


SAN DIEGO REGION

Stormwater Capture and Use Feasibility Study

DRAFT


SAN DIEGO REGION

Stormwater Capture and Use Feasibility Study

DRAFT

Prepared for the
County of San Diego

Prepared by:

ESA

Brown and Caldwell, and Burns and McDonnell,
with support from Katz and Associates

Purpose, Goals, and Benefits

What is the purpose of this study?

The San Diego Stormwater Capture and Use Feasibility Study (SWCFS) is designed to provide a regional analysis of the feasibility of planning, constructing, operating, and managing facilities that capture and use stormwater for supply, restoring hydrology, irrigation, conservation, and other beneficial uses.

What are the goals of this study?

- Quantify the volume of stormwater that could be captured and stored on public lands and used in the San Diego region.
- Identify the opportunities and constraints for a range of stormwater capture and use alternatives to provide a management tool in the development and planning of similar projects.
- Assess the feasibility of implementing the potential stormwater use alternatives on a short-, mid-, and long-term basis.
- Support the goals of the updated (2019) Integrated Regional Water Management (IRWM), which addresses stormwater capture and use.

What are the benefits of this study?

- To identify pathways to implement stormwater management projects.
- To identify water supply opportunities.
- To attract additional funding to the region.
- To provide useful management/planning tools for stormwater and water resource managers.

Project Overview

Development of the SWCFS consists of five tasks:

1. Data collection and existing conditions analysis
2. Technical feasibility analysis of stormwater capture and use
3. Implementation approach for capture and use and prioritization
4. Cost analysis of stormwater capture alternatives
5. Preparation of Feasibility Report

Tasks 1 through 4 have been completed and summarized in separate technical memoranda. This Feasibility Report summarizes the findings of those previous tasks.

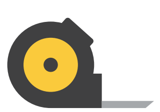
The SWCFS Tool Box

Designed by
brgfx / Freepik

This study determines the feasibility of stormwater capture and use alternatives within San Diego County. Feasibility is assessed through a quantitative analysis of potential volumes and costs of implementing these alternatives on public parcels. Alternative feasibility is also evaluated considering opportunities, constraints, and multi-benefits. An outcome of this study is a tool box for stormwater and water resource program and project managers and leads. This tool box provides a set of planning tools to identify, assess, and develop stormwater capture and use projects.

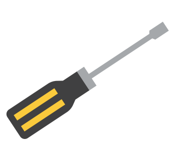
Constraints and Opportunities for Regional Stormwater Capture and Use Projects: This planning tool can be useful in assessing a parcel's potential for capturing, storing, and using stormwater. To analyze a site's potential for capture and use, opportunities (such as gaining regulatory clarity) and constraints (such as limited funding) are analyzed and weighed to enable better decision making.

Parcel Assessments: The SWCFS includes excel spreadsheets and maps of the public parcels assessed throughout the County. This tool provides managers with an evaluation of the potential stormwater capture volume for a parcel and the range of uses that may be feasible.



Guidance for Proposition 1 Grant Funding: This tool provides guidance to stormwater capture project leads on how to estimate capture and use volumes for project planning and design, and for Proposition 1 stormwater grant solicitation applications.

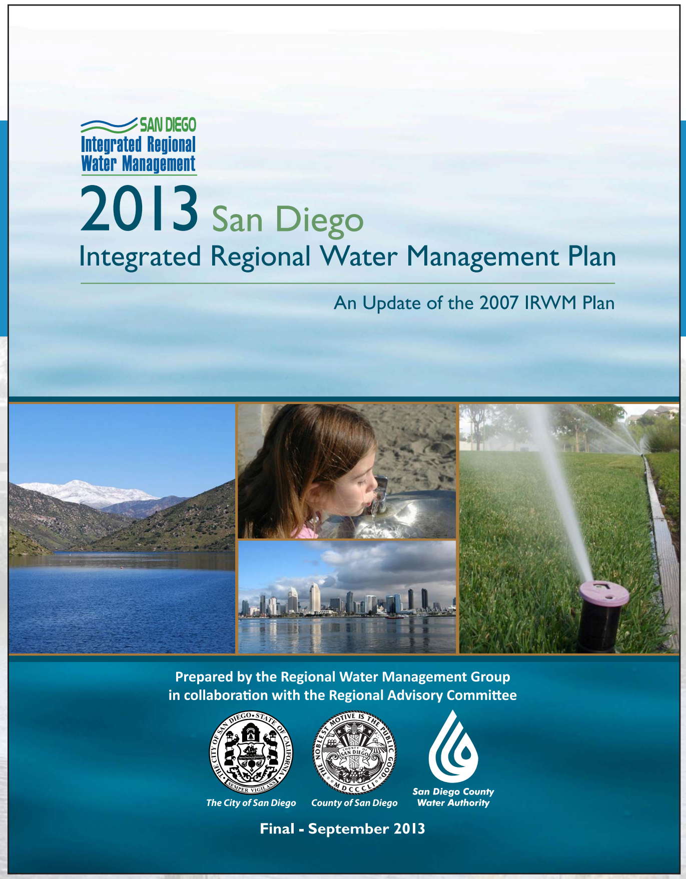
Example Projects: Over 20 example projects from conceptual to constructed provide a management tool for project sponsors and lead in the identification and development of similar projects. These example projects include a summary of the constraints and opportunities, quantities of stormwater captured and used, and in some cases estimated costs. These example projects inform the planning of projects with similar stormwater use alternatives.



Regional Prioritization of Stormwater Use Alternatives: This tool provides managers with the results of the regional analysis of the higher priority use alternatives. In combination with the other tools, the prioritization provides regional managers with a planning tool to identify, assess, and develop stormwater capture and use projects for short-, mid- and longer-term consideration.

Designed by
Anindyanfitri / Freepik

Related Plans


SAN DIEGO
Integrated Regional Water Management

2013 San Diego
Integrated Regional Water Management Plan

An Update of the 2007 IRWM Plan

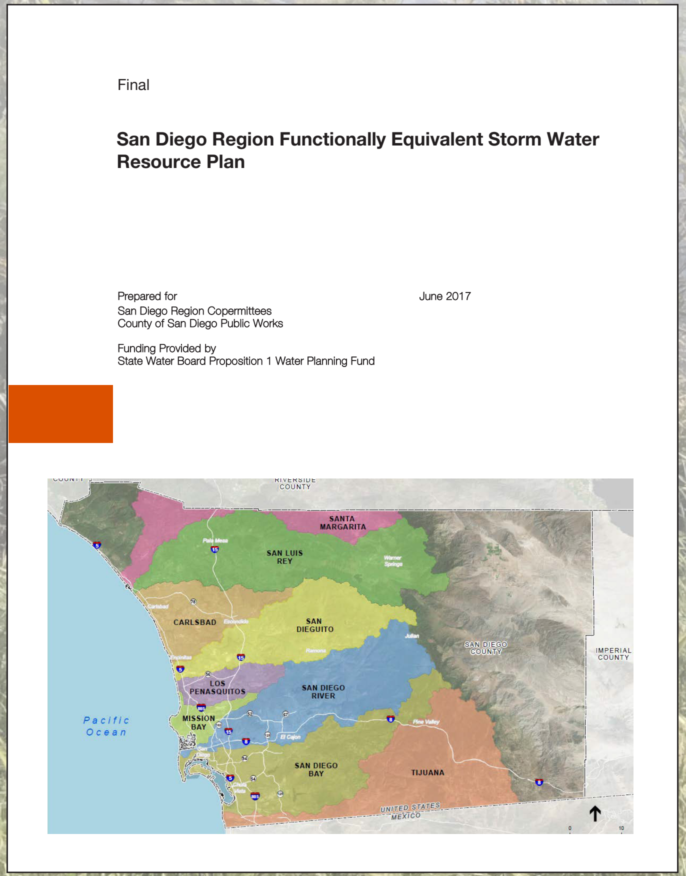
Prepared by the Regional Water Management Group
in collaboration with the Regional Advisory Committee

The City of San Diego
County of San Diego
San Diego County Water Authority

Final - September 2013

Integrated Regional Water Management (IRWM) planning is a state initiative through the Department of Water Resources, aimed at developing long-term water supply reliability, improving water quality, and protecting natural resources. The San Diego IRWM Program began in 2005 and is an interdisciplinary effort by wastewater agencies, stormwater and flood managers, water retailers, watershed groups, the business community, tribes, agriculture, and nonprofit stakeholders to improve water resources planning in the San Diego IRWM Region. The 2013 IRWM Plan provides a mechanism for: 1) coordinating, refining, and integrating existing planning efforts within a comprehensive, regional context; 2) identifying specific regional and watershed-based priorities for implementation projects; and 3) providing funding support for the plans, programs, projects, and priorities of existing agencies and stakeholders.

The SWCFS will be incorporated into the next IRWM Plan update in 2019.


Final

San Diego Region Functionally Equivalent Storm Water Resource Plan

Prepared for
San Diego Region Copermittees
County of San Diego Public Works

June 2017

Funding Provided by
State Water Board Proposition 1 Water Planning Fund

Stormwater resource plans (SWRP) are required by Senate Bill 985 for stormwater capture projects to be eligible to receive state grant funding. These plans list and prioritize projects designed to capture stormwater for multi-benefit use. The legislation is intended to change the perception of stormwater from a nuisance to a resource.

The SWCFS supplements the SWRP with more detailed analysis of stormwater capture and use opportunities. It also provides the tools to quantify and prioritize projects required for grant funding.

Funding for this project was provided through the San Diego Integrated Regional Water Management (IRWM) Prop 1 Planning Grant and contributions from regional agencies and nongovernmental organizations.

