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Managing California's Water: A Look at the Sustainable Groundwater Management Act of 2014

Matt Brown

Abstract

Groundwater management in California lacked statewide regulations until the passage of the Sustainable Groundwater Management Act in 2014. The Act allows for local groundwater sustainability agencies to draft groundwater sustainability plans in order to ensure sustainable water usage in California's aquifers. Through an examination of scientific studies and policy-maker suggestions, it is evident that water rights stakeholders should be consulted in the drafting of these plans and effective, measurable objectives must be established. In a region that will be highly prone to the effects of climate change, it is important for California to successfully plan for this century.

I. Introduction

California has been in a drought for close to four years, which has contributed to drastically less surface water and a smaller snowpack.¹ As these sources of water have diminished, people, particularly farmers in the Central Valley, have turned more and more to relying on groundwater.² This is of great consequence when considering how much food the Central Valley produces for the world.³ With no real regulation or monitoring, the aquifers

1. Adam Nagourney, *As California Drought Enters 4th Year, Conservation Efforts and Worries Increase*, N.Y. TIMES (Mar. 17, 2015), <http://www.nytimes.com/2015/03/18/us/as-california-drought-enters-4th-year-conservation-efforts-and-worries-increase.html>.

2. Dale Kasler et al., *Central Valley Sinking Fast in Drought, NASA Study Shows*, SACRAMENTO BEE (Aug. 19, 2015), <http://www.sacbee.com/news/state/california/water-and-drought/article31527953.html>.

3. Brian Palmer, *The C-Free Diet*, SLATE (July 10, 2013), http://www.slate.com/articles/health_and_science/explainer/2013/07/california_grows_all_of_our_fruits_and_vegetables_what_would_we_eat_without.html.

in this region are being stressed, meaning that water is being withdrawn at a faster rate than its replenishment rate.⁴ Governor Jerry Brown signed the Sustainable Groundwater Management Act into law in 2014. The Act aims to provide for sustainable groundwater management through local means over the coming decades.⁵

California is currently in one of the worst droughts in its history, and while it hasn't solely been caused by climate change, it has certainly been exacerbated by it.⁶ Scientists believe that droughts will only get worse and more frequent in the future, so it is important to examine how California is aiming to combat drought and preserve our water resources, specifically groundwater. Historically, groundwater hasn't been heavily regulated and the Sustainable Groundwater Management Act is the first significant piece of legislation to focus on the issue.⁷ Groundwater sustainability agencies must involve water rights stakeholders in the groundwater sustainability plan creation process and establish effective, measurable objectives.

Part II of this paper will go over a brief history of water in California. It is important to recognize how water rights have developed in California in order to understand why the Sustainable Groundwater Management Act is needed. Part III of this paper explores climate change's effect on drought, specifically California's current drought. Climate change has the potential to cause more frequent and more severe droughts, thus it sets a backdrop for understanding the future of water use in California.

Part IV of this paper outlines some key elements of the Sustainable Groundwater Management Act. Without a proper understanding of the Act, it will be difficult to contextualize the issues in its implementation. Part V of this paper looks at groundwater management in other states in the American West, with an emphasis on Arizona's Groundwater Management Act. The examination of other groundwater management regimes is useful because it may grant some insight into issues groundwater sustainability agencies may want to avoid or copy in their plans. Part VI of this paper will focus on several issues that groundwater sustainability agencies will face in implementing their groundwater sustainability plans. The issues that are addressed include involvement of stakeholders in the planning process and establishing effective, measurable objectives.

4. Study: *Third of Big Groundwater Basins in Distress*, NASA (June 16, 2015), <http://www.jpl.nasa.gov/news/news.php?feature=4626>.

5. *Legislation*, California Groundwater, <http://groundwater.ca.gov/legislation.cfm>.

6. Daniel Griffin & Kevin J. Anchukaitis, *How Unusual is the 2012-2014 California Drought?*, 41 *GEOPHYSICAL RESEARCH LETTERS* 9017, 9021 (2014), <http://onlinelibrary.wiley.com/doi/10.1002/2014GL062433/epdf>.

7. Emily Allshouse, *Governor Brown Signs Sustainable Groundwater Management Act*, Association of California Water Agencies (Sept. 16, 2014), <http://www.acwa.com/news/groundwater/governor-brown-signs-sustainable-groundwater-management-act>.

II. A Brief History of Water in California

The beginning of water rights in California can be traced back to the arrival of the Spanish in the 1700s.⁸ At the time, Spanish law granted missions and pueblos a preferential right to water, in the form of wells and diverted water.⁹ In 1848, the Treaty of Guadalupe Hidalgo was signed at the conclusion of the U.S.-Mexico War and recognized all property rights established under Spanish and Mexican law.¹⁰ In the 1899 decision, *City of Los Angeles v. Pomeroy*, and the 1903 decision, *Hooker v. City of Los Angeles*, the California Supreme Court and the U.S. Supreme Court ruled that California water rights law incorporated these Spanish pueblo rights, which was of great importance to the City of Los Angeles in their claim to Los Angeles River waters.¹¹

The next major development in California water law was the arrival of the gold miners in the second half of the 19th century. During this time, miners resolved water claims on the principle of “first-in-time, first-in-right.”¹² The California Supreme Court in the 1855 decision, *Irwin v. Phillips*, recognized this approach.¹³ This decision was in contrast with the English and American common law of riparian rights. The riparian system involves “the right to use water from rivers and streams that flow within or along the boundaries of one’s property” and is to be shared with all other riparian landowners along the river.¹⁴

By the 1880s, the miners’ prior appropriation system and the common law doctrine of riparian rights were at odds. In the 1886 decision *Lux v. Haggin*, the California Supreme Court ruled the two systems could coexist, but in most cases, appropriative rights would be inferior to riparian rights.¹⁵ This decision had a huge impact on Central Valley agriculture because the water supply was largely diverted from rivers, thus making the farmers’ water rights secondary to those of riparians.

8. *California Water Timeline*, Water Education Foundation, <http://www.watereducation.org/aquapedia/california-water-timeline>.

9. Ellen Hanak et al., *Managing California’s Water: From Conflict to Reconciliation*, Public Policy Institute of California 1, 21 (2011), http://www.ppic.org/content/pubs/report/R_211EHR.pdf.

10. Treaty of Guadalupe Hidalgo, Mexico-U.S., Art. VIII, Feb. 2, 1858, http://avalon.law.yale.edu/19th_century/guadhida.asp#art8.

11. *City of Los Angeles v. Pomeroy*, 124 Cal. 597, 640 (Cal. 1899); *Hooker v. City of Los Angeles*, 188 U.S. 314, 319 (1903).

12. Hanak et al., *supra* note 9, at 22.

13. *Irwin v. Phillips*, 5 Cal. 140 (Cal. 1855).

14. Hanak et al., *supra* note 9, at 23.

15. *Lux v. Haggin*, 69 Cal. 255 (Cal. 1886).

In order to address the conflict between the two systems of rights, the Wright Act was enacted in 1887 and authorized “the formation of irrigation districts with the power to acquire water rights, to construct water projects, and to sell bonds and impose property assessments to support water development and distribution.”¹⁶ Several successful water districts formed throughout the Central Valley and were able to build large dams and canal systems to store and distribute water within their region.¹⁷

The agriculture industry in the Central Valley continued to grow throughout the last half of the 19th Century and into the 20th century, which led to increased pumping of groundwater.¹⁸ As farmers pumped more groundwater, it caused the groundwater table to lower further and eventually led to a legal conflict that made its way to the California Supreme Court in 1903.¹⁹ In *Katz v. Walkinshaw*, the California Supreme Court ruled that the absolute ownership doctrine that ruled groundwater was not compatible with public policy or the general welfare.²⁰ The Court replaced the absolute ownership doctrine with the doctrine of reasonable use stating, “It limits the right of others to such amount of water as may be necessary for some useful purpose in connection with the land from which it was taken.”²¹ At this point there was still no statewide regulatory regime for groundwater.²²

As California’s population continued to grow at the beginning of the 20th century, the California Legislature passed the Water Commission Act of 1913, which aimed to create statewide regulations for water use.²³ The Act exempted pueblo rights, riparian rights, and groundwater rights, but the Act did create a permitting system for water appropriations authorized after 1914.²⁴

In 1928, California voters passed a constitutional amendment in response to the state’s handling of water use, and particularly in response to the California Supreme Court decision *Herminghaus v. Southern California Edison Company*, which held that a riparian’s use of water was not limited to reasonable use.²⁵ This amendment is included in the California Constitution under Article X, § 2 and states:

16. Hanak et al., *supra* note 9, at 30.

17. *Id.*

18. Hanak et al., *supra* note 9, at 21.

19. *Katz v. Walkinshaw*, 141 Cal. 116 (Cal. 1903).

20. *Id.* at 134.

21. *Id.*

22. Hanak et al., *supra* note 9, at 32.

23. Joseph L. Sax, *We Don’t Do Groundwater: A Morsel of California Legal History*, 6 U. Denv. Water L. Rev. 269, 287 (2002), available at <http://scholarship.law.berkeley.edu/facpubs/1394>.

24. Hanak et al., *supra* note 9, at 38.

25. Marybelie D. Archibald, *Appropriative Water Rights in California: Background and Issues*, Governor’s Commission to Review California Water Rights Law Staff Paper No.

“It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use... be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare.”²⁶

A great deal of water law conflicts in the second half of the 20th century concerned water quality and construction of water projects aimed at water delivery to major cities, such as Los Angeles and San Francisco.²⁷ Since 2011, California has been in a drought, which led to the passage of the Sustainable Groundwater Management Act in 2014, making California the last Western state to regulate groundwater use.²⁸ In 2015, also in response to California’s historic drought, Governor Jerry Brown ordered statewide cuts in urban water use for the first time ever.²⁹

III. Climate Change’s Effect on Drought

Droughts present huge environmental and economic difficulties in countries around the world, and climate change is only going to make these problems worse. Drought can also have social impacts that include health problems and forced migration.³⁰ Drought causes annual losses close to \$9 billion per year in the United States, ranking it second in terms of national weather-related economic impacts.³¹ In the coming decades, the American Southwest, which includes California, is predicted to experience increased drought and drier soil.³²

1 1, 13 (1977) http://www.waterboards.ca.gov/publications_forms/publications/general/docs/1597.pdf.

26. California Constitution, Article X, § 2 (1928).

27. *California Water Timeline*, Water Education Foundation, <http://www.watereducation.org/aquapedia/california-water-timeline>.

28. *Id.*

29. *Id.*

30. *Types of Drought Impacts*, National Drought Mitigation Center, <http://drought.unl.edu/DroughtforKids/HowDoesDroughtAffectOurLives/TypesofDroughtImpacts.aspx>.

31. *Causes of Drought: What’s the Climate Connection?*, Union of Concerned Scientists, http://www.ucsusa.org/global_warming/science_and_impacts/impacts/causes-of-drought-climate-change-connection.html#references.

32. Justin Sheffield & Eric F. Wood, *Projected Changes in Drought Occurrence Under Future Global Warming from Multi-Model, Multi-Scenario, IPCC AR4 Simulations*, *Climate Dynamics* 31.1 79,101 (2008), <http://ruby.fgcu.edu/courses/twimberley/EnviroPhilo/Drought.pdf>; Thomas R. Karl et al., *Global Climate Change Impacts in the United States* (2009), <https://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf>.

The Western United States is not the only region in the world that has experienced drought over the last decade. The Midwest, Russia, Ukraine, and Brazil have also felt the effects of drought in the 21st century.³³ The World Bank reported that the price of crops such as corn, wheat, and soybeans, which are harvested in these regions, climbed by over 10 percent from June to July 2012.³⁴ The effects of drought in these regions cause the overall price of food to rise, which can lead to social unrest.³⁵

Another effect of drought is overdraft of groundwater basins. Close to 2 billion people rely on groundwater as their primary source of water.³⁶ According to a decade-long study that concluded in 2015, 21 of the 37 largest aquifers are being depleted faster than they are being replenished.³⁷ The study found that California's Central Valley Aquifer System was one of the most overstressed basins in the world.³⁸

There are three types of drought that can take place: meteorological, hydrological, and agricultural.³⁹ Meteorological drought refers to the dryness in a region and the duration of the dryness.⁴⁰ It is highly specific to region. Hydrological drought occurs when there is a decreased precipitation, which in turn affects streamflow, soil moisture, reservoir and lake levels, and groundwater recharge.⁴¹ Finally, agricultural drought occurs when available water supplies are not able to meet the water demands of crops.⁴² Climate change has the greatest effect on hydrological and agricultural drought because of its effect of increased temperatures on precipitation.⁴³

As the Earth's climate continues to warm, droughts are expected to become more frequent, severe, and longer lasting.⁴⁴ Increasing temperatures due to anthropogenic emissions, combined with enhanced evaporative

33. Annie Lowrey, *Experts Issue a Warning as Food Prices Shoot Up*, N.Y. TIMES (Sept. 4, 2012), <http://www.nytimes.com/2012/09/05/business/experts-issue-a-warning-as-food-prices-shoot-up.html>.

34. *Id.*

35. Christopher Alessi, *U.S. Drought and Rising Global Food Prices*, Council on Foreign Relations (Aug. 2, 2012), <http://www.cfr.org/food-security/us-drought-rising-global-food-prices/p28777>.

36. Janet Raloff, *Many of Earth's Groundwater Basins are Drying Out*, Student Science (June 30, 2015), <https://student.societyforscience.org/article/many-earth%E2%80%99s-groundwater-basins-are-drying-out>.

37. *Id.*

38. *Study: Third of Big Groundwater Basins in Distress*, NASA (June 16, 2015), <http://www.jpl.nasa.gov/news/news.php?feature=4626>.

39. Union of Concerned Scientists, *supra* note 31.

40. *Id.*

41. *Id.*

42. *Id.*

43. *Id.*

44. *Drought Basics: Climate Change*, National Drought Mitigation Center, <http://drought.unl.edu/DroughtBasics/ClimateChange.aspx>.

demand, will have a significant effect on future water supply and management.⁴⁵ In states such as California, the effects of such droughts will be particularly harsh because of the state's large population. Climate change also affects water supply through increased competition for available water, poor water quality, and groundwater overdraft.⁴⁶

A. California's Current Drought

On January 17, 2014, in response to the ongoing drought, the California Governor Jerry Brown declared a State of Emergency throughout the state.⁴⁷ California's current drought is the worst drought in the last 1,200 years of the region, according to a 2014 study.⁴⁸ The study found that over the last 1,200 years there have been 37 occurrences of three-year droughts, but none have been as severe as the current drought, which was measured from 2011 to 2014.⁴⁹ While climate change hasn't been the sole reason for the current drought, it has exacerbated it. In fact, it has been estimated that high temperatures linked to climate change have intensified the drought by 36 percent.⁵⁰

With lower precipitation and warmer temperatures depleting snow in the mountains, parts of California have moved towards groundwater extraction. During normal years, groundwater makes up around 40 percent of fresh water used, but during drought, this number jumps to an estimated 65 percent of fresh water used.⁵¹ In 2014, farmers in the Central Valley pumped an additional six-million acre-feet of groundwater compared to 2011.⁵² All this increased groundwater extraction, which has been exacerbated by the

45. Daniel Griffin & Kevin J. Anchukaitis, *How Unusual is the 2012-2014 California Drought?*, 41 *GEOPHYSICAL RESEARCH LETTERS* 9017, 9022 (2014), <http://onlinelibrary.wiley.com/doi/10.1002/2014GL062433/epdf>.

46. National Drought Mitigation Center, *supra* note 44.

47. *Governor Brown Declares Drought State of Emergency*, <https://www.gov.ca.gov/news.php?id=18368>.

48. Daniel Griffin & Kevin J. Anchukaitis, *How Unusual is the 2012-2014 California Drought?*, 41 *GEOPHYSICAL RESEARCH LETTERS* 9017, 9021 (2014), <http://onlinelibrary.wiley.com/doi/10.1002/2014GL062433/epdf>.

49. *Id.*

50. Alex Emslie, *Study: California Drought Most Severe Dry Spell in at Least 1,200 Years*, KQED, <http://ww2.kqed.org/science/2014/12/04/study-california-drought-most-severe-dry-spell-in-at-least-1200-years/>.

51. Todd C. Frankel, *California's Water Woes Primed to get Worse as Groundwater is Drained*, WASH. POST, https://www.washingtonpost.com/business/economy/californias-water-woes-primed-to-get-worse-as-groundwater-is-drained/2015/04/02/bb6d2b0e-d965-11e4-b3f2-607bd612aeac_story.html.

52. Dale Kasler et al., *Central Valley Sinking Fast in Drought, NASA Study Shows*, SACRAMENTO BEE, <http://www.sacbee.com/news/state/california/water-and-drought/article 31527953.html>.

drought, has led to land subsidence throughout California, but primarily in the Central Valley.

Land subsidence is a “gradual settling or sudden sinking of the Earth’s surface owing to subsurface movement of Earth materials” and more than 80 percent of the United States’ subsidence is caused by the exploitation of underground water.⁵³ During the current drought, parts of the Central Valley have sunk 13 inches in a year.⁵⁴ While the damage related to subsidence may not be seen immediately, over several years there can be damages to roads, pipes, and changes in drainage patterns. Damages related to land subsidence during this drought have cost the state millions of dollars.⁵⁵ Another grave impact of land subsidence, which will be made worse as the climate continues to change, is as the land subsides more, the soil becomes more compact and thus creates less space to store groundwater.⁵⁶

The Central Valley’s land subsidence can be traced to the overdraft of the underground aquifers and lack of comprehensive regulations to limit the extraction of groundwater.⁵⁷ Farmers have been faced with the decision to either let their crops fallow because of the lack of surface water, or drill wells deep into underlying aquifers. Many farmers decided to drill wells. By June of 2014, Tulare County in the Central Valley had issued 874 well permits, compared to 830 in all of 2013.⁵⁸

In addition to the impact this drought has had on California’s geography, it has also had a large impact on the state’s agricultural sector. In 2014, it is believed the drought cost the industry \$2.2 billion and 17,000 jobs.⁵⁹ In 2015, the numbers were \$2.7 billion and 21,000 jobs, including indirect job losses such as truck drivers and food processing workers.⁶⁰ Continued drought could have a huge impact on available fruits and vegetables to purchase, as California produces “99 percent of the nation’s artichokes, 99

53. *Land Subsidence*, U.S. Geological Survey, <http://water.usgs.gov/ogw/subsidence.html>.

54. Kasler et al., *supra* note 52.

55. Bettina Boxall, *Another Toll of the Drought: Land is Sinking Fast in San Joaquin Valley, Study Shows*, L.A. TIMES (Aug. 19, 2015), <http://www.latimes.com/local/lanow/la-me-ln-groundwater-20150819-story.html>.

56. Kasler et al., *supra* note 52.

57. Boxall, *supra* note 55.

58. Brian Clark Howard, *California Drought Spurs Groundwater Drilling Boom in Central Valley*, NATIONAL GEOGRAPHIC, <http://news.nationalgeographic.com/news/2014/08/140815-central-valley-california-drilling-boom-groundwater-drought-wells/> (last visited Nov. 7, 2015).

59. Richard Howitt et al., *Economic Analysis of the 2014 Drought for California Agriculture*, Center for Watershed Sciences, https://watershed.ucdavis.edu/files/biblio/DroughtReport_23July2014_0.pdf.

60. Dale Kasler & Philip Reese, *California Drought Impact Pegged at \$2.7 Billion*, SACRAMENTO BEE, <http://www.sacbee.com/news/state/california/water-and-drought/article31396805.html> (last visited November 7, 2015).

percent of walnuts, 95 percent of garlic, and 71 percent of spinach.”⁶¹ This is just a partial list of crop production that could be affected by continued drought.

The combination of lack of a statewide groundwater regulatory regime, the critical overdrafting of California’s aquifers, and the severity of the drought led the California Legislature to pass the Sustainable Groundwater Management Act in 2014

IV. The Sustainable Groundwater Management Act

The Sustainable Groundwater Management Act is a combination of three bills: AB 1739, SB 1319, and SB 1168.⁶² According to Governor Jerry Brown, “A central feature of these bills is the recognition that groundwater management in California is best accomplished locally. Local agencies will now have the power to assess the conditions of their local groundwater basins and take the necessary steps to bring those basins in a state of chronic long-term overdraft into balance.”⁶³

Some of the primary goals of the Sustainable Groundwater Management Act include providing for the sustainable management of groundwater basins⁶⁴; enhancing local management of groundwater consistent with Article X, § 2 of the California Constitution⁶⁵; establishing minimum standards for sustainable management of groundwater⁶⁶; and providing local groundwater agencies with the authority and the technical and financial assistance necessary to sustainably manage groundwater.⁶⁷

By June 30, 2017, groundwater sustainability agencies must be established in High and Medium priority basins across California.⁶⁸ There are 127 High and Medium priority basins in California and these basins make up approximately 96 percent of groundwater use in the state.⁶⁹ The California Department of Water Resources prioritized California’s basins pursuant to the following eight criteria: Overlying population; projected growth of overlying population; public supply wells; total wells; overlying irrigated acreage; reliance on groundwater as the primary source of water; impacts on the

61. Palmer, *supra* note 3.

62. *Legislation*, California Groundwater, <http://groundwater.ca.gov/legislation.cfm>.

63. *Id.*

64. California Water Code § 10720.1(a).

65. California Water Code § 10720.1(b).

66. California Water Code § 10720.1(c).

67. California Water Code § 10720.1(d).

68. California Water Code § 10735.2(a)(1).

69. *Initial Groundwater Basin Prioritization under the SGM Act*, California Department of Water Resources, http://www.water.ca.gov/groundwater/sgm/SGM_BasinPriority.cfm.

groundwater, including overdraft, subsidence, saline intrusion, and other water quality degradation; and other information the Department determines to be relevant.⁷⁰

A groundwater sustainability agency is one or more local agencies that implement provisions of the Sustainable Groundwater Management Act.⁷¹ To do this, groundwater sustainability agencies must adopt a groundwater sustainability plan by either 2020 or 2022, depending on the priority of their basin.⁷² Groundwater sustainability agencies must achieve their groundwater sustainability goals by 2040 or 2042, depending on the basin's designation.⁷³

A groundwater sustainability plan is any plan put forth or adopted by a groundwater sustainability agency, which may be "a single plan covering the entire basin developed and implemented by one groundwater sustainability agency or multiple groundwater sustainability agencies; or multiple plans implemented by multiple groundwater sustainability agencies and coordinated pursuant to a single coordination agreement that covers the entire basin."⁷⁴ A groundwater sustainability plan shall include: "a description of the physical setting and characteristics of the aquifer system underlying the basin; measurable objectives; a planning and implementation horizon; and monitoring protocols."⁷⁵

All in all, one of the primary goals of the Sustainable Groundwater Management Act is to provide for sustainable management of groundwater basins in California.⁷⁶ "Sustainable groundwater management" means the "management and use of groundwater in a manner that can be maintained during the planning and implementation horizon without causing undesirable results."⁷⁷ For purposes of the Act, an "undesirable result" means one or more of the following:

Chronic lowering of groundwater levels indicating a significant and unreasonable depletion of supply; Significant and unreasonable reduction of groundwater storage; Significant and unreasonable seawater intrusion; Significant and unreasonable degraded water quality; Significant and unreasonable land subsidence that substantially interferes with surface land uses; Depletions of interconnected surface water that have significant

70 California Water Code § 10933(b)(1-8).

71 California Water Code § 10720.1(j).

72 California Water Code § 10720.7(a)(1-2).

73 California Water Code § 10727.2(3)(A).

74 California Water Code § 10721(k); California Water Code § 10727(b)(1-3).

75 California Water Code § 10727.2.

76 *Legislation*, California Groundwater, <http://groundwater.ca.gov/legislation.cfm>.

77 California Water Code § 10721(u).

and unreasonable adverse impacts on beneficial uses of the surface water.⁷⁸

V. Groundwater Management in the American West

In 2014, with the passage of the Sustainable Groundwater Management Act, California became the last state in the West to regulate groundwater pumping.⁷⁹ It would be beneficial for groundwater sustainability agencies to examine several other states' groundwater regulatory regimes to possibly find lessons as they implement their groundwater sustainability plans. For this paper, I will examine several parts of Arizona's Groundwater Management Act.

A. Arizona

Arizona has been much more proactive in groundwater management than California, passing the Arizona Groundwater Management Act in 1980.⁸⁰ The conditions that led to the passage of the Code in Arizona were similar to the conditions that led to the passage of the Sustainable Groundwater Management Act in California; the state's groundwater basins were in a state of overdraft and the land was subsiding as a result.⁸¹ Also, similarly to California, groundwater makes up 40 percent of Arizona's water supply.⁸²

The Arizona Groundwater Management Act has three primary goals: "control severe overdraft occurring in many parts of the state; provide a means to allocate the state's limited groundwater resources to most effectively meet the changing needs of the state; and augment Arizona's groundwater through water supply development."⁸³ To achieve these goals, the state established the Arizona Department of Water Resources and established three levels of water management that vary by groundwater conditions.⁸⁴ These three levels consist of the lowest level, which includes general provisions that apply

78. California Water Code § 10721(w).

79. David Siders, *California Becomes Last Western State to Regulate Groundwater*, GOVERNING MAGAZINE (Sept. 17, 2014), <http://www.governing.com/news/headlines/mct-california-groundwater-regulations.html>.

80. *Overview of the Arizona Groundwater Management Code*, Arizona Department of Water Resources, http://www.azwater.gov/AzDWR/WaterManagement/documents/Groundwater_Code.pdf.

81. *Id.*

82. Caitlin McGlade, *Parched: Arizona's Shrinking Aquifers*, THE REPUBLIC (Mar. 24, 2015), <http://www.azcentral.com/story/news/arizona/investigations/2015/03/24/parched-water-arizona-table-declines/25100651/>; Frankel, *supra* note 51.

83. Arizona Department of Water Resources, *supra* note 80.

84. *Id.*

statewide; the intermediate level, Irrigation Non-Expansion Areas; and the highest level, which has the most extensive provisions, Active Management Areas, where groundwater overdraft is most severe.⁸⁵

According to the Arizona Department of Water Resources, the six key provisions of the Act are “establishment of a program of groundwater rights and permits, a provision prohibiting irrigation of new agricultural lands within Active Management Areas, preparation of a series of five water management plans for each Active Management Area designed to create a comprehensive system of conservation targets and other water management criteria, development of a program requiring developers to demonstrate a 100-year assured water supply, a requirement to measure water pumped from all large wells, and a program for annual water withdrawal and use reporting.”⁸⁶

One aspect of the Arizona Groundwater Management Act that groundwater sustainability agencies should incorporate into their groundwater sustainability plans, is the creation of management time periods within the plan. Management plans for Active Management Areas are made up of four 10-year periods and one 5-year period.⁸⁷ As each period comes to pass, the water conservation and management requirements become more rigorous.⁸⁸

California groundwater sustainability agencies should effectively break their plans down into four 5-year periods during their plans’ lifetimes. This will enable the agencies to see the progress they are making towards groundwater sustainability. According to one commentator, one of the successes of the Arizona Groundwater Management Act has been the creation of a long-term goal that allows areas to respond to changing conditions by requiring 10-year incremental management plans.⁸⁹

Another consideration that should be reviewed is setting more rigorous requirements as each period passes. When plans are first adopted in 2020, the groundwater sustainability agencies in many basins will be starting from scratch, but as their plans become more entrenched over the following years, it should be feasible to meet more rigorous goals. Also, by setting more rigorous goals, it could be possible to give the agencies some leeway to adapt to changing conditions and meet their 2040 or 2042 goals by having these self-imposed deadlines.

One final aspect that should be examined by groundwater sustainability agencies is the usage of metering and reporting in Arizona’s Active

85. *Id.*

86. *Id.*

87. *Id.*

88. *Id.*

89. Katharine L. Jacobs & James M. Holway, *Managing for Sustainability in an Arid Climate: Lessons Learned from 20 Years of Groundwater Management in Arizona, USA*, 12 *HYDROGEOLOGY JOURNAL* 52, 64 (2004), https://sustainability.asu.edu/docs/water_institute/water_overview.pdf.

Management Areas. In these Areas, water users who have wells that pump more than 35 gallons per minute are required to install measuring devices and report water usage to the state annually.⁹⁰ This data allows for the state to “monitor aquifer conditions, plan, and track compliance.”⁹¹ The Sustainable Groundwater Management Act allows groundwater sustainability agencies to mandate “well registration, mandatory measurement devices, pumping reports, and pumping fees.”⁹² Agencies should use these management tools in the same way Arizona has as a way to meet their groundwater sustainability goals.

After reviewing parts of the Arizona Groundwater Management Act and literature addressing the Act, it is clear there can be some great guidance for groundwater sustainability agencies as they implement their groundwater sustainability plans. Groundwater sustainability agencies should effectively use five-year periods in their sustainability plans and use the enforcement tools that are available to them in order to have a greater amount of data at their disposal.

VI. Issues in Implementation of the Sustainable Groundwater Management Act

Groundwater sustainability agencies will encounter various obstacles throughout the planning process. In order to successfully address these issues, groundwater sustainability agencies must involve water rights stakeholders in the groundwater sustainability plan creation process and establish effective, measurable objectives.

A. Involving Stakeholders

Stakeholder engagement can be defined as an organization’s “efforts to understand and involve stakeholders and their concerns in its activities and decision-making processes.”⁹³ Groundwater sustainability agencies must involve water rights stakeholders in the groundwater sustainability plan creation process in order to help facilitate successful implementation. Participation of stakeholders is vitally important because it assists in the coordination of decisions and allows for decisions to be carried out more

90. Janny Choy, *7 Lessons in Groundwater Management from the Grand Canyon State*, WATER IN THE WEST (June 1, 2015), <http://waterinthewest.stanford.edu/resources/forum/7-lessons-groundwater-management-grand-canyon-state>.

91. *Id.*

92. *Id.*

93. Katharine Partridge et al., *The Stakeholder Engagement Manual Volume 1: The Guide to Practitioners’ Perspectives on Stakeholder Engagement*, Stakeholder Research Associates Canada Inc. (July 2005) pg. 6, <http://www.accountability.org/images/content/2/0/207.pdf>.

effectively.⁹⁴ The upfront costs and time of effectively involving stakeholders may seem daunting at first for groundwater sustainability agencies, but the cost and time of lawsuits and lack of compliance can be much more, especially when a strict deadline must be met like the Sustainable Groundwater Management Act's 2040 or 2042 deadline.⁹⁵

Water Code Section 10723.2 states groundwater sustainability agencies "shall consider the interests of all beneficial uses and users of groundwater, as well as those responsible for implementing groundwater sustainability plans."⁹⁶ Some of these interests include: holders of overlying groundwater rights, including agricultural users and domestic well owners; municipal well operators; public water systems; local land use planning agencies; environmental users of groundwater; and surface water users.⁹⁷ Some resources for effectively identifying and contacting stakeholders include local farm bureaus, county well permitting offices, environmental groups, and state websites for municipal well operators and local agencies.⁹⁸

There are several conditions that should be met in order to effectively build some consensus between these stakeholders, groundwater sustainability agencies, and the general public. One condition that should be met is ensuring that there is a basic understanding of the Sustainable Groundwater Management Act by stakeholders.⁹⁹ This requires that the stakeholders, as well as the public, be aware of the statutory requirements of the Act.¹⁰⁰ Stakeholders will hopefully be more likely to help agencies meet goals and less likely to defy orders once they understand what is legally required of them.

One potential method groundwater sustainability agencies should employ to ensure there is an understanding of the Act is by holding monthly outreach meetings for stakeholders and the general public. These meetings can be used to facilitate an understanding of the Act and allow for any unanswered questions to be addressed. These meetings should continue throughout the planning process to ensure every stakeholder has an opportunity to ask questions.

94. Hector Garduno et al., *Shareholder Participation in Groundwater Management: Enabling and Nurturing Engagement*, The World Bank, pg. 2, http://siteresources.worldbank.org/EXTWAT/Resources/4602122-1210186362590/GWM_Briefing_6.pdf.

95. Kristin Dobbin et al., *Collaborating for Success: Stakeholder Engagement for Sustainable Groundwater Management Act Implementation*, 1, 26 (July 2015), http://www.swrcb.ca.gov/water_issues/programs/gmp/docs/local_asst/sgma_stakeholderengagement_whitepaper.pdf.

96. California Water Code, §10723.2.

97. California Water Code, §10723.2(a-j).

98. Dobbin et al., *supra* note 95, at 3.

99. Gina Bartlett, *Seven Benchmarks to Build Consensus on a Groundwater Sustainability Agency*, CALIFORNIA GROUNDWATER (Sept. 17, 2015), <http://groundwateractblog.com/2015/09/17/seven-benchmarks-to-build-consensus-on-a-groundwater-sustainability-agency/>.

