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Local Governmental Collective Action and Mandated Policy Implementation

A Dissertation Presented

By

MICHAEL ROBERTS

Submitted to the Graduate School of
the University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree of

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ABSTRACT

LOCAL GOVERNMENTAL COLLECTIVE ACTION AND MANDATED POLICY IMPLEMENTATION

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Groundwater depletion is a global concern. Around the world, groundwater supplies more than half the water used for agriculture and human drinking. Many other species and ecosystems are supported by groundwater and rely on the integrity of groundwater and surface water connections. Like many social and environmental problems, addressing the overextraction of groundwater requires collective action across governmental authorities and jurisdictions. To date, there are few examples of successful, voluntary groundwater management. To steer collective action at the local level, higher levels of government often use policy mandates. This dissertation examines the implementation of one such mandate. California's Sustainable Groundwater Management Act (SGMA), a state-legislated mandate, was passed in 2014. SGMA requires local governmental agencies to work together to address decades of groundwater depletion. From 2018-2022, I conducted ethnographic fieldwork to study the mandated groundwater management planning processes that were undertaken by hundreds of local governmental agencies who, for the first time in California's history, were faced with a choice: either they work across their jurisdictions to achieve groundwater sustainability or they forfeit local

control of groundwater resources to the state of California. Using a comparative case analysis approach, I address three core topics that are currently underexplored in research on mandated policy implementation: what motivates local governmental agencies to engage in collective action when under a mandate, how do local governmental agencies interact with one another to achieve mandate requirements, and why do we see variation in the ways local governmental agencies interpret their role in mandate implementation.

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INTRODUCTION

Local Governmental Collective Action in Mandated Policy Implementation

This dissertation examines the early implementation of the Sustainable Groundwater Management Act (SGMA) in the state of California. SGMA is a state-legislated mandate that requires local governmental collective action to achieve coordinated, groundwater sustainability. Signed into law in 2014 amidst a prolonged drought, SGMA is the first comprehensive attempt in California to address several environmental, social, and economic problems resulting from decades of unrestricted groundwater pumping. The central tenet of SGMA is the empowerment of local governments to manage groundwater so long as basin-wide sustainability is achieved by complying with the mandated requirements for coordination. Under SGMA, local governmental agencies were given discretion to choose decision-making approaches and planning processes that fit the local context for each groundwater basin. Yet, if governmental agencies fail to meet the requirements for coordinated sustainable planning, SGMA allows for state intervention and the potential loss of local control of groundwater resources.

Policy mandates, such as SGMA, are increasingly being used to address critical social and environmental problems that cross governmental jurisdictions (May 1995; Newig & Koontz, 2014; Schafer 2016; Bell & Scott, 2020; Nur Afandi, 2023). Federal and state government often use mandates to incentivize collective action across local governments to address transboundary problems. At other times, higher levels of government may steer collective action by employing support and sanction elements familiar in federal-state programs in several domestic policy areas (Blum et al. 2015; Engel 2015). While the specific approaches to mandating local governmental collective action vary, most mandates seek to create efficiencies, shape lower-level governmental policies, or

stimulate actions that lower-level governments may view as contrary to their needs or dominant position (Moseley et al., 2008; Saz-Carranza et al., 2016). Despite the prevalence of policy mandates, implementation scholarship examining the factors that influence how local governmental agencies implement mandated policy programs is lacking.

One reason we know less about how local governmental agencies implement mandated policies is because, over the past few decades, research on policy implementation (including the implementation of mandates) has been largely subsumed by the interrelated study of governance and the management of policy networks (Provan & Milward, 1995; O'Toole, 2000; Provan & Kenis, 2008; Turini et al., 2010; Raab et al., 2015). Research on governance emphasizes the multi-level, multi-scalar nature of addressing public problems and delivering services (Brown, 2018). As such, governance approaches to examining implementation attend to the ways the public, private, and non-profit sectors interact with one another, negotiate conflicts, and make decisions (Lemos & Agrawal, 2006; De Pourcq & Verleye, 2012). Similarly, research on network management focuses on the ways public sector and service delivery networks take on different structural forms that influence their ability to achieve different types of outcomes (Carboni et al., 2019). Here the focus is often on how different factors such as network size, resource munificence, and density influence the way actors within the network interact with one another, make decisions, and resolve conflicts (Turini et al., 2010). Thus, recent policy implementation scholarship has focused on vertical interactions (i.e., federal-state-local) across different sectors (i.e., public, private, and non-profit) that relate to one another using various network structures to implement

programs and deliver services. These foci have tended to overlook horizontal interactions between governmental agencies that are mandated to implement top-down directives.

The study of public policy and implementation has further been defined by the theoretical development of collaboration (Thomson & Perry, 2006; Margerum, 2008; Sullivan, 2020). Whether conceptualized as a form of governance (Ansel & Gash, 2008; Wang & Ran, 2021), a tool for public management (Agranoff, 2008; O’Leary & Vij, 2012), or an approach to policymaking and planning (Innes & Booher, 2011; Lee et al., 2018), collaboration has largely been conceptualized as interactions between state and non-state actors working at varying scales (federal, state, and local), often with an eye toward increasing diverse participation in governmental decision-making and planning. The development of theory on collaboration provides a rich lexicon for describing interorganizational and cross sector interactions built on trust and a shared commitment to accomplish goals that individuals (actors or organizations) cannot achieve alone. Additionally, research on collaboration has shed light on the fact that designing and carrying out collaborative governance arrangements requires time and effort that may or may not lead to the desired environmental or societal outcomes (Koontz & Thomas, 2006). While research on collaboration sometimes examines how state and non-state interactions occur under a policy mandate (Cheng, 2006; Rodriguez et al., 2007) it has not provided thorough accounts of how mandated collaboration between governmental agencies unfolds during implementation.

Much of what we do know about local governmental collective action comes from studies of interlocal cooperation (Bickers et al., 2010; Carr & Hawkins, 2013; Delabbio & Zeemering, 2013; Blair & Janousek, 2013) and interagency coordination (Jennings &

Ewalt; 1998; Bardach, 2001; Bouckaert et al., 2010; Kwon & Feiock, 2010; Freeman & Rossi, 2012). A substantial body of this work has examined voluntary efforts to align policy goals and synergize management actions between local governmental agencies, producing a rich literature that describes the varied forms such efforts entail and the outcomes they achieve. The line of reasoning often taken in this research assumes that governmental agencies weigh the risks and costs of collaborating (e.g., loss of autonomy and time invested to make the collaboration work) with one another with the expected benefits of doing so (e.g., elimination of redundancies or improved efficiencies) (Tavares & Feiock, 2018; Yi & Cui, 2019). Theoretical frameworks applying this line of inquiry have produced detailed empirical accounts that explain why and how collective action emerges horizontally across local governmental agencies in some contexts yet not in others (Kim et al., 2020). While providing a basis for understanding the behavior of local governmental agencies, this body of research does not fully account for how the presence of a mandate changes the context within which governmental actors make strategic decisions.

There exists a gap, therefore, between research examining how mandates shape collaboration between state and non-state actors within governance networks and research examining why and how governmental agencies choose to engage with one another to address shared problems. The papers in this dissertation fill this gap by exploring the factors that influence how local governmental agencies engage in collective action under a policy mandate. In doing so, I address three core topics that are currently underexplored in research on mandated policy implementation: what motivates local governmental agencies to engage in collective action when under a mandate, how local

governmental agencies interact with one another to achieve mandate requirements, and what explains observed variation in the ways local governmental agencies interpret their role in mandate implementation.

The questions framing the inquiry into these topics are: When a policy mandate requires specific coordination outcomes yet allows local governmental actors to choose how to engage with one another, what are the factors that motivate the selection of institutional mechanisms? Do governmental agencies need to adopt collaborative approaches to meet the mandate's requirements? How do organizational level interpretations of the mandate within governmental agencies influence variations in the ways mandates are implemented? Through these questions, the dissertation examines a core theme that weaves throughout the papers: the tension between local governmental discretion and the specter of loss of local authority. In addition to contributing to theory on mandated governmental collective action, this dissertation aims to provide practical insights that may inform the design of policy mandates and help local level governmental actors, in California and elsewhere, navigate the challenges and opportunities posed by a mandate.

An Interdisciplinary Approach to Studying Mandated Policy Implementation

This dissertation draws on diverse theoretical perspectives and disciplinary traditions to understand why and how local governmental agencies implement policy mandates. As mentioned above, research on the governance and management of public networks has much to offer scholars studying the implementation of policy mandates. The extant literature incorporates theories from economics (e.g., local public economies, transaction cost economics, public markets), political science (e.g., polycentricity, public choice

theory, game theory), and sociology (e.g., toolkit theory of culture, structuration theory, institutional isomorphism) as well as related subfields of management studies, organizational studies, and public policy and administration.

Within these theoretical perspectives and disciplinary traditions, this dissertation adopts an institutionalist lens. Institutional theories offer diverse conceptualizations of the ways human and organizational behavior are constrained and enabled by formal and informal rules, resources, processes, practices, symbols, and artifacts that give structure and meaning to social life (North, 1991; Hall & Taylor, 1996; Ostrom, 2005; Hodgson, 2006; Lounsbury & Crumley, 2007; Ocasio & Gai, 2020). A focus on institutions is useful because it allows us to consider how implementation processes are rooted in socially embedded ways of thinking about and addressing societal problems (Clever, 2017). Additionally, institutionalist approaches center on the mechanisms (e.g., decision-making rules) and arrangements (e.g., patterns of formal and informal communication) that governmental actors strategically use to structure their interactions with one another. Yet, institutional theories also stress the ways that humans inhabit institutions and are therefore cognitively influenced by their unique organizational contexts (Hallett & Ventresca, 2006). The insights gleaned from these perspectives shed light on the ways humans select from a toolbox of institutional mechanisms and arrangements to alleviate perceived risks and achieve common goals. They also help us see how micro-level interactions shape the “rational” and “sensible” actions of governmental actors (Ocasio & Gai, 2020). As such, an institutional lens highlights the interplay between agency and structure in mandated local governmental collective action.

Employing a Comparative Method that Embraces Causal Complexity

Research Context and Methods for Data Collection

The data underlying the dissertation chapters were gathered through ethnographic fieldwork conducted in the state of California, beginning in fall 2018 to summer 2022. This period coincided with the early phases of SGMA implementation. In mandating basin-wide groundwater sustainability, SGMA took a triage approach. Groundwater basins that were already in a state of critical overdraft, meaning that groundwater extraction was causing a number of economic, social, and environmental problems, were the first to comply with SGMA's mandate. Initially, there were 21 critically overdrafted basins. Over time (and for different reasons) this number was reduced to 18. Once SGMA was passed in 2014, local governmental agencies (e.g., counties, cities, irrigation districts, water districts, community services districts) located in critically overdrafted basins had two years to form new political entities called Groundwater Sustainability Agencies (GSAs). This phase of implementation is referred to as GSA formation. Following this, GSAs in these basins had two more years to develop one or more Groundwater Sustainability Plans (GSPs) that covered groundwater basins. Thus, the ethnographic fieldwork conducted for this dissertation was carried out in the critically overdrafted groundwater basins that formed GSAs (2015-2017) and then developed one or more GSPs.

Comparative Methodology

To glean insights from data collected during ethnographic fieldwork, I adopted a comparative analytic approach, one that embraces causal complexity. Comparative case approaches are held together by an underlying logic that affirms the possibility of gaining “useful empirical generalizations from the examination of multiple instances of social

phenomena” (Ragin, 2000, p. 332). In the social sciences, there are different ways to model causal relationships in comparative case study research. Throughout the chapters assembled in this dissertation, I adopt a configurational view of causal complexity, meaning outcomes are understood as the combined impact of conditions that interact in different (and sometimes contradictory ways) (Byrne, 2007; Rihoux & Ragin, 2008). What this means is that a configuration of causal conditions that are linked to an outcome in one context may not be the same in a different context (Funari et al., 2021). This idea of equifinality (the possibility that multiple pathways lead to the same outcome) is useful for many types of comparative research but is especially relevant for studies of policy and governance processes where multiple types of factors influence social, environmental, and economic outcomes (Meyer et al., 2018).

The chapters in this dissertation apply the logic of comparison (as outlined above) in different ways. Chapters II and III employ Qualitative Comparative Analysis (QCA). QCA refers to a family of mixed methods approaches that use set theory and Boolean algebra to discern causal links between causal conditions and outcomes. In Chapter II, crisp set QCA is used to compare across cases to test theoretically derived propositions, relating agency concerns to the selection of institutional mechanisms. Chapter III uses multi-value QCA to examine whether and how the approaches agencies in critically overdrafted basins led to achievement of the mandated coordinated outcomes. In using QCA applications, theoretical interpretations are grounded in ethnographic understandings of the cases (Rubinson et al., 2019). In Chapter IV, a process-oriented, comparative case study approach is used to provide a descriptive account of two governmental agencies’ process for making sense of SGMA’s mandate (Bartlett &

Vavrus, 2017; Simmons, 2019). Here the aim is not to draw comparisons that articulate clear causal claims but rather to show how variations in collective, organizational processes influence the ways knowledge is produced and acted upon.

Overview of Chapters

The chapters in this dissertation aim to shed light on how local governmental agencies implement a state-legislated policy mandate. Collectively, the chapters outlined below provide empirical accounts that address a gap in the literature on mandated policy implementation.

Chapter I gives an overview of the SGMA legislation, providing context for the empirical research presented in the remainder of the dissertation. The primary aim of the chapter is to situate SGMA within the larger context of theory and research on groundwater governance, and to offer initial insights as to the factors that may make the approach adopted by SGMA effective. This is accomplished by describing the institutional landscape within which SGMA emerged; discussing the approach to groundwater governance set forth in the SGMA legislation and accompanying regulations; and providing an initial assessment of the early stages of implementation of SGMA, based on published empirical accounts and institutional theories of groundwater governance.

Chapter II examines how local governmental agencies that shared critically overdrafted basins were influenced by various concerns about the potential risks of coordination when they were deciding how to coordinate. This focus highlights the gap in our knowledge about how coordination mandates change the calculus of agency decision

making. Using a well-known theoretical framework (the Institutional Collective Action framework) as a starting point for theorizing how configurations of concerns influence the institutional mechanisms agencies select, this chapter uses data collected through ethnographic fieldwork and csQCA to test a number of propositions. The findings from the analysis suggest opportunities to improve the explanatory power of theories of interagency coordination by incorporating potential hierarchies of concerns, their distribution across the multiple local governmental agencies tasked with coordinating, and configurational effects. To this end, the chapter proposes a contingency theory of agency concerns and coordination mechanism choice under a mandate to coordinate.

Chapter III takes up where Chapter II leaves off by evaluating how the approaches that local governmental agencies select influence their ability to achieve SGMA's mandated requirements. With this focus, the chapter explores whether local governmental agencies, when they are given leeway to decide how to work together, adopt collaborative approaches, and if so, whether collaborative engagement leads to coordinated outcomes. To do so, the chapter weaves together different literatures related to collaborative governance, public sector networks, interorganizational relationships, and interagency coordination to develop a framework for conceptualizing the organizational forms and institutional arrangements agencies adopt to meet the mandate's requirements for coordinated outcomes. Using ethnographic data, the chapter employs mvQCA to discern causal links between different configurations of organizational forms and institutional arrangements and the achievement of coordinated outcomes. The findings highlight the importance of adopting certain types of collaborative institutional arrangements, pointing to the need for policymakers to consider how mandates such as

SGMA may be used to steer local governmental agencies towards collaborative engagement.

Chapter IV returns to the question posed in Chapter II of what motivates local governmental agencies to make decisions and act in the ways that they do when they are facing a policy mandate. Rather than examine how agencies are motivated by multiple concurrent concerns, this chapter offers a nuanced, descriptive account about how local governmental agencies collectively interpret their role in mandate implementation. Situated within organizational institutional theory and the collective sensemaking literature, the comparative analysis centers on two neighboring county governments that took different pathways to interpreting their role in implementation. Insights from this comparative case study shed light on how variation in implementation behaviors are rooted in the idiosyncratic ways local governmental actors construct shared understandings.

CHAPTER I

THE SUSTAINABLE GROUNDWATER MANAGEMENT ACT (SGMA)— CALIFORNIA’S PRESCRIPTION FOR COMMON CHALLENGES OF GROUNDWATER GOVERNANCE

Governing Groundwater—A Global Conundrum

Intensive use of groundwater has led to what some are calling a “global groundwater crisis” (Famiglietti, 2014; Alley & Alley, 2017; Thomas & Gibbons, 2018). Throughout the United States and the rest of the world, groundwater resources are immensely important, supplying 50% of human drinking water and half of the irrigation water used to grow food (Siebert et al., 2010). Groundwater resources also support ecosystems and are critical for managing the temporal variation in surface water availability. In many regions, groundwater abstraction has resulted in groundwater depletion (Konikow & Kendy, 2005; van Beek et al., 2010; Castilla-Rho et al., 2019; Tracy et al., 2019), causing lower groundwater levels, reduction in groundwater storage, salt-water intrusion, degraded water quality, land subsidence, and impacts on interconnected surface waters.

The United Nations, the Organization for Economic Cooperation and Development, academics, and many practitioners have concluded that current rates of depletions are largely due to a failure in governance (Foster et al., 2013; UNESCO, 2003). Governance includes the full set of organizations, structures, rules, and processes that enable collective action to occur (Lemos & Agrawal, 2006). Management refers to the specific policies and decisions that guide day-to-day actions influencing water. Governance is a predecessor to and sets up the framework through which management is decided and

acted upon. Thus the failure of groundwater governance is in essence a failure of the systems that enable decisions to be made, actions taken, and policies enforced.

Globally, groundwater is governed poorly or not at all (Foster et al., 2013; Hoogesteger & Wester, 2015; Sagala & Smith, 2008). Where existing mechanisms for governing groundwater have been ineffective or are non-existent, new governance systems will need to be put in place (Molle & Closas, 2017). As explained below, reforming existing or developing new systems for groundwater governance is far from simple (Mukherji & Shah, 2005; Theesfeld, 2010). Furthermore, for new or reformed systems of governance to persist and to support water resilience, they will need to adapt to uncertainty and ever-changing conditions (Rockström et al., 2014)

The state of California is one place where the struggle to effectively govern groundwater has been particularly visible. California is home to 39 million people and the sixth largest economy in the world. Across the state, groundwater provides between 38-46% of annual freshwater supply, with the majority being used for agriculture (DWR, 2013). In drought years, groundwater supplies the majority of water used in the state. Across the state there are as many as 2 million wells (DWR, 2019c). Prior to 2014, California could be considered a microcosm of the global groundwater conundrum in that state-level attempts to govern groundwater met substantial political resistance, and the modest state policies and programs that were adopted generated tepid local responses at best. Finally, in 2014 during an extended drought, the California legislature passed the Sustainable Groundwater Management Act (SGMA) (State of California, 2014), which directly seeks to confront many of the challenges intrinsic to groundwater governance.

This chapter examines the structure of SGMA and explains how it serves as a potentially promising alternative to prior approaches for groundwater governance. In doing so, we highlight common challenges for groundwater governance and how SGMA seeks to overcome them. We also illuminate how contextual factors, including support for implementation of SGMA by state and non-governmental actors, serve to alleviate some of the potential challenges of the governance structures created by SGMA. Combined, these findings shed light on factors that will be important for other regions seeking to follow California's novel approach to multi-level groundwater governance to consider.

Challenges for Groundwater Governance

The physical complexity of groundwater combined with the fact that it is a shared resource, used by diverse and dispersed interests, makes groundwater particularly challenging to govern (Alley et al., 1999). First, groundwater is invisible - it flows below the land surface and is generally only measurable at discrete points. In addition to its invisibility, groundwater is abstracted widely and by dispersed users. Groundwater is subtractable, such that pumping in one location impacts flows and availability in others (Bredehoeft, 2005). Adding to its complexity, groundwater is constantly in motion, and thus characterized by flows rather than stocks. These flows vary both due to the stochastic nature of the hydrologic cycle as well as heterogeneity of the subsurface through which it flows (Burke et al., 1999). Consequently, there can be a time lag between when groundwater is abstracted and when impacts of abstraction are experienced (Burke et al., 1999; Hugman et al., 2013). Lastly, multiple interconnected attributes of groundwater systems are important to human and ecological systems,

including water levels, quality, storage, impacts on interconnected surface waters, and land-surface stability (subsidence) (Margat & Van der Gun, 2013; Theesfeld, 2010)

Groundwater's physical properties provide an impetus for users to deplete the resource and set the stage for disagreement across users as well as those affected by impacts of groundwater use (Hoogesteger & Wester, 2015). Its invisibility complicates monitoring and enforcement of use. Its subtractability increases the potential for conflict across users. The heterogeneity of the aquifer and stochasticity of inflows and outflows increase uncertainty and require greater technical capacity needed to evaluate quantities of water available and to assess impacts of groundwater use (Theesfeld, 2010). Further, the interconnected attributes of the groundwater system means governance requires planning and managing for multiple objectives (Kiparsky et al., 2016; Milman et al., 2010). Effective governance of groundwater thus requires development of mechanisms that account for groundwater's physical complexity as well as groundwater's multiple uses and the interests of those who use or are affected by extraction. How to best achieve effective governance has been a topic of scholarly interest for decades (see e.g., Burke et al., 1999; Megdal et al., 2015; Clark, 1978; Varady et al., 2016). The multitude of groundwater problems around the world indicates that development of such mechanisms is not straightforward and will require a departure from status quo paradigms of water governance. Given existing groundwater problems need to be addressed in an uncertain and changing world, groundwater governance systems will need to be resilient (Rockström et al., 2014; Plummer & Baird, 2020).

The attributes of water governance systems that promote resiliency are a topic of ongoing enquiry (Rodina, 2019). There are many attributes and practices of water

governance systems that help to enhance resilience (Plummer & Baird, 2020); yet how to create new governance systems for groundwater that have these characteristics remains a conundrum. In particular, and as described below, creating groundwater governance systems with the attributes described by Plummer and Baird (2020) entails resolving many challenges. Specifically, these include establishing governance structures that are both self-organizing and polycentric; ensuring inclusive participation and building shared understanding; and creating systems that are adaptive, evaluate risks, and address a wide range of ecosystem services (Doremus & Hanemann, 2008). Before examining how SGMA addresses these challenges, and thus represents a departure from prior, failed attempts to govern groundwater in California, we further define how the challenges introduced above stymie resilient groundwater governance and management.

Organizing and Enhancing Governance Structures

Resilient water governance relies on there being polycentric networks of institutions that are both flexible and adaptive across multiple scales and boundaries (Plummer et al., 2014). Moreover, institutions with the authority, jurisdiction, and capacity to develop and implement policies and management are essential (Kiparsky et al., 2016). However, designing resilient governance structures for groundwater is no small undertaking.

Where some groundwater management capacity exists at any particular location, the governance challenge is determining whether to strengthen the capacities of existing jurisdictions or to create new jurisdictions and fit them in with the array of existing authorities. Where no groundwater management capacity exists, new institutions must be created. In either case, a central concern is matching capacity to the physical conditions of a basin and the set of management needs. There are contrasting advantages to

governance of groundwater at differing levels and spatial extents. Governance at the local level can facilitate incorporation of place-specific knowledge; monitoring and sanctioning; accountability of the governance system; and participation and support from groundwater users (Blomquist & Schlager, 2005; Hoogesteger & Wester, 2015; Ostrom, 1990). Yet, local level governance may be subject to pressures from local interest groups and have less access to the knowledge, resources, and administrative capacities needed for management (Larson & Soto, 2008; Olsson & Andersson, 2007). Governance at higher levels has the advantage of separation from local-level politics, the ability to reduce potential externalities occurring across local-levels, and often includes access to greater capacities and resources. However, top-down arrangements for governance across a groundwater basin can generate political opposition due to local-level concerns about change, fairness, and potential inefficiencies (Ashley & Smith, 1999; Hoogesteger & Wester, 2015) and larger-scale institutions may have their own problems of interest influence (Lebel et al., 2005).

Closely related is the question of geographic boundaries. Governance at the basin-scale allows for developing understandings of and managing the implications of use across the groundwater system as a whole, including avoiding conflicting actions (externalities) arising from poor coordination or disparate interests (Chermak et al., 2005). Yet basin-wide governance can involve significant transaction costs (Huitema & Meijerink, 2010) and it is difficult to devise rules effective across the full variety of interests and circumstances in a basin (Blomquist & Schlager, 2005; Olsson & Andersson, 2007). These tradeoffs mean that a common challenge to achieving resilient groundwater

governance is developing institutional arrangements that best fit the policy-shed and the problem-shed (Davidson & de Loë, 2014; Foster et al., 2013).

Incorporating Diverse Interests and Values

Resilient water governance involves the full inclusion of diverse perspectives and actors throughout the decision-making and planning process (Plummer et al., 2014). As described above, the physical properties of groundwater, including the dispersed nature of groundwater use and impacts and challenges of monitoring flows and abstractions, makes it especially challenging to consider the breadth of actors who have control over or will be impacted by groundwater use. Across the globe there are countless examples of when politics and/or the failure to incorporate the diversity of water users has undermined groundwater governance (e.g., see for example the special issue of the *Journal Water Alternatives* edited by Molle et al., 2018). This diversity includes differences among direct users of groundwater supplies (i.e., the pumpers themselves); differences with regard to both the quality and quantity of groundwater needed and the impacts of users on groundwater quality; differences in perceptions and valuations of impacts on interconnected surface water, habitat and other ecosystem needs; and differences in views on how to balance use of groundwater today versus using it as a storage reservoir for tomorrow. Consideration of the full spectrum of interests and needs leads to increased support for policies and can reduce the potential for future conflicts (Buizer et al., 2010; Foster et al., 2009; Jacobs et al., 2010). While active efforts to engage stakeholders and promote participation have been championed throughout the policy literature (Carr, 2015; Koontz & Johnson, 2004; OECD, 2015), a major challenge

to achieving resilient groundwater governance is incorporating the perspectives of multiple water users and uses, values and interests, in policy and management decisions

Using Science-informed Adaptive Management

The ability of policymakers and managers to adjust decision-making through an iterative process is critical to designing resilient systems of water governance (Clarvis et al., 2014). Adaptive management, also described as “learning by doing”, thus seeks a balance between accessing reliable and timely information with needing to make decisions under uncertainty (Plummer & Baird, 2020; Plummer et al., 2014). As described earlier in this section, substantial information and technical expertise is needed to understand groundwater flows and to predict the impacts of groundwater use in order to adaptively manage the multiple attributes of a particular groundwater system. In many, if not most, groundwater systems, an information deficit impedes the ability to take action (Mukherji & Shah, 2005; Theesfeld, 2010). Insufficient data on hydro-geologic properties; recharge pathways; historic water levels, withdrawals, and hydro-climatic conditions; and socio-economic conditions creates uncertainty and prevents future planning (Moench, 2004; Varady et al., 2016). Further, a lack of understanding of interconnections across the groundwater system (e.g., between groundwater quality and quantity, groundwater and surface water, water levels and subsidence, etc.) often means groundwater management focuses on specific, localized actions or effects (e.g., well spacing or an area of poor groundwater quality), rather than the system as a whole. Water management outcomes are highly correlated with goal specificity (Koontz & Newig, 2014), thus a challenge for groundwater governance is to develop science-informed

policy that adaptively manages across multiple inter-connected objectives (Knüppe & Pahl-Wostl, 2011; Megdal et al., 2015).

As with many areas around the world, the challenges summarized above (organizing and enhancing governance structures; addressing the diversity of water users' interests and needs; and using science-informed adaptive management) have been a barrier to groundwater governance throughout California. Below we provide an overview of California's historical approach to groundwater governance and how, through SGMA, it has sought to overcome them.

Groundwater Governance in California Prior to SGMA

As noted earlier, California is a large, diverse, and groundwater-dependent state (DWR, 2018a). Across the state there are 515 groundwater basins (Figure 1), 127 of which are deemed high or medium priority due to the pressures upon them; with 21 of the 127 considered to be in a state of critical overdraft (DWR, 2016a; DWR, 2018a). Groundwater used in these basins is subject to a body of water law that may be the most complicated in the United States. Groundwater in California is governed through multiple overlapping arrangements, including water rights, state-level administrative and legislative laws, regional agencies, and local-level agencies and ordinances. In this section, we review the evolution of groundwater governance and management over the last thirty years as California has grappled with increasing demands on water resources, variable climatic conditions, and changing values regarding beneficial use of groundwater.

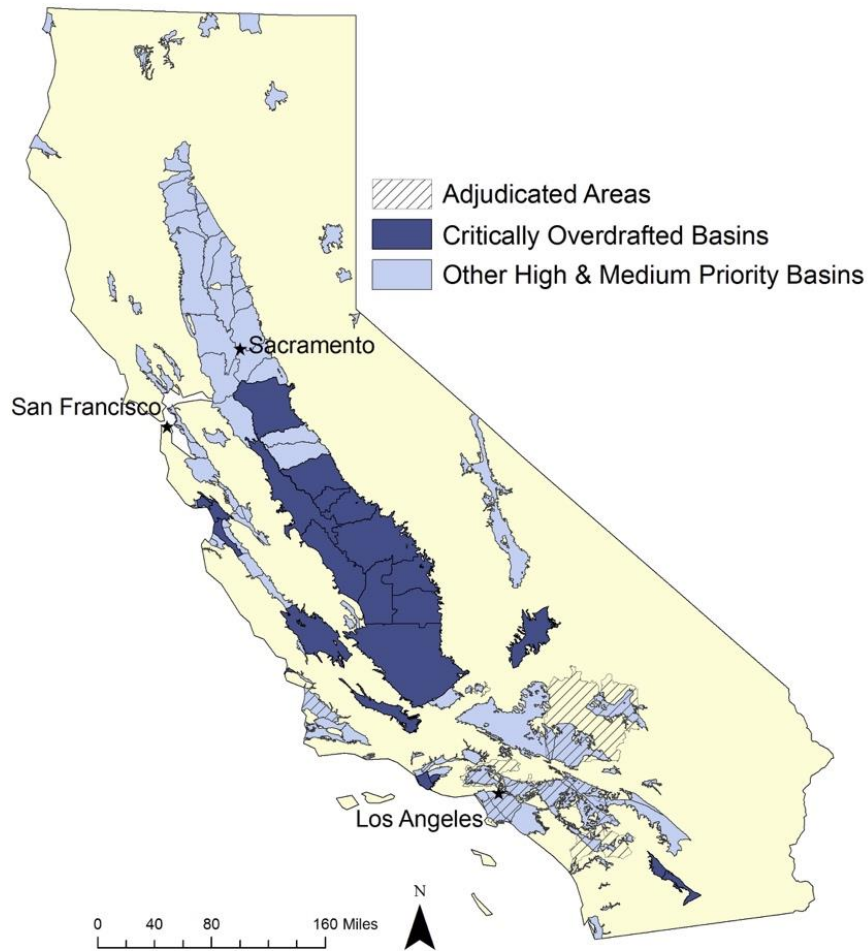


Figure 1. High and medium priority groundwater basins in California, including those designated as critically over-drafted. Based on 2016 prioritization [Data source: DWR Bulletin 118]

Rights to the use of underground water supplies in California are recognized and allocated by a multi-faceted (and sometimes overlapping) set of rules. These rules recognize overlying land ownership; prior withdrawal and use of groundwater; recovery of water that introduced directly or indirectly into an aquifer; and the acquisition of prescriptive rights through uninterrupted invasion of other users’ rights (Bachman et al., 1997; Blomquist, 1992; Littleworth & Garner, 2019). Underground flows of surface water streams are distinguished in California law from “percolating groundwater” or

groundwater per se and is treated as if it were surface water. Unlike surface water, there is no statewide permitting system in place for the withdrawal of percolated groundwater. Rights to groundwater use in California have been determined on a local basin-by-basin basis, primarily through adjudication, when they have been determined at all. Outside of 24 adjudicated basins, groundwater in California is treated as a common resource and all overlying landowners have unquantified and correlative rights to its use. Supplementing the allocation of water rights, are a number of groundwater management institutions, laws and regulations.

Consistent with the state's political tradition of supporting local governments and home rule (Krane et al., 2001), California has operated mainly to support local water management. State government has performed this function by acceding to most requests for the creation of local special-purpose districts or agencies, by providing incentives and assistance to local agencies, and by conveying surface water from the water rich, northern part of the state to the central and southern regions through the State Water Project. The California State Water Resources Control Board (SWRCB) and the California Department of Water Resources (DWR) are the two prominent state agencies concerned with the allocation and management of water supplies. The Water Resources Control Board administers the surface water right permit process, but also includes a system of Regional Water Quality Control Boards with authority to issue rulings, orders, and fines concerning land or water uses that may impair water quality. The Department of Water Resources operates the State Water Project and conducts studies of water conditions and the hydrogeologic properties of water resources.

Beyond state-level government, local water management activities are performed by an immense array of governments, including hundreds of counties and municipalities, thousands of special districts, and dozens of joint-powers authorities. Most water districts in California were created under general-purpose legislative enabling acts, each of which creates a class of water districts with a different mix of authority and responsibilities. Enabling acts have been the basis for county water districts, irrigation districts, California water districts, municipal water districts, flood control and water conservation districts, water storage districts, and community service districts. California also features many special-act districts, created by their own legislation. Although some local water agencies—most notably water storage districts, water replenishment districts, and groundwater management agencies—are authorized to manage groundwater extractions or to develop and operate water replenishment programs, they represent a minority of California water organizations with clear authority to manage either groundwater pumping or groundwater storage. Most local agencies lack clear authority to manage either groundwater pumping or groundwater storage.

In 1992, in an effort to promote groundwater management within the state while retaining the tradition of local control, the California legislature enacted Assembly Bill (AB) 3030 (See California Water Code [CWC] § 10753). Under AB 3030, the authority to engage in a wide variety of groundwater management activities was conferred upon any type of local water district, as long as it undertook an extensive process of consultation and planning with all other water agencies and general-purpose governments overlying a basin (CWC §10753.7). AB 3030 did not, however, provide local authority to assign, allocate, or restrict groundwater rights (CWC §10753.9). Senate Bill 1938, signed

in 2002, amended AB3030, incentivizing the groundwater management, by making state funding of groundwater projects contingent on development of groundwater management plans (DWR, 2019a)

Other state efforts to support local groundwater governance include the 1999 California Budget Act, directing DWR to develop model ordinances for groundwater management; the Local Groundwater Management Assistance Act, which provided assistance for local agencies to conduct scientific studies to improve management; the Groundwater Quality Monitoring Act, designed to improve coordination between monitoring networks, and the 2002 passage of the Integrated Regional Water Management (IRWM) Planning Act, which provided local agencies with incentives to cooperatively manage water. Following passage of the IRWM Planning Act, DWR developed guidance documents to support local development and adoption of management plans. (Grabert & Narasimhan, 2006). Lastly, in 2009 California took legislative action to establish the California Statewide Groundwater Elevation Monitoring (CASGEM) Program with the goal of improving state and local monitoring of groundwater elevations throughout the state (CWC §10920.(a,b)). By 2012, there were a total of 10,834 wells being monitored throughout the state (DWR, 2013). The CASGEM program has allowed DWR to classify basins based on their state of overdraft every five years (DWR, 2013).

