban demand. Reclaimed water accounts for only 2 percent. **(SJ1)** Section 2.4 on Land Use and Demand is unique. No proposed policies, but connection is acknowledged. **(SJ10)** refereces land use/quantity connection, especially in regard to crop type. **(SJ17)** Actually is IRWMP. Section 3.2.3.6 Influcence of Land Use on Water Use is relevant, supports planning agencies in considering water availabilit impact of proposed developments. **(SJ18)** Frequent mention of land use, but no corresponding policy proposed. **(SJ12)** **Offers no technical interventions, but has detailed land fallowing/water transfer program. **(SJ19)** **Has overdraft mitigation section and discusses fallowing, low-water crops, land retirement and limiting pump extractions.
	5-22.06 SAN JOAQUIN VALLEY (SJ19/SJ6/SJ5/S	1	1	1	0	3					
	5-22.04 SAN JOAQUIN VALLEY (SJ8)	1	1	1	0	3					
	5-22.03 SAN JOAQUIN VALLEY (SJ18)	1	1	1	0	3					
	5-22.07 SAN JOAQUIN VALLEY (SJ14 and SJ 12)	1	1	1	0	3					
	5-22.02 SAN JOAQUIN VALLEY (SJ17)	1	1	1	0	3					
	5-22.15 SAN JOAQUIN VALLEY (SJ4/SJ3/SJ13)	1	1	1	0	3					
	5-22.01 SAN JOAQUIN VALLEY (SJ10/SJ9/SJ15/	1	1	1	0	3					
	5-22.16 SAN JOAQUIN VALLEY (SJ20/SJ16/SJ10	1	1	1	0	3					
TULARE LAKE	5-22.14 SAN JOAQUIN VALLEY (TL20/TL11/TL2	1	1	1	0	3	monitoring, artificial recharge, balancing wells, increase imported/surface water use, water storage, wastewater reclamation, water banking	efficient irrigation, landscaping, fixtures	conjunctive use, interagency cooperation, recharge area protection	public education, water waste prohibition, limits on exportation	**(TL1)** Is authored by irrigation district and in section 5.2.4 calls urban development incompatible with water supply. Section 5.2.6 calls for protection of agricultural economy and land uses. **(TL11)** mentions that a decrease in temporary fallowing and a relative increase in irrigated crops has contributed to overdraft. **(TL17)** notes a connection between land use and groundwater demand. **(TL8)** Is a regional plan. Notes change in land use over time to increasing urban development. **(TL13)** Is careful not to propose wide change to land use, but does suggest "land-use planning goals that can aid in protecting and preserving resources." **(TL9, 14, 23, 28)** acknowledged that croppping changes or land fallowing could reduce demand, but either did not offer any details or commitments (TL14, 23, 28) or did not consider them because of "adverse economic impacts"(TL9). **(TL13, 22, 26)** note historical effectiveness of fallowing or shifting to lower water-demand crops in addressing past water shortages, but none of the plans make suggestions for implementing such programs.
	5-22.10 SAN JOAQUIN VALLEY (TL25 and TL23)	1	1	1	0	3					
	5-22.13 SAN JOAQUIN VALLEY (TL6/TL7/TL12)	1	1	1	0	3					
	5-22.12 SAN JOAQUIN VALLEY (TL28/TL13/TL2	1	1	1	0	3					
	5-22.11 SAN JOAQUIN VALLEY (TL12 and TL22)	1	1	1	0	3					
	5-22.09 SAN JOAQUIN VALLEY (TL25)	1	1	1	0	3					
	5-22.08 SAN JOAQUIN VALLEY (TL28/TL1/TL17	1	1	1	0	3					
	5-27 CUMMINGS VALLEY (TL3)	1	1	0	0	2	metering and monitoring	efficient fixtures	-	public education and outreach, conservation pricing, water waste prohibition	Was potential candidate for case study. Local general plan is in progress that has some land use diagrams, but does not give complete indication of whether water resources will be considered.
	5-28 TEHACHAPI VALLEY WEST (TL3)										
SOUTH LAHONTAN	6-81 BUTTE VALLEY (NOT AVAILABLE)										
	6-54 INDIAN WELLS VALLEY (SL1)	1	1	1	1	4	exlpore portential for water mgmt programs and monitoring. encourage use of recycled, retreated, reclaimed, gray and lower quality water where possible. well balancing	-	Develop interagency mgmt structure.	limit additional large scale pumping in areas that are adversely impacted. Pursue development of water conservation and education programs.	Incomplete GWMP. Primarily to establish cooperative agreement among agencies to explore solutions to overdraft.
	6-12 OWENS VALLEY (SL2)	1	1	1	0	3	monitoring, well locations	-	vegetation management	Several Measures included for determining impact of export on pumping areas, including degree and attributability.	Is more an agreement for Inyo County to supply LA than for any real techniques to curb or prevent overdraft. Perhaps this exportation is why the aquifer is in trouble.
	6-44 ANTELOPE VALLEY (NOT AVAILABLE)										
	6-40 LOWER MOJAVE RIVER VALLEY (SL4)	1	1	0	0	2	monitoring, find additional supply, recycling, wastewater treatment, recharge/injection, spreading basins, storage	-	conjunctive use, buffer zones	public education and outreach	Also is their IRWMP and UWMP. Brief mention of fallowing on pg 4/3-5. Seems cursory and not actual suggestion. Acknowledgement of LU/supply connection (Review LU Plans as action item, pg 10-16; Land Use Planning, Appendix H-19)
	6-42 UPPER MOJAVE RIVER VALLEY (SL4)	1	1	0	0	2					
	7-12 WARREN VALLEY (SL4)	1	1	0	0	2					
	6-43 EL MIRAGE VALLEY (SL4)	1	1	0	0	2					
	8-09 BEAR VALLEY (NOT AVAILABLE- should be part of MWA?)										
CENTRAL COAST	3-27 SCOTTS VALLEY (CC5)	1	1	1	1	4	monitoring, recharge, wastewater reclamation, recycled water	-	-	-	Outdated. Some focus on an environmental threat to the GW quality. But plan was written by engineers and has a distinctly technical focus.
	3-23 UPPER SANTA ANA VALLEY (NOT AVAILABLE)										
	3-03.04 GILROY-HOLLISTER VALLEY (CC8)	1	1	1	0	3	water banking/storage (both in and out of basin), wasterwater reclamation, conveyance facilities, control runoff (via tile drains/wetlands), recycled water/recharge, data/monitoring, water transfers	increased agricultura/residential efficiency	well ordinance, protect recharge areas	water conservation, public outreach and education	Some focus on land use- right away, major overlying land uses above each sub basin are identified. Surface imported water might only be available in "wet" years going forward due to CVP contract. More fluff langugage: "Objectives should be legal and affordable". Project Toolbox Elements. Issue with banking is it sometimes leaves less basin space for natural recharge; identifying recharge areas is important. Issue with recycled water is high TDS concentration. Project time/cost estimates helpful
	3-03.02 GILROY-HOLLISTER VALLEY (CC8)	1	1	1	0	3					
	3-03.03 GILROY-HOLLISTER VALLEY (CC8)	1	1	1	0	3					
	3-03.01 GILROY-HOLLISTER VALLEY (CC8)	1	1	1	0	3					
	3-01 SOQUEL VALLEY (CC6)	0	1	0	0	1	local only desalination (w/ City of Santa Cruz), import/banking (PVWMA), enhance/protect recharge, water storage, monitoring (uniformity among all agencies), recyceld water (incl. on-site), outreach for private pump data, metering	water conservation (retrofit, landscape, fixtures, etc.)	Private Well Incentive Policy (to stop pumping & connect to municipal supply)	public education, conservation pricing/commodity rates, restrict land use for quality	interagency coordination. Limited ability to distribute wellfields. Jurisdictional boundary maps helpful. BMO 1-1: Pump within the Sustainable Yield (unique goal hasn't been seen yet- targets role of demand in overdraft reduction). A lot of "support _'s efforts" and "continue to_". Section 5, element 4: coordination w/ County of Santa Cruz for land use regulation w/in primary recharge areas. (See Section 5 for specific conservation measures/suggestions). *Section 6.1 framing of JPA never made for GWMP implementation, and must be rewritten to include this capacity.