100. *Id.*

Groundwater sustainability agencies can also benefit from assessing what issues are important to different stakeholders.¹⁰¹ This process should involve discussing concerns and opportunities related to the implementation of the Sustainable Groundwater Management Act, which will grant insight to what issues are important to different stakeholders.¹⁰² Some issues that are likely to arise include “respecting the sovereignty of local government” and determining what role stakeholders will play influencing agency actions in the future.¹⁰³ There will be a variety of different interest groups and stakeholders who will all have different concerns, which must be addressed by the agencies.¹⁰⁴ In the monthly meetings suggested above, agencies will be able to gain a sense of what issues are important to different stakeholders and incorporate them into the next month’s meeting.

After successfully communicating with stakeholders, groundwater sustainability agencies must provide transparency to the decisions they make.¹⁰⁵ This means that members of the agency should be able to explain to stakeholders what decisions were made and why that decision was made.¹⁰⁶ One method of ensuring that decisions are transparent may include an easily navigable website for the groundwater sustainability plan.¹⁰⁷

i. Groundwater Adjudication

Before the passage of the Sustainable Groundwater Management Act, disputes over groundwater usage were often solved through adjudication.¹⁰⁸ This process involved courts defining all groundwater rights within a particular basin.¹⁰⁹ This process is often expensive and can take years, thus in 2015, the California Legislature passed SB 226 and AB 1390 to reform the groundwater adjudication process.¹¹⁰ One of the primary objectives of these two bills is to “harmonize the process with the Sustainable Groundwater Management Act to provide parties a forum to determine their water rights but also to prevent them from using it to obstruct or delay the Act.”¹¹¹ The

101. *Id.*

102. *Id.*

103. *Id.*

104. *Id.*

105. *Id.*

106. *Id.*

107. *Id.*

108. *Summary: Groundwater Adjudication Reform*, CALIFORNIA GROUNDWATER (Oct. 12, 2015), <http://groundwateractblog.com/2015/10/12/summary-groundwater-adjudication-reform/>.

109. *Id.*

110. *Id.*

111. *Id.*

passage of these two bills will hopefully encourage groundwater sustainability agencies to recognize the importance of involving stakeholders when designing their groundwater sustainability plans.

The Sustainable Groundwater Management Act allows groundwater sustainability agencies to limit the extraction of groundwater, but it does not have any effect on existing water or property rights.¹¹² Thus, groundwater sustainability plans that limit groundwater pumping must respect the property rights of the users of such groundwater.¹¹³ This underscores the importance of involving stakeholders because a user who claims their property rights have been violated may file for a groundwater adjudication.¹¹⁴ Any time this happens, a groundwater sustainability plan can fall behind on meeting its sustainability goal.

In the event parties file lawsuits to disrupt the implementation of a groundwater sustainability plan, AB 1390 allows a court to issue a preliminary injunction.¹¹⁵ A court may issue a preliminary injunction when the basin is in overdraft and “to discourage delay, minimize ongoing damage, and encourage settlement.”¹¹⁶ This article in AB 1390 allows for courts to help groundwater sustainability agencies implement their plans in basins where stakeholders are unwieldy.

ii. Curtailment Lawsuits as a Lesson

To see the importance of involving stakeholders in the planning process, one should look at the different lawsuits that have been filed in 2015 against the State Water Resources Control Board over curtailment of surface water rights.¹¹⁷ One particular example occurred in the Delta region where the Board ordered 114 water rights holders to cease pulling water from rivers because of overdraft being caused by the drought.¹¹⁸ A Sacramento Superior Court judge issued a temporary restraining order instructing the Board to not

112. Tara Moren & Amanda Cravens, *California's Sustainable Groundwater Management Act of 2014: Recommendations for Preventing and Resolving Groundwater Conflicts*, WATER IN THE WEST 1, 14 (April 2015), http://waterinthewest.stanford.edu/sites/default/files/SGMA_RecommendationsforGWConflicts_2.pdf.

113. *Id.*

114. *Id.*

115. AB 1390, Article 13 (Ca. 2015), http://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160AB1390.

116. *Id.*; CALIFORNIA GROUNDWATER, *supra* note 108.

117. Dale Kasler, *California Regulators, After Setback, Issue New Water Rights Curtailments*, SACRAMENTO BEE (July 15, 2015), <http://www.sacbee.com/news/state/california/water-and-drought/article27347341.html>.

118. Dale Kasler & Ryan Sabalow, *California Curtails Senior Water Rights*, SACRAMENTO BEE (June 12, 2015), <http://www.sacbee.com/news/state/california/water-and-drought/article23849281.html>.

enforce the curtailments in four districts because the districts did not have an opportunity to defend themselves in a hearing at the water board.¹¹⁹

Groundwater sustainability agencies should use this action as a teaching moment for involving stakeholders. If the agencies involve stakeholders in the planning process, they can hopefully build consensus on goals that will prevent stakeholders from filing suit. When a potential roadblock like this is removed, it helps the groundwater sustainability agencies meet the goals of their plans.

In June of 2015, the City of Riverside filed suit against the State Water Resources Control Board, alleging the Board abused their discretion by ordering the City to cut their water use by 25%, pursuant to Governor Jerry Brown's Executive Order B-29-15.¹²⁰ Riverside alleged that the city is "Water Independent," has at least a four year supply of water in its groundwater basins, its groundwater basins are naturally recharged, and Riverside has no plans to import water to serve the needs of its customers."¹²¹ It is for these reasons that Riverside believed they should be exempt from the 25% reduction, and instead qualify for a lower 4% conservation tier set forth in Section 865(c) of Article 22.5 of the Board's proposed regulation.¹²²

The *City of Riverside v. State Water Resources Control Board* suit is not directly comparable to the planning process that groundwater sustainability agencies will go through, but it does demonstrate the importance of the input process with stakeholders. When a stakeholder feels that their valid input is not considered, similar to Riverside's contention that they belong in the 4% tier, they may file suit to serve their own interests.

iii. Examples of Effective Stakeholder Involvement

Before the Sustainable Groundwater Management Act was passed, California allowed local agencies to create voluntary groundwater management plans within their jurisdictions.¹²³ It is beneficial to look at some of these plans to see how effective stakeholder involvement was successful in meeting goals.

One groundwater management plan that should be used as an example by groundwater sustainability agencies is the Sonoma Valley Groundwater Management Plan. In 2006, the Sonoma County Water Agency began gathering regional stakeholders to prepare a groundwater management

119. Kasler, *supra* note 117.

120. *City of Riverside v. State Water Resources Control Board*, 1, 2-4 (2015), <https://www.documentcloud.org/documents/2095735-1558646-c1.html#document/p8>.

121. *Id.* at 2.

122. *Id.* at 5.

123. California Water Code § 10750(a).

plan.¹²⁴ These stakeholders consisted of agricultural alliances, environmental groups, water purveyors, and residential groundwater users.¹²⁵

The Sonoma County Water Agency created a Basin Advisory Panel, made up of 20 stakeholders from various industries and interests.¹²⁶ Through meetings and briefings with constituents, the Panel was able to build a strong consensus on what the goals of the groundwater management plan were.¹²⁷ While preparing the plan, the Panel met with stakeholders to learn what they wanted to know about the plan and then gathered information to address any stakeholder uncertainties.¹²⁸ The Sonoma County Water Agency also kept the general public informed throughout the process by maintaining an email list and distributing draft documents with public comment periods.¹²⁹

The Sonoma County Water Agency adopted the Sonoma Valley Groundwater Management Plan in 2007.¹³⁰ As a testament to successful stakeholder involvement, the Plan was endorsed by a variety of groups including the Sonoma Valley Vintners & Growers Alliance, the Sonoma Ecology Center, the Mission Highlands Mutual Water Company, and the Sonoma County Water Coalition.¹³¹

When groundwater sustainability agencies are creating their groundwater sustainability plans, they should try and emulate the stakeholder involvement that was used in the creation of the Sonoma Valley Groundwater Management Plan. By bringing stakeholders from different constituencies together, agencies can gauge what issues are important and what issues need to be clarified. Agencies should also keep stakeholders involved and informed throughout the entire planning process. The Sonoma Valley Groundwater Management Plan exemplifies how to bring stakeholders from opposite interests together and build a strong consensus.

Another benefit of effective stakeholder involvement is avoiding litigation. A successful example of such involvement is the Sacramento Water Forum. The Sacramento Water Forum was created in 1993 to manage concerns regarding the American River.¹³² The Forum brought together members of local governments, water purveyors, environmentalists, and

124. Marcus Trotta & Tim Parker, *Sonoma Valley Groundwater Management Program*, North Bay Agricultural Alliance (2014), http://www.scwa.ca.gov/files/SV_NVAA_2014.pdf.

125. *Id.*

126. *Sonoma Valley Groundwater Management Program*, Sonoma County Water Agency, <http://www.scwa.ca.gov/svgroundwater/>.

127. Dobbin et al., *supra* note 95, at 35.

128. *Id.*

129. *Id.*

130. Sonoma County Water Agency, *supra* note 126.

131. *Id.*

132. *About Us*, THE WATER FORUM, <http://www.waterforum.org/stakeholders/about-the-water-forum/>.

other stakeholders to sign the Water Forum Agreement in 2000.¹³³ In the words of the Water Forum, the group “takes a balanced approach to water management and water-based ecosystem protection, relying on interest-based collaboration and the best available scientific information.”¹³⁴ For the past 20 years, the Forum has been able to find common ground between various stakeholders and avoided similar litigation that led to the creation of the group in 1993.¹³⁵

Groundwater sustainability agencies should use the Sacramento Water Forum as a model for how to avoid litigation. The Forum is able to create consensus between adversarial stakeholders such as business interests and environmental interests. The Forum has been so successful that in addition to managing American River concerns, the group has also developed groundwater management plans for three basins and developed a habitat management program.¹³⁶

The Sonoma Valley Groundwater Management Plan and the Sacramento Water Forum should both serve as examples for effectively involving stakeholders.

B. Effective, Measurable Objectives

Groundwater sustainability agencies must incorporate effective, measurable objectives into their groundwater sustainability plans to ensure that the goals of the Sustainable Groundwater Management Act are met. Water Code Section 10727.2(b)(1-2) states:

A groundwater sustainability plan shall include all of the following: . . . (1) measurable objectives, as well as interim milestones in increments of five years, to achieve the sustainability goal in the basin within 20 years of the implementation of the plan. (2) A description of how the plan helps meet each objective and how each objective is intended to achieve the sustainability goal for the basin for long-term beneficial uses of groundwater.¹³⁷

As noted in Part IV, the Sustainable Groundwater Management Act directs groundwater sustainability agencies to set measurable objectives to avoid “undesirable results.” The Act does not however state what these

133. *Id.*

134. *Id.*

135. *Id.*

136. *Groundwater Management*, The Water Forum, <http://www.waterforum.org/water-supply/groundwater-management/>; *Habitat Management*, THE WATER FORUM, <http://www.waterforum.org/the-river/habitat-management/>.

137. California Water Code, §10727.2 (2015).

measurable objectives should be. In order to be effective, the measurable objectives should define clear baselines, set quantitative thresholds, and account for uncertainty, among other things.¹³⁸

i. Quantitative Thresholds

Setting a clear baseline is a key component for a groundwater sustainability plan because it creates an understanding of what the goal of the plan is. Clear goals may also eliminate some opposition because it limits conflict related to disagreement over definitions. A baseline will also create a point of reference to which groundwater sustainability agencies can measure as a “significant and unreasonable” undesirable result.¹³⁹

Setting quantitative thresholds is also of great importance for a groundwater sustainability plan to be successful. Quantitative is defined as “of, relating to, or involving the measurement of quantity or amount.”¹⁴⁰ A threshold is a “defined target level or state based on the avoidance of unacceptable outcomes or an ecologically defined shift in system status.”¹⁴¹

Many past groundwater basin management objectives in California used qualitative statements, rather than quantitative targets.¹⁴² The lack of specific objectives made it extremely difficult to determine whether these plans were meeting their own goals.¹⁴³ This impedes progress towards successful groundwater sustainability. The reason for this is that one person’s definition of “significant and unreasonable” can be completely different from another person’s definition. When groundwater sustainability agencies set an actual quantitative target, progress can be measured with actual figures.

In the Department of Interior’s technical guide to adaptive management, the Department makes the case for the effectiveness of measurable objectives. The guide suggests: “objectives need to be measurable for two purposes: first, so progress toward their achievement can be assessed; second, so performance that deviates from objectives may trigger a change in

138. Juliet Christian-Smith & Kristyn Abhold, *Measuring What Matters: Setting Measurable Objectives to Achieve Sustainable Groundwater Management in California*, Union of Concerned Scientists 1 (2015), <http://www.ucsusa.org/sites/default/files/attach/2015/09/measuring-what-matters-california-sustainable-groundwater-report.pdf>.

139. *Id.* at 7.

140. *Quantitative*, Meriam-Webster, <http://www.merriam-webster.com/dictionary/quantitative> (last visited Nov. 7, 2015).

141. Christian-Smith & Abhold, *supra* note 138, at 8. (quoting Stephen Poalsky et. al, *Decision-Making Under Great Uncertainty: Environmental Management in an Era of Global Change*, 26.8 TRENDS IN ECOLOGY & EVOLUTION 398 (2011)).

142*Id.* at 7.

143Rebecca Nelson, *Uncommon Innovation: Developments in Groundwater Management Planning in California*, WOODS INSTITUTE FOR THE ENVIRONMENT 1, 12 (2011), http://water.inthewest.stanford.edu/sites/default/files/UncommonInnovationMarch_2011.pdf.

management direction.”¹⁴⁴ When groundwater sustainability agencies are creating their groundwater sustainability plans for submission in 2017, they should be incorporating measurable objectives whenever possible.

For example, one “undesirable result” is the “significant and unreasonable land subsidence that substantially interferes with surface land uses.” A successful groundwater sustainability plan will define “significant and unreasonable” with a quantitative figure, such as “subsidence will be limited to 3 inches per year and any figure greater than that shall be significant and unreasonable.”

ii. Adaptive Management

A groundwater sustainability agency’s groundwater sustainability plan must also account for uncertainty. Two factors that underlie the importance of accounting for uncertainty are the length of time a plan covers, and the process of measuring groundwater.¹⁴⁵ The Sustainable Groundwater Management Act requires plans to go into effect between 2020 and 2022, and must achieve sustainability by either 2040 or 2042. 20 years is a long period of time and many things can change.

One factor that may have effects during this period is climate change. As scientists learn more about climate change, these developments can factor into how agencies develop their plans. Agencies should account for scientific uncertainty and allow for adaptation to new developments. The California Department of Water Resources recognizes this as an issue in statewide strategies. In a 2008 white paper, the Department wrote, “As the prediction of climate change impacts will never be perfect, flexibility must be a fundamental tactic, especially regarding water system operation.”¹⁴⁶

One successful opportunity for addressing ever-changing circumstances is adaptive management. One component of this can involve incorporating triggers to initiate action. An effective use of a trigger can be found in the South Westside Basin Groundwater Management Plan.¹⁴⁷ One objective of this plan is to “maintain groundwater elevations to prevent further seawater intrusion.” For this goal, the Basin has created two triggers: “For wells designated for seawater intrusion monitoring: Trigger 1 is the historical low minus two feet, rounded down. Trigger 2 is 10 feet below Trigger 1 for all

144. Bryon K. William et al., *Adaptive Management: The U.S. Department of the Interior Technical Guide*, U.S. Department of the Interior 1, 11 (2009), <http://www.usgs.gov/sdc/doc/DOI-%20Adaptive%20ManagementTechGuide.pdf>.

145. Christian-Smith & Abhold, *supra* note 138, at 11.

146. *Managing an Uncertain Future: Climate Change Adaptation Strategies for California’s Water*, Department of Water Resources 1, 16 (October 2008), <http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf>.

147. *South Westside Basin Groundwater Management Plan*, 4-4 (July 2012), <http://sfwater.org/Modules/ShowDocument.aspx?documentid=3104>.

wells.”¹⁴⁸ Triggers like these will help groundwater sustainability agencies account for uncertainty and respond to condition changes over the 20-year timeline of their groundwater sustainability plans.

One groundwater management plan that provides a great framework for designing triggers is the Central Sacramento County Groundwater Management Plan. This Plan uses a system of four trigger points to determine what course of action the basin governance body must take when a basin management objective is breached.¹⁴⁹

The trigger points for groundwater levels are as follows: for trigger point 1, the basin governance body and overlying groundwater extractor(s) are informed and there will be an investigation into what caused the condition; for trigger point 2, a reduction in pumping may be required in the affected area to bring it back into compliance; trigger point 3 usually indicates there is excessive pumping and an “assessment will be levied against those well owners who continue to pump at the higher level”; finally for trigger point 4, the basin governance body will determine whether the groundwater levels are acceptable, and if they are not, supplemental water supplies will be found and infrastructure to deliver these supplies will be built, at the cost of the local well owners.¹⁵⁰ This trigger point system is also used for “average groundwater extraction rate, water quality, land subsidence, and aquifer stream interaction basin management objectives.”¹⁵¹ For each of these, the basin governance body decides what measurement parameters to use and the “set of actions and penalties.”¹⁵²

The Central Sacramento County Groundwater Management Plan’s basin governance body plays a similar role to groundwater sustainability agencies in relation to their groundwater sustainability plans. Earlier in this paper, I suggested a quantitative figure for “significant and unreasonable” land subsidence. The example was “land subsidence will be limited to 3 inches per year and any figure greater than that shall be significant and unreasonable.” For this goal, a groundwater sustainability agency could incorporate a four-trigger point system similar to the Central Sacramento County system. The first trigger point could be .5 inch of land subsidence; the second, 1 inch; the third, 1.75 inches; and the fourth, 2.25 inches. At each point, the agency can establish an action such as decreased pumping or acquiring supplemental water supplies to ensure there is no further subsidence.

148. *Id.* at 4-5.

149. *Central Sacramento County Groundwater Management Plan*, 4-2 (February 2006), http://www.amwater.com/files/CSCGMP_final.pdf.

150. *Id.*

151. *Id.*

152. *Id.*

VII. Conclusion

The remainder of this century will feel many impacts from climate change. In California, one of the many repercussions of climate change will involve a shrinking water supply. While California cannot combat climate change on its own, the state can prepare for the future and be ready to adapt. The Sustainable Groundwater Management Act is one of many actions California has taken to be prepared for a changing future.

In conclusion, groundwater sustainability agencies must involve water rights stakeholders in the groundwater sustainability plan creation process and establish effective, measurable objectives. Successfully involving water rights stakeholders in the groundwater sustainability plan creation process includes building consensus among stakeholders, finding out what issues are important to stakeholders, and making their decisions transparent. Groundwater sustainability agencies should seek to emulate the successes of groups such as the Sonoma Valley Groundwater Management Plan and the Sacramento Water Forum. Both of these are models for finding consensus between stakeholders with opposite interests and avoiding costly litigation.

Establishing effective, measurable objectives involves defining clear baselines, setting quantitative thresholds, and accounting for uncertainty, among other things. One way groundwater sustainability agencies can account for uncertainty is through adaptive management. Incorporating trigger point systems into groundwater sustainability plans will allow agencies to adapt to condition changes over the next two decades. Agencies can find good examples of trigger point systems in the South Westside Basin Groundwater Management Plan and the Central Sacramento Country Groundwater Management Plan.

Through these steps, groundwater sustainability agencies will be able to ensure the beneficial use of groundwater for decades to come. Between 2020 and 2042, it will be important for researchers and policy-makers to continue to monitor the successes and failures of groundwater sustainability plans.