Despite numerous state efforts to promote better groundwater management in California, groundwater levels in much of the state continued to decline. In the Central Valley between 2003-2010, 26 million acre feet of water were extracted, yielding various deleterious effects such as land subsidence, seawater intrusion, and diminished surface

water flows (DWR, 2013; Leahy, 2015). By 2012, many state groundwater policy initiatives had been tried in California. There were some locally initiated successes but also many false starts and widespread continued reluctance. Groundwater data were getting better, but there were still considerable gaps, and the data that had been collected were often collected inconsistently and in different formats, leading to issues of incompatibility (Hanak, 2011; Nelson, 2012). State policies that tried to encourage groundwater planning and management had produced mostly disappointing results. Of the 119 groundwater management plans adopted under AB3030, only 82 were considered active by DWR and only 35 were in full compliance with California Water Code (DWR, 2013) Further, though local agencies who created plans under AB3030 were empowered to impose mandatory and fee-based policies to curtail groundwater extraction, few local government agencies elected to do so (Nelson, 2012). Where local management existed, it tended to be controlled entirely by pumpers' interests with little recognition or incorporation of other uses and values.

The pre-SGMA experience provided important lessons for the study of groundwater management generally and for California state policymakers in particular. On one hand, California's enabling environment allowed for considerable local initiative and supported local action where it occurred. There are locally managed basins (e.g. Orange County) within California that have been managed within a safe yield for long periods (Ostrom, 1990; Blomquist, 1992) and some are internationally renowned models of groundwater management. On the other hand, having a legal framework that addresses groundwater and allows local action is not enough to produce effective groundwater management everywhere. At best, having state groundwater laws and programs is a necessary

condition. At worst, state groundwater laws and policies may inhibit the development of effective groundwater governance and management at the local level, and there are reasons to believe that California's complicated body of groundwater law has had that effect. The state's complex and changing system of water rights distributed veto positions and claims of superior rights to enough different interests that many perceived themselves and their water use to be immune from change. Even state-provided incentives (including the availability of funding) were unable to move enough groundwater users away from the deteriorating status quo. With the inadequacies of California's approach to groundwater governance exposed, the stage was set for crafting a new law to address the multiple negative impacts caused by over-extraction.

The Sustainable Groundwater Management Act

Governor Jerry Brown signed the Sustainable Groundwater Management Act (SGMA) into law in 2014. The drafting and passing of SGMA—which is a three bill package AB 1739 (Dickinson), SB 1168 (Pavley), and SB 1319 (Pavley)—was a highly contested process, with many environmental organizations and water policy institutes (e.g. Public Policy Institute California Water Policy Center) in favor and many local municipalities, particularly counties in the Central Valley and food production lobbyists (e.g. California Aquaculture Association and California Federal Farm Bureau) against (DiMento, 2017; Leahy, 2015).

SGMA was passed with the goal that local governments achieve sustainable groundwater management across all groundwater basins designated by DWR as medium to high priority (CWC §10720.7). To do so, SGMA requires the formation of new governing bodies - Groundwater Sustainability Agencies (GSAs) and delegates to them

responsibility and authority to plan for and manage groundwater to achieve sustainability. Existing local agencies interested in becoming GSAs had until June 2017 to formally notify DWR with their intent to become a GSA in their basin (CWC §10723.8). Existing local agencies were given the option to independently become a GSA or partner with other existing agencies to jointly form a GSA (CWC §10723.6). To make sure the entire expanse of each groundwater basin was covered by a GSA, SGMA designated counties as the default GSAs, though counties could opt out of being a GSA (CWC §10724.a).

SGMA requires groundwater sustainability be achieved at the basin scale, and defines sustainability as the avoidance of six undesirable results: chronic lowering of groundwater levels, reduction of groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletions of interconnected surface water (California Code of Regulations [CCR] §354.26). To help them meet this requirement, GSAs are tasked with developing and implementing Groundwater Sustainability Plans (GSPs). In developing GSPs, GSAs must ensure their planning is based on the best available science and must adopt an adaptive approach, evaluating the status of the basin and updating plans every five years. Groundwater Sustainability Agencies must also plan for and implement specific management actions and projects that are designed to avoid the negative impacts referred to by SGMA as undesirable results (CCR §354.44). Throughout the planning and implementation process, GSAs need to adopt a transparent approach that includes the multiple perspectives of diverse stakeholders, many of whom have conflicting values and perspectives (CWC 10727.8).

While SGMA mandates that sustainability should be achieved at the basin scale, DWR regulations do not limit the number of GSPs in a basin (CCR § 355.4.b). Figure 2

illustrates the various combinations of GSPs that may occur. The simplest of these is the case where a single GSP covers the entire basin and is developed and implemented by a single GSA. Slightly more complex is a case where a single plan covers the entire basin, but is developed and implemented by multiple GSAs. Lastly, there could also be multiple GSPs within a basin that are developed and implemented by multiple GSAs. In cases where there are multiple GSPs covering the basin, GSAs are required to make formal coordination agreements with all GSAs in the basin that are developing a plan, showing that GSAs are working in a coordinated effort to achieve sustainability on the basin scale (CWC §10727).

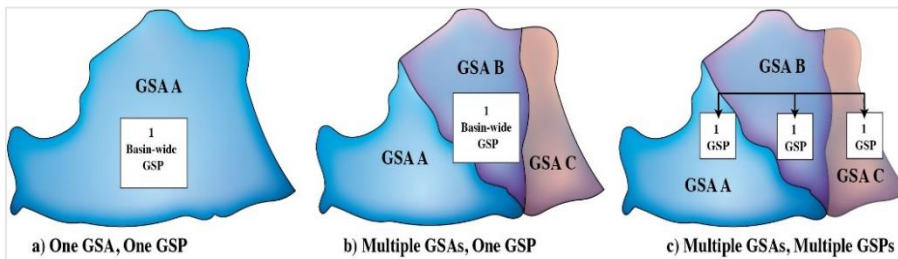


Figure 2. Illustration of the multiple approaches GSAs may take when submitting groundwater sustainability plans (GSPs). [Picture adapted from (DWR 2016)].

Groundwater Sustainability Agencies must work on a short deadline in order to comply with SGMA. Groundwater Sustainability Plans for basins that are currently experiencing overdraft conditions must be submitted by January 2020. The plans for all other medium and high priority basins must be submitted by January 2022. After submittal, DWR will evaluate submitted plans to determine if a plan is considered approved. If a plan is considered inadequate, the SWRCB acts as a backstop by placing the basin on probation thus requiring GSAs within that basin to file extraction reports with the state. In cases

where a plan is out of compliance, the state, acting through the State Water Resources Control Board is given authority to develop their own groundwater plans, take over management of groundwater resources in the basin, and charge a management fee (CWC §10735.6-8).

SGMA's Approach to Groundwater Governance Challenges

SGMA did not attempt to supplant local groundwater management where it had developed. Existing local arrangements – particularly the allocation and limitation of groundwater withdrawals in the adjudicated basins and the groundwater taxing and recharge programs of various special districts – were largely grandfathered by SGMA and left in place with the addition of some reporting requirements. The bridge from the pre-SGMA environment in California to the current situation was built instead on attempts to address the aforementioned groundwater governance challenges.

Organizing and Enhancing Governance Structures

SGMA adopts a hybrid institutional structure that merges state-level oversight with local-level governance, and in doing so, addresses many shortcomings and tensions associated with developing polycentric systems of governance. At the core of SGMA is the principle that local agencies are best able to govern and manage groundwater within their jurisdictions. The law grants the local level entities that form GSAs substantial responsibility and authority (CWC §10725), and provides local decision-makers a maximum amount of flexibility to adapt institutional structures, jurisdictional boundaries and groundwater management to local contexts. Yet SGMA also requires sustainability be achieved at the basin scale, and, where multiple GSAs are producing multiple GSPs

within a basin, those GSAs must coordinate the data information and assumptions and demonstrate how their varying analyses and efforts are compatible with sustainability on the basin scale (CCR §357.4.a). Further, SGMA also provides a backstop by granting the state the power to intervene in basins that are non-compliant with the law's regulatory requirements (CWC §10735.2).

For such a hybrid approach to organizing and enhancing governance structures to be successful, GSAs will need to overcome significant challenges and constraints. Local-level agencies forming GSAs face the challenge of forming resilient institutional and decision-making governance structures that have the financial and technical capacity to develop their management plans by the statutory deadline. While the state has provided assistance to GSAs, in the form of technical support, best management practices and opportunities for financial assistance for coordination, GSA responsibilities and the resources and capacities needed are still quite large (Kiparsky et al., 2016). Further, SGMA's requirement groundwater sustainability be achieved at the basin scale compels existing local agencies to plan beyond their individual, jurisdictional boundaries. Where multiple GSAs exist in a basin, this means that some elements of compliance with the law are beyond their control. Coordination of data, methodologies, metrics, and goals requires communication and a will across multiple parties. Historical relationships, current differences and differential GSA capacities and concerns will influence how coordination plays out. Groundwater Sustainability Agencies may also face challenges to their newly vested power and authority. Interest groups may challenge a GSA's authority to manage groundwater, resulting in potentially lengthy and costly court battles. These challenges may come from external entities or from a GSAs own constituents, either with the

concern that the GSA is not doing enough to achieve sustainability or with the concern that the GSA has adopted rules and polices that negatively affect local, agricultural economies.

GSA compliance will also be constrained by factors external to SGMA. GSAs must plan for and take actions to achieve groundwater sustainability in the context of the multitude of pre-SGMA laws and regulations that exist across the state. SGMA does not change or affect surface water rights and laws or prior groundwater adjudications. Further, the local-level entities forming GSAs are all subject to the various public administration, tax, and other laws governing local-level governmental agencies throughout the state. The outcomes of SGMA are thus contingent on the ability of GSAs to navigate this complex regulatory environment as they seek to govern groundwater for sustainability.

Lastly, the outcomes of SGMA will very much depend on how GSAs interpret the threat of state intervention. If GSAs are unconcerned about the threat of state-level intervention in the basin, they may lack motivation to implement policies that are stringent enough to achieve groundwater sustainability. For some GSAs, state intervention may not be viewed negatively and may even be welcomed. This may especially be true in cases where the relationship between the GSA and their constituents prevents the GSA from undertaking policies it sees as necessary. If the threat of state intervention is not taken seriously, it remains to be seen the impacts on state resources and capacities.

Incorporating Diverse Interests and Values

SGMA explicitly requires incorporation of the diverse interests and values of groundwater by mandating GSAs provide opportunities for stakeholder engagement. Throughout the GSA formation process and plan development, GSAs were tasked with gaining a detailed understanding of who their stakeholders were and keeping them informed through notification. Local agencies forming GSAs had to identify, notify, and consult all of the beneficial uses and users in the basin (CWC §10723.1-4) prior to GSA formation. Further, prior to preparing a GSP, GSAs had to provide written notice town, city or counties located within a geographic area covered by a plan (CWC §10727.8) and to any report to DWR on how interested parties could engage with the GSA on development of the GSP (CCR §353.6.a).

Moreover, the extent to which GSAs provide avenues for stakeholder engagement and address the interests and values of groundwater uses is one of the metrics the DWR will use to evaluate GSPs (CCR §355.4.b.4,10). GSAs must, therefore, include a description of the beneficial uses and users of the groundwater basin (CCR §354.10.a), including groundwater dependent ecosystems (CCR §354.16.g) in GSPs. GSAs must also design monitoring networks to track impacts of groundwater use on beneficial uses and users in the basin and adjoining basins (CCR §354.34.f.3). When submitting the GSPs, GSAs must demonstrably show how they engaged these interests by providing a list of public meetings the agency held and a description of the agency's decision-making process, which includes an account of how public engagement was incorporated into the plan's development (CCR §354.10.b-d). Beyond incorporating stakeholder feedback, GSAs

must also outline the process by which interested parties are informed of potential management actions (CCR §354.44.b.1.B).

SGMA's mandate that GSAs consider the full range of interests and values of groundwater users and provide substantive and meaningful avenues for stakeholder engagement push GSAs beyond familiar notification and public comment processes and toward the aim of greater inclusivity consistent with calls for resilient governance (Ebdon, 2002; Nabatchi & Amsler, 2014). Yet the extent to which this requirement serves to facilitate governance, including producing more balanced or innovative policies, garnering support, reducing conflict, increasing compliance, etc., will depend on how GSAs implement these requirements. As the regulations do not provide specific requirements regarding the mechanisms to be used for engagement, nor the extent to which engagement must occur, GSA interpretations of the mandate and their capacities and will to engage, will have a strong impact on engagement outcomes.

Integration of diverse interests into governance and development of meaningful mechanism for engagement and participation are challenging processes (Carr, 2015). Success will likely vary across GSAs. Identifying and engaging with the full scope of beneficial users and affected parties is complex. While some GSAs have incorporated representatives from stakeholder groups into their boards or have created advisory roles for those stakeholders (Conrad et al., 2018; Milman et al., 2018), other GSAs are relying solely on less formalized engagement and participation mechanisms. Reaching out to stakeholders is time consuming, costly, and requires skills and capacities that GSAs may not have. For example, while counties have institutionalized requirements and processes for such engagement, other entities, such as small water districts may have less

experience and expertise. Further, GSAs need to consider stakeholders who fall outside their own social, cultural, and economic understandings. Such engagement may require translators in order for communication to occur with stakeholders who do not speak English. Additionally, GSAs, particularly in the critically over-drafted basins, have a short time frame in which to develop GSPs. Transparent and inclusive processes can entail substantial transaction costs, and the GSP development timeline is quite short. Lastly, meaningful engagement requires stakeholders have a fairly deep knowledge of the requirements and specific meanings of technical terms. As described below, groundwater is highly technical and SGMA requires GSAs adopt science-informed policy making. Many of those affected by SGMA lack knowledge of groundwater systems and familiarity with the regulations. Thus, the success of GSAs in engaging with stakeholders will also be contingent on GSAs ability to educate and communicate, as well as stakeholder willingness and abilities to learn.

Using Science-informed Adaptive Management

SGMA answers the call for governance that supports knowledge-driven adaptive management (Burton & Molden, 2005) while pushing for policy and management actions based on current understanding of the system, even in cases where that knowledge is minimal. As discussed earlier, SGMA regulations require that GSAs identify where they lack understanding and then outline their plan for expanding monitoring networks to fill knowledge gaps. In their five-year updates, GSAs must assess their monitoring networks and data management systems. They must also examine how their current policies and management actions are meeting their plan's interim milestone targets to avoid undesirable results. GSAs that are not meeting their targets must articulate in their GSPs

what changes they will make to achieve sustainability by 2040. If updated plans are not re-approved by DWR, the intervention process outlined above takes effect, which may result in SWRCB taking over management in a basin (CCR § 356.2; CCR §356.4).

GSA face barriers to gaining the level of understanding needed to develop and implement their plans. While the state of California has made effort to gain knowledge of groundwater systems and has developed several modeling tools to inform GSA policy and management actions, there are still large gaps in data and understandings that GSAs will need to fill (Moran et al., 2016; Moran & Wendell, 2015). Yet filling those gaps is fraught with technical, logistical, and financial challenges. For many GSAs, acquiring new data and turning that data into information requires technical expertise outside their capabilities. Thus, they will need to hire technical consultants, adding to the financial costs of plan development. GSAs may also face legal challenges in establishing well monitoring networks, requiring extensive negotiations with private landowners and state and federal agencies. Similarly, data a GSA needs for understanding a portion of the basin outside their jurisdictional boundaries may be proprietary. Lastly, even in cases where GSAs have a sufficient amount of data, that data may be of poor quality or incompatible due to a lack of standardized data collection methods and protocols.

The requirement that GSAs implement adaptive management also poses significant challenges. Design and implementation of the projects and management actions that will be used to achieve groundwater sustainability requires substantial time, analysis, and at times resources. Projects may require securing grant funding, acquiring land, developing infrastructure, navigating existing legal requirements and approvals, and drafting complex sets of rules. Adapting projects and management actions in a short timeframe, or

even at all, may be infeasible. The time lag between when GSAs submit their GSPs for evaluation and periodic review and when DWR is able to complete evaluation of the plan is another challenge for adaptation. A GSA is expected to begin implementation of their GSP once it is adopted; however, DWR has two years to evaluate the first iteration of GSPs. Consequently, GSAs must make decisions and begin implementation without the certainty their plan will be approved by DWR.

Lastly, implicit in SGMA's requirement that GSAs use best available science for adaptive management is the need for high levels of collaborative knowledge production and decision-making between large numbers of actors with various perspectives, levels of expertise, and motivations. In basins where multiple GSAs are developing GSPs, SGMA requires GSAs develop formal agreements and processes for data and information sharing (CCR §357.4.a), yet GSAs still have a high degree of agency in determining what those agreements and processes contain. How well these institutional processes facilitate basin-scale knowledge production may determine successful implementation of policies and management actions, particularly if high levels of collaboration decrease the prohibitive costs associated with acquiring groundwater data and information—often thought a barrier to science-based management (van der Gun, 2017).

SGMA as a Model for Resilient Groundwater Governance?

California's adoption and implementation of SGMA, if successful, may serve as a model for resilient governance of groundwater in multi-level governance contexts elsewhere in the United States and around the world. However, California's success (or failure) in achieving groundwater sustainability may be as much attributable to the design of this new governance system as to the defining political, economic, and social contexts

of California. As such, scholars and practitioners must consider which aspects of SGMA are likely generalizable and which may be peculiar to California. Here, we discuss the potential for SGMA to inform global groundwater governance and draw attention to unanswered questions about the transferability of SGMA.

First, it is worth noting while not all groundwater users or managers are in favor of SGMA, both governmental and non-governmental entities are dedicated to its success. The State of California has invested vast financial and technical resources to ensure SGMA is successful. It has awarded over 85 million dollars in grants and loans to support GSA formation, GSP development, and GSP implementation, financed through bond measures and the state budget (DWR, 2019b). Further, through the Department of Water Resources, the state has developed best management practices, model ordinances, and other examples for GSAs to draw upon. The state has also hired additional staff to ensure it can provide advice and the high level of oversight mandated by the law. In addition, countless academics, universities, non-governmental organizations, policy think tanks, and professional associations have been offering a range of services including undertaking analyses; providing advice; organizing and facilitating workshops and trainings; creating websites and otherwise disseminating information. The high-level of engagement by both the state and civil-society has been an important element of the early stage implementation of SGMA and may or may not be replicable by other states or governments.

Another unique aspect of SGMA is that it is not starting *tabula rasa*. SGMA builds upon California's existing institutional structures and water management policies that for decades have served to engage policy makers and water managers in water management

and in collaborative planning. The local-level agencies eligible to form GSAs have prior experience managing surface and groundwater, and with engaging in planning processes. In addition to participating in development of California's state-wide water plan, many of these agencies (along with county and city governments) have developed integrated water resources plans, urban water management plans, and groundwater management plans under AB3030. Lastly, while large data gaps do indeed exist, SGMA is not being implemented in a data vacuum. Substantial data and information on water resources geology, climate, and more are available through repositories, such as the Water Data Library, California Irrigation Management System, and Groundwater Information Center. Further, the state has developed myriad localized datasets and models, such as the California Central Valley Groundwater-Surface Water Simulation Model (C2VSIM), and local-level agencies have information based on their management of water over the past decades (DWR, 2018b). This history of collaboration, management models, and information may be imperfect and incomplete, but provides a starting point from which SGMA builds.

Yet this robust history also provides a potential constraint to implementation of SGMA. Governance, and institutional formation, is frequently the result of bricolage – in which mechanisms for governance are borrowed from or reconstructed from existing sources (Cleaver, 2017; Merry & Cook, 2011). The GSAs formed under SGMA were created by existing local-level agencies, which voluntarily took on new responsibilities themselves or in partnerships. The extent to which these agencies adopt novel institutional approaches or choose instead to govern as an extension of past practices is still unfolding. It is possible that bricolage may lead to inefficiencies or barriers to

information sharing and decision-making (Milman et al., 2010). Conversely, local level agencies may develop truly novel institutional structures and arrangements, driven by the need to comply with the short statutory deadlines. In particular, the processes and mechanisms GSAs use to coordinate their knowledge production with other agencies, engage in meaningful dialogue with stakeholders and interest groups, and adopt adaptive management policies may be different from previous approaches or may be continuations of the same. What choices they make will likely depend on history, resources, and imagination, informed by legal and technical considerations.

Another factor influencing both implementation of SGMA and its applicability as a transferrable model for groundwater governance is the role of state agencies in California who are charged with oversight and enforcement. While the state has invested large amounts of time and resources to ensure SGMA is successful, it is unknown how state regulating and enforcing agencies (e.g. DWR and SWRCB) will adapt to their respective roles as evaluators and enforcers of the mandatory requirements of the law. These agencies have historically not had a strong enforcement role within the state, and have limits to their human resource, financial, and legal capacities. The extent to which local agencies perceive the threat of state intervention as credible may influence their depth of compliance with SGMA. Further, even if GSAs take seriously the threat of state intervention, and try to comply fully, GSAs will likely interpret the requirements different from each other and the state. Thus, the state must adapt its dual role of continuing to support local agencies by providing clear guidance while maintaining a perceived power differential. This distinctive interplay between the state and local

agencies is integral to the success of SGMA and should be considered if applied to other political and regulatory contexts.

SGMA's novel approach to achieving groundwater sustainability may be one of the most intentional efforts currently underway to promote resilient groundwater governance. Therefore, implementation of SGMA is a natural experiment from which scholars and practitioners can learn about groundwater governance processes. Close examination of SGMA as it unfolds, including its successes and its shortcomings, can help provide insights on how to organize and enhance governance structures, incorporate the diverse interests and values of groundwater users, and adopt science-informed adaptive management across multiple objectives. Specific attention should be given to the multitude of contextual factors influencing implementation, so as to illuminate which aspects of SGMA are transferrable, and where adaptations need to be made to ensure applicability to other locations. Whether or not SGMA is immediately successful in curtailing over-extraction of groundwater in California, implementation of this law will alter our understanding of what resilient groundwater governance looks like and will likely lead to redefinitions of the metrics by which we measure success or failure. If, however, SGMA achieves its aspirational goals, the lessons learned offer hope of a solution to the common challenges of groundwater governance.

CHAPTER II

NOT WHETHER TO COORDINATE, BUT HOW: AGENCY CONCERNS AND MECHANISM CHOICE UNDER A MANDATE FOR INTER-AGENCY COORDINATION

Introduction

The ubiquity of polycentric and/or nested multi-level governance makes inter-agency coordination an essential feature of contemporary policy, law, and administration (Marks & Hooghe, 2004; Peters, 2013; Freeman & Rossi, 2012). Coordination, which refers broadly to processes and practices that aim to synchronize activities across organizations, is needed to reduce the negative effects of redundancies, inconsistencies, and contradictions in laws, policies, and actions (Peters, 2013). Coordination can also enhance agency capacity, capture benefits from economies of scale, and mitigate or avoid externalities (Watson, 2015; Krause & Hawkins, 2021; Kim et al., 2020).

While inter-agency coordination confers multiple benefits (Lindsay et al., 2008; Watson, 2015; Peters, 2013), it does not always emerge, and where it does, it takes myriad and complex forms. Agencies can strategically employ a variety of mechanisms to coordinate. These mechanisms delineate procedures agencies will use to coordinate, including how decisions will be made and how commitments and responsibilities will be defined, shared, modified, or ended. The mechanisms used to coordinate affect how coordination unfolds, and potentially, its success. Coordination mechanisms can have other consequences as well, including ‘policy feedbacks’ (Moynihan & Soss, 2014, p 321) that restructure inter-agency power relationships, redistribute resources, and

otherwise affect organizational cultures and governance structures (Rodríguez et al., 2007).

Where coordination between agencies does not emerge voluntarily, or to ensure it occurs, higher-level government officials may seek to steer it (Moseley & James, 2008; Saz-Carranza et al., 2016). States may induce local coordination through incentives and information or through mandates with support-and-sanction elements familiar in several federal-state programs (see e.g., Blum et al., 2015; Engel, 2015). Some coordination mandates specify how coordination should occur, but most mandates are “vague... leaving implementing agents’ ample space to determine how to coordinate” (Schafer, 2016, p 25).

Much remains to be understood and explained about inter-agency coordination. There has been progress in identifying the conditions under which voluntarily agencies choose to coordinate, but less (albeit growing) attention to how they organize that coordination. Agencies have many concerns about coordination and seek to minimize those concerns when making decisions regarding coordination. The Institutional Collective Action (ICA) Framework provides a conceptual model for examining this topic (see Kim et al., 2020 for a detailed review). However, this framework and research employing it have not addressed the complexities that arise when agencies must balance across differing types of concerns about coordination. Further, while the framework may be capable of addressing a broad range of inter-agency relationships, it was designed to theorize voluntary inter-agency relationships rather than mandated coordination. Consequently, we still need explanations of the variations in coordination arrangements when coordination is mandated rather than voluntary.

Our research addresses how agencies' concerns about the potential risks of coordination, including compliance with a mandate, affect their choice of coordination mechanisms. We examine inter-agency coordination in implementation of California's Sustainable Groundwater Management Act (SGMA). SGMA mandates that agencies located within specified groundwater basins coordinate to share knowledge, develop sustainability plans and metrics, and take actions to achieve basin-level groundwater sustainability. Our analysis identifies agencies' coordination concerns and analyzes how those concerns combine configurationally to affect their choices of coordination mechanisms. Drawing on this analysis, we then present a contingency theory relating coordination concerns to the selection of coordination mechanisms.

Agency Concerns and Coordination Mechanisms

Inter-agency relationships have been studied under a variety of nomenclatures, including: coordination, collaboration, inter-organizational partnerships, joined-up management, network governance, and contracting, among others (e.g., Cejudo & Michel, 2017; Pollitt, 2003; Provan & Kenis, 2008; Rossignoli & Ricciardi, 2015; Peters, 1998; Kim et al., 2020; Milward & Provan, 2003; Shrestha & Feiock, 2021; Anderson et al., 2014; Bryson et al., 2015). While each term conveys nuances, there is both overlap across them and differences in how they are applied (Costumato, 2021; Peters, 2015; O'Flynn, 2009). For example, the terms coordination and collaboration are sometimes used as broad categories indicating some form of constructive or mutually beneficial relationship (see e.g., Peters, 2015; Bouckaert et al., 2010; Bjurstrøm, 2019), other times as neighboring but distinct points on a spectrum of integration (see e.g., McNamara, 2012; Bryson et al., 2006; Thurmaier & Wood, 2016), and other times as contingent

components with coordination viewed as a prerequisite for collaborative success (see e.g., Gulati et al., 2012). Collaboration is also sometimes conflated with collaborative governance, which refers specifically to bringing together public and private stakeholders in a forum for joint decision-making (Ansell & Gash 2008).

We use the term coordination to refer broadly to the processes and practices adopted by agencies to ensure agency goals and activities account for, adjust to, and or align with those of other agencies (see e.g., Alexander, 1995; Bouckaert, Peters, & Verhoest, 2010; Peters, 2015). Under this definition coordination can be pursued through varied forms of relationship (informal to formal) and can entail any depth of integration (from none to outright consolidation).

A useful starting point for examining coordination is the ICA Framework, which depicts inter-agency relationships as resulting from boundedly rational decision-making processes during which agencies weigh the risks, costs, benefits, and broader implications of coordination. The situational context affects the perceived risks and benefits of coordinating. Agencies form relationships with each other when they expect the benefits of doing so outweigh the costs. The coordination mechanisms they select are contingent upon the risks of coordination (Kim et al., 2020; Yi & Cui, 2019; Tavares & Feiock, 2018).

As the ICA Framework theorizes voluntary coordination and risks of coordination differ between mandated vs voluntary coordination, the framework must be adapted for settings in which coordination is mandated. The ICA Framework defines three risks of voluntary coordination: *coordination* – the inability to identify partners and reconcile mutually beneficial opportunities; *distribution* – the difficulty reaching agreement

regarding the division of collective benefits and costs, and *defection* – the potential that one or more agencies will not follow through with agreed-upon actions (Kim et al., 2020). Under a coordination mandate, the first of these risks diminishes if the mandate not only requires that coordination occur but identifies who is required to coordinate. Distribution and defection risks remain but are modified. Under a mandate, the distribution risk is that coordination will result in an inequitable allocation of responsibilities, costs, and benefits; the defection risk is that an agency will need to make up for the inadequacies of a coordination partner.

Further, two additional risks arise under a mandate. First, the mandate introduces the risk of loss of *autonomy*. In conceptualizing voluntary coordination, the ICA Framework characterizes loss of autonomy as a transaction cost associated with the coordination mechanism. In other words, loss of autonomy is portrayed as the cost that arises due to the external imposition of decisions that differ from an agency's preferred choice plus the monitoring and enforcement costs associated with the coordination mechanism (Kim et al., 2020, p 7). However, when under a coordination mandate, beyond being concerned with minimizing the cost or maximizing the net-benefits of a potential relationship, agencies are concerned about the effects of situational variables (power relationships, ideational differences, etc.) on coordination decisions and each agency's ability to pursue core tasks (Bjurstrøm, 2019; Bouckaert, Peters, & Verhoest, 2010; Schafer, 2016). As those effects are speculative until mechanisms are selected and coordination begins, we conceptualize loss of autonomy as a direct risk of coordination rather than a transaction cost.

Second, mandated coordination introduces the risk of non-*compliance*. Unlike autonomy, distribution, and defection risks that arise within the inter-agency relationship itself, compliance risk reflects the potential that agencies collectively do not satisfy the mandate's requirements and are exposed to potential penalty.

The risks of coordination under a mandate (*autonomy, distribution, defection, and compliance*) affect how agencies structure their relationships. Agencies can choose from a multitude of mechanisms for coordinating (Alexander, 1995; Rogers & Whetten, 1982). Prior research on coordination characterizes mechanisms in several ways. The ICA Framework, while acknowledging a need to develop more sophisticated depictions, distinguishes mechanisms based on their degree of authority over participating agencies and whether a mechanism encompasses bi- or multi-lateral relationships (Kim et al., 2020, pp 19 & 21; Tavares & Feiock, 2018). Outside the ICA Framework, scholars have characterized mechanisms based on the depth of integration of decision-making (see e.g., Provan & Kenis, 2008) and mechanisms that set performance targets for coordinating partners to meet while retaining separate operations (Boyne & Chen, 2007; Waylen et al., 2015). These identifications of coordination mechanism attributes are complementary and not mutually exclusive, and we can combine them to produce a characterization of coordination mechanisms based on three attributes (Table 1).

Table 1. Attributes of Coordination Mechanisms, Potential Options for Each Attribute, and How Attribute Options Relate to Coordination Concerns

Attribute	Options for Each Attribute	Relationship Between Coordination Concerns and Attribute Options
<p>Mechanism</p> <p>Authority:</p> <p>The degree of authority of the coordination mechanism.</p>	<p>The coordination mechanism may entail authority that:</p> <ul style="list-style-type: none"> ▪ imposes binding commitments on agencies. ▪ makes non-binding recommendations to agencies. 	<p>Non-binding decisions or decisions that must be ratified by each agency reduce <i>autonomy</i> concerns by giving each agency final decision-making authority but may increase <i>defection</i> and <i>compliance</i> concerns.</p>
<p>Decision-Making:</p> <p>The extent to which agencies make decisions jointly or independently</p>	<p>The mechanism may structure decision-making to be:</p> <ul style="list-style-type: none"> ▪ fully joint, through shared governance or delegation to a lead agency. ▪ limited scope, encompassing only a defined set of joint decisions. ▪ deliberative only, with joint discussion yet fully 	<p>Joint decision-making can increase <i>autonomy</i> and <i>distribution</i> concerns while lowering <i>compliance</i> concerns. Constraining the scope of topics for which joint decisions are required may reduce <i>autonomy</i> concerns.</p>

independent decision-making.

Performance Targets:	The coordination mechanism may:	Specifying concrete and quantitative responsibilities for each agency
The assignment of agency responsibility for achieving specific outcomes.	<ul style="list-style-type: none"> ▪ set concrete and quantitative goals for each agency. ▪ not set outcome responsibilities for each agency. 	reduces <i>distribution</i> and <i>compliance</i> concerns by defining expectations agencies must meet.

In selecting coordination mechanisms, agencies can weigh these attributes to control or minimize perceived coordination risks. Mechanisms can reduce or intensify agency concerns by imposing behavioral controls related to rules and procedures or outcome controls related to expected performance and monitoring (Dekker, 2004; Anderson et al., 2014). Mechanism attributes protect against some concerns more than others (Table 1). Mechanisms that entail joint decision-making may reduce concerns regarding *defection* and *compliance* but be seen as negatively affecting *autonomy*. As illustrated through research on contracting and controls, formal agreements with binding authority can protect against risks of *defection* whereas goal setting and allocations of responsibilities through performance targets can address *distribution* as well as *compliance* concerns.

How agencies balance their coordination concerns and why they select the coordination mechanisms they do has yet to be fully understood. The ICA Framework's assertion that higher overall risks lead to the adoption authoritative coordination mechanisms has gained empirical support in studies explaining why formal mechanisms are selected over informal ones (see e.g., Park et al., 2020; Yi et al., 2018; Terman et al., 2020; Tavares & Feiock, 2018; Hansen et al., 2020). Research has also begun to identify the influences of contextual conditions (e.g., population size, agency capacity, etc.) on selection of coordination partners and adoption of formal vs informal mechanisms (see e.g., Krause et al., 2019; Hulst et al., 2009; Bel & Fageda, 2006; Tavares & Feiock 2018). Yet progress in understanding the choice of formal vs informal coordination has not been matched with knowledge regarding selection other attributes of coordination mechanisms, including depth of decision-making integration or adoption of performance targets (see Iborra et al., 2018 for an exception).

To better understand the coordination that will emerge under a mandate, we need greater knowledge of why agencies choose the coordination mechanisms they do. Thus, our research is directed towards determining which types of coordination risks most strongly drive coordination mechanism selection, how differing risks influence agency preferences for some mechanisms over others, and how the risks associated with a mandate influence mechanism selection.

Influence of Concerns on Selection of Coordination Mechanisms

To examine the relationship between agencies' concerns regarding the risks of coordination and the coordination mechanisms they employed to coordinate under SGMA, we drew upon the ICA Framework as well as the literature on inter-

organizational relationships that forms the underpinnings of it to develop a set of propositions, summarized in Table 2, which we then evaluated using empirical data.

The first four propositions address the expected effect of coordination concerns on the selection of specific coordination mechanism attributes. Since agencies may have multiple types of concurrent concerns and can employ coordination mechanisms with multiple attributes, subsequent propositions relate to how concerns combine to influence sets of attributes.

Separate Coordination Concerns and Mechanism Preferences

*Proposition # 1: Agencies with **autonomy** concerns will employ a coordination mechanism that entails decision-making processes that are deliberative only and/or non-binding.*

Agencies value self-determination and seek to protect their budgets, personnel, and resources (Verhoest et al., 2004; Peters, 2018; Bardach, 1996). Under a mandate, agencies fear that the required coordination may lead to loss of turf or create a dependency on other agencies (Zhou & Dai, 2021). By selecting a coordination mechanism that is deliberative only, agencies retain control over their policies and resources. By selecting a coordination mechanism that is non-binding, agencies avoid being locked into any particular path of action.

*Proposition #2: Agencies with **distribution** concerns will employ a coordination mechanism that entails joint decision-making processes and/or that sets performance targets.*

When coordinating, agencies seek to reduce costs and increase the benefits achieved through coordination (Williamson, 1991; Dekker, 2004; Feiock, 2013). A coordination mandate imposes not only direct costs and benefits but also the risk that other agencies' actions may have indirect effects. Distribution concerns arise when agencies perceive coordination will translate into an unsatisfactory allocation of responsibilities, costs and/or benefits. By selecting a coordination mechanism that employs joint decision-making, agencies can exercise influence over the full set of direct and indirect costs and benefits.

Although joint decision-making provides agencies with influence over the distribution of costs and benefits, it increases the transaction costs of decision-making and implementation. By setting performance targets, agencies can allocate costs, benefits, and responsibilities yet reduce the transaction costs of negotiating details of mandate implementation.

*Proposition #3: Agencies with **defection** concerns will employ a coordination mechanism that is binding.*

Agencies engaging in inter-organizational relationships want to ensure that partners take agreed-upon actions and achieve the desired outcomes (Dekker, 2004; Feiock, 2013; Anderson et al., 2014). Defection concerns arise when agencies perceive that one another's failure to follow through on a commitment will lead to additional responsibilities or costs. By selecting a binding coordination mechanism such as contracting, agencies seek greater assurance that coordination partners undertake the actions agreed upon.

*Proposition #4: Agencies with **compliance** concerns will employ a coordination mechanism that entails joint decision-making processes and/or that sets performance targets.*

Agencies responding to a top-down mandate evaluate the implications of taking vs not taking required actions or failing to achieve mandated policy goals (Hill & Hupe, 2002; May & Burby, 1996; Deyle & Smith, 1998). Compliance concerns are most acute when agencies expect full enforcement of the mandate and perceive the costs of non-compliance to be substantial. Agencies then will seek to ensure coordinating agencies collectively meet the requirements of the mandate. By employing joint decision-making, agencies exercise influence over discursive understandings of the mandate as well as the actions to be undertaken. Adopting performance targets as a coordination mechanism alleviates compliance concerns by allocating to each agency measurable outcomes that would meet their collective interpretations of the requirements of the mandate.

Concern Combinations and Mechanism Preferences

Where agencies have multiple types of concerns, resolving them will depend on whether the concerns can be alleviated by the same coordination mechanisms. As suggested in the propositions above, some mechanisms can address more than one concern, as with performance targets alleviating *distribution* and *compliance* concerns. Other concerns can be addressed by combining coordination mechanisms with synergistic attributes. For example, *defection* and *compliance* concerns can both be addressed by combining fully joint decision-making with binding authority. Unknown however, is how agencies

respond when they have more than one coordination concern and those concerns are best addressed by differing attributes of a coordination mechanism. That situation leads to three more propositions.

*Proposition #5: Agencies with both **autonomy** and **compliance** concerns will employ a coordination mechanism that combines limited scope joint decision-making with performance targets.*

Autonomy and **compliance** concerns pull agencies in differing directions regarding decision making. **Autonomy** concerns lead agencies to avoid joint decision making and protect their self-determination, yet **compliance** concerns lead agencies toward joint decision-making so as influence other agencies' actions. Agencies can balance **autonomy** and **compliance** concerns by selecting a coordination mechanism that combines limited-scope joint decision-making with performance targets. By engaging in limited scope joint decision-making, agencies can influence collective decisions over some topics while maintaining independence over others. By setting performance targets that specify each agency's responsibilities, agencies reduce concerns about meeting mandate requirements.

*Proposition #6: Agencies with both **autonomy** and **defection** concerns will employ a coordination mechanism that entails deliberative-only decision-making and is non-binding.*

Autonomy and **defection** concerns pull agencies in differing direction regarding the authority of the coordination agreement. **Autonomy** concerns lead agencies to prefer non-binding but **defection** concerns lead agencies to prefer a binding authority. Agencies can balance their autonomy and defection concerns by limiting the actions that rely on joint

agreement/action, thus reducing the fallout from defection. Under this approach, agencies will opt for deliberative-only decision-making and non-binding decision authority.

*Proposition # 7: Agencies with both **autonomy** and **distribution** concerns will employ a coordination mechanism that entails deliberative only decision-making and is non-binding.*

Autonomy and **distribution** concerns also pull agencies in differing directions regarding decision making. **Autonomy** concerns lead agencies to protect their self-determination by avoiding joint decision-making; while **distribution** concerns lead agencies toward joint decision-making so they can each influence the allocation of responsibilities as well as the costs/benefits of coordination. By engaging in deliberative only decision-making that is non-binding, agencies can address their autonomy concerns, avoid committing to a distribution of responsibilities, and reduce their share of administrative costs of coordination. Although such an arrangement leaves them unable to directly influence the costs/benefits that spill over from another agency’s actions, it allots them full control over the allocation of costs/benefits within their jurisdiction.

Table 2. Propositions Regarding How Coordination Concerns Influence Preferences for Mechanism Attributes

Notation in the table uses standard Boolean operators: * represents logical AND

Proposition Number	Agency Concerns	Expected Attributes of Coordination Mechanisms
#1	autonomy	deliberative only decision-making
	autonomy	non-binding agreement
#2	distribution	joint decision-making processes

	Distribution	performance targets.
#3	defection	binding
#4	compliance	joint decision-making processes performance targets
#5	autonomy * compliance	limited scope joint decision-making * performance targets
#6	autonomy * defection	deliberative-only decision-making * non-binding
#7	autonomy * distribution	deliberative only decision-making * non-binding

Coordination Under California's Sustainable Groundwater Management Act

Our research examines agency coordination in response to SGMA (Cal. Water Code §10720-10737). Groundwater management provides a useful lens for examining inter-agency coordination because it is an issue for which agencies could achieve mutual gains by coordinating their activities, yet doing so entails risks to agencies. As with many social and environmental issues that span jurisdictional boundaries, the effects of one agency's groundwater management activities can have spillover effects (positive or negative) on other agencies. How those effects are distributed may be uneven, as the geography and hydrogeology of the aquifer in relation to human activities influence where drawdown of water levels, saltwater intrusion, water quality degradation, subsidence, and effects on interconnected surface waters occur and the rate at which

those effects spread across the basin. Agencies and the constituents they serve also range in their capacities to respond to groundwater depletion. For example, well depth, access to alternative water supplies, the elasticity of water demands, the speed at which current practices can be changed, and present versus future value of water vary. Agencies may therefore hold disparate views on the causes and consequences of groundwater depletion, responsibilities for taking steps to address it, and the time frame for doing so.

In passing SGMA, state policymakers recognized potential effects across agency boundaries and required groundwater sustainability be achieved at the basin scale. The law provides local government agencies in a groundwater basin with new authorities and requires those agencies to coordinate in planning and implementing activities to achieve sustainability. To incentivize agencies in these efforts, the state also provided opportunities for agencies to apply for state funding to support planning as well as implementation. To ensure agencies coordinate in groundwater sustainability planning and implementation, the law grants the State Water Resources Control Board (SWRCB) the ability to intervene should local action not achieve this goal, thus providing the specter of loss of control to motivate local-level action. Should the SWRCB intervene it will charge the local agencies a management fee as well as displacing their authority (CWC §10735.6–8).

Under SGMA local agencies have substantial discretion in how to comply with this mandate. First, any city, county, public utility or special district government, or combinations thereof, could request designation as a ‘Groundwater Sustainability Agency’ (GSA). GSAs are new legal governmental organizations with responsibility for groundwater management. Multiple GSA could form in a groundwater basin provided

they do not overlap. Second, once designated, GSAs must develop and implement groundwater sustainability plans (GSPs) leading to sustainability within 20 years of plan adoption. GSP development entails determining basin conditions, defining sustainability, and devising an action plan for managing groundwater. Where multiple GSAs formed within a basin, SGMA requires they either work together to develop a single GSP for the entire basin or develop separate but coordinated GSPs that use the same data and methodologies for developing a hydrologic model of the basin, water budgets, and sustainable yield estimates. In basins with multiple GSPs, GSAs must demonstrate how the implementation of their separate plans will satisfy the law's requirements.

Data and Methods

In 2015, California's Department of Water Resources (DWR) evaluated groundwater basins across the state, designating 21 of them as 'critically over-drafted' if it determined "continuation of the present management practices would probably result in significant adverse overdraft related to environmental, social, or economic impacts." (CA Bulletin 118). SGMA required GSAs in critically over-drafted basins submit GSPs by January 2020, though two of the 21 critically over-drafted basins were exempted. Our research examines coordination across the 19 critically over-drafted groundwater basins in which GSAs had to develop GSPs. There were 96 GSAs in those 19 basins and they developed 44 GSPs.

We used a mixed methods approach to obtain data on agency concerns and the coordination mechanisms selected for GSA formation and GSP development. We interviewed representatives from 55 GSAs plus 5 consultants who worked closely on

GSP development.¹ Interviewees spanned 17 of the 19 basins and 38 of the 44 GSPs produced. Data were also collected through participant observation of more than 55 public meetings (in person, virtually, or reviewing recordings). Additional information was collected from secondary data including meeting minutes, inter-agency agreements, and GSPs. See the appendices for supplemental information for Chapter II for further information on data collection and analysis.

These data were coded to denote which types of coordination concerns were held by agencies within each basin. Basin-level concerns were identified based on whether (a) the majority of agencies within the basin expressed the concern or (b) one or more agencies explicitly identified a concern as a primary reason for the selection of the coordination mechanism for the basin. While there are intrinsic limitations to measuring and monitoring subjective concerns, when they were present, concerns were manifest across multiple forms of data – interviews, observation, and secondary data. Thus, triangulation across these datasets provides a robust source for coding. For the two basins without formal interviews, informal conversations with state and local officials and consultants confirm those basins are not outliers and corroborate our analysis of observational and secondary data for those basins. Information on coordination mechanisms adopted for each basin was compiled through analysis of inter-agency agreements and GSPs.

To examine how coordination concerns related to mechanism choice – i.e., to test the propositions in Table 2 – we employ methods from qualitative comparative analysis (QCA) (Rihoux & Ragin 2008). QCA is a configurational analysis method for evaluating

¹ To avoid identifying individual interviewees, we do not list the GSAs and the corresponding number of interviews. Some GSAs are quite small.

relationships between conditions and outcomes. QCA uses set theory and Boolean algebra to identify necessary and/or sufficient conditions. Necessary means the outcome cannot occur in the absence of the condition. A condition is necessary if it is present in all instances of the outcome. Sufficient means that whenever the condition is present, the outcome also occurs. A condition is sufficient if in every instance where it is present the outcome also occurs, even though other conditions may contribute to that result.

We use crisp-set QCA, which is appropriate when both the conditions (in our study, coordination concerns) and outcomes (in our study, coordination mechanism attributes) are intrinsically binary (Rihoux & De Meur, 2009). With binary data, no calibration of threshold crossover is necessary. Robustness checks followed recommended QCA methods for in-depth case study research with a small number of cases (e.g., Skaaning, 2011; De Block & Vis, 2019). Given our intimate knowledge of the 19 basins developed over three years, validation of our results was undertaken by comparing the QCA analysis with detailed ethnographic data to explain any inconsistencies in configurations of conditions. To check further for consistency, we compared QCA analysis of presence and absence of the outcomes and found equivalent results. Further details on methods are included within the relevant sections below.

Coordination Concerns Under SGMA

Agencies' concerns about coordination under SGMA varied across basins. Table 3 shows the frequency of concerns at the basin-level, which range from all four types of concerns being present to all four being absent.

Table 3. Concerns About Coordination Held by Agencies in Each Basin

x denotes a majority of agencies in the basin hold the concern,
 -- denotes the concern was not widespread in the basin.

# of Basins	Autonomy	Division	Defection	Compliance
8	--	--	--	--
4	X	X	--	--
3	X	X	--	X
1	X	--	--	--
1	X	X	X	--
1	X	--	--	X
1	X	X	X	X

Autonomy concerns were most prominent (11/19 basins). In those basins, most agencies had concerns about the effects of coordination on their ability to make their own decisions and pursue their own goals. Rationales for this apprehension varied – some agencies held the perspective that, due to their situated knowledge, agencies are uniquely positioned to make the best decisions for their own jurisdictions. Others thought coordination would prevent them from undertaking their desired approach to achieving groundwater sustainability. Other agencies were concerned about the prospect of other entities controlling their operations. For example, one interviewee commented:

“that’s the nexus of basically every GSA – to maintain autonomy and not have somebody else tell them how to manage your groundwater. It kind of goes back to the autonomy thing. They didn’t want another group or agency making decisions on their finances and stuff like that and telling them how to do their things.”
 (Interviewee #11)

Distribution concerns were also common (8/19 basins). These concerns arose particularly in relation to how coordination over groundwater would relate to agencies' differing access to surface water or their respective responsibilities for reducing pumping. Distribution apprehensions were expressed by an interviewee explaining a coordination choice:

“differences lie in the fact that the, you know – the haves and the have-nots – are so great.... I think those that have [surplus] water look at us as somebody that is gonna pay them as much money as they can expect to help solve our problem rather than looking at it as a whole basin... So that's how we ended up with separate GSPs” (Interviewee #29).

Defection concerns were substantially less prevalent (2/19 basins). In those basins agency representatives expressed concern that another agency may not reduce its groundwater pumping or implement projects and management actions as planned. Defection concerns also included fears that agencies might not enter into an agreement in good faith or that differences between agencies would impede GSP development and implementation. For example, one interviewee worried about holdout strategies by other agencies:

“everything has to be made as this unanimous decision. So, any one of us at any point time can just scuttle the process. Makes it a little bit concerning.”
(Interviewee Agency #11)

Compliance concerns were somewhat more common (5/19 basins). In several basins, agencies thought allowing each agency to decide its own path rather than undertaking a collective approach would not achieve groundwater sustainability and risk state intervention. Conversely, in other basins, agencies considered the risk of noncompliance to be higher under greater coordination.

As we expected, agencies often held more than one concern. The two concerns most prevalent – *autonomy* and *distribution* – often occurred in tandem, reflecting the perceived connection between decision-making autonomy and the resulting division of coordination costs and benefits. Both concerns were also connected to control over water sources in basins where some but not all GSAs had surface water rights in addition to groundwater.

Coordination Mechanisms Adopted Under SGMA

In making choices regarding GSA formation and GSP development, agencies adopted rules and procedures governing how these institutional arrangements would function. Varying combinations of coordination arrangements could create essentially equivalent coordination practices. For example, a GSP created jointly by multiple GSAs under non-binding rules might function similarly to each agency forming its own GSA and fashioning a separate GSP subject to coordinated implementation. Consequently, to test the propositions in Table 2, we categorized the coordination mechanism resulting from combined set of decisions related to GSA formation and GSP development using the attributes of coordination mechanisms described in Table 1.

Table 4 summarizes the coordination mechanisms adopted by the basins in the study, grouping together basins selecting coordination mechanisms with similar attributes.

Mechanism A: Centralized entails fully joint decision-making and binding authority.

Mechanism B: Joint Goals, Separate Action entails limited scope joint decision-making and binding authority. ***Mechanism C: Regionalization with Defined Responsibilities***

entails limited scope joint decision-making and non-binding authority yet includes a clear allocation of responsibility to agencies. Lastly, ***Mechanism D: Regionalization with***

Strong Independence entails decision-making through deliberation only and entails non-binding authority.

Table 4. Coordination Mechanisms Adopted by Each Basin, by Attributes

x denotes the coordination mechanism contains this attribute.

-- denotes the coordination mechanism does not contain this attribute.

Coordination Mechanism	# of Basins	Mechanism Authority Binding	Decision-Making			Performance Targets
			Fully Joint	Limited Scope	Deliberative Only	
<i>Mechanism A: Centralized</i>	7	X	X	--	--	--
<i>Mechanism B: Joint Goals, Separate Action</i>	4	X	--	X	--	--
<i>Mechanism C: Regionalization with Defined Responsibilities</i>	4	--	--	X	--	X
<i>Mechanism D: Regionalization with Strong Independence</i>	4	--	--	--	X	--

The coordination mechanisms adopted display some patterns. Binding authority is associated with the presence of either fully joint or limited scope joint decision-making, and the absence of deliberative only decision-making. Where agencies chose joint decision-making, they committed to adopting the decisions made. Limited scope joint

decision-making also coincides with performance targets, likely because at a minimum, some joint accord is needed to assign performance targets.

Concerns and Coordination Mechanism Choice

The propositions presented above articulate certain set-theoretical relationships between concerns (conditions) and attributes of coordination mechanisms (outcomes), which we examined using QCA. In this section, we present our analysis of Propositions 1-4, the hypothesized pairwise relationships between each coordination concern and coordination mechanism attributes. After that, we present our analysis of Propositions 5-7, the hypothesized relationships between configurations of coordination concerns and combinations of coordination mechanism attributes. Those analyses find support for only a few of our propositions.

Below we draw on our ethnographic data to further illuminate the relationships between agency concerns and coordination mechanism selection. Those data indicate the reason coordination concerns alone are insufficient for explaining the attributes of the coordination mechanism adopted is that beyond concerns about the risks of coordination, considerations of efficiency, of efficacy, and interpretations of what is necessary to achieve compliance influence which attributes of coordination mechanisms are adopted. Details on these findings are provided below.

Selection of Individual Attributes of Coordination Mechanisms

As propositions 1-4 hypothesize the relationship between a single condition and a particular outcome, we use set coincidence to evaluate whether the condition is necessary and/or sufficient for the outcomes posited. Results appear in Table 5. A proposition is

supported if the condition being evaluated is either necessary or sufficient for the outcome. A consistency metric (portion of basins with the outcome that also have the condition) with a value close to one indicates a condition is necessary. When analyzing a single condition, the necessity coverage metric is equivalent to sufficiency metrics (portion of the basins with condition that also have the outcome) and a value close to one indicates the condition is sufficient. The data provide partial support for proposition 1: **autonomy** concerns are a necessary but not sufficient condition for adopting deliberative-only decision-making and non-binding authority. Proposition 2 is partially supported and partially contradicted. **Distribution** concerns are a necessary yet insufficient condition for performance targets, but they do not lead to fully joint decision-making. **Defection** concerns had the opposite of the expected effect from Proposition 3, although as noted earlier only two basins out of nineteen held defection concerns. In those basins, the presence of **defection** concerns coincides with the adoption of non-binding decision authority, suggesting that rather than encouraging agencies to adopt authoritative arrangements to alleviate concerns (as posited), **defection** concerns may signal lack of trust and an unwillingness to be bound in an agreement with another agency. Proposition 4 is contradicted: **compliance** concerns are unnecessary and insufficient for explaining adoption of fully joint decision-making or performance targets.

Table 5. Propositions 1 – 4 Analysis of Set-Theoretic Relationships Between Individual Concerns and Individual Attributes of Coordination Mechanisms

Notation in the table uses standard Boolean operators: ~ represents absence of a condition. Consistency denotes the proportion of cases with the outcome that also have the specified condition. Coverage denotes the portion of cases with the specified condition that exhibit the outcome. Low coverage indicates the constraining effect of the condition is limited (Ragin 2008, 61-63). A threshold of ≥ 0.9 is used to evaluate consistency (Greckhamer et al. 2018), indicated though **bold** font.

Proposition (#)	Concerns [Condition]	Mechanism	Proposition	Set Coincidence	
		Characteristics [Outcome]	Supported (Y/N)	Consistency [Consistency]	Necessity [Coverage]
(1)	autonomy	deliberative only	Y	1	0.36
		decision-making		(4/4 basins)	(4/11 basins)
(1)	autonomy	~binding authority	Y	1	0.73
				(8/8 basins)	(8/11 basins)
(2)	distribution	fully joint	N	0	0
		decision-making		(0/7 basins)	(0/9 basins)
(2)	distribution	performance	Y	1	0.44
		targets		(4/4 basins)	(4/9 basins)
(3)	defection	binding authority	N	0	0
(4)	compliance	fully joint	N	0.14	0.2
		decision-making		(1/7 basins)	(1/5 basins)
	compliance	performance targets	N	0.5	0.4
				(2/4 basins)	(2/5 basins)

Selection of the Overarching Coordination Mechanisms

We next examine relationships between concerns and adoption of the overarching coordination mechanism types we identified in Table 4. Since these propositions

hypothesize configurational relationships between multiple conditions and a particular outcome, our analysis includes two steps. First, we use set coincidence to examine whether the conditions are jointly necessary for the proposed outcomes. A proposition is supported if the conditions being evaluated is either necessary or sufficient for the outcome; these results appear in Table 6. Second, for each outcome we examine configurational patterns of all four concerns to identify the combinations of concerns sufficient for adoption of the overarching coordination mechanism; those results appear in Table 7.

Table 6. Propositions 5-7 Analysis of Set-Theoretic Relationships Between Multiple Concerns and Coordination Mechanisms

Notation in the table uses standard Boolean operators: ~ represents absence of a condition; * represents logical AND. Consistency and coverage defined as in Table 5. Low coverage indicates the constraining effect of the condition is limited (Ragin, 2008, 61-63). A threshold of ≥ 0.9 is used to evaluate consistency (Greckhamer et al., 2018), indicated though **bold** font.

Proposition (#)	Concerns [Condition]	Coordination Mechanism [Outcome]	Proposition	Set Coincidence	
			Supported (Y/N)	Necessity	
				[Consistency]	[Coverage]
		C: Regionalization with			
(5)	autonomy * compliance	Defined Responsibilities [limited scope decision- making * performance targets]	N	0.4 (2/5 basins)	0.5 (2/4 basins)
		D: Regionalization with			
(6)	autonomy* defection	Strong Independence [deliberative only decision- making * non-binding]	N	0.5 (1/2 basins)	0.25 (1/4 basins)
(7)	autonomy * distribution	D: Regionalization with Strong Independence	Y	1 (4/4 basins)	0.5 (4/8 basins)

[deliberative only decision-
making * non-binding]

Neither Proposition 5 nor 6 is supported by the analysis results, but there is some support for Proposition 7. The combination of *autonomy* and *distribution* concerns appears as a necessary yet insufficient condition for *Coordination Mechanism D*. All four basins adopting *Coordination Mechanism D* featured the autonomy-plus-distribution configuration of concerns; however, some basins with that configuration selected other coordination mechanisms.

Notably, for *Coordination Mechanisms B, C, and D*, contradictions among the coordination mechanism attributes selected by basins with similar patterns of concerns precluded solution to a QCA sufficiency analysis (Table 7). This finding indicates conditions other than coordination concerns are important in mechanism selection.

Table 7. Propositions 5-7 Analysis of Set-Theoretic Configurational Relationships Between Multiple Concerns and Coordination Mechanisms

Notation in the table uses standard Boolean operators: ~ represents absence of a condition; * represents logical AND. Consistency and coverage defined as in Table 5. Low coverage indicates the constraining effect of the condition is limited. Best practice for sufficiency analysis is a consistency threshold of ≥ 0.8 and not less than 0.75 (Greckhamer et al. 2018) indicated though **bold** font.

Outcome	Proposition (#) and expected relationships	Proposition		Consistency	Raw Coverage	Unique Coverage
		Supported (Y/N)	Sufficient Conditions			
<i>Mechanism A:</i>	n/a	n/a	~autonomy	0.75	0.86	0.86
<i>Centralized</i>			~distribution*compliance	1	0.14	0.14
			<i>Solution</i>	0.78	1	

<i>Mechanism B:</i>	n/a	n/a	<i>No Solution – only one row with this outcome, representing one basin has a consistency > 0.75</i>
<i>Joint Goals, Separate Action</i>			
<i>Mechanism C:</i>	(5) autonomy	N	<i>No Solution – only one row with this outcome, representing one basin has a consistency > 0.75</i>
<i>Regionalization with Defined Responsibilities</i>	* compliance		
<i>Mechanism D:</i>	(6) autonomy*	N	<i>No Solution – only one row with this outcome, representing one basin has a consistency > 0.75</i>
<i>Regionalization with Strong Independence</i>	defection		
	(7) autonomy*	N	
	distribution		

Ethnographic Explanations of Coordination Mechanism Choice

Bringing our ethnographic data from interviews and observation of meetings into conversation with the QCA results adds insights regarding how concerns combined to influence the selection of coordination mechanisms and why set theoretic patterns are difficult to discern. Below we draw on that data to explain the rationales for mechanism selection in the nineteen basins.

Coordination Mechanism A: Centralized

Seven basins selected *Coordination Mechanism A*, with fully joint decision-making and binding authority. The QCA analysis of sufficient conditions yield two patterns of concerns related to this mechanism: either basins exhibit a lack of *autonomy* concerns or basins that might have autonomy concerns lack *distribution* concerns but have *compliance* concerns. An example was a basin in which groundwater overdraft is extensive and alternative sources for water extremely limited. Agencies in that basin agreed that management actions to reduce groundwater pumping would be essential for *compliance* and agreed that despite their autonomy concerns they needed joint decision-making to ensure sufficient management actions would be undertaken and to address potential conflict regarding those actions.

The solution to the QCA sufficiency analysis has a consistency of 0.78, indicating that there are some contradictory cases. Specifically, rather than adopt *Coordination Mechanism A*, two basins without *autonomy* concerns adopted *Coordination Mechanism B*, which features limited scope decision-making. Ethnographic data indicate that in those two basins *autonomy* concerns were not the main reason they rejected fully joint decision-making. Agencies were focused instead on expeditious implementation of their already planned projects. As explained by an individual from an agency in one of the basins:

“the rationale for this decision was the long-standing engagement of [redacted] agencies in groundwater management and water supply reliability planning ... in several cases work has proceeded far enough to make it significantly more efficient for these agencies to continue their efforts rather than switching project implementation actions to the [collective of agencies]” (GSP#36: pg4-1)

Coordination Mechanism B: Joint Goals, Separate Action

Four basins selected *Coordination Mechanism B*, which combines limited scope joint decision-making with binding authority. Concerns in these basins vary: in two basins agencies held a mix of *autonomy* and *distribution* concerns, whereas in the other two basins agencies did not have these concerns. Although the QCA analysis indicates concerns alone are insufficient to explain selection of *Coordination Mechanism B*, ethnographic data indicate that in these four basins *compliance* concerns combined with considerations of efficacy and efficiency, and in some instances *autonomy* concerns, to influence selection of *Coordination Mechanism B*.

Most agencies in these basins believed actors were already planning or could reasonably pursue the actions needed to achieve sustainable groundwater conditions. However, they had concerns about complying with SGMA's shared knowledge and goal setting requirements. As suggested by other research on the potential benefits of coordinated decision making (see e.g., Rogers & Whetten, 1982; Krause, Hawkins, & Park, 2019; Costumato, 2021), these agencies opted for working together in ways that would promote SGMA compliance but also capture benefits from working jointly on scientific assessment of the state of the basin, setting sustainability metrics, and monitoring basin conditions. As one interviewee explained:

“There's benefits to not doing things four times, you can just have one entity doing the monitoring, or filling the data gaps, or some of that more of the practical stuff.” (Interviewee #50)

Furthermore, agencies in all four basins were concerned about garnering the necessary constituent support for actions needed to achieve groundwater sustainability and wanted

to select the mechanisms that would generate and maintain that support. As explained by one interviewee:

“You can’t necessarily fit everything under the regional box...” and “...It’s hard for us to justify taking rate payer money to do things that don’t have a direct benefit back to that rate payer... taking that money and putting it into projects that are outside of their area or even benefiting their own water system is going to be problematic.” (Interviewee #2)

Consequently, agencies restricted joint decision-making to basin monitoring and measurement tasks while leaving agencies to select and to implement their own projects and policies. In the two basins where agencies also held *autonomy* concerns, avoiding joint decision-making about policy and actions also helped to assuage those concerns. As one interviewee explained:

“There’s a lot of discomfort because of the policy stuff...” and “...it was a little bit of well, we’re still going to need our own chapters, because we might want to handle this a little different than your GSA” (Interviewee #50)

Coordination Mechanism C: Regionalization with Defined Responsibilities

Four basins selected *Coordination Mechanism C*, which combines limited scope joint decision-making with performance targets. In all four, agencies had *autonomy* and *distribution* concerns, yet varied in relation to *defection* and *compliance* concerns. A similarly mixed configuration of concerns appears in the basins selecting *Coordination Mechanism D*. Consequently, QCA could not identify configurations of concerns sufficient for selection of either *Coordination Mechanism C* or *D*.

Our ethnographic data indicate that the basins selecting *Coordination Mechanism C* had different reasons for doing so. In two, adoption of performance targets was linked, as expected, to a combination of *autonomy* and *compliance* concerns. In these basins, agencies believed it possible to achieve groundwater sustainability across at least a

portion of the basin. Further, they expected that the state would evaluate non-compliance on a localized basis (by GSP) rather than for the basin as a whole. Consequently, as explained by one interviewee:

“Everybody wanted to be able to present the conditions in their area independent of everyone else... Everyone wanted to be able to tell their own story”
(Interviewee #25)

In these basins, performance targets served the dual purpose of supporting agencies in making the argument that their portion of the basin was in compliance, while also protecting autonomy to make one’s own decisions.

In another basin *distribution* concerns influenced the adoption of *Coordination Mechanism C*. There, agencies recognized compliance would require substantial pumping reductions and land fallowing but differed about how such reductions should be achieved and where land should be fallowed. Particularly prevalent were concerns that larger commercial farms served by a minority of agencies would seek to reduce basin-wide water use by buying out the smaller farms represented by a majority of agencies. Allocating groundwater yield to each agency (setting performance targets) provided a means to “fence off” those larger pumpers.

In the fourth basin selecting *Coordination Mechanism C*, agencies adopted performance targets primarily to support their management actions rather than to address coordination concerns. Agencies in this basin saw pumping reductions as necessary for achieving sustainability. Allocating the basin yield among agencies was seen as a needed step toward developing a market for groundwater trading and crediting, which was perceived by the participating agencies as providing the most efficient and acceptable way of reducing groundwater pumping.

Coordination Mechanism D: Regionalization with Strong Independence

Four basins selected *Coordination Mechanism D*, with deliberative only and non-binding decision-making. While QCA analysis did not identify configurations of concerns sufficient to explain adoption of this mechanism, we note that unlike basins selecting *Coordination Mechanism C*, within each basin selecting *Coordination Mechanism D* at least one agency insisted on operating fully independently. As one interviewee said:

“We never really even considered doing a joint GSP. We always wanted to do one on our own.” (Interviewee #9)

Our ethnographic data indicate these agencies would not have accepted a coordination mechanism that might constitute oversight of their decisions. The specific groundwater context of the basin reinforced this desire for independence, as the distribution of groundwater problems across each of these basins was especially heterogeneous. For example, in two of the basins, land subsidence is serious in only a portion of the basin. Agencies saw independence as necessary for addressing the distinctive groundwater problems within their respective jurisdictions.

These staunchly independent agencies constrained the options for basin-level coordination since their refusal to consider other coordination mechanisms outweighed any other concerns or lack thereof held by other agencies. Thus, even when coordination decisions are collective, mechanism selection may reflect some agencies' preferences over others.

A Contingency Approach to Selection of Coordination Mechanisms

Most of our propositions regarding the influence of coordination concerns on mechanism choice were not supported by the evidence. Further, with the exception of fully joint decision-making and mechanisms with binding authority (*Coordination Mechanism A*), the QCA analysis indicates that in any configuration, coordination concerns alone do not explain the selection of coordination mechanism. This finding does not mean coordination concerns have no influence on mechanism selection. Rather, as our ethnographic data indicate, the influence of coordination concerns on mechanism selection is mediated by other considerations.

Where agencies concurrently hold multiple and diverse coordination concerns, they may need to balance across those concerns as well as across other perceived costs and benefits of potential coordination mechanisms. Agency choices under SGMA suggest that the risk of autonomy loss functions as a threshold concern that sets the stage for agency selection of coordination mechanisms. Our findings indicate that when deciding how to coordinate under a mandate, agencies first evaluated their concerns about autonomy loss, after which they considered other coordination concerns, and then finally, they weighed the potential benefits of varying approaches to coordination. This finding is conceptually aligned with the ICA Framework, which indicates coordination risks, then net benefits, drive mechanism selection. Yet our findings add important nuance by depicting a hierarchy of concerns and through recognition that configurations of concerns and of benefits/costs of the coordination mechanism drive mechanism selection.

These insights suggest the need for a contingency approach to understanding coordination mechanism choice that accounts for how differing contextual conditions

lead to adoption of differing institutional arrangements (see e.g., Molenveld et al., 2021; Ansell & Gash 2008). Drawing on the findings from the QCA analysis combined with additional ethnographic data, we propose the following contingency theory of agency choices under a mandate to coordinate (Figure 3).

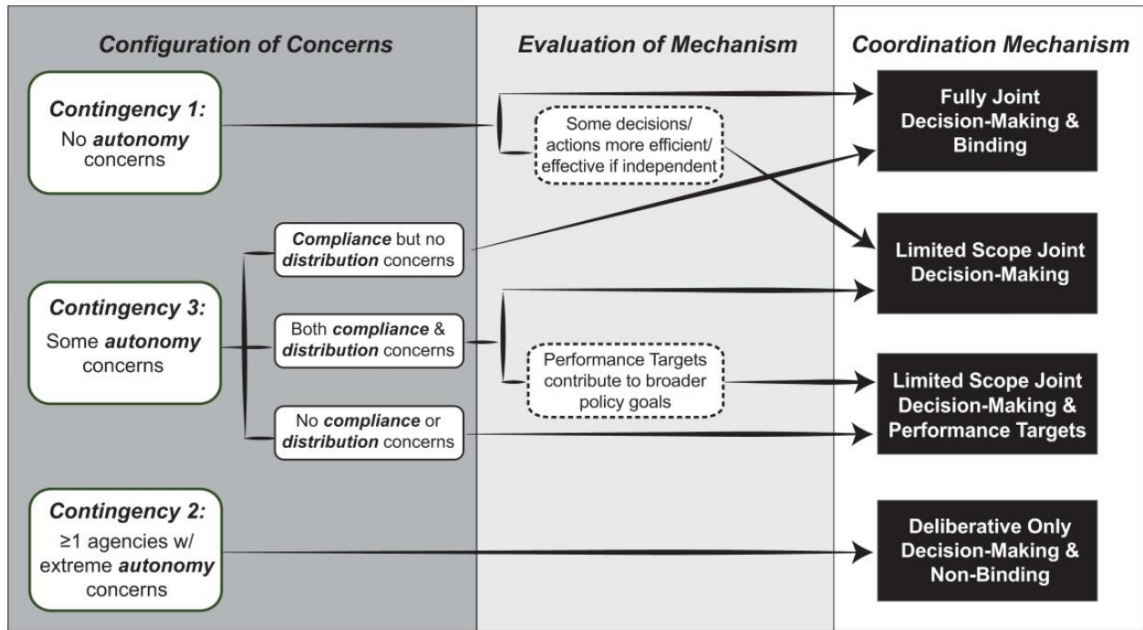


Figure 3. Contingencies Guiding Coordination Mechanism Choice

Autonomy forms the starting point. The QCA necessity analysis supports Proposition #1 and the sufficiency analysis indicates that agencies adopted joint decision-making and binding decision authority only in the absence of *autonomy* concerns. The ethnographic data reinforce this: even where *autonomy* concerns did not suffice for explaining the choice of attributes of coordination mechanisms, they still influenced agency choices. These observations about *autonomy* are compatible with a recent survey of GSA managers (An & Tang, 2022), showing autonomy concerns as the primary consideration in decisions regarding whether to collectively form a basin-wide GSA. They are also

compatible with the extensive literature on bureaucratic turf-protecting behavior (e.g., Bardach, 1996; Bjurström, 2019).

The first contingency is thus whether there is a presence or absence of autonomy concerns. If agencies do not have *autonomy* concerns, they will adopt joint decision-making with binding authority. Whether that decision-making is fully joint or limited in scope will depend on agencies' perceptions of whether some actions will be more efficiently or effectively made separately. This contingency, demonstrated by the basins selecting *Coordination Mechanism A* and one of the basins selecting *Coordination Mechanism B*, is compatible with the ICA Framework's conceptualization of agencies as boundedly rational entities that examine the net benefits of working together, but adds the caveat that autonomy considerations come first.

The second contingency is whether any one agency wants to protect its autonomy above all else. When agencies' coordination concerns differ, even if most agencies share concerns, a single agency disagreeing can greatly influence the forms of coordination undertaken. In this context, agencies have limited options for working together and may select mechanisms with deliberative-only decision-making and non-binding authority. This contingency, demonstrated by the basins selecting *Coordination Mechanism D*, highlights the multi-lateral dynamic of coordination mandates. Differences in agency perspectives are not well addressed in the existing literature on inter-agency coordination, in part due to the literature's original emphasis on voluntary coordination under which agencies choose whether to coordinate and with whom. Thus, this contingency highlights the need for future research to examine, perhaps from a game-theoretic perspective, how agencies negotiate coordination mechanism selection when their concerns differ.

If neither of the above contingencies hold, in other words, if agencies have autonomy concerns yet are willing to work together, they will engage in some form of joint decision-making, the boundaries of which will be determined by how agencies balance their concerns about mandate requirements with their perceptions of the costs and benefits of working together. This leads to a third contingency, which is whether agencies have concerns about *compliance* and *distribution*. How those concerns combine can lead agencies down three potential pathways.

Agencies with autonomy concerns but without compliance or distribution concerns, will adopt coordination agreements with limited-scope joint decision-making and may adopt performance targets. This contingency, observed in two of the basins selecting *Coordination Mechanism B* and two of the basins selecting *Coordination Mechanism C*, is consistent with the ICA Framework's efficiency argument, i.e., agencies seek to minimize risks and maximize benefits of coordination. Limited-scope joint decision-making allows agencies to balance *autonomy* concerns with anticipated benefits of coordination.

Agencies with autonomy concerns plus *compliance* and *distribution* concerns will adopt mechanisms with both limited-scope joint decision-making and performance targets. This contingency, demonstrated by two of the four basins selecting *Coordination Mechanism C*, aligns with our propositions related to the combined effects of compliance and distribution concerns. Here, limited-scope joint-decision making allows the setting of performance targets. Using performance targets concurrently addresses concerns about mandate compliance and the allocation of responsibilities while preserving as much autonomy as possible. This contingency reflects literature on policy implementation

suggesting agencies will comply in ways that least disrupt their status quo (Schafer 2016) and literature on the role of controls in inter-organizational relationships (e.g., Dekker, 2004; Rossignoli & Ricciardi, 2015)

Finally, where agencies have both *autonomy* and *compliance* concerns but not *distribution* concerns, they will adopt coordination mechanisms that involve fully joint decision-making and binding authority. This contingency matches the basin selecting *Coordination Mechanism A* despite agencies' *autonomy* concerns. This contingency illustrates that strong compliance worries can outweigh some *autonomy* concerns, particularly in the absence of strong *distribution* concerns. Joint and binding decision making may seem the most effective means of avoiding penalties from non-compliance even though it encroaches on agency autonomy.

Notably, several sets of conditions led to the selection of coordination mechanisms with the same attributes—that is to say, the contingency approach displays equifinality. Fully joint decision-making, for example, was selected in basins where agencies did not have *autonomy* concerns but also where agencies did have *autonomy* concerns combined with strong *compliance* concerns. Similarly, limited-scope decision-making was selected in basins that had *autonomy* concerns combined with *distribution* concerns, but also in a basin where agencies did not have *autonomy* concerns but thought it would be more efficient or effective to make some decisions independently. Limited-scope decision-making plus performance targets was arrived at in basins where agencies had *autonomy*, *compliance*, and *distribution* concerns but also in cases where those concerns were not present if one or more agencies saw performance targets as serving their other policy objectives. This equifinality finding is worth exploring in future research on inter-agency

coordination, as it strengthens the contention that coordination concerns operate configurationally and calls into question simple cause-to-effect linkages from any one coordination concern to the selection of a coordination mechanism.

Further, it merits mention that *defection* concerns do not appear in the contingencies. This may be due to the low prevalence of *defection* concerns in our dataset. Since defection was a real possibility, we do not know why few agencies held concerns about it. Indeed, after coordination mechanisms were selected yet while coordinated GSPs were still being developed (i.e., after research for our study was completed), defection occurred in four of the nineteen basins: one or more agencies withdrew from a GSP, refused to sign a final form, or submitted to the state a GSP containing information that was inconsistent with the submissions from other agencies in the basin. In the two basins where *defection* concerns were present, agencies also had *autonomy* and *distribution* concerns and we expect the attributes of the coordination mechanisms selected served to sufficiently assuage agencies' *defection* concerns. Further research in other empirical settings is needed to confirm this supposition and test its role in our contingency theory.

Conclusion

Findings from our examination of the choices agencies made in response to SGMA have important implications for theorizing inter-agency coordination and for policy making. Foremost, our research illustrates both similarities and differences between voluntary and mandated coordination. In coordinating under SGMA, agency behavior aligns in part with the ICA Framework's conceptualization of voluntary coordination, in that agencies made decisions based on perceived risks of coordination as well as potential net benefits. However, because the risks of coordination under a mandate differ from that

of voluntary coordination, agencies faced additional considerations. A mandate obviates the risk of not finding coordination partners, yet the requirement to coordinate may force agencies with differing viewpoints and objectives to work together. This accentuates the risk of autonomy loss and may exacerbate distribution and defection risks. The mandate also adds risks associated with non-compliance.

Beyond illustrating how agencies balance concerns when selecting coordination mechanisms under a coordination mandate, our findings also underline the need for further examination of the design of coordination mandates. Agency decisions are affected by concerns about compliance, yet ethnographic data revealed that agencies responding to SGMA varied in how they interpreted the mandate and its prospective penalties. Some agencies anticipated the state would assess and enforce compliance at the scale of the basin, while other agencies anticipated compliance would be evaluated and enforced at the scale of an agency or sub-group of agencies. Such variability in how ‘street level bureaucrats’ perceive a mandate is well recognized (see e.g., Hupe & Hill, 2016; May, 2015). The implication is that agencies’ concerns about compliance will depend on clarity of the mandate’s requirements as well as its monitoring and enforcement. A challenge that remains is thus how to articulate mandates to reduce ambiguity and variability in agencies’ perceptions of the risks of non-compliance.

Related, our findings make clear that one cannot assume that mandating coordination will produce similar coordination arrangements across cases. Diverse responses to a mandate may be desirable if that diversity reflects agencies tailoring coordination mechanisms to their respective contexts. Yet the resulting heterogeneity may generate inconsistent implementation and goal attainment. Heterogeneity in coordination may also

increase the challenge of steering agency actions in the future, as subsequent steering attempts may be difficult to design for diverse institutional arrangements. Thus, an important unanswered question is the extent to which a mandate should allow agency discretion in deciding how to coordinate.

While our research examines mandated coordination in the context of groundwater, our findings are likely generalizable to a variety of social and environmental issues. This includes not only the management of other common-pool resources (e.g., forests, fisheries, and irrigation systems) but any issue where there is potential for transboundary externalities or inefficiencies to arise from a myriad of approaches to knowledge production, goal setting, and/or policy adoption (e.g., health care, transportation, crime). Agency contexts, including their histories, power dynamics, resource scarcity and competition, organizational missions, and politics will influence their coordination concerns. Improved understanding of how agencies respond to coordination mandates can support policy makers in crafting more effective mandates. Such policy design improvements may in turn enhance the effectiveness of efforts to remediate social and environmental problems through inter-agency coordination.

CHAPTER III

THE RELATIONSHIP BETWEEN HOW AGENCIES WORK TOGETHER AND COORDINATED OUTCOMES: A CONFIGURATIONAL ANALYSIS

Introduction

A primary challenge of developing and implementing law and policy is the need for collective action (Marks & Hooghe, 2004; Freeman & Rossi, 2012; Peters, 2013; Thomann & Sager, 2017). Through collective action implementing actors can address problems that do not match jurisdictional boundaries, prevent externalities, align policies or actions, and achieve outcomes that individual organizations cannot attain alone (Agranoff, 2006; Bryson, Crosby & Stone, 2015; Lee et al., 2018). Yet, collective action between governmental agencies does not always voluntarily emerge (Schafer, 2016). This lack of action stems from a variety of factors including the failure of agencies to reconcile their individual and collective interests, transaction costs, risks and uncertainty, or a lack of a capacity to engage with other agencies (Thomson & Perry, 2006, Kim et al., 2020). To encourage, or at times ensure, that lower-levels of government work together, upper-levels of government are increasingly using coordination mandates (O'Toole & Montjoy, 1984; Schafer, 2016). Coordination mandates aim to create efficiencies or simplify processes; shape lower-level governmental policies; or stimulate actions that lower-level governments may view as contrary to their primary needs (Rodríguez et al., 2007).

Research examining policy implementation suggests the design of a mandate, including its legal requirements, will influence how the mandate is implemented and

consequently its effects (Brummel et al., 2012; Schafer, 2016; Cisneros, 2021). When designing a coordination mandate, policymakers can decide whether to prescribe how the agencies tasked with implementation are to work together or to allow those agencies to determine for themselves how they will structure their interactions. Granting agencies discretion may enable them to select the paths of action best suited to their needs and specific context; it may also lead to innovative solutions to complex policy issues (Hupe & Hill, 2020). However, not all forms of interaction may be equally effective in achieving the coordination mandate's requirements. Improved understandings of whether and how the structure of agencies' interactions affect achievement of the objectives of a coordination mandate is needed to inform the design of such mandates.

Implementation of California's Sustainable Groundwater Management Act (SGMA) provides an opportunity to shed light on this topic. SGMA mandates that local agencies sharing a groundwater basin work together to sustainably manage their groundwater resources and articulates specific outcomes of groundwater planning that must be coordinated in their management plans to comply with the mandate. These include coordinated knowledge of the groundwater basin; policy goals; policy actions; and basin-wide oversight for plan implementation. In steering agencies to develop and coordinate specific sections of groundwater management plans, SGMA does not prescribe the approaches agencies must use to plan for and achieve groundwater sustainability. Rather, agencies sharing a groundwater basin can choose how they will work together.

The structure of SGMA thus enables us to investigate the question: *When agencies are under a coordination mandate yet are allowed to determine how they make decisions and manage interactions as a group, how does the structure of agency interactions affect*

their achievement of the objectives of a coordination mandate? To answer this question, we conduct a comparative analysis of the 18 groundwater basins required to comply with the first phase of SGMA – development of groundwater sustainability plans – by January 2020. Using multi-value Qualitative Comparative Analysis (mvQCA), we examine the relationship between how the groups of agencies in each basin worked together and whether those agencies achieved the mandate’s coordination requirements. Our analysis has two aims. The first is to determine which approach(es) to working together led to achievement of each individual mandate requirement (i.e., coordinated knowledge of the groundwater basin, coordinated policy goals, coordinated policy actions, and coordinated oversight for plan implementation). The second is to determine which approach(es) to working together led to achievement of all the coordination mandate’s requirements. We interpret the mvQCA results using ethnographic evidence collected over three and a half years of fieldwork.

By capturing how agencies interacted during the planning process, we contribute to theories examining how, when creating structures for network governance, agencies select from a toolbox of organizational forms and institutional arrangements to coordinate multiple and varying forms of outcomes (Scott & Thomas, 2017; Costumato, 2021; Nabatchi & Emerson, 2021). We also respond to the need for critical examination of the role of collaboration in collective action (Koontz & Thomas, 2006; Rogers & Weber, 2010).

How Groups of Agencies Work Across Boundaries to Achieve Mandated Coordinated Outcomes

Within the public sector, collective action is the process through which agencies work across boundaries to achieve one or more common goals. The nature of this goal will vary. In some instances, the goal may be to improve or gain new understandings of a shared socioecological system (SES), to set compatible policy goals, to ensure activities are not countervailing, or to oversee implementation of projects/management actions. In the public management and administration literature, the term coordination is used alternately to describe the process through which agencies work together to achieve such goals (Bouckaert et al., 2010) or to refer to the outcome of working together (Lee et al., 2018). To avoid confusion, hereafter, the term coordinated outcomes is used to refer to the result of collective action efforts.

To engage in collective action, groups of agencies interact through formal and/or informal means. In doing so, they select the organizational form and the institutional arrangements that will be used to govern and manage the process through which collective action unfolds. Organizational forms define how agencies will make decisions as a group (Provan & Kenis, 2008; Bouckaert et al., 2010; Blair & Janousek, 2013) whereas institutional arrangements define how agencies will communicate, share information, formulate goals, and develop plans (Fjeldstad et al., 2012). Section 2.1 below delineates the typical organizational forms adopted by agencies, while Section 2.2 explains the types of institutional arrangements used by agencies to structure how they work together.

Whether and how agencies engage in collective action is contingent on the antecedent conditions that create the need for collective action, the motivations of agencies to work together, and the a priori social dynamics that influence interactions between the agencies (Emerson et al., 2011, Bryson et al., 2015). These contextual factors influence both the potential risks and the potential benefits of engaging in collective action. Consequently, the context within which agencies are embedded influences how agencies work together and the outcomes of those efforts (Agranoff, 2008; Turrini et al., 2010; Raab et al., 2015; Kim et al., 2020). Theory and empirical evidence suggest these dynamics unfold as a nested process. Contextual factors proximately influence how agencies initially coalesce around common goals and make decisions about how they will structure their interactions (Bryson et al., 2015; Kim et a. 2020). Subsequently the organizational form and institutional arrangements used to structure agency interactions affects the coordinated outcomes agencies achieve (Provan & Kennis, 2008). While there is a rich literature on this topic, linkages between contextual factors; organizational form and institutional arrangements; and coordinated outcomes are complex and have yet to be fully delineated (see work by Douglas et al., 2020 for advances in this line of inquiry).

Our research examines the linkage between how agencies structure their interactions through organizational forms and institutional arrangements and their achievement of coordinated outcomes when under a coordination mandate. We adopt this as our focus because, while a coordination mandate has limited ability to alter antecedent contextual conditions, it can stipulate the process used by agencies to engage in collective action. Which organizational forms and institutional arrangements are needed to achieve coordinated outcomes may vary by the type of coordination with which agencies are

tasked. For example, coordinated knowledge may only require information-sharing between agencies whereas coordinated policy goals may require identification of mutual interests and joint-decision making. At the end of this section, we introduce a systematic approach for analyzing which configurations of organizational forms and agency engagement through institutional arrangements lead to coordinated outcomes.

Organizational Forms for Working Together to Achieve Mandated Coordinated Outcomes

When engaging in collective action, agencies generally adopt one of three organizational forms to structure their collective decision-making and administration: two are centralized and one is decentralized. The first centralized form involves autonomous agencies creating an organization with a single decision-making body comprised of representatives from each agency. Such **intergovernmental (IG)** organizations are empowered to act on behalf of their member agencies. In essence, IG forms blur organizational boundaries and ensure all agencies are represented in the decision-making process (Bouckaert et al., 2010; Blair & Janousek, 2013). A second centralized organizational form consists of agencies delegating authority to a **lead agency (LA)**. In this form, the LA organization is empowered to act on behalf of other agencies through the LA's decision-making body. Unlike the IG form, LA organizational forms consolidate authority within a single agency (Provan & Kenis, 2008; Fjeldstad et al., 2012). Lastly, agencies may adopt a **polycentric (PC)** organizational form. In PC organizational forms, autonomous agencies, each with their own center for decision-making, have authority over their jurisdictions and typically lack authority to make

decisions for areas outside their jurisdictions. Thus, collective action occurs through each agency decision-making body's participation in the process (Carlisle & Gruby, 2019).

Which organizational form is needed to achieve coordinated outcomes likely depends on the complexity of the task. In cases where agencies are directed to achieve multiple coordinated outcomes, a centralized organizational form, either IG or LA, may provide the best apparatus for administration and decision-making (Provan & Kenis, 2008; Turrini et al., 2010; Bryson, Crosby & Stone, 2015). Although centralized forms can have high start-up costs, their clear lines of authority, leadership, and communication reduce transaction costs once agencies begin interacting on a regular basis (Berardo, 2009; Bouckaert et al. 2010; Cristofoli & Markovic, 2016). However, research shows centralized forms may not lead to coordinated outcomes in all cases, especially when the intergovernmental body or lead agency lacks the support of the agencies they represent during the planning process (Rodríguez et al., 2007). The PC organizational form is thought to pose challenges to achieving coordinated outcomes because decentralized decision-making structures increase the likelihood that agencies will make policy and planning choices that conflict with one another (Dale et al., 2017). The effectiveness of organizational forms may depend, in part, on how far along agencies are in their efforts. Studies on this topic indicate centralized approaches are initially effective for achieving coordinated technical knowledge; as agencies engage in deeper levels of social learning, centralized organizational forms may be replaced with more decentralized structures, which may lead to achieving a wider range of policy and management outcomes (Bos & Brown, 2012).

Institutional Arrangements for Working Together to Achieve Mandated Coordinated Outcomes

While the organizational form agencies adopt in response to a mandate provides an apparatus for administration and decision-making, agencies also interact through additional institutional arrangements (Nabatchi & Emerson, 2021). A variety of theoretical lenses in the public administration and management literature have been used to capture these arrangements (see e.g., Jennings & Ewalt, 1998; Bryson, Crosby & Stone, 2015; Bouckaert et al., 2010; Turrini et al., 2010) with overlaps and variations in the conceptualizations used (see e.g., Emerson et al., 2012). In the context of SGMA implementation, four types of institutional arrangements are particularly relevant for understanding how agencies engage with one another to achieve coordinated outcomes. These distinct arrangements include: (i) the platform used for communication, (ii) use of boundary spanning agents, (iii) processes used for policy evaluation and (iv) processes used for planning review and approval.

The first type of institutional arrangement, **platform for communication**, encompasses the format (e.g., one-on-one meetings between agency staff, advisory committees etc.) and scope (e.g., technical planning, policy planning) of communication strategies employed by agencies to exchange information, knowledge, and ideas for the purpose of guiding collective learning and decision-making (see e.g., Gerlak & Heikkila, 2011; Emerson et al., 2012; Brummel et al., 2012). The second type of institutional arrangement, use of **boundary spanning agents**, refers to the contracting or other deployment of individuals (e.g., technical consultants, meeting facilitators, policy advisors) to bridge knowledge gaps, transfer ideas across agencies, facilitate timely

exchange of information, and assist in science and knowledge production (see e.g., Agranoff, 2006; Moulton & Sandfort, 2017; Bell & Scott, 2020). A third type of institutional arrangement, process for **policy evaluation**, includes the specific methods and tools (e.g., economic feasibility studies, environmental impact assessments, project scenario modeling) used by agencies to assess the potential social, economic, and/or environmental impacts of policies across jurisdictions (Bouckaert et al., 2010). Lastly, the fourth type of institutional arrangement, **planning review and approval** (see e.g., Bardach, 1998; Bouckaert et al., 2010), pertains to the processes used by agencies to review and approve goals, plans, and policies. Planning review and approval may involve review of documents through public comment, internal reviews by agency staff, formal vote-taking, or consensus-based approval (Bardach, 1998; Bouckaert et al., 2010).

Each of these institutional arrangements can be adopted in ways that vary in their approach to interaction across agency boundaries. These approaches can be described as consisting of three categories that are fully distinct from one another, yet also reflect a spectrum from lesser to greater integration: ad hoc, formal, or collaborative. Used to define minimal interagency interaction, **ad hoc** refers to situations where agencies rely primarily on informal interactions that entail as-needed communication and information sharing. In adopting an ad hoc approach, agencies make few changes to existing institutional arrangements and thus do not adopt participation rules that ensure all agencies are included in communication and planning (Bouckaert et al., 2010; Peters, 2018). **Formal** engagement entails greater, though still moderate, levels of interaction. With this approach, agencies create more regular communication and information sharing practices. Agencies taking a formal approach may also integrate selected activities such

as joint planning and may pool some resources, often with the aim of improving efficiency (Cristofoli & Markovic, 2016; Costumato, 2021). By adopting formal rules for engagement, agencies ensure that a greater diversity of participants are included in the process (Baldwin, 2020). **Collaboration** represents interagency interactions designed to achieve higher levels of integration (Gray, 1985; Peters, 2018). When collaborating, agencies often craft shared power arrangements, pool resources, and intentionally create venues for collective learning through open and transparent deliberation (Gerlak & Heikkila, 2014). Beyond ensuring inclusive engagement, collaboration thus involves agencies co-laboring towards a common good (Thomson & Perry, 2006).

A prevailing assertion in research examining collective action in the public sector is that collaborative institutional arrangements help agencies achieve coordinated outcomes (Rogers & Weber, 2010; Costumato, 2021). Collaboration creates more opportunities for collective learning, which can induce agencies to re-evaluate their values and assumptions, can foster a greater sense of interdependency between agencies, and may lead to the development of novel and mutually beneficial solutions (Bryson, Crosby & Stone, 2006; Brummel et al., 2012; Gerlak & Heikkila, 2011). Yet, adopting collaborative arrangements has potential drawbacks. The transaction costs of initiating and maintaining collaborative arrangements can be high (Kim et al., 2020). In addition, agencies may have concerns about entering arrangements that constrain their organizational autonomy (Sedgwick, 2017). For example, an agency may view a consensus-based planning review and approval process as interfering with that agency's perceived independence. In addition to these drawbacks, some research shows that collaborative arrangements do not always lead to coordinated outcomes (Koontz & Thomas, 2006). Given these drawbacks

and uncertainties, a key question is whether adopting collaborative arrangements helps agencies achieve mandated coordinated outcomes. As agencies adopt multiple and concurrent approaches, shedding light on this question requires a more comprehensive analysis of how different configurations of organizational forms and institutional arrangements lead to coordinated outcomes.

A Configurational Approach to Understanding How Organizational Forms and Institutional Arrangements Combine to Achieve Mandated Coordinated Outcomes

When agencies are mandated to achieve coordinated outcomes, yet have discretion regarding how to do so, they may adopt any combination of organizational forms and the four institutional arrangements (hereafter, pathway). For example, a group of agencies may adopt a pathway that includes a **polycentric organizational form**, giving each agency full autonomy to make decisions for their jurisdictions along with institutional arrangements that include an **ad hoc approach to communication** (e.g., direct their staff to communicate as-needed in informal settings), designate a **formal role for boundary spanning agents** (e.g., appoint a policy advisor to gather information from each agency about their respective interests), create a **formal process for policy evaluation** (e.g., conduct an environmental impact evaluation to stay informed about how setting policy goals to address a single issue might impact one another), and agree to take an **ad hoc approach to plan review and approval** (e.g., provide comments during public review of each other's plans). Other groups of agencies who are under the same mandate may adopt very different pathways.

As described above, the pathways agencies adopt likely influence their ability to achieve coordinated outcomes imposed by a mandate. By adopting a configurational

approach to an analysis of the relationships between organizational forms, institutional arrangements, and coordinated outcomes, we can determine which pathways lead to coordinated outcomes and whether more than one pathway exists. If coordinated outcomes can be achieved through a variety of means, then mandates can allot discretion in how agencies work together. However, if certain organizational forms must be matched with specific institutional arrangements, then mandates will need to more explicitly dictate how agencies interact.

California's Sustainable Groundwater Management Act (SGMA)

In 2014, California's legislature passed the Sustainable Groundwater Management Act (SGMA), a law that seeks to address a decades long problem of groundwater overuse by mandating that groundwater sustainability be achieved at the geographic scale of the groundwater basin. Groundwater depletion is a common problem around the world (Famiglietti, 2014) that stems from a failure of collective action to manage pumping. The ability to access groundwater from many dispersed points (e.g., wells), the difficulty of monitoring flows, and its subtractable nature, makes groundwater the typical example of a resource easily subject to a tragedy of the commons. Interventions to address groundwater overdraft are often characterized by conflicts between water users who have different perceptions of who is to blame for the overextraction of the resource and/or have different ideas of how to address the problem (Jarvis, 2018).

Due to a history of local-control and the politics of the state, SGMA dictates that mandated sustainability be achieved through the collective action of local-level agencies (Leahy, 2016; Dennis et al., 2020). SGMA requires the formation of new governing bodies called Groundwater Sustainability Agencies (GSAs) which are then delegated

responsibility and authority to develop and implement Groundwater Sustainability Plans (GSPs). Only existing public agencies with prior authority over land and water were eligible to form GSAs. SGMA and its accompanying regulations do not prescribe the number of GSAs allowed within a basin nor does it limit the number of GSPs (CWC§10723). Agencies sharing a basin could adopt any of the three organizational forms described in the previous section. In addition, agencies were free to decide how they would interact through adoption of institutional arrangements.

SGMA's allowance for agencies to select organizational forms and institutional arrangements was tempered with the mandated requirement for basin-wide coordinated planning. Through the development of their GSPs, local agencies had to demonstrate a coordinated approach to avoid undesirable results related to the following prescribed indicators: chronic lowering of groundwater levels, reduction in groundwater storage, seawater intrusion, degraded water quality, land subsidence, and depletion of interconnected surface and groundwater (CCR §354.26). To accomplish this, the regulations accompanying SGMA specify required plan components that must be coordinated in the GSPs. These include: a basin setting describing the socioecological system (CCR §354.12-20), a section outlining policy goals (referred to in SGMA as sustainable management criteria) (CCR §354.22-30), a section detailing the specific policy actions the GSA(s) intend to implement to achieve sustainability (CCR §354.42-44), and a section outlining the governance and administrative structures for plan implementation (CCR §354.2-10). Where multiple GSPs were developed for differing portions of a groundwater basin, agencies needed to show how the GSPs, when implemented together, satisfied the requirements of SGMA (CCR §355.4). If basins fail

to comply with SGMA’s requirements for coordinated outcomes, the State Water Resources Control Board (SWRCB) may intervene, which could result in the state taking control of groundwater resources management within the non-compliant basin.

Groundwater basins designated by the California Department of Water Resources (DWR) as critically overdrafted, meaning “[the] continuation of present water management practices [in these basins] would probably result in significant adverse overdraft-related environmental, social, or economic impacts” (DWR, 2023, para 1), were required to submit initial groundwater sustainability plans by January 2020. Subsequently, GSAs are tasked with implementing those plans to achieve groundwater sustainability by 2040, with the requirement that they evaluate the status of the basin and update GSPs every five years. Our research examines the initial phase of SGMA implementation, development of GSPs.

Groundwater Use and Management in the Critically Overdrafted Basins

Our study examines groundwater sustainability planning within the 18 critically overdrafted basins² To comply with SGMA, in these basins, 265 public agencies formed 99 GSAs by June 2017. While the number of GSAs that formed within each of the critically overdrafted basins varies, in each, the agencies involved included a mix of irrigation districts, water districts, community services districts, counties, and cities. After GSA formation, those agencies began developing GSPs. In twelve basins, one GSP was

² In 2015, 21 groundwater basins were designated by California’s Department of Water Resources as critically overdrafted basins. Two of those basins followed an alternative pathway for compliance allowed under SGMA. A third basin filed completed a groundwater sustainability plan while concurrently filing for a streamlined court adjudication of groundwater rights. These basins were excluded from our analysis because they did not engage in comparable GSP planning processes and did not produce comparable plans by which coordination outcomes could be evaluated.

developed. In the other six basins, the number of GSPs ranged from 3-6. Many GSPs contained chapters describing only a portion of the basin that were separately produced by the GSAs or member agencies of a GSA that had control over that portion of the basin. Thus, regardless of whether one or several GSPs were developed for a basin, GSAs/member agencies needed to ensure their plan(s) were coordinated.

The GSAs that formed in the critically overdrafted basins are embedded in similar socio-economic contexts. Most are in California's Central Valley, where two-thirds of annual groundwater pumping in the state occurs (DWR, 2020). Agencies in these basins utilize both surface and groundwater; however, access to surface water rights is uneven, and even those with surface water rights often use groundwater due to variability in the availability of surface water deliveries (DWR, 2020). Most of the groundwater pumped (~ 80%) is used for agriculture, with 20% used for municipal or residential use (DWR, 2020). The intensive use of groundwater over the last several decades caused a significant loss of groundwater storage (100 million acre-feet over the last 100 years) and additional negative impacts, such as de-watered wells and subsidence, among others, that SGMA aims to address (DWR, 2020). Both continued over-pumping of groundwater and any potential management solutions have the potential to differentially affect users and uses of groundwater. Within each of the critically overdrafted basins, the groundwater sustainability challenge is often expressed as balancing across not just urban and agricultural uses, but also between small and large agricultural users, as well as between agencies with and without access to alternative water supplies. While environmental justice, including income and racial disparities, is a problem, especially considering the more than 400 low-income, primarily Latinx, unincorporated communities that depend on

shallow wells for drinking water, disadvantaged communities have not had a substantial influence on groundwater planning (Dobbin et al., 2022) and neither race nor ethnicity are primary drivers of interagency relationships related to groundwater planning.

Prior to the passage of SGMA, many agencies with water and/or land use authority within each of the critically overdrafted basins had undertaken some form of voluntary groundwater management (Lubell et al., 2020). Although these voluntary efforts were unsuccessful in addressing chronic overdraft at the basin-scale, the result is that within each basin, agencies have experience with groundwater planning. In addition, DWR provided agencies with resources (e.g., GSP planning grants, GSP planning workshops, dissemination of best management practices and technical support) to increase capacity during the initial phase of SGMA implementation (DWR, 2020). Thus, each of the critically overdrafted groundwater basins had access to financial and technical resources for GSP planning.

Data and Methods

Members of the research team spent more than three years (fall 2018-spring 2022) conducting ethnographic fieldwork throughout the study basins. To identify the organizational forms and institutional arrangements adopted by agencies within each basin, we conducted 67 semi-structured interviews with GSA representatives, attended 58 GSA public meetings, and collected secondary data from GSA representatives and websites. To determine whether agencies achieved the coordinated outcomes mandated by SGMA, we analyzed the 44 GSPs developed in the critically overdrafted basins and submitted to the DWR in January 2020. These plans, along with their attached technical memoranda, were the initial outputs agencies were expected to produce. SGMA specifies

that agencies must demonstrate coordination of the required components of basin-wide sustainability planning in their GSPs. All GSPs and technical memoranda associated with them were obtained from DWR's SGMA website. Supplementary information related to our methodology can be found in the appendix to this dissertation.

Using mvQCA to Understand How Configurations Of Organizational Forms and Institutional Arrangements Influence Coordinated Outcomes

MvQCA uses Boolean logic to determine which configurations of organizational forms and institutional arrangements (i.e., causal conditions) lead to coordinated outcomes (Cronqvist & Berg-Schlusser, 2008). QCA methodologies are well-suited for comparative research aimed at generalizing causal patterns from a small to medium number of cases (Ragin, 2008). Following QCA best practices, the underlying causal mechanisms are interpreted using in-depth case knowledge and/or existing theory (Rihoux & Ragin, 2008; Rubinson et al., 2019). In what follows, we describe the mvQCA analytic process.

We used the QCA package developed for R (Dusa, 2019) to perform a two-step process. First, we conducted truth table analyses. Truth tables show the unique combinations of causal conditions that are present when the outcome is also present. Following best practices for QCA, we constructed truth tables for both the presence (i.e., groundwater plans are coordinated) and negation (i.e., groundwater plans are not coordinated) of the outcome (Rubinson et al., 2019). However, as our analysis focuses on coordinated outcomes, we present results from the truth tables indicating coordination has occurred. Second, we used the minimization feature in the R QCA package to find the

parsimonious solutions³ for each type of outcome (i.e., the four types of coordinated requirements GSPs were mandated to demonstrate). Parsimonious minimization identifies the simplest configurations of casual conditions that are sufficient for the presence of the outcome. As this approach does not include researcher expectations in the minimization process, it is recommended for empirical research (Thiem, 2017). QCA solutions are evaluated using parameters of fit that indicate the empirical relevance of the solution in terms of consistency and coverage. Solution consistency (Cons.) measures the extent to which configurations of causal conditions within the solution are present when the outcome is present. Solution coverage (Cov.) measures the extent to which observed cases are explained by the configuration of causal conditions (Dusa, 2019).

Categorizing Organizational Forms and Institutional Arrangements

MvQCA is used to examine causal conditions (organizational forms and institutional arrangements) and outcomes (coordinated GSPs) that are multi-value and binary categories, respectively. For each basin, we used ethnographic data to designate the organizational forms adopted and agency engagement for each institutional arrangement. Organizational forms and institutional arrangements were defined as mutually exclusive categorical conditions based on the criteria in Tables 8 and 9. Each basin was categorized as having either intergovernmental, lead agency, or polycentric organizational forms. For each institutional arrangement, basins were categorized as following either an ad hoc, formal, or collaborative approach. Categories assigned reflect interactions between agencies at the **basin-level**. For example, an intergovernmental organizational form may

³ In finding parsimonious solutions, we followed best practices (Dusa, 2019) to examine whether contradictory simplifying assumptions were used in the minimization, and if so, they were excluded from the minimization process.

entail a single GSA comprised of multiple agencies, or a single basin-level committee through which multiple GSAs each representing one or more agencies make binding decisions. Similarly, the adoption of a formal boundary spanning agent may refer to a policy advisor used by all agencies participating in a basin-wide GSA, or by all GSAs within the basin.

Table 8. Criteria for Categorizing Organizational Forms Used During GSP Planning

The organizational forms (causal condition) are denoted by one of the following: Intergovernmental=IG; Lead agency=LA; Polycentric=PC.

	Intergovernmental [IG]	Lead Agency [LA]	Polycentric [PC]
Organizational Forms	Agencies or their respective GSA representatives create a multi-agency organization with a single board of decision-makers who are empowered to make decisions on parent agencies' behalf	Agencies or their respective GSA representatives delegate authority to a lead agency with a single board of decision-makers who are empowered to make decisions on agencies' behalf	Agencies or their respective GSA representatives create multiple organizations, each with their own board of decision-makers who are empowered to make decisions on their own behalf

Table 9. Criteria for Categorizing Institutional Arrangements Used During GSP Planning

The institutional arrangements (causal conditions) are denoted by one of the following: Ad hoc=Ah; Formal=F; Collaborative=C.

Institutional Arrangements	Ad hoc Engagement [Ah]	Formal Engagement [F]	Collaborative Engagement [C]
Platform for Communication	Agencies or their respective GSA representatives meet as-needed, one-on-one, and on an informal basis to share information related	Agencies or their respective GSA representatives meet regularly as a group in one or more formal venues to share information on a	Agencies or their respective GSA representatives meet regularly as a group in one or more formal venues to integrate information,

	to a limited set of planning topics (i.e., technical <i>or</i> policy)	limited set of planning topics (i.e., technical <i>or</i> policy)	deliberate, and arrive at shared understandings for a range of planning topics (i.e., policy <i>and</i> technical)
Boundary spanning agents	Agencies or their respective GSA representatives employ shared consultants on an as-needed basis to perform limited technical services	Agencies or their respective GSA representatives employ shared consultants and facilitators throughout the planning process to assist with the production of technical knowledge <i>or</i> policy proposals	Agencies or their respective GSA representatives employ shared consultants and facilitators throughout the planning process to assist with the co-production and integration of technical knowledge <i>and</i> policy proposals
Policy evaluation process	Agencies or their respective GSA representatives meet one-on-one to evaluate the expected impacts of some policy proposals, yet do not agree to adjust their policies based on evaluation outcomes	Agencies or their respective GSA representatives adopt a formal process for joint evaluation of the expected impacts of some policy proposals yet do not agree to adjust their policies based on evaluation outcomes	Agencies or their respective GSA representatives adopt a formal process for joint evaluation of the expected impacts of all proposed policies and agree to adjust policies based on evaluation outcomes
Planning approval process	Agencies or their respective GSA representatives adopt a process that allows agencies or their respective GSA representatives to provide comments on final plans as part of the public comment period	Agencies or their respective GSA representatives adopt a formal process that requires all agencies or their respective GSA representatives review and approve the science basis of the plan prior to public comment and allows comments on the non-science parts of the plan as part of the public comment period	Agencies or their respective GSA representatives adopt a process that requires all agencies or their respective GSA representatives review, discuss then reach a consensus on approval of full plans prior to the public comment period

Assessing Coordinated Outcomes in the Groundwater Sustainability Plans

To assess whether groundwater planning outcomes in the 18 critically overdrafted basins were coordinated as required by SGMA, we evaluated coordination of the

groundwater sustainability plans produced in those basins. To carry out this assessment, we developed a qualitative evaluation framework (Table 10) depicting the requirements for each type of coordination mandated under SGMA (e.g., knowledge of the SES, policy goals, policy actions, and oversight for plan implementation) and specifying criteria defining what constitutes a coordinated outcome. For each type of coordination required under the mandate, outcomes were assigned numerical values reflecting the degree of coordination achieved based on the criteria in the framework. The supplemental appendices describe the qualitative evaluation framework in detail, including providing information on the process for applying the framework, the numerical ranking for all basins, and an explanation of the thresholds used to define coordinated outcomes.

The GSP(s) in each basin were analyzed using this framework to identify, for each mandated requirement, that basin's coordinated outcomes. The result was a numerical score reflecting the coordinated outcome for each type of mandated requirement for each basin. An aggregate coordinated outcome score was calculated for each basin by averaging across outcome scores. As mvQCA requires binary outcome variables, coordinated outcomes were then converted into a determination of either coordinated or not coordinated. For each type of outcome, a basin was considered coordinated if the numerical score for that basin was in the top tercile of scores for that outcome across all basins. In using mathematical methods to determine the threshold that distinguishes coordinated from not coordinated outcomes, we followed best QCA practices (Rihoux & Ragin, 2008). For case study research with a small number of cases—meaning, studies where researchers have in-depth knowledge of their cases and the qualitative data being used—mathematical approaches to locating thresholds are evaluated by the researchers'

knowledge of their cases to ensure they capture meaningful distinctions in the data (Oana & Schneider, 2021). Sensitivity analysis of the data indicate the top tercile is a reasonable threshold for measuring coordinated outcomes.

Table 10. Qualitative Evaluation Framework for Assessing Coordinated Outcomes

SGMA mandated coordination of four distinct aspects of groundwater planning (depicted in the far-left column), each of which consists of multiple elements (the middle column). The far-right column qualitatively defines coordinated outcomes for each mandated requirement.

SGMA Requirements for GSPs	Coordinated Outcomes
Knowledge of the social-ecological system	Hydrogeological features of the basin GSPs use consistent scientific descriptions of the groundwater system
	Water budgets GSPs use consistent estimates of water entering and exiting the basin
	Overdraft and sustainable yield GSPs use consistent estimates of the amount of water available for use
Policy goals	Water levels GSPs set uniform minimum thresholds and measurable objectives, or, if different, provide detailed justifications for how the metrics are compatible
	Groundwater storage GSPs set uniform minimum thresholds and measurable objectives, or, if different, provide detailed justifications for how the metrics are compatible
	Water quality GSPs set uniform minimum thresholds and measurable objectives, or, if different, provide detailed justifications for how the metrics are compatible
	Land subsidence GSPs set uniform minimum thresholds and measurable objectives, or, if different, provide detailed justifications for how the metrics are compatible
	Seawater intrusion GSPs set uniform minimum thresholds and measurable objectives, or, if different, provide detailed justifications for how the metrics are compatible
Policy actions	Surface water depletion GSPs set uniform minimum thresholds and measurable objectives or, if different, provide detailed justifications for how the metrics are compatible Implementation plan GSPs articulate awareness of the full set of groundwater projects and management actions planned for the basin

Oversight for plan implementation	Expectation of effects	GSPs articulate how joint and/or individual efforts contribute to basin-wide sustainability goals
	Accountability	GSPs articulate responsibilities for project implementation
	Designated roles	GSPs designate one or more entities to oversee coordination of basin-wide knowledge production, policy implementation, decision-making, and administration
	Basin-level decision-making	GSPs describe a detailed process for making decisions related to basin-wide plan implementation
	Dispute resolution process	GSPs describe a detailed process for resolving a wide range of disputes, including specifying roles for mediators and facilitators

Achieving Mandated Coordinated Outcomes Under SGMA

As noted above, our research examined the relationship between organizational forms and institutional arrangements that were used during the initial phase of SGMA implementation, groundwater sustainability planning, and coordination of those plans across the groundwater basin. Thus, we categorized the organizational forms and institutional arrangements used at the basin-level during the period of GSP development, which occurred between 2017 and 2020. The first step in the analysis was to develop truth tables (Table 11) which reveal broad patterns regarding how agencies in the 18 critically overdrafted basins combined organizational forms with institutional arrangements to achieve coordinated outcomes.

Table 11. Combined Truth Table for all Coordinated Outcomes

The columns on the left depict the configurations of organizational forms and institutional arrangements influencing achievement of coordinated outcomes, which are shown on the right. Each row in the combined truth table represents a unique configuration of conditions. Basin IDs indicates the basins that adopted each combination. For organizational form, LA=Lead Agency, IG=Intergovernmental, PC=Polycentric. For institutional arrangements, approaches to engagement are denoted by Ah=Ad hoc, F=Formal, C=Collaborative. For each type of outcome, “X.” indicate the basin was coordinated. Dashes “—” indicate the basin was not coordinated.

Basin ID	Organizational Forms & Institutional Arrangements					Coordinated Outcomes				
	Org. Form	C. Platform	B.S. Agent	Evaluation	Approval	Knowledge of SES	Policy Goals	Policy Action	Oversight	Overall
6	LA	Ah	Ah	Ah	Ah	X	X	X	--	X
10,11	LA	Ah	Ah	C	Ah	X	X	--	--	--
5	LA	C	C	C	Ah	X	X	X	--	X
13	PC	C	Ah	F	C	X	X	--	--	--
7	PC	C	F	F	C	X	X	--	--	--
4,8	PC	C	C	C	C	X	X	X	--	X
9	IG	Ah	F	C	C	X	--	--	X	--
2	IG	C	F	C	C	X	X	X	X	X
1,3	IG	C	C	C	C	X	X	X	X	X
18	PC	Ah	Ah	Ah	Ah	--	--	--	--	--
17	PC	F	Ah	Ah	Ah	--	--	--	--	--
16	PC	F	Ah	F	F	--	--	--	X	--
15	PC	F	F	F	F	--	--	--	X	--
12	PC	C	C	Ah	Ah	--	--	--	X	--
14	PC	C	C	F	F	--	--	--	--	--

Organizational Forms and Institutional Arrangements Adopted by Basins

The organizational forms and institutional arrangements adopted vary considerably across basins. Only three sets of basins (Basins 4 & 8; Basins 1 & 3; and Basins 10 & 11) adopted the same configurations. Agencies in basins that structured decision-making through the **intergovernmental forms** (Basins 1,2,3,9) interacted with one another using mostly collaborative institutional arrangements. However, there are some exceptions. Basin 9, for example, adopted an **ad hoc communication platform** and a **formal boundary spanning agent**. Basin 2 was collaborative apart from their adoption of a **formal boundary spanning agent**. Yet, in general, agencies in basins with **IG forms**

invested in collaborative institutional arrangements that would integrate processes during GSP planning.

In contrast, the agencies in basins that structured decision-making through the **lead agency form** (Basins 6,10,11) adopted mostly ad hoc institutional arrangements. Basin 5 is a notable exception to this pattern. Agencies in Basin 5 engaged collaboratively in all but their final process for **plan review and approval**. While not as stark a contrast, Basins 10 and 11 adopted **collaborative policy evaluation processes**, but otherwise adopted ad hoc institutional arrangements.

Most of the 18 critically overdrafted basins organized through the **polycentric form**. Basins with the **PC form** (Basins 4,7,8,12,13,14,15,16,17,18) demonstrate the widest diversity in their approach to interacting through institutional arrangements. Two basins (Basins 4,8) interacted collaboratively in all four institutional arrangements; one basin (Basins 15) was entirely formal; and two basins (Basins 17,18) were mostly ad hoc. The remaining five basins interacted through combinations of collaborative, formal, and ad hoc approaches.

Basin Achievement of Mandated Coordinated Outcomes

The truth table analyses (Table 11) also reveal patterns relating the achievement of coordinated outcomes across all four mandated requirements. Most basins were coordinated in their knowledge of the SES (12/18 basins) and in setting policy goals (11/18 basins). Only one basin (Basin 9) that achieved coordinated knowledge of the SES, did not achieve coordinated policy goals. Yet, when it came to coordinating policy actions less than half (7/18 basins) were able to achieve coordinated outcomes. The

basins that did so were also basins that demonstrated coordinated knowledge of the SES and policy goals. With respect to oversight during plan implementation, less than half (7/18 basins) achieved coordinated outcomes. While most basins achieved at least one coordinated outcome (15/18 basins), only seven basins were coordinated across most mandated requirements.

Pathways to Achieving Mandated Coordinated Outcomes

The second step of the analysis was to examine how agency engagement during the initial planning process influenced coordinated outcomes in the 18 critically overdrafted groundwater basins. Results from the mvQCA parsimonious minimization (Table 12) indicate that for each outcome category, more than one pathway led to coordinated outcomes. In this section, we draw on ethnographic understandings of the basins to interpret these results and present exemplar case studies to illustrate our findings. We begin by examining how basins in our study achieved coordinated outcomes for each mandated requirement and end with a discussion of the two pathways that led to coordinated outcomes across all requirements.

Table 12. Pathways to Achieving Mandated Coordinated Outcomes

Parsimonious mvQCA solutions for coordinated outcomes are depicted on the left column. Each numbered row denotes a distinct pathway in the mvQCA solution for the outcome analyzed. For organizational forms: IG=Intergovernmental, LA=Lead Agency, PC=Polycentric. For the institutional arrangements, agency approaches are denoted: Ah=Ad hoc, F=Formal, C=Collaborative. The “*” denotes the Boolean operator AND. Consistency (Cons.) and coverage (Cov.) of each pathway are shown in the middle two columns. The solution totals for all outcomes equal 1 indicating empirical relevance of the solutions. Basin ID #s indicating which basins followed each pathway are listed on the right of the table.

	Cons	Cov.	Basin IDs
<i>Pathways to coordinated knowledge of the socioecological system (SES)</i>			

1. Approval[C]	1	.7	1,2,3,4,7,8,9,13
2. Org.Form[LA]*Approval[Ah]	1	.3	5,6,10,11
<i>Pathways to coordinated policy goals</i>			
1. C. Platform[C]*Approval[C]	1	.7	1,2,3,4,7,8,13
2. Org.Form[LA]	1	.3	5,6,10,11
<i>Pathways to coordinated policy actions</i>			
1. C. Platform[C]*Evaluation[C]	1	.85	1,2,3,4,5,8
2. Org.Form[LA]*Evaluation[Ah]	1	.15	6
<i>Pathways to coordinated oversight for plan implementation</i>			
1.Org.Form[IG]*Evaluation[C]*Approval[C]	1	.57	1,2,3,9
2.Org.Form[PC]*C. Platform[F]*Evaluation[Ah]*Approval[Ah]	1	.3	15,16
3.Org.Form[PC]*B.S. Agent[C]*Evaluation[Ah]*Approval[Ah]	1	.13	12
<i>Pathways to coordinated outcomes across all mandated requirements</i>			
1. C. Platform[C]*Evaluation[C]	1	.85	1,2,3,4,5,8
2. Org.Form[LA]*Evaluation[Ah]	1	.15	6

Pathways to Coordinated Knowledge of the Socioecological System (SES)

To achieve coordinated knowledge of the SES, agencies within each basin needed to agree on the scientific methodologies and data informing their GSPs. In addition, they needed to present a consistent narrative of the SES at the geographic scale of the basin regardless of the total number of management plans. In achieving coordinated knowledge, our ethnographic evidence suggests the primary challenge was aggregating, harmonizing, and interpreting data collected across jurisdictions. These tasks were complicated due to variation in the scale, temporal scope, and methods used by each agency to collect or approximate data. The mvQCA solution indicates two pathways to coordinated knowledge. The first pathway, followed by eight basins, entails a **collaborative process for plan review and approval**. The second pathway, followed by

four basins, includes two causal conditions: use of a **lead agency organizational form** and the **ad hoc process for plan review and approval**.

Pathway 1

The adoption of a **collaborative process for plan review and approval** led to coordinated knowledge because it ensured agencies reviewed and agreed on the science for their basin and jointly determined how the SES was described in their final plan. Our ethnographic data indicate through iterative review, agencies jointly made stepwise decisions about the methodological approach used for creating knowledge, allowing them to coordinate fundamental assumptions underpinning the descriptions of their basin's SES. As agencies adopting a collaborative process for plan review and approval agreed to jointly approve the final plan(s) for the basin, each agency staff carefully examined how the science they agreed to in earlier iterations of the review process were characterized within the description of the SES for one another's plan area. This approach alerted agencies to potential contradictions in how each agency was describing the state of the basin, which led to the negotiation of compromises prior to submitting their plan for final approval.

Basin 7 illustrates how this pathway led to coordinated knowledge. The agencies in Basin 7 focused the first year of GSP planning on development of a basin-wide water budget. Early review of the basin-wide estimates caused concern for some agencies who felt the groundwater model (i.e., the tool used to develop water budgets) did not reflect their understandings of the surface and groundwater moving in and out of their jurisdiction. Following some negotiation with these agencies and some updates to the model, agencies approved a shared water budget. During a subsequent review period,

district managers noticed contradictions between the agreed upon basin-wide water budget and the estimates presented in the text used to describe water flows in a subset of jurisdictions. These contradictions occurred because the agencies with ongoing concerns about the accuracy of the water budget further augmented the sections of the plan describing their areas inflows and outflows. Knowing they needed to unanimously approve the entire plan, including the SES descriptions specific to individual agencies, the managers found a path forward. They agreed to only use the basin-wide water budget estimates in the text describing their jurisdictions with the understanding that future updates to the GSP would include the additional data some agencies had inserted. With this strategy in place, each agency's board of directors were able to unanimously approve descriptions of the SES at the basin-scale.

Pathway 2

The use of a **lead agency organizational form** combined with an **ad hoc process for plan review and approval** led to coordinated knowledge of the SES because delegating development, review, and approval of knowledge to a single entity eliminated the risk of contradictory information being included in the final plan. Basin 5 illustrates how pathway 2 led to coordinated knowledge. In Basin 5, the agencies who ceded authority sent data and information on water flows within their jurisdiction to the lead organization, who then conducted an internal review for quality and accuracy. After this internal review, the lead agency incorporated the data it received into a groundwater model, which they used to create a basin-level water budget. When other agencies wanted to incorporate additional information, the lead organization considered each request on a case-by-case basis and made the final determination regarding inclusion of the data. Our

interviews with lead agency representatives indicate that, in adopting a leadership role, they wanted other agencies in the basin to agree with the characterization of inflows and outflows of the SES in the final plan. To accomplish this, managers and staff from the lead agency periodically reviewed the descriptions of the plan areas with representatives from each agency in the basin. This ad hoc approach to keeping agencies informed through informal plan review ensured non-lead agencies would support the plan once it was released for public comment review.

Pathways to Coordinated Policy Goals

For policy goals to be coordinated, agencies in each basin needed to articulate concrete and quantifiable definitions for groundwater sustainability based on social, economic, and environmental factors. Agencies then had to specify indicators for the six undesirable groundwater conditions outlined in SGMA and develop a compatible path and timeline to basin-wide sustainability. In working towards coordinated policy goals, agencies in our study faced the challenge of selecting metrics that balanced across diverse user needs and interests and accounted for locally specific hydrogeologic conditions. The mvQCA solution highlights two pathways to coordinated outcomes. The first combines a **collaborative platform for communication** with a **collaborative process for plan review and approval**. This approach was taken in seven groundwater basins. The second pathway is the **lead agency organizational form**, which as mentioned above, was used in four basins.

Pathway 1

Adoption of a **collaborative platform for communication** with a **collaborative process for plan review and approval** led to coordinated policy goals because this configuration of institutional arrangements facilitated collective learning about how policy goals could be both politically feasible and scientifically sound. Through our interviews and observations of each basin's approach to communication, we found that agencies who met face-to-face in one or more collaborative forums learned about each other's interests and values. These conversations led to deliberations between agency managers and policy planners regarding where their interests aligned and where they were potentially incompatible. In addition, the repeated interactions provided an opportunity for the hydrogeologists and engineers working on technical aspects of plan development to provide scientific support to the process of setting policy goals. Technical experts weighed in and at times redirected agency managers and policy planners when their analysis indicated a lack of alignment of potential policy goals. As with achieving coordinated knowledge of the SES, agencies had additional opportunities to notice and resolve incompatible policy goals through the collaborative approach for plan review. Agencies were therefore able to ensure the collective learning achieved through the deliberation process was translated in the final text prior to seeking joint approval.

We present Basin 13 as an example for pathway 1. The agencies in Basin 13 represented constituents with municipal and agricultural interests. Recognizing their diverse water uses posed challenges to setting policy goals, managers and planners within each agency felt they needed to learn about each other's policy preferences. To do this, they met monthly throughout the GSP planning process. The primary topic of deliberation during their monthly meetings was where to set minimum thresholds for

groundwater levels. Agencies with municipal interests wanted to establish higher thresholds that would protect groundwater wells for drinking water. In contrast, the agencies representing agricultural interests advocated for lower thresholds, which would allow more operational flexibility. As a group, agency managers and planners deliberated the possibility of separating Basin 13 into management zones that aligned with jurisdictional boundaries, thus affording each agency the ability to set thresholds that fit their interests. However, hydrogeologists and engineers who were part of the deliberative process demonstrated to managers and planners that, due to the hydrogeology of the basin, thresholds that varied by political boundary would be incompatible. Consequently, agencies identified uniform minimum thresholds for groundwater levels that balanced their individual and collective interests. Once the agreed-upon policy goals were written in Basin 13's GSP, each agency's managerial, planning, and technical staff reviewed the text to ensure the determinations reached through the deliberative process were reflected in the GSP prior to submitting the plan for final approval by each agency's board.

Pathway 2

The use of the **lead agency organizational form** led to coordinated policy goals because a single entity was given the task of formulating and approving policy goals in the GSP. Basin 10 illustrates this pathway. In Basin 10, following consultation with the agencies who ceded authority, the lead agency relied on its own managers, policy planners, and technical experts to develop policy goals. Policy goals were then presented to the lead agency's board of directors for evaluation and approval. These board presentations were regularly attended by managers and staff from the non-lead agencies for the purpose of staying informed about how the policy goals being developed by the

lead agency might impact them. If agency representatives had concerns about where a policy goal (e.g., minimum thresholds for groundwater levels) was being set, they expressed them during public presentations. Yet, our interviews with representatives from the non-lead agencies suggest they largely supported the policy goals determined by the lead.

Pathways to Coordinated Policy Actions

For policy actions to be coordinated, agencies in our study needed to ensure the projects and management decisions they included in their GSPs would jointly achieve basin-wide sustainability as defined by the policy goals for the basin. Working towards coordinated policy actions was challenging because local agencies, for the first time in California's history, were mandated to consider the effects of their actions across political boundaries. Planning projects at larger geographic scales therefore required a fundamental change in perspective for agency managers accustomed to evaluating actions based on the cost and benefit to their water users. Two pathways led to coordinated policy actions. The first, adopted by six basins, includes the combination of a **collaborative platform for communication** with a **collaborative process for policy evaluation**. The second pathway, adopted by only one basin, entails adoption of a **lead agency organizational form** combined with an **ad hoc process for policy evaluation**.

Pathway 1

The adoption of a **collaborative platform for communication** with a **collaborative process for policy evaluation** led to coordinated outcomes because this configuration of arrangements provided a framework for collective learning and discussion about how

each agency's potential actions might impact (positively and/or negatively) other jurisdictions. In all six basins, policy proposals were evaluated during monthly or bi-monthly face-to-face meetings using a basin-wide groundwater model that was trusted by all participants. Participation in these sessions allowed agencies to discuss the outcomes predicted by the model and re-evaluate their initial premises if policy proposals either had the potential to cause harm to another agency or did not contribute to meeting the basin's agreed-upon policy goals. Moreover, examining the basin as an integrated whole helped to convince some agency representatives that investing their collective resources to solve groundwater issues in one area of the basin could benefit their jurisdiction's water users by offering the clearest path to achieving basin-wide sustainability.

Basin 3 illustrates how pathway 1 facilitated deeper levels of collective learning. Prior to SGMA, agencies in Basin 3 had never engaged in groundwater planning at the basin scale. Doing so meant that agencies in more urban areas, who had previously worked with one another, had to engage with agencies in rural areas who had not participated in regional groundwater planning. To facilitate interagency communication and build trust, the agencies in Basin 3 created an advisory forum comprised of agency managers and technical experts. The advisory forum met monthly throughout the two-year planning process. In the second year of GSP development, the forum participants reviewed one another's proposed policies. This stage of the planning process was contentious because the managers from rural areas claimed their constituents would not support their agency directing resources to solve groundwater overdraft in the more developed parts of the basin. The evaluation process involved each agency submitting project proposals to the group. These proposals were used to run simulations in a basin-wide groundwater model.

Discussion of the simulation results helped managers from rural agencies understand the hydrogeology connecting them to their neighboring jurisdictions. In addition, the results provided rural agencies quantitative evidence demonstrating how a regional approach to groundwater planning would, over time, benefit their constituents. The insights gained from this process led agencies to reframe their understandings about cross-jurisdictional impacts. As a result, agencies were able to select regional and local projects for the basin that they all felt they would be able to justify to their respective constituents.

Pathway 2

The use of the **lead agency organizational form** with an **ad hoc process for policy evaluation** led to coordinated policy goals in only one basin—Basin 6. To interpret causality of this configuration, we highlight how Basin 6 was unique among the subset of cases that adopted the lead agency organizational form, which heretofore followed the same pathways to coordinated outcomes. The lead agency in Basin 6 not only had full control of the development and approval of policy actions, but it also assumed full responsibility for implementation of policy actions. As the agencies ceding to that lead organization would have no role in project implementation, agencies in this basin did not create a formal or collaborative role for ceding agencies in the evaluation of policy proposals. This finding suggests an ad hoc approach to policy evaluation leads to coordinated policy actions in unique cases (such as Basin 6) where the lead agency has full control over development and full responsibility for implementation of policy actions across all jurisdictions in a plan area.

Pathways to Coordinated Oversight for Plan Implementation

To develop coordinated oversight for plan implementation, agencies needed to identify in the GSP(s) for their basin which staff or administrative units would be responsible for the day-to-day tasks of implementation. In addition, they needed clear procedures for how decisions related to implementation and adaptive management would occur at the basin scale. Our ethnographic data indicate many basins did not achieve coordinated oversight either because they ran out of time to put implementation structures in place or because they viewed planning for implementation as a concern for the future. For the agencies that did achieve coordinated outcomes, the mvQCA solution indicates three pathways. The first, followed by four basins, combines the **intergovernmental organizational form** with a **collaborative process for policy evaluation** with a **collaborative process for final plan review and approval**. The second pathway, followed by two basins, combines the **polycentric organizational form** with a **formal platform for communication** with an **ad hoc process for policy evaluation** with an **ad hoc process for plan review and approval**. Finally, the third pathway, followed by only one basin, combines the **polycentric organizational form** with a **collaborative boundary spanner** with an **ad hoc process for policy evaluation** with an **ad hoc process for plan review and approval**.

Unlike the mvQCA solutions discussed thus far, the pathways for this outcome entail more complex configurations of institutional arrangements, making it more difficult to discern causal links to coordinated outcomes. Additionally, with the exception pathway 1, each pathway only describes one or two basins. Based on our ethnographic data, we expect the coordinated outcomes in basins adopting pathways 2 and 3 are more related to

the specific context of those basins than the configurations of institutional arrangements they selected.

Pathway 1

The adoption of an **intergovernmental organizational form** with a **collaborative process for policy evaluation** with a **collaborative process for final plan review and approval** led to coordinated outcomes because, to adopt those arrangements, agencies had to explicitly develop and articulate procedures and processes for interacting with one another and to identify a point person/unit to ensure communications occurred. In Basin 9, for example, early in the GSP development phase, agencies negotiated formal agreements that clearly defined agency roles, planning procedures, processes for conflict resolution and decision-making. They also designated responsibilities and delineated procedures for joint implementation of the GSP. Having these structures in place meant agencies in Basin 9 were able to clearly articulate their approach to implementation in their management plan.

Pathways 2 And 3

As mentioned above, pathways 2 and 3 include multiple causal conditions. Pathway 1, which entailed adoption of the **polycentric organizational form** with a **formal platform for communication** with an **ad hoc process for policy evaluation** with an **ad hoc process for plan review and approval**, describes Basins 15 and 16. Pathway 2, adopted by Basin 12, entailed the **polycentric organizational form** with a **collaborative boundary spanner** with an **ad hoc process for policy evaluation** with an **ad hoc process for plan review and approval**. For both pathways, our case knowledge suggests

the context of these basins combined with a single institutional arrangement was what led to coordinated oversight during implementation. As they were developing their GSPs, the agencies adopting pathways 2 and 3 had difficulty reaching agreement throughout the planning process. Agencies in all three basins were concerned about how they would continue to achieve coordinated decision-making during implementation. The agencies described by pathway 1 decided to delegate administrative and decision-making tasks to their formal basin-wide technical advisory committee. The agencies described by pathway 2 decided to delegate oversight of implementation to their collaborative basin-wide consultant. The lead consultant had a history of working with each agency and was trusted by most managers, planners, and boards of directors in the basin. Thus, in all three basins adopting pathways 2 and 3, it was not the specific configuration of institutional arrangements that led to coordinated oversight. Rather, it was that agencies designated a specific entity associated with one of their institutional arrangements to take on that role during implementation of the GSPs.

Pathways to Coordinated Outcomes Across All Mandated Requirements

Agencies in the 18 basins needed to achieve coordinated outcomes across at least 3 of the 4 types of mandated requirements to be considered coordinated as an aggregate outcome. Only seven basins achieved this outcome. Pathway 1, which was followed by six basins, included any of the three organizational forms combined with a high level of commitment to **communicate in a collaborative platform** along with a process for **evaluating basin-wide impacts of policy proposals**. Pathway 2, which was only adopted by one basin, combined a **lead agency organizational form** with **an ad hoc approach to policy evaluation**.

Notably, the two pathways identified by the mvQCA solution as leading to overall coordinated outcomes mirrors the pathways identified as leading to coordinated policy actions because only the basins that coordinated policy actions achieved coordinated outcomes across a majority of the mandated requirements. This finding does not mean that pathways to coordinated knowledge and policy goals are unimportant for achieving overall coordinated outcomes. Rather, it shows that coordinated outcomes build upon one another. No basins achieved coordinated policy actions without also achieving coordinated knowledge of the SES or policy goals. This indicates shared knowledge of the SES and compatible policy objectives form a common basis upon which to coordinate policy actions. Further, it suggests that shared learning and dialogue that occurs to develop knowledge and agree to compatible policy objectives can support coordinated policy actions. However, as demonstrated by the four basins that coordinated knowledge of the SES and policy objectives yet did not achieve coordinated policy actions, having a common basis does not mean agencies will coordinate policy actions. As the mvQCA pathway 1 solution points out, the extra step of ensuring collaborative dialogue and deliberation that occurred during the knowledge and policy goal development phases of planning continue through evaluation of impacts across the basin is key. The only instance in which this is not important, as illustrated by the one basin following pathway 2, is if agencies delegate authority to a lead organization who takes full responsibility for plan development and implementation.

Discussion

Our examination of mandated groundwater sustainability planning under SGMA indicates groups of agencies can achieve coordinated outcomes under any organizational

form (i.e., IG, LA, or PC) so long as they use collaborative institutional arrangements. This finding demonstrates that adoption of centralized organizational forms (LA or IG) does not serve as a substitute for collaboration. It also supports scholarship emphasizing the value of collaborative institutional arrangements (see e.g., Ulibarri, 2015; Favereu et al., 2016; Costumato, 2021; Nabatchi & Emerson, 2021) and highlighting the importance of managing agency interactions by facilitating engagement, easing tensions, and unifying interests (see e.g., O'Toole & Meier, 2004; Berardo et al., 2014; Cristofoli & Markovic, 2016).

Only one basin achieved coordinated outcomes across all mandated requirements without interacting through collaborative institutional arrangements. This basin, which adopted a LA organizational form, was unique in that the lead agency accepted responsibility for all planning and implementation at the basin-level. As other agencies agreed to relinquish full control, only ad hoc interactions were needed for communication, policy evaluation and plan review and approval. In the other three basins adopting a LA organizational form, non-lead agencies retained varying degrees of control over decisions or approvals. This distinction illustrates that there is heterogeneity regarding how agencies interact even within an organizational form, pointing to the need for more nuanced conceptualizations of organizational forms than the broad categories of IG, LA, and PC used in the literature (see e.g., Cristofoli & Markovic, 2016; Raab et al., 2015).

Our analysis provides nuanced understandings linking collaboration to the achievement of mandated coordinated outcomes. Specifically, our examination highlights the specific configurations of collaborative institutional arrangements needed for

achieving different types of coordinated outcomes. The agencies who coordinated knowledge of the SES did so by adopting a **process for collaborative plan review and approval**. To achieve coordinated policy goals, agencies combined a **collaborative communication platform** with a **collaborative review and approval process**. Achievement of coordinated policy action resulted from combining a **collaborative platform for communication** with a **collaborative process for evaluation**. These findings suggest agencies tasked with implementing a mandate may tailor their adoption of collaborative institutional arrangements to the type of outcome they are required to achieve.

While collaborative **communication platforms, review and approval processes** and **policy evaluation** are needed to achieve coordinated knowledge of the SES, policy goals, and policy actions, the pathways leading to coordinated oversight for plan implementation are different and more diverse. This finding reflects the fact that in working towards coordinated oversight for plan implementation, agency interactions primarily entail navigating logistics, transaction costs, and communication. In contrast, interactions between agencies in relation to achieving coordinated knowledge, policy goals, and policy actions requires agencies negotiate their understandings, values, and priorities. While achieving coordinated oversight for implementation might be less complicated than achieving other types of coordinated outcomes, as it does not involve negotiating values and priorities, fewer basins achieved this aim. Our ethnographic evidence indicates this is because agencies in many basins were preoccupied with achieving what they saw as the more important mandated requirements and overlooked the need for ensuring oversight during implementation. These findings point to the need

for mandates to clearly define their expectations for oversight as agencies transition from plan development to implementation.

Lastly, it merits mention that the mvQCA analysis did not identify collaborative boundary spanning agents as key for achieving mandated coordinated outcomes. This finding does not mean that consultants, facilitators, and third-party advisors were unimportant in supporting agency engagement. Based on our participant observation of the GSP development process and interviews with third-party actors, we know boundary spanning agents played a large role in transferring knowledge and ideas, especially in basins that adopted IG and PC organizational forms. The fact that collaborative boundary spanning agents are not identified by the mvQCA as essential to coordinated outcomes does not contradict the literature highlighting the value of boundary spanning agents (see e.g., Bell & Scott, 2020). Rather, our findings indicate that when groups of agencies are mandated to work towards coordinated outcomes, the role of boundary spanners is secondary to creating collaborative spaces for agencies to engage in face-to-face collective learning and to ensuring compatibility through collaborative review and approval of planning documents. This is likely because the presence of these collaborative institutional arrangements influences the ability of third-party actors to work across agency boundaries.

Conclusion

Collective action is needed to address many of our current social and environmental challenges. How to foster collective action in the public sector is yet to be determined. When higher levels of government use coordination mandates, a critical question remains about whether groups of agencies should be allotted the discretion to choose how they

will structure their interactions as they seek to achieve the mandated coordinated outcomes. Our research takes an initial step in answering this question by demonstrating that the selection of organizational forms and institutional arrangements does indeed influence achievement of the mandate's requirements for coordinated outcomes.

Results from our research suggest coordination mandates need not dictate the specific organizational form (e.g., intergovernmental, lead agency, or polycentric) agencies adopt. However, mandates may be more effective if they require agencies develop a collaborative platform for communication that include the diverse set of actors (e.g., decision-makers, policymaker, technical experts, agency staff) needed to reach technically sound and politically feasible decisions. Agencies should also be required to engage in joint evaluation and plan review and approval processes. We note the similarity of this recommendation to calls for collaborative governance (Margerum, 2008; Innes & Booher, 2010), though it is important to acknowledge the potential limitations of externally generated collaborative governance, (see e.g., Gerlak et al. 2012; Cain et al., 2020; Nabatchi & Emerson, 2021). A mandate cannot force agencies to engage in collective learning or to develop the trust that is central to the success of collaborative governance (see e.g., Bryson, Crosby, & Stone, 2006; Ansell & Gash, 2008; Gerlak & Heikkila, 2011). Mandating the use of a collaborative communication platform and collaborative processes for approval and evaluation would set the stage for such interactions to occur, and, together with contingent sanctioning, could make agencies aware of the potential for mutual gains that might generate a commitment to work together. Yet, a mandate for such institutional arrangements would not, on its own, change the underlying contextual conditions that influence agencies a priori relationships.

As our research sought to shed light on the implications of policymaker's allowance for discretion when agencies are mandated to engage in collective action, it focused on the causal conditions policymakers can influence – specifically the organizational forms and institutional arrangements to be used. We did not investigate how contextual factors influence agencies' selection of the organizational forms and institutional arrangements, nor did we evaluate how those contextual factors may have affected coordinated outcomes. Including additional contextual factors in the analysis of critically overdrafted basins under SGMA was impracticable for the following reasons. First, due to the limited number of cases (18) in our study, we were unable to include a larger number of conditions using mvQCA. Second, while empirical research has shed light on how contextual factors—history of conflict, resources, size and/or stability of the network, cultural barriers, income disparities, pre-existing trust etc.—influence whether, why, and how groups of agencies interact with one another to achieve common goals (Bryson et al., 2015; Mattor & Cheng, 2015; Kim et al., 2020), how such factors are moderated or mediated through organizational forms and institutional arrangements is less well understood. Prior to incorporating such factors in mvQCA, additional research is needed to determine any moderating or mediating relationships, otherwise these interlinked relationships cannot be modeled appropriately and there is a risk of misattribution of causal conditions in the analysis. Carrying out such research will require identification of a larger set of empirical cases with sufficient variation across them.

We do not expect exclusion of contextual factors greatly impacted our findings. As noted earlier in the paper, agencies in the critically overdrafted basins were embedded in similar socio-economic contexts of groundwater overdraft, diverse types of agencies with

authority over groundwater, the need to balance across water uses and users, and economic impacts of both reducing and continuing current groundwater use. Nonetheless, nuances in contextual conditions exist across basins in our study, and future inclusion of those factors is important for development of theory regarding the full suite of factors that influence the achievement of coordinated outcomes.

Further research is also needed to provide more in-depth guidance about how to design mandates to foster collective action between public agencies. Our research only examined responses to a single mandate – SGMA. A comparative study of the effects of institutional arrangements across multiple mandates, each with differing requirements, is needed to determine the extent to which the language and threat of sanctions within a mandate influence the effectiveness of institutional arrangements in achieving coordinated outcomes. Additional research is also needed to determine why and under what circumstances agencies choose some organizational forms and institutional arrangements over others. Engaging in collaboration requires resources and entails risk (see e.g., Carr et al., 2013; Hansen et al., 2020). The pathways agencies adopt vary in the time, human, financial, and other resources required, as well as their impacts on agency autonomy (Thomson & Perry, 2006). Consequently, we need to develop better understandings of the benefits and shortcomings of different configurations of organizational forms and institutional arrangements to effectively address concerns and encourage agencies to adopt the pathways most likely to achieve coordinated outcomes.

Finally, this research examined the relationship between the structures used to guide agency interactions and coordinated outcomes during the initial stage of SGMA – that of sustainability planning. Future implementation of SGMA will entail agencies undertaking

the projects and management actions specified in the GSPs, re-evaluating groundwater conditions, and updating their plans. How local-level contexts and state-level oversight influence SGMA implementation in the long-term remains to be seen; however, we expect the organizational forms and institutional arrangements adopted during this first phase SGMA will shift as agencies take steps to actualize their plans. Thus, we acknowledge a need for longitudinal research to fully understand the implications of affording agency discretion in mandated contexts.

CHAPTER IV

MAKING SENSE OF A MANDATE TO MANAGE GROUNDWATER: A COMPARATIVE CASE STUDY OF PROSPECTIVE SENSEMAKING IN TWO CALIFORNIA COUNTIES

Introduction

Policy mandates —whether legislated, court-ordered, or executive-ordered— are increasingly used by higher levels of government to steer collaboration between public organizations (May 1995; Schafer 2016; Bell & Scott, 2020; Afandi et al., 2023). The implementation of policy mandates is a complex endeavor, involving diverse actors working within and across organizational boundaries in multi-level systems of governance (Newig & Koontz, 2014; Moulton & Sandfort, 2017; Heidbreder, 2017). The complexities of mandated policy implementation often stem from lack of clarity both within and between public organizations regarding the requirements of the mandate, leading to the possibility of multiple interpretations (i.e., ambiguity). (Montjoy & O’Toole, 1979; Schafer, 2016). When ambiguity is coupled with uncertainty, these complexities give rise to variation in the ways mandates are understood and implemented (Matland, 1995; Fowler, 2020).

While policy implementation research has moved beyond normative expectations of fidelity in the ways public organizations translate top-down policy-as-written to policy-as-action (O’Toole, 2000; Hill & Hupe, 2002; Saetren, 2014), public administration and management scholarship demonstrates an abiding concern for understanding why and how variation in implementation occurs across multiple sites (Winter, 2012; Sandfort &

Moulton, 2020). This concern stems, in part, from an interest in illuminating the conditions and contexts that support public sector autonomy and potential innovation while achieving more consistent outcomes and thus avoiding policy implementation failures (May, 2015; Fowler, 2023).

To shed light on the topic of variation in policy implementation, research has examined how frontline workers and street-level bureaucrats interpret their role in implementing policy programs and has generally followed one of two lines of inquiry. One area of research has examined the contexts and conditions that allow implementing actors to interpret policies in ways that vary from policymaker's expectations and goals (Hupe, 2011; Sandfort, 2018). In these studies, variation is understood as stemming from lack of clarity or clear direction in the mandate and thus resulting from the policymaking process (Van Meter & Van Horn, 1975; Montjoy & O'Toole, 1979; Matland, 1995; May, 2015; Khan & Khandaker, 2016). Another area of research has instead attended to the ways street level bureaucrats and frontline workers develop coping mechanism strategies to balance conflicting demands during the day-to-day process of implementing policy programs (Lipsky 1980; May & Winter, 2007; Tummers & Bekkers, 2014). Here variation is understood as rooted in the discretion of individuals who are motivated to make meaning of their work (Ricucci, 2005; Winter 2012).

Thus, research on variation in implementation has produced narratives that either emphasize how a policy's stated goals and structure influences variation in interpretation or has given weight to the underlying motivations of individuals and micro-level social dynamics that shape actor perceptions and actions (Winter, 2012; Cecchini & Harrits, 2022; Winter et al., 2022). What has received less attention is *how* interpretations of top-

down directives are collectively constructed at the organizational level (Rice, 2013).

Illuminating the organizational processes that influence how actors construct interpretations provides insight about how variations shape organizational action and thus fills a gap in the study of mandated policy implementation.

In addressing this gap, our paper views mandate interpretation through an organizational lens. At the organizational level, a policy mandate's goals and approach must be construed by the actors charged with implementation as appropriate for solving shared problems (May, 2015). Interpreting policy mandates is thus a social and collective process whereby organizational actors construct shared understandings of their organization's role in implementation that are generally accepted as sensible and rational (Johnson & Dowd, 2003; Tan et al., 2020).

Drawing on insights from organizational institutional theories (Feldman & Rafaeli, 2002; Feldman & Pentland, 2003; Johnson & Dowd, 2003; Jensen et al., 2009; Ocasio & Gai, 2020) and the organizational sensemaking literature (Weik, 1995; Maitlis, 2005; Gephart et al., 2010), this research contributes to our understanding of how variation in implementation behavior arises as a consequence of whether and how public organizations construct shared understandings of their role in mandate implementation. By adopting this lens, our research answers recent calls for public administration and management scholarship to illuminate the interactions between structure and agency within the organizational field of policy implementation (Whitford et al., 2020; Sandfort & Moulton, 2020; Cecchini & Harrits, 2022; Cheng & Sandfort, 2022).

To that end, we offer a comparative case analysis that describes *how* two county governments in California enacted two different collective sensemaking processes to

construct shared understandings of their role in implementing the Sustainable Groundwater Management Act (SGMA). SGMA, a state-wide mandate signed in 2014, requires that local public organizations address chronic groundwater overuse at the geographic scale of groundwater basins. While hundreds of public organizations (e.g., water districts, irrigation districts, community services districts, cities etc.) were impacted by the passage of SGMA, county governments were placed in the unique position of being the assumed managers of groundwater for areas within their jurisdiction. Additionally, county governments could potentially play a role in the governance and management of groundwater under the jurisdiction of existing districts and municipalities. Yet, the legislation lacked detail about how county government should assume their management role. Also lacking was a clear indication of the consequences of inaction. Whether and how county governments assumed a role in SGMA implementation was largely left to each county to decide. With the county role in SGMA implementation as a backdrop for our comparative analysis, we ask the question: *How does variation in collective, organizational sensemaking influence whether and how public organizations construct shared understandings of their role in mandate implementation?*

Interpreting Policy Mandates through Organizational Prospective Sensemaking

When public organizations are directed by higher levels of government to implement new policy programs, they must decide how they will participate. To arrive at shared decisions, organizational actors (i.e., people representing the organization either as elected/appointed officials, employees, and/or stakeholders) engage in prospective sensemaking. Prospective sensemaking involves the “conscious and intentional

consideration of the probable future impact of [a] certain action” (Gioia et al. 1994, p. 378) and is often employed when organizations engage in strategic planning (Stigliani & Ravasi, 2012; Kaplan & Orlikowski, 2013). Prospective sensemaking is necessary because organizational actors must grapple with ambiguity (i.e., the presence of multiple, reasonable interpretations of the same phenomenon) when deciding how they will participate in implementation (Fowler, 2020). Thus, rather than being a backward-looking exercise (e.g., organizational actors making sense of a crisis or event that has already occurred), prospective sensemaking is a collective process whereby organizational actors rationalize a future action or desired condition (Gephart et al., 2010; Maitlis & Christianson, 2014). As this type of sensemaking often occurs when organizations experience disruptions to the status quo that require adaptation and change, it offers a process model for how organizations construct shared interpretations of their role in mandate implementation.

Broadly speaking, organizations are defined as “collections of people, material assets, financial resources, and information, whose members have common goals that they cooperate to pursue” (Haveman & Wetts, 2018, p.2). This definition centers on organizations as assemblages of structures (i.e., rules, resources, routines, practices, and cultures) that provide frameworks within which actors (i.e., people with situated identities who have opportunities and abilities to influence structures) collectively interpret appropriate, rational, and sensible action (Sandfort & Moulton, 2020). By conceptualizing organizations as unique contexts within which actors interact, we bring into focus the idiosyncratic ways public organizations may enact different prospective sensemaking processes.

The theoretical framing outlined below is structured in three parts that describe key aspects of the prospective sensemaking process. The first examines the initial organizational context within which local actors learn about policy mandates and focuses on the role of existing practices for coordinating knowledge in structuring how prospective sensemaking is initiated. The second part describes how prospective sensemaking is enacted following initiation and explains how three different forms of sensemaking constrain or enable the ability of organizational actors to arrive at shared understandings. In the third part, we explore how variation in prospective sensemaking may influence whether and how organizational actors construct shared and acceptable understandings of the organizational role in implementation. We end by discussing how such variation illuminates our understanding of how inconsistencies in implementation behavior patterns arise.

The Initiation of Prospective Sensemaking in Response to A Policy Mandate

While prospective sensemaking is undertaken with the goal of strategizing a future action or desired condition, sensemaking processes are shaped by rationales that stem from existing organizational contexts (Feldman & Rafaeli, 2002; Jensen et al., 2009; Rerup & Feldman, 2011; Jensen & Kjærgaard, 2010; Sandfort & Moulton, 2020). Research suggests that existing practices and routines through which actors interact, coordinate information, and produce knowledge provide a framework with which actors perceive the need for a collective response to external or internal cues (Stigliani & Ravassi, 2012; Sandberg & Tsoukas, 2020). In the context of mandated policy implementation, this occurs when knowledgeable actors draw on existing repertoires to articulate a salient rationale for responding to a top-down mandate (Feldman & Pentland,

2003; Sandfort & Moulton, 2020). By “knowledgeable” we mean actors who possess tacit knowledge (i.e., knowledge learned by doing or gained through professional expertise and lived experience) related to the issues or problems the mandate seeks to address (Baumard, 1999; Gephart et al., 2011; Kaplan & Orlikowski, 2013; Berkley & Beratan, 2021). In addition, the relative influence of knowledgeable actors (related to how actors are socially positioned to one another) helps determine how and when prospective sensemaking is initiated (Maitlis & Lawrence, 2007; Tan et al., 2020). Thus, the initiation of prospective sensemaking in response to a policy mandate, including seemingly mundane decisions about when, how, and who participates is likely contingent on the knowledgeability and influence of organizational actors who are embedded in existing practices and processes (Maitlis & Lawrence, 2007).

Understanding Variation in Prospective Sensemaking Process

Prospective sensemaking often occurs in the context of executive planning committees, ad hoc task force meetings, or stakeholder advisory groups who are collectively charged with determining a potential role for the organization in mandate implementation. Once prospective sensemaking is initiated, organizational actors deliberate the interpretations that arise with the goal of arriving at a shared understanding thereby alleviating ambiguity (Gioia et al., 1994; Stigliani & Ravasi, 2012). Yet, how organizational actors arrive at shared understandings varies from one organizational context to another. Scholars describe variations in sensemaking based on social dynamics that determine who participates in deliberation and how knowledge is shared and constructed. When knowledgeable actors (typically these are executive decision-makers and/or political leaders) have a greater ability to influence the deliberative process,

restricted prospective sensemaking occurs (Maitlis, 2005). Restricted sensemaking is characterized by a one-way flow of information where knowledgeable actors located at higher levels of the organization impose their interpretation, which is (at least nominally) accepted by the organizations mid-level managers, frontline workers, and wider stakeholder community (Maitlis & Christianson, 2014). When participants include knowledgeable actors from different parts of the organization (e.g., executive/political decision-makers and mid-level managers) and the wider stakeholder community (e.g., local government agency managers, non-governmental representatives, constituents), yet the process is largely steered by an organization's executive and/or political leaders, a *guided* prospective sensemaking process occurs (Maitlis, 2005). Guided sensemaking is often characterized by cycles of contestation and negotiation as highly animated, knowledgeable participants attempt to steer the group toward their preferred interpretations (Maitlis & Lawrence, 2007). When knowledgeable actors are stakeholders within the organization yet exercise their ability to influence the timing and structure of sensemaking occasions, *fragmented* prospective sensemaking occurs (Maitlis, 2005). Fragmented sensemaking is characterized by a bottom-up flow of information where executive and/or political leaders of an organization largely accept the interpretations of knowledgeable stakeholders (Maitlis, 2005).

Enacting Shared Understandings in Mandated Policy Implementation

At the organizational level, the goal of prospective sensemaking is to reduce ambiguity (i.e., the presence of multiple interpretations) about the role of the organization in mandate implementation. Prospective sensemaking therefore typically concludes when the organizational actors who engaged in prospective sensemaking coalesce around a

shared understanding that is construed as appropriate, sensible, and/or rational (Gioia et al., 1994; Johnson & Dowd, 2003). Depending on whether restricted, guided, or fragmented forms characterize the prospective sensemaking process, we can expect differences in whether and how shared understandings are constructed, and subsequently, whether actors within the organization arrive at a clear or ambiguous understanding of the role of the organization in implementing the mandate.

Restricted prospective sensemaking leads to a shared understanding that reflects the narrow perspectives of the organization's executive decision-makers and/or political leaders (Maitlis, 2005). In such cases, we may expect restricted prospective sensemaking to produce clear policy statements, top-down directives, and guidance documents that lay out the organization's role in implementation. Yet, since such understandings are constructed through acquiescence, ambiguity may exist behind a veneer of consensual agreement. Whether the understandings arrived at through restricted sensemaking reduces or retains ambiguity likely depends on whether the views of executive decision-makers and/or political leaders continue to dominate and eventually become taken for granted. If those views become contested by knowledgeable actors (e.g., mid-level managers and/or frontline workers) who cast doubt on the perceived efficacy of executive decisions, we might expect to see street level bureaucrats and frontline workers relying more on their own discretion to implement programs in ways that align with their own understanding while developing administrative or bureaucratic structures that signal alignment with the organization's executive decision-makers (Schafer, 2016).

Guided prospective sensemaking leads to a single, shared understanding that reflects the collective views of organizational actors and is agreed to by most participants as a

sensible and appropriate response (Maitlis, 2005). Because guided sensemaking is a result of a negotiated process that is inclusive of multiple viewpoints, shared understandings should reduce ambiguity as the organization begins the process of implementation. As a result, policy statements, top-down directives, and guidance documents that follow guided prospective sensemaking are likely to be understood by street-level bureaucrats and frontline workers in ways that are congruent. In such cases, implementation at the front-line may follow patterns associated with processes of translating policy-as-written from the organizational level to policy-as-action at the individual level and a corresponding reduced need for relying on individual discretion to cope with ambiguity (Davis & Stazyk, 2016; Fowler, 2020).

Fragmented prospective sensemaking leads to multiple, potentially conflicting, understandings of the organization's role in mandate implementation that reflect narrow perspectives of different organizational actors (Maitlis, 2005). As a result of fragmented prospective sensemaking, actors within the organization may not reach consensus, making it difficult to coalesce around a single role for the organization in implementation. In such cases, we could expect the retention of ambiguity. While fragmented prospective sensemaking may produce policy statements, top-down directives, and guidance documents, these are likely to remain broad and open to interpretation. In some cases, the co-existence of different viewpoints may lead actors to call for ongoing prospective sensemaking to help clarify how the organization should participate in implementation activities. If ambiguity continues, as the implementation process unfolds, we might expect ongoing inconsistencies in the implementation behavior

of street level bureaucrats and frontline workers that align with different articulations of an organization's role (Winter, 2012).

Research Background

The passage of the Sustainable Groundwater Management Act (SGMA) in 2014 signaled a new approach to groundwater governance and management in California, one which held the tension between local governmental discretion and state oversight. Prior to SGMA, the state legislature—with support from the California Department of Water Resources (DWR) and State Water Resources Control Board (SWRCB)—made attempts at correcting overdraft caused by decades of groundwater pumping by providing financial and technical support for local decision-makers to develop groundwater management plans. These voluntary approaches were largely unsuccessful at curbing groundwater depletion (Leahy, 2015), resulting in the designation of 127 groundwater basins in a state of overdraft (Department of Water Resources, 2016). Twenty-one of these groundwater basins were designated as “critically overdrafted” meaning, “significant adverse [groundwater] overdraft-related environmental, social, and economic impacts” were likely to occur (DWR, 2023, para 1). With SGMA, achieving groundwater sustainability at the geographic scale of groundwater basins was mandatory. If local government failed to meet SGMA's mandated requirements for coordinated planning, the state was empowered to intervene. Thus, unlike prior approaches, local governmental agencies were held accountable by the state and could be made to forfeit local control of groundwater resources.

SGMA was structured to occur in a series of implementation phases that first focused on the 21 critically overdrafted basins. During the first phase of implementation, existing

governmental agencies with jurisdiction in critically overdrafted basins had two years (from 2015-2017) to form new political entities called groundwater sustainability agencies (or GSAs). Eligible agencies included single purpose districts, such as irrigation districts, water districts, water storage districts, and community services districts, to name a few. General purpose governments (i.e., cities and counties), were also eligible to participate in SGMA either as independent GSAs and/or by joining single purpose districts to create multi-agency GSAs. SGMA required local governmental agencies to form one or more GSAs by the summer of 2017. Once GSAs were formed, the second phase of implementation began. In each groundwater basin, GSAs had two years (2017-2019) to develop one or more groundwater sustainability plans (GSPs) which needed to be submitted to the DWR for evaluation by 2020. If GSPs failed to meet compliance, the non-compliant basins could (at least temporarily) have their groundwater resources managed by the SWRCB. In this study, we mostly examine the GSA formation period (2015-2017) because this was when governmental agencies were making sense of the SGMA legislation.

Unlike cities and the single purpose districts mentioned above, the SGMA legislation placed counties in a unique position. Under SGMA, undistricted land (meaning irrigated acreage that was not covered by another public agency) defaulted to county government to manage. The law described the role of county government as follows:

In the event that there is an area within a high- or medium-priority basin that is not within the management area of a groundwater sustainability agency, the county within which that unmanaged area lies will be presumed to be the groundwater sustainability agency

for that area...unless the county notifies the department [DWR] that it will not be the groundwater sustainability agency for that area (CWC §10724).

Nine of the 16 counties with jurisdiction covering critically overdrafted basins are in California's Central Valley. Agriculture is an economic driver for groundwater pumping in this region of the state. Two-thirds of groundwater extraction in California occurs in the Central Valley with 80% being used for agriculture (DWR, 2020). While many water districts and irrigation districts use both surface water and groundwater conjunctively, the undistricted water users tend to rely solely on groundwater for agriculture and for drinking. For many water district and irrigation district managers who have access to surface water supplies, overreliance on groundwater use in undistricted land is viewed as a primary cause for the groundwater depletion crisis. Prior to SGMA, county governments were often entangled in conflict between water agencies and the constituents who farmed in undistricted land, a conflict that was heightened in 2014 and 2015 as the Central Valley region was experiencing prolonged drought.

From late 2014 to early 2015, many of the nine county governments in the Central Valley began placing SGMA on their monthly board of supervisor meeting agendas to deliberate and decide how their county would respond to SGMA's mandate. While some county governments had participated in the development of voluntary groundwater plans mentioned above, most counties in California (as is the case across the United States) were not directly involved in groundwater governance and management. As stated in SGMA, counties were not compelled by the state to participate in the implementation of the law, although not participating would likely leave significant areas of irrigated land without local governmental representation thus exposing the entire groundwater basin to

risk of state intervention. And so, once SGMA was signed into law county governments had to decide whether and how they would participate.

Data and Methods

This research adopts a process-oriented comparative case study method (Bartlett & Vavrus, 2017; Simmons & Smith, 2019) with the aim of comparing across the prospective sensemaking processes enacted in two California county governments. Our purpose in carrying out this analysis is to shed light on the ways organizations provide frameworks for interpretation and action. We therefore consider the county governmental organizations as the contexts within which prospective sensemaking (i.e., our unit of analysis) occurs.

The idea for this research came in the summer of 2019 when the authors were conducting ethnographic fieldwork for another study examining interagency coordination during the second phase of SGMA implementation—the development of groundwater sustainability plans (GSPs). As the authors were attending public meetings and conducting interviews, the role of county government in SGMA kept coming up. This was, in part, triggered by a recent event where a county walked away from the GSP planning process, an act that left GSAs in the same basin wondering how they would proceed with undistricted land unrepresented by an existing governmental agency. A news article covering the story quoted the chief county administrative officer as saying:

The county has been told throughout history to stay out of the water business, Suddenly, we are in this unprecedented position where we are in the water business, and we shouldn't be.

In contrast to this, other participants we spoke with believed the county governments they were working with were overbearingly involved in the GSP planning process. A

phrase that often came up when talking about the role of county government in SGMA implementation was “It’s all over the map.” This diversity of interpretations that different county governments seemed to have about whether and how they participated in SGMA implementation led us to seek IRB approval for a study focused on the role of county government in SGMA implementation, which was granted in September 2019, (IRB protocol # 2019-5800).

Case Study Site Selection

Following IRB approval, the first author conducted one year of exploratory ethnographic fieldwork to gain a broad understanding of how county governments initially responded to SGMA. Seven open-ended interviews were conducted with representatives from 6 county governments. These interviews were 1-2 hours long and were broadly aimed at understanding the perspectives of county supervisors, planning staff, administrators, and legal advisors who were involved in trying to interpret the role of county government after SGMA was signed. In addition, the first author with assistance from an undergraduate researcher collected publicly available secondary data from each of the 16 county websites (i.e., meeting agendas, meeting minutes, power point presentations, livestreamed video footage of public meetings). These data were used to create timelines that broadly detailed each county’s public process for deliberating SGMA. From these timelines we were able to see variation in approaches to discussing SGMA. Additionally, we were able to assess the quantity and quality of secondary data available for each county.

After the first year of exploratory study, we selected two county governments for our study site. In selecting these county governments, we had the following criteria. We

wanted county governments that shared similar socio-economic contexts. In particular, we wanted to select counties with similar economic reliance on groundwater pumping and that had a significant amount of undistricted groundwater users. Additionally, we wanted to invite participants from county governments who held (based on our early understanding) different perspectives of the role of county government in SGMA and appeared to be taking different approaches to GSP implementation. Based on these criteria (and the availability of secondary data), we invited participants from two neighboring county governments located in the Central Valley of California. To protect the anonymity of our research participants, we refer to these as County A and County B.

Ongoing Collection and Organization of Data

Ten more semi-structured interviews were conducted in 2020. Each interview lasted approximately one and a half hours. The purpose of these interviews was two-fold. First, we wanted to capture the lived experience of county governmental actors who participated in the prospective sensemaking process. Second, we wanted to validate the process-tracing research we conducted while creating the public meeting timelines during the exploratory phase. In County B, asking validating questions alerted us to public meeting data that was missing from the publicly accessible county archive. Working with the County B clerk we were able to get additional audio recording of public meetings. Lastly, we collected local newspaper articles published contemporaneously with the GSA formation period (2015-2017). We then used MAXQDA software to organize our data. For each county, we grouped data based on context. For example, audio and/or video files of public meetings on certain dates were grouped with interview excerpts, newspaper articles, meeting agendas, meeting minutes, power point presentations, and

fieldnotes related to that event. Organizing our data in this way allowed us to interpret various sources and types of data in relation to one another with the goal of gaining more holistic understandings of each county's prospective sensemaking process.

Comparative Case Analysis

We began our comparative analysis by writing summary accounts for each sensemaking occasion (e.g., working group meeting, study sessions, county board of supervisor meetings) that occurred in each county between 2015-2017. From these we temporally bracketed the prospective sensemaking process along a continuum (i.e., demarcated the phases of sensemaking from initiation and enactment to construction of shared accounts) (Tan et al., 2020). We then reanalyzed the data within each phase and coded them based on key concepts from the sensemaking literature (Maitlis, 2005; Maitlis & Lawrence, 2007). This phase of analysis captured who was speaking in each sensemaking occasion (e.g., county supervisor vs water district manager) and coded any utterance related to the prospective role of the county. During coding analysis, we wrote analytic memos that began to integrate our theoretical understandings of prospective sensemaking in response to a policy mandate. Using these memos as a guide, we wrote new summaries for sensemaking occasions, which were then rewritten as case study accounts. Refinement of our analysis consisted of iterative rounds of rewriting case summaries, comparing across each county's prospective sensemaking process, and revising analytic memos. Throughout each round of analysis, we would periodically return to the non-summarized/non-coded data to help ensure our case interpretations reflected the experiences and perspectives of participants we interviewed and the sequence of events as they unfolded.

Constructing Shared Understandings of the Role of County Government in SGMA

Implementation through Prospective Sensemaking

The cases described below trace the prospective sensemaking processes that were enacted in County A and County B—two neighboring county governments located in the Central Valley of California. Following the structure of our theoretical framing (outlined in Section 2), our narrative is divided into three parts. For each county government, we first describe how existing organizational contexts influenced the initiation of prospective sensemaking in response to SGMA. We then trace how each county enacted different forms of prospective sensemaking. Each case concludes by considering whether and how County A and County B constructed shared understandings of their role in SGMA implementation and describe the implementation patterns that followed. After presenting our case descriptions, we draw insights from a comparison of prospective sensemaking processes.

The Initiation of Prospective Sensemaking in County A

In the ten years preceding the passage of SGMA, planners and managers in the County A water division regularly interacted with other local government agencies to coordinate the development of pre-SGMA voluntary management plans. To participate in these multi-party, planning activities, the county's water division planners and managers regularly held meetings with directors and staff from water districts, irrigation districts, community services districts, and cities located in the county's jurisdictional footprint. The purpose of these meetings was to share data about groundwater use and exchange knowledge about the unique challenges that different groundwater users faced, challenges that often led to conflicts between local districts with secure surface water rights and

those who only relied on groundwater. As part of their involvement in groundwater planning, water division staff would periodically provide progress updates to the five-member county board of supervisors. These regular updates kept the county board of supervisors aware of groundwater issues and concerns. Participation in voluntary groundwater planning also brought the county's water division staff in regular contact with state agencies (i.e., the Department of Water Resources and the State Water Resources Control Board), who would later provide state oversight for the implementation of SGMA. Speaking to how the presence of knowledgeable water planners and managers in the county's water division influenced their early response to SGMA, one County A supervisor explained:

“Our folks in the [county’s] water division were really paying attention to what the state [Department of Water Resources] was saying and doing. They had true knowledge of SGMA. See, we’re technically an urban county, but to have people on staff at high levels that totally understand SGMA, then you can start formulating—how are we going to attack this?”

The experience of participating in voluntary groundwater planning thus enabled the county's water division staff to become part of the larger network of groundwater management agencies and stakeholders who closely followed the development of the new SGMA legislation. Moreover, these interactions alerted water division staff to potential conflicts that might arise if independent agencies (in particular, irrigation districts and water districts) located throughout the county's jurisdiction decided to develop and implement multiple groundwater management plans mandated by SGMA.

On March of 2015, the role of the county in SGMA implementation was discussed during a regular meeting of the county board of supervisors. In attendance that day were representatives of several water agencies, city managers, community-based organizations,

and private citizens. During this meeting, senior managers of the county's water division articulated their initial interpretation of the county's role under SGMA. Representatives from water agencies located in the county responded by articulating a different viewpoint.

The interpretation of the county's role, presented by senior managers of the water division was that SGMA, in addition to mandating responsibility for the undistricted lands, envisioned a direct role for counties in the governance of all GSAs. This, they believed, included areas already managed by existing public agencies who were eligible to become their own GSAs. By taking this role, the water division managers argued, the county could ensure a consistent and uniform approach to SGMA implementation—an approach that minimized interagency conflicts and would help align groundwater policy with the county's existing land use authority.

In contrast, the water agency managers in attendance at the March 2015 meeting—many of whom had worked with the county water division staff on voluntary groundwater planning—held a different interpretation of the role of counties in SGMA implementation. SGMA's mandate, in their view, only gave county governments the authority to manage areas outside of existing jurisdictions. While the county could play a supporting role by helping existing agencies coordinate planning efforts, SGMA did not, they believed, give the county any designated role in the governing boards of those agencies. Reflecting the views of many of the assembled water agency managers who cautioned the county's supervisors and water division managers to respect the autonomy of local water agencies, one district manager stated:

“We have worked closely with [county water division staff] and they will continue to be welcome as we move forward. The [SGMA] rulemaking process is gonna tell us what the law really means. The Act provides for coordinated groundwater governance built on existing management structures. While the county has a common interest, if you know anything about groundwater, you know that no two groundwater basins are the same. It’s important for the county to recognize our role as your local water agencies in implementing these plans.”

After more than three hours of public comment and board discussion, it became clear to those attending the March 2015 meeting that there were divergent interpretations of the role the county in SGMA implementation. As described above, differences between the county water division and the independent water agencies’ interpretations primarily centered on whether county government could or should intervene in the governance for areas under existing water agencies’ jurisdictions. Recognizing the necessity of working towards a consensual understanding of the new legislation, water division managers proposed the creation of a SGMA working group. The SGMA working group, water division managers argued, would provide a forum where representatives from water agencies, cities, public utilities, neighboring counties, and community services districts could work through their different interpretations and provide recommendations to the five-member board of county supervisors, thereby having a direct impact on county decision-making. Two county supervisors, who were the most knowledgeable about groundwater, were appointed by the other three supervisors to act as the board liaisons by chairing the SGMA working group.

To summarize, in County A, the rationale for the county water division managers’ initial interpretation that county government should play a direct role in GSA governance was informed by more than ten years of regular conversations and interactions with water district and irrigation district managers. While the managers of those districts did not

share this interpretation, they did not contest the influence that the county exercised as conveners of the SGMA working group, giving the county water division managers and county supervisors greater influence over the sensemaking process. That the convening role of the county was not contested is likely because the county water division managers and staff had a history of working with independent water agencies and were generally viewed as both influential in terms of bringing multiple agencies/interests together and as knowledgeable when it came to groundwater management issues. Also clear from the initiation of the SGMA working group is that both the county water division managers and the agency managers of water and irrigation districts recognized the necessity of having a shared space for arriving at a consensual understanding of the role of counties in SGMA implementation. It is out of this necessity that prospective sensemaking was initiated.

How Prospective Sensemaking Unfolded in County A

Following the March 2015 meeting, the county board of supervisors approved a 21-member SGMA working group that was reflective of the diversity of local governmental entities that were eligible to form GSAs. Chaired by the two county supervisors and staffed by the county's water division, the working group held 11 meetings from 2015-2016 to make sense of the role of County A in SGMA.

The year-long prospective sensemaking process that followed provided a space for negotiating the divergent interpretations of the county's future role in groundwater governance. In their attempt to persuade the county's water division managers and supervisors to reframe their interpretation of the role of counties in GSA governance, water agency managers questioned the county's depth of knowledge when it came to

managing groundwater outside of their jurisdiction. Moreover, as the following excerpt from a water district manager illustrates, the water agency community challenged the logic of the county water division managers who saw a need for ensuring consistency in groundwater policy approaches through county regional governance:

“We agree there’s a role for the county to be involved [in the governance] in any areas where they are invited...[W]e strongly object to the idea that you [the county] insert yourself where you’re not invited. We’ve been managing groundwater for the last 100 years and then along comes the county and says, “We want be part of your governance structure.” We don’t see a need for the county. You talk about consistency? If you know anything about the groundwater basin, you know it’s not consistent. Trying to apply a consistent approach is like the state coming in and telling us what to do. We’re the experts. Do you have any expertise in groundwater management? What the county brings is politics.”

The concern expressed above was echoed by other members of the SGMA working group who were troubled not only by the county advocating for taking a direct role in GSA governance, but by the county’s intention to enforce their view by formally opposing local agencies during the GSA formation process. County water division managers and county supervisors proposed filing challenges with the state Department of Water Resources when local agencies submitted their paperwork to form GSAs if the county were not included in GSA governance. This action would trigger boundary overlaps that would need to be resolved before GSAs were recognized by the state. Opposition to the county filing an overlapping claim was expressed by an irrigation district manager who participated in the SGMA working group:

“What the county is contemplating here is that local agencies wanting to form a GSA, if the county doesn’t approve, then you’re gonna interfere. If you do that, you need to be ready to manage groundwater.”

As the SGMA working group continued to meet, the county’s water division manager and supervisors signaled they were listening to the concerns expressed by members of

their stakeholder community, in particular those of the water and irrigation districts who challenged the county's interpretation of its role in SGMA implementation. Moreover, the county supervisor chairing the SGMA working group indicated a shift in perspective. While still holding the view that the county should negotiate formal agreements with all GSAs in basins located in the county jurisdictional footprint, the supervisor re-framed the role of county government in GSA governance. The role of the county was re-articulated such that it would not be providing oversight through shared decision-making with all the GSAs, and thus expanding its role in groundwater governance. Rather the county would work to ensure cohesion across the county's jurisdiction by supporting the cooperative activities of other agencies through negotiated, formal agreements. This revised understanding, which was justified as related to the county's land use authorities, is evidenced in the following excerpt by a county board of supervisor chairing the SGMA working group:

“We understand every GSA is gonna be a little bit different. We still believe the county should be active because we are the land use authority. As this thing [SGMA implementation] moves forward the county will take a secondary role. What the county is concerned about is cohesion. As we move forward, the county is gonna need to be involved to make sure agencies are cooperating with each other, but there's a lot of different opinions out there. Any time you're talking about water it's not an easy subject.”

Prospective sensemaking in County A thus followed a guided process. Although the SGMA working group meetings held in County A from 2015-2016 were often characterized by conflict between the county supervisors and other members of the working group, the SGMA working group engaged in a process aimed at reducing ambiguity through a collective and negotiated interpretation of the role for County A in SGMA implementation. The learning that occurred through this process led the county

government to understand the perspectives of water agency managers who saw the role of county government in SGMA as primarily supporting the implementation efforts of GSAs while also enabling water agency managers to acknowledge the county needed to be involved. County supervisors and county water division managers were thus able to reach formal agreements with local agencies that not only articulated the county's interest in ensuring cohesion across groundwater management policies but also provided a clear understanding of the role for county government in that GSA's governance and/or GSP planning process. The prospective sensemaking process also served to alleviate concerns of water agencies that the county government would oppose GSA formation or challenge the autonomy of local agencies to develop GSPs.

Enacting the Shared Understanding of County A's Role in SGMA Implementation

As described above, the SGMA working group arrived at a shared understanding of the role of County A in GSA governance. The clarity that followed the conclusion of the SGMA working group meetings is reflected in the following quote from a member of the water division planning staff:

“There wasn't a lot of confusion about how the county would be involved [in SGMA implementation]. They [the water agencies] knew where we [the county] stood. We wanted them to have some autonomy in how they actually ran the GSAs. Our deal was: “Hey, we don't want to get involved; we'll only get involved if you [GSAs] start fighting [with one another].”

Following the conclusion of the SGMA working group and the subsequent formalization of GSAs, County A and the water agencies participated in a new phase of SGMA implementation—developing Groundwater Sustainability Plans. Throughout the GSP development phase (2017-2020), the agreements County A made with GSAs were never re-negotiated. Nor did County A or any GSA withdraw from a signed agreement.

The interagency conflicts between the county and the water agencies who initially challenged the county's interpretation of their authority under SGMA did not resurface throughout GSP planning. While at the outset of GSP development, some water agency staff may not have fully trusted the county would stick to the revised conceptualization of its role, the county's consistent actions following the negotiated formal agreements provided a basis for cooperatively developing GSPs that were completed by the mandated deadline of January 2020.

The Initiation of Prospective Sensemaking in County B

Prior to the passage of SGMA in 2014, staff in the County B community development agency established regular interactions with two stakeholder advisory groups, which were created to advise the five-member county board of supervisors on water and agricultural policy matters in County B. The monthly advisory groups were staffed by community development agency managers who, in addition to providing administrative support (e.g., preparing and sending out public meeting notices, meeting agendas and minutes) acted as liaisons to the board of supervisors. One of these groups, the agricultural committee, was comprised of board-appointed stakeholders who represented various lobbying groups (e.g., the farm bureau) and business interests (e.g., dairy industry). The other advisory group, the water commission, was comprised of board-appointed representatives for local government entities (e.g., water districts, irrigation districts, cities) and constituents who represented county voting districts. Given the overlap in agriculture and water policy, these advisory groups would sometimes hold joint meetings to discuss federal, state, and/or local policy that might impact agricultural producers and water users in County B.

As the SGMA legislation was being written, managers from the community development agency would relay summaries of the discussions within the advisory groups regarding the potential impacts of the law for the county’s agricultural economy. In these early discussions, it became clear that members of the water commission (in particular, representatives of water districts and irrigation districts) wanted to help the county government define their role within the SGMA legislation. As one of the community development agency staff who was involved in these early discussions explained:

“There was a desire by the irrigation companies and water districts to be able to manage the process, so they took the lead, and the county, obviously, was agreeable to that.”

While, as the above expert indicates, the county board of supervisors were willing to take the advice of their water commission, the board of supervisors attempted to bring in the expertise of their legal counsel. In addition to the interactions with the policy advisory groups described above, the county board of supervisors were regularly advised by senior staff in their legal department who had expertise in California water law. Prior to SGMA, the county’s legal department mostly provided recommendations pertaining to land use planning and well permitting. Given their expertise in water law, the senior legal counsel was initially asked by the county board of supervisors to meet with the managers in the water commission to go through the SGMA legislation and provide a recommendation about how the county should participate in implementation.

On August of 2016, the role of the county in SGMA implementation was discussed during a special study session for the county board of supervisors. In attendance that day were the staff of the county community development agency, county senior legal counsel,

and the members of the agricultural committee and water commission. The county senior legal counsel gave a presentation to the board of supervisors. Throughout their presentation, the senior legal counsel called on the water experts in the room to clarify and/or answer questions posed by the board of supervisors. In deferring questions to the members of the water commission, the senior legal counsel admitted the new SGMA legislation was uncharted legal territory when it came to California water law. Moreover, as explained in the below quote, while the county legal department was willing to work with members of the water commission, senior legal counsel advised the board to rely on the knowledge and expertise of the “water experts” who, unlike the county government, had the technical background to understand what SGMA’s mandate would mean for the county government and their largely agricultural economy.

“I don’t have the technical background to understand what all this [groundwater] stuff means. A lot of the other counties have more resources and they have actual water departments and water civil engineers and [Geographic Information Systems] mapping people on staff, or they have some facilities that they already manage. We’re kind of unique in that. But we do have a lot of water experts and we’re really trusting them and not only trusting them but working with them to find the best way to keep it [groundwater management] local.”

As the above excerpt indicates, the senior legal counsel viewed SGMA implementation as a technical and managerial undertaking, which the county, lacking a dedicated engineering staff or water division, was unable to fully participate in. And so, while two members of the county board of supervisors suggested the county government start thinking about bringing on engineers and water planners with the knowledge to help the county clarify their role in SGMA implementation, the board recognized the immediate need for clear guidance to meet the GSA formation deadlines imposed by SGMA that required county governments to determine their role by the summer of 2017.

The county board of supervisors, in keeping with the practices that preceded the SGMA legislation, determined they would continue to listen to the stakeholders who served on the agricultural committee and water commission.

To summarize, the rationale for County B's involvement in SGMA was informed by a collective deferment to the knowledgeable experts of water agency professionals who, prior to SGMA acted as policy advisors to the board of supervisors. Existing interactions provided a logic that led most county supervisors, the managers of the community development agency, and county legal counsel to view the new SGMA legislation as a policy matter that was beyond county government's ability to fully understand or implement. As a result, prospective sensemaking was initiated with a statement from the board of supervisors that the county government would rely on the advice of the water experts in their policy advisory groups with the goal of helping the water districts and irrigation districts maintain local control of groundwater. This statement positioned the county government in a supporting rather than a leading role.

How the Prospective Sensemaking Process Unfolded in County B

Following the August 2016 study session, the water commission held monthly meetings during which the role of the county in SGMA was discussed along with other topics. Less frequently, the agricultural committee also discussed the SGMA legislation in their regular meetings. In 2017, the water commission and agricultural committee held one joint meeting to discuss SGMA. Thus, while prospective sensemaking occurred in both advisory committees, the water commission was the primary forum for strategizing around GSA formation and the prospective role of the county government in SGMA implementation. Periodically, members of the county board of supervisors, and county

legal counsel would attend the water commission meetings, yet they did not have a formal role in the deliberation.

The prospective sensemaking process that unfolded in County B—a process steered primarily by the county’s water commission— did not lead to a clear articulation of the county’s role in SGMA implementation. By the summer of 2017, two years after SGMA was signed into law, the water commission representatives tasked with advising the county board of supervisors had not arrived at a shared understanding. Rather, multiple interpretations emerged. Most water agencies thought the role of the county in SGMA should be to help provide financial and administrative support for each agency’s groundwater planning efforts. Under this interpretation, the county would help agencies by applying for funding to help pay for the development of GSPs but otherwise would largely defer decision-making to existing water agencies. Yet, some members of the water commission disagreed. Commission members representing county voting districts with large populations of undistricted water users believed the county needed to be directly involved in the governance of GSAs. Their primary concern was to ensure the larger, well-resourced water and irrigation districts did not make planning decisions that negatively impacted smaller agricultural operations and community drinking water supplies.

As the prospective sensemaking process unfolded, the initial deferment of the county board of supervisors to the water district and irrigation district managers was later reconsidered by one county supervisor who attempted to take a more direct role in the water commission meetings. However, the county supervisor’s participation in these meetings was discouraged by some members of the water commission and thus they had

little influence in steering the sensemaking process. This lack of influence was described by the county supervisor as follows:

“I would go to the [water commission] meetings and I would stand up and say things, and I would get a call that night saying, “Just because you’re all in the same room doesn’t mean you’re all friends. You need to listen. That’s not your place to speak up because what they discuss, they will bring to you.”

The exclusion of county supervisors from fully participating in the water commission meetings was viewed by some supervisors as an intentional effort to keep the county government on the margins of the prospective sensemaking process. In response, a newly hired county administrative officer, along with support from two county supervisors, gained approval from the other three supervisors to create a natural resources agency within the county organizational structure. A newly hired member of the county’s legal department was appointed the director of the newly formed county natural resources agency. With these structural and personnel changes to the county government, two county supervisors, the chief county administrative officer, and the director of the county’s new natural resources agency indicated an interest in taking a more direct role in the implementation of SGMA.

The new director of the natural resources agency began regularly attending the standing agricultural committee and water commission meetings. As it was clear most water districts and irrigation districts in the county would not agree to the county government taking a more direct role in SGMA implementation, the natural resources agency director proposed an alternative way for county government to gain more influence—one that involved passing an ordinance that would prohibit the exportation of groundwater outside the county’s jurisdiction. A county supervisor who attended water commission meetings during which the groundwater exportation ordinance was proposed

described the impact of the county's natural resources agency director trying to steer the prospective sensemaking process as:

“[The director of the natural resources agency] was a strong advocate for the health and safety code. Making sure that with SGMA we [the county government], while collaborating [with water agencies], still retain our rights under the health and safety code. The director forcefully delivered that message to the water agencies and there was clearly frustration sometimes about that, but it's not an easy process and they [the water agencies] need to know our rights as a county and we need to know their feelings and what their responses are.”

Because the board of county supervisors had stated from the outset they would only consider water and agriculture policy recommendations that gained consensus among their stakeholders in the agricultural committee and water commission, the natural resources agency director was unable to steer the prospective sensemaking process. The water commission members who represented undistricted water users agreed with the views of the natural resources director and envisioned a direct role for county government in the governance of local agencies forming GSAs. However, most water commission members did not want county government influencing policymaking for areas outside the county's jurisdiction. Additionally, most of these same water commission members opposed passing groundwater ordinances designed to prohibit the exportation of groundwater outside the county jurisdiction. Thus, gaining consensus within the water commission about passing such ordinances was unlikely. Knowing the county board of supervisors would not pass a groundwater exportation ordinance without support of the water commission, the director of the natural resources agency was unable to bring a recommendation to the board of supervisors for a vote.

Prospective sensemaking in County B thus followed a fragmented sensemaking process through which most county board of supervisors largely relied on a bottom-up

flow of information. The interpretations of stakeholders in the policy advisory groups were varied, yet water commission members who represented water districts were able to push their interpretation of the role of county government in SGMA implementation onto a minority of water commission members who represented voting districts. While the interpretations of most members of the water commission dominated the deliberation, a growing number of county governmental actors were aligned with the public health and safety understanding of the role of county government in protecting groundwater resources. These contrasting understandings simultaneously positioned the county government as supporting the local autonomy of water districts and irrigation districts in their management of groundwater while also needing to have a more direct role and impose policy restrictions aimed at protecting the health and safety of undistricted groundwater users. The presence of multiple concurrent interpretations only increased ambiguity regarding what role the county would take as implementation of SGMA proceeded.

Enacting Divergent Understandings of County B's Role in SGMA Implementation

The year-long fragmented prospective sensemaking that occurred between the representatives of the water commission, the agricultural committee (albeit to a lesser extent), the county board of supervisors, the county administrative officer, and director of the county's new natural resource agency did not lead to a single, shared understanding of County B's role in SGMA implementation. Rather, two conflicting perspectives that continued to divide the county board of supervisors were retained. Reflecting the majority view of the members of the water commission and agricultural committee, the county supervisors gained support of the full board to sign agreements that largely

delegated GSA governance, GSP development and plan implementation to the water districts and irrigation districts. Yet, the perspective that county government should be more directly involved in groundwater management continued to be held by the natural resources agency director, voting district members of the water commission, and two county supervisors.

The result of ongoing fragmented interpretations of the mandate was that the role of the county was inconsistent during GSP development (2017-2020). While most county supervisors continued to make public statements that indicated the county government's support of the policies that local water districts and irrigation districts (now formalized as independent GSAs) were making as part of the GSP development process, other actors within the county government took actions that opposed those policies. For example, while GSPs were being developed, the county's legal department in coordination with the director of the county's natural resources agency requested formal consultation with GSA managers to express their concerns about what they viewed as lack of consideration for public health and safety in their GSP policies. Once GSPs were released for public comment, two county supervisors contradicted the statements made by their colleagues on the board by submitting comments that openly criticized the GSPs policies. This action is evidenced by the following quote from a county supervisor:

"I wrote my own comments. And I went out and got 20 signatures from all my neighbors, with my comment, then I submitted them. It might have been two years ago... So, I submitted my comments that [county counsel] helped me with, my neighbors all signed, and I submitted it. And [the district manager] from a water district says, "You sure?" I said, "Yeah, I'm sure." And I go, "I'm submitting them. These are my comments".

The result of this inconsistency was a growing concern among GSA managers of whether the county could be relied upon during the mandated groundwater planning

process. Of particular concern was whether some factions in the county government might use their influence to petition the state Department of Water Resources to get more involved during implementation of GSPs. This view is reflected in the following quote by a water agency manager who expressed their concern about the trajectory of county governmental involvement in SGMA implementation.

“Going back, the county decided they didn't want to have anything to do with it [SGMA]. We gave them opportunities when the [GSA] formation process was going on. They have had staff come and attend, very occasionally, our meetings. Then their legal counsel decided, “We have no choice. We have to be involved in this to protect our general planning authorities and other latent powers.” They jumped in and participated more directly. I think they're really going to try to maybe be a little bit more stubborn than they would have been and maybe even try to get the state more involved.”

As the County B case shows, fragmented prospective sensemaking siloed different understandings of the role of the county in SGMA implementation. Divergent perspectives were simultaneously agreed to as sensible and rational by different groups of organizational actors. As a result, inconsistent policy actions were undertaken by county governmental actors.

Synthesis and Comparison of Cases

The case descriptions presented above trace two different prospective sensemaking processes. These processes occurred in parallel as two neighboring counties in the Central Valley of California determined how they would participate in the implementation of the Sustainable Groundwater Management Act, a statewide mandate passed in 2014. In this section, we draw on key distinctions within each phase of prospective sensemaking and discuss insights gleaned from our comparative analysis.

How Existing Organizational Practices Influenced Initiation of Prospective Sensemaking

Comparing how prospective sensemaking was initiated in each county reveals two distinct patterns of information sharing between knowledgeable and influential actors. As we discuss below, existing organizational practices not only informed the rationale for initiating prospective sensemaking but also served to expose or obscure the existence of divergent interpretations.

In County A, existing groundwater planning practices created a horizontal exchange of information between the county's water division staff and the managers of local government agencies (e.g., water districts and irrigation districts). Having knowledge gained through professional experience in voluntary groundwater management positioned the county government as knowledgeable participants. In contrast to this, in County B, interactions with existing policy groups established a bottom-up relay of information from knowledgeable experts outside the county government to the county board of supervisors, an information sharing process that positioned actors within the county government as unknowledgeable. These patterns of information and knowledge exchange impacted the initiation of prospective sensemaking by providing county governmental actors a perceived sense of authority (or lack thereof) within the realm of groundwater management. Articulating an initial interpretation of the County A role in SGMA implementation was a trigger for exposing alternative interpretations held by managers of water districts and irrigation districts. In County B, not having a sense of authority from which to articulate their own interpretation of the role for county government in SGMA implementation initiated prospective sensemaking based on the assumption that there

would be a unified recommendation from the county's policy advisory groups that clarified how the county government would participate. Thus, prospective sensemaking initiated without clearer understandings about where ambiguity might exist, obscured the presence of equivocality.

How Different Forms of Prospective Sensemaking Unfolded in Each County

The guided and fragmented prospective sensemaking forms that unfolded in County A and County B (respectively) provides insight on how ensuring full participation in the negotiation of multiple interpretations can contribute to reaching a single, shared understanding. As discussed below, the ability of actors to arrive a shared understanding of the role of counties in SGMA implementation was contingent on their being a process that not only allowed the articulations of multiple perspectives, but also enabled collective negotiation.

In County A, guided prospective sensemaking was initiated with the goal of collectively constructing a consensual understanding of SGMA, one that satisfied county governmental actors and the water agencies intending to form GSAs. Therefore, the process was guided not only in the sense that it included the parties who held divergent interpretations, but also in the sense that it was directed towards a shared goal. Being directed towards having a single understanding necessitated negotiation. In contrast to this, fragmented prospective sensemaking in County B was initiated with the goal of receiving advice from water experts and stakeholder representatives. While this process enabled multiple perspectives to emerge, there was no clear path for negotiating differences. As our analysis of County B illustrates, not having a central space for negotiating divergent interpretations hampered the ability of county governmental actors

(i.e., supervisors, legal counsel, administrative executives, natural resources agency staff) to work with one another and the members of their policy advisory groups to construct a shared understanding.

Enacting the Role of County Government in SGMA Implementation

Lastly, the case studies illustrate that whether and how organizational actors construct negotiated, shared understandings through prospective sensemaking have implications for how implementation processes are enacted.

Collectively constructing shared understandings at the organizational level provides a basis for consistent policies and interactions during implementation. As our analysis of County A reveals, when county governmental actors institutionalized (i.e., craft formal, written agreements) the negotiated understanding of their role in implementation, the agreements they made with GSAs provided guidance for how county supervisors and/or water division managers and staff should interact. While these varied from one GSA to another, consistency was perceived when county governmental actors participated in the process of GSP development in ways that matched the expectations of their local implementing partners (i.e., GSAs). Yet, as our examination of County B reveals, not arriving at single, shared understandings of the role of counties in SGMA, provides opportunity for inconsistent policy and interactions to occur. In participating in the GSP development phase of implementation, inconsistent actions were rooted in different rationales that found resonance with different county governmental actors and stakeholder groups.

Discussion and Conclusion

The purpose of this study was to illuminate *how* public organizational actors interpret policy mandates in ways that inform what constitutes as “sensible” and “meaningful” action during implementation. In doing so, our research addresses a gap in policy implementation research examining how and why variation in implementation occurs across multiple sites. On the one hand, research has produced theoretical models that predict variation in implementation behavior patterns as resulting from differing levels of ambiguity (i.e., multiple interpretations) of the policy content coupled with differing degrees of local political conflict and/or available resources to comply with the mandate (Montjoy & O’Toole, 1979; Matland, 1995; May, 2015; Khan & Khandaker, 2016). While useful for generalizing at the macro-level, such research does not shed light on how multiple interpretations are constructed, nor does it provide insight about how conflicting interpretations may be negotiated in different organizational contexts. Consequently, it downplays the social skills of actors and the role of group-level dynamics and interactions in the interpretive process (Moulton & Sandfort, 2017; Sandfort & Moulton, 2020). On the other hand, research underscoring the motivations of street level bureaucrats and frontline workers has generated micro-level theories that attend to the ways variation in implementation patterns emerge from individuals finding personal meaning in the goals of the policy and/or perception of their ability to fill in the gaps between policy-as-written and policy-as-action (Lipsky 1980; May & Winter, 2007; Tummers & Bekkers, 2014;). While illuminating, such perspectives downplay the role of organizational structures that provide meaningful guidance or rationales for the implementation of mandates.

Our research is situated between these two perspectives. As our comparative case analysis of two prospective sensemaking processes enacted in different county governmental organizations shows, existing organizational practices structure the ways information about a policy mandate is shared between knowledgeable and influential actors. As such existing organizational contexts inform the rationales actors use to articulate one or more initial interpretations. Once prospective sensemaking in response to a mandate is initiated, our findings suggest the ability of actors to reach a shared understanding of the role of the organization in implementation is contingent on their being a process that allows for multiple perspectives, but also enables collective negotiation of conflicting interpretations. In our study, this occurred through guided prospective sensemaking. Lastly, our research suggests ambiguity during implementation is minimized when prospective sensemaking leads to shared understandings that forms the basis for crafting cooperative agreements and other policy statements that provide ongoing guidance for frontline implementation processes. In cases where ambiguity persists throughout the implementation of a mandate, our research indicates there may be equivocality that has been institutionalized at the organizational level, providing multiple rationales for action. In the remainder of this article, we discuss the relevance of these findings for research in policy implementation.

Our findings complement policy implementation research examining how variation in process and practices are driven by varying levels of ambiguity and uncertainty. Recent research suggests that day-to-day decision-making during implementation shifts from the organizational level to the individual (i.e., frontline) level when organizations are addressing complex policy issues and are unable to control the flow of information and

types of knowledge informing multiple rational approaches (Fowler, 2020; Fowler; 2023). Insights from our study complement this line of inquiry by providing a framework for understanding *how* ambiguity is shifted from the organizational level to the individual level. Our findings suggest ongoing ambiguity may become institutionalized at the organizational level when multiple interpretations of the organization's role are constructed through fragmented prospective sensemaking, which may have cascading impacts on the behaviors of street level bureaucrats and frontline workers.

Insights from our study support another area of research seeking to better understand how variation in frontline implementation stems from the fact that individuals draw on different types of logic (policy, social, cultural, and personal) for their work. Recent research suggests that frontline workers activate different forms of knowledge (including knowledge based in professional expertise) that likely vary depending on their organizational context and implementation setting (Cecchini & Harrits, 2022). The implication of such research is that organizational structures, as we have argued in this paper, provide frameworks for interpreting what constitutes as “rational” or “sensible” action. Our findings support this supposition and moreover provide a theoretical basis for hypothesizing how organizational structures (e.g., practices and routines) and processes (e.g., prospective sensemaking) influence (and are influenced by) knowledgeable actors.

Finally, while our study focuses on the role of prospective sensemaking in constructing shared understandings at the organizational level, our research resonates with scholarship examining the implementation of multi-party, mandated collaborative governance regimes (Nabatchi & Emerson, 2021; Bianchi et al., 2021). While our theoretical framing draws on organizational sensemaking—rather than collective or

social learning—to conceptualize how organizational actors learn and arrive at shared understandings, our findings support the idea that reaching shared understandings are contingent on deliberative processes that include a wide range of knowledgeable participants, are aimed at reaching joint determinations, and are capable of resolving conflicting understandings (Gerlak & Heikkila, 2011; Brummel et al., 2012; Emerson et al., 2012). Where our research adds nuance is in attending to the organizational context within which actors interact and construct shared knowledge. Exploring the ways agency and structure interactively influence collaborative process in policy implementation is a line of inquiry that could contribute to development of mid-level, collaborative governance theories.

Our research has limitations that should be considered before generalizing to other implementation settings. First, the empirical context for our study is the early implementation of a state-wide mandate that narrowly pertains to groundwater governance and management. Policy mandates that are employed to address different and/or multiple public sector issues likely influence the degree to which knowledge and expertise are key factors in determining whether and how prospective sensemaking leads to shared understandings of a public organization's role. Groundwater management is largely informed by scientific knowledge and tools that are generally held within a relatively small epistemic community of engineers, hydrogeologists, and water resources managers. Second, as our study involved neighboring county governments located in the Central Valley of California, the social and cultural contexts were similar. Federal mandates broaden the geographic scope of implementation and therefore increase diversity of social and cultural contexts within which public organizations, such as

county governments, are embedded. Third, we focused our analysis on county governments, which share similar structures and processes for decision-making. Other types of public organizations (e.g., single purpose agencies and municipalities) may engage in different forms of prospective sensemaking and/or may arrive at shared understandings using different social processes. Lastly, we only compared two prospective sensemaking processes that occurred in different county governments. While sensemaking models such as the one used in this comparative analysis are mostly employed in small N studies, future research in this vein might adopt configurational analytic approaches to evaluate whether the patterns described in our research are discernable across a larger number of cases.

In conclusion, the prevalence of policy mandates that steer local-level collective action necessitates research that captures how mandates are interpreted by the public organizations tasked with implementation. We still have much to learn about how public organizations make sense of their role in implementation and the ways in which variation in structures and processes at the organizational level influences divergence in implementation behaviors at the frontline. Recent calls in public administration and management research (see e.g., Whitford et al., 2020; Sandfort & Moulton, 2020) highlight the value of scholarship that draws on organizational theories to illuminate the interactions between structure and agency both within and across the public organizations who will continue to make sense of their role in addressing the environmental and social challenges we all face. This research contributes to that endeavor.

FINAL DISCUSSION AND CONCLUSION

So long as higher levels of government use policy mandates to steer local governmental collective action, scholars of policy implementation will need examine the factors that support the achievement of mandated societal and environmental outcomes. This means gathering empirical evidence and developing theoretical frameworks that focus on interactions between local governmental agencies as they interpret their role in mandated implementation, alleviate multiple concerns by selecting mechanisms to coordinate, and decide whether and how to collaborate to achieve mandated outcomes. While decades of research on policy implementation in the context of network governance, collaborative governance, and interagency coordination have produced rich understandings about how cross sector and multi-level collective action influences outcomes, these foci have left gaps in our understanding. The chapters assembled in this dissertation serve as a starting point to addressing these gaps. In these concluding comments, I reflect on how the core findings from the empirical examination of the early implementation of California's Sustainable Groundwater Management Act (SGMA) inform the development of theory and practice on mandated local governmental collective action.

Core Findings and Theoretical Considerations

The research presented in this dissertation examined key aspects of local governmental collective action in response to a policy mandate. Chapters II and III shed light on why we need nuanced theoretical frameworks that delineate the similarities and differences between voluntary and mandated policy contexts. For example, the findings from Chapter II indicate local governmental agency behavior under a mandate is more

complex than when agency participation is voluntary. While partially aligned with how agency behavior is characterized in voluntary collective action contexts (see e.g., Kim et al. 2020), the findings show that agency concerns are hierarchically related to one another and that, rather than weighing single concerns, agencies have configurations of concerns and of benefits/costs of the coordination mechanism, which drive mechanism selection. In Chapter III, insights gleaned from comparing how different pathways (i.e., configurations of organizational forms and institutional arrangements) lead to mandated coordinated outcomes show that collaborative approaches to communication and policy evaluation are key for achieving multiple types of mandated requirements, a finding which supports the consensus in the collaborative governance literature that stress the need for building trust through collective learning while also ensuring interorganizational accountability (see e.g., Ansell & Gash, 2008; Gerlak & Heikkila, 2011). Yet, Chapter III's findings also point to alternative pathways to mandated coordinated outcomes that centralize policymaking and implementation authority within a single lead agency.

The findings from Chapters II and IV provide insights about how local governmental interpretations of the mandate influence organizational behavior. While not a primary focus of Chapter II, the ethnographic evidence indicated variations in how GSAs interpreted the mandate (in particular, the prospective penalty of state intervention) helped to inform their concerns about engaging in collective action. Chapter IV sheds light on how such ambiguities (i.e., multiple interpretations) are constructed at the organizational level and may become institutionalized if intentional effort is not made to negotiate shared interpretations. Collectively, these findings suggest the institutionalization of ambiguity in mandated policy contexts have direct impacts on how

local governmental agencies engage in collective action, which may help explain why and how variation in implementation occurs across multiple sites.

Taken together these findings suggest the need for theories of mandated local governmental collective action to focus greater attention on the implications of granting local governmental discretion when outcomes are determined by higher levels of government and non-compliance means loss of local authority. To develop more nuanced theories of the role of collaboration in mandated engagement, scholars should pay attention to how ambiguity (i.e., presence of multiple, potentially countervailing interpretations) influences the ability of governmental actors to build trust and ensure accountability. Theory on collaboration suggests that collaborative processes and outcomes are mutually reinforced by shared motivations and understandings of the problems/solutions between participants (see e.g., Emerson et al. 2012). Under this theory, ambiguity poses challenges to building shared motivation. Yet, it may be that, under mandated policy implementation, arriving at shared motivations is contingent on their being a mechanism for accountability and an initial design for facilitating collective learning. If so, this insight would shift the way we currently conceptualize collaboration and would suggest the need for policy mandates to impose guidelines for local governmental collective action. However, as the findings woven throughout the papers in this dissertation suggest, granting discretion produced variety in the ways governmental agencies engaged with one another, which allowed for multiple pathways to meeting the mandate's requirements. Had there been more stringent guidelines imposed on the agencies in our study, local innovation may have been stymied. Thus, explicating the

relationship between ambiguity and equifinality in mandated policy implementation is central to developing theory on local governmental collective action.

Limitations and Future Directions

The implementation of SGMA is unfolding as part of continuum of legal doctrines, state policies, politics, and local management practices that have and will continue to shape how groundwater is governed in the state of California (Chapter I of this dissertation). The research undertaken in this dissertation offers a snapshot of this complex history. As discussed throughout the dissertation chapters, the particularities of SGMA as a type of policy mandate coupled with contextual factors that may also have influenced how GSAs engaged in collective action impose some limitations on the generalizability of the findings. Most notably, by focusing on local governmental interactions within an early phase of implementation, this research does not fully consider how outside influences (e.g., private sector interests and industries, federal regulatory programs, local politics and histories of collaboration, environmental conditions) shaped GSA decision-making or their ability to achieve coordinated outcomes. While, as discussed in Chapter IV, these pressures are worth considering in studies of mandated policy implementation, modeling how contextual factors shape organizational behavior and group interactions is difficult to delineate. Future studies on mandated local governmental collective action may look to recent theoretical contributions in public policy, administration, and management (see e.g., Sandfort and Moutlon's (2017) Strategic Action Fields Framework and recent updates to Kingdon's (2003) Multiple Streams Framework) to conceptualize how various factors of the policymaking and implementation process influence organizational behaviors.

Finally, local governmental agencies play a critical role in finding solutions to address our current societal and environmental challenges (Sandfort, 2018; Costumato, 2021). We still have much to learn about how local governmental agencies engage in mandated collective action. Future research should further illuminate the opportunities and challenges of affording local level discretion while balancing that with the need for accountability to achieve sustainable societal and environmental outcomes. The findings from this dissertation research provide some insights that can inform the design of policy mandates. Most notably, policymaking processes should assess whether including stricter guidelines that facilitate collaborative engagement might foster greater accountability at the local level. Adopting this recommendation may require designing frameworks and tools that assess the capacity of collaboration between local governmental agencies prior to passing legislative mandates such as SGMA. For local governmental actors tasked with mandate implementation, the findings in this dissertation suggest the need for investing in collaborative approaches to comply with mandated requirements. Yet, these findings also highlight that implementing agencies may tailor approaches that fit their local contexts and needs.

APPENDICES

Appendix A: Supplemental Information for Chapter II.

Coding of Coordination Concerns

Coordination concerns within each basin were identified through triangulation of multiple sources of data, including a total of 65 interviews, participant observation of 74 public meetings, and review of 482 secondary data documents (e.g., meeting minutes, reports, news articles, social media etc.). Data was coded to indicate the type of concern and to ascribe which entity (GSA) within the basin held the concern. Where a concern appears in the data yet was not self-applied by an agency (for example, if an interviewee described another agency in the basin as having a concern), that information was triangulated with at least one other data source to ensure the concern was held by the entity to which it was attributed. Table A.1 below describes the coding definitions applied to assign concerns to agencies.

Table A.1. Criteria for Coding Concerns and Illustrative Examples

Definitions of Concerns & Criteria for Coding of Them	Illustrative Examples
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AUTONOMY

Data indicate an agency held concerns about any one of:

Loss of Control Over Decision-Making Competencies:

Coordination might affect the agency's authority to set policy, reduce the agency's ability to exercise its discretion, or otherwise influence the agency's ability to make day-to-day decisions within their own jurisdiction.

Agency was concerned that coordination would lead to:

- external imposition of pumping restrictions within their jurisdictional area.
- loss of control over their surface water portfolios.

- limits on their trading of surface water outside of the groundwater basin.
- adoption of a timeline for achieving sustainable groundwater conditions different from what they preferred.

Interference with Operations:

Coordination will reduce the agency's independence to decide how to manage, allocate, and/or expend its resources (e.g., personnel, budgeting).

Agency worried coordination would obligate it to increase drilling of groundwater monitoring wells within their jurisdiction.

Interference with Resources:

Coordination will affect control over how agency's funds and resources are expended.

Agency wanted to protect its budget from being spent on implementation of projects outside their jurisdiction.

DISTRIBUTION

Data indicate an agency held concerns about any one of:

Inequity: Either the gains or the costs of coordination might be inequitably experienced by the coordinating agencies.

Agency was concerned that:

- it would be obligated to share or trade its surface water with other agencies who were entirely reliant on groundwater.
- agencies in the basin with surface water supplies would charge high prices to the agencies in the basin entirely reliant on groundwater.
- coordination would primarily benefit agencies who lacked the technical expertise to create groundwater management plans.

Unnecessary Expenses:

Coordination might be more costly than acting independently.

Agency believed engaging in joint planning with other agencies would increase:

- their staffing needs, thereby increasing their agency's cost for GSP development.

- their costs because they would have to pay for the development of a basin-wide groundwater model.

Unnecessary Transaction Costs:

Coordination might increase the timeframe required for conducting the actions required under SGMA.

Agency thought coordination would delay progress in groundwater planning because it would require:

- time-consuming scientific studies to understand problems outside their jurisdiction.
- lengthy negotiations between agencies.

DEFECTION

Data indicate an agency held concerns about any one of:

Inaction: Coordinating agencies might not take a necessary action

Agency thought other coordinating agencies would not:

- impose groundwater pumping allocations agreed upon.
- meter or otherwise monitor groundwater pumping in their jurisdictions.

Lack of Follow-Through:

Coordinating agencies might not follow through on commitments made.

Agency had concerns that:

- “bad actor” agencies might veto final GSP approval.
- other agencies would back out of agreements prior to completing joint GSP planning.

COMPLIANCE

Data indicate an agency held concerns about any one of:

Failure to Achieve Sustainability: Coordinating agencies may not

Agency held the perspective that:

successfully manage groundwater sustainability.

- it would not be possible to achieve groundwater sustainability if they partnered with agencies whose jurisdiction included land subsidence along a major surface water delivery canal.
- areas of the basin totally reliant on groundwater could not be sustainable without a redistribution of surface water across agencies.

Failure to Meet Deadline:

Coordinating agencies might not complete the planning process by the deadline imposed by SGMA.

Agency was concerned that:

- agencies in the basin would not have time to complete all the regulatory required documents by the statutory deadline if they did not integrate planning from the start.
- agencies in the basin that lacked technical expertise might not complete their water budgets before the statutory deadline.

Failure to Meet Other Regulatory Requirements:

Coordinating agencies may not fulfill other planning requirements stipulated under SGMA.

Agency worried that:

- because other agencies did not want to incorporate climate change predictions in their water budgets, any plan they developed jointly might not comply with SGMA's regulations.
- other agencies might not engage in sufficient outreach to disadvantaged communities, which would lead the state to reject the final groundwater plan.

When the data identified any of the conditions reflecting concerns described in Table A.1, that concern was assigned to the agency(ies) within the basin holding the concern. For each basin, it was also noted whether a particular concern was described by interviewees or in public meetings or secondary data as the reason for basins adopting a particular approach to coordination. This information was then used to determine

whether to assign concerns at the basin level, using the criteria in Table A.2. A summary of the data sources and the concerns identified for each basin is included in Table A.3

Table A.2. Coding of Concerns at the Basin Level

A basin was coded as having a concern if **either** or **both** of the following conditions were met:

- **Majority of Agencies Hold Concern:** The concern was shared across a majority (>50%) of agencies in a basin.
- **Explicitly Stated as Primary Reason:** The concern was cited by several agencies as the primary reason for selection of the coordination mechanism.

Table A.3 Concerns Coded for Each Basin and Data Sources

GSAs Letters: refer to the number of GSAs in the basin. A=1 to 3 GSAs; B=4 to 10 GSAs; C=>10 GSAs. *Secondary documents* refer to meeting agendas, meeting minutes, presentation slides, and news articles/social media. The quantity of secondary data varies based on a) availability/accessibility of public archives b) the extent to which secondary data were needed to confirm primary data sources, c) the number of GSAs in the basin. *Rational for Coding at the Basin-Level* refers to criteria in Table A.2. *Nature of Concerns* refers to criteria in Table A.1

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
1 (A)	Interviews: 3 Public meetings: 1 Secondary documents: 12	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
2 (A)	Interviews: 0 Public meetings: 3 Secondary documents: 35	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
3 (A)	Interviews: 2 Public meetings: 2	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
	Secondary documents: 15				
4 (A)	Interviews: 1 Public meetings: 3 Secondary documents: 29	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
5 (C)	Interviews: 13 Public meetings: 5 Secondary documents: 47	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	Concern not identified at the basin-level
		<i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies; Interference with Operations	<i>Nature of Concern:</i> Inequity, Unnecessary Expense	<i>Nature of Concern:</i> Lack of Follow-Through	
6 (C)	Interviews: 5 Public meetings: 3 Secondary documents: 44	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
		<i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies; Interference with Operations;			

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
		Interference with Resources			
7 (A)	Interviews: 0 Public meetings: 5 Secondary documents: 29	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies	Concern not identified at the basin-level	Concern not identified at the basin-level	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Failure to Achieve Sustainability
8 (A)	Interviews: 5 Public meetings: 5 Secondary documents: 23	<i>Rational for Coding at Basin Level:</i> Majority of Agencies; Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies; Interference with Operations	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Unnecessary Expenses, Unnecessary Transaction Costs	Concern not identified at the basin-level	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Failure to Meet Deadline
9 (A)	Interviews: 6 Public meetings: 5 Secondary documents: 46	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason	Concern not identified at the basin-level	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
		<i>Nature of Concern: Loss of Control Over Decision-Making Competencies</i>	<i>Nature of Concern: Unnecessary Expense, Unnecessary Transaction Costs</i>		<i>Nature of Concern: Failure to Achieve Sustainability</i>
10 (B)	Interviews: 7 Public meetings: 9 Secondary documents: 40	<i>Rational for Coding at Basin Level: Majority of Agencies; Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Loss of Control Over Decision-Making Competencies; Interference with Operations</i>	<i>Rational for Coding at Basin Level: Majority of Agencies; Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Inequity</i>	<i>Rational for Coding at Basin Level: Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Inaction</i>	<i>Rational for Coding at Basin Level: Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Failure to Achieve Sustainability; Failure to Meet Deadline</i>
11 (B)	Interviews: 4 Public meetings: 4 Secondary documents: 19	<i>Rational for Coding at Basin Level: Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Loss of Control Over Decision-Making Competencies</i>	<i>Rational for Coding at Basin Level: Explicitly Stated as Primary Reason</i> <i>Nature of Concern: Inequity</i>	Concern not identified at the basin-level	Concern not identified at the basin-level
12 (B)	Interviews: 2 Public meetings: 2	<i>Rational for Coding at Basin Level:</i>	<i>Rational for Coding at Basin Level:</i>	Concern not identified at the basin-level	Concern not identified at the basin-level

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
	Secondary documents: 16	Majority of Agencies; Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies; Interference with Operations	Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Inequity		
13 (A)	Interviews: 1 Public meetings: 6 Secondary documents: 13	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
14 (B)	Interviews: 3 Public meetings: 2 Secondary documents: 10	<i>Rational for Coding at Basin Level:</i> Majority of Agencies; Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies	<i>Rational for Coding at Basin Level:</i> Majority of Agencies <i>Nature of Concern:</i> Inequity	Concern not identified at the basin-level	Concern not identified at the basin-level
15 (A)	Interviews: 1 Public meetings: 6	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
	Secondary documents: 13				
16 (A)	Interviews: 1 Public meetings: 3 Secondary documents: 36	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level
17 (B)	Interviews: 4 Public meetings: 4 Secondary documents: 17	<i>Rational for Coding at Basin Level:</i> Majority of Agencies; Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Inequity	Concern not identified at the basin-level	Concern not identified at the basin-level
18 (C)	Interviews: 6 Public meetings: 5 Secondary documents: 25	<i>Rational for Coding at Basin Level:</i> Majority of Agencies; Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Loss of Control Over Decision-Making Competencies; Interference	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Inequity	<i>Rational for Coding at Basin Level:</i> Explicitly Stated as Primary Reason <i>Nature of Concern:</i> Failure to Meet Regulatory Requirements	Concern not identified at the basin-level

Basin ID (# GSAs)	Data Sources	Autonomy	Distribution	Defection	Compliance
		with Operations			
19 (A)	Interviews: 2 Public meetings: 3 Secondary documents: 13	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level	Concern not identified at the basin-level

Categorization of Coordination Mechanisms used in Each Basin

To categorize the mechanisms used for coordination, we reviewed the content of all inter-agency agreements within each basin, basin coordination agreements (applicable only in basins that produced multiple GSPs), GSPs, agreements between GSAs for joint development of GSPs, and GSA formation agreements (applicable only for GSAs comprised of multiple agencies). This information was verified with information from interviews, meeting minutes and participant observation to ensure the mechanisms described in the agreements were the mechanisms used in practice for inter-agency coordination. Table A.4 includes a summary of those documents.

Table A.4. Documents Reviewed

Type of Document	# of Documents	Explanation
Basin Coordination Agreements	6	Formal basin coordination agreements are required under SGMA if multiple GSPs were produced in a basin. <ul style="list-style-type: none"> ▪ 6 basins included multiple GSPs. ▪ 13 basins were covered fully by one GSP and thus did not produce a basin coordination agreement.
GSPs	44	One or more GSPs were produced in each basin. <ul style="list-style-type: none"> ▪ 13 GSPs span the entire basin.

		<ul style="list-style-type: none"> 31 GSPs span part of a basin.
GSP Development Agreements	17	Agencies working together in a group to develop a GSP entered into formal agreements governing the GSP development process.
GSA Formation Agreements	42	<p>All GSAs submitted formal notification to the state. Where multiple agencies joined together to form a GSA, they entered into either Memorandums of Agreement or Joint Powers Agreements.</p> <ul style="list-style-type: none"> 4 multi-agency GSAs span a full basin. 38 multi-agency GSAs span only part of a basin. 58 single-agency GSAs span only part of a basin. Single-agency GSAs did not include information on coordination in their formation agreements.

Information from these documents was combined to determine the arrangements used to coordinate within each basin. Doing so involved tracing how agencies were working together across the full institutional arrangements for SGMA implementation (i.e., from GSA formation through basin-level coordination). Using this information, each basin’s coordination mechanism was then coded using the definitions described in Table A.5.

Table A.5. Definitions used to Code the Attributes of Coordination Mechanisms

Basin-Level Decision-Making	<ul style="list-style-type: none"> Fully Joint: Agencies in the basin engage formally in joint decision-making in relation to basin-wide planning for sustainability. Limited Scope: Agencies in the basin engage formally in joint decision-making in some aspects of basin-wide planning for sustainability, generally including the production of knowledge on the hydrogeologic conditions, the setting of sustainability metrics, and development of monitoring networks. Deliberative Only: Agencies in the basin jointly discuss decisions in relation to basin-wide planning for sustainability, yet decisions are made at the sub-basin level.
Mechanism Authority	<ul style="list-style-type: none"> Binding: Decisions made jointly at the basin-level are obligatory to GSP groups, GSAs, and member-agencies. Non-Binding: Decisions made jointly at the basin-level are recommendations. Each GSP group, GSA or agency can decide whether to abide by them.
Performance Targets	<ul style="list-style-type: none"> Allocation of Either Yield or Overdraft: Agencies in the basin specified quantifiable targets each GSP group or GSA agreed to abide.

These targets reflect either the portion of the basin's sustainable yield that GSP Group/GSA may plan to use or the portion of the basin's overdraft that GSP Group/GSA will be responsible for reducing.

- **None:** There is no basin-level specification of performance targets for the GSP groups or GSAs.
-

Appendix B: Supplemental Information for Chapter III.

Criteria and Categorization of Organizational Forms and Institutional Arrangements

Appendix B provides additional information on the data collection, organization, and analytic processes we used to categorize the organizational forms and institutional arrangements employed by each of the 18 critically overdrafted basins. Data collection for this project began in 2018, following a determination of *Not Human Subjects Research* by the Institutional Review Board (IRB) at UMass Amherst (IRB Number 18-127). The ethnographic data we collected over a period of three and half years are summarized in Table B.1. These data were used to categorize the basin-level organizational forms and institutional arrangements agencies used to develop GSPs under SGMA. Our study focuses on GSP planning in the critically overdrafted basins, which lasted from 2017-2020.

Table B.1. Data Collected (2018-2022, by Basin) used to Categorize Organizational Forms and Institutional Arrangements

The number of interviews roughly corresponds to the number of agencies within a basin. To protect basin anonymity, we are not reporting the exact number of agencies/GSAs within a basin). For interagency agreements (shown in the right column), JPA= Joint Powers Agreement, MOU= Memorandum of Understanding, CA= Coordination Agreement, and IOA= Interim Operating Agreement. An “X” indicates the basin did not sign an agreement.

	Interviews	Participant Observation	Public Meeting Materials	Interagency Agreements
Basin IDs	# of Interviews	# of Events	# of Documents	#/Type of Agreement

1	1	2	7	1 (JPA)
2	1	1	3	1 (JPA)
3	4	3	10	1 (JPA)
4	1	1	5	1 (MOU)
5	4	1	7	1 (CA)
6	2	3	9	1 (MOU)
7	3	2	6	1 (IOA)
8	2	3	11	1 (MOU)
9	1	2	8	1 (JPA)
10	1	2	6	X
11	1	2	6	X
12	8	11	29	1 (MOU)
13	3	2	7	1 (MOA)
14	13	5	16	1 (CA)
15	5	5	14	1 (MOU)
16	6	3	6	1 (MOU)
17	6	5	11	X
18	5	5	17	1 (MOU)
Totals	67	58	178	15

We interviewed a total of 67 GSA representatives, the majority of whom were agency managers. Agency managers were chosen because a) they were listed as the primary contact for the agency b) they were the most knowledgeable about basin-level process. In addition to agency managers, we interviewed six third-party actors (technical consultants and meeting facilitators), and three representatives who served as agency board of directors. The latter were interviewed because, in some cases, agencies lacked a full-time manager and thus were represented either by a third-party actor or a member of the

agency's board of directors. Interviewees were not compensated for their participation. Interviews typically lasted two hours and were semi-structured, meaning that the interview script included both specific closed-form questions intended to identify the organizational forms and institutional arrangements used in each basin and open-ended questions to get a better understanding of interviewees' experiences and perceptions of the GSP development process. In most cases, interviews were recorded using an audio recording device.

In addition to conducting interviews, we attended 58 publicly noticed meetings. These meetings were either agency board meetings, public workshops, or advisory committee meetings. Meeting time varied considerably. Agency board meetings typically lasted between two to five hours, while advisory meetings and public workshops lasted between one to three hours. During public meetings, we took notes of the process. If more than one researcher attended a meeting, we compared and collated fieldnotes following the meeting.

Participant observation of public meetings provided in-depth insight about how the process unfolded in the various decision and non-decision-making venues. Yet, to gain a longitudinal understanding of the process for each basin, we collected public meeting materials from GSA websites. These included meeting agendas, minutes, action summaries, and powerpoint presentations.

Lastly, we collected the basin-level interagency agreements that some agencies in our study signed early in the process to guide GSP development. While these data gave insight into the organizational forms and institutional arrangements agencies intended to

adopt, they were compared to the field data outlined above to ensure that those forms and arrangements were employed.

Data collection, organization, and analysis occurred in an iterative fashion. Following interview transcription, the lead author and a research assistant used the data described above to construct organizational charts for each of the 18 groundwater basins. Each organizational chart depicted the governance structures used at the basin level (i.e., the entities involved in planning and decision-making for the basin as a whole) as well as those used by individual agencies or GSAs within their own jurisdictions. In addition, we wrote in-depth case descriptions which provided a narrative summary for the organizational charts. These preliminary analyses were reviewed and discussed by all members of the research team to ensure they accurately described each basin based on our ethnographic fieldwork experience.

Using these organizational charts and case descriptions along with theoretical knowledge (as outlined in the literature review section), we iteratively developed a qualitative framework for categorizing each basin's organizational form and approach for each institutional arrangement. The framework was designed to capture meaningful and mutually exclusive distinctions between categorical conditions such that it would be impossible to simultaneously assign a basin to two categories. The resulting categories are thus mutually exclusive. The data summarized in Table B.1 were then re-analyzed and each basin was assigned to a category. Table B.2 provides an example for the qualitative categorization of one of the basins in our study.

Table B.2. Example of Qualitative Evaluation Sheet – Criteria for Categorizing Organizational Forms and Institutional Arrangements

The coding framework delineates the key attributes for each of the three types of organizational forms (IG=Intergovernmental, LA=Lead Agency, PC=Polycentric) and the three approaches to interaction (Ah=Ad hoc, F=Formal, C=Collaborative) used to structure decision-making and planning for each of the 18 critically overdrafted groundwater basins. An ‘X’ in the third column indicates that row’s criteria applied to the basin. An ‘--’ indicates that row’s criteria did not apply to the basin. Note: To protect the basin’s anonymity, in the below table, some details are excluded from the description of the determination (e.g., exact number of agencies/GSAs in the basin or specific names of consultancy firms or names of advisory groups).

Evaluation Sheet for Basin 14				
Key Attributes of Organizational Forms		Type	Select which applies	Explanation of Determination
Organizational Forms	<p>Number of Agencies/GSAs</p> <ul style="list-style-type: none"> There are multiple (>2) agencies/GSAs in a basin <p>Number of Decision-Making Bodies</p> <ul style="list-style-type: none"> There is one decision-making body in the basin <p>Membership of Decision-Making Bodies</p> <ul style="list-style-type: none"> Comprised of all agencies/GSAs in the basin <p>Designation of Decision-Making Authority</p> <ul style="list-style-type: none"> Formally granted to one decision-making body 	[IG]	--	
	<p>Number of Agencies/GSAs</p> <ul style="list-style-type: none"> There are multiple (>2) agencies/GSAs in a basin <p>Number of Decision-Making Bodies</p> <ul style="list-style-type: none"> There is one decision-making body in the basin 	[LA]	--	

	<p>Membership of Decision-Making Bodies</p> <ul style="list-style-type: none"> Comprised of one or a subset of agencies/GSAs in the basin <p>Designation of Decision-Making Authority</p> <ul style="list-style-type: none"> Formally granted to one decision-making body 			
	<p>Number of Agencies/GSAs</p> <ul style="list-style-type: none"> There are multiple (>2) agencies/GSAs in a basin <p>Number of Decision-Making Bodies</p> <ul style="list-style-type: none"> There are multiple (>1) decision-making bodies in the basin <p>Membership of Decision-Making Bodies</p> <ul style="list-style-type: none"> Comprised of one or a subset of agencies/GSAs in the basin <p>Designation of Decision-Making Authority</p> <ul style="list-style-type: none"> Formally granted to multiple (>1) decision-making bodies 	[PC]	X	There are multiple GSAs in Basin 14. Each GSA has a decision-making body with designated authority to make decisions on their own behalf.
Key Attributes of Institutional Arrangements		Type	Select which applies	Explanation of Determination
Communication Platform	<p>Agency/GSA Representation</p> <ul style="list-style-type: none"> Agencies/GSAs do not adopt a process that guarantees membership/inclusion for representatives of all agencies/GSAs in the basin <p>Agency/GSA Participation</p> <ul style="list-style-type: none"> Agencies/GSAs schedule meetings infrequently (less 	[Ah]	--	The GSAs in Basin 14 adopted a formal process that allowed GSAs to appoint representatives to the basin-wide advisory forums. Two basin-wide forums (a Policy Coordination Committee and a Technical Advisory Committee) had scheduled meetings once a month throughout the GSP development process (2017-2019). Technical topics were

<p>than once every 3 months) on an as-needed basis</p> <p>Scope of Topics</p> <ul style="list-style-type: none"> Agencies/GSAs share information related to policy or technical topics 			<p>deliberated by the Technical Advisory Committee who would then provide recommendations to the Policy Coordination Committee. The Policy Coordination Committee would then deliberate and come to a shared understanding before providing agreed-upon recommendations to the individual GSAs in the basin.</p>
<p>Agency/GSA Representation</p> <ul style="list-style-type: none"> Agencies/GSAs adopt a process that guarantees membership/inclusion for representatives of all agencies/GSAs in the basin <p>Agency/GSA Participation</p> <ul style="list-style-type: none"> Agencies/GSAs schedule meetings regularly (at least once every 1-3 months) throughout the GSP development process <p>Scope of Topics</p> <ul style="list-style-type: none"> Agencies/GSAs share information related to policy or technical topics 	[F]	--	
<p>Agency/GSA Representation</p> <ul style="list-style-type: none"> Agencies/GSAs adopt a process that guarantees membership/inclusion for representatives of all agencies/GSAs in the basin <p>Agency/GSA Participation</p> <ul style="list-style-type: none"> Agencies/GSAs schedule meetings regularly (at least once every 1-3 months) throughout the GSP development process <p>Scope of Topics</p> <ul style="list-style-type: none"> Agencies/GSAs share information, deliberate, and arrive at shared understandings on both policy and technical topics 	[C]	X	

Key Attributes of Institutional Arrangements		Type	Select which applies	Explanation of Determination
Boundary Spanning Agent(s)	Types of Third-Party Assistance <ul style="list-style-type: none"> • Technical Scale of Third-Party Assistance <ul style="list-style-type: none"> • Basin-level assistance is limited to technical support 	[Ah]	--	<p>The GSAs in Basin 14 hired a basin consultancy firm to assist the GSAs in collecting and developing the knowledge of the SES for the Basin Setting Chapter of the GSP(s). In addition, the shared consultants provided policy recommendations to the GSAs. A third-party (non-GSA) agency was hired to provide administrative and planning assistance. Tasks included creating workflow schedules, facilitating public meetings, and acting as a liaison between the GSAs and the shared basin consultant.</p>
	Types of Third-Party Assistance <ul style="list-style-type: none"> • Policy and/or technical and/or meeting facilitation Scale of Third-Party Assistance <ul style="list-style-type: none"> • Basin-level assistance is limited to two of the three types of third-party support 	[F]	--	
	Types of Third-Party Assistance <ul style="list-style-type: none"> • Policy, technical, meeting facilitation Scale of Third-Party Assistance <ul style="list-style-type: none"> • Basin-level assistance includes all three types of third-party support 	[C]	X	
Key Attributes of Institutional Arrangements		Type	Select which applies	Explanation of Determination
Policy Evaluation Process	Scale of Evaluation <ul style="list-style-type: none"> • One or more agencies/GSAs evaluate the impacts of proposed policies on their 	[Ah]	--	<p>All GSAs in Basin 14 adopted a process where they jointly evaluated the basin-wide impacts of setting policy goals related to land subsidence. The</p>

	<p>jurisdiction(s) within a basin</p> <p>Scope of Evaluation</p> <ul style="list-style-type: none"> Inclusive of some policy goals and/or some policy actions yet agencies/GSAs do not agree to make adjustments based on evaluation outcomes 			<p>purpose of evaluating land subsidence was for information-sharing. The GSAs did not agree to make specific adjustments in their plan based on the evaluation outcomes. They did not evaluate basin-wide impacts of setting policy goals related to any of the other 5 sustainable management criteria, nor did they evaluate any of the proposed management actions.</p>
	<p>Scale of Evaluation</p> <ul style="list-style-type: none"> All agencies/GSAs evaluate the impacts of proposed policies across the entire basin <p>Scope of Evaluation</p> <ul style="list-style-type: none"> Inclusive of some policy goals and/or policy actions yet agencies/GSAs do not agree to make adjustments based on evaluation outcomes 	[F]	X	
	<p>Scale of Evaluation</p> <ul style="list-style-type: none"> All agencies/GSAs evaluate the impacts of proposed policies across the entire basin <p>Scope of Evaluation</p> <ul style="list-style-type: none"> Inclusive of all policy goals and all policy actions; agencies agree to make adjustments based on evaluation outcomes 	[C]	--	
Key Attributes of Institutional Arrangements		Type	Select which applies	Explanation of Determination
Planning Approval Processes	<p>Scope of Review and/or Approval</p> <ul style="list-style-type: none"> Agencies/GSAs may review all the completed plans in the basin 	[Ah]	--	

	<p>Timing of Review and/or Approval</p> <ul style="list-style-type: none"> Agencies/GSAs may review and provide written public comment after the plans are made available to the public 			
	<p>Scope of Review and/or Approval</p> <ul style="list-style-type: none"> Agencies/GSAs may review all the completed plans in the basin All agencies/GSAs must review and approve at least one component of the final plan(s) (e.g., shared basin setting chapter(s) in final plan(s), shared technical memoranda in final plan appendix) in the basin <p>Timing of Review and/or Approval</p> <ul style="list-style-type: none"> Agencies/GSAs may review and provide written public comment after the plans are made publicly available Agencies/GSAs must approve shared planning documents before full drafts are made available to the public 	[F]	X	<p>All GSAs in Basin 14 agreed to jointly review and unanimously approve a shared basin setting technical memoranda prior to releasing the full drafts of groundwater sustainability plans for public comment.</p> <p>During the public comment period GSAs reviewed and provided written comments on each other's completed plans.</p>
	<p>Scope of Review and/or Approval</p> <ul style="list-style-type: none"> Agencies/GSAs must review all the completed plans in the basin All agencies/GSAs must approve all components of the plan(s) in a basin 	[C]	--	

	<p>Timing of Review and/or Approval</p> <ul style="list-style-type: none"> • Agencies/GSAs must review and provide written comments before the plan(s) are made available to the public • Agencies/GSAs must approve all planning documents before full drafts are made available to the public 			
--	--	--	--	--

Coding and Calibration of Coordinated Outcomes

Here we provide additional information regarding our qualitative evaluation framework used to determine coordinated outcomes. Forty-four Groundwater Sustainability Plans and associated technical memoranda were downloaded from the DWR’s website in January 2020. These documents were qualitatively coded to determine each groundwater basin’s coordinated outcomes. Three members of the research team carried out this analysis. To ensure inter-coder reliability, members of the research team met weekly to read through and compare coding sheets. If discrepancies were observed, they were resolved during those meetings and corrected across all previously coded documents.

For each of the mandate’s requirements (knowledge of the SES, policy goals, policy actions, oversight during plan implementation) there were several elements that were evaluated to determine coordinated outcomes. In what follows, we describe the coding process for coordinated policy goals to illustrate the general procedure used to evaluate coordinated outcomes for the other four requirements. We then describe our process for distinguishing coordinated from not coordinated outcomes.

Coordinated policy goals were evaluated for each of the six sustainability indicators mandated by SGMA—water levels, groundwater storage, water quality, land subsidence, seawater intrusion, and surface water depletion. For each of these, our qualitative coding delineated between different types of outcomes that ranged in terms of their level of coordination. Table B.3 provides an example of the coding sheet used in our assessment of policy goals for groundwater levels. The qualitatively defined potential coordinated outcomes for water level policy goals were assigned a corresponding point. Thus, 1 point was given if the basin had an outcome described at the bottom end of the scale; two points were given if they were described by the outcomes in the middle range; and 3 points were given if the basin was at the higher end of possible coordinated outcomes.

The same criteria were used to evaluate coordinated outcomes for groundwater quality, land subsidence, seawater intrusion, and surface water depletion. The points were then recorded and summed to give a ratio of total number of points achieved divided by the total number of possible points. These ratios were normalized to 1. Table B.4 shows the number of points earned in each basin for their coordinated outcomes of policy goals.

Table B.3. Example of Qualitative Coding Sheet – Coding for Policy Goals

The criteria outlined in bullet points under the header “Potential Coordinated Outcomes...” were also used to evaluate coordinated outcomes for groundwater storage, water quality, land subsidence, seawater intrusion, and surface water depletion. For each policy goal, we assigned points (1,2,3) that corresponded with the that Basin’s coordinated outcome as described in this example coding sheet. An ‘X’ in the third column indicates that row’s coding was applied. A ‘--’ in the third column indicates that row’s coding did not apply.

Coordinated Outcomes for Basin X’s Water Level Policy Goals				
Category	Potential Coordinated Outcomes for Water Level Policy Goals	Select which applies	Points possible (3)	Explanation of Coding Determination
Water Levels	<ul style="list-style-type: none"> • Full basin GSP with a set of minimum thresholds and measurable objectives that applies uniformly across the basin. • Full basin GSP with management areas, minimum thresholds and measurable objectives vary across management areas, yet there is a well delineated explanation for how the thresholds can be simultaneously achieved. • The multiple GSPs have all adopted the same set of minimum thresholds and measurable objectives. • The multiple GPSs have adopted minimum thresholds and measurable objectives that vary, yet there is a well delineated explanation for how the thresholds can be simultaneously achieved. 	--	3	There are four GSPs in the basin. Sustainable Management Criteria for groundwater levels are different for each GSP. There is no explanation as to how their varying policy goals can be simultaneously achieved.
	<ul style="list-style-type: none"> • Full basin GSP with management areas, minimum thresholds and measurable objectives that vary across management areas along with a description or rationale for the different the thresholds, yet no explanation for how 	--	2	

	<p>they can be simultaneously achieved.</p> <ul style="list-style-type: none"> The multiple GPSs have adopted minimum thresholds and measurable objectives that vary with a description or rationale for the differing thresholds, yet no explanation for how they can be simultaneously achieved. 			
	<ul style="list-style-type: none"> Full basin GSP with management areas, minimum thresholds and measurable objectives vary across management areas with no explanation. The multiple GPSs have adopted minimum thresholds and measurable objectives that vary with no explanation. 	X	1	

Table B.4. Coordinated Outcome Scores for Policy Goals Related to SGMA’s Six Sustainability Indicators

Each basin was qualitatively evaluated to determine their policy goal coordinated outcomes. Qualitative outcomes were assigned a corresponding point. Points were then summed and normalized to 1 to give a coordinated outcome score for each basin.

Basin ID	Water Levels 3 Possible Points	Water Storage 3 Possible Points	Water Quality 3 Possible Points	Sub-sidence 3 Possible Points	Sea-water Intrusion 3 Possible Points	Surface Water Depletion 3 Possible Points	Sum of Points 18 Possible Points	Normal-izing to 1
1	3	3	3	3	3	3	18	1
2	3	3	3	3	3	3	18	1
3	3	3	3	3	3	3	18	1
5	3	3	3	3	3	3	18	1
6	3	3	3	3	3	3	18	1
7	3	3	3	3	3	3	18	1
8	3	3	3	3	3	3	18	1
10	3	3	3	3	3	3	18	1
11	3	3	3	3	3	3	18	1
13	3	3	3	3	3	3	18	1

4	2	2	3	3	3	3	16	0.89
12	3	3	2	1	3	3	15	0.83
16	2	1	3	1	3	3	13	0.72
9	1	1	3	3	3	1	18	0.67
18	1	1	1	2	3	3	11	0.61
14	1	1	1	2	3	2	10	0.56
17	1	1	1	1	3	3	10	0.56
15	1	1	1	1	3	2	9	0.5

As mentioned above, the process for qualitatively assessing coordinated outcomes was the same for the other three mandated requirements. Once the qualitative evaluation was complete and each basin was assigned an outcome score for each type of mandated requirement, we determined the basins that were coordinated. To do this, we divided the scores into terciles. We then reviewed the qualitative coding for basins on either side of the thresholds to assess whether using terciles to determine coordinated outcomes captured meaningful differences in the coding determinations. We conducted a sensitivity analysis comparing results to other mathematical approaches (e.g., using quartiles, cluster analysis) and found that dividing the data into terciles was representative and best captured differences in outcomes based on our qualitative assessment of the plans. Consequently, basins that were in the top tercile were considered coordinated. All other basins were coded as not coordinated. This method of evaluating the sensitivity of cut-off thresholds is appropriate for case study research where the researchers have in-depth knowledge of their cases (Oana & Schneider, 2021). Table B.5 shows the coordinated outcome scores for each basin across all four mandated requirements under SGMA, along with the thresholds dividing basins into coordinated/not coordinated categories. The column on the far-right side of Table B.5 depicts the aggregate scores which reflect each basin’s ability to achieve coordinated outcomes in at least three of the mandate’s requirements.

Table B.5. Thresholds for Coordinated Outcomes

The solid line indicates the threshold dividing coordinated basins from basins that were not coordinated. Basins in the top tercile range (shown in the shaded row) of scores were considered coordinated.

Knowledge of the SES		Policy Goals		Policy Action		Oversight for Plan Implementation		Aggregate	
Coordinated (.95-1)		Coordinated (.86-1)		Coordinated (.8-1)		Coordinated (.89-1)		Coordinated (.9-1)	
Basin ID	Score	Basin ID	Score	Basin ID	Score	Basin ID	Score	Basin ID	Score
1	1	1	1	4	1	1	1	1	.98
2	1	2	1	6	1	15	.95	2	.96
3	1	3	1	1	.93	2	.94	3	.96
4	1	5	1	2	.93	9	.94	4	.92
5	1	6	1	3	.93	12	.9	8	.9
6	1	7	1	5	.93	16	.9	6	.9
7	1	8	1	8	.8	3	.9	5	.9
8	1	10	1	10	.73	8	.88	7	.88
9	1	11	1	11	.73	14	.87	10	.85
10	1	13	1	7	.67	7	.85	11	.85
11	1	4	.89	18	.67	18	.85	9	.8
13	1	12	.83	12	.6	17	.83	13	.75
15	.85	16	.72	14	.6	4	.82	12	.73
14	.77	9	.67	9	.53	13	.79	15	.7
12	.62	18	.6	15	.53	6	.65	14	.7
17	.54	14	.56	17	.53	10	.65	16	.61
16	.39	17	.56	16	.47	11	.65	17	.61
18	.30	15	.5	13	.2	5	.65	18	.61

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