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NEW APPROACHES FOR DELIVERING SUSTAINABLE
WATER INFRASTRUCTURE TO DISADVANTAGED
CALIFORNIA CITIES

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COVER PHOTO: YUBA WATER AGENCY

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EXECUTIVE SUMMARY

California's economically challenged small communities suffer from insufficient tax and service-based revenues, low capital bases and limited staff capacity capable of keeping their aging infrastructure fully maintained. These challenges are pitted against an increasing need for environmentally resilient infrastructure that can meet the demands of rising populations and uncertainty due to climate change. Water infrastructure maintenance and modernization needs are often paramount to any water system's capital improvement planning yet are typically far out of reach for the budgets of economically challenged small systems, districts and cities. Unmet system needs include outdated drinking water treatment facilities, incorrectly sized and leaking distribution pipes, low quality groundwater sources, crumbling wastewater collection systems, failing wastewater treatment plants, stormwater management systems that fail to meet changing weather and regulatory conditions, and localized flood mitigation hazards. Concurrently, decades of fire suppression have left many northern California regions and/or their vital water supplying watersheds at risk of catastrophic wildfire damage.

In this report, we explore the current circumstances of Disadvantaged Communities in the Sacramento River Funding Area for financing improvements to a range of water management systems as well as the

possibility of connecting these efforts to holistic water conservation and economic development throughout the agricultural and environmental settings in which they are located. Alternative financing schemes, such as environmental impact bonds, are explored as possibilities to diversify municipal funding portfolios for these vital projects and to consider thinking beyond loans and grants that typically cover shortfalls in funding for capital projects.

This community-based guide has been developed to help municipalities navigate through the steps necessary to consider non-traditional funding and financing options when developing funding strategies and implementing projects. We hope it is a useful guide for municipal leaders and the stakeholders with which they work. Like many guides, we do not expect the steps in the process to be followed exactly. Rather, local municipalities should adapt the guide and its resources to meet their local needs. We encourage sharing lessons learned and communications of results with neighboring cities to facilitate learning across water systems to develop resources, capacity and finances to meet system needs. The California Department of Water Resources Integrated Regional Water Management program is a venue that could be leveraged for this purpose.

PART ONE:

FINANCING NEEDS IN THE SACRAMENTO RIVER FUNDING AREA

This section examines the purpose and audience for the document as well as the problem of infrastructure and restoration finance, and how they apply to stormwater systems and associated communities.

PURPOSE AND AUDIENCE

The purpose of this guide is to provide information about, and pathways toward, non-traditional planning, funding and financing approaches that are accessible to Disadvantaged Communities (DACs), but are often under-utilized. It is intended to complement the many informational resources available from California state agencies about government grant and loan programs.¹ The goal of this document is to assist the Sacramento River Funding Area (SRFA) DACs in taking advantage of opportunities to access private capital to identify, plan and finance projects that benefit the public and the environment. Projects that link upper and lower watershed resources in these communities in ways that increase resiliency, biodiversity, economic and social community benefits are likely the most attractive to DACs as well as the investment sources.

The target audience for this document is small municipal and DAC water system staff and elected officials interested in diversifying and expanding their capital improvement funding portfolio beyond grants and low-interest loans. It is particularly aimed at SRFA DAC drinking water, wastewater and stormwater managers but seeks to provide linkages between water, recreation, economic development, agriculture and upland forest management activities for a holistic approach to infrastructure and land management.

The Department of Water Resources Prop 1 SRFA comprises six Integrated Regional Water Management Regions: Upper Pit River Watershed; Upper Sacramento-McCloud; North Sacramento Valley; and portions of Westside Yuba County and the American River Basin (Figure 1).

The Department of Water Resources mapping tool was used during the 2016 SRFA DAC involvement proposal development process to investigate the distribution and coverage of DAC Places, Community Tracts and Community Block Groups to define the DAC Areas to focus the geographic effort for SRFA DAC Activities.²

PROBLEM STATEMENT

California's DACs suffer from insufficient tax and service revenues (e.g., drinking and wastewater services, capital base), staff capacity and often a lack of technical expertise capable of keeping their aging infrastructure and related systems fully maintained. These challenges are pitted against an increasing need for environmentally resilient water infrastructure that can meet the demands of rising populations and uncertainty in the water supply due to climate change. Water system needs often include outdated drinking water treatment facilities, incorrectly sized and leaking distribution pipes, low quality groundwater sources, crumbling wastewater collection systems, failing wastewater treatment plants, stormwater management systems that fail to meet current weather and regulatory conditions and localized flood mitigation hazards. Concurrently, decades of outmoded forest management strategies have left many northern California DACs and/or their vital water supplying watersheds, at risk of catastrophic wildfire damage.

FUNDING VS. FINANCING **Understanding the Difference**

Throughout this document, readers will frequently encounter the terms funding and financing. Funding refers to money provided for a capital investment that is not required to be paid back; whereas financing is any method that an agency or municipality uses to borrow or incur debt to pay for the project.

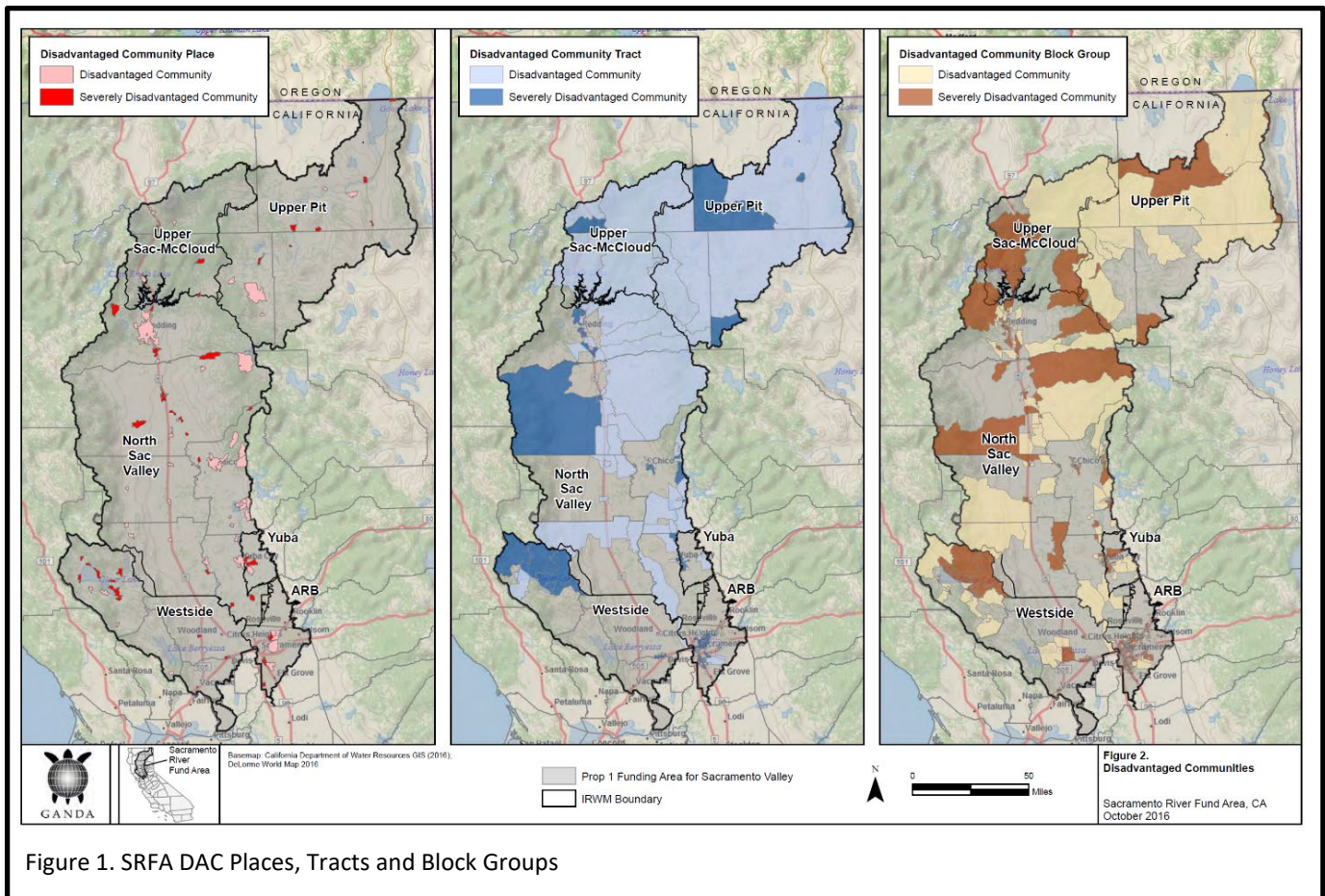


Figure 1. SRFA DAC Places, Tracts and Block Groups

OVERCOMING UPFRONT COST BARRIERS THROUGH PARTNERSHIPS

One typical obstacle that small or under-funded water agencies encounter is the difficulty in incurring up-front project design, permitting and construction costs while they await reimbursement from state loans or grants. While some state funding programs provide DACs with limited flexibility to address this problem, another option is to develop partnerships with outside entities that can float these costs until reimbursement invoices are paid. Private sector businesses, special purpose entities created to finance the project and, particularly, non-profit organizations may be able to provide this service.

For example, when eligible, a partnering nonprofit may apply for a state agency grant to fund a project that a small water agency will ultimately undertake. Drawing on its own ability to fund its work with other grants and donations, the nonprofit will carry the upfront design, permitting and construction costs and invoice the funding agency for these expenses. Another approach could have the agency apply for the loan or grant and contract with a nonprofit that encumbers reimbursement payments as they are received. It should be noted that not all nonprofit organizations or other partners have the financial or managerial capacity to carry large, upfront project costs. In fact, one of the downsides to most state and federal grants is that they are reimbursement based, meaning that grant funds are only disbursed once the grantee submits invoices for costs incurred. This differs considerably from most grants awarded by philanthropic foundations which are typically provided up front, in advance of any actual expenditures.

DRINKING WATER INFRASTRUCTURE

The paramount concern for many DAC water system operators is their aging drinking water infrastructure. Asbestos-cement distribution lines, once common, are now increasingly fractured, causing locally significant losses of treated water and creating opportunities for the infiltration of contaminants into the supply network. In other instances, development and growth have outpaced the available supply, leaving neighborhoods or entire communities without adequate sources and/or storage to meet demand. Still other communities face the challenge of supplying safe potable water from groundwater sources that have high levels of arsenic, nitrates or other contaminants. These challenges are exacerbated by small ratepayer populations and constitutionally imposed obstacles to rate or tax increases which combine to make it difficult to raise sufficient revenue to fund replacement or rehabilitation of failing systems through traditional budgetary approaches. Importantly, for DACs, the customer base lacks the ability to pay needed rate increases, even if such increases were voter approved and initiated.

Difficulties in providing safe, secure drinking water, coupled with increasing exposure to fire and other natural disasters have increased focus on consolidation of small, underfunded systems into larger, more sustainable systems. Recent state legislation has encouraged appropriate consolidations and provided some funding for assessment and infrastructure implementation, although only a few successful consolidations have happened to date. Across the SRFA there are significant opportunities, not just for formal consolidation but for increased collaboration between independent system operators.

WASTEWATER TREATMENT INFRASTRUCTURE

Wastewater system operators in DACs share similar economic and technical challenges. Collection system breakages and disrepair result in raw sewage leaks and high maintenance costs that operators struggle to manage. Outdated treatment systems may be inadequately sized to meet contemporary demands and/or incapable of meeting current regulatory requirements. Wet weather infiltration into collection systems increases treatment costs and leads to overflow events. As with drinking water systems, wastewater operators are hamstrung by funding challenges, with inadequate rate revenue and traditional government grant/loan opportunities insufficient to meet all needs.

The public wastewater sector has long relied on support from federal and state loan programs, particularly the Clean Water State Revolving Fund administered by the State Water Resources Control Board. In recent years, the Fund has heavily focused its resources to support DAC wastewater infrastructure projects; however, it is dramatically oversubscribed. Integrated Regional Water Management funding, a source of support for wastewater projects, is similarly limited in availability. Accessing new capital is needed to jump start local projects.

STORMWATER MANAGEMENT

Stormwater management improvements are usually lower priority projects for DACs due to the need to focus on more critical needs associated with drinking water and wastewater compliance. However, the lack of attention to this problem can lead to an unending spiral, impacting the economic viability of vast areas of these communities and ensuring that they remain disadvantaged. Many urbanized areas struggle to fund and implement stormwater management programs that meet permitting requirements for municipal separate storm sewer systems and reflect green infrastructure best practices.³

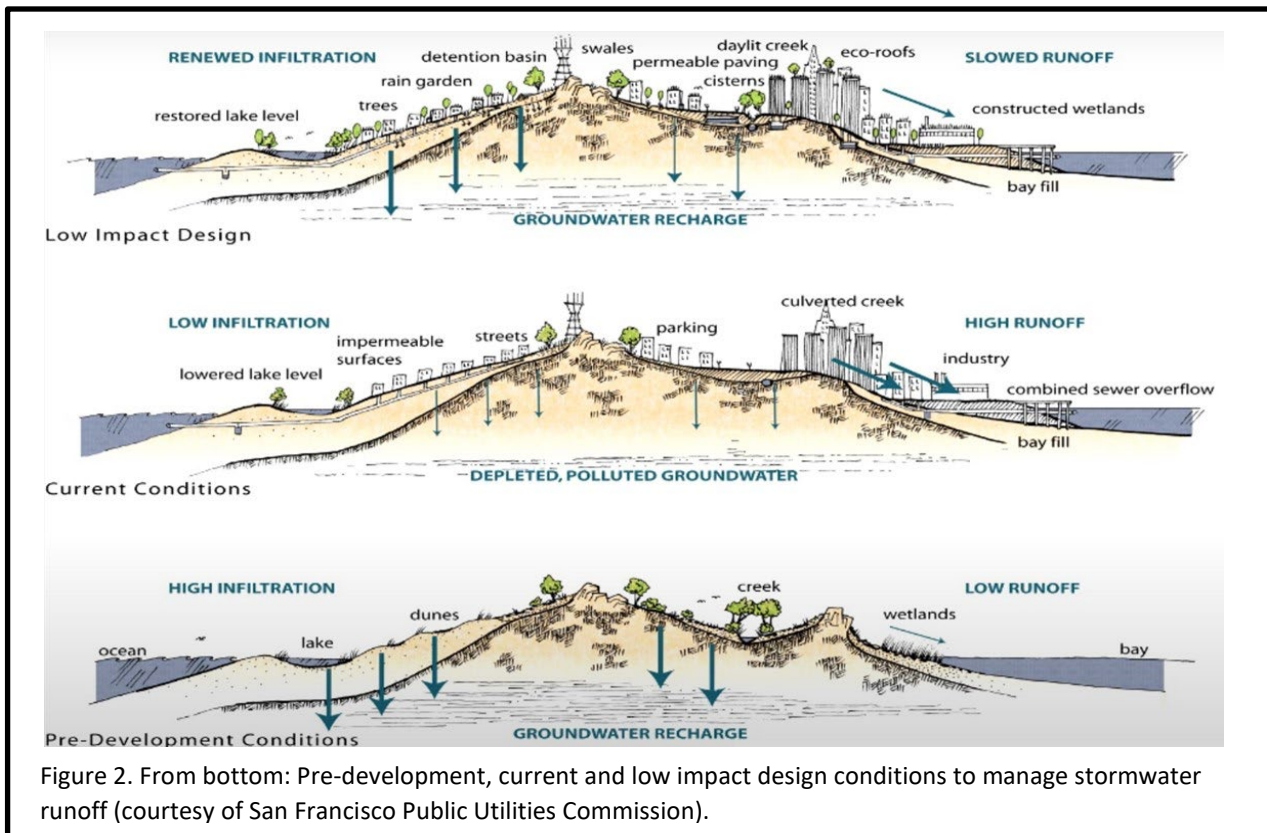
Traditional stormwater management approaches have included paving large areas and directing stormwater runoff to pipes that quickly move polluted water to drains and waterways. Newer and innovative stormwater solutions focus on landcovers and installations that slow runoff, allow rain to sink in where it falls or to spread it on areas where it can infiltrate ([Dolman, 2012](#)). The old high runoff, low infiltration approach is costly to install and maintain, harmful to the environment and detrimental to surrounding communities when it fails or is undersized. New, green infrastructure approaches such as curb cutting, rain gardens, infiltration basins, tree

planting and permeable paving appreciate in value over time while providing several benefits to the community and watershed including: reduced runoff, lower management and maintenance costs, sequestration of carbon, reduced summer temperatures, fostering habitat/wildlife and increase recreation/public enjoyment (Figure 2). Despite the high social, economic and environmental benefits from implementing green stormwater management, the capacity and financing for large-scale retrofit programs is often lacking, particularly in DACs. Even when funding is available from state and federal sources, competition for grants can be fierce and the lack of staff capacity to develop grant applications and the experience to successfully implement large-scale projects are massive barriers, leaving these communities behind.

Most SRFA DACs have been slow to adopt green infrastructure policies and techniques for managing stormwater. Unfortunately, these communities will not realize the benefits that green infrastructure can provide until the concept is more fully integrated into the project selection/design/implementation approaches of counties and cities (Zuniga-Teran, et al., 2019). The challenges faced by DACs in achieving this shift in approach are often intensified due to lack of diverse financing, institutional risk aversion, reliance on familiar design standards and difficult pathways to regulatory compliance. Even though the cumulative benefits of green infrastructure can outweigh installation and maintenance costs, lack of awareness of these benefits often defeats interest in these approaches, making it difficult to secure funding from municipal budgets. This is particularly acute in DACs where budgets are extremely tight and there is no appetite for any perceived risk for new project approaches.

GREEN INFRASTRUCTURE PLANNING

Often, municipalities identify future water infrastructure projects based on immediate needs and readily available funding to meet those needs. A simple ranking or needs-based assessment may miss out on relationships between water system enhancements and broader community or watershed benefits. These benefits, in turn, can be important for securing additional, or even primary, financial support for the water system investment. One approach to identifying these benefits is to use spatial, socio-economic and



environmental data. Assembling this portfolio of information into a GIS-based prioritization tool and utilizing its functionality in community or stakeholder workshops can be a significant benefit to project identification, planning and decision-making.

An outstanding example of informational prioritization is the [Green Infrastructure Prioritization Tool](#) created by the Pima Association of Governments in Pima County, Arizona. This resource allows project planners and other users to identify relationships between typical stormwater-related values (e.g., impervious cover, land use, flow depth and direction) and important community needs or values (e.g., park and open space deficits, shade canopy gaps and heat island impacts). Visualizing these relationships, and the locations where they occur, can help identify opportunities for multi-benefit green infrastructure projects, engage important community stakeholders, and uncover non-traditional funding or financing sources that can help deliver stormwater management projects.

PART TWO: NON-TRADITIONAL FINANCING FOR WATER SYSTEMS

Traditionally, investments in California community water infrastructure have been funded in two ways: water utility debt financing through issuance of municipal-grade bonds or through grants and loans provided by state agencies, particularly the Clean Water and Drinking Water State Revolving Loan Funds managed by the State Water Resources Control Board. These sources of capital are typically matched, or repaid, from water service rate revenue or property tax revenues. While these traditional public funding approaches have enabled the construction of considerable water infrastructure across the state, DACs face challenges in accessing these typically limited funds which are consistently insufficient to meet demand. In 2019, for example, the Clean Water State Revolving Loan Fund received applications for \$7 billion worth of projects but was able to provide \$600 million in funding.

Recognizing that public funding will never be sufficient to meet water infrastructure investment demand, there is a growing interest in engaging the comparatively greater resources within the private sector. Private investors, particularly impact investors, or investors committed to funding projects with social and environmental benefit, collectively have access to more capital than government agencies. Private financing may be a pathway to overcome funding limitations and implement community and watershed enhancement projects at a large scale. A recent report indicates that rather than too many projects competing for this financing, too few projects are seeking private investors, leaving a considerable resource underutilized.⁴

Additionally, partnering with philanthropic foundations or donors can be especially beneficial for low-income communities. In general, there are two pathways through which philanthropic foundations provide financial support to their grantees and partners. The first, and most common, is through competitive grants. Foundations typically have regular grant application and award cycles in which they invite applications. These applications tend to be less onerous than those required by state and federal funding agencies and foundation staff tend to be accessible for questions and assistance. Early coordination and contact with these staff can be valuable. One important distinction of philanthropic grants—they are typically disbursed in one lump sum up front. They are not reimbursement grants as administered by government programs. As such, they are highly flexible and do not always impose the burden of carrying costs while awaiting payment of invoices, which is often a significant barrier to DAC water systems being able to fiscally manage government grants.

The second, relatively underutilized method foundations use to provide funding is direct investment of the foundation's principal through Program Related Investments, or Mission Related Investments. Program and Mission Related Investments typically take the form of below market rate loans or loan guarantees to organizations, agencies or businesses undertaking projects or programs that advance the foundation's strategic area of interest. These investments are typically of a larger amount than competitive grants and allow foundations to partner with private sector actors to achieve social or environmental outcomes.

One of the more compelling new financing approaches is the environmental impact bond and variations on this approach that are emerging from innovative communities across the nation. Environmental impact bonds are based on social impact bonds pioneered in the early 2010s. A social impact bond is a public-private partnership which funds effective social services through a performance-based contract ([Dear, et al., 2016](#)). The first social impact bond was launched in the UK in 2010 targeting reducing recidivism by Social Finance.

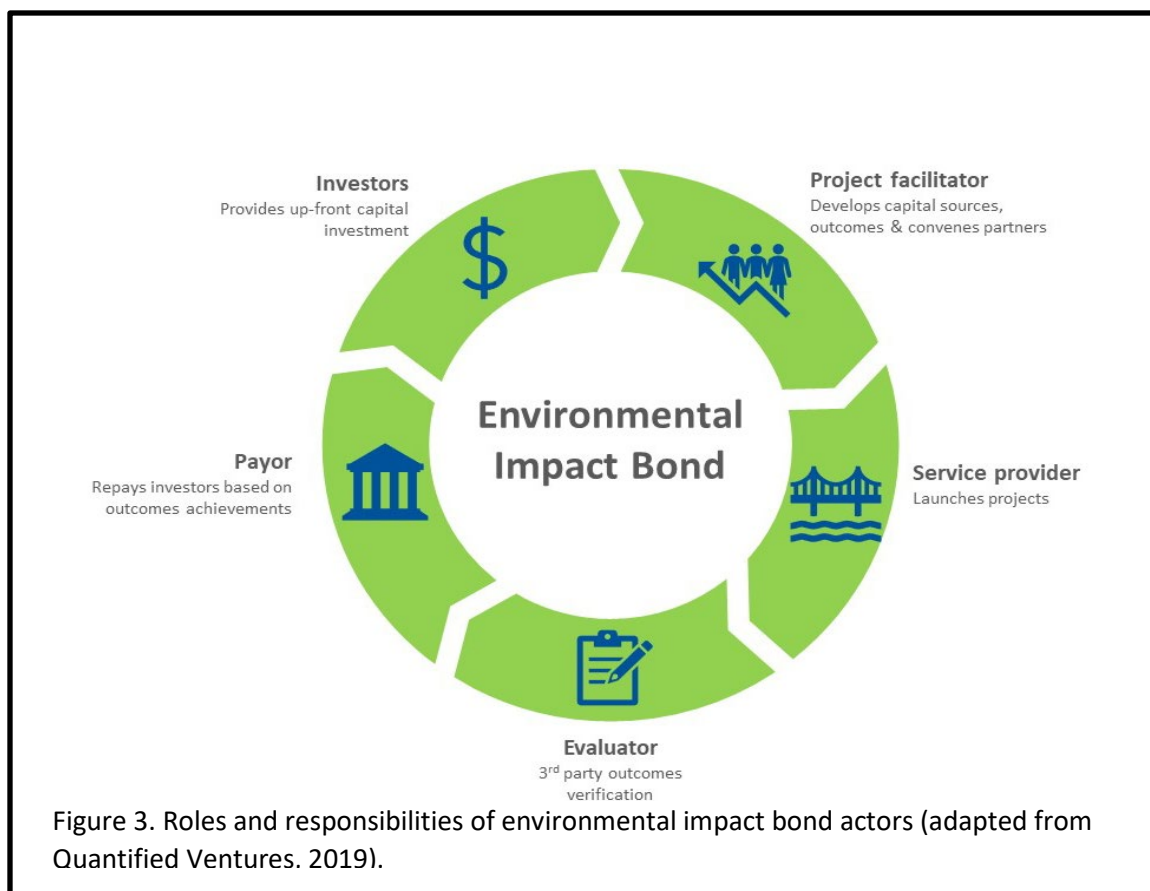
Unlike state and federal grant programs, environmental impact bonds are flexible and can be structured to combine public, private and philanthropic funding sources to support the design, construction and operation of water and watershed infrastructure. Various foundations have made program related investments to support

the development of environmental impact bonds and to fund competitions that attracted pilot environmental impact bond projects. The following sections provide a basic summary of the environmental impact bond approach, cover some pre-requisites that may need to be in place locally before considering or pursuing an environmental impact bond, survey some of the non-target outcomes that may benefit an environmental impact bond project area and describe case studies of environmental impact bonds (and related approaches) that have been implemented across the U.S.

Bonds are not, however, a silver bullet to green infrastructure financing. Using the right tool for the right situation as well as looking for ways to diversify funding sources are critical for long-term project implementation and success.

ENVIRONMENTAL IMPACT BONDS

Environmental impact bonds are a cost-share model that are specifically tailored to attract private investors who are motivated by the social and environmental effects of their investments. This newly emerging model may involve pay-for-success repayment structures that can increase the accountability and effectiveness of private funds dedicated to public infrastructure and natural resource management projects.



For an impact bond, a governing body borrows money from investors and develops a contract for a set of desired social, economic and/or environmental outcomes; investors in the projects can be rewarded when the projects deliver the desired outcomes (Figure 3). If the project performs as expected, the borrowing agency repays a base amount. If outcomes are better than expected, the agency pays an additional amount, with the understanding that there is an increased return on investment. Like any investment, if the bond/projects underperform, investors may have to accept a reduced return. One key benefit of the environmental impact bond approach is the opportunity to transfer project risks from the governing body to the investors, thereby

removing a key hurdle for the agencies undertaking the infrastructure projects. Between the risk reduction and the privately supplied up-front capital, the environmental impact bond creates increased incentives to deploy innovative solutions.⁵

A recent environmental impact bond success story in California is the [Blue Forest Conservation](#) Forest Resilience Bond in the Yuba River watershed, where investors are providing upfront capital for forest health and fire prevention activities. Under the Forest Resilience Bond, public and private beneficiaries make contracted payments to the investors based on an estimate of the water, fire and other watershed benefits created by the forest health restoration activities such as tree thinning and prescribed fire that help to reduce the risk of fire in the Yuba River watershed.⁶

Perhaps equally important, environmental impact bonds can make blending local, state and federal sources of repayment together in an elegant solution. Each level of government and local beneficiary has their own definition of success, fiscal schedule, legal authority and governance structure. This environmental impact bond allows a water agency to contribute over a 5-year time frame with some repayment flexibility, allows for immediate cost share from the federal government (as required by law) and allows access to state money that would otherwise be accessed as reimbursable grants which present a challenging working capital situation for many eligible nonprofits.

IMPORTANT CONSIDERATIONS FOR SUCCESS

Role of government. The role of government is critical in developing and implementing environmental impact bonds since local government is the primary provider of environmental and social services targeted in bond agreements. Environmental impact bonds are a particularly good model for infrastructure investment for governments in DAC areas since they both enable a reduced risk (i.e., risk is shifted from government to capital providers) and provide additional needed funds beyond municipal bonds and grants ([Nicola, 2013](#)). This approach is a familiar investment model for other forms of infrastructure but has recently been extended to natural infrastructure such as watersheds and distributed green stormwater infrastructure.

Repayment source. Traditional infrastructure financing depends on tax or rate revenue for repayment of capital loans or bonds. While these sources of revenue may also fund environmental impact bond repayment, the environmental or social outcomes of the project are often associated with new revenue that can be utilized to repay investors. For example, projects that reduce flooding or fire risk may have economic value to counties, landowners, insurance companies, electrical utilities and water agencies and may lead to new or expanding business development. These values translate into incentives to invest in the project.

Risk and Transparency. Environmental impact bonds are attractive to investors and affordable for communities when investor risk is reduced. Risk is reduced by having clear, measurable project outcomes. These outcomes need to be independently verifiable in a transparent, objective fashion.

Outcome driven repayment. Unlike traditional bond or loan financing in which repayment is tied only to completion of project implementation, environmental impact bond repayments are conditioned on delivery of specific social or environmental outcomes. Investors are only repaid when these beneficial outcomes are produced at measurable levels. This arrangement allows for the flexibility to transfer the risk of the project's performance from the borrowing municipality to the investors. Additionally, environmental impact bonds can target projects that are difficult to fund in other ways, e.g., green stormwater infrastructure retrofits, bike paths or water recapture and recirculation projects.

Diversity in benefits and investors. The most robust environmental impact bonds produce multiple benefits that appeal to multiple investors and potential payers. For example, watershed restoration projects reduce fire risk, stabilize water supplies, create valuable timber and biomass, protect private property and increase local employment opportunities. Successful environmental impact bonds should be able to demonstrate diverse

benefits and be able to link each benefit to an entity that has an economic interest in the benefit and be willing to repay investors after receiving it.

Scale and Scalability. Environmental impact bonds are not a good fit for projects with a small footprint. They are best applied to projects that are large scale in scope and purpose. Their inherent complexity and risk transfer components make them suitable for projects that require at least \$4 million to complete. If single projects do not meet this threshold, consider how multiple projects can be combined to create a broad, comprehensive program that delivers consistent benefits, e.g., a city's capital improvement plan could be funded entirely via an environmental impact bond if the project components provide the right outcomes.

Local champions for innovation. Environmental impact bonds are not entirely new, but they are innovative enough to still be uncharted territory for most public agencies and communities. For this approach to succeed, local champions must be capable of building support among members of the public, elected officials, other stakeholders and regulatory agencies. This document is intended to support these efforts by providing real-world examples of successful environmental impact bonds that can be modified and repeated to help bridge the funding gap for DACs.

ASSOCIATED BENEFITS FOR DACS

While the primary goal of an environmental impact bond may be to achieve specific environmentally beneficial outcomes, the investment may also create additional social, economic or environmental opportunities that benefit the participating community. The infusion of capital to achieve the project has the potential to build local workforces, create transformative community change that draws additional investment, deliver recreation and other improvements that uplift local quality of life and property values, and stabilize flood/fire insurance rates for property owners ([FRBSF, 2019](#)). In fact, the performance payout may be tied to achieving local business development, employment or poverty reduction goals (see [Baileys Trail System environmental impact bond case study](#)) or engaging private property owners (see [City of Buffalo case study](#)).

Workforce benefits may be particularly attainable from forest management, disaster mitigation and green infrastructure environmental impact bond efforts. These types of projects often require long-term labor commitments either to accomplish the scale of the project or to provide ongoing maintenance. At the same time, the skills required for this work are not highly technical and can often be provided by local, small businesses using existing staff.

ENVIRONMENTAL IMPACT BOND CASE STUDIES

In the following section we review several of the growing number of environmental impact bonds that have been successfully negotiated throughout the country. Most are still at the implementation stages, but they demonstrate the broad applicability of this solution to varying situations and the flexibility of this approach to grow to new communities.

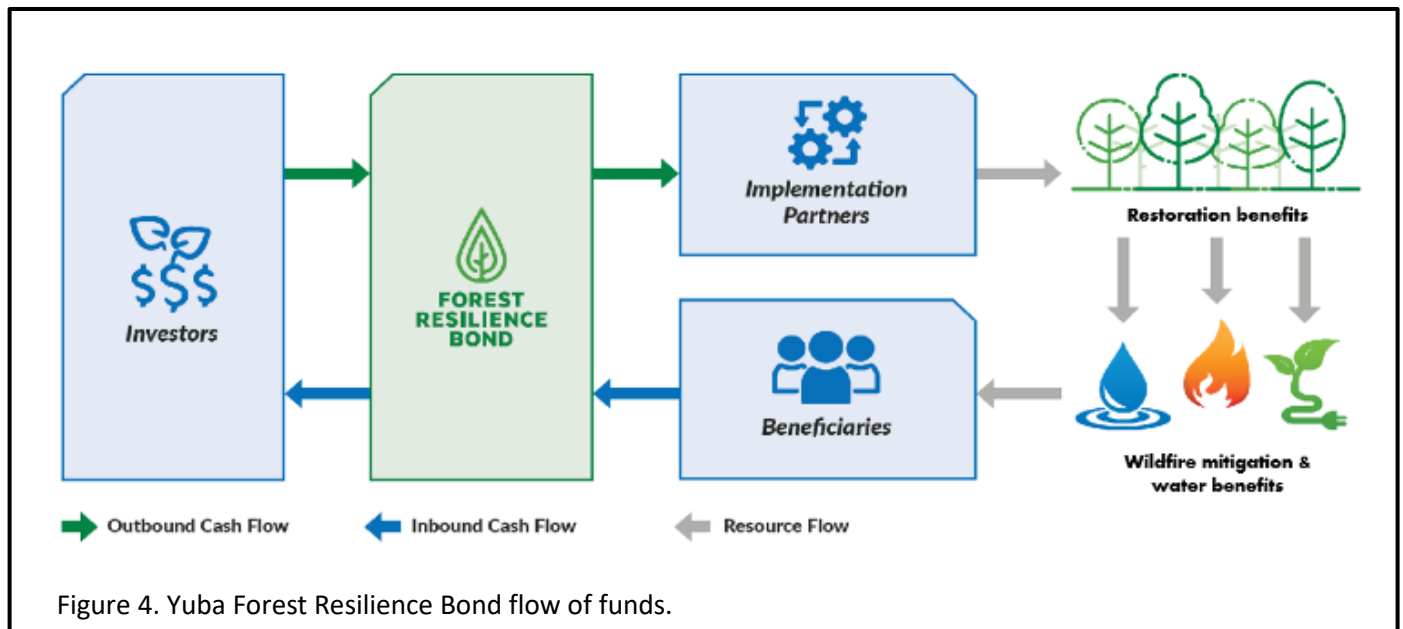
NORTH YUBA RIVER WATERSHED FOREST RESILIENCE BOND

The following case study is excerpted and re-written from Woolworth and Knight ([2019](#)). Figures are from Nick Wobbrock and reproduced with permission.

Blue Forest Conservation launched its first Forest Resilience Bond pilot in 2018, raising \$4 million for a \$4.6 million project to restore 15,000 acres of California's North Yuba River Watershed. The repayment of the \$4 million investment came from reimbursable grants awarded by CAL FIRE, retained receipts from the US Forest Service, and a commitment from the Yuba Water Agency to make annual payments for 5 years. When blended, these sources were the anticipated repayment and grant reimbursements that would ultimately return capital with a modest amount of interest 2.5% to investors. Initial investment was made to a wholly owned subsidiary of a non-profit, serving as the least cost and most tax efficient pass-through entity created to facilitate the transaction.

In addition to philanthropic concessional investment from foundations, Blue Forest found a well-aligned institutional investor in CSAA Insurance and Calvert Impact Capital. The Forest Resilience Bond appealed to CSAA Insurance for several reasons. First, investing in the Forest Resilience Bond made good business sense for the insurer, which serves thousands of customers living in areas at risk of wildfire. CSAA Insurance saw an opportunity to reduce its risk of insured losses over time. Moreover, the structure of the Forest Resilience Bond offered a compelling investment opportunity and a chance to diversify CSAA's portfolio, especially as future bonds come to market ([Convergence, 2020](#)).

Bond sales from below-market or concessional capital, market rate investors and program related investments from foundations will repay market rate investors at a return of 4% and foundation program related investments at a rate of 1%. Bond proceeds are channeled to Implementation Partners who undertake the on-the-ground project work to achieve the impact outcomes specified in the bond. Upon verification of completed work and submission of a yearly report (Figure 4).



Subsequent phases of the project will allow greater scale of restoration and increased access to larger investors. Blue Forest Conservation plans to scale the investment to \$25-50 million over time.

The Forest Resilience Bond's potential to unlock opportunities for ecological and community resilience falls into five primary buckets where it:

1. Matches investment-ready capital with on-the-ground restoration projects that yield both environmental and social returns;
2. Accelerates the pace and scale at which restoration work can yield these dual returns by raising funds upfront and decreases the time for project completion from decades to 2-3 years;
3. Stabilizes otherwise irregular funding from public sources, allowing work to move forward more rapidly and predictably significantly aiding cash poor non-profits and municipalities in starting and completing projects;
4. Signals to the broader market a steady supply of woody biomass, encouraging investment in rural economies awaiting growth opportunities; and
5. Builds local capacity and greatly eases the contracting burden across project proponents.

This same structure can be readily adapted to other infrastructure investment needs. Large scale and innovation water infrastructure improvements would be straightforward for environmental impact bond development because the environmental benefits for water, stormwater and wastewater management are well known and the monetization of water has a long history.

COLORADO WILDFIRE MITIGATION ENVIRONMENTAL IMPACT FUND

Past fire suppression policies, drought conditions and beetle-infested forests have increased the threat of wildfire Southwest Colorado. Quantified Ventures' [Wildfire Mitigation Environmental Impact Fund](#) is utilizing funding from private investors and revenues from biomass generated from forest thinning to offset the financial burden that any one payor covers for wildfire mitigation in the San Juan National Forest wildland-urban interface. The project fosters regional collaboration through shared project financing and implementation. It also creates the opportunity for scaling up forest treatments and fire reduction by creating a revolving loan fund that reinvests proceeds into additional projects ensuring that capital is available for long-term re-treatment and/or expansion of forest health interventions. Because of its revolving loan nature, the impact of the fund will continue to grow over time as capital is re-deployed for forest health treatments in new areas beyond this initial plan.

The Environmental Impact Fund will deploy financing for an initial proposed plan to reduce the risk of wildfire over 64,871 acres in Southwest Colorado that encompass private, federal, state, local and tribal lands. An analysis of three representative parcels within the larger proposed geography demonstrated a benefit-cost ratio of nearly 300% based on avoided risk and damage to properties, infrastructure and water resources if a wildfire were to occur. In addition, an estimated 287,708 green tons of biomass would be made available through the treatments, which can be converted to electricity or other commercial uses if biomass plants can be built to consume the woody by-products of forest restoration projects.

QUANTIFIED VENTURES

Many of the case studies discussed in this section have been developed by Quantified Ventures, a private impact investment firm that has significantly pioneered environmental impact bonds in the United States. Because of their interest in promoting the environmental impact bond approach, information about Quantified Ventures projects is readily available. There are other environmental impact bond developers who have realized success in social services rather than water-related services.

CITY OF ATLANTA GREEN INFRASTRUCTURE ENVIRONMENTAL IMPACT BOND

The City of Atlanta's Department of Watershed Management worked with Quantified Ventures to develop a publicly offered environmental impact bond in January 2019. The first of its kind, the bond secured \$14 million for regional scale green infrastructure projects intended to reduce stormwater-related flooding in the city's economically disadvantaged Proctor Creek neighborhood. The bond's ten-year term and base interest rate of approximately 3.6% will allow the City to make a significant upfront investment in projects that are calculated to deliver \$18 million in environmental and economic benefits derived from reduced flooding and increased water quality.

Repayment of this bond has additional performance-based payments; if projects funded by the bond reach a clearly specified level of performance within six years, investors will benefit from a performance payment of \$1 million, effectively increasing the interest rate to 4.7%. However, if this level of performance is reached, the city calculates that it will realize an additional \$1.8 million in benefits ([Lewis, 2019](#)). These benefits include socio-economic gains through locally created sustainable jobs, increased neighborhood green space and protection of hundreds of homes against flood damages ([Quantified Ventures, 2020a](#)).

This project is significant because it opened the public bond market to environmental impact bonds. The bond was backed by revenues from the Atlanta's Water and Wastewater Enterprise, resulting in a high rating by both

the S&P and Moody's. These ratings made the bond attractive to mainstream municipal bond investors rather than the narrower set of boutique investors that had responded to earlier impact bond issuances. In addition, the bond structure simplified pay-back levels and relies on a simple evaluation methodology to determine if the higher level of performance and return on investment have been met ([Quantified Ventures, 2020b](#)).

BAILEYS TRAIL SYSTEM ENVIRONMENTAL IMPACT BOND

The Baileys Trail System is a proposed 88-mile, premier mountain biking trail system in Athens County, Ohio, in the Wayne National Forest. Through increased visitation, the trail system is revitalizing one of the poorest and most underserved counties in Ohio. Private investment is providing the upfront cost of building trails with repayment tied to the successful achievement of the economic development outcomes, in this case increased sales tax and transient guest taxes. The project is supported by the US Forest Service, Great Lakes and St. Lawrence Governors and Premiers, The National Forest Foundation and the US Endowment for Forestry and Communities ([Quantified Ventures, 2018](#)). To date, 14 miles of trails have been built and another 10-15 miles is slated for construction soon.

A collaboration of local municipal governments known as the Outdoor Recreation Council of Appalachia worked with Quantified Ventures to develop a financial approach that includes the creation of the first outdoor recreation environmental impact bond. The \$5.4 million impact bond enables communities to fund, manage, promote and evaluate large scale trail building projects on federal land. Mountain biking trails have been proven to produce health, environmental, financial and social benefits for the communities in which they are built. The project is expected to attract over 180,000 visitors/year, resulting in an increase of \$7.3 million in tax revenues over 10 years. These increased revenues serve as the means for the local government coalition to repay the private investors. Repayments are conditioned upon independent verification of meeting predetermined project outcomes.

In this example, the sound economic case for building the trails, which included real data on the costs and benefits of similar trail systems elsewhere, developed the foundations for a finance scheme that the city and County of Athens could support. This demonstration of reduced implementation costs and economic benefits was critical to obtaining vital government backing.

CITY OF BUFFALO, NEW YORK RAIN CHECK 2.0 PROGRAM

In February 2020, the Mayor of Buffalo, New York announced the City's ambition to launch the country's largest environmental impact bond. Valued at \$30 million, the funds from this investment will allow the City of Buffalo and Buffalo Sewer Authority to capitalize on the stormwater management focused Rain Check 2.0 Program. As in most urbanized areas, private properties both contribute the most stormwater runoff and present the largest opportunity for retrofits that reduce overall urban impervious surfaces and stormwater volumes. Private property retrofits form a key component of the Buffalo Sewer Authority's goal of using green infrastructure to manage over 500 acres of impervious surface area to help eliminate the effects of combined sewer overflows on Buffalo's waterways. Through the Rain Check Program, Buffalo will become the first city to use an environmental impact bond to capitalize a green infrastructure incentive program for private property owners. Funds from the environmental impact bond will be used to fund incentive programs that motivate private property owners to install green infrastructure in six priority sewer basins within the city.

Rain gardens, green roofs, bio-swales and other green infrastructure practices that manage stormwater will be eligible for funding. Through this infusion of capital, Rain Check 2.0 aims to maximize stormwater reduction as well as associated environmental, equity and economic benefits. Repayment of environmental impact bond investments will be tied to goals that reflect private property uptake, including acres of impervious surface managed through green infrastructure.

COMMUNITY-BASED PUBLIC-PRIVATE PARTNERSHIPS

In addition to environmental impact bonds, other methods for attracting private capital may be suitable for SRFA DACs. A particularly interesting model in the stormwater management and stream restoration arena is a community-based public-private partnership. While environmental impact bonds focus solely on providing financing for projects, private public partnerships can be structured to bring financing, project design and implementation as a single package. Community-based public-private partnerships take the well-established public-private partnerships model and modify it by tying payment to achievement of environmental and social outcomes that benefit the community and increase stakeholder engagement in project delivery ([Adaptation Clearinghouse, 2020](#)). Public-private partnerships have the potential to help many communities optimize their limited resources through agreements with private parties to help build and maintain their public infrastructure ([EPA, 2015](#)).

PRINCE GEORGE’S COUNTY

In March 2015, Prince George's County, Maryland entered the first of its kind, 30-year community-based public-private partnership agreement, referred to as the Clean Water Partnership, between County government and the private sector to retrofit up to 4,000 acres of impervious surfaces using green infrastructure features.

Located within the Chesapeake Bay Watershed, Prince George’s County has a Municipal Separate Stormwater Sewer Systems compliance obligation to reduce stormwater pollutant loadings by retrofitting approximately

CITY OF SALINAS CBP3

In 2019, the City of Salinas took Initial steps to set up a thirty-year Design-Build-Finance-Operate CBP3. This program is intended to implement and maintain green stormwater infrastructure to meet stormwater permit requirements. Metrics for performance include quantitative environmental and social metrics that will serve as the performance measures for the Partnership. The City is planning an initial investment of \$50 million depending on the establishment of a stormwater utility, or alternatively a cohesive, low-cost and responsible financing approach.

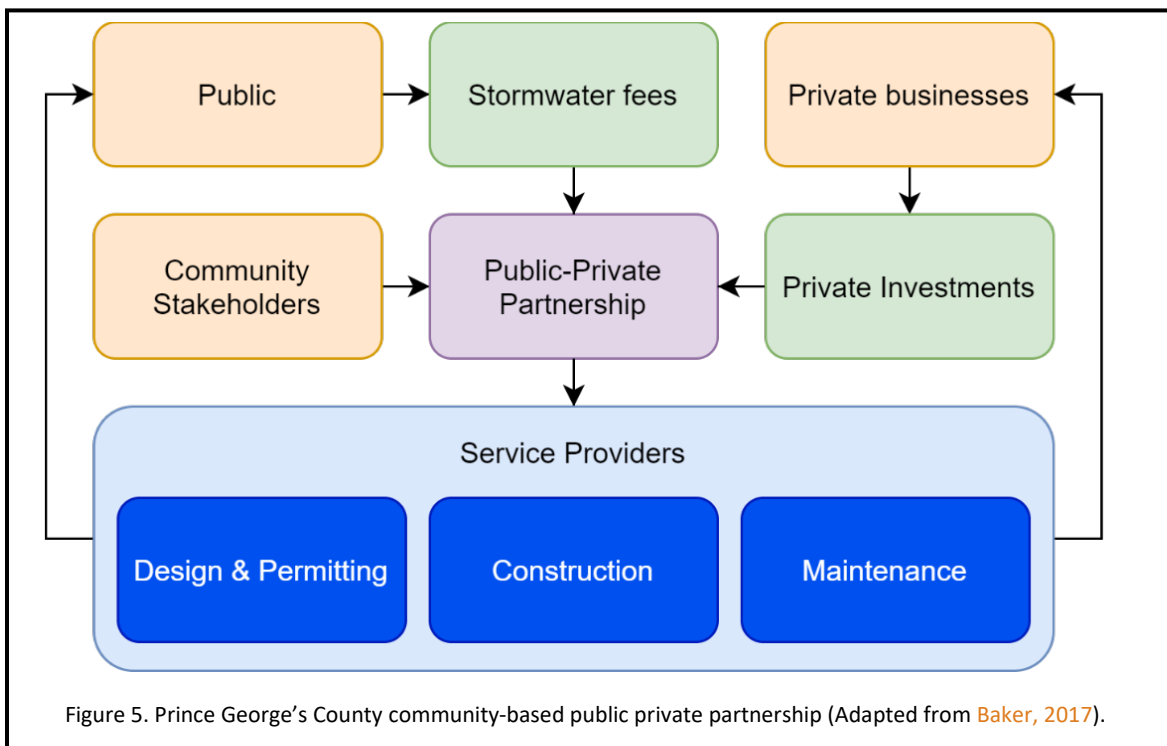


Figure 5. Prince George’s County community-based public private partnership (Adapted from Baker, 2017).

15,000 acres of uncontrolled impervious surfaces by 2025. To fund these retrofits and manage its stormwater program the County adopted a parcel-based stormwater fee.

Although the fee provides a sustainable long-term revenue source, annual collected revenues were insufficient to fund the amount of pollution prevention or treatment required to meet Municipal Separate Stormwater Sewer System requirements. To accelerate implementation of stormwater retrofits, the County developed the Clean Water Partnership approach (Figure 5).

Through a request for qualifications process, the County formed a partnership with the private service provider Corvias Group under which Corvias would be responsible for the financing, design, construction and maintenance of retrofits sufficient to manage runoff from 4,000 acres of impervious area. In addition to meeting this stormwater reduction goal, the partnership requires Corvias to meet specified local business development and hiring benchmarks. Payments to Corvias are dependent upon meeting both environmental and social outcomes. Corvias, in turn, secured private financing to fund its activities and developed its own partnerships with local workforce development organizations and employers.

The Partnership, with private funders, provides up to 40% of the County's compliance costs upfront, enabling projects to begin sooner and removing much of the reimbursement challenges typically encountered with public funding. The Partnership also reduces the County's administration and procurement costs by up to 80%. The agreement requires small and minority-powered businesses to be contracted for up to 40% of the total project, creating a projected 5,000 jobs. The County plans to reduce stormwater runoff from 90% of storm events and reduce pollution by up to 50% nitrogen, 40% phosphorus and 80% sediment. The private partner is responsible for long-term project maintenance.

The community-based public-private partnership model may be applicable to communities in the SRFA and stormwater program managers should draw key lessons from Prince George's County's experience. First, there were high transaction costs related to establishing the Clean Water Partnership and resolving contracting and risk issues. Reducing these costs should be feasible, particularly for communities with relevant public-private partnership experience. Second, having secure sources of funding for repayment of the private sector partners reduces risks for private sector investors and implementation partners. Highlighting economic development goals as part of a stormwater retrofit program helped to build support with local elected and civic leaders and attracted interested investors. Third, stormwater agencies and their private partners should reach an early and detailed agreement about the desired/allowable types of stormwater management practices and projects. Specific outcomes and quality-controlled milestones must be spelled out as well. This specificity avoids later disappointments associated with under-performing projects and programs.⁷

ENHANCED INFRASTRUCTURE FINANCING DISTRICTS

The Prince George's County program depended on the secure revenue provided over time by the County's stormwater fee, a factor which is not always available in all communities. However, other sources of revenue tied to environmental outcomes may make the model feasible for DACs. For example, funding made available from an Enhanced Infrastructure Financing District may be leveraged to support a community-based public-private partnership program to deliver urban area green infrastructure retrofits that manage stormwater while providing neighborhood and business district enhancements.

Enhanced Infrastructure Financing Districts are a recent evolution of the tax increment financing tools previously developed in California and support financing infrastructure projects with anticipated increased property tax revenues associated with the future benefits of the projects ([Lefcoe, 2014](#)). Revenues from Enhanced Infrastructure Financing Districts can be used for public works, transportation, parks, libraries and water and sewer facilities—with an emphasis on sustainable community goals under California’s landmark climate legislation ([Flint, 2018](#)). Recent revisions to the Enhanced Infrastructure Financing District law reduced some of the challenges to adoption; for example, no public vote is required to establish a District. If the District opts to forego financing options such as a public-private partnership or performance-based financing; a 55 percent vote is required to issue bonds. Unlike earlier tax increment finance restrictions, Enhanced Infrastructure Financing Districts impose no geographic limitations on where revenue funds can be used, and a blight finding is not required. With this new flexibility available, developing an Enhanced Infrastructure Financing District may be a particularly useful tool for funding regional projects that benefit multiple agencies or jurisdictions ([CSDA, 2019](#)). Indeed, revenues gathered through an Enhanced Infrastructure Financing District may be one option for repaying the investment used to secure an environmental impact bond.

SACRAMENTO REGION EIFD EXAMPLE

In 2017, the city of West Sacramento became one of the first California cities to take advantage of the new Enhanced Infrastructure Financing District law. The City’s Enhanced Infrastructure Financing District covers approximately one-quarter the area of West Sacramento and is expected to generate revenues of \$1.1 billion for parks and recreational spaces, sewage and stormwater infrastructure improvements and other projects that foster community revitalization and sustainability.

ADDITIONAL EXAMPLES

While the following case studies do not fall specifically into the categories detailed above, they do provide valuable insights about the practical application of innovative planning, financing and project delivery at a scale intended to address the pressing issues facing communities in the SRFA and western United States.

LARGE-SCALE APPLICATIONS

The Tahoe Central Sierra Initiative aims to accelerate large-landscape forest restoration to improve the health and resilience of the Sierra Nevada (Figure 6). The Initiative focuses on developing and demonstrating innovative planning, investment and management tools across a 2.4-million-acre landscape ([Sierra Nevada Conservancy, 2020](#)). Known widely as TCSI, this initiative is led by state, federal, nonprofit, and private partners, and responds to agency mandates that call for increasing the pace and scale of forest management and restoration and improved community wildfire protection. As of 2020, project partners secured over \$32 million in California Climate Investments grant funds to implement high-priority forest health projects that sequester carbon and reduce the risk of wildfires. Funded projects include thinning 20,000 acres, removing 164,000 tons of biomass and implementing 8,000 acres of prescribed fire across multiple ownerships and jurisdictions throughout the landscape ([Sierra Nevada Conservancy, 2020](#)).

TCSI started with nonprofits and agencies genuinely wanting to change business as usual when it comes to project scale, a massive issue given the widespread state of fire suppression, overall poor forest health in California and the increasing devastation and size of wildfires. Collaboration across the partnership led to greater leverage of funding and project implementation. This approach is completely conceivable, in fact advantageous, for small communities that neither have the capacity or funding on their own to implement all of the projects needed to reduce stormwater runoff, provide sustainable clean drinking water and restore the environment for ecosystem and community health.

Collaboration across multiple communities and projects could be the only way that enough capital is raised to make the revenue and implementation scalable and feasible.

Other similar forest health projects in small, disadvantaged, rural communities are having similar successes from the Klamath to the Sierra and coastal range. Additional collaborative forest landscape examples include the: [Sierra to California All-Lands Enhancement Collaborative](#), [Lake Tahoe West Restoration Partnership](#), [Western Klamath Restoration Partnership](#), [Yuba Forest Network](#) (which includes Blue Forest Conservation) and the [Amador-Calaveras Consensus Group](#).

A similar large landscape approach is the Northern Arizona Forest Fund. The Northern Arizona Forest Fund was established in partnership between the Salt River Project and the National Forest Foundation to address declining forest health concerns in the Salt and Verde River watersheds ([NFF, 2020](#)). These important watersheds are the sources of irrigation, commercial and municipal water supplies for millions of Arizonans in the Greater Phoenix Metropolitan area. The fund facilitates business and resident investment in forest health and fire mitigation in the lands they depend on for their livelihoods, e.g., breweries need clean water. Over the course of 5 years \$6.2 million has been invested with projects treating 13,600 acres of fuel reduction, 170 miles of erosion control and drainage improvements, 2,600 acres of stream and wetland restoration and 90,000 trees planted ([NAFF, 2019](#)).

Although the total size of these examples is in the millions of acres, the actual size of treated or restored acres is typically in the tens of thousands of acres, further illustrating the challenge to scale. Nevertheless, these examples are a huge leap forward in terms of coordinated efforts across multiple agencies as well as coordinated compliance and funding efforts and these initial efforts will greatly speed future restoration efforts. There are at least two lessons to draw from these examples: first, that agencies shouldn't be deterred from considering innovative financing models for large scale projects, and second, that financing models can be adapted to a range of project sizes.

DISASTER MITIGATION

Approaching alternative finance through disaster mitigation is a double-edged sword for municipalities since they must plan for flooding, drought and wildfire, but may not want to admit to their constituencies they are prone to different types of disaster. Flood and drought plans have often been produced on the heels of high and low water years and typically supplant each other depending on how wet or dry it is at the time. However, plans that include finance strategies for mitigating flood, fire and drought risk as an integrated holistic plan can help communities become resilient to each risk factor. In fact, some activities, such as tree planting, reducing impermeable surfaces and native plants in parks and green areas help to mitigate all three types of disasters via different natural mechanisms.

Recently, collaboratives and communities are examining avoided costs to aid in planning and to call attention to the potential costs of inaction when future disasters hit. The [Mokelumne Avoided Costs Analysis](#) asked the question of whether it makes economic sense to increase investment in fuel treatments to reduce the risk of large, damaging wildfires ([MACA, 2014](#)). The study found that modelled fuel treatments can reduce the average

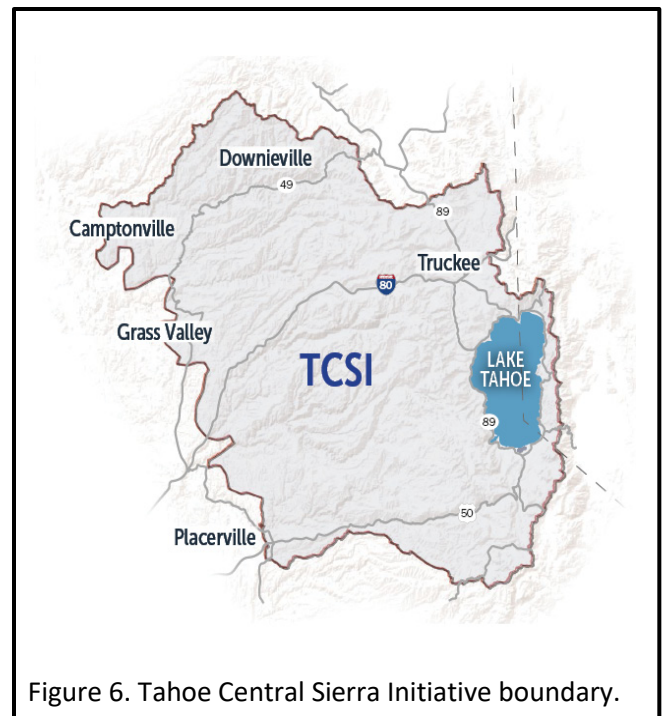


Figure 6. Tahoe Central Sierra Initiative boundary.

size of fires by approximately 41% in the entire Mokelumne watershed and reduced high-intensity fires by 75%. The economic benefits (including loss avoidance and treatment opportunities) of large-scale treatments were estimated to be more than twice the cost of the treatments. The study found that the primary beneficiaries of fire fuel reduction treatments are broad and include public and private landowners, insurers and utilities, while the costs of the fuel treatments are borne by public land managers, so also spread broadly across taxpayers. An additional benefit of the fuel treatments program was estimated to add up to 55 fuel treatment-based and biomass energy-based jobs over a 10-year period ([MACA, 2014](#)). Cost avoidance analyses can make strong cases for other types of hazard mitigations and when combined with economic opportunities, a community problem could become the key to sustainable solutions and growth.

Insurance companies are increasingly interested in minimizing their exposure through disaster mitigation. A recent example is a mitigation program that is a collaboration between the Swiss Re insurance company, The Nature Conservancy and Mexican regional governments to help protect the Mesoamerican Reef along Mexico's Yucatan Peninsula in the state of Quintana Roo. Research demonstrated that there was a connection between a healthy coral reef and economic sustainability. If the reef were to die because of pollution and storm damage, it would no longer be able to prevent beach erosion, which in turn would threaten tourism, the local key source of income. The partners devised an insurance solution that would ensure rapid disbursement of funds to enable trained community members to address reef damage following a severe storm. This program was the first nature-based solution to protect Mexico's coral reefs ([Swiss Re, 2019](#)).

The project will work through the Coastal Zone Management Trust, which will receive funds from an existing beachfront property owner fee. The funds will continue to finance repair and maintenance for Quintana Roo's reef and beaches, in addition to paying for the reef's new parametric insurance policy, in other words, the policy is triggered by predetermined boundaries. For example, the policy states that hurricane damage is characterized (parameterized) by wind speeds greater than 100 knots. Should 100+ knot wind speeds hit a predefined area during a storm, an insurance payout will be made to the Trust, allowing swift damage assessments, debris removal and initial repairs to be carried out allowing increased reef and property protection ([TNC, 2019](#)).

Hazard Mitigation Programs are increasingly making grants available to target large-scale projects addressing community risks. CAL FIRE is investing approximately \$1 billion of California Climate Investment funds in wildfire mitigation projects that focus on fuels reduction, prescribed fire and reforestation throughout California's forested lands through its [Forest Health Program](#). CAL FIRE's [Fire Prevention Program](#) offers similar grants to rural forested communities. In a similar vein, the Wildlife Conservation Board's [Forest Conservation Program](#) offers grants for meadow restoration, fuel reduction, post-fire restoration and logging road decommissioning in the Sierra Nevada and Cascade mountains. The [Sierra Nevada Conservancy](#) offer grants for fuels and fire mitigation projects as well. The [California Department of Water Resources](#) offers a variety of grants for flood management that can help mitigate flooding and flood risk for rural communities. Although some land is lost, levee setbacks are an effective way to reduce flood risk, increase wildlife habitat, increase groundwater recharge and improve water quality. Grants for levee setback work can be obtained both through the Wildlife Conservation Board and the Department of Water Resources.

Given the insurance crisis facing homeowners in the wildland urban interface in California and that many communities will continue to live in these forested areas at high risk to wildfires, there could be significant interest for creating an impact bond that includes public and private funds with significant investment by the insurance industry. In such a scheme, funds from the state of California, Forest Service, private investors and insurance companies would contribute to an environmental impact bond or revolving loan fund that provides monies for defensible space, home hardening, fire breaks and forest health/restoration projects. Wildland urban interface communities surrounding these projects would qualify for more affordable and durable homeowners' insurance and property values will likely increase. Incentives to create programs in other similar communities could be a part of a fire revolving loan fund similar to that created by Quantified Ventures in Colorado. Calculating avoided costs such as water quality and quantity could be incorporated into the program to integrate water districts and communities that also need water infrastructure upgrades. Creative thinking and

collaborations that combine avoided risk and costs with created opportunities, economic value and environmental benefits will lead to a myriad of impact bonds to solve problems unique to a given region or district. This flexibility should be leveraged as often as possible to make use of the vast private capital that is available and awaiting an opportunity for an impact investment.

AGRICULTURAL LOANS AND SALMON RESTORATION PROGRAMS

An emerging approach tied to agricultural incentives is FarmLink. FarmLink has primarily been focused on delivering excess food that can no longer go to restaurants to foodbanks. A new FarmLink program reduces or forgives interest on agricultural loans if the farmers plant pollinator habitat. The pollinator habitat can be in the form of planting a pollinator friendly mix of flowers and native species in hedgerows, field margins and borders. Establishing bare earth in some places also benefits native solitary ground nesting bees and bee blocks (essentially blocks of wood with varying diameter holes drilled into one side of the block) provide additional habitat at a low cost. It could be possible to create a program that provides grants or low interest loans to farmers and other landowners that incentivizes water quality projects through restoration, removal of impermeable surfaces and planting native species to slow down water, reduce stormwater runoff and provide native species habitat.

Another example exists from certifying municipalities and parks through [SalmonSafe](#), a private nonprofit organization promoting healthy land-management practices that keep rivers clean and safe for salmon to spawn and thrive. SalmonSafe has worked with municipalities through park and natural area certification to reduce chemical use and stormwater runoff. For a park system to become certified, it needs to address six key management categories that collectively deal with these impacts: instream habitat protection and restoration; riparian and wetland protection and restoration; management of water use (irrigation activities); management of surface water runoff; erosion control; and chemical and nutrient containment ([Baur, 2003](#)).

A SalmonSafe certification program could be developed for the vast agricultural areas of the Central Valley and Sierra hill towns working with local parks departments. Such a program could greatly benefit DAC areas and help them to implement large-scale green infrastructure projects. Ultimately the certification would help increase salmon habitat while providing multiple ecosystem service benefits. In foothills areas these benefits could extend to reducing wildfire risk and improving forest health in surrounding riparian areas.

PART THREE:

IMPACT INVESTMENT—PUTTING LESSONS INTO PRACTICE

Adapting a suitable approach for a specific set of projects will be critical to the success of developing a new environmental impact bond.

Generally, the process consists of the following steps that are explained in more detail below:

1. Develop system understanding
2. Apply options to finance decision tree
3. Create a project prioritization process
4. Develop feasibility study
5. Secure investment from diverse sources
6. Implement projects
7. Measure outcomes and analyze results
8. Communicate and share results
9. Iterate (return to step 1)

We suggest an iterative process with step 9 that utilizes and integrates the lessons learned from step 8 and uses those to develop new projects while returning to step 1. Using the results to test assumptions made during step 1 is recommended for any type of project. Highlighting this essential, good management practice helps to ensure that an environmental impact bond continues to deliver positive results during its lifetime.

STEP 1. DEVELOP SYSTEM UNDERSTANDING

Developing a visual representation or conceptual model of how the system in question works using simple box and arrow relationships can greatly aid in common system understanding across stakeholders and communicate this understanding to other parties (Figure 7). System understanding models also allow implementers to test and acknowledge explicit and implicit assumptions they commonly make about the efficacy of project implementation. Better understanding of these assumptions leads to increased project success and improves the likelihood of current and future funding sources. A bonus to creating such a model is that an increased number of donors are basing funding decisions on outcomes-based project design and system understanding due to the complexity of such systems and effectively measuring their success.⁸

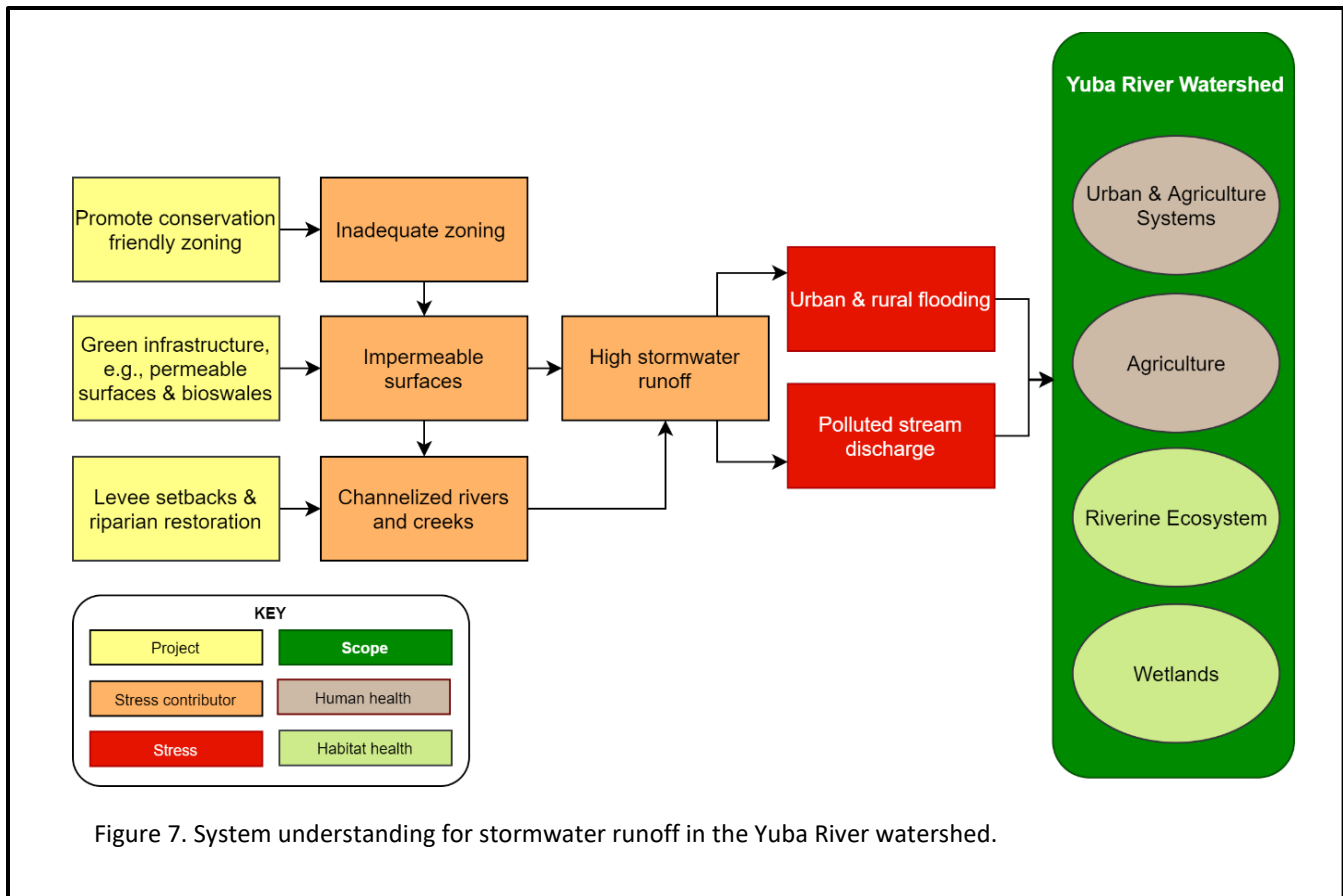
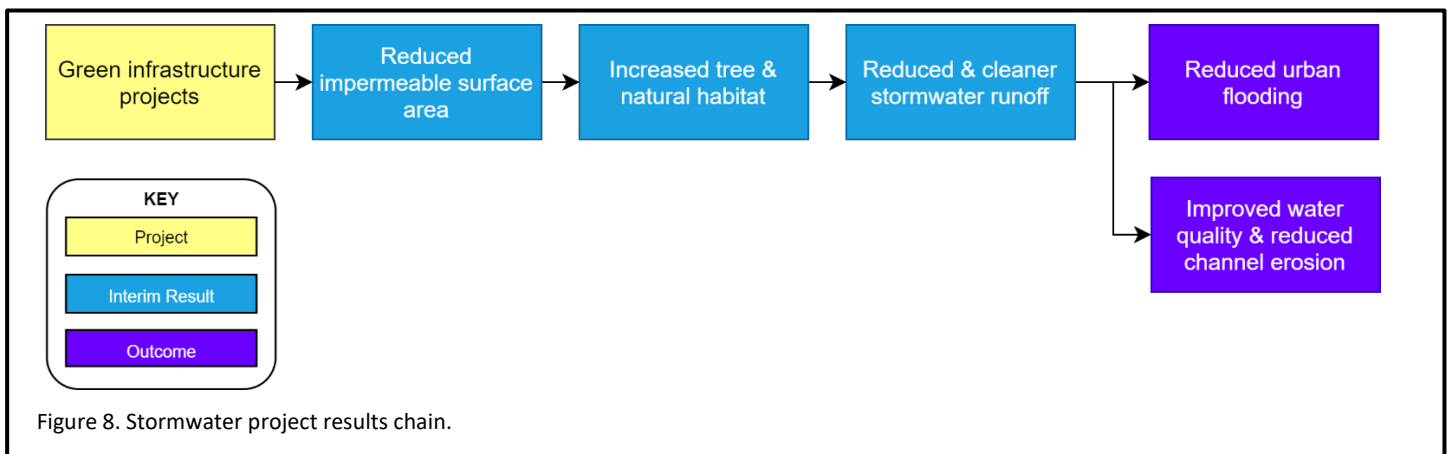


Figure 7 is read from right to left, i.e., the health and well-being of urban, agricultural and natural habitat in the Yuba River watershed are stressed by flooding and polluted discharges to waterways. The stresses in turn are affected by, among other things, high stormwater run-off, which is affected by inadequate zoning, impermeable surfaces and channelized, narrow riparian systems. Projects to reduce these contributors to system stress are zoning changes, green infrastructure installations and levee setbacks/riparian restoration.

To arrive at project implementation results from the projects, implementers often create a results chain that help to define objectives and activities to complete the project and develop an if-then sequence of results that affect the system (Figure 8). Unlike the system understanding, the results chain is read from left to right, e.g., green infrastructure projects reduce impermeable surfaces, increase trees and plants, reduce stormwater runoff ultimately reducing urban flooding, improve water quality and reduce channel erosion.



Whereas these boxes and steps may seem obvious to implementers, their representation often only exists in their knowledge and understanding of the system and are not visually depicted or written down, sometimes leading to confusion and making measurements of project outcomes and success difficult.

STEP 2. APPLY OPTIONS TO THE FINANCE DECISION TREE

A decision tree with yes/no pathways is useful for determining the types of financial tools most useful for the Project. Figure 9 graphically outlines those pathways for the traditional and newer finance structures described in this paper. A semi-automated key for arriving at the same decisions can be found [here](#).

How does this work? Let's say a utility has a need or project but no identified funding. If government grants are available, adequate for the project scope and agency staff has strong grant writing capacity, it makes sense to apply for a grant. However, it is unlikely grants alone will ever be able to fully fund a project and grant size limits how we think of the total project size. On the other hand, if staff do not have strong grant writing experience and/or the need is much higher than the grant program alone could cover, perhaps local businesses can provide up-front project costs since they will ultimately benefit from the project. In this case, a public-private partnership might be a good option for financing. Since benefits often last for decades it makes sense to use low interest loans, which may also factor into a successful financing model. As demonstrated by many projects in the SRFA region, there are considerable benefits to taking time for relationship building and working across multiple entities to create an environmental impact bond. This approach requires some out-of-the-box thinking to develop support across key leaders in businesses and jurisdictions to generate the project implementation revenue. Including co-benefits that accrue to more than one source will enhance the potential repayment streams and provide a reduced cost for each payer to achieve project outcomes.

The examples and guidance presented here are intended to provide models that can be adapted where new and different opportunities exist. The key in this step is to not allow the newness of the idea or relationships to stymie the discussion.

If property values consistently rise in your municipality over time, your jurisdiction could take advantage of funding through Enhanced Infrastructure Financing Districts. If you have general funds to service loans, then a loan might be an option. Bonds via propositions are a great possibility particularly if voters can be shown the benefits to them of increased sales, income or property taxes. But if not, you may need to implement smaller pilot projects and/or build grassroots support working with local organizations and nonprofits until there is sufficient voter support. Again, the key is to be collaborative and creative to build coalitions to support these efforts.

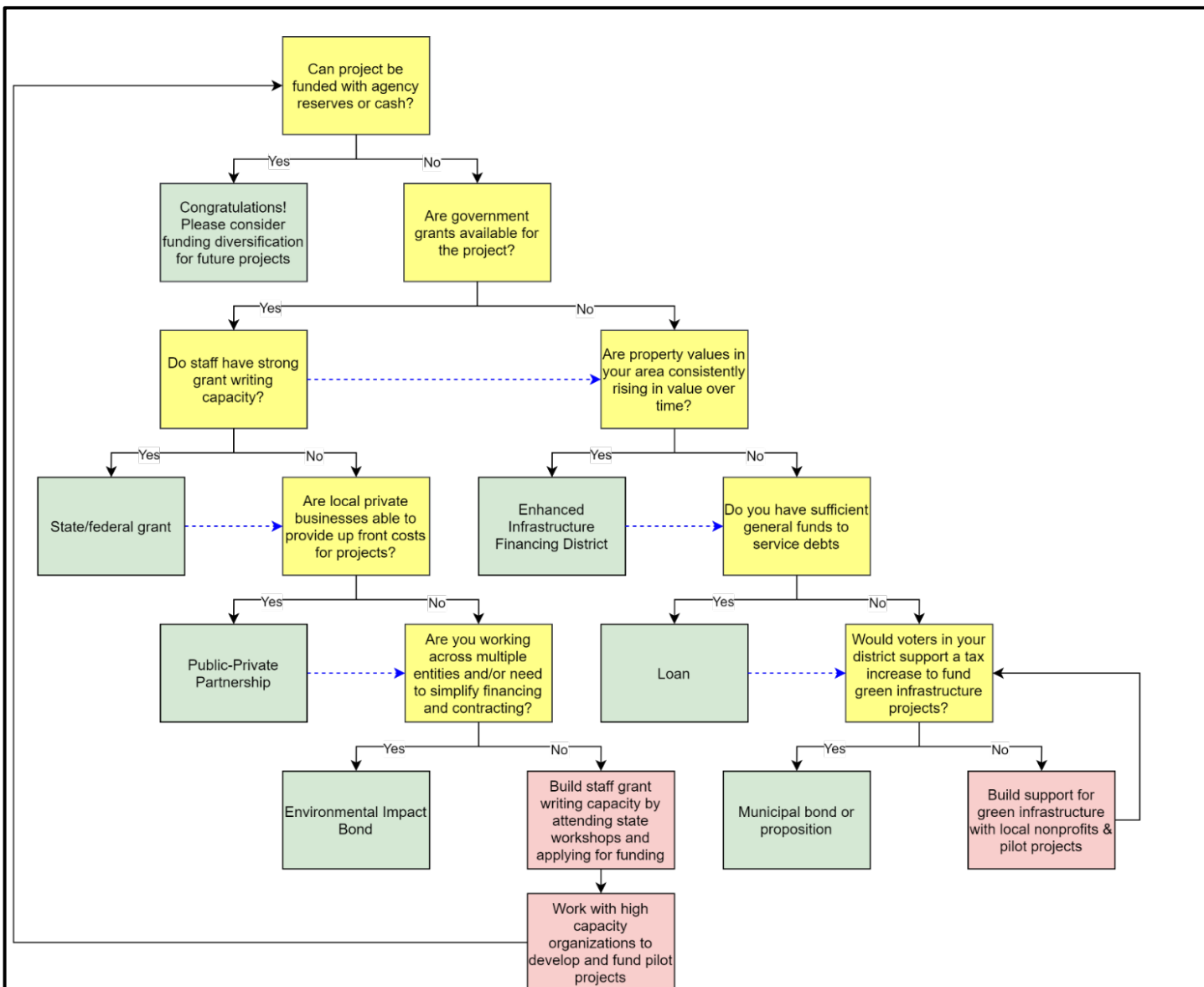
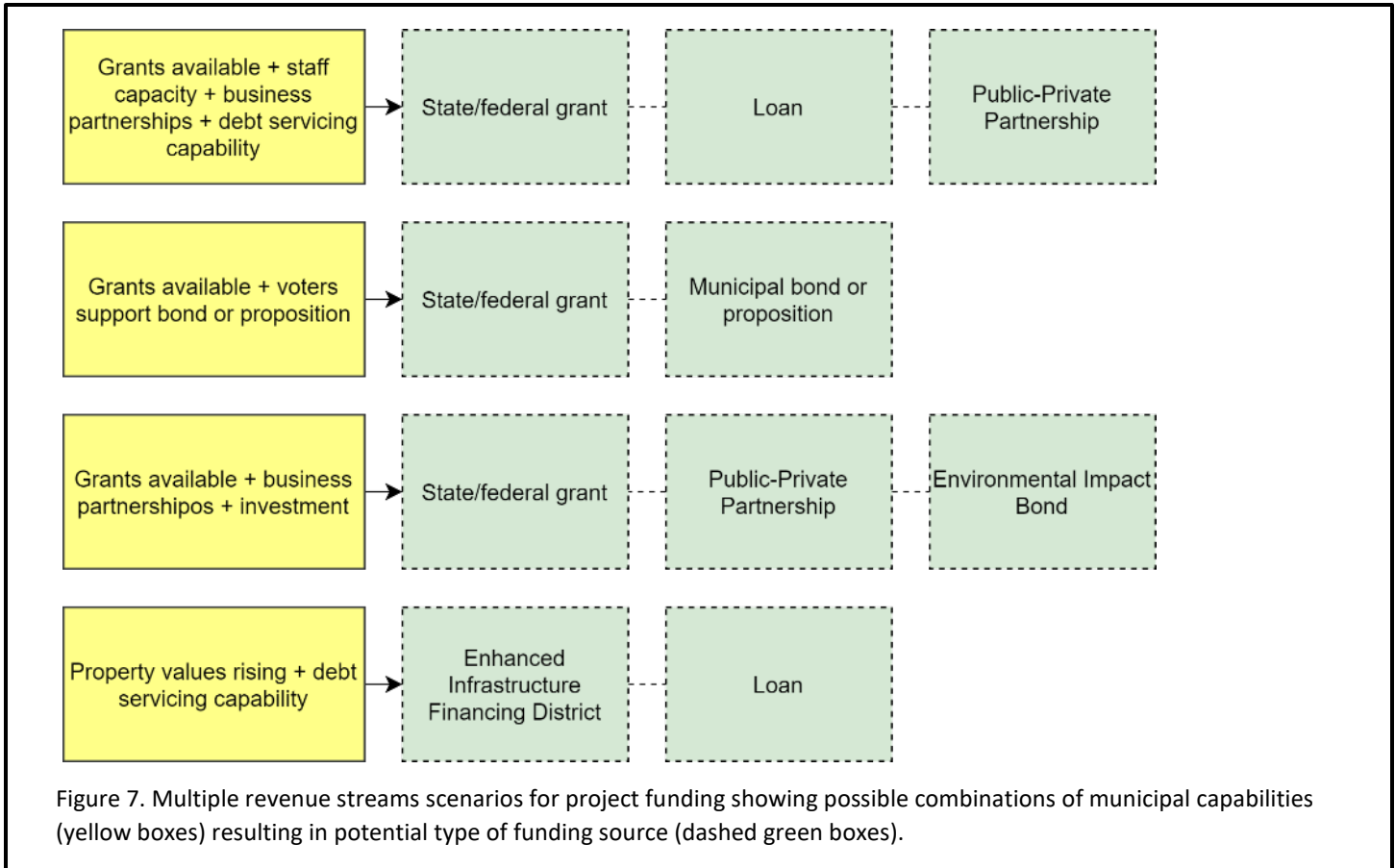


Figure 9. Decision tree showing the pathways to determining the right type of financial tool for generic funding situations. Blue arrows represent decisions implied by a diversified funding portfolio, e.g., multiple financial tools may be employed to fund a project, and more than one option should be explored.

Although the decision tree leads to one finance tool or another, project proponents should always consider creating revenue from multiple sources rather than just one (Figure 10). For example, a municipality may have staff capable of writing grants, partnerships with local or regional businesses and debt servicing possible in its budgets. That might lead to a project funding portfolio of state/federal grants, loans and public-private partnerships.



STEP 3. CREATE PROJECT PRIORITIZATION PROCESS

Given the number of projects to fund and complete at any one time, a prioritization process is warranted to select the projects that are shovel ready, funded and ranked highest priority to meet a community’s needs. It is worthwhile considering a weighted matrix with various project prioritization criteria, e.g., funding, safety, feasibility, risk and other scoring criteria on a scale from 1-5 or 1-10 with higher numbers equating to higher importance. Weighting criteria that are particularly important can help to separate projects if scores are similar. In other words, funding could be multiplied by 3. If a project scores a 4 of 5, its total score would then be 12 rather than 4.

Participatory prioritization could take place during a public workshop and greatly increase public ownership, understanding and support of projects, community staff and other development. Furthermore, prioritization could bring in donors, investors and other entities to greatly increase their project understanding and possibly increase the interest in and funding of projects that are the best fit for donors, investors and agencies.

STEP 4. DEVELOP FEASIBILITY STUDY

A feasibility study is an analysis of the components that make up the practicality of a project or proposed plan. It can help determine if a project is appropriate, determine whether it will meet the immediate and broad needs of the community, identify any co-benefits that could be provided by the project (and potentially additional funding sources related to these benefits and assure that socio-economic needs are addressed. Most importantly, it will include a risk assessment and projection of return on investment to determine whether the project and financing make business sense for all parties involved. A feasibility study may begin by building a general information foundation that includes the overall context for the project. A GIS-based approach may be used to assemble layers of geotechnical, land use, demographic, economic, existing infrastructure and other

relevant data. This foundation, and the project's location within it, can be a useful outreach and engagement tool with local stakeholders.

Going to a more detailed study, the water agency and its partners and stakeholders generally would include all structural, institutional, financial, compliance, capacity, technical, legal and timing considerations for the project or plan in question. Additional items to consider would be a description of the study approach and methods, a general project needs assessment and prioritization, project scope (including local context and existing and/or similar projects), the economic model, transaction structure (including investors, implementation partners, evaluators, payers, issuers and their roles in the project implementation, management and long-term maintenance), outcome metrics (determining how project success and in the case of environmental impact bonds, payments, will be evaluated) recommendations and next steps. Recommendations for further research and analysis to characterize the capital needs, revenue streams, and return on investment for financing opportunities associated with regional water system needs may be included.

STEP 5. SECURE INVESTMENT FROM DIVERSE SOURCES

Local agencies and municipalities frequently depend on state or federal loans and grants. Consideration of diversifying funding portfolios would not only greatly increase potential revenue for new projects but could act as insurance against the elimination of state/federal programs that may put municipal finances at risk over the long-term. Local agencies should examine the benefits of non-traditional funding approaches, including impact bonds and other approaches to debt financing. Building a diverse portfolio of funding and financing sources and types at project development and planning stages can improve the likelihood of project completion within a timeframe that meets pressing needs and provides greatest benefit. A diverse portfolio can draw on customer rates, local taxes and other revenue sources, as well as traditional state/federal grants and loans. In fact, these traditional funding sources have important roles, even within a more innovative financing strategy.

GOVERNMENT GRANTS AND LOANS

Grant funding can be a critically important part of a portfolio for water system improvements and complement other funding mechanisms, such as environmental impact bonds. Because they do not have to be repaid, grants offer tremendous flexibility for covering project development and up-front implementation costs. Typically, grants are offered by two types of funders: philanthropic foundations and state or federal agencies.

An initial challenge is simply finding regular and timely information about the availability and applicability of grant opportunities. Many of the California state agencies offer regional workshops to present new grant rounds and provide applicants with the opportunity to ask specific questions and funding feasibility for project ideas. There are email listservs, websites and other online resources that can assist with this process. It literally pays to establish relationships with staff at either state/federal funding agencies or philanthropic grant-makers. Grantmaking staff are important sources of information, advice, and guidance about the funding process as well as the relevance of a funding program to a local water system project. These relationships can help water agencies work through the processes and restrictions of a given grant program to uncover flexibilities that can benefit a project.

Writing successful grant applications is a specialized skill, particularly for the complex and relatively demanding grant proposals required by California State and Federal funding agencies. Water agencies with a long-term interest in accessing these sources of funding would do well to invest in staff capacity with this expertise or to contract with experienced, successful grant writers. Additionally, water agencies may be able to partner with nonprofits or other organizations that can share grant development capacity and costs. The Sierra Nevada Conservancy's [Partnerships & Community Support Program](#) has a wealth of knowledge and experience developing government grants.

Importantly, from an environmental impact bond perspective, grant funding can fulfill two especially important functions. The first is to provide capital⁹ to cover the costs of developing and initiating the outreach and

planning needed for a future environmental impact bond-funded project. The second is to send a signal to other potential funders and partners that the project is fundable, and to reduce some of the risk of these early investments and/or leverage additional needed funding. In this way, securing an initial grant can be a key to leverage other private financing. A brief list of funding programs from California and federal agencies can be found in Appendix A.

LINKING FEASIBILITY ANALYSIS DATA TO NON-TRADITIONAL FINANCING OPTIONS

Integrating geospatial, demographic and environmental data into a project planning framework can lead to funding and financing opportunities. Rather than viewing a water system investment in isolation, this approach can provide important contextual information, particularly about project benefits that may be of interest to non-traditional sources of project capital. For instance, stormwater management, watershed health, water distribution and wastewater collection system projects may result in complementary benefits such as ecosystem services, instream flow augmentation, wildfire risk reduction, heat island reduction, public health gains, climate change adaptation.

These benefits may be associated with climate change adaptation markets, tax increment financing, or public health agency grants. Particularly, impact investors are drawn toward the environmentally or socially beneficial outcomes that can be created by innovative and large-scale projects. For example, repayment to the investors in the Bailey Trail System environmental impact bond is based in part on the number of local jobs and business created. Investors in the Prince George's County community-based public-private partnership likewise benefit when the green infrastructure projects constructed by the partnership deliver local economic gains.

STEP 6. IMPLEMENT

By the time a project is at this stage, funding, effective designs and competent implementers will be in place to carry out the project build. Partnering across multiple agencies, nonprofits and financial institutions is more complicated than single entity management, but funding and agreement efficiencies can still be created. For example, the Yuba Forest Resilience Bond partnered with the National Forest Foundation to facilitate grant and stewardship agreements with state and federal agencies.

STEP 7. MEASURE OUTCOMES AND ANALYZE RESULTS

Project sponsors often rush to implementation without carefully developing a system to measure project outcomes effectively and feasibly. Yet, if there is no data and results to demonstrate the project's success, it can be difficult to ask for more funding and the important feedback of 'method efficacy' cannot inform future projects. Planning for the collection and management of outcome data and agreed analytical methods is a critical element for the development of an impact bond.

Establishing the assumptions to be tested and the methods that will be employed are important valuation steps that will ensure transparency of process and trust amongst partners. Poor data management can result in a lot of information that is paid to be collected but not analyzed, used or applied to learn from implementation ([CMP, 2020](#)). Taking the time to set up the data collection, quality control, management and analytical tools is as important to a project as project design, permitting and implementation.

STEP 8. COMMUNICATE AND SHARE RESULTS

Outreach and communication are critically important to project implementation. By highlighting pursuit of innovative water system projects and investment models, agencies have an opportunity to be recognized as leaders amongst their constituents, peers, local elected officials and future investors. Throughout the project and financing development process, and once project and data analysis are complete, the sponsoring agencies will benefit from participating in wide-ranging outreach opportunities (e.g., articles, presentations and/or social media) to share results, challenges, lessons and recommendations. This outreach will amplify learning across

many agencies and organizations as well as foster transparency in communications with the public and will build the case for future efforts.

STEP 9. ITERATE

Iteration is about taking a step back to examine the project outcomes and results as well as examining the shared understanding of the system. Based on your analyzed results, are there new relationships that should be built into the model or did the interventions change the system based on your previous assumptions? Were there any steps during the process or implementation that could be improved, costs cut without sacrificing the quality of project implementation? Was your communication and outreach effective? Closing the loop in the iteration stage is not about an endless loop of work but it is about reiterating the steps in the project cycle to determine if you need to change or improve the process over time (CMP, 2020).

HYPOTHETICAL APPLICATIONS IN THE SRFA

With these broad concepts in mind, we turn to additional example applications of non-traditional financing to actual project needs. Water resource agencies and their communities will benefit from considering private investment approaches either to complement public sources of funding or to make up for unavailable public funds. Agencies may also approach infrastructure and project development from a disaster or risk mitigation perspective. Table 1 summarizes these examples and they are described in more detail in the following sections.

Table 1. Summary of hypothetical applications in the SRFA.

Applications	Funding	Challenges	Cases/Examples
Multi-benefit green infrastructure	Foundations, state/federal grants or loans	Grant capacity, lack of foundation connection to municipalities	City of Atlanta EIB, City of Buffalo
Source water fire reduction and recovery	Foundations, state/federal grants or loans, utilities, insurance companies, revolving loan fund	Scale, partnerships, new idea	Denver Water, City of Santa Fe, Rio Grande Water Fund
Drinking water system upgrades	Foundations, state/federal grants or loans, monetizing avoided costs	Grant capacity, new idea	Prince George's County, Wildfire Mitigation Environmental Impact Fund
Wastewater system upgrades	State/federal grants or loans, monetizing avoided costs	Grant capacity, new idea	City of Anderson, environmental impact bonds
Water re-use for agricultural irrigation	Water sales	Develop business case	Environmental impact bonds
Groundwater sustainability	Foundations, state/federal grants	Funding, scale	Groundwater Recharge Initiative ¹⁰
Water system consolidation	State/Fed grants leveraged with private funds	Grant capacity, compliance challenges, public resistance	Prince George's County, impact bonds

MULTI-BENEFIT GREEN INFRASTRUCTURE

Several Sacramento Valley communities struggle to meet existing municipal separate storm sewer systems permit requirements or to reduce local stormwater problems associated with concentrated impervious areas and inadequate storm drainage. Funding to address these challenges is chronically in short supply due to state constitutional hurdles to assess new stormwater fees or raise taxes to fund stormwater programs. At the same time, as discussed previously, a concerted green infrastructure program could realize multiple regulatory and non-regulatory benefits, such as reduction in localized flood damages, improved community liveability and enhanced business activity. By monetizing the value of these benefits, a multi-payor investment model such as the Rain Check 2.0 Program could allow local governments to use Clean Water State Revolving Fund and private foundation grants to attract private investment tailored to these outcomes.

For example, the City of Mt. Shasta recently finalized a stormwater master plan update.¹¹ This plan identified a set of recommended stormwater projects based on a prioritization approach that evaluated proposed projects against weighted ranking criteria. There are existing state and federal grant and loan programs that can provide funding for these projects; however, given the differences in timing and focus of these grant programs, it could be difficult to assemble sufficient funds to pursue the updated master plan projects in a concerted, timely manner. The comprehensive bundle of benefits provided by the plan has a monetizable value which could inform the formation of a consolidated, outcome-based investment approach. It may be worth considering whether an Enhanced Infrastructure Financing District could be an appropriate vehicle for the City to capture the future value of certain benefits. Initial development and start-up funding could come from a sequence of grants, with the bulk of implementation financed by an impact bond. Repayment of this bond could (a) be conditioned on delivery of the specified outcomes and (b) funded from innovative funding streams like Enhanced Infrastructure Financing District revenues or repurposed savings from avoided municipal flood insurance and response costs. Additional project beneficiaries, who may have an interest in investing in the project, could include insurance and/or re-insurance companies.

A different approach, conceptually related to the multi-funder, outcomes-based model employed by Blue Forest Conservation, would use a performance partnership model to incentivize, finance and build green infrastructure on private property. It is a generally held belief that private property installations of green infrastructure can be 50% less expensive than equivalent public property, public agency-led projects. In the performance partnership model, a municipality such as Mt. Shasta could release an RFP seeking project developers who will commit to delivering a specified amount of stormwater reduction by locating property owners willing to host a green infrastructure project, financing the design and construction of the aggregated bundle of projects and installing and maintaining the projects for a specified performance period, such as 20 years. This approach transfers almost all risk to the project developers who are repaid based on the completed green infrastructure projects' ability to meet the specific stormwater and community benefits set out by the municipality. The municipality may incur little or no upfront costs while achieving its goals at lower cost, with favorable long-term repayment obligations.

Revenue to repay the project developers may come from a variety of sources, including regular stormwater or general fund budget allocations coupled with federal or state grant contributions, parks/open-space or transit funding. In addition, it may be possible to leverage repayment capital based on the avoided costs of localized flood response or damage, reduced operations & maintenance costs for existing stormwater infrastructure and budgets set aside for other flood control or water quality projects. In this case, it would no longer be necessary for private property owners to provide this public benefit and the municipality could offer a credit against property taxes or a small annual availability fee.¹²

SOURCE WATER FIRE REDUCTION AND RECOVERY

Public and private water agencies have an interest in healthy watersheds and forest health projects, such as thinning and prescribed fire, that reduce fire risk within the watershed. Yuba Water Agency is among several water agencies in the western U.S. that have invested in pre- and post-fire forest projects to protect and restore the integrity of their water supply. In addition to the innovative Blue Forest Project highlighted in a previous section, Denver Water and the City of Santa Fe have each partnered with the Forest Service and others to fund and implement forest treatment projects within their respective watersheds. In 2010, Denver Water and the Forest Service formed the [From Forests to Faucets](#) partnership to collaboratively fund, prioritize and implement forest management activities on federal lands within the utility's water supply watershed. The partnership will fund \$33 million worth of projects to reduce fire risk on 40,000 acres on federal, state and private lands. Corporate and private foundation partners provided additional funding for the initiative.

Facing similar concerns and cost drivers, in 2002 the City of Santa Fe launched the Santa Fe Municipal Watershed Project by assembling key partners and embarking on a collaborative approach to prioritizing, planning and implementing forest and watershed management activities ([Carpe Diem West, 2014](#)). Funded by Forest Service grants during its initial start-up, the program is now supported by revenue from water rates. Conducting an avoided cost study was crucial to making the case to ratepayers that rate increases to fund this program were wise investments.

A study of the Rio Grande Water Fund determined that an estimated \$92-288 million in fire suppression, post-fire rehabilitation and sediment dredging costs could be avoided with \$5 million invested over a 20-year forest treatment program ([RGWF, 2014](#)). The fund is a mechanism for linking beneficiaries of a healthy Rio Grande watershed to projects that promote long-term watershed health and increasing the pace, scale and funding of these projects. In addition to forest and water supply security benefits, the Fund also creates economic and employment development opportunities, through forestry, construction and administration jobs. Investors in the Fund include state, federal and local agencies; private philanthropic foundations; local and national businesses; and financial institutions.

DRINKING WATER SYSTEM UPGRADES

DAC water systems across California face significant infrastructure related challenges. Buried distribution pipes, long past their intended service life, have crumbled in place, leading to lost water, lost revenue and increased treatment costs. Groundwater contamination from naturally occurring and human-caused pollutants increases treatment complexity and cost, reduces demand and revenue and requires provision of substitute supplies. While State Revolving Loan funding is available for corrective rehabilitation and updated systems, these funds are insufficient to meet demand and require straightforward repayment of interest and principal, a daunting prospect for cash-poor water providers.

For instance, the City of Red Bluff (population 14,283) has approximately 5,000 households that currently rely on private wells and leaking septic systems for their water source and disposal needs. These wells have high nitrate levels, so the residences will eventually need to be tied into the City's water system to ensure they have a water supply that meets health requirements. Connecting this area to the current sewage collection and treatment system will require significant capital, in addition to significant water and sewer pipeline extensions. Currently, the existing wastewater treatment plant is operating at full capacity, necessitating an expansion or construction of an additional facility. Taken together, the infrastructure capital costs are beyond the city's budget.

One approach to financing this package of upgrades and expansions may be to capture the monetary value of treatment and operations & maintenance costs that could be realized with upgraded systems as well as the potential uplift in revenue from increased water sales and sewer rates. Quantifying the value of these avoided costs and new revenue can serve as the basis for long-term repayment of private capital used to fund an outcomes-based impact bond or public private partnership arrangement. The Prince George's County

community-based public private partnership may be instructive as a model, and there are parallels with the mode used to fund the Southwest Colorado Forest Resiliency initiative.

WASTEWATER SYSTEM UPGRADES

Upgrades and repairs to wastewater collection and treatment systems may be financed using a model like that described in the preceding section. Damaged or under-maintained wastewater collection systems typically allow for considerable infiltration and inflow during wet weather events as well as shallow groundwater or surface water pollution throughout the year. The increased volumes of untreated inflow can overwhelm treatment systems and increase treatment costs, wear and tear on equipment and result in financial penalties for non-compliance. All costs may be reduced or avoided through upgrades, repair or replacement of failing equipment. Benefits may include significantly reduced materials and operations and maintenance costs. These avoided costs can be tapped as capital to repay a private impact investor.

For example, the city of Anderson (population 10,476) is a severe DAC in Shasta County. Anderson's aging and crumbling sanitary sewer system creates significant inflow and infiltration problems for the City. Influent flows to the wastewater treatment plant range from 2-3.5 times the normal dry weather flows. In addition, the sewer system could benefit from other water system improvements, including new water mains, storage tanks and wells. To date, lack of sufficient funding has prevented the city from realizing these improvements. California State Revolving Fund loans and Integrated Regional Water Management funding may be available, but competition for these limited resources reduces the likelihood of fully funding Anderson's upgrades. At the same time, ongoing repair, replacement and operations costs consume the city's budget. Taken together, these costs represent an opportunity to repay the up-front capital that could be provided through an impact bond or similar private investment.

Another option to further reduce costs and increase upgrade efficiencies may be to pool the needs and resources of multiple wastewater operators. Acting through a partnership or formal enterprise collaboration that stops short of actual consolidation, a collective approach could produce a package of upgrade and rehabilitation needs that could be addressed by a single provider acting under a performance-based contract. Because the scale of the project is larger, it could attract developers and investors who are able to deliver the required improvements at scale and at reduced cost.

WATER REUSE FOR AGRICULTURAL IRRIGATION

The implementation of the Sustainable Groundwater Management Act, and the likelihood that future surface water deliveries in some areas may be reduced or even curtailed due to changes in precipitation and regulatory environments, will create an incentive for projects that deliver recycled water to irrigation districts or for groundwater recharge. Already, some California water providers have entered innovative transactions that fund the construction of necessary treatment and delivery infrastructure and supply of this new source of agricultural water. Assuming that all water rights conditions and limitations are met, this approach could prove to be a valuable tool in building local water resilience.¹³

The business case is relatively straightforward. If the cost of recycled water is less than alternative groundwater or surface water supplies but can serve as a sufficient repayment revenue stream, the arrangement will make financial and water supply sense. In addition, the creation of a durable water supply could have long-term benefits that outlast the repayment term on any financing needed to construct the project. Making a 30-year investment in a new 100+ year water supply is a fiscally sound path that water providers should investigate. Again, the upfront costs to develop, design and construct the infrastructure required for this type of project may be prohibitive for a water utility to take on independently. A combination of debt financing and performance-based contracting or impact bonding could be a fiscally efficient way to implement the project.

GROUNDWATER SUSTAINABILITY

Along similar lines, innovative finance options may be appropriate for constructing and operating the infrastructure needed to capture and recharge reclaimed water and/or stormwater flows to recharge depleted or threatened aquifers. Even within the SRFA, recovery of sustainable groundwater levels and yields in some Groundwater Sustainability Agencies and sub-basins depends on secure supply of surface water. This security may be reduced by climate change, increased competition for surface water and need to meet future instream flow requirements. In addition, managed aquifer recharge projects involving reclaimed water could be useful for mitigating poor groundwater quality. Indirect potable water reuse is way of improving the quality of groundwater sources, which could assist DAC water providers in meeting drinking water quality requirements.

Managed aquifer recharge projects have much in common with projects that provide recycled water for irrigation. Similar financing options could be applicable for either or both types of projects. The water price could be attractive, particularly in groundwater sustainability agencies with sustained yield challenges, financing recharge, flow augmentation, water conservation/demand management. The most obvious source of repayment revenue would be income earned from sales of recycled water to local Groundwater Sustainability Agencies, irrigation districts or other beneficiaries of enhanced groundwater supplies.

WATER SYSTEM CONSOLIDATION

Many SRFA communities are served by small water systems that are more likely to have trouble delivering safe and reliable water supplies to local consumers. Small water system rate bases tend to be DAC households, equipment often is out of date or failing and local management and technical expertise may be insufficient. In addition, a legacy of local racial and class bias is often cited as a barrier to consolidation and system extensions. California legislation and State Water Board programs have been adopted in recent years to ensure that DAC urban communities have access to safe, affordable drinking water, as required by the state's human right to water policy, but consolidation is not feasible everywhere.¹⁴ Capital costs for connections, as well as design and permitting costs, can be significant obstacles for small system operators. State grant programs play a critical role in overcoming these obstacles, but complementary private finance could deliver more financial resources to accelerate appropriate consolidations.

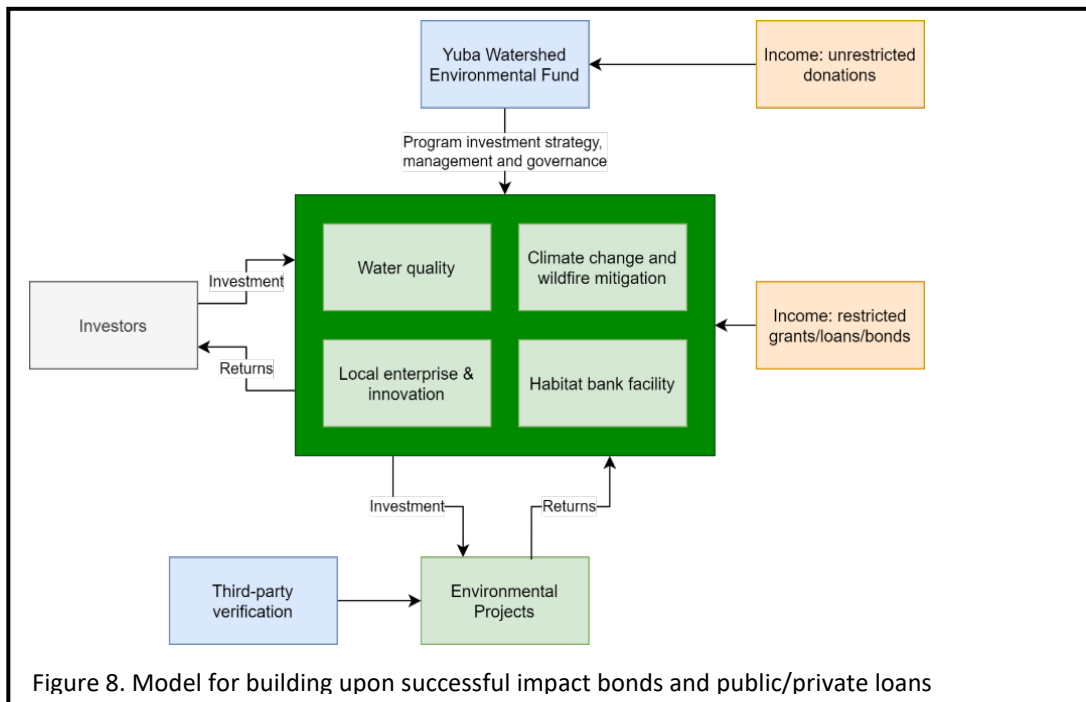
Consolidation should lead to more reliable and safer water supply and could also lead to reduced cost of service. In this case, maintaining current rate levels for a specifically defined period could provide the water utility with income that exceeds expenses. This income could be directed to repay private investors who supplied up-front capital for the infrastructure costs. Additionally, some consolidation infrastructure improvements will eliminate leaks and reduce non-revenue water loss creating increased system efficiency and possibly an additional supply of either raw or treated water that may be sold for additional revenue. Potential purchasers may include groundwater replenishment districts or agricultural users.

As an example, Fresno State completed a feasibility study that identified 12 public water supply systems that are vulnerable to failure or non-compliance with health requirements, and which could be consolidated and connected to Fresno's water system ([Fresno State, 2020](#)). In addition to failure/non-compliance, small water system customers in the region typically pay considerably higher rates than City of Fresno system ratepayers and receive lower quality service. Recently enacted State of California legislation provides funding for system consolidation projects; however, this funding has limitations and may not be sufficient to meet statewide needs. In short, there is no guarantee that Fresno will receive funding at all or on terms it can afford. An impact bond that delivers consolidation, funded by a combination of state funding and water rate revenues, may be an option, particularly if current rates for disconnected customers could be maintained for some period of time and at a level that does not impose financial hardship.

PART FOUR: RECOMMENDATIONS

What might municipalities, DAC water systems and others do to move a project or program forward and overcome key obstacles or challenges? We offer the following recommendations:

1. Create regional scaling opportunities. Collate watershed-wide programs for regional funding and projects and avoid creating bespoke environmental impact bonds for every city or jurisdiction.
2. Facilitate multiple community water system consolidation and collaboration. Consolidation does not necessarily need to apply to an entire water system. It could be for joint water treatment chemical purchase to reduce costs as well as sharing technical knowledge, capacity and economies of scale to implement prioritized projects.
3. Diversify funding sources. Create opportunities, capacity and finance for small communities to easily develop new funding sources beyond loans and grants while still strengthening their ability to secure the latter. Bonds and other alternative finance mechanisms are not silver bullets to green infrastructure financing: use the right tool for the right situation. Also, advocate for policies that create new funding streams where costs are externalized, such as carbon and wildfire risk to insurance.
4. Establish self-sustaining funding sources. As environmental impact bonds are created and successful, build a sustainable funding portfolio that takes advantage of multiple private and public funding sources as well as grants vs. revenue generation (Figure 11). Beneficiaries of a water system project can be brought in as payors or investors, contributing additional revenue to support the project. Self-sustained funding could also be based on the community foundation model. The funding entity would allow for investment in projects as well as charitable donations, pooling those resources into buckets targeted at locally or regionally specified priorities. An example of self-sustaining funding sources is Quantified Ventures' Colorado Wildfire Mitigation Revolving Loan fund.



5. Develop regional innovation centers for new capacity, tech and funding. Regional centers could include training, access to funding and new technologies related to water infrastructure and restoration. An innovation center could also attract people to work in DAC communities.
6. Create a clear and defensible case for investment. Quantified Ventures' work building the case for bonds and revolving loan funds is instructive here. In each project they made the case to investors and implementers for the appropriate finance tools but also completed the due diligence to analyze the investment risk. The Washington, D.C. Water Environmental Bond, for example, provided a clear understanding of the investment confidence intervals, three performance tiers, and a 95% likelihood that the outcomes would be congruent with those expected by investors ([Cortes, 2017](#)).
7. Increase collaboration, transparency and information to maximize replication and mitigate risks. Collaboration creates stronger programs across multiple partners and increases scale and transparency. Transparency not only aids replication but minimizes risk. Information sharing is a way of building trust among partners and stakeholders, improving project outcomes and diversifying the funding and implementation base. Tell your neighboring towns and counties how you are solving these problems!
8. Standardize metrics for measurement. It can be difficult to measure environmental outcomes. There are catalogs to help standardize sustainable development goal metrics and these are becoming more accessible and easier to use. [IRIS+](#) is the generally accepted system for managing, measuring and optimizing impact.
9. Link capital investments with projects. Conservation finance experts have commented that funding is not the problem delaying investment for environmental projects, but instead there are billions of unallocated investment resources undeployed due to lack of projects ([Hamrick, 2016](#)). In the future, perhaps a technical app-based solution could support linking projects to investors and even to each other for greater impact bond development. Nevertheless, implementers often despair over lack of funding and competition/oversubscription to grant funding resources is fierce and high. The purpose of this paper is to provide outreach and education to ensure that project proponents are aware of these resources and can start to investigate the options that best fit their situation.
10. Establish alternative finance as a value-driver instead of value-added tool. For example, as the market for assets such as carbon credits continues to gain traction and grow, forest land managers interested in non-timber forest revenue still view alternative finance sources as a value-add rather than a value driver ([Bilhorn, 2020](#)). Considering alternative finance up-front when planning capital investment projects rather than when funds are needed should be an increasingly important revenue generating strategy.

APPENDIX A: GRANT FUNDING SOURCES

There are a variety of funding sources for state, federal and foundation grants available to communities and nonprofits for a variety of infrastructure, water and restoration projects. We refrained from making a list of the sources since grant programs change so frequently, but a few of the most consistent and relevant sources are discussed below.

CALIFORNIA STATE FUNDING AGENCIES AND GRANT PROGRAMS

Many California water agencies have turned to the funding programs offered by the State Water Resources Control Board to support local drinking water and wastewater projects. In particular, the Clean Water State Revolving Fund and Drinking Water State Revolving Fund can provide below-market rate lending to build or enhance water systems. Together, these programs have been vitally important for delivering low-cost financing to disadvantaged community water systems, particularly wastewater treatment and drinking water supply projects. The State Board's Division of Financial Assistance manages both funds and is increasingly receptive to innovative projects that they can manage within their existing programmatic structures and requirements. For example, the Clean Water State Revolving Fund has been used to purchase watershed lands, implement sustainable forestry and sediment control measures to meet local watershed protection goals. The Clean Water State Revolving Fund can also be used for green infrastructure and stormwater management projects; however, these are generally less competitive than wastewater projects.¹⁵

Importantly for DACs, both State Revolving Funds allow for generous forgiveness of the loan principal and zero percent interest rates for qualifying disadvantaged community projects. The most significant downside of these programs; however, is the limited funding available. Recently, applications to the Clean Water State Revolving Fund totaled over \$7 billion for approximately \$600 million in available funding. This shortfall in public funding availability is a significant motivation to develop private finance options.

The California Department of Food and Agriculture and other state agencies—Departments of Fish and Wildlife, Water Resources, CAL FIRE and CalTrans also manage grant programs to distribute funds from voter approved bond measures. These programs have delivered significant value to water system operators and their local partners; however, the grant application and management processes can be extremely burdensome and time consuming, creating obstacles for DACs. Once again, partnering should be considered as nonprofits and other local Agencies may have expertise in navigating and managing these grant programs and can act as a fiscal agent on behalf of a DAC.

In recent years, California voters approved ballot-measures authorizing the sale of state bonds to fund water infrastructure and other investments in watershed health and water system implementation. Propositions One (2014) and 68 (2018) provided millions of dollars to grant programs administered by the State Water Board, Department of Water Resources, Natural Resources Agency, California Department of Fish and Wildlife, Wildlife Conservation Board, and numerous state conservancies. Websites maintained by the Natural Resource Agency for [Proposition One](#) and [Proposition 68](#) grant programs contain up to date information for each program.¹⁶

Additionally, several grant programs administered by federal agencies can provide funding or financing for local water infrastructure projects. Notable examples include:

[Community Development Block Grants](#): The U.S. Department of Housing and Urban Development (HUD) Community Development Block Grants (CDBG) program provides annual grants through a formula to local governments and states. The CDBG program is designed to assist in community redevelopment, providing funding to expand economic activity, improve community services, and revitalize neighborhoods. Eligible activities include the construction of water infrastructure and streets. States and local governments could look

to the CDBG program as a potential source of funding to add green infrastructure elements into a street reconstruction project, for example.

EPA Section 319 Funding: Authorized by Section 319 of the Clean Water Act, this program provides funding to projects that address nonpoint source pollution reduction projects. These funds are distributed by the Environmental Protection Agency (EPA) to state and tribal agencies which then administer them. In California, the State Water Board manages the 319 Program.

EPA/NFWF Five Star and Urban Waters Small Grants Program: This program, an evolution of an earlier EPA Urban Waters Small Grants Program, is co-sponsored by EPA and the National Fish and Wildlife Federation (NFWF). The program supports projects that develop community stewardship of natural resources and address water quality issues. Urban tree canopy restoration and stormwater management are among the activities funded through the program.

FEMA Pre-disaster Mitigation Grant Program: This Federal Emergency Management Agency (FEMA) program is designed to assist local communities with implementing a natural hazard mitigation program to reduce overall risk from future disasters. This program awards planning and project grants and provides opportunities for raising public awareness about reducing future losses before disaster strikes. To be eligible, projects must be consistent with the goals and objectives identified in a current FEMA approved hazard mitigation plan. Green infrastructure is an eligible mitigation method.

FEMA Flood Mitigation Assistance Grant Program: FEMA's Flood Hazard Mitigation Assistance program provides funding support to communities for projects that reduce the risks associated with flood and drought conditions. Aquifer storage and recovery, floodplain and stream restoration, flood diversion and storage, and green infrastructure methods are eligible for funding.

In addition to these specific grant programs, the [United States Fish and Wildlife Service, Bureau of Land Management, Bureau of Reclamation,](#) and [Department of Agriculture](#) all offer grant and/or loan programs that may support water infrastructure projects in the SRFA.

PRIVATE PHILANTHROPIC FOUNDATIONS

Non-profit organizations typically rely heavily on foundation grants as part of their fiscal resource base. Their ready access to these funders, and a competence in obtaining and managing foundation grants, make them attractive co-sponsors of innovative water system projects. One notable distinction between foundation and government grants: foundation grants are typically awarded in a cash up-front manner rather than the cost-reimbursement model of state and federal grants. This approach to funding provides valuable flexibility and security in the initial phases of project development and deployment. Foundations may also solely fund operating costs and are increasingly able to provide impact investment grants or low-interest loans.

California is home to some of the world's largest foundations; many of them are focused on environmental issues. These include the William and Flora Hewlett Foundation, David and Lucile Packard Foundation, Moore Family Foundation and the Schmidt Family Foundation.

ENDNOTES

- ¹ See California [Department of Food and Agriculture](#), [Department of Water Resources](#) and [CAL FIRE](#) webpages.
- ² See [srfadacip.com](#) website for more information. Municipal separate storm sewer system permits are required of certain cities by the Clean Water Act and applicable California statutes and regulations.
- ³ Municipal separate storm sewer system permits are required of certain cities by the Clean Water Act and applicable California statutes and regulations. See the [State Water Resource Control Board's Municipal Stormwater webpage](#). Note that although municipal separate storm sewer systems are widely referred to MS4s we chose to generally avoid use of acronyms throughout the document to make it more readable and accessible to those not familiar with the language associated with water use and management.
- ⁴ See [Nine Ideas to Bridge the Gap in Conservation Finance](#).
- ⁵ See Quantified Ventures' [What is an Environmental Impact Bond?](#)
- ⁶ However, the payments for a first project in the North Yuba watershed ultimately were fixed payments with some repayment flexibility if the utility experiences a low water year.
- ⁷ See Heidi Niggemeyer, City of Salinas, "[Preparing for a Community Based Public Private Partnership](#)."
- ⁸ See the [Open Standards for Practice of Conservation](#) for tools, resources and examples of how to incorporate this into project design, implementation and monitoring.
- ⁹ Note that government grants are nearly always reimbursable, e.g., funding is not provided up-front.
- ¹⁰ See [Sustainable Conservation's technical resources page](#) scrolling to the Water Sustainability section for an overview, guidance, tools and reports related to recharging groundwater.
- ¹¹ See [Mt. Shasta city stormwater master plan](#).
- ¹² This approach is based on a description of the [Stormwater Performance Partnership](#). Also see [Financial Innovations for Green Infrastructure](#).
- ¹³ See [California Ag Water Sustainability Initiative](#).
- ¹⁴ See The [Great Divide](#) article from the Fresno Bee.
- ¹⁵ An introduction to the Clean Water State Revolving Fund financing is available [here](#).
- ¹⁶ The [California Grant's Portal](#) website is a convenient access point for more information about current state funding opportunities.