	3-21 SANTA CRUZ PURISIMA FORMATION (	1	1	0	0	2					
	3-26 WEST SANTA CRUZ TERRACE (CC6)	0	1	0	0	1					
	3-02 PAJARO VALLEY (CC6)	0	1	0	0	1					
	3-07 CARMEL VALLEY (NOT AVAILABLE)										
	3-04.09 SALINAS VALLEY (CC3)	1	1	1	0	3	monitoring, recycled water	irrigation efficiency	well ordinance, agency relationships, recharge area management	public education, mandatory urban conservation	Plan very general. Means to objectives not very clear or specific. Mandatory urban water conservation methods in place but very little focus on reduction of agricultural water use (outside of irrigation efficiency). No mention of fallowing.
	3-04.05 SALINAS VALLEY (CC3)	1	1	1	0	3					
	3-04.04 SALINAS VALLEY (CC3)	1	1	1	0	3					
	3-04.10 SALINAS VALLEY (CC3)	1	1	1	0	3					
	3-04.08 SALINAS VALLEY (CC3)	0	1	1	0	2					
	3-04.02 SALINAS VALLEY (CC3)	1	1	1	0	3					
	3-04.01 SALINAS VALLEY (CC3)	0	1	1	0	2					
	3-04.06 SALINAS VALLEY (CC9)	1	1	1	0	3	monitoring, increasing imported water, recycling, wastewater treatment, recharge/injection, storage, banking	increased agricultural efficiency	well ordinance, conjunctive use	(incentivized) water conservation, demand mangement, public education, land use regulation preventing increased use, identify Low Impact Development (LID) opportunities	Agricultural uses are 67% of pumpage. (See Land Uses and Water Demands within Plan Area, pg 34) pg 46 has useful Implementation Table. The water conservation focuses on "feasible" measures. Section 5.5 Water Demand Management and Conservation pg 86.
	3-36 SANTA ROSA VALLEY (NOT AVAILABLE)										
	3-08 LOS OSOS VALLEY (NOT AVAILABLE)										
	3-09 SAN LUIS OBISPO VALLEY (NOT AVAILABLE)										
	3-12 SANTA MARIA (NOT AVAILABLE. Legal Ruling 2012- See Dunn et al)										
	3-14 SAN ANTONIO CREEK VALLEY (NOT AVAILABLE)										
	3-13 CUYAMA VALLEY										
	3-15 SANTA YNEZ RIVER VALLEY (CC4)	0	1	1	0	2	monitoring, recharge, wastewater reclamation, recycled water	efficient landscape, fixtures	conjunctive use	water conservation measures (incentives, conservation awards)	Outdated.
	3-16 GOLETA (CC2)	0	1	0	0	1	monitoring, import, well ordinance	recycling, wastewater treatment, conjunctive, recharge, spreading basins, storage	-	interagency cooperation	Very technical. No mention of water conservation or demand management methods. Plan clearly limited by single author and adjudication circumstances.
	4-02 OJAI VALLEY (SC7)	1	0	1	0	2	artificial recharge, monitoring, wastewater reclaimation	-	-	public outreach and education	No mention of land use. GP outdated
	4-3.02 VENTURA RIVER VALLEY (NOT AVAILABLE)										
	4-3.01 VENTURA RIVER VALLEY (NOT AVAILABLE)										
	4-4.02 SANTA CLARA RIVER VALLEY (SC6)	0	1	1	0	2	recycled water, injection/recharge, spreading basins, surface		protect recharge sources, expand	limitation of groundwater extraction, voluntary	"A portion of the decrese in agriculutral pumping [from 1985-2005] can also be attributed to land conversion to urban uses." Pg. 17 "An analysis of changes in land use during the period between... 1998 and 2002 indicates that about 1150 acres converted
	4-4.03 SANTA CLARA RIVER VALLEY (SC6)	0	1	1	0	2					
	4-4.04 SANTA CLARA RIVER VALLEY (SC6)	1	1	1	0	3					

Region	Basins North-South		Basin Relevance Factors: Coastal/ Inland	Agriculture /Golf	Adjudicated/ Unmanaged	Imported /Surface Water	Basin Total Relevance	Interventions: Technical & Engineering: supply side	Technical & Engineering: demand side	Behavioral & Planning: supply side	Behavioral & Planning: demand side	Other Comments
SOUTH COAST	4-4.05	SANTA CLARA RIVER VALLEY (SC6)	1	1	1	0	3	recycled water, injection/recharge, spreading basins, surface water/import, monitoring/metering, storage	-	protect recharge sources, expand outcrop buffer zone	urban/agricultural conservation, pumping restrictions/penalties to purchase replacement water	from agriculture to M&I [municipal and industrial]...that represents about 2,300 AFY of allocation to M&I." Pg 18. "This modeling indicsted that when all current projects...are operational, there will still be an overdraft in the basins w/in the agency." pg. 52. No mention of fallowing.
	4-4.06	SANTA CLARA RIVER VALLEY (SC6)	1	1	1	0	3					
	4-06	PLEASANT VALLEY (SC6)	0	1	1	0	2					
	4-08	LAS POSAS VALLEY (SC6)	0	1	1	0	2					
	4-07	ARROYO SANTA ROSA VALLEY (Camro	0	1	1	0	2	monitoring, water import, recycling, wastewater treatment, recharge/injection, storage	-	stakeholder involvement, interjurisdictional involvement, conjuctive use, well ordinance	-	DWR name is "Arroyo Santa Rosa". Basin plan refers to "Santa Rosa Basin" which could be confused. No focus on water conservation or demand management.
	4-4.07	SANTA CLARA RIVER VALLEY (SC1)	1	1	1	0	3	Recycling, wastewater treatment, storage, banking, monitoring, imported water	efficient fixtures/landscape	conjuncitve use, recharge area management, interagency coordination/conservation coordinator, well ordinance	public education, conservation pricing	-
	4-11.03	COASTAL PLAIN OF LOS ANGELES (SC1	0	0	0	0	0	monitoring, increase import, balanced basin pumping, protect recharge, capture runoff, incl. offshore reservoir,increased recycled water, spreading basins, banking	-	facilitate inter district coordination, conjunctive use	-	Outdated. Surprising for such a major metropolitain area
	4-11.04	COASTAL PLAIN OF LOS ANGELES (SC1	1	0	0	0	1					
	4-11.01	COASTAL PLAIN OF LOS ANGELES (SC1	0	0	0	0	0					
	4-11.02	COASTAL PLAIN OF LOS ANGELES (SC1	1	0	0	0	1					
	4-12	SAN FERNANDO VALLEY (NOT AVAILABLE)										
	4-23	RAYMOND (NOT AVAILABLE)										
	4-13	SAN GABRIEL VALLEY (NOT AVAILABLE)										
	8-01	COASTAL PLAIN OF ORANGE COUNTY (SC8)	0	1	1	0	2	monitoring, recharge, storage	efficient landscape, fixtures	-	public education, water conservation (very limited)	Very very technically-focused document. While it is clear that the feats of engineering and technology are significant for the OCWD, there is very little discussion of curbing demand or tailoring land use. Land use exclusively discussed in context of GW quality.
	8-02.03	UPPER SANTA ANA VALLEY (SC18) (SC	1	1	1	0	3	recycled water, recharge, wastewater reclamation, desalter, imported water, monitoring, substitution of alternate supplies, well balancing	-	conjunctive use	conservation measures	Agricultural to urban area. Adaptive management (1st mention). Cites potential need for enforcement mechanisms in the future (not now). Stakeholder and agency invovlement. *Interesting Governance section- includes both a MOU and JPA options at the basin level (as opposed to individual interest-based approach)
	8-02.06	UPPER SANTA ANA VALLEY (SC18) (SC	1	1	1	0	3					
	8-02.01	UPPER SANTA ANA VALLEY (NOT AVAILABLE)										
	8-02.02	UPPER SANTA ANA VALLEY (NOT AVAILABLE)										
	8-02.04	UPPER SANTA ANA VALLEY (NOT AVAILABLE)										
	8-02.05	UPPER SANTA ANA VALLEY (NOT AVAILABLE)										
	8-02.09	UPPER SANTA ANA VALLEY (SC3)	1	1	1	0	3	imported water, monitoring, recharge, wastewater reclamation, recycled water	-	coordination with agencies, conjunctive use	water conservation and demand management, public education, pumping limitations	Urbanization lead to decrease in agriculture in the city and environs. Runoff from Santa Ana mountains has decreased percolation into Temescal Subbasin. Plan refers to a Coldwater Subbasin and Bedford Subbasin (part of Elsinore basin 8-04), which are not identified by DWR. This could be a precedent for planning in Borrego b/c of subbasin definitions.
	8-02.08	UPPER SANTA ANA VALLEY (SC3)	1	1	1	0	3					
	8-02.07	UPPER SANTA ANA VALLEY (SC3)	1	1	1	0	3					
	8-04	ELSINORE (SC5) (See also SC3)	1	1	1	0	3	monitoring, injection, recharge, recycled water, wastewater reclamation, storage of imported water via dual purpose wells, spreading basins, develop new supply	efficient fixtures	stakeholder involvement	public education ("increased awareness") and financial incentives	Land use inclusions are focused on water quality/potential for adverse effects from development. No mention of LU as contributing factor in overdraft. Also mention of efficient landscaping and irrigation.
	8-05	SAN JACINTO (SC4)	1	1	1	0	3	reclamation, recharge, recycle, monitoring	-	conjunctive use	water conservation (as an older plan, the conservation is discussed as an institutional, rather than resident, responsibility). Also no mention of education.	Outdated.
	9-06	CAHUILLA VALLEY (NOT AVAILABLE)										
	9-04	SANTA MARGARITA VALLEY (NOT AVAILABLE)										
	9-07	SAN LUIS REY VALLEY (NOT AVAILABLE- See Rainbow MWD?)										
	9-05	TEMECULA VALLEY (NOT AVAILABLE)										
	9-10	SAN PASQUAL VALLEY (SC10)	1	1	1	0	3	monitoring, improving data, desalination & surface water in "put" and "take" periods to allow recharge	-	protection of recharge areas, increasing stakeholder involvement, interjurisdictional involvement	increasing cluster development	Unique approach to stakeholder involvement identified prime concerns and one by one described how and where in the GWMP those concerns were addressed. Only plan as to land use in the area is to "Participate in relevant land use planning updates." (Section 3, Land Use Planning)
	9-15	SAN DIEGO RIVER VALLEY (NOT AVAILABLE)										
COLORADO RIVER	7-21.01	COACHELLA VALLEY (CR3)	1	1	1	0	3	recharge, monitoring, water imports, recycled effluent/waste/agricultural water, wells balancing	increased efficiency	-	urban/agricultural/golf conservation, tiered rates, public outreach/education, wells capping/conversion programs	Section on "Relation to other planning efforts" is a useful tie between IRWMP, GWMP, adjudication agreements and conservation plan. A lot of focus since the 2002 plan has been on reducing in particular golf and ag water use; By 2009, usage was down 9.9% for Ag and 14 for golf. Pg 2-7 (see pg 2-9 for specifics on implementation). Population is growing much faster than Borrego- ag expectd to decrease but golf to increase. P 3-11. If pop grows and vacant land- not ag land- is converted to urban, water demand will be even higher. Overdraft continues. (BMPs, see pg 6-5, fallowing pg 6-15, Stakeholder involvement pg 6-45. *Future: pg 8-
	7-21.03	COACHELLA VALLEY (CR3)	1	1	1	0	3					
	7-21.04	COACHELLA VALLEY (CR3)	1	1	1	0	3					
	7-21.02	COACHELLA VALLEY (CR3)	1	1	0	0	2					
	7-52	PLEASANT VALLEY (NOT AVAILABLE)					0					

Note: For the review of Sacramento River, San Joaquin and Tulare Lake, many plans overlapped the same basin, or multiple basins and jurisdictions. To clarify trends, all interventions observed were noted and any exceptions were listed. Standout approaches are marked by the DWR plan code and discussed in the "Other Comments" column.

Greyed-out sections did not have a GWMP on file with the DWR.

Yellow-highlighted basins were chosen for in-depth case studies.