retrofitted with permeable, interlocking pavers, with the goal of ultimately converting 240 alleys (SCN, 2018).

Funding the Green Alley Program has been a significant challenge for the small community. Yet building partnerships with state agencies and accessing revolving fund dollars enabled them to pursue their innovative stormwater management approach. The program partners include the local wastewater treatment agency, which is the main sponsor, the Iowa Department of Natural Resources, and the Iowa Department of Agriculture and Land Stewardship. With help from these partners, the program sponsor was able to secure funding through the Iowa Clean Water State Revolving Fund. This fund provides low-interest loans to finance publicly-owned capital projects that help protect water quality in the environment.

Dubuque's local wastewater treatment agency also took advantage of a recent Iowa state-level code update that allows sewer revenues to be used for addressing nonpoint source water quality issues. In effect, this update created a new and potentially dedicated funding source for the City of Dubuque's stormwater program. This code change is an example of how state-level policy can promote integrated water management.

California's Clean Water State Revolving Fund (CWSRF) and Drinking Water State Revolving Fund (DWSRF) provide similar opportunities for financing stormwater projects. Indeed, California's CWSRF contains a Green Project Reserve that can offer principal forgiveness loans for certain projects, including the use of green infrastructure to mitigate stormwater runoff. Yet these funds are rarely used for stormwater projects (CASQA, 2016) because most California-based MS4 permittees lack the dedicated source of revenue needed to repay these loans.

CULVER CITY, CALIFORNIA

A Parcel Tax for Clean Water and Clean Beaches

Developed properties drive the generation of stormwater runoff in urban areas, so a tax based on property ownership is a reasonable basis for assessing stormwater program funding. Parcel taxes are one mechanism that links property ownership, and associated runoff generation, to the cost of stormwater services provided. In California, parcel taxes must be passed with support from two-thirds of the voting public or from at least half of all property owners. One advantage of a parcel tax is that the revenue can be used for project capital and/or maintenance costs. Culver City, in Los Angeles County, passed The Clean Water, Clean Beach Parcel Tax in 2016 (Measure CW) to pay for stormwater management projects that help reduce and prevent water pollution in local water bodies. Under their parcel tax structure, single-family property owners pay $99 annually, multi-family property owners pay $69 per dwelling unit annually, and non-residential customers pay $1,096 annually per acre of land or portion thereof. In general, these rates are such that those who own more property, and generate more runoff, pay more for the city's stormwater management program.

Another important aspect of a parcel tax in California is that it qualifies as a "special tax." A special tax is imposed for a specific purpose and the revenue from it is restricted to projects directly related to that purpose. Culver City has identified augmenting the local drinking water aquifer with captured stormwater as one of the projects to be funded by their parcel tax (Culver City, 2016). This identification recognizes stormwater capture for water supply as a legally acceptable pollution prevention measure in Culver City.

SAN ANTONIO, TEXAS

Property-Related Stormwater Fee

San Antonio established a stormwater fee in the early 1990s. The original fee was based on lot size and type (i.e., single-family residential, commercial, multi-family residential, and government), but in 2012, the city council began raising concerns about the fairness of the fee structure.[19] For example, under the old system a property owner with a 10-unit multi-family building on an acre of land would pay the same amount as a property owner with the same number of units on two acres. The city worked with a consulting firm to analyze different fee structures and found that fees based on impervious area would be the most equitable and are considered a best practice within the industry (Hammer and Valderrama, 2018).

Changing fee structures can be contentious, because some end up paying more and others less. To minimize public backlash, San Antonio developed a tiered fee structure and implemented a credit program to help those with large impervious areas reduce their fees. The fee is divided into two categories: residential and non-residential (Table 2). The residential fee has three tiers based on the extent of impervious area (in square feet), whereas the non-residential fee has four tiers based on percent of impervious area. As the tiers increase for non-residential properties, the cost per 1,000 square feet of impervious cover increases. This creates a significant incentive for larger commercial property owners to reduce their impervious cover. At the same time, the city created an LID credit as an incentive for property owners to reduce impervious cover. The credit provides a discount of up to 30% of the stormwater fee to the property owner once LID features have been installed on a property. To remain eligible for the credit, the LID structures must be maintained to a certain standard. Fee credit programs can both incentivize voluntary retrofits with green infrastructure and ongoing maintenance (Hammer and Valderrama, 2018).