Regional Setting

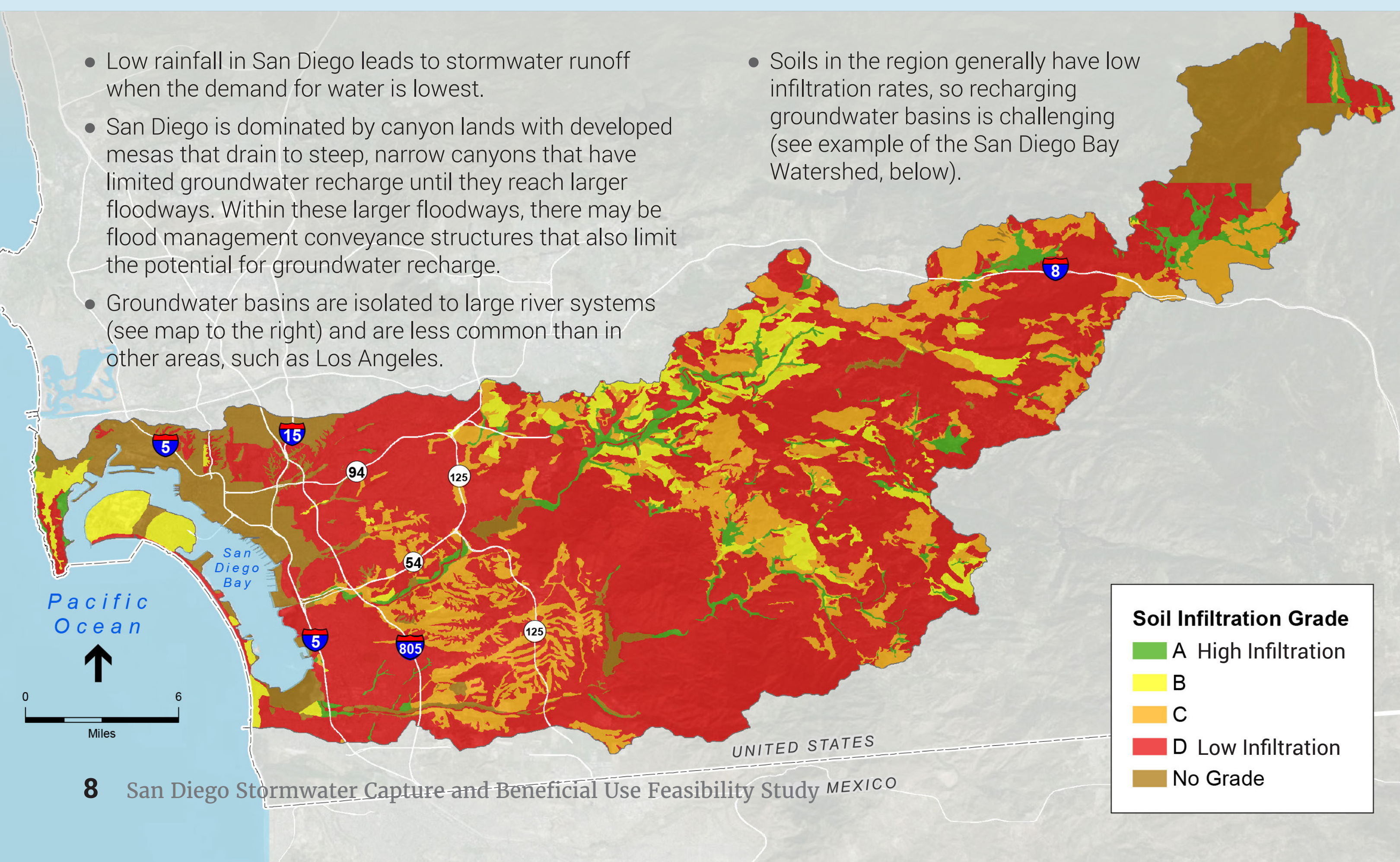
Current use and storage of stormwater in the San Diego region

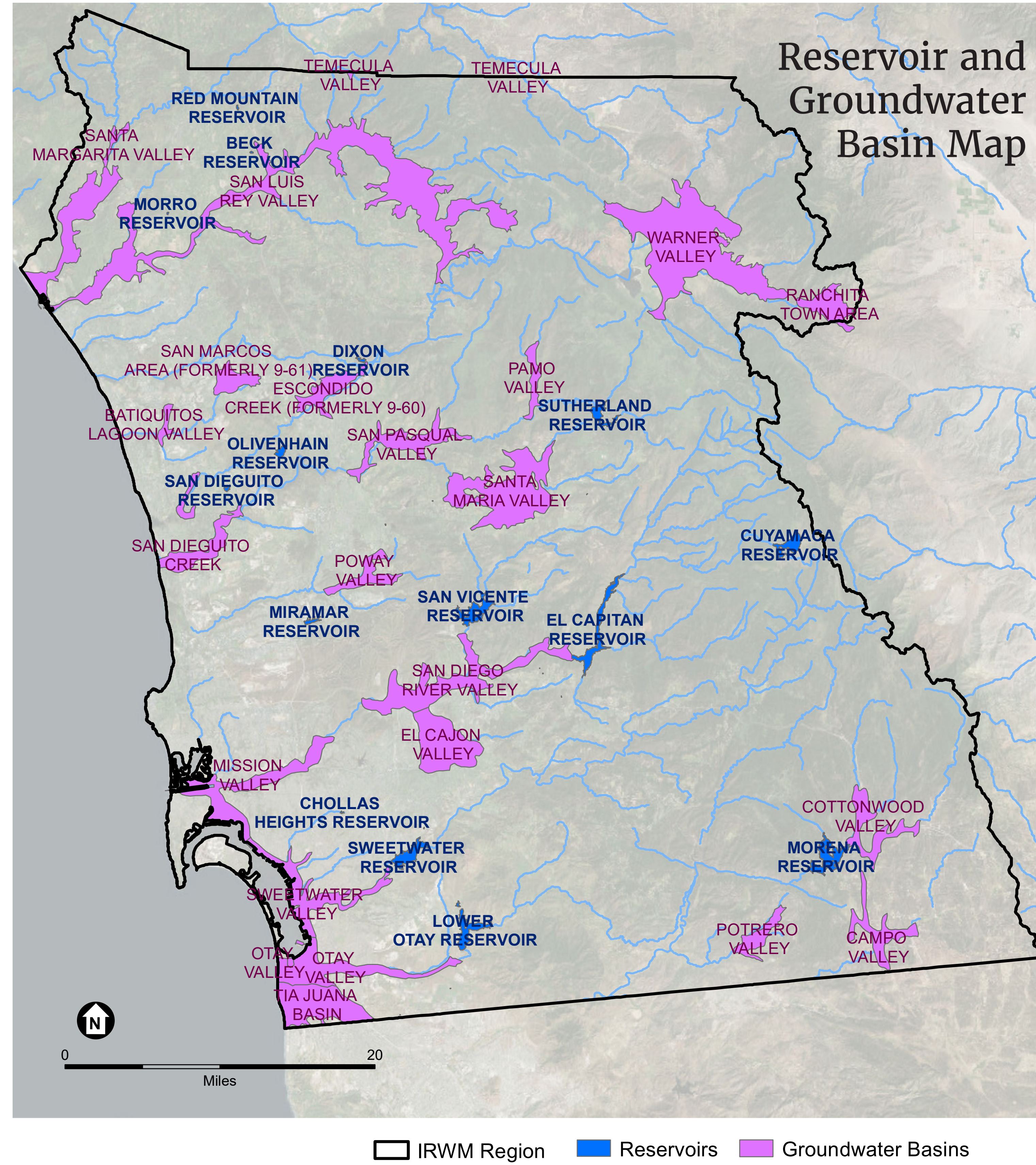
The storage and beneficial use of stormwater in the San Diego region is being effectively implemented in the upper watersheds. As shown on the map to the right, a system of reservoirs captures and stores runoff from the less-urbanized, eastern, upstream portions of the county's watersheds. Opportunity for future local water supply augmentation is likely to come from stormwater capture in the urbanized, coastal, downstream portions of the watersheds. Capture and use of stormwater in those urbanized areas is currently limited.

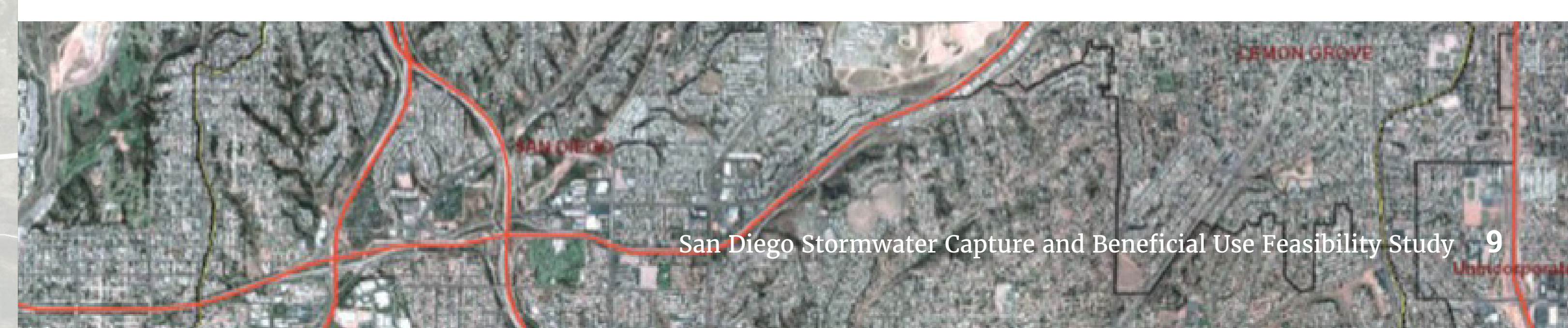
What makes the San Diego region different and more constrained for stormwater use?

The San Diego region has unique geology, topography, and micro-climates, when compared to many other areas in the state.

- Low rainfall in San Diego leads to stormwater runoff when the demand for water is lowest.
- San Diego is dominated by canyon lands with developed mesas that drain to steep, narrow canyons that have limited groundwater recharge until they reach larger floodways. Within these larger floodways, there may be flood management conveyance structures that also limit the potential for groundwater recharge.
- Groundwater basins are isolated to large river systems (see map to the right) and are less common than in other areas, such as Los Angeles.
- Soils in the region generally have low infiltration rates, so recharging groundwater basins is challenging (see example of the San Diego Bay Watershed, below).

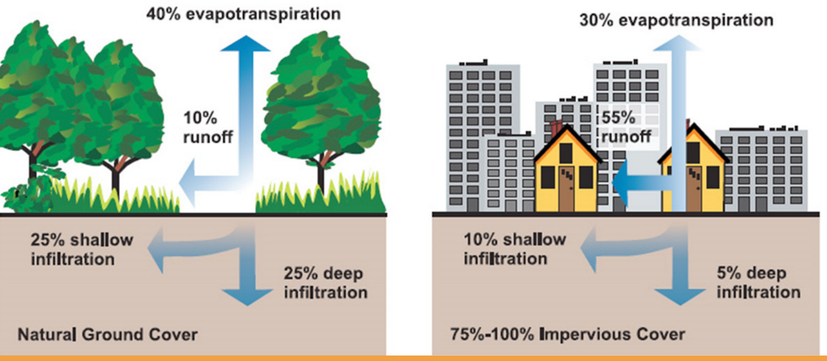






Why is Stormwater Storage Important?

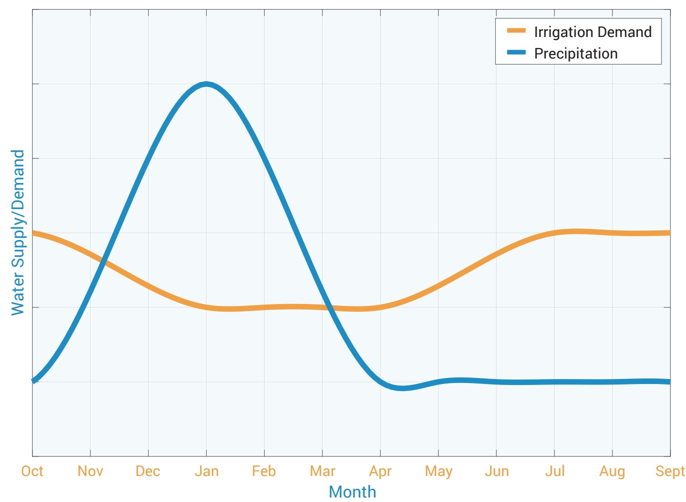
Stormwater in Urban Areas



In urbanized areas of watersheds, greater amounts of impervious cover increase the volume and velocity of stormwater runoff. The Municipal Separate Storm Sewer System (MS4) and flood control channels are designed to convey the runoff to the ocean quickly to protect the community from flooding. Under natural conditions, more stormwater infiltrates into the ground, which provides storage for future use.

Urban areas produce greater volumes of stormwater than under natural conditions due to impervious cover and/or limited infiltration opportunities.

To use stormwater in urbanized areas of the watershed, storage is required, since it comes at times when demand is lower. Because stormwater is delivered in variable and sometimes large volumes during a short timeframe, stormwater collection and storage is needed prior to distribution to a beneficial use. Stormwater runoff in Southern California is also generated when the demand for water (such as for irrigation) is lowest, as shown in the adjacent figure. Conveyance of stormwater to wastewater treatment plants via existing sanitary sewer lines is also constrained during storm events, since increased infiltration to the system results in reduced sewer line capacity. Furthermore, subsurface soils may limit the rate of stormwater infiltration to recharge groundwater basins and restore natural hydrology, requiring temporary storage of collected stormwater.



The Stormwater Challenge: supply vs. demand and the need for storage.

Storage of stormwater in urbanized areas is often limited; however, current new and re-development regulations encourage the use of low impact development (LID) to increase retention time of stormwater and allow stormwater to infiltrate into the soil. The filtration reduces impacts of pollutants and peak flows on receiving waters, and provides opportunities for greater storage, while helping restore natural hydrological conditions.

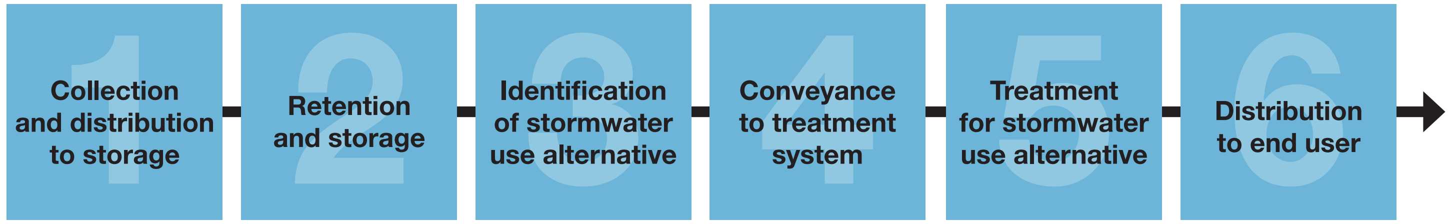
The availability and capacity of stormwater storage is often the limiting factor for use and must be assessed prior to identifying and quantifying potential use alternatives, particularly in urban settings.

Water Quality of Stormwater

Urban stormwater runoff collects and transports numerous constituents from roadways, landscaped areas, and various commercial, industrial, and residential land uses and activities. These constituents include indicator bacteria, metals, pesticides, sediment, nutrients, and trash. Treatment to address these constituents may be required prior to use or conveyance to further treatment at a wastewater facility, depending on the end use and established water quality standards, treatment facility requirements, and quality of the stormwater captured.

SWCFS Conceptual Model

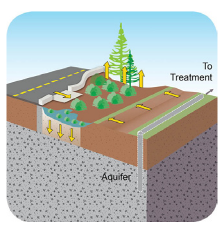
The SWCFS is based on a framework that considers each step of the stormwater capture and use process. As discussed above, stormwater collection and storage is needed first. Depending on the stormwater use alternative identified, stormwater may need to be treated. Lastly, the treated stormwater needs to be distributed to the end user.



Alternative Uses for Stormwater in the San Diego Region

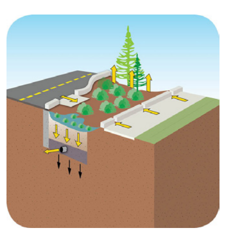
Eight separate stormwater use alternatives were evaluated for their feasibility in the San Diego Region. These alternatives have been developed based on the review of existing plans for projects in the San Diego County region and Southern California and input from the Technical Advisory Committee.

As presented in the SWCFS Conceptual Model, all use alternatives require stormwater capture and storage. Collected stormwater is then treated on-site, infiltrated, or diverted to a treatment facility. The level of treatment depends on the end use, which can include recharge to groundwater to augment local water supply or to restore natural hydrology, natural wetland treatment, on-site or nearby irrigation, or treatment for potable or recycled water uses. The feasibility of the implementation of these eight alternatives is assessed and prioritized in this study.



A

Direct discharge to designated groundwater basins to be extracted for potable use.



B

Discharge to groundwater to reestablish natural hydrology and, by extension, to restore biological uses.

C

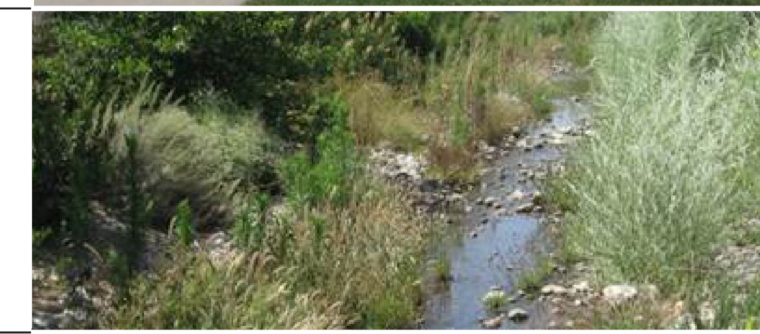
Irrigation to be used on-site or at nearby parks, golf courses, or recreational areas on public parcels.

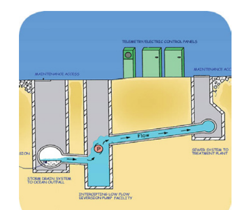
D

Small scale on-site use for irrigation and other private use on private parcels.

E

Flow-through to sustain vegetation in natural treatment system (wetland treatment) and/or restoration sites.





F

Controlled discharge to wastewater treatment plants for solids management during low flows.

G

Controlled discharge to wastewater treatment plants for indirect potable use.

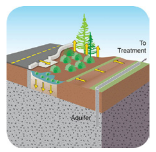
H

Controlled discharge to wastewater treatment plants for recycled water use.

Example Projects of Stormwater Use

In addition to local reservoirs, there are a number of existing and conceptual stormwater capture and reuse projects within the San Diego Region and Southern California. Examples of completed, pending, and conceptual projects for each stormwater capture and use opportunity are presented in the following pages.

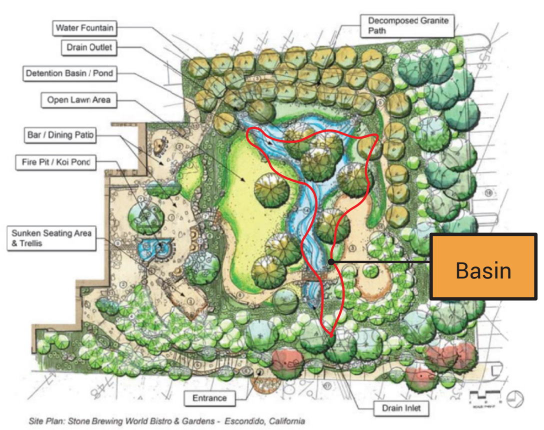
Implemented Projects



Franklin D. Roosevelt Park Regional Stormwater Capture Project

The Los Angeles County Department of Public Works (LACDPW) took an innovative approach to achieve MS4 permit requirements by using the Franklin D. Roosevelt (FDR) Park to capture and infiltrate runoff from storm events. The 195-acre drainage area contains two underground infiltration systems and seven underground drywells.

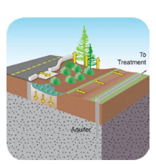
Prior to infiltration, the diverted stormwater passes through a baffle filtration unit, a sediment removal chamber, a screen system to capture and store solid debris, and a skimmer system that removes hydrocarbons. Annually, the FDR is expected to infiltrate to groundwater 120 acre-feet for potable use (Alternative A).



Stone Brewing World Bistro and Gardens

Stone Brewing World Bistro and Gardens

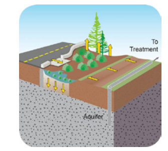
The Stone Brewing World Bistro and Gardens in Escondido converted approximately one acre of impervious land to a landscaped stormwater detention facility. The park-like area is also graded to collect runoff from surrounding industrial park buildings. The facility includes pervious paths, a detention basin and pond, and an on-site rain garden (Alternative B). Annually, the one-acre plot captures and infiltrates approximately 9 acre-feet of stormwater.




National City "A" Avenue Green Street

National City has implemented an integrated stormwater capture and use system to Kimball Park, along "A" Avenue in National City. The project includes low impact development infrastructure, which improves infiltration to groundwater and irrigation water storage (Alternative A and Alternative B). The project constructed infiltration basins that are capped with river rock to prevent erosion and include a thick layer or rock and sediment through which water percolates into the natural groundwater system. In addition to the infiltration basins, the project also constructed a filtration and 30,000-gallon cistern system beneath Kimball Park. Annually, the project captures 90.5 acre-feet annually.

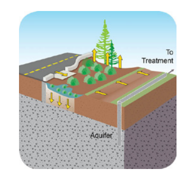
Planned/Conceptual Projects



San Elijo Joint Powers Authority Stormwater Use Alternative Project

This conceptual project at the existing San Elijo Water Reclamation Facility in Cardiff proposes altering and expanding the existing stormwater channel, check dam, and sediment collection area. The expansion would allow stormwater to infiltrate and recharge the shallow groundwater table (Alternative A). Following infiltration, the stored stormwater would be pumped from a groundwater well, treated to Title-22 standards, and used as recycled water. The proposed project will result in the infiltration and potential reuse of approximately 12 acre-feet per year.

SEWRF Stormwater Capture Elements



Telegraph Canyon Channel Improvement Project

The City of Chula Vista has plans to improve portions of the Telegraph Canyon Channel to increase stormwater detention and infiltration and alleviate flooding. The concept-level project will increase the channel capacity and introduce vegetated bioswales into the improved channel (Alternative B). These modifications will allow for increased stormwater detention, infiltration, and controlled discharge, which in turn will reduce surface flows and decrease flooding potential along the creek. The project modifications will also encourage channel bank revegetation and stabilization.

Telegraph Canyon Channel Improvement Proposed Project Location

Planned/Conceptual Projects (Continued)

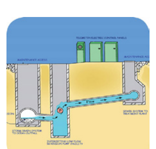
Santa Monica Sustainable Water Infrastructure Project

The City of Santa Monica, as part of their Sustainable Water Infrastructure Project (SWIP), is implementing a recycled municipal wastewater treatment and conjunctive reuse project at the planned SWIP Recycled Water Treatment Facility (SRWTF). The proposed project will have the capacity to harvest and divert approximately 4.5 million gallons of stormwater from a single storm event into the SRWTF (Alternative G).

San Diego Safari Park

San Diego Zoo Safari Park – Green Parking Lot and Storm Water Capture and Use Project

The San Diego Zoo Safari Park in Escondido proposes to use innovative best management practices to capture, treat, and reuse stormwater from two parking lots. The 52-acre concept project utilizes low impact development techniques, including permeable pavers and improved surface materials, to capture 5.1 acre-feet of stormwater per year. As runoff from parking lots often carries oils, grease, heavy metals, and other environmental stressors, the captured stormwater will be treated through a biofiltration system before being used for irrigation within the Safari Park (Alternative C).



Dry Weather Flow Diversion at Los Coches Creek Outfall, Alternative 1

The Ray Stoyer Water Reclamation Facility in Lakeside is investigating the feasibility and benefits of augmenting flow through the facility by diverting dry-weather discharge from a site adjacent to the Los Coches Road Bridge (Alternative F). The diversion would increase flows through the facility by 2.6 million million gallons annually. The diversion would also serve to reduce pathogen levels in discharge to Los Coches Creek.

Los Coches Creek

Olivenhain Municipal Water District 4S Ranch Pilot Stormwater Treatment for Recycled Water

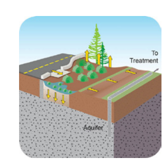
This conceptual project at the 4S Ranch Water Reclamation Facility is to expand the production of recycled water using captured and stored stormwater (Alternative H). Stormwater would be treated using the older 0.2 MGD treatment facility that has been replaced and upgraded by a new 2.0 MGD treatment system. Stormwater will be collected from the community MS4 and stored in a basin or underground vault on public lands. Stored stormwater will then be diverted at a controlled flow to the facility as a separate inflow from the wastewater.

4S Ranch Water Reclamation Facility

San Marino Drive Green Street and Dry Weather Flow Management

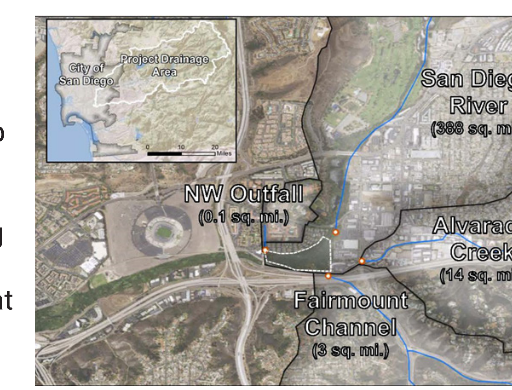
This concept-level project in the community of Lake San Marcos in Unincorporated San Diego County proposed to use Green Street best practices (including low impact development features and incorporating smaller impervious areas) to treat and infiltrate the persistent dry-weather flow that currently enters the County's municipal MS4 system along San Marino Drive. In addition to capturing and treating the dry-weather flow, the proposed project will discharge the captured stormwater to the groundwater and help restore natural hydrology for biological purposes (Alternative B). The project will incorporate approximately 9,500 square feet of Green Street low impact development. Quantities of stormwater captured and infiltrated are not yet available.

San Marcos Drive



Mission Valley Stormwater Capture Project

This concept-level project within the City of San Diego will help achieve the City's desire to focus on a strategic storm water capture framework that will help address a number of water management concerns, including maintaining a reliable and local water source, improving water quality in impaired waterbodies, and flood risk reduction. The City of San Diego has identified a parcel located upstream of the SDCCU Stadium at the approximate confluence of three stream or tributary systems – the San Diego River, Alvarado Creek, and Fairmont Channel. The City of San Diego plans to install both a detention facility paired with an injection well, and an infiltration gallery on the identified parcel for direct discharge to designated groundwater basins for future potable-use extraction (Alternative A). These conceptual facilities could potentially receive runoff from four diversion structures, for a total of 1,900 acre-feet per year of captured stormwater.

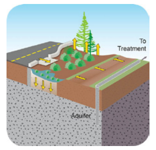


Map of the Project Site, Stream Inputs, and Their Corresponding Drainage Areas
Source: TetraTech, 2017

Planned/Conceptual Projects (Continued)

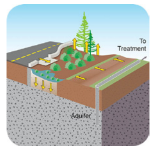
Lindbergh Field Terminal 2 Parking Plaza

This project at the San Diego International Airport will capture and store stormwater beneath the Terminal 2 Parking Garage for re-use at the airport's Central Utilities Plant cooling towers (Alternative D). A series of 36-inch-diameter pipes will hold the runoff collected from inlets on the roof of the parking structure before being routed through a Bio Clean Modular Wetland Unit for treatment. The project is estimated to capture and reuse 6.1 acre-feet per year.



Alternative Compliance Retrofit Project at Mountain View Park, Escondido

The City of Escondido is currently evaluating three alternative compliance and water quality projects (bioretention, underground storage and infiltration, and runoff storage and use for irrigation) at Mountain View Park. The conceptual project will implement a retrofit of an existing 36-inch reinforced concrete storm drain on the eastern side of the park under its municipal storm water permit. Escondido has performed a hydraulic study to estimate the volumes of stormwater captured, stored, and used for each of the three project alternatives (Alternative B and Alternative C), but no final project alternative has been decided. The annual volume of stormwater infiltrated or used for irrigation under the project alternatives ranged from 2.7 to 6.5 acre-feet.

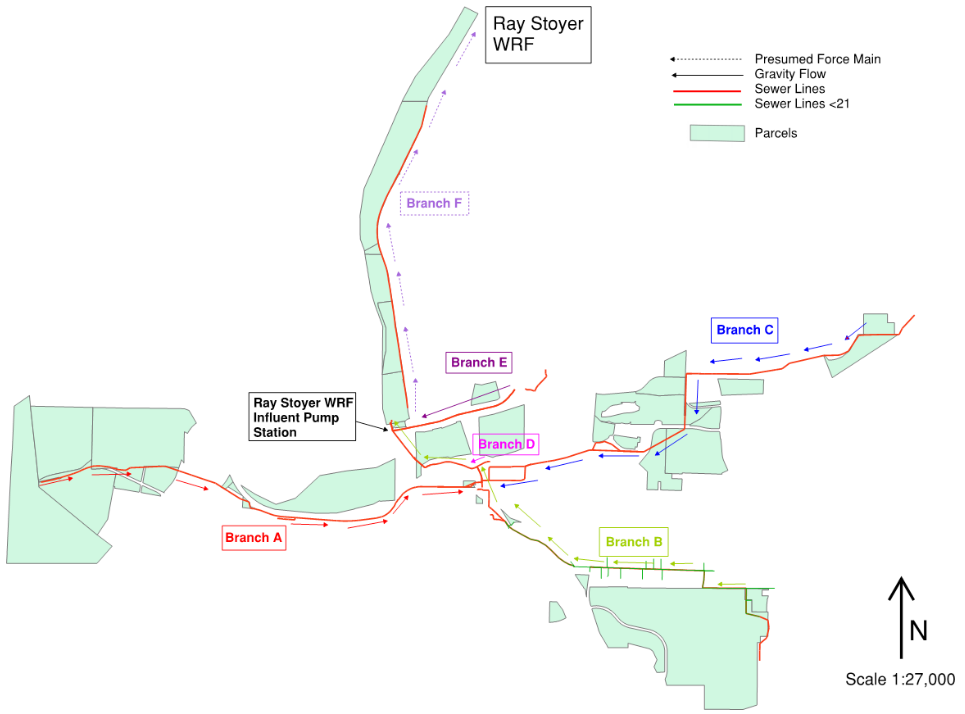


Rincon Band- Luiseño Indian Reservation Regional Stormwater Capture Project

The tribal government of the Rincon Band of Luiseño Indians is seeking funding to implement a phased stormwater capture and infiltration project to secure adequate and sustainable water supply and water quality for over 170,000 people who live in the tribal reservation in the San Luis Rey River watershed. The conceptual project includes an evaluation of appropriate locations within the reservation to capture and contain stormwater to reduce contaminant migration, including metals, bacteria, and nutrients, into the San Luis Rey River (Alternative B and Alternative C). Approximate capture and use volumes have not yet been calculated.

Flow Augmentation to the Ray Stoyer Water Reclamation Facility for Non-Potable and Indirect Potable Reuse

The Padre Dam Municipal Water District (Padre Dam) is planning a major three-phase expansion of the Ray Stoyer Water Reclamation Facility (RSWRF) for the production of recycled water for non-potable reuse (Alternative G). Over the three phases, the RSWRF will increase its current treatment volume from 2 MGD to 21 MGD. This conceptual level project has begun an evaluation of volumes of stormwater in the RSWRF's sewershed, and has investigated the sewer system's capacity to handle flows from controlled discharge. The preliminary investigation evaluated the maximum flow available to augment RSWRF and whether there are any capacity limitations within the existing sewer system. The modeling performed for the Phase 1 analysis indicates that the project has the potential to increase recycled water generation and distribution up to 3.9 MGD or 4,380 acre-feet per year.



Study Process

The stormwater capture and use feasibility study followed an eight step process that builds on to the preliminary estimate of potential stormwater capture volumes using public parcels conducted for the Stormwater Resource Management Plan (SWRP). The worked completed in the SWRP is shown as steps 1 and 2. The third step is the identification of the eight stormwater capture and use alternatives based on input from the Technical Advisory Committee (TAC) and a review of available studies. Steps 4 and 5 refine the estimated volumes from the SWRP. Refinement was completed by first screening public parcels based on the feasibly of implementing the alterative, for example, soil permeability for infiltration or proximity to a sanitary sewer for treatment for recycled water use. Conceptualize projects were then applied to a select number of screened public parcels and modeled using a continuous simulation model based on over 40 years of rainfall data. The result was a quantified range of capture and use volumes that is used to both refine the regional volume range and also provide a quantified metric under the volume criteria to assess the feasibility and prioritization of each of the alternative. Cost estimates for the conceptualized projects were then developed in Step 6 to provide an additional quantifiable metric for the cost criteria to assess feasibility and alternative prioritization. The prioritization of the alternatives is the final step in this feasibility study process.

Technical Advisory Committee

Stakeholder engagement was essential to the development of the SWCFS, and was a requirement for projects receiving grant funding through the San Diego IRWM Program. To ensure stakeholder input, feedback was obtained through the study development process throughout the Technical Advisory Committee (TAC).

The TAC consisted of representatives from identified stakeholder groups related to three areas of stormwater capture: storage, conveyance, and use. Members of the TAC were responsible for sharing data sources and reviewing and providing input on technical memos and ultimately the Feasibility Report. TAC meetings were held periodically during the development of the study and were open to the public. A public comment period was held at the end of every meeting.

Steps in the Process

1. **Identification of Potential Capture and Storage Sites**
2. **High-Level Estimated Total Potential Stormwater Storage**
3. **Identification of Uses**
4. **Identification, Development, & Quantification of Typical Projects for Each Use Alternative**
5. **Refine Parcel List and Match to Potential Uses**
6. **Determine Costs for Typical Projects and Apply to Refined Parcel List**
7. **Develop and Apply Criteria to List Stormwater Use Alternatives**
8. **Prioritize Stormwater Use Alternatives**

Outcomes

Step 1:
- 12,731 public parcels in the region
- Found 1,200 parcels feasible for capture, storage, and use.

Step 2:
- Quantified potential capture for three stormwater use alternatives

Step 3:
- Eight stormwater use alternatives identified (uses described on page 4).

Step 4:
- Used case studies provided by the TAC and conceptual projects applied to screened public parcels to develop methods to quantify stormwater capture for typical projects

Step 5:
- Applied rigourous screening criteria and found 211 – 977 feasible parcels
- Applied quantification to estimate potential volume for region

Step 6:
- Used case studies, conceptual projects, and literature values to develop typical unit costs
- Applied unit costs to projects and parcels

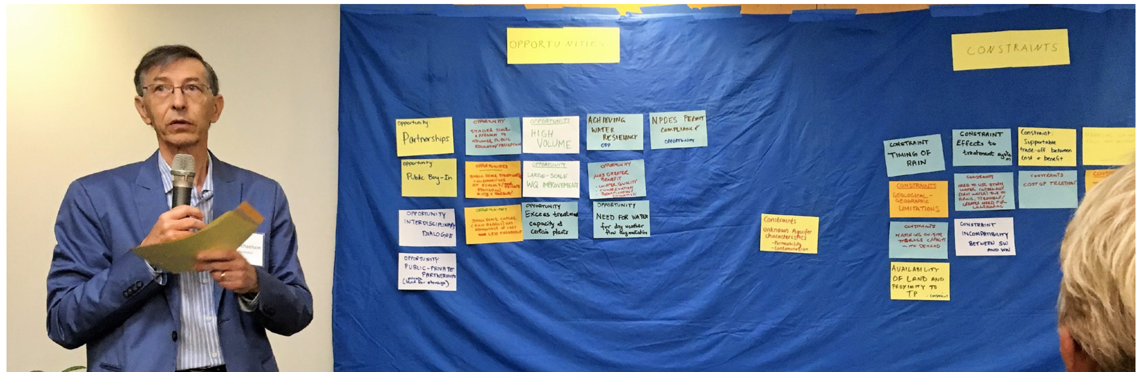
Step 7:
- Volume captured criteria
- Cost criteria
- Multi-benefit criteria
- Opportunities and constraints criteria

Step 8:
- Prioritized as near-, mid-, or long-term projects based on feasibility given constraints today

Technical memorandums documenting each step

- Steps 1–2: Presented in Appendix H of the San Diego Region Storm Water Resource Plan (ESA 2017)
- Steps 3–5: Presented in the SWCFS Modeling Approach and Results Technical Memorandum (ESA 2018)
- Step 6: Presented in the SWCFS Cost Analysis Memorandum (ESA 2018)
- Steps 7–8: Presented in the SWCFS Implementation Approach Memorandum (ESA 2018)

★ Indicates when a TAC meeting was held in the process.



Stormwater Alternatives Feasibility Assessment Criteria

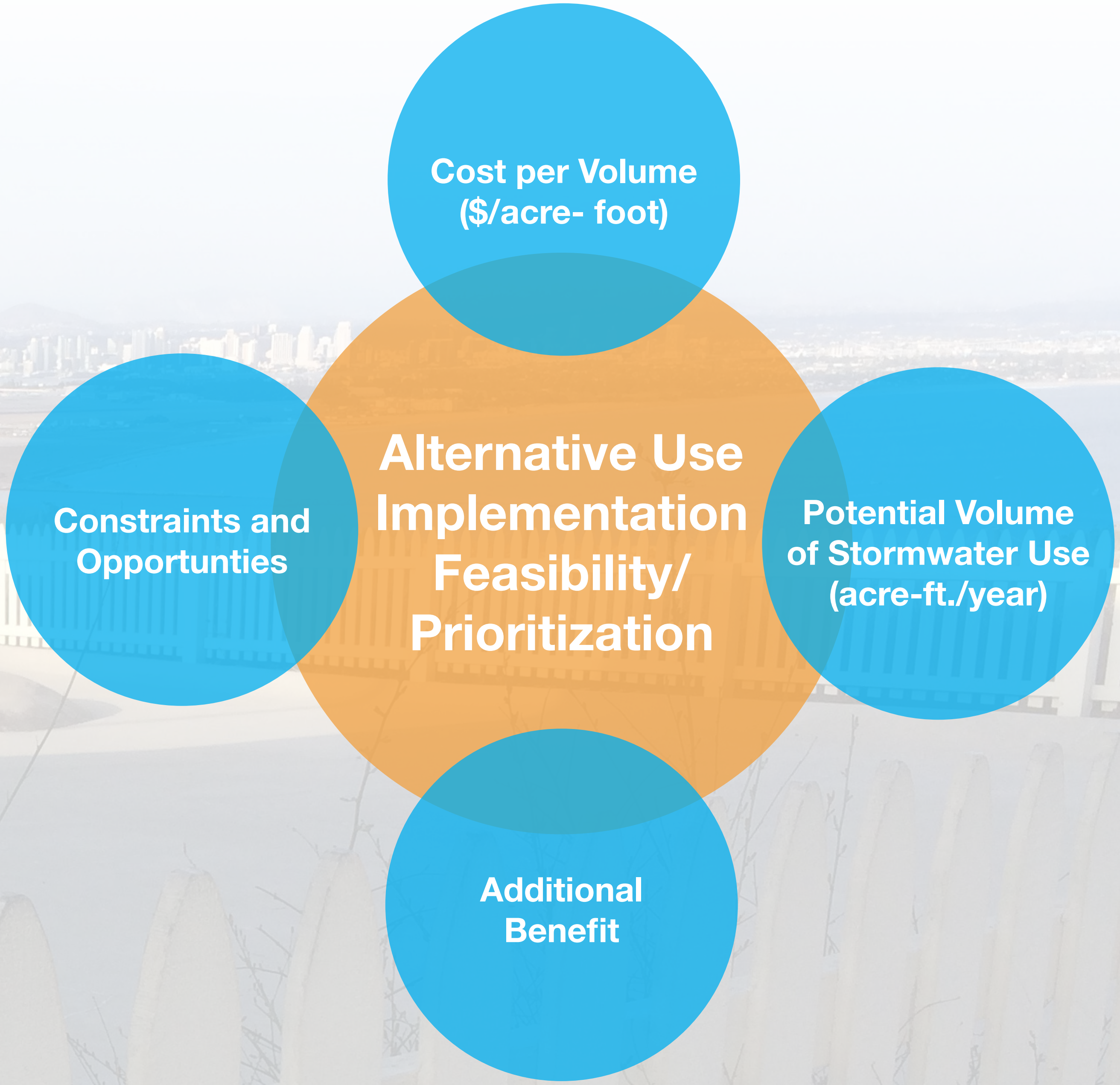
The method for prioritizing stormwater use alternatives is based on a set of evaluation criteria that include:

1) Potential Volume of Stormwater Use;
2) Cost per Volume;
3) Additional Benefits; and,
4) Constraints and Opportunities.

The prioritization criteria, their metrics, and the method and source for developing those metrics are presented in the Table below. Further detail is provided in the referenced technical memos.

Stormwater Use Alternative Prioritization Criteria and Metrics

Criteria	Metrics	Basis of Quantification or Qualitative Assessment	References
Potential Volume	Acre-feet/year of stormwater used	• Volume range developed from modeled parcels. • Number of parcels (as a percentage of the total) in low and high for each use alternative identified	Analysis Methodology Technical Memorandum (ESA 2017c) Modeling Approach and Results Technical Memorandum dated February 2018 (ESA 2018a)
Cost	Cost in $/acre-foot	• Total cost including operations and maintenance over the project life divided by the total stormwater volume used over the project life • Cost of providing potable water from desalination as a cost benchmark for comparison	Cost Analysis Technical Memorandum Dated February 21, 2018 (ESA 2018b)
Additional Benefits	Number of additional benefits	• A numerical value is assigned for each of the SWRP benefit categories that can be achieved: Water Quality, Environment, Flood Management, and Community	SWRP (ESA 2017a)
Constraints and Opportunities	Qualitative assessment of the constraints and opportunities developed by TAC	• Informed by the Constraints and Opportunities identified for each example project • Constraints and Opportunities identified for each alternative	Modeling Approach and Results Technical Memorandum dated February 2018 (ESA 2018a) This technical memorandum (Attachment A)



Overview of Prioritization Process:

A defined goal of the SWCFS is the prioritization of the stormwater use alternatives based on a set of prioritization criteria, then identifying which alternatives should be considered for near-, mid- or long-term implementation. The prioritization concludes the eight-step study process. Alternatives are assessed based on both quantitative and qualitative criteria. The quantitative criteria include the range of stormwater volumes that are captured and used based on the public parcel screening and modeling. Prioritization is also based on the estimated range of cost per volume for each alternative. The qualitative criteria include multi-benefits achieved, and the type and number of constraints that are "gates" for potential implementation, and the potential opportunities or "keys" to open these "gates. The prioritization analysis concludes by identifying regional constraints to implementing stormwater capture and use, with the goal of being a tool to guide the region over time as those constraints are overcome. Overcoming these constraints, or "gates", will allow some near- and potentially mid-term projects and alternatives to move forward toward implementation.

How can Stormwater, Water Resource, and Watershed Managers Use the Feasibility Assessment (Prioritization) Process and Outcomes

Prioritization Process Outcomes: Identification of the regional stormwater use alternatives that are likely to be implemented in the near-, mid-, and long-term time frame. This classification of the alternatives by feasible timeline can inform planning efforts on a program or project level.

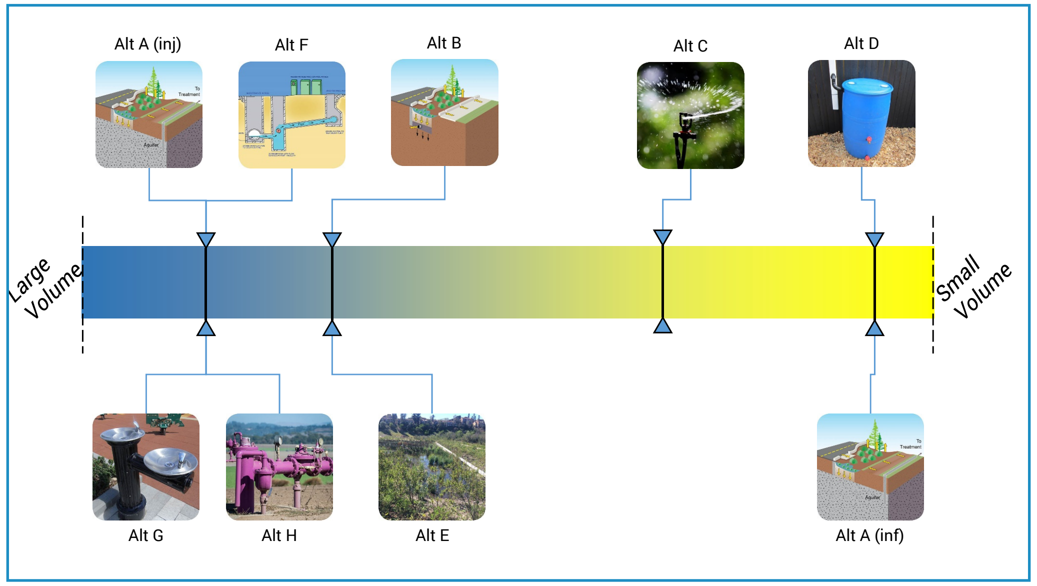
PROGAM LEVEL PLANNING: At the program level, for example in implementing a watershed-wide stormwater water quality program in accordance with a Water Quality Implementation Plan (WQIP), stormwater use alternatives that have an identified near-term feasible timeline through the assessment process may have available program resources directed toward their development and implementation. Whereas, alternatives that need a longer-term period to address constraints may lead managers to focus available program resources on addressing those constraints that can move these uses into the nearer-term for development and implementation.

EXAMPLE: For example, the outcome of this feasibility assessment indicates that dry weather diversions to sanitary sewer for solid management and reclamation is a near term alternative. Using the criteria and assessment from this study, a watershed manager as part of an overall program may plan to direct more available program resources to the planning and implementation of this alternative that also meets MS4 permit compliance goals under the WQIP. The process and outcome of this study are not recommendations, rather are a planning tool for managers to apply to their own programs and projects. The quantification methods also provide guidance for planning programs and applying for stormwater capture grant funding.

PROJECT LEVEL PLANNING: On a project level, the prioritization process may be used during development to evaluate a project's constraints and opportunities and help define the project elements that may require additional assessment. This process can be used to identify the more feasible alternatives for stormwater capture and use that will often be site specific. This tool can also provide project leads to assess projects for application of stormwater capture and use that can then improve the competitiveness of the project for grant funding.

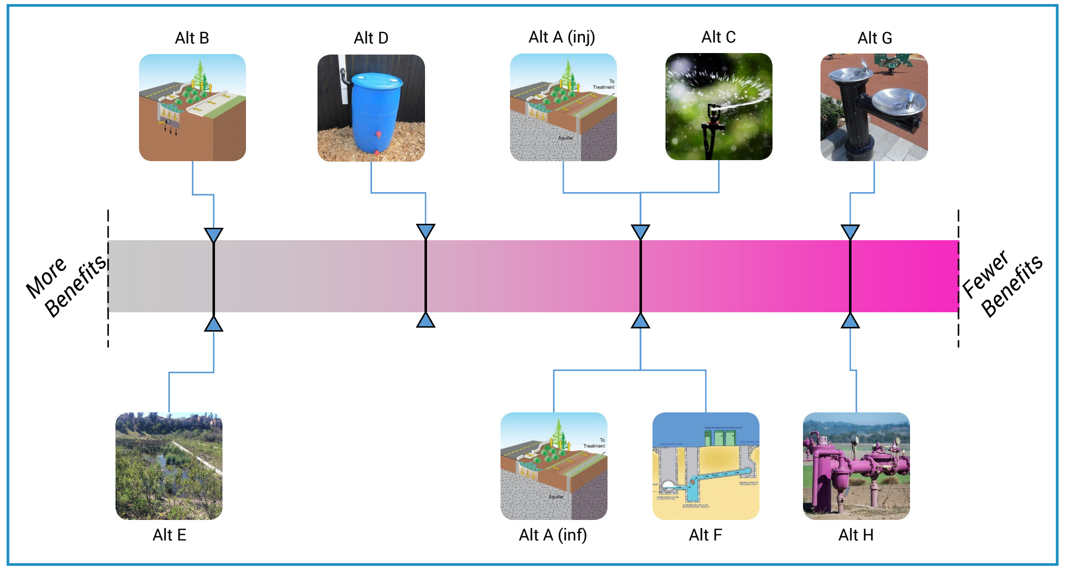
Key Findings on Prioritization Criteria (Step 7)

Volume Captured Criteria (Steps 3-5)



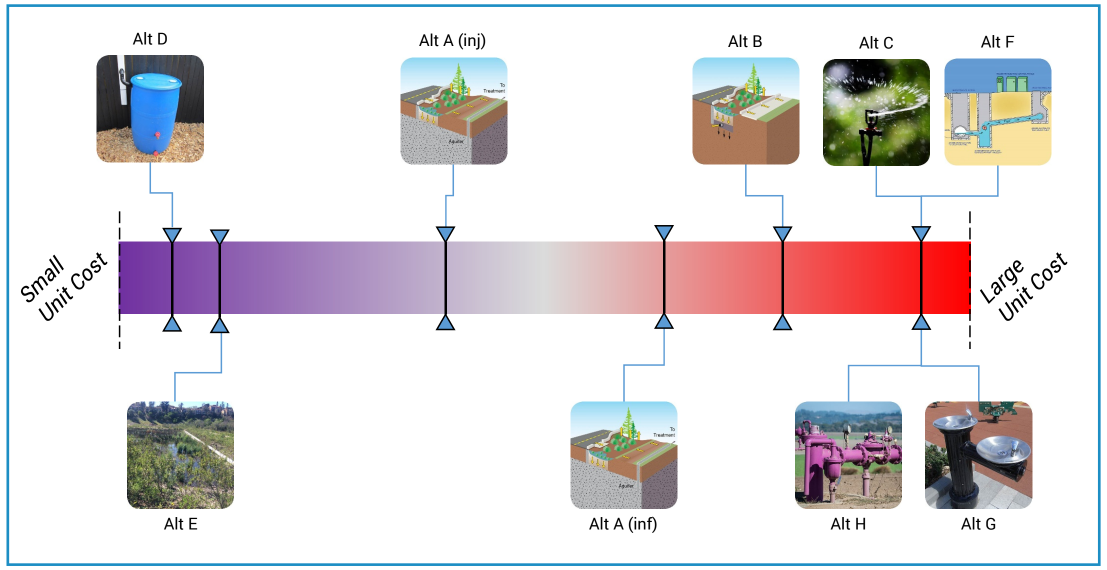
Key Findings: The prioritization under this criterion is based on the potential range of project-level capture and use volumes for screened parcels and the total potential regional volumes for the alternative. The results indicate groundwater injection (Alternative A), controlled discharge to wastewater treatment plant for recycled use (Alternative H) and potable reuse (Alternative G), and dry weather diversion to wastewater treatment plant (Alternative F) are ranked higher. This is due to the larger annual volumes achieved using dry weather flows in addition to storm flows, and the greater number of feasible sites for these alternatives. Lower ranked alternatives have constraints that limit the discharge rates that reduce storage efficiency and reduce site volumes. The number of parcels that meet screening criteria also reduce the ranking. Rain barrels and down-spout disconnects are ranked lowest due to the small site-level volumes although these can be implemented on a large number of sites.

Multi-Benefit Criteria



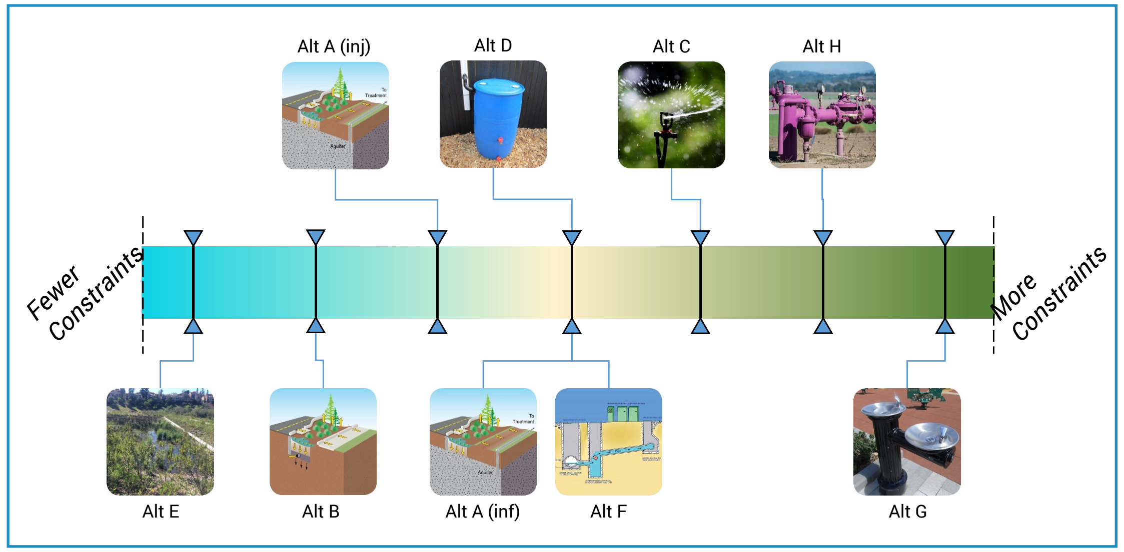
Key Findings: The multi-benefit criterion identified benefits beyond water supply. Alternatives that achieve a greater number of benefits may be more feasible through greater opportunity for grant funding and multiple agency and stakeholder support. The results of this qualitative analysis is that many of the alternatives achieve multi-benefits that include water quality, flood management and community benefits that opens up greater funding opportunities and inter-agency cooperation. These multi-benefits may also provide cost off-sets for benefits such as water quality compliance.

Cost Criteria (Step 6)



Key Findings: The cost criterion has a metric of unit cost (in dollars per acre-foot) over the design life of the project under each alternative, and then compared to the cost of desalination: $2,500 per acre-foot (SDCWA 2016, 2017). The results of this ranking indicate that the lowest unit cost alternatives are treatment wetlands (Alternative E) and private parcel capture (Alternative D). This is a result of the lower implementation costs and higher annual volumes through the use of dry weather flows. When pre-treatment is required and limitations on discharge rates (for example constrained by soil infiltration or discharge to a sanitary sewer line) reduce storage efficiencies unit costs per volume are higher and these alternatives are ranked lower.

Opportunities and Constraints Criteria



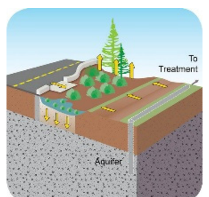
Key Findings: The constraints and opportunities criterion provides a qualitative measure of additional conditions that may affect design and implementation of an alternative, and therefore contributes to the prioritization of use alternatives at the program and project level. The number of constraints and the status of the opportunities to overcome the "gates" provide a basis to define near- and longer-term priorities. Alternatives are ranked higher when the "gates" generally have existing "keys", compared to those where opportunities to overcome the constraints are currently not available or have not been developed. The results of applying this criterion to the alternatives indicate treatment wetlands (Alternative E), infiltration to restore natural hydrology (Alternative B) and groundwater injection (Alternative A) are ranked higher as they have fewer constraints and also have near-term keys to open these gates.

What are the Overall Feasibility Assessment Results for the Alternative Uses?

Feasibility Timeline: The results of applying the four criteria and associated combined scoring to each of the eight alternatives are represented in this timeline. Alternatives that are generally more feasible for implementation in the near-term are to the left of the timeline, whereas alternatives that have a longer term feasibility of implementation are on the right of the timeline. These are not recommendations for the implementation of specific alternatives or project, rather a planning tool for the identification and development of stormwater capture and use projects and programs. This tool can also be used to consider addling these alternatives to planned projects to attract funding and other benefits.

Alternative A - Infiltration or Injection to Designated Groundwater Basin for Water Supply

- Technology (dry wells for groundwater injection) increases feasible sites and total feasible volumes
- Groundwater injection requires treatment that increases cost
- Inter-agency agreements needed to increase storage and use

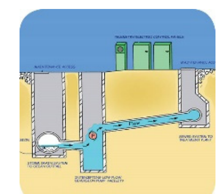


Alternative B - Infiltration to Groundwater to Restore Natural Hydrology (Low Impact Development)

- Number of feasible sites is high
- Local soils limit infiltration and total volumes
- Addition of dry weather flows can increase volume and reduce unit costs
- Water quality benefit and potential cost "off-set" for compliance
- Multi-benefit that may attract grant funding

Alternative F - Dry Weather Flow Diversion to WWTP

- Addition of flows can improve solids management
- Flows occur when sewer lines have likely capacity
- Water quality benefit that may provide cost off-set for compliance
- Need for program level inter-agency agreements



Alternative C - Site or Nearby Irrigation Use

- Stormwater generated when demand is low requiring storage
- Greater and costlier storage needed to capture and use multiple storm events
- Pre-treatment required that can increase costs, but treatment costs can be lowered for drip irrigation
- Economies of scale are less viable for these individual site systems

Near-Term Feasibility of Implementation

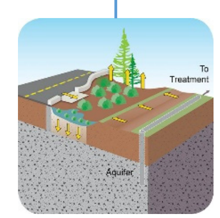
Long-Term Feasibility Implementation

Alternative E - Natural Treatment Systems

- Uses dry-weather flows that increase total annual volumes and lowers unit costs
- Vector issues need to be addressed
- Multi-benefit
- Creation of habitat may impact long-term maintenance

Alternative D - Private On-Site Use

- Rain barrels and downspout disconnects to landscaping are most cost effective alternative
- Total regional volume is low due to low storage capacity
- Larger scale storage and use on private lands provides a much larger potential volume
- Use of Alternative Compliance program provides opportunity for public/private partnerships and funding



Alternative A - Infiltration or Injection to Designated Groundwater Basin for Water Supply

- Regional geologic constraints limit sites and potential volumes
- Low cost alternative where surface infiltration is high and site located above groundwater basin

Alternative H - Controlled Discharge to WWTP for Recycled Water Use (H)

- Stormwater flows occur when sewer lines have lower capacity due to infiltration
- Higher unit costs due to greater storage need
- Treatment plant compatibility requires controlled discharge
- Stormwater flows occur when recycled water demand is lower

Alternative G - Controlled Discharge to WWTP for Indirect Potable Use (G)

- Stormwater flows occur when sewer lines have lower capacity due to infiltration
- Higher unit costs due to greater storage need
- Treatment plant compatibility requires controlled discharge
- Advanced treatment at existing facilities under development

How Do I Prioritize My Projects and Find Funding?

STEP 1

Quantify Capture and Use Volumes

- Gather data on the site/parcel:
  - Determine the potential drainage area to the site based on topography and MS4 drainages.
  - Identify land uses and soil types within the drainage area.
- Model runoff volume and timing of flow (e.g., using the San Diego Hydrology Model (SDHM3.0)).
- Using the flow time series from the SDHM3.0, calculate the possible volume that can be stored and used based on the desired stormwater use alternative (or run multiple options and compare).
- See the Modeling Approach and Results Technical Memorandum (ESA 2018) for further details.

→ Quantified benefits = Higher ranking in Stormwater Resources Plan for Prop 1 funds.

STEP 2

Calculate Project Costs

- Gather data on unit costs that are appropriate to the specific project or area.
- Determine quantities for the project (e.g., volume of excavation, number/size of culverts, area of plantings).
- Develop cost table for project features, including line items for mobilization/demobilization, operations and maintenance, planning, engineering, and permitting, and contingency

→ Cost analysis required for grant funding.

STEP 3

Determine Additional Benefits

- Consider additional benefits the project provides (e.g., water quality improvements).
- Consider whether the project can be modified to provide more benefits, such as to provide water quality improvements, flood risk reduction, community involvement, or environmental enhancements.

→ Additional Benefits = Higher ranking in Stormwater Resources Plan for Prop 1 funds.

STEP 4

Consider Constraints and Opportunities

- Evaluate whether the project has any constraints that will prevent it from being implemented.
- Evaluate whether there are any opportunties to overcome project constraints.

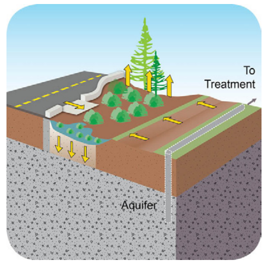
→ Opportunities may include access to other funding sources, or partners.

Prioritizing Projects within a Municipality

- Does your project provide water at a cost less than $2,500 per acre-foot? If so, the project price is competitive with alternative water supply sources = feasible in the near-term.
- If your project is more expensive, does it provide other benefits that could "be cost shared"? For example, if your project costs $3,000 per acre-foot of water supply, but also provides for meeting valuable water quality compliance targets, the price of achieving regulatory compliance may make up the price difference to make the project feasible = feasible in the near- or mid-term.
- If the project is very expensive and cannot be justified by off setting the cost among multiple benefits, are there future opportunities that could make the project less expensive in the future? If so = feasible in the long-term

Alternatives' Constraints and Opportunities

Alternative A - Infiltration or Injection to Designated Groundwater Basin for Water Supply

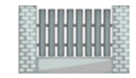
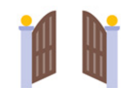
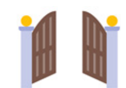
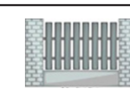
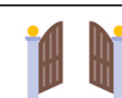


Alternative A has a mid-term feasibility timeline. The primary constraint for direct infiltration is the limited number of sites regionally that possess higher permeability soils that would allow for sufficient infiltration and that are close enough to feasibility convey stormwater to a designated groundwater basin. A key to opening the site constraint for direct infiltration is the use dry well injection technology to penetrate through the lower permeability soil layers to reach the groundwater basin. This technological opportunity moves this alternative to a shorter feasible timeline. Constraints to wider spread use of this alternative include regulatory clarity on potential treatment requirements by applying potable water standards to stormwater prior to infiltration or injection (see text box). These requirements increase the cost per volume. Regularity clarity is needed that provides flexibility in the use of stormwater to increase groundwater storage while also protecting the groundwater resource. An additional constraint is interagency agreements between municipalities and water authorities to facilitate the development of stormwater infiltration and injection projects that convey stormwater from the MS4 to groundwater basins under water agency management. The establishment of a Joint Powers Authority (JPA) or Memorandum of Understanding (MOU) may be considered for this and the wastewater alternatives (see text box). These agreements may lead to cost sharing and cooperation on grant solicitations to overcome the cost constraints.

Technology: increase feasibility by using injection wells to penetrate through low permeability soils

Partnerships: Locations where MS4 conveyance is in close proximity to groundwater basins.

Funding: Prop 1 funding opportunities

Constraints	Alternative A
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

Water Quality Standards for Injection Wells: Dry wells for use in Alternative A for groundwater injection of stormwater are considered Class V injection wells and are subject to underground injection control (UIC) regulations. Dry wells are only allowed when registered with the US EPA. The applicable injection standards for all of California stem from this EPA-administered UIC Program. Any injection activity, as described in 40 CFR § 144.12(a), cannot allow the movement of fluid containing any contaminant into USDWs, if the presence of that contaminant may cause a violation of the primary drinking water standards under 40 CFR part 141, other health-based standards, or may otherwise adversely affect the health of persons. Stormwater is a non-point source discharge that may contain constituents that are regulated under the drinking water standards, although the concentrations and presence may vary greatly depending on the land-use from which the runoff is generated. Due to the highly variable nature of stormwater water quality, pre-treatment requirements may also vary and the regulations do not currently specify specific treatment requirements for stormwater. Runoff from highly urbanized and industrial use land-uses is not recommended for this alternative. The costs for this alternative have included pre-treatment to meet current regulations. Regulatory clarity is needed to encourage storm water capture and use, but under circumstances where there would be no threat of harming the public's water supply.

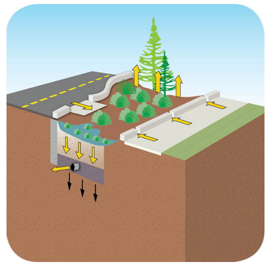
Inter-Agency Agreements: If authorized by their governing bodies, two or more public agencies may jointly exercise any power common to both through a Joint Powers Authority (JPA), Memorandum of Understanding (MOU), or contract. The agreement may set up a governing board composed of representatives of the contracting agencies. The inter-agency contract or agreement defines the governance and functions of the JPA. As part of overcoming the constraint of using stormwater for diversion to groundwater basins or wastewater treatment plants for the ultimate distribution as potable or recycled water, a JPA could be formed. Benefits of forming this JPA include:

- The creation of new avenues for stormwater capture;
- Organizing and coordinating stormwater capture and water supply activities across city boundaries;
- Receiving state and federal funding which may be more accessible through regional planning;
- Creating a more resilient water supply;
- Sharing information and identifying common needs and issues across jurisdictions; and,
- Uniting a single voice at the regional, state and federal levels

Watershed issues transcend jurisdictional boundaries. Alternative governmental structures like a JPA allows a for a more rational model for conducting watershed planning and management that correspond to geographic boundaries. JPAs allow their partner agencies to collaboratively address issues of mutual concern and provide legal mechanisms for joint funding, financing and planning design and management of the shared water resources.

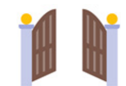
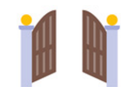
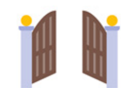
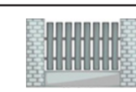
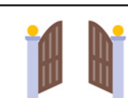
Alternatives' Constraints and Opportunities

Alternative B - Infiltration to Groundwater to Restore Natural Hydrology (Low Impact Development)



Alternative B has a short to mid-term feasibility timeline. This alternative has a high number of potential sites and planned region wide implementation for water quality compliance. Regional soil constraints reduce the volume that can be infiltrated to restore natural hydrology. However, bio-filtration techniques are used when soil permeability is lower and allows for greater retention and infiltration into these soils. This alternative would have a higher prioritization if the cost per volume were lower. However, these projects are often implemented to achieve water quality benefits and therefore the costs are "off-set" by the regulatory compliance achieved. Cost per volume can be further reduced and these projects ranked higher if the volume used is increased through diversion of dry weather flows into these bio-filtration systems for filtering and infiltration, where feasible. These projects are strong candidates for grant funding that can reduce the implementation costs, and project sponsors are encouraged to list their projects in the SWMP and apply for Prop 1 Round 2 in early 2019.

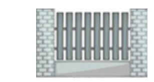
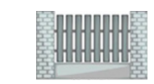
- **Technology:** Increase feasibility by increasing storage and volumes going to bio-infiltration
- **Funding:** Prop 1 funding opportunities
- **Multi-Benefit:** High cost is "offset" by multiple additional benefits

Constraints	Alternative B
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

Alternative C - Site or Nearby Irrigation Use

Alternative C has a long-term feasibility timeline. This alternative has a lower priority due to the high cost per volume and regulatory ambiguity. Although the high cost per volume may be off-set by the water quality compliance benefits these projects provide, there are other less costly alternatives under Alternative B that provide similar benefits. Treatment requirements under current regulation require above ground systems to meet Title 22, and drive up the cost for these small scale systems. Treatment costs can be lowered if drip irrigation is used. If in the future more cost effective treatment technologies are developed under greater regulatory clarity, this alternative may be feasible for implementation and move to a higher priority. Alternative D that includes using stormwater for on-site landscaping on private properties through down-spout disconnects and rain barrels provides is more cost effective.

- **Technology:** Future technologies may reduce costs
- **Regulatory Clarity:** Stormwater must meet current recycled water requirements
- **Funding:** Prop 1 funding opportunities
- **Small-Scale Implementation:** Projects can be scaled

Constraints	Alternative C
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

Alternatives' Constraints and Opportunities

Alternative D - Private On-Site Use

Alternative D has a near-term feasibility timeline as small scale residential stormwater capture and use (rain barrels and down-spout disconnects) are successfully being implemented. Although these projects use a small amount of the total runoff volume, there is the potential for large scale implementation in the region. For these smaller scale projects, partial funding will likely increase support and implementation of residential rain barrels and down-spout disconnects projects as evident from the programs that have been implemented by the County and City of San Diego. (See text box for larger scale private implementation)

Public/Private Partnerships - Opportunities for larger scale private use of stormwater could be realized on large private residential developments, commercial and industrial sites. For these larger scale commercial and industrial projects, public/private partnerships are needed to use private funding to build needed infrastructure to convey and treat stormwater captured from private sites for use. Larger scale projects would become more feasible through greater regulatory clarity and flexibility under the stormwater alternative compliance program to allow private developers to purchase water quality credits to meet on-site stormwater regulatory requirements that would fund public infrastructure to convey and treat captured stormwater from these sites for potable or recycled use. For more information on public/private partnerships from the industrial business and developer perspectives, please refer to the Water Reliability Coalition (WRC) white paper entitled, "Assessing the Potential for Stormwater Capture and Reuse", (WRC, 2017).

Constraints	Alternative D
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

- **Partnerships:** Public/Private partnerships could help fund public
- **Regulatory Clarity:** Alternative Compliance program would provide greater flexibility to Alternative D Projects
- **Small-Scale Implementation:** Scaled to meet on-site demands
- **Funding:** Prop 1 funding opportunities

Alternative E - Natural Treatment Systems

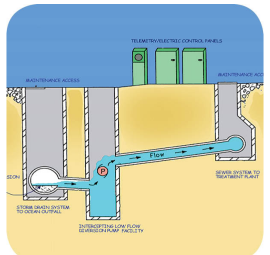
Alternative E has a near-term feasibility timeline, due to its cost effectiveness, potential regional volume and multi-benefits that include water quality compliance, environmental and community benefits. A lower cost per volume is associated with this alternative due to the use of dry weather flows that significantly increases the total annual volume captured and used. Dry weather flows are routed through the treatment wetland to sustain the wetland vegetation that also removes pollutants such as sediment and nutrients. Constraints associated with this alternative includes long-term operation and maintenance costs and permitting that allows for continued maintenance that may require mitigation for established habitat. Consideration is needed in preparing the permits for these projects to negotiate up-front mitigation to allow for continued maintenance and performance of the wetland

- **Reduced Cost Per Volume:** Dry weather flows significantly increase annual volume used
- **Regulatory Clarity and Flexibility:** Permits can be negotiated
- **Funding:** Prop 1 Funding Opportunities

Constraints	Alternative E
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

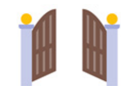
Alternatives' Constraints and Opportunities

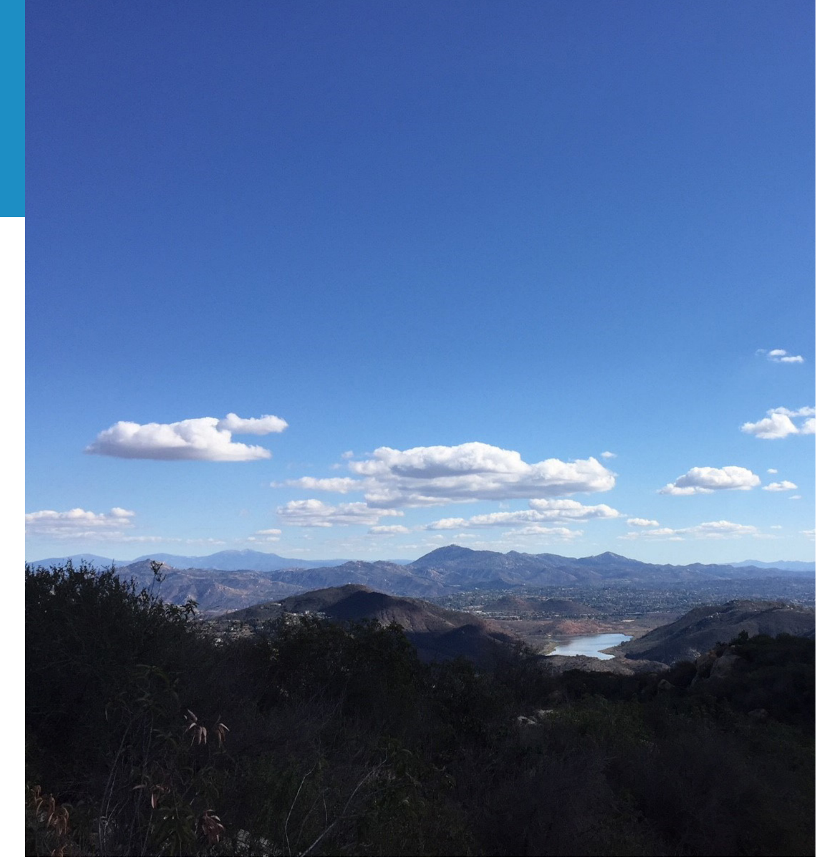
Alternative F - Dry Weather Flow Diversion to WWTP

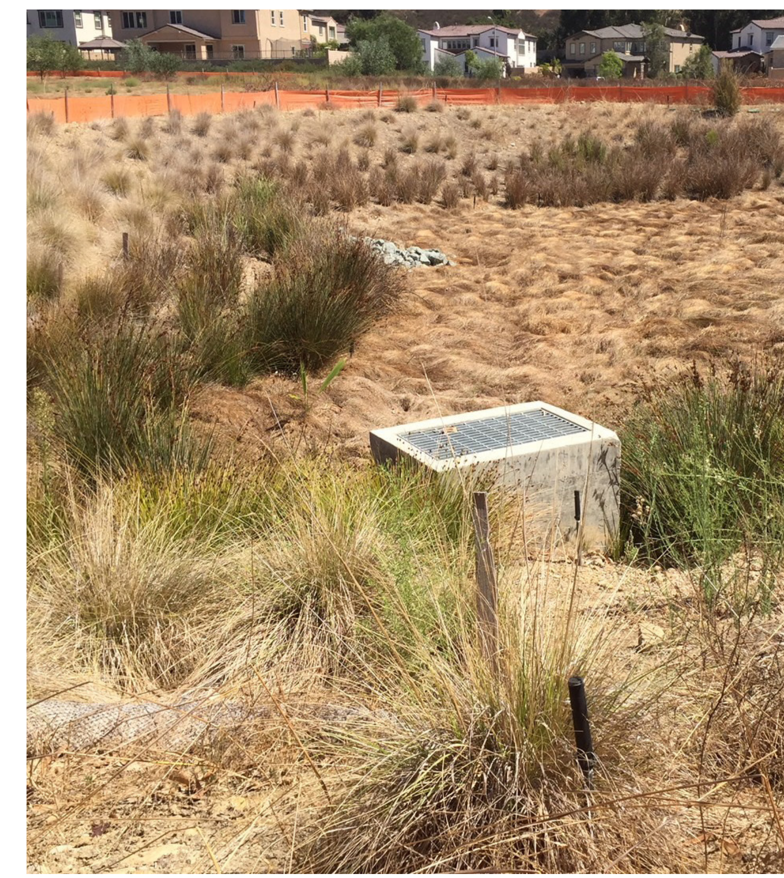


Alternative F has a mid-term feasibility timeline. This alternative has a higher priority than the alternatives that treat stormwater at an existing wastewater facility for potable or recycled use because of the lower cost per volume and better match of supply to the demand. The lower cost per volume is due to the use of dry weather flows that, similar to Alternative E increases the total annual flow used and therefore reduces the unit cost. There is also existing capacity generally in sanitary sewers during dry weather periods. Addition of dry weather flows provides for solids management which has become a greater issue as water use has decreased due to conversation efforts. The constraints to a greater implementation of this alternative include the need for agreements between wastewater authorities and stormwater departments to provide a program level approach to dry weather diversion discharge permits that can provide greater certainty and standardization of the process. Diversion of dry weather flows from MS4 may reduce flows in receiving waters that have established habitats from these perennial flows. Although the current MS4 permit prohibits non-storm flows from MS4, diversion of these flows may be restricted due to the establishment of these habitat downstream of these MS4 outfalls. Regulatory clarity is needed to address these conflicting regulatory goals.

- **Match Supply/Need:** Existing systems generally have capacity
- **Partnerships:** Example projects show partnerships are developing
- **Reduced Cost per Volume:** Alternative has a lower cost per volume due to dry-weather flows significantly augmenting annual volume used
- **Funding:** Prop 1 Funding Opportunities

Constraints	Alternative F
Site Characteristics	
Production and Demand Timing	
Existing Infrastructure	
Partnerships	
Treatment Requirements	
Regulatory Clarity	
Costs and Funding	
Public/Agency Support	

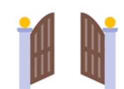




Alternatives' Constraints and Opportunities

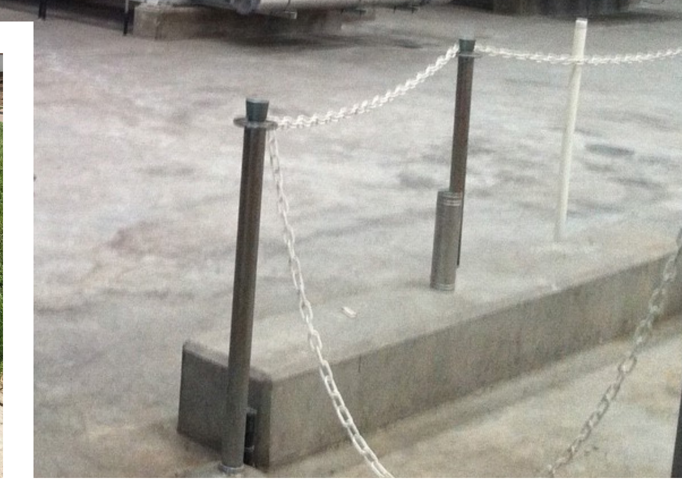
Alternatives G + H - Controlled Discharge to WWTP for Indirect Potable Use (G) and Recycled Water Use (H)

Alternatives G and H have long-term feasibility timelines. These alternatives have a greater timeline for regional implementation due to a greater number of constraints that include high cost per volume and limits to the current capacity of sanitary sewers and treatment facilities. Stormwater is generated when sanitary sewers and treatment plants have limited capacity due to infiltration into the sewer lines. In addition, incompatibility of stormwater quality to the sewer treatment systems also limit discharge rates **(see text box)**. These restrictions due to stormwater volume and quality can be controlled through the use of temporary storage and controlled discharge. These restricted discharge rates from stormwater storage facilities limit the efficiencies of these facilities by limiting the capacity to capture and store multiple storm events. This increases the cost per volume. This constraint may be overcome by larger regional storage facilities. However, the availability of large enough public areas for these facilities will limit the overall regional application of these alternatives. There is a long-term opportunity for larger scale storage at private sites (Alternative D), but conveyance and treatment capacity would be needed. Use of stormwater to supplement sources for recycled water have a slightly higher priority score than potable water use as there are examples of greater support and interest in this alternative from public utilities where the cost per volume is comparable to other sources. Currently these costs for stormwater are higher than these other sources. These alternatives are also longer term as no agreements have been established between MS4 managers and public utilities for acceptance of stormwater flows. These alternatives may move up in priority and feasible timeline as stormwater quality compliance goals and State-level policies for increased use of local water supplies provide regional drivers that "off-set" the higher costs of these alternatives and incentivize inter-agency agreements.

Constraints	Alternative G	Alternative H
Site Characteristics		
Production and Demand Timing		
Existing Infrastructure		
Partnerships		
Treatment Requirements		
Regulatory Clarity		
Costs and Funding		
Public/Agency Support		

- **Production and Demand Timing:** Economies of Scale: Large projects may overcome capture
- **Partnerships:** Example projects indicate future partnerships are developing
- **Funding:** Prop 1 funding opportunities
- **Public/Agency Support:** Public/private partnerships for larger-scale projects could help provide funding

Stormwater Compatibility with Treatment Processes: In the San Diego region, existing waste water treatment/ water reclamation facilities receive only sanitary sewer flows and are not combined systems (sanitary sewage and stormwater). These facilities are therefore designed and operated (above the operational design for incidental infiltration during storm events) for high biological oxygen demand (BOD) sanitary flows. The introduction of lower BOD and highly variable storm flows into these facilities would result in an impact to the operations unless flows are controlled to address system compatibility. The impacts to the wastewater treatment processes must be considered for Alternatives G & H that include stormwater capture, storage, and subsequent discharge to sanitary sewers, for flow augmentation to Water Resource Recovery Facilities (WRRF) that produce water for potable or non-potable reuse. Stormwater impacts on wastewater treatment process have been tested from the perspective of wet weather flows, where stormwater is added to WRRFs in the form of Infiltration and Inflow (I/I) and combined sewer flows. However, the concept of low, sustained flows of stormwater that are captured and stored prior to sewer discharge has not been tested operationally. Chemical and physical treatment processes at a WRRF may need a re-evaluation of chemical dosing and operational set points (primary treatment, disinfection), while biological treatment processes may require a higher Solids Retention Time (SRT) to buffer against the input of unexpected toxic or recalcitrant contaminants. For the volume and cost estimates for Alternatives G & H, stormwater was assumed to be captured and stored for a controlled discharge after the storm event to accommodate existing sanