Measuring Performance of Water Systems in California

By Thomas Mercer and Jon Christensen

Woods Institute for the Environment | The Bill Lane Center for the American West

Stanford University

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COVER IMAGES, CLOCKWISE FROM LEFT: DISCOVERY BAY DEVELOPMENT NEAR SAN JOAQUIN DELTA; DRY BED OF LEXINGTON RESERVOIR NEAR LOS GATOS, CA IN 2008; SWANS ON THE SACRAMENTO RIVER DELTA; HOOVER DAM ON THE COLORADO RIVER, NEVADA; WORKING IN MATADERO CREEK, PALO ALTO, CA **CREDITS:** SARA TOLLEFSON; CHRISTOPHER HYNES; INGRID TAYLAR; ANDREAS METZ; ALAN LAUNER

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Executive Summary

The state of information about water in California is woefully inadequate. Given that California has long been a center for innovation in the world's emerging information economy and water is among the state's most precious resources, this is nothing short of shocking.

In its 2009 Water Plan, the state Department of Water Resources recognized the inadequacies and inefficiencies of the state's information systems: "Easily retrievable, standardized, and comprehensive baseline data about California urban water use are not available." The plan went on to note that DWR "agreed to begin the effort of improving information exchange by exploring how information produced for UWMPs [Urban Water Management Plans] could be used more effectively to support regional and statewide planning efforts." Moreover, the plan also noted that a state law, Assembly Bill 1404, had tasked the State Water Resources Control Board with studying the feasibility of a coordinated database of water use information and reporting to the governor by January 2009 (Department of Water Resources 2009a, 3-30). That report was delivered in May 2009, and called for the creation of a coordinated centralized database for water management in the state (State Water Resources Control Board 2009). The proposal, however, was not funded and has since languished.

In a comprehensive recent report, "Managing California's Water: From Conflict to Reconciliation," the Public Policy Institute of California (Hanak et al. 2011, 424) noted this glaring problem: "California woefully lags on information and analyses of water use, flows, quality, and costs—essential tools to support water management goals. Most information will need to be developed locally and regionally, but the state must ensure that adequate data are collected and made available to policymakers, stakeholders, and the public at large in a usable format."

Despite the central importance of information, the PPIC's report said little more about the issue. This report fills the gap. Based on a broad survey of state officials, water managers, nongovernmental organizations, and experts, we examine the shortcomings of data collection and analysis needed to measure and improve performance in state agencies, water utilities, and watershed management. And we make recommendations for improvements including: state-mandated data sharing, standardization and efficient reporting; the reporting of outcomes rather than outputs; cultivating a culture of acceptance of accountability through performance measurement; widely disseminating best practices, particularly since the performance of small organizations has a critical impact on the state's water; using comparisons carefully to motivate change; and communicating effectively.

The Consumer Confidence Report that nearly every consumer of water in California gets in the mail once a year is a classic example of nearly everything that is wrong with data gathering, analysis, and communication of performance measurements in California today. It is unreadable. Hardly anyone knows what to do with it. It is ignored. It is useless. Unfortunately, the CCR is symptomatic of a larger more widespread problem. What we have here is not just a failure to communicate. It is a failure to gather, make available, analyze, communicate, and use information to sustainably manage our water systems in California. We have the information resources and performance measurement frameworks we need to change that.

Introduction

The West's water management institutions are under more stress than ever before. The region faces recovery from a recent drought in California and a decade-long drought in the Colorado Basin, continued population growth, the long-term threat of climate change, overdraft of groundwater resources, and growing realization that freshwater ecosystems and dependent species are in decline. Facing this set of complex issues, policymakers and water managers find themselves needing to develop more sophisticated strategies of managing a scarce resource; to integrate local, state, and regional planning; and to manage tradeoffs between human and environmental uses of water. Institutions originally formed to address a single mandate or goal sometimes find themselves responsible for managing and balancing a complex set of competing goals. Moreover, in recognition of the financial resources demanded by water challenges, the state and federal governments, as well as the reform community, are allocating more money to address water issues in the West.

With calls for financial accountability and competing resource demands at a fever pitch, the margin of error for water management in the West has narrowed, and the pressure is higher than ever to define and achieve desired outcomes. The tools needed to ensure effective resource allocation and water investment strategies and manage outcomes in multi-objective planning efforts are examples of how better performance measurement – systems, processes and metrics – are needed in the water context, both in California and across the West.

The obvious need for performance measurement in water management in the West can be distilled to the following three policy questions:

1. How do we know if we're managing our water resources sustainably?
2. How do we know whether our water resource management strategies are effective?
3. How do we know that we're allocating financial resources efficiently?

This paper will start by reviewing performance measurement frameworks relevant to a water resource management context. Then, it will address the current state of performance measurement in California water management, studying several different institutional contexts as a way to uncover where performance measurement is being done well and where there are opportunities for improvement. Based on this examination, this paper will conclude with key recommendations, as well as a framework of factors that make performance measurement efforts easier and more likely to succeed. While the focus of this study is California, many of the assessments and recommendations have relevance across the West.

Resources for Water Management in California

A key motivation for the assessment of performance in California's water systems is the sheer amount of money spent on water and wastewater services, flood protection, environmental restoration, water quality programs, and other water related expenditures. Any way you slice it, the state devotes significant financial resources to water. While the state's water governance complexity and mix of private, public, and non-profit funding sources make it very difficult to come up with a grand total figure, key statistics makes it clear how significant the number is.

Many of the state's water programs (including flood protection, integrated regional water management planning, groundwater management, and more) receive the bulk of their funding from general obligation bonds. Since 2000, voters have approved $22.5 billion in general obligation bonds, much of which has been issued and spent by the state. The institution responsible for the largest chunk of that $22.5 billion is

the CALFED Bay-Delta Program that has now been superseded by the state Delta Stewardship Council. CALFED spent over $3 billion allocated from the 2002 and 2006 bond measures. An $11.1 billion bond proposition was slated for the fall 2010 ballot as part of the 2009 water legislation package, but was pushed back to 2012, because of concern about voter appetite for spending.

According to the latest data, California households spend approximately $7.7 billion per year for water and wastewater services, provided both by municipalities ($6.48 billion) and independently owned utilities ($1.2 billion) (California Public Utilities Commission 2010, 1). Furthermore, special districts in the state with "water utility enterprise activity" (including wholesale agencies, irrigation districts, and more) collected more than $6.1 billion in revenues in 2007-08 (Chiang 2010, xviii). Simply adding these annual figures double-counts the cost of some water, as wholesale districts pass their cost along to retail agencies, but it gives a sense of the scale of the cost of water supply in the state.

Another way of looking at state-level expenditures is by examining budgets at the agency level, which include funding from bonds (mentioned above, which would be partially counted again here), special funds, and the general funds. The combined 2009-10 budgets for the four largest state agencies with regulatory responsibilities for water management (State Water Resources Control Board, Department of Water Resources, Department of Public Health, and Department of Fish and Game) totaled $10.7 billion, although that total includes funding for some DPH and DFG programs that are not water-related. Of course, reducing water management to these four agencies leaves out many other water-related budget line items. Note that the annual budget of DWR alone is $6.3 billion (California Department of Finance 2009).

Also contributing resources to California water management – though much more difficult to track – are federal agencies such as the Environmental Protection Agency, National Marine Fisheries Service, and Bureau of Reclamation, as well as a diverse set of local, state, and national non-profits and community groups. While we acknowledge the merit of a project to take this analysis further and calculate the total annual expenditure on water management in the state, here we are content to show simply that the bill runs into the billions or tens of billions of dollars – a real motivating factor for making sure that the performance of water supply services, ecosystem protection, and regulatory actions that are funded with that money are performing well.

Methodology

The data, quotes, and conclusions presented in this report are the result of research conducted in the 2010. The authors conducted meetings and phone calls to discuss performance measurement practices, systems, and specific metrics in water with nearly 100 policymakers, urban and agricultural water managers, water users, watershed advocates, and leaders of nongovernmental organizations across the state. Meetings were held in Sacramento, Los Angeles, Fresno, San Francisco, and Stanford University. In parallel, the authors also conducted a literature review in the field of corporate and governmental performance measurement, effectiveness of natural resource management, as well as a broad review of California water resource strategy, information systems, and monitoring programs at different institutional levels.

Performance Measurement Frameworks Applicable in Water Management

Before looking at specific case studies of performance measurement in California water systems and institutions, it makes sense to take a step back and review the relevant literature on performance measurement to understand the frameworks and concepts that can be applied to the myriad institutions, processes, and information platforms that can be found in the world of California water management.

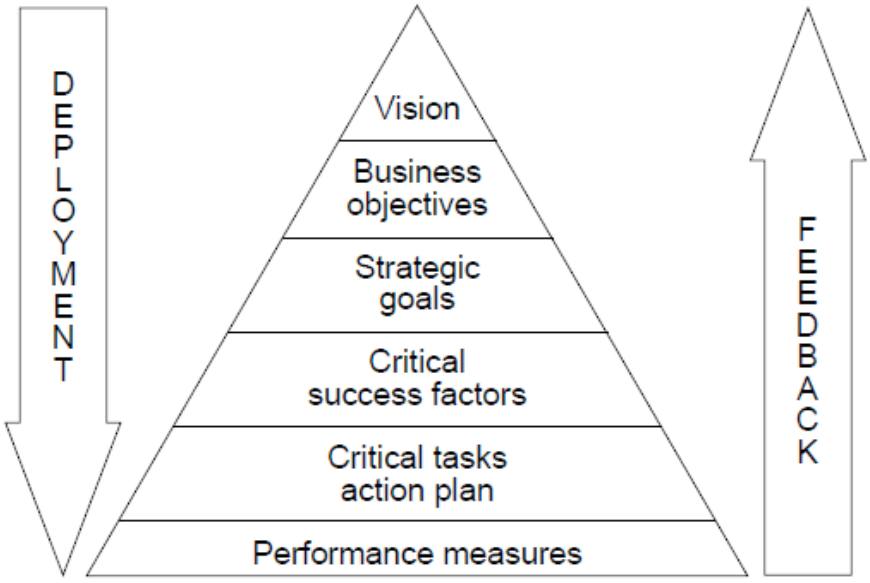
Corporate Performance Measurement

Stacks of articles and books have been written about the practice of corporate performance measurement. For the purposes of this study, it is relevant to understand the current literature on performance measurement practices, the connection to corporate strategic planning and understanding the connection between performance measurement processes, systems, and individual metrics.

The discipline of performance measurement had its first heyday after World War II in corporations looking to improve their efficiency. What began with simple measurement of outputs for industrial systems has evolved into the more sophisticated art of measuring performance to motivate employees, allocate investment, and identify areas for improvement. In addition to measures of output and activity, performance measurement is also well known for tools like Total Quality Management and Six Sigma, which were developed to improve quality and reduce variability and errors.

Performance measurement is defined as "the formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities." (Simons 2000) This includes such activities as strategic planning, data collection, institutional structures and incentives, resource allocation, and strategic response. In companies that most effectively employ performance measurement, the information and metrics collected map directly to the company's strategy and also provide feedback on the effectiveness of strategy implementation as well as the validity of the strategy itself. Another article on the topic defined performance measurement as the process by which a company "manages its performance in line with its corporate and functional strategies and objectives. The objective of this process is to provide a proactive closed loop control system, where the corporate and functional strategies are deployed to all business processes, activities, tasks and personnel, and feedback is obtained through the performance measurement system to enable appropriate management decisions." (Bittici, Carrie, and McDevitt 1997, 524)

The connection between strategy and performance measures is illustrated by this pyramid (ibid.) showing the crucial value of performance measurement for deployment and feedback in executing strategies:



Sophisticated performance measurement systems are most common in large corporations and organizations, as they provide a framework for allocating capital and incentives among multiple business units in a systematic way, communicating strategic priorities, and changing behavior within the organization to conform to the priorities of executives, and adapting to changing internal or external conditions. In fact, experts have questioned the benefit of performance measurement for early stage or smaller enterprises, where sophisticated data collection systems could divert critical resources (Neely, Gregory, and Platts 2005, 1255).

One important distinction made in the literature of performance measurement is distinguishing between performance measurement, performance measures, and a performance measurement system (ibid., 1229):

- *Performance measurement* can be defined as the process of quantifying the efficiency and effectiveness of an action.
- A *performance measure* can be defined as a metric used to quantify the efficiency and/or effectiveness of an action.
- A *performance measurement system* can be defined as the set of metrics used to quantify both the efficiency and effectiveness of actions.

Oftentimes, managers speak of performance measurement and metrics synonymously, but metrics are merely components of a larger measurement system, which is developed through a process that attempts to "quantify the efficiency or effectiveness" of actions or a strategy. For the purposes of this study, we are interested in the entire process (the "routines and activities") rather than focusing solely on particular metrics or data collection methods.

Another important point about performance measurement is that all measurement processes are not the same and not designed for the same purpose. Managers can design different systems and measures to accomplish different objectives, including to evaluate effectiveness of actions or strategies, to influence or control behavior within the organization, and to decide where to allocate resources.

An important take-away from this review is that corporate performance measurement systems are not just information collection systems – they are intimately tied to organizational structure and strategy. Moreover, systems can be designed for many different functional purposes to deliver information for different effects on different audiences (employees, managers, the public, etc.) When brought back to California water management and water governance, these points illustrate that performance measurement systems must be designed with a particular purpose in mind, as well as tied to a particular organizational strategy. One cautionary note, though, is that in the private sector, corporations can be swiftly reorganized, and strategies can be changed quickly. In the public sector, changing strategy or governance structure is a much longer process that often involves external stakeholders (legislators and the public), which explains why performance measurement can be more challenging in that context.

Balanced Scorecards

In the field of corporate performance measurement, one of the major new ideas, championed by Robert Kaplan and David Norton (1996a), was that of a balanced scorecard. The basic premise was that strictly financial measures of a company's success were a short-term, even lagging indicator of the company's strategic success, and that companies focused on these financial measures to their long-term detriment. In their words, "Most companies' operational and management control systems are built around financial measures and targets, which bear little relation to the company's progress in achieving its long-term strategic objectives. Thus the emphasis most companies place on short term financial measures leaves a gap between the development of strategy and its implementation." With its four "balanced" categories of indicators – financial performance, customer satisfaction, internal process management, and learning and growth – the balanced scorecard aims to incorporate indicators of strategic success, which would presumably also be leading indicators of ongoing financial success. Kaplan and Norton (1996b) also considered the specific

measures to be incorporated in each outcome category and stated: "a good balanced scorecard should have a mix of core outcome measures and performance drivers. Outcome measures without performance drivers do not communicate how the outcomes are to be achieved."

Given the multiple goals, long-term planning, and complex causality of water management, the balanced scorecard is a useful framework to consider for adaptation and application. In fact, as will be addressed later in this analysis, efforts to weigh outcomes and measures in different categories, such as water supply reliability and ecosystem protection, face many of the same challenges as balanced scorecards, where properly weighting different outcome categories is one of the chief stumbling blocks.

Governing for Results and Public Agency Accountability

Over the past two decades, there has been a dramatic increase in the emphasis and resources devoted to accountability of public agencies and programs, both at the state and federal level. Although the results are decidedly mixed, it's clear that the "good government" movement has changed the way that budget and program review processes take into account the performance of agencies.

In 1993, Congress passed the Government Performance and Results Act (GPRA) to "improve the efficiency and effectiveness of Federal programs by establishing a system to set goals for program performance and to measure results." (Senate Committee on Government Affairs 1993) The act required collection of three different types of reports from federal agencies – strategic plans prepared at least every five years, as well as performance plans and performance reports prepared annually. The government provided a template for the sort of performance indicators that should be used and reports. Reporting began in 1999. Under the Bush Administration, another performance-based regulation, the Program Assessment Rating Tool (PART), was introduced in 2002 to link performance to budgeting and "ensure that every government program identifies the outcomes it works to achieve, implements clear, quantifiable long-term and annual performance measures, and collects data on whether it is achieving results." (Gueorguieva et al. 2009, 227) Because it is used to evaluate the allocation of budget funds, PART is implemented at the program level, not the agency level, and every federal program has now been evaluated.

These federal reforms came at the same time that a movement for good government and public accountability was sweeping through the non-profit community, as well as state and local governments. Among others, the Performance Institute and Harry Hatry's group at the Urban Institute were major advocates for government accountability and authored many papers and reports documenting best practices and making recommendations for smoother adoption of public agency accountability.

In the state of California, this move toward "managing for results" began in earnest with the State Government Strategic Planning and Performance Review Act of 1994, which called on agencies to consider preparing strategic plans and the Department of Finance to review their activities. In 1998, the governor's budget letter required the following year's budget adjustments to consider each agency's strategic plan. Strategic planning and performance sat on the back burner until the mid-2000s, when the topic returned. The California Performance Review (2004) was convened by the governor to assess the state's governance, and the Little Hoover Commission (2004) published a report called "Governing the Golden State: A Critical Path to Improve Performance and Restore Trust." Both reports called for increased accountability, both in terms of enhanced strategic planning efforts and better monitoring and information systems for ongoing performance measurement. In the Little Hoover Commission report, lack of information in particular was called out as a primary culprit for the failure of reforms: "Good information is needed to produce good analysis, to thoroughly explore solutions and to support alternatives that arise through negotiations."

This rise in government focus on program effectiveness has been mirrored in the past two decades in the academic literature by a rise in literature on public performance measurement. In particular, some authors have sought to add nuance and caution to the mandate of "making government accountable," noting that

one-size-fits-all frameworks and vague mandates could actually have negative consequences for program efficiency. One prominent critic noted that "performance measures are frequently irrelevant – or worse. Used in isolation, they invariably reward and encourage the wrong activities and result in less, rather than more, attention to outcome and quality." (Perrin 1998, 367) Moreover, as performance measures were developed for the public sector, other authors noted that in the case of public agencies, there was a great amount of heterogeneity in terms of the kinds of outputs (completed actions) and outcomes (results) that agencies were responsible for. James Q. Wilson formalized this in his book *Bureaucracy* (1989) in which he classified a two-by-two matrix of types of political organizations in the government, depending on whether their production processes (or outcomes) where visible from the outside and whether their outputs are directly observable.

Another important contribution to the literature is the discussion of the purposes of agency performance measurement and how different purposes require different metrics and measures. Harry Hatry proposed his own list of possible purposes, which was refined by Robert Behn (2003): "From the diversity of reasons for measuring performance, I think public managers have eight primary purposes that are specific and distinct (or only marginally overlapping). As part of their overall management strategy, the leaders of public agencies can use performance measurement to (1) evaluate; (2) control; (3) budget; (4) motivate; (5) promote; (6) celebrate; (7) learn; and (8) improve."

He goes on to explain the different sorts of metrics (for measuring inputs, outputs, outcomes, etc.) that would be required to accomplish each of these purposes. Using a framework like this to lay out the specific applications of performance measurement helps to put a finer point on the practice in the context of performance measurement and to try to avoid agencies measuring everything at great cost or, conversely, trying to boil performance down to a single metric, which Behn notes is futile.

Scholars and experts seem to agree that the demands for accountability and performance measurement are not going away, but that the processes for public performance evaluation must be both tailored to the agency and its program goals. (The Obama administration seems to have taken a recent step in this direction by allowing agencies to define their own performance priorities, goals, and performance measures for their GPRA reporting. (Newell 2009)) Moreover, practices such as the use of strict performance-based budgeting based on quantitative outcome measures (without discretion) are discouraged.

In 2010, the federal Governmental Accounting Standards Board released "suggested guidelines for voluntary reporting" of "service efforts and accomplishments" or "SEA." The board offers "conceptually based suggested guidelines for voluntary reporting of SEA performance information that will help officials effectively communicate the government's SEA performance in a way that the public will find meaningful and understandable." But the guidelines did not include "establishing the goals and objectives of state or local governmental services, establishing specific nonfinancial measures or indicators of service performance, or establishing standards of or benchmarks for service performance." That is left up to agencies.

In the context of this larger movement, California water regulatory agencies, such as the State Water Resources Control Board and the Department of Water Resources, are good examples of agencies that have felt the demands for performance assessment and accountability, and have therefore been forced to struggle with the topic of what metrics to use to assess their own performance.

Ecosystem-Based Management and Adaptive Management

Turning to performance measurement in ecosystem-based management and adaptive management makes for a truly voluminous literature review. Since the 1970s and 1980s, these topics have emerged as popular frameworks for approaching natural resource issues with the goal of management regimes that integrate multiple goals outcomes, account for complex linkages of human and natural systems, engage stakeholders in collaborative management processes, and incorporate feedback based on science-based adaptive management and monitoring processes. This is not the place to summarize all of the literature on

this complex topic. (Some good sources to start with include Lee 1993, N.L. Christensen et al 1996, Walters 1997, J. Christensen 2003, Layzer 2009.)

What is worth discussing briefly is the crucial role of monitoring and performance measurement in collaborative ecosystem-based management. As Kai Lee notes in *The Compass and the Gyroscope:* "Monitoring is the environmental counterpart to financial accounting and reporting. It is logically part of the ordinary cost of doing business." (1993, 175) Many others have echoed Lee's comments to note the value of ongoing performance measurement (or monitoring and evaluation) in sustaining collaborative institutions over time, promoting adaptation, and allowing for the long-term "social learning" that Lee and others cite as one of the benefits of adaptive or ecosystem-based management. Another key point of debate in the world of collaborative management processes is how to define success. Douglas Kenney (2000) notes that many watershed-based collaborative groups have pushed away from monitoring and evaluation of ecosystem outcomes as the only measure of success, pointing at outputs or process metrics for success, such as "improved relations and trust among stakeholders and managers." These process metrics are helpful, in his estimation, only insofar as they serve as intermediate indicators of ecosystem outcomes, which are more difficult and expensive to assess.

The relevance of these frameworks in the context of California water systems starts with the Bay Delta. Layzer (2009) used the CALFED delta process as an example of ecosystem-based management in her book *Natural Experiments*, and the continuing Bay-Delta Conservation Plan development process and Delta Stewardship Council governance structure continue to work toward incorporating these frameworks. In particular, past and present Delta governance processes have been a test for the limits and critical factors for implementation of both collaborative and adaptive management principles (Kallis, Kiparsky, and Norgaard 2009). Moreover, California watershed conservation groups, watershed management processes, and state-funded integrated regional water management plans (IRWMPs) have elements of ecosystem-based management, although most of them fall short of being true adaptive or collaborative management.

Multi-Criteria Assessment and Integrated Water Resources Management

The next frameworks considered and examined were multi-criteria assessment tools and integrated water resources management. Multi-criteria assessment (MCA) tools are generally decision support tools using decision frameworks and model outputs to evaluate alternative options. The discipline of MCA requires settling on a decision framework and analyzing options based on that framework. The framework serves to establish "the transparency, auditability and analytic rigor of these decisions." (Hajkowicz and Collins 2007) It is not unlike an engineering-oriented version of the balanced scorecard in that it incorporates the ability to weigh performance along multiple objectives. Because of the complexity of systems, researchers have found that MCA is quite often used in the context of natural resource management, and, in particular, in water (Romero and Rehman 1987).

A particular, somewhat vaguer relative of multi-criteria assessment is Integrated Water Resources Management (IRWM), a popular buzzword in the field of water management. The Global Water Partnership's Technical Advisory Committee (2000) defined IRWM as "a process which promotes the coordinated development and management of water, land and related resources in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems." Because of the expansive scope of this definition and the unarguable premise of coordination and integration – in theory, at least – IRWM is a concept much cited in the literature and discussed by practitioners but very rarely connected with practical efforts on the ground. One particularly acerbic critic (Biswas 2004) noted, "The question then arises is whether this well-intentional and good-sounding definition has any real meaning in terms of its application and implementation to improve existing water management, or is it just an aggregation of trendy words which collectively provides an amorphous definition which does not help water planners and managers very much in terms of actual application of the concept to solve the real life problems." Biswas goes on to note flaws with the model such as ambiguity about what exactly is

being integrated, the institutional barriers to integration, and the dangers of lumping all "IRWM" processes under a single framework when particular local institutional, social, and ecological conditions are so critical to management schemes.

Performance management for water systems in California clearly draws on elements of multi-criteria decision analysis and the integrative instincts of IWRM. In fact, the Department of Water Resources evokes IRWM in their its bond-funded Integrated Regional Water Management Planning grants, as well as in the State Water Plan itself, which is branded "Integrated Regional Water Management." When approaching this topic, it's helpful to have a handle on these generic frameworks, as well as a healthy skepticism of their applicability and usefulness.

NGO Accountability, Logic Models and Impact Assessment

Over the previous twenty years or so, various factors including the emergence of more large philanthropic foundations and a cultural shift toward more accountability in the non-profit world have resulted in more sophisticated models of performance measurement being employed both by foundations and their non-profit grantees. A whole language has emerged in the field, with organizations defining their "theory of change," "logic chain" or "logic model" to explain how "inputs" and "activities" can lead to "outputs," "outcomes," and "impacts." This logic model should explain a non-profit's intended impact and strategy to get there (McLaughlin and Jordan 1999). Much like corporate performance measurement, the performance measurement systems in non-profits should map to their strategies – however, resources for measurement are more meager, and NGOs struggle to allocate resources between accomplishing program work and measuring, documenting, and reporting what they've done.

One of the most active areas of discussion in non-profit performance measurement is the appropriate mix of measuring outputs (measures of completed activities) and outcomes (the desired effect in the world). Outputs tend to be relatively easy to measure, but outcomes and impact (the specific program effect on the outcome) are quite difficult. As Paul Brest and Hal Harvey (2008) put it in *Money Well Spent*, "Most efforts at social change are like a tug of war, with the forces for change pulling on one side of the rope and all the forces causing the problem pulling on the other. It's often hard enough to know if your team has won, let alone whether it would have won if you hadn't been tugging." A recent Harvard Business School working paper on the topic (Ebrahim and Rangan, 2010) noted the pressure on non-profit managers to "measure results as far down the logic chain as possible: outcomes and impacts," but concluded that this was not necessarily a productive impulse: "It is not feasible, or even desirable, for all organizations to develop metrics at all levels on the logic chain. The more important challenge is one of alignment: building systems and structures for measurement that support the achievement of organizational mission."

The struggle to decide where on the logic chain to measure is not unique to the non-profit sector. In water management, causality is often convoluted, but the pressure for accountability is nearly as strong as it is in the general philanthropic community, as we will see in the case studies laid out below.

Factors in Success of Performance Measurement in California Water Systems

Because this analysis is broad-based, we encountered and evaluated institutions and systems at many different geographical scales with different mandates, different intended objectives, different sources of funding, and different audiences. We took the evaluation of performance measurement of California water systems to be everything from the performance of local water supply systems in providing safe, reliable, and affordable water supply to a watershed group achieving restoration of flow in a local river, to the statewide evaluation of water management effectiveness in exercises such as the Department of Water Resources Water Plan. Having looked at the many different levels of water management, though, we began to see patterns emerge in the efforts that were most successful and those that seemed to be more embattled. Moreover, after

scouring the literature on performance measurement, we borrowed frameworks from other fields to classify barriers or pitfalls for effective performance measurement, which fall into six categories:

1. Complexity of Causality in Outcome Response

Managing natural watersheds and human infrastructure are very different challenges when it comes to performance measurement. Operating a dam, reservoir, or treatment system and anticipating its effects is fairly routine – causality is well defined and the system responds. In the case of managing natural freshwater ecosystems, management actions and interventions are typically much more complicated. For example, anadromous fishery restoration could certainly be improved by efforts to improve the timing of flows, water temperature, water quality, and stream habitat; however, ocean conditions or predation could partially or completely counteract the effects of those restoration actions. This is the primary reason that urban water managers can institute complex performance control systems, but watershed managers or environmental regulators struggle. A simple prerequisite to outcome measurement is "a chain of logic demonstrating how their various projects contribute to communitywide outcomes." (Campbell 2002) This is the sort of logic chain that the Bay Delta Conservation Plan is tasked with developing and struggling with.

2. Latency and Gestation of Outcome Response

If the true measured effects of work will not be measured for years or decades, performance measurement becomes much more challenging. Ambient water quality results often lag well behind management actions, but biological indicators tend to take even longer to respond. A classic case of this performance measurement challenge is the challenge of measuring the impact of the investment in fundamental research, which is sometimes not appreciated until years or decades later after the results of the research have been verified and the applications are well understood (Feller 2002).

3. Good Faith and Trust

"Do no harm" is a principle one commentator suggested for performance measurement, highlighting how important the intent of the measurer is, as well as the working relationship between the institution reporting information and the one using that information for evaluation (ibid.). If there is a (perceived) adversarial relationship with compromised trust, measurement will be much more difficult, because the subject of measurement will do whatever in its power to muddle, confuse, or hide information that might show negative results. Applications to measurement in the California water context is obvious as "opposing" or "competing" stakeholders bristle at attempts to gather more information, if only because of a lack of trust in how that information will be used.

4. Clarity of Organizational Mandate and Strategy

It would seem to go without saying, but clarity of organizational purpose, desired outcomes, and strategy for achieving those outcomes could have a real impact on the effectiveness of performance measurement implementation. In the context of California water, state agencies often have overlapping jurisdiction or, in the case of the State Water Resources Control Board, might have regulatory authority to manage much more than they are able to practically manage with the resources, will, and political capital at their disposal. Ambiguity of this sort inhibits effective performance measurement. For it to work, "agreement must be established among sponsors, users, and performers about organizational objectives, and consequently about the specification and measurement of outputs and outcomes." (ibid.)

5. Causality and Observability of Output or Outcome Measures

In other cases, causality is difficult to determine. Not every output or outcome is measurable, which makes performance measurement more difficult. For example, there has been a great amount of debate about

the number of jobs lost as a result of the reduction in water supply to the Central Valley in 2009 (Michael et al. 2010). If incremental jobs from water supply decisions were a performance measure, it would be incredibly difficult to measure.

6. Culture and Leadership of Organizations

The culture and leadership of organizations can largely determine how receptive they are to the institution of performance measurement. An organization is more likely to effectively implement performance measurement if it has strong leadership and a culture that embraces transparency, learning, and even tolerates failure.

Case Studies in Measuring Performance of California Water Systems

The following case studies of performance measurement of water systems and institutions in California were conducted through interviews with members of the institutions, processes, and agencies involved, as well as a review of public documents pertaining to particular attempts to institute performance measurement. Because it is a broad look at the institutions involved, more in-depth study is warranted, but the goal of this survey was to uncover trends, themes, and key issues, and identify opportunities for improvement and reform.

Case Study 1: State and Regional Water Boards

The State Water Resources Control Board (SWRCB) and the eight Regional Water Quality Control Boards (RWQCBs, and collectively with the SWRCB known as "the Water Boards") have authority over the state's water quality (surface and groundwater), water rights administration, and the public trust resources held in the surface waters of the state. The boards, therefore, possess broad regulatory authority, although they have historically been hesitant to exercise its authority for fear of political fallout. The members of the SWRCB are appointed by the governor and have historically been subject to replacement if the Board were to address a politically sensitive issue in California water (such as regulating groundwater).

Because the boards are tasked with state implementation of the Federal Clean Water Act, which requires annual progress reports, they are accustomed to the notion of reporting. These annual reports to EPA contain progress information on all of the state and regional boards' various clean water activities (e.g. State Water Resources Control Board, California Regional Water Quality Control Boards, and California Coastal Commission 2007). However, the SWRCB's more intimate relationship with performance information has come within the last two decades. The State Board issued its first strategic plan in 1995, shortly after the state's Strategic Planning and Performance Review Act. It was followed by revisions in 1997, 2001, and 2008. The goal of these efforts was to articulate the boards' purpose and connect it to specific goals. From the 2001 plan to the 2008 plan, it is clear that the State Board's approach to strategic planning and performance measurement has become more sophisticated, mainly in terms of the logic and scope of the plan. The 2008 plan incorporates fewer, more targeted actions, which are tied to priority and goal areas, and more importantly, rather than throwing in performance measures as what seemed like an afterthought to the strategy in 2001, the State Board has developed a separate performance reporting process to measure both outcomes and outputs.

The boards' current approach to performance reporting could be classified in four areas: output-level metrics in 7 key activity areas (plan and assess, regulate, clean up, enforce, fund, allocate, targets), outcome-level measures of water quality, progress toward completion of the strategic plan, and reviews to assess the effectiveness of specific programs (State Water Resources Control Board 2010a). The first area, output-level metrics, is actually where much of the boards' work has been focused thus far. State and regional level actions in every regulatory category are logged in the boards' CIWQS database and rolled up into reports that show how many actions the boards are taking in each category. Moreover, in the 2009-10 fiscal year, each regional

board set targets for actions taken in each area, and a report card was produced showing how each regional board performed against their targets. Although on the public website, the State Board has yet to evaluate each of the regional boards with an aggregate score or "grade," these "grades" have been distributed internally to the regional boards, causing some consternation because of the boards' frustration about how these outputs are counted inconsistently. Clearly this system of output measures (some call this "bean-counting") serves the board well in terms of directing the state and regional staffs in implementation of plans and priorities. It does not give staff much freedom to respond to changing conditions, but considering the regulatory purpose of the boards, that may not be necessary.

The State Board's measurement of outcomes is reported on the MyWaterQuality website, which is managed by the California Water Quality Monitoring Council. The site is the result of a movement toward consolidation of water quality monitoring across the state. In 2000, the California legislature mandated that the Water Boards centralize their water quality data collection, which resulted in the Surface Water Ambient Water Monitoring Program (SWAMP) (State Water Resources Control Board 2011a). Then, in 2006, the legislature mandated the coordination of water quality monitoring beyond the State Boards to the other state and local institutions collecting data in the field, which resulted in the creation of the California Water Quality Monitoring Council (CWQMC). The MyWaterQuality site is organized around questions that the public cares about, such as "Is it safe to swim?" "Is it safe to eat the fish or shellfish?" "Is the water safe to drink?" and "Is the ecosystem healthy?" This portal, which is driven largely by Water Boards data, is the public entry point for what is planned to be a coordinated database of environmental information from various state and local agencies and other groups with monitoring data ((State Water Resources Control Board 2011b). The State Board was heavily involved in the development of the site, which is clearly on the right track in terms of presenting data to the public on topics they care about, although the current design, presentation of data, and links to external sources are fairly clumsy.

The SWRCB also measures implementation of its strategic plan. In 2010, the State Board published a plan update and lists all the actions in its current strategic plan with a status and target date of completion (State Water Resources Control Board 2010b). Clearly, the continuity and public reporting of strategic plan information is a motivator for staff to take strategic actions in the same way that the output measurement is a motivator to take regulatory actions.

Finally, the Water Boards announced this year that they were beginning a full programmatic review to "identify problems, understand the declines in performance, and to strengthen these programs through improvements." (ibid.) They had identified three programs to start with and would work their way through all the Water Boards' programs. Given the ongoing measurement of outcomes and outputs, these in-depth examinations may be a good forum to bridge the gap and understand the reasons for decline in output or outcome metrics and adjust the strategic approach accordingly.

Little Hoover Commission Report

All of this work to implement more comprehensive performance measurement processes, though, did not keep the Little Hoover Commission from issuing a generally scathing report about the State Water Boards' ability to regulate water quality in California in 2009. In the context of emerging water quality challenges such as storm water pollution and agricultural runoff, the commission took the boards to task for failing to effectively coordinate the state and regional offices, failing to prioritize actions to achieve outcomes efficiently, and failing to collect and analyze data sufficiently. The commission's recommendations were remain as outstanding issues nearly two years later, although the board is clearly trying to work toward addressing them. They will be addressed more in the following sections.

Connecting Outputs to Outcomes

Interviews with board members and staff discussing performance measurement left little doubt that connecting outputs to outcomes is the main challenge facing the state water boards. The process of integrating performance measures into the boards has been painful and slow. And there is still a real gap between outputs and outcomes. (Outputs are bean counts or function counts. Outcomes are things like beach water quality reporting.) Board members and staff acknowledge their work should be based on how outputs change outcomes. The effectiveness of TMDLs, for example, shouldn't be judged on the number of permits, but achievements in terms of water quality. It's easier to link performance measurement to actions in the near-term, but the long term is harder to grasp. Results can take a long time to gestate. While the State Board knows it has to solve this problem, it hasn't made much progress toward doing so, which is borne out by the gap between outputs and long-term outcomes in the board's performance measurement system. What are missing are intermediate-term outcomes or conditions that might be leading indicators of changes in long-term outcomes.

Furthermore, prioritization of the most important or most-used waters (or discharges) might give the board a way to prioritize regulatory actions to see progress on a subset of outcomes while working toward overall statewide improvement. The U.S. EPA gives incentives based on percentage and number of permits issued on time, for instance. But there is no focus on which permits are the highest priority. The same goes for prioritizing TMDLs. The board and staff realize they need outcome-related goals of fixing impairment, and to focus on ecosystems as a whole and prioritization of problems. This inability to prioritize was also echoed in the Little Hoover Commission report, which noted that one structural reason for this inability to prioritize was that the boards were largely funded by 74 different fee-based revenue streams, which all required board attention, and that the federal and state regulations they were tasked with enforcing mandated absolute standards to the detriment of prioritization (2009, 37). Moreover, the commission urged the boards to start considering cost and benefit as a way to prioritize regulatory actions. An example cited both in our interviews and the Little Hoover Commission report was the money and effort spent regulating mercury discharges from wastewater in the Central Valley and Bay Area, even though the vast majority of mercury in the watersheds originated from defunct mines in the foothills of the Sierras.

Data and Information Technology

Despite their recent focus on coordinating water quality data through SWAMP and the Groundwater Ambient Monitoring and Assessment Program (GAMA), and the California Water Quality Monitoring Council's efforts, there is still a recognized need by the board and staff that they need to continue to improve information systems, data aggregation, data analysis, and communication of that data to the public. The August 2010 launch of the California Environmental Data Exchange Network (CEDEN) may be a harbinger of good things to come, although it is entirely dependent on the quality, consistency, and extent of data that populates the database. The Little Hoover Commission still notes that the collection, digitization, and communication of data and scientific research still lags, and that the extent of current monitoring efforts is insufficient (ibid., 42-43). Although state central databases are improving, data management and use of information technology still lag at the regional level. For example, we found that basin plans created by some of the regions to manage beneficial uses are still only on paper or scanned copies, so the catalog of beneficial uses and contaminant thresholds are not available, either to the public or the regional boards, in digital form. One regional board we spoke to that was well regarded for its enforcement handled many basin plan issues entirely on paper maps. Clearly, the technological revolution at the boards is not yet complete.

There are some good signs, however. For example, the environmental group Heal the Bay uses water quality data from the SWRCB website to compile Beach Report Cards. This is a model example of how an agency can provide public access to data, so that third-party groups can analyze the data and present findings to the public. In this model, the State Boards can focus on regulatory and data aggregation functions, and let

researchers and interested organizations digest and interpret of the data for the public, which can in turn pressure for changes in regulation where desired.

Regional Water Boards

A final area of concern and interest in the Little Hoover Commission report, which also came up in our interviews with the Water Boards was coordination and resource issues pertaining to the regional boards. As the Little Hoover Commission (2009) put it, "The relationship between the state and regional boards is not well defined, leading to inconsistencies and inefficiencies among boards, an inability to set statewide priorities and a lack of focus on holding regional boards accountable for clean water outcomes." Our research confirmed these findings, although in the area of performance measurement, we actually found that the autonomy granted to regional boards could occasionally benefit the whole organization. For example, the Central Coast board has instituted reporting and performance measurement practices that were modeled and adopted by the State Board for the whole Water Boards organization. But this was an isolated case. Lack of information sharing between the state and regions was evident in discussions with other boards, which clearly lacked resources and the technical and personnel capacity to effectively execute policy mandates distributed down from the State Board.

Although the regional boards chafe at being held to account for output measures in the internal board scorecard mentioned above, the State Board has not even begun to think about holding regions to accountable for outcomes. That could be started by a wholesale revision of the regional basin plans, which is currently on the Water Boards strategic roadmap, an effort that the Little Hoover Commission report heartily endorsed.

Changes Needed from the State Boards

In order to have a more effective Water Boards organization, we recommend the following changes:

1) **Give the State Board more autonomy and insulation from political influence.** The board has suffered over the years because of being subject to influence by the governor whenever it took on a controversial political issue. Creating a way to insulate the board and give it more autonomy would help solve some of the performance issues, which are partially tied up in whether the board thinks it has the political backing to actually implement the water laws of the state.

2) **Improve prioritization of regulatory actions.** The state board needs to start tackling the connection of outputs to outcomes. Whether that means watershed-based permitting using data collection and modeling, or using multi-criteria analysis to identify high-priority water bodies, the board must begin to allocate resources where they will be most effective and efficiently utilized.

3) **Better coordination between the state and regional boards.** The Water Boards organization is a classic example of the problems of scaling water governance. The statewide regulatory body should be better at setting policy direction and prioritizing resource allocation, but the regional boards must have the ability to customize regulation to their own local circumstances. That said, the regional boards are in need of a lot of technical assistance, for which they will need to communicate more with other regional boards as well as centrally with the state board.

4) **Unification of information platforms, reporting protocol, and development of a data strategy.** The advent of the California Water Quality Monitoring Council is a good first step in trying to centralize all of California's physical, chemical, and biological water data, but it is just a start, and with all the pressing data collection needs in the near future, the process to centralize the data, assure adequate coverage, and make it available to third parties and the public at large is quite pressing.

5) **Change the culture.** More than once in our interviews with State Board members and state and regional board staff, we heard about the need to "change the culture" within the organization to one that will "solve problems" not just count beans. Unfortunately, the internal scorecard and annual performance measurement reports reinforce the regulatory culture, rather than one based on results. Although some outcomes will not be seen for years or decades, the board should look at ways to find and evaluate intermediate outcomes and celebrate successes in outcomes, not just timely regulatory actions.

Case Study 2: Department of Water Resources Water Planning

The Department of Water Resources manages a number of different facets of the state's water systems, most notably the operation of the State Water Project. However, it also manages the state's flood control programs, administers and allocates bond funding, oversees state urban and agricultural efficiency programs, has authority over groundwater quantity, provides data for a real-time view of the state's water supply system, and develops the state's water plan every five years.

Each of these responsibilities carries with it planning and measurement responsibilities. DWR's approach to strategic planning has been to use the State Water Plan update as a way of articulating overall state water strategy (since the 2005 update), and then to delegate strategic planning to each of its individual program areas large enough to require them. While DWR has a number of different performance measurement roles, for the purpose of this analysis, we'll focus on the Water Planning effort and data aggregation at the state level, since it represents the only real current statewide opportunity for comprehensive strategic planning and assessment.

Updated since 1960, DWR's Bulletin 160 State Water Plan updates have occurred approximately every five years and represent an opportunity to assess the state of water resource management issues in the state and project emerging resource constraints or concerns. Since 2005, the plan has served more formally as a strategic planning process, engaging external stakeholders from other state, regional, and local agencies, and institutions to develop a comprehensive water strategy for the state of California. Additionally, the plan has historically served as an occasion to gather data about water supply and use across the state, gradually developing more and more sophisticated techniques for collecting data and modeling to inform water management strategies. These data collection and modeling exercises have made the State Water Plan update one of the most used and cited sources of California water information.

Shortcomings of the State Water Plan in Strategy and Performance Measurement

Although the State Water Plan is a valuable exercise, it fails in several ways to deliver on its potential as a strategic and performance measurement tool. First, the consensus-based process used to generate the vision, mission, goals, guiding principles, strategies, and actions has created a monster of a framework that takes a catch-all approach rather than presenting a tight logic model of how certain inputs and actions could lead to specific outputs and outcomes. It's impossible to imagine that DWR or the state water agencies together could be accountable for such a broad plan. Even if they could be held to account, DWR has no authority to delegate actions and tasks to other entities and is unlikely to attain compliance unless the other agency is provided with a funding source. Moreover, some of the items in the various categories seem to be mislabeled. For example, the stated goal of the "state government supports integrated water resources planning and management through leadership, oversight, and public funding" seems much more like a strategy than a goal (Department of Water Resources 2009b, 2-12). The plan, rather, feels more like an implicit strategic document in that it lays out strategies from which one could deduce the real goals and desired outcomes of state water management rather than the actual goals and desired outcomes.

In the 2009 update, DWR failed to effectively track implementation progress of the 2005 plan, which illustrates the lack of consistency and lack of accountability in the State Water Plan. What DWR did produce

to show progress toward 2005 plan goals was a spreadsheet that roughly correlated the best-fitting implemented state water initiative to the implementation actions listed in the 2005 update. Some of the listed actions don't seem to fit (Department of Water Resources 2009c). This illustrates a missed opportunity to do what the State Water Boards do in their strategic plan updates and provide some accountability for accomplishing the strategic plan items that the agency recommends.

Finally, in terms of a performance measurement document, the State Water Plan fails to illustrate the outcomes of sustainable water management by laying out metrics or indicators that could be tracked to trace the state's path toward better water resource strategies. These indicators should not be terribly difficult to compile given the existing data collection effort that supports the water plan and the fact that many outcome metrics are included in the plan but not labeled as such. Moreover, a template of what these indicators might look like (or not) was already laid out by the Environmental Protection Indicators for California (EPIC) Indicator Updates, which published trend indicator data on key environmental management topics (including water) to managers and the public (CalEPA and California Resources Agency 2005).

DWR is not unaware of these shortcomings of the planning and performance measurement process, and on its set of planned enhancements for the 2013 Plan, the agency notes the desire to "develop new evaluation metrics and sustainability indicators" and "develop a California Water Management progress report." These enhancements would infuse the planning process with more continuity and accountability.

Water Plan as Information System

Until recently with the development of multiple (sometimes poorly utilized) databases of California water information, the California Water Plan update cycle was the best and only way to compile water data on a regular basis and evaluate the state's resource conditions. With the advent of CEDEN, SWAMP, the California Data Exchange Center (CDEC) and the Integrated Water Resources Information System (IWRIS), there is somewhat more data available digitally, but the state still has a long way to go on this front. Evidence of this issue abounds with no better example than the data collection and analytical effort that goes into supporting each water plan update. A successful data collection system would require analysis and processing, but would require much less primary collection work and deduction. While we praised the CWQMC earlier in this report, the council's mandate to streamline monitoring and data collection only extends to water quality issues, but the state's water data issues go beyond that one topic. In fact, both DWR and the Little Hoover Commission note that California needs better water information systems. DWR (2009a, 6-6) notes that "today, it is difficult to compare, much less integrate, information from different local entities to understand and resolve regional water management issues, and even more difficult to understand the statewide linkages." The Little Hoover Commission (2009, 74) also noted this lack of centralized and shared information platforms and recommended that "the state needs a water data library" or a water data institute, an idea mentioned in the report about the water boards, but nonetheless relevant to water quantity measures, as well. The Little Hoover Commission report on water governance (2010, 72) echoed this point, suggesting that the Water Board's division of water rights and DWR's planning division be combined to "bring together the state's existing data collection systems with the expectation that analysis of the combined databases would begin to build an overall picture of the state's water resources."

Critical parts of a centrally managed water supply and use database would include data from urban water management plans, agricultural water management plans, and data from integrated regional water management efforts, all of which will be discussed later in this report.

Changes Needed from DWR's Planning Effort

In order to have a more effective State Water Planning Effort run by DWR, the following changes should be made:

1) **Require centralized water use data reporting and improve data management.** Rather than spending precious work-hours reassembling data for the State Water Plan, DWR should move more toward the model of having the Water Plan be a living database that is updated digitally as information about state conditions change, but is only updated in print every five years. This would involve collecting much better centralized data on water use and water flows throughout the state. AB 1404 provided the impetus for a proposal from the Water Boards to create a Water Institute for Statewide Data Management, which has yet to come to fruition. Whether that institute belongs within the Water Boards or DWR, there is clearly a need for better collection of water supply and use data.

2) **Create a logic model to explain connections of actions to outcomes.** The existing framework of the strategic plan is the sprawling result of a consensus process rather than the kind of tight, logical "theory of change" one would expect from a sophisticated agency. This framework should be changed to illustrate cause-and-effect relationships

3) **Develop sustainability metrics to evaluate water management over time.** Although many water outcome metrics change very slowly, the five-year update process would be a great forum to introduce indicator trends to show how the state is succeeding or failing in water management goals over time.

4) **Track implementation of strategies.** There is no point developing a strategic plan if you don't bother implementing it. The only way for DWR to keep track of efforts statewide is to introduce a progress-tracking tool to evaluate which strategies have been fully implemented and which have not.

Case Study 3: Delta Restoration Efforts (CALFED, BDCP, and DSC)

Although it is not an institution, but instead a collection of organizations and stakeholders working on a massive ecosystem restoration project, the Sacramento-San Joaquin Delta restoration effort is one of the current efforts in California water management that could most benefit from effective use of performance measurement.

The ecological history of the Delta is a long and complicated one. The Delta was once a vast tidal estuary that had fluctuating levels of salinity and supported the largest salmon run on the West Coast. Through steady human development, the estuary has gradually been converted into a highly altered freshwater system through the draining of wetlands, construction of levees, agricultural development, and construction of the State Water Project and Central Valley Project water export infrastructure. As early as the 1960s and 1970s, the Delta began to show signs of stress on the ecosystem and decline of fish populations, and by the late 1980s and early 1990s, the ecosystem's condition had deteriorated to the point where fish species (Fall-run Chinook salmon and Delta smelt, in particular) were listed as threatened under the Federal Endangered Species Act, and pressure mounted to do something about their decline (Layzer 2008, 142-143).

The development of a separate governance structure for Delta ecosystem restoration was largely due to the failure of the State Water Resources Control Board to exercise authority through its mandate to protect water quality and administer water rights – because of political pressure from the governor and legal challenges to their decisions. Under threat of federal ESA regulation, the loose collaboration of the 23 state

and federal agencies involved in the Delta embarked on a decade long trial of ecosystem-based management processes in the Delta backed by both state and federal funding (Hanemann and Dyckman 2009).

Upon the slow and painful failure of the CALFED process, judged as such by a return of stakeholders to the courtroom, the governor requested a report on CALFED by the Little Hoover Commission, which was damning and helped set a new course for the Delta. (The commission's findings and recommendations will be covered later, along with other delta governance matters). The result was the governor's appointment of a Delta Blue Ribbon Task Force to begin to articulate a vision for the Delta. The legislature handed CALFED over to the Bay-Delta Authority for temporary stewardship before the evolution of the current management/governance structure.

Four individuals and institutions are currently leaders in overseeing the restoration of the Delta. The Bay Delta Conservation Plan is being developed by water users, agencies, and environmental groups with the goal of developing a habitat conservation plan that includes new through-Delta conveyance infrastructure. The 2009 water legislation package set up the Delta Stewardship Council, a seven-member independent body to oversee actions in the delta and to provide third-party objective evaluation of the Bay-Delta Conservation Plan. The Delta Protection Commission is charged with developing a plan that oversees the protection and preservation of ecological, social, and economic vitality of the Delta region. Finally, the State Water Resources Control Board has appointed a Delta Watermaster to manage water quality and water rights issues pertaining to the Delta region. Other agencies are involved in the reconstitution of a governance structure, but these are the key players, and they all have their own planning and performance measurement processes with slightly different perspectives on goals and how to define success. To give a sense of how difficult and important is the task of setting performance measures, this working paper examines CALFED's failure to establish effective performance measures and its role in the effort's overall failure, and then examine the current efforts by BDCP and DSC to establish clear goals and measurement systems.

CALFED: A Failure to Define Success

A post-mortem analysis of the failure of CALFED often focuses on the governance factors involved. A Little Hoover Commission report (2005) pointed first and foremost to the lack of leadership and authority, noting that: "One lesson from the last few years is that there is no substitute for leadership – certainly not structure or process. A good governance structure will focus the authority and responsibility on leadership positions." With CALFED, the involvement of so many federal and state agencies created the effect of diluting both authority and responsibility. Others have pointed to the retreat of federal agencies from the process in the early 2000s as doing great damage to the cohesion (and funding) of the effort. Certainly, the governance mechanisms were flawed, and the state government has reconstituted the Delta restoration effort to reflect these lessons.

A somewhat less common but compelling point of view is that the CALFED effort failed due to shortcomings in its strategic planning process. There were two components of this failure. First, CALFED was unable to set specific goals for the restoration effort and instead fell back on the platitude of "getting better together" by "achieving environmental protection and provide meaningful regulatory stability for users of the Bay-Delta resources." (Layzer 2008, 146) In Layzer's view, because CALFED continually fell back on broad goals and emphasized achievement of mutual goals, the effort failed to engage in serious trade-offs or sacrifices that would be required for real progress. Indeed, Hanemann and Dyckman (2009) propose a "zero-sum game" model for water supply and ecological tradeoffs in the Delta, noting that "in such a game, any equilibrium leaves at least one group in the position that it can do better for itself by dropping out and going it alone." In such a situation sacrifices need to be made, which has implications for governance and planning, and also exposes the serious limits of "getting better together." In a situation where sacrifices must be made, much clearer goals and objectives must be set, so that there is a framework other than consensus for decision-making. In the vagueness of goals for the CALFED effort, one can see the echoes of today's "co-equal goals" and the potential pitfalls of leaning too heavily on such a malleable concept.

In addition to the deficiencies of the planning and goal-setting process, Layzer notes that CALFED's approach to performance measurement was also limited. Several years into implementation, it was "difficult to assess progress toward ecological health and would have been impossible to manage adaptively because the program neither adopted performance measures nor adequately funded monitoring." Even where measures were adopted, such as in the Ecological Restoration Program, it was too difficult to get consensus on outcome-level metrics, so the program relented and measured outputs instead (Layzer 2008, 159-160). The Little Hoover Commission's report on CALFED (2005) echoed all of these points and went further, proposing a reformed CALFED governance structure that "is strategic, performance-based, and accountable for outcomes." In terms of specifics, the commission recommended a robust strategic planning process, annual progress reports and strategic plan updates, and performance-based budgeting. The message was clear: the next Delta restoration restart should rigorously focus on performance measurement.

Assessment of Current Delta Institutions

Assessing the improvements that BDCP and DSC have made to performance measurement processes is a bit premature, given that the resulting plans are still to be created, but an early look at the draft documents and meeting materials shows that both efforts are taking their responsibility for performance measurement seriously.

BDCP is the more substantive example to consider, given that the habitat conservation plan development started in 2006 and more than $140 million has been spent on consultants, staff, and scientific research to support the effort. Among the stacks of material, the skeleton of plan exists in a logic chain, which ties together goals and objectives, conservation measures, anticipated effects on stressors, potential adverse effects, and performance metrics. Such a systems model of a complex ecosystem like the Delta is an audacious and groundbreaking effort, and although the logic chain still seems to have some kinks to work out, the principals and staff should be commended for taking on an effort that CALFED did not dare to take. An August 23, 2010 consultant review of the logic chain revealed, however, that there were still shortcomings. BDCP goals and objectives needed to be more clearly articulated and tied to the rest of the logic chain. Performance metrics had largely not been clearly developed. Moreover, there was still work to be done to connect local and regional efforts to more global effects in the ecosystem, to the best of the group's ability (Reed et al. 2010). The development of the robust scientific logic chain and effects analysis is encouraging, but the biggest red flag is the continued lack of clearly articulated conservation goals and objectives.

As of this writing, the Delta Stewardship Council's strategic plan and development of performance measures for the Delta is still "under development." (Delta Stewardship Council 2011, 31) The council faces a daunting task. Since the Delta Vision Blue Ribbon Task Force (2007), the mantra and state policy for Delta oversight has been the "co-equal goals" articulated in the draft plan as "restoring a healthy ecosystem" in the Delta and "promoting a more reliable water supply." (Delta Stewardship Council 2011, 24) Unfortunately, at this level, the mantra of "co-equal goals" is barely more helpful or specific than CALFED's "getting better together." The Delta Stewardship Council is tasked with more precisely defining these "co-equal goals" for the Delta and attempting to assess whether the habitat conservation plan, EIR, and EIS produced by BDCP meet those goals. The draft Delta Plan also states that for each of the plan's yet-to-be-defined performance measures, the Council will "establish a measurable target to be achieved at specified times" and that "those targets shall be a basis for action under the adaptive management" required by the state Water Code (ibid.). This is, indeed, a clear articulation of how to implement a performance measurement system. But, if this iteration of Delta restoration is to succeed where CALFED failed, the council will have to make courageous choices and have the authority and legitimacy to stick by those choices.

Changes Needed from Delta Efforts

In order to enable interventions and governance in the Delta that surpass the effectiveness of CALFED and ensure ecosystem restoration and water supply reliability for future generations, the following changes should be made:

1. **Early Definition of Co-Equal Goals.** The use of "co-equal goals" as a consensus term has fostered a productive relationship between the environmental community and water users, but now that the governance structures are in place, it's time to put specific objectives and goals to that phrase. During interviews, stakeholders repeatedly mentioned PPIC reports on the Delta as influential in moving the debate about conveyance from "if" to "how." Independent, non-partisan groups will have to lend similar voices to the debate about what "co-equal goals" really means to move the debate forward toward productive compromise.

2. **Streamline Organizational Strategies and Performance Measures.** Given the number of different players involved in the Delta with different mandates, it is critical that the Delta Stewardship Council take the lead in coordinating the goals, performance measures, and monitoring programs once plans are in place.

3. **Development of robust scientific research and monitoring databases.** The Interagency Ecological Program and Independent Science Board, respectively, must work to consolidate and digitize historical and future research and data related to the Delta ecosystem to ensure that decisions continue to be based on the best available science and that no money is wasted on science and monitoring programs. The San Francisco Estuary Institute is a model of a research group that has done this well.

Case Study 4: Urban Water Agencies

California's urban wholesale and retail water providers are another key piece of the water management picture in the state, and they have a difficult task: to provide clean water to growing urban areas when many of the natural water sources they rely on are becoming increasingly unreliable. As it becomes more difficult to export water from the Delta or pump water from the drought-stricken Colorado River, water managers are working hard to fill the gaps through transfers, water recycling, more water storage, and better utilization of groundwater resources, among other tactics.

Empowered by their important mission and their ability to monitor and measure the water infrastructure at their disposal, large urban water managers are deploying performance measurement and control systems that are nearly as sophisticated as those in private sector firms. When we asked about performance measurement, we heard over and over from water managers at large wholesale and retail districts that they have all the information they need. They are awash in data – about operational performance and economic efficiency, water use efficiency, water quality, and supply constraints. If anything, the struggle is to pare the voluminous data sets down to reveal the most important and revealing trends or issues.

Urban water managers use data and performance measurement in three key areas: internal goals, which include operational metrics like outages, "wrench time," and no water quality violations; external metrics, which have to be communicated with stakeholders, such as water rates, efficiency metrics (for the 20x2020 legislation), or financial information for bond rating agencies; and, finally, planning, which includes the state-mandated Urban Water Management Plans (UWMPs) or an equivalent process to project future conditions.

For the purposes of this analysis, we focus mostly on the practices of medium to large municipal water providers, although we recognize that there is a great gap in resources and technical capacity from the

largest agencies like Met to small retail utilities that supply water to small communities throughout the state. Moreover, some of these small water providers in rural parts of the state fail to provide drinking water that consistently meets state water quality standards – an issue that we will not address in detail here, but one that clearly needs to be addressed.

Clear Organizational Goal Motivates Performance Measurement

Whereas state ecosystem restoration efforts and water planning efforts struggle to define goals, the purpose of water supply agencies is crystal clear: to provide "safe, high quality water," "highly reliable water supplies," manage "efficient use of water," and provide water at "reasonable rates" while still ensuring financial viability. These principles are articulated in the California Water Utility Commission's "Water Action Plan" (2005), but they also echoed the information we heard from water managers. If one accepts that the first step toward effective water management is clearly stating a manageable set of goals, then the urban water management sector has a leg up in that regard.

Internal Reporting and Benchmarking

Perhaps the area where urban water wholesalers' and retailers' performance measurement systems are best developed is in the area of internal reporting and control systems. Before outlining some of the tools that they have developed and used, it bears mentioning that the culture of these agencies is receptive to metrics and performance analysis, since the vast majority of employees are engineers, who are well-acquainted with the notion of process control. This cultural acceptance of performance measurement should not be underestimated.

Apart from all of the individually tailored performance measurement systems that utilities used to evaluate their performance, they also referenced useful external sources of benchmarking tools, such as the Effective Utility Management principles that were developed in a collaborative effort by the Association of Metropolitan Water Agencies (AMWA), the American Public Works Association, the American Water Works Association (AWWA), the National Association of Clean Water Agencies, the National Association of Water Companies, the United States Environmental Protection Agency, and the Water Environment Federation (Effective Utility Management Steering Committee 2007). The framework includes 10 attributes of an effective utility and 34 sample indicators or metrics. In addition to this overarching framework, water managers often turned to AMWA and AWWA for ideas for benchmarking and performance measurement, as these associations published journal articles and reports for practitioners focused on sharing best practices for urban water management. Other resources for performance measurement included the California Urban Water Conservation Council's best management practices, as well as water rate surveys conducted by both Black and Veatch and AWWA.

Informed by these external sources of performance measurement and benchmarking practices, the urban water managers we spoke to described employing an array of different internal performance measurement systems. In addition to common utilization of external annual financial and operational reports as a way to organize collection of information, they described keeping track of a set of key operational metrics in a dashboard format to track on an ongoing basis. Metrics tracked included everything from water quality violations, wrench time, maintenance costs, system losses, storage status, and consumption trends. The Santa Clara Valley Water District has gone beyond standard operational metrics and employs new techniques for performance measurement, including the adoption of a balanced scorecard, as well as pursuing ISO 14001 and 9001 to demonstrate and execute their commitment to environmental stewardship.

From the standpoint of internal operations control, it was clear that these large districts and utilities had all the information they needed to manage their operations on a daily basis. That said, when it came to reporting that information for other stakeholders, they and some of their counterparts fell short in key areas.

External Reporting and Benchmarking

Districts and utilities seemed to struggle a bit more when it comes to reporting information to external stakeholders – particularly to customers, regulators, and even board members.

In communicating information to their customers, water suppliers seemed to have two goals: to provide information to consumers that would effectively motivate them to conserve and to get consumers to accept rate increases needed to keep the utilities financially viable. The managers we spoke with suggested that the utilities were much more adept at the former than the latter. The Metropolitan Water District's "fuel gauge" is its most effective external metric (Metropolitan Water District 2011).

This "fuel gauge" was the centerpiece of a conservation campaign in 2008 and 2009 that included television advertising and communications through the Met's member utilities. The results of these conservation programs (in addition to water rationing) had significant results. In San Diego, water consumption was down 11 percent in fiscal year 2010, more than the 8 percent target (Lee 2010). The success of temporary conservation programs like this is critical to long-term water supply reliability, and for the most part, California urban utilities have shown the ability to go to their consumers and get these savings when needed.

Another way that water managers provide their consumers with performance information is the Consumer Confidence Report (CCR) required by the Safe Drinking Water Act, administered by EPA and the state Department of Public Health. Utility managers, however, have very mixed feelings about this tool. In its currently mandated format, the CCR is nearly unreadable for consumers – the chart in which water quality information is conveyed is not designed to be easily interpretable. The rest of the report is often so verbose or in such small font that it is hard to imagine a customer reading it. Urban water managers acknowledge that they don't really gain much from this communication channel. The CCR does serve to signal to consumers that they are providing information. However, from the water manager's standpoint, it might be best if their consumers don't know how to interpret the reports and don't bother reading them. Consumers might become concerned about detailed information regarding variances in water quality that they don't know how to interpret

Water managers acknowledged, however, that they have great difficulty convincing boards, city councils, and customers to accept or approve needed rate increases. As supply reliability decreases, water suppliers are forced to turn to either water conservation efforts or expensive supply options such as water recycling and desalination. Either of these measures increase rates – the demand-side measures because fixed costs are spread over fewer units, and the supply-side measures because of the cost of financing water projects. In other words, rates are on an upward trend, but customers and other stakeholders do not often

respond well, often feeling like the utility or district must be in the financial hole because of fiscal irresponsibility (Batra 2010). Urban water managers recognize the need to communicate information to consumers that explain the need for rate increases and makes them realize that a lot of hard work and investment is required behind the scenes so that water came out of the tap when they turn it on.

For private utilities and special districts this difficulty in persuading constituents to accept rate increases can actually affect bond ratings. In fact, the CPUC has spent a good deal of time communicating with Wall Street bankers to assure them that the private water utilities will be able to include conservation and supply augmentation programs in their rate bases. A drop in bond ratings could affect a utility's cost of borrowing, which could actually send them into a classic corporate "debt spiral."

In addition to these forms of external reporting, the water utilities and wholesalers are required to report conservation programs and water quality information to the state government. Signatories to the California Urban Water Conservation Council's MOU have to report compliance with the 15 urban water conservation best management practices (BMPs) and the council (2011) is developing a web-based service for this reporting. Furthermore, all retail utilities have to report their CCR information to the California Department of Public Health, so that it can be evaluated for compliance and aggregated to send to the U.S. EPA. Although most agencies take these reporting requirements seriously, the general lack of public availability and utilization of this data means that these requirements do not necessarily result in another level of accountability for urban water agencies.

Urban Water Management Planning

Another example of performance measurement for urban utilities is California's Urban Water Management Plans. The Urban Water Management Planning Act of 1984 requires urban water suppliers who supply more than 3,000 acre-feet retail or wholesale or have more than 3,000 retail connections to submit an urban water management plan to the Department of Water Resources every five years (Department of Water Resources 2006). These plans are thorough descriptions of various aspects of the utility or district's supply system, portfolio of sources, demand projections, adoption of conservation BMPs, supply projects, reliability assessments, and drought contingency plans. Many agencies use this process as a focus for an internal strategic planning effort, although a few others have separate internal processes. For example, the Metropolitan Water District creates an Integrated Resource Plan, which has slightly different components and tends to focus much more on the contingency plans and supply-demand scenarios.

Compliance with the Urban Water Management Plan is required for eligibility for state funding of water projects, but even with that carrot only 344 of 406 eligible suppliers had completed the 2005 plans (due in January 2006) by December 31, 2006. The Department of Water Resources had the resources to examine only 139 plans by the time it submitted its report to the Legislature on December 31, 2006, and 100 of the plans were deemed to be incomplete in terms of the information provided (ibid.). A sampling of plans, which are posted on DWR's FTP site, reveals the broad range of data quality and availability, as well as the quality of analysis.

Sadly, the Urban Water Management Plans represent one of the best examples of inefficiency in state reporting, data collection, and performance measurement. There is a significant amount of money spent on preparation of UWMPs. Most water suppliers hire engineering consultant firms to prepare the reports, because of the specific format and reporting requirements. Those firms then collect data from the suppliers, put it in a report template, and submit the plan in PDF form. The data in the plan is not aggregated into a state level database to be analyzed. DWR receives the plans and, by law, is required to analyze them and report the analysis to the legislature, but because of the length of the plans and the barebones staff at DWR, the majority of plans go unread. Although some independent institutions have attempted to use the UWMPs to analyze urban population growth, supply, and demand projections, these plans are largely unused (Hanak 2005).

Meanwhile, there's a question how much these plans are truly operationalized in some water suppliers, or whether they just view it as a regulatory requirement and another box to be checked off. During the drought of 2007-2010, many urban suppliers pleaded for drought assistance, and when they were asked about their UWMP contingency plans, they admitted that they didn't have implementable contingency plans.

If the UWMP doesn't serve its planning purpose for some suppliers, it also doesn't serve an effective data collection purpose for the state. DWR also publishes the State Water Plan every five years, and in that plan, they do aggregated projections of urban water demand. However, rather than use data from the UWMP, which is not easily scraped from the documents, they instead gather data from a separate survey, which asks many of the same questions. Moreover other similar surveys of urban demand, supply, and conservation practices are also gathered by the Department of Public Health and CUWCC. In their 2009 Water Plan, DWR recognizes the inefficiency of the data collection: "Easily retrievable, standardized, and comprehensive baseline data about California urban water use are not available." The plan goes on to note that DWR "agreed to begin the effort of improving information exchange by exploring how information produced for UWMPs could be used more effectively to support regional and statewide planning efforts." (Department of Water Resources 2009a, 3-30) Moreover, the plan also notes that AB 1404 tasked the SWRCB with studying the feasibility of creating a coordinated database for state water management. The report was delivered in May 2009 with a strong recommendation to proceed, but has not yet been acted upon.

Although the UWMP planning process could be improved in some agencies, the state also owes it to the urban suppliers to make better use of the various sources of data and get rid of the redundancy in reporting. A streamlined process would save time, save consulting fees, and more importantly, improve the state's water information dramatically.

Recommendations for Improvements in Urban Water Performance Measurement

In order to improve performance measurement for urban water suppliers and their stakeholders, the following changes should be made.

1. **Mandate streamlined annual urban supply, demand, and conservation data.** The recent water legislative package requires new urban reporting as part of the 20x2020 initiative, which creates a perfect impetus to streamline centralized reporting of urban water data to all the water agencies that need the information, as well as the public. UWMPs could be streamlined to reflect strategies rather than data collection, which would make the reports less onerous to prepare and read.

2. **Aggregate Safe Drinking Water Act reporting at the state level and present the information to the public.** CCRs are prepared by 1660 water providers in California, and their customers receive copies of those reports. However, many of the Californians who still do not have safe drinking water are some of the state's more politically marginalized residents. Publishing water quality data in a public database would increase accountability for the suppliers and state regulators to ensure all Californians have safe drinking water. Moreover, the Environmental Working Group's report (2009) on urban drinking water quality shows the value of aggregated water quality information to better educate the public.

3. **Redesign the CCRs to be an informative and useful communication tool.** Customers lack good information on their water quality. For most consumers, CCRs are very difficult, if not impossible, to interpret. Utilities are missing a channel to communicate with their customers about how costly and difficult the provision of water is. Could the CCR be a vehicle that truly educates consumers about what their water quality is, where their water comes from, and the biggest supply and reliability challenges facing their utility? It's time to re-imagine the CCR and change the format, so it serves customers and utilities.

4. **Dissemination of performance measurement practices to small utilities.** Given the wide spectrum of sophistication in internal operational performance metrics, there is a role for universities or NGOs to play in working with smaller utilities to enable implementation of similar systems at smaller scales.

Case Study 5: IRWMP and Watershed Planning

As mentioned before in this report, the state of California has put a lot of resources – in the form of bond funding – and attention toward "Integrated Regional Water Management" since the mid-2000s. Moreover, resources are being expended by non-profit watershed groups all over the state to restore flows or improve water quality in rivers and streams. These efforts have been going on since the 1980s. Given this regional and local focus on watersheds and integrated planning, how can groups measure the performance of their work and investment? How will we know if watershed planning or integrated regional water management works?

While there are many groups doing good work and funding presumably good projects, current performance measurement, monitoring, and accountability for watershed and IRWMP programs are grossly inadequate. Interviewing participants in the processes and reviewing details of some of the planning efforts shows that more work needs to be done to aggregate data and to spread best practices to create a culture and expectation of accountability among integrated watershed planning efforts.

Integrated Regional Water Management Plans: To What End

The 2009 California Water Plan plastered "Integrated Water Management" on the cover for a reason. In the absence of the political will or the ability to address California's biggest water issues at the state level, the state took inspiration from the growth of the watershed movement and effective regional planning efforts, and settled on the mantra for an integrated, decentralized approach. Propositions 50 and 84 provided primary sources of bond funding for IRWM projects, which had to demonstrate multiple benefits at the watershed or regional scale (depending on the scope of the planning effort). The benefit of the state's approach to IRWMPs was that it showed a bias toward action. The goal for planning was to identify criteria and a series of potential projects that could then be funded in part or in full with bond money. A real downside, though, to the state's approach was the lack of attention to measuring and learning from results. With so many different types of projects and approaches being tried in watersheds and regions all over the state, there was a huge potential to learn what worked and what didn't and change future approaches accordingly. Unfortunately, there isn't enough performance data to do this analysis. The Little Hoover Commission report on the Water Boards (2009, 32) notes, "Mark Lubell, an assistant professor in the Department of Environmental Science and Policy at the University of California, Davis, said he had attempted to study whether one of the state's main thrusts on water policy – gathering local water interests together to develop long-term water resource plans, referred to as Integrated Regional Water Management Planning – was protecting water quality. He found that due to different data gathering and monitoring in different watersheds, it was impossible to compare different water bodies in a meaningful way. Thus, he was unable to determine whether a major statewide initiative – one that has consumed hundreds of millions of dollars – is effective." The Department of Water Resources has been getting requests for evidence that the Integrated Regional Water Management Planning approach works, and as of yet, DWR has not established a methodology for doing so.

The latest round of Proposition 84 funding has stricter monitoring and performance requirements, asking applicants to identify both outputs and outcomes associated with the projects to the funded. However, to this point, applicants have focused much more on the projected benefits and criteria for selection of projects rather than the performance of projects. An IRWMP grantee noted that IRWM objectives started out being pretty qualitative, but over time, have become much more quantifiable. There is thorough project implementation reporting, but attributing post-project changes in indicators to actions is much tougher.

Some of the difficulty in measuring performance is inherent in the task – it's hard to isolate cause and effect in complex hydrological systems. Moreover, it's even more difficult to measure performance and quantifiable objectives in ecological systems, which may be one that ecological watershed projects have generally taken a backseat to integration of flood control and water supply projects, for example. Clearly, if projects with ecological objectives are taking a back seat, then either the criteria for project selection need to be changed or better performance monitoring systems need to be developed to enable advocates for watershed projects to present more quantitative project benefits.

DWR's 2009 Water Plan (Department of Water Resources 2009a, 27-15) noted the problems with data collected in these watershed programs and its top two policy recommendations were to:

1. Establish a scientifically valid means of tracking and reporting change in the state's major watersheds that may provide reliable, current information to local communities, State agencies, and others regarding the net effects of management against the background of external change.

2. Support adaptive management programs that regularly assess performance of projects and programs to determine if they are actually satisfying ecological and community needs compatibly. Adjust the operations or re-design existing projects or programs as needed.

Clearly, these are the primary issues: collecting data systematically to provide effective baselines, which would then enable planning efforts to practice more adaptive approaches.

Watershed Groups: Monitoring and Scaling Performance

There are hundreds of non-profit or community-based watershed groups operating in California. Some of them are local and watershed-specific; others are state or national non-profit groups that operate in multiple watersheds all over the state and region. In California, the goal of most of these groups is to restore well-timed flows of appropriate temperatures to rivers and streams to restore habitat for fish. Some groups also tackle water quality issues such as nutrient and sediment runoff.

We spoke with multiple groups of this sort in our research. What emerged from these conversations were two key challenges faced by watershed groups: a lack of funding for monitoring programs, and for larger organizations, the need to take approaches that work in a small number of watersheds and scale them to be applied all over the state.

This area, however, is deserving of further study, particularly focusing on a meta-analysis or case studies of watershed groups' attempts at performance measurement. Given the overall scale of resources being devoted to these groups, more study of their effectiveness is critical.

Recommendations for Improvements in IRWMP and Watershed Planning

In order to improve performance measurement for integrated regional water management and watershed management, the following changes should be made.

1. **Improve accountability for bond funding as a method for making watershed and regional-scale performance measurement and monitoring more consistent.** The Little Hoover Commission on Water Governance recommended that the California Water Commission assume greater responsibility over all bond funding, including remaining Prop. 50 and Prop. 84 funding. Whether or not the CWC takes this on, more consistent

measurement of outputs and outcomes is needed to assess whether watershed and regional projects are effective – with the caveat that many projects may not show immediate results.

2. **Replicate the model of joint scientific and modeling work at the watershed and regional level to support management.** Good examples of organizations that have tackled this kind of work are the San Francisco Estuary Institute, the Tahoe Environmental Research Center, and the Southern California Coastal Research Program. Joining a scientific research organization with a management planning organization creates the preconditions for informed and adaptive decision making. Certainly, the Delta Science Program could take some lessons from SFEI, but these types of organizations and approaches are also needed elsewhere, at different scales, such as in watersheds upstream of the Delta and on the North Coast.

Case Study 6: Agricultural Water Districts and Water Management

While urban water districts have a long way to go in the consolidation and transparency of water data for analysis at the state level, agricultural water districts have even farther to go. A lot of attention and debate of late has focused on the opportunity for greater efficiency in agriculture in California. However, the debate over agricultural water efficiency largely masks important issues in performance measures for agricultural water use.

First and foremost, is the utter lack of available data. Agricultural districts that are Central Valley Project contractors are forced to submit Agricultural Water Management Plans (AWMPs), which are not unlike Urban Water Management Plans. However, the Agricultural Water Management Council (AWMC), unlike DWR, does not publish the water management plans on their site. Some districts do so on their own, but they're the exception, not the rule. With this lack of transparency into on-farm water use, researchers and state-level managers are forced to use indirect measures to estimate water usage. These methods include the use of county-level farm bureau reports for crop statistics, the use of satellite imagery to estimate water application rates, and the use of water balances to back out agricultural water use given all other system inputs and outputs. Sharpening the effectiveness of these indirect measurement tools, as well as increasing available data on water diversions could greatly advance knowledge in this area.

While perhaps less accountable to the general public than their urban counterparts, agricultural water managers we consulted assert that they have all the information they need to make optimal decisions at the district and farm level. They are able to optimize their operations given the information they have. But they do have a pressing need to increase the reliability of their water supplies more generally. One area where they believed that the public lacked sufficient information is in understanding how much water is required to produce their food supply. This data, they believed, could help rally the public and policymakers to make more water available to the agricultural sector through policy changes.

While our research did not go deep enough to develop authoritative recommendations for performance measurement in the California agricultural sector, which is an exceedingly complex topic, we do highlight the need for future study and research. A comprehensive look at available agricultural water data and data gaps is long overdue. Furthermore, research that gets beyond the topic of technical efficiency to economic efficiency (crop value per unit of water rather than crop volumes per unit of water) would greatly advance the debate at the policy level.

Case Study 7: Groundwater Management

Outside of adjudicated basins (particularly in urban Southern California), groundwater in California is mostly unmeasured and unregulated. The 2009 state water legislation takes a step in the right direction in giving the state the right to step in to regulate groundwater basins where no institution steps forward to self-

regulate. However, the ability of DWR to actually enforce this law will be largely dependent on funding available to do so. In parallel, more thorough monitoring systems will need to be implemented to enforce regulation and provide information to public interests.

Groundwater is a particular focus of the Program on Water in the West. This study does not address this topic in depth, since it will be addressed in other working papers.

Conclusion and Overarching Recommendations

The intent of this report of performance measurement in California water management is to provide analysis of some existing practices, identify gaps, and provide policy and management recommendations. While in each area, this report provides specific recommendations, it is worthwhile to abstract from those and noting higher-level principles that still remain to be adequately followed and implemented in California water management:

1. **Mandate Data Sharing, Standardization, and Efficient Reporting.** Water management is complex and interconnected, and many different agencies and stakeholders require the same data. While information asymmetry has traditionally been a source of power for different stakeholders, it's critical that the state move toward a more open, shared architecture for all water data. Moreover, reporting must not be duplicative – the case of UWMPs shows that wasteful and inefficient reporting is a drain on all parties involved.

2. **Spread Best Practices.** Urban utilities, groundwater districts, and watershed groups, among many others, would all benefit from more capacity-building and diffusion of best practices for performance measurement. Because the state's water management is so fragmented, the performance of small organizations has critical impacts on the state's water.

3. **Report Outcomes.** Not every State Board enforcement action or off-stream retention pond installation is going to have an observable outcome in terms of water quality, quantity, and ecosystem health. However, the reporting and monitoring of outcomes must be required as part of the scientific process. As modeling techniques and our understanding of hydrological and ecological processes continue to improve, that database of outcomes and monitoring trends will provide a critical basis for analysis.

4. **Create New Cultures of Accountability.** Performance measurement is not just a discipline, it's a culture. Acceptance of accountability in an organization is a critical step in making performance measurement work. Just as important is that performance measurement should not be used crudely or vindictively. If organizations are going to improve, failures must be embraced and learned from. There are two levels at which cultures of accountability should be cultivated. The first is within organizations, where strategy, goals and desired outcomes, and interim performance measures, are used to manage performance. The second level embraces a larger public ecosystem of accountability, where strategy and goals are articulated by agencies and organizations in response to public input, information about actions and results is shared openly through robust public reporting and accessible data systems, nongovernmental organizations and other members of civil society participate in interpreting and debating performance measurement data and results, and the public responds with redirection by exerting influence with policymakers.

5. **Use Motivating Comparisons (Carefully).** We heard over and over across the state that different water districts could not be effectively compared in water use efficiency, quality, and other metrics. Certainly, comparisons must be done sensitively, but comparisons are motivating and are a powerful tool in moving toward a culture of accountability.

6. **Communicate Effectively.** Performance measurement is only valuable insofar as the key metrics are distilled from all the noise and communicated effectively to a relevant stakeholder for evaluation or action. The Consumer Confidence Reports are a classic example of a failure of communication. More robust data and better presentation of that data will serve to better educate and influence key stakeholders, including the public and policymakers.

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