Table 2

San Antonio's Stormwater Fee Schedule

Residential Stormwater Fee Schedule		
Tier	Impervious Area (Sq. Ft.)	2018 Fee
1	≤2,750	$3.60
2	>2,750-4,220	$4.74
3	>4,220	$10.02

Non-Residential Stormwater Fee Schedule Base Fee (per month, flat fee): $64.53		
Tier	Percent Impervious Area	2018 Fee (per 1,000 Sq. Ft.)
1	≤20%	$0.29
2	>20% – 40%	$0.43
3	>40% – 65%	$0.56
4	>65%	$0.71

Source: http://www.sanantonio.gov/TCI/Projects/Storm-Water-Fee

SALEM, OREGON

Property-Related Stormwater Fee with Community Outreach

Salem, Oregon's journey to instate a stormwater fee highlights the importance of outreach and public relations for agencies considering this funding mechanism. Salem is a city of approximately 150,000 people in an agricultural region of Oregon. In the 1980s, city officials attempted to create a stormwater utility; however, the public relations campaign failed to clearly articulate the need for and reasoning behind the associated fee, and it was blocked after significant public outcry (Reese et al., 2015). In 2010, city officials decided to try again.

19 City of San Antonio Ordinance No. 2015-09-10-0761

Like their counterparts in San Antonio, City of Salem officials felt that creating the stormwater fee based on impervious area would be the most equitable means of funding their program. They focused on community relations and outreach to minimize public backlash. Key aspects of their successful outreach campaign included more than 12 months of engagement with neighborhood associations, trade and business organizations, citizen boards, the city council, and interested individuals and business owners. In addition, they focused a portion of their research on comparing their fees to those in other Oregon communities with similar characteristics, such as population, economic, and cultural characteristics. This enabled city officials to demonstrate that their fees were in line with similar communities from across the state.

Through their community engagement effort, they learned several valuable lessons that they were able to apply to the rollout of the fee as well. First, they learned that they needed more time to get adequate support from the community. Second, they decided to phase in the fee rather than institute it all at once. And third, they added a base charge that is applied equally across all accounts to cover street sweeping, billing, debt collection, public works personnel, and impervious areas of public streets. Public engagement and city leadership were key, throughout the process and after the fee was passed, to prevent backsliding (Reese et al., 2015).

PALO ALTO, CALIFORNIA

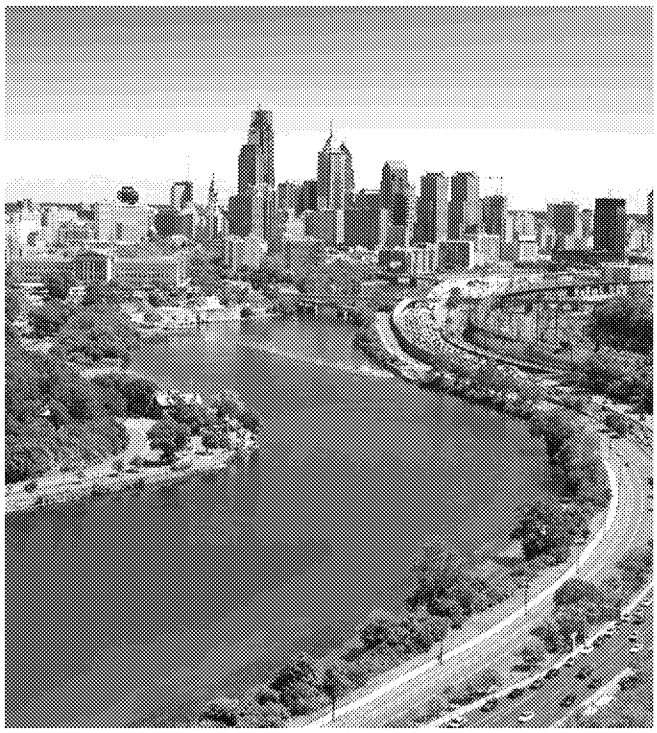
Two Components, One Stormwater Management Fee

An example of success on a voter-supported stormwater fee in California comes from the City of Palo Alto. Since 1989, Palo Alto has charged residents a "storm drainage fee," similar to fees for other utilities, such as for drinking water and wastewater services (City of Palo Alto, 2016). Palo Alto voters supported the continuation of this fee in 2005, and then in 2017, they supported an update to this fee. The update ensures continued funding for stormwater management, including new efforts to use green infrastructure. The updated fee, which is based on actual impervious area, includes an amount to be paid in perpetuity, as well as an amount that will sunset within 15 years. The portion of the fee that is set to sunset will only be extended if needed, and again, only with voter approval. The decision to divide the fee into two separate components may have helped voters to find the fee more palatable, allowing the measure to successfully pass.

PHILADELPHIA, PENNSYLVANIA

Incentivizing Cost-Effective Stormwater Capture on Private Property

The City of Philadelphia is nationally recognized as a leader in stormwater management (e.g., AAEES, 2014), installing over 200 public projects and incentivizing nearly 500 green infrastructure projects on private land since 2011 (Stutz, 2018). Driven by water quality concerns and high stormwater costs, the Philadelphia Water Department (PWD) took a bold approach to their combined sewer overflow (CSO) issues when it launched its Green City Clean Waters program. The program tackles local water quality challenges by both fixing problems with the existing storm drain system and executing a comprehensive strategy to deploy green infrastructure. From the beginning, PWD acknowledged that it was seeking a solution to the water-quality impacts of the CSO system that would also provide co-benefits to the community, local economy, and environment (PWD, 2009a). Using a triple-bottom-line analysis, PWD found that combining gray and green infrastructure would provide nearly $2.85



Source: Bonnie J., iStock

The City of Philadelphia is a national leader in implementing green infrastructure. Since 2011, the Philadelphia Water Department has installed over 200 public projects and incentivized nearly 500 projects on private land.

billion dollars in benefits to the city, compared to only $122 million in benefits from using traditional gray infrastructure alone (PWD, 2009b). This holistic, watershed-based approach has been key to the city's success in large-scale implementation of green infrastructure.

Greening of publicly-owned land is a key part of meeting their overall goal. However, PWD has also put significant funding and effort into programs that support voluntary greening of private land. An in-depth program analysis by the Natural Resource Defense Council (Valderrama and Davis, 2015) examines how PWD was able to incentivize green infrastructure on private land for less than half the cost of applications on public land. Using data collected from their early efforts, PWD found that green infrastructure on publicly-owned land cost $250,000 to $300,000 per acre, compared to $100,000 per acre on privately-owned land.

Initially, PWD offered a more standard incentive program, with direct subsidies to property owners for the capital costs of green infrastructure. After several years, PWD realized that the paperwork required to receive the subsidy was a barrier for some property owners. In response, the city launched the Greened Acre Retrofit Program, which has several innovations to reduce the cost of green infrastructure. In particular, funds are limited to companies and project aggregators that can assemble projects over large areas (the minimum conversion requirement is 10 acres). In addition, projects compete with one another, with the city awarding the most cost-effective projects.[20] With this program, PWD effectively reduced the cost of green infrastructure on private land to approximately $90,000 per acre.

CONCLUSIONS AND RECOMMENDATIONS

Stormwater has long been considered a liability. Communities have traditionally managed stormwater with the goals of mitigating flood risk and reducing water quality impairments. Yet stormwater is increasingly being viewed as an asset in a water-short state, and a growing number of communities are investing in stormwater capture as a means of augmenting their water supplies. As droughts become longer and heavy rainfall events more common in California, effective urban stormwater capture can enhance community resilience to climate change. Moreover, many of these projects, especially those that use green infrastructure, provide additional co-benefits, such as enhancing community livability and improving air quality.

20 To learn more about the Green Acres Retrofit Program and other PWD stormwater grant programs go to: http://www.phila.gov/water/wu/stormwater/Pages/Grants.aspx.

Over the past decade, the state has made major efforts to advance stormwater capture, from adopting statewide volumetric goals for stormwater use to clarifying the regulatory framework and dedicating funds for multi-benefit stormwater projects. Yet communities still struggle with inadequate and unreliable funding sources, a lack of state guidance on health and safety standards, and a host of other barriers. To overcome these barriers, many communities in California and elsewhere have adopted innovative policies and programs that can be applied more broadly. We highlight some of those efforts in this report.

Local governments can play a key role by developing regulations that directly or indirectly support stormwater capture. For example, the City of Gonzales made modest updates to their city code, ensuring new developments could incorporate curb cuts and other LID features that allow stormwater runoff to enter bioswales and other distributed infiltration structures. Others have taken a bolder approach. The City of Santa Monica, for example, adopted a citywide goal to source all water supplies locally by 2022, and identified stormwater capture as a key element to meeting that goal.

Funding stormwater management remains a major challenge. Yet here, too, communities have proven themselves to be both innovative and pragmatic. San Mateo County's integrated approach to address transportation and its impact on water quality and Dubuque, Iowa's use of partnerships opened the door to funding solutions that otherwise may not have been available. San Antonio, Texas and Salem, Oregon highlight the importance of careful communication and stakeholder engagement when designing and implementing a dedicated, local funding source. Finally, Philadelphia offers a creative solution to incentivize stormwater capture on private property that comes at a much lower cost than similar structures on public land.

While the opportunities for stormwater capture will depend on site-specific factors, there are options for communities across California to more effectively use stormwater as a local water supply. Below, we offer six recommendations for increasing stormwater capture in California.

Advance state and regional policies and provide resources to help communities pursue stormwater capture for water supply.

In some cases, local communities only need support in the form of guidelines and model ordinances to advance stormwater capture. For example, statewide health and safety guidelines on stormwater reuse could empower otherwise hesitant communities to pursue policies that support capture. Additionally, state and/or regional coordination could help facilitate public-private stormwater projects, such as through alternative compliance options.

Expand state funding and reduce barriers for local funding of stormwater management.

Many state funding programs now require projects to provide multiple benefits, and stormwater capture typically meets these criteria. However, there is still limited funding available for stormwater management, and additional state and local funding sources are needed. We recommend that the state examine how to improve the usefulness and uptake of the Clean Water and Drinking Water State Revolving Funds for stormwater capture. Additionally, the state should seek ways to reduce the onerous voter-approval requirements for stormwater services. While SB 231 could help local agencies develop dedicated funding sources, it is not a silver bullet

and additional policies that increase long-term funding and cover operation and maintenance (O&M) expenses should be explored.

Develop dedicated, local funding sources for stormwater management.

Local funding is needed to effectively manage stormwater. Communities that elect to establish stormwater fees should follow best practice by basing that fee on impervious area. Significant public outreach and engagement are essential for obtaining the necessary support for fees. Non-traditional partnerships can also present opportunities, such as the use of development fees or leveraging funds from the private sector to pay for stormwater projects.

Adopt policies that drive innovative and sustainable approaches for water supply.

Local communities can use a variety of tools to advance stormwater capture. They may opt to use regulatory approaches, as in San Francisco or Gonzales. They may also adopt explicit local water supply goals, as has been done in Santa Monica and Los Angeles.

Use the cross-cutting nature of stormwater management to initiate innovative partnerships.

The multi-benefit nature of stormwater projects can facilitate partnerships between agencies and organizations. Local agencies should seek partnerships that can advance stormwater projects that provide environmental, community, and economic benefits. Local opportunities to partner will be unique. Our example from the Fresno area demonstrates how a flood agency has led stormwater recharge efforts, while in San Mateo County, collaboration on stormwater management has evolved around transportation issues.

Continue research to characterize the true cost and full benefits of stormwater capture projects.

Limited data are available on the cost of stormwater capture for supply, and those that exist often fail to account for the multiple benefits of these projects. Additional research is needed so that communities better understand the opportunities for improved stormwater management and for innovative partnerships and collaborations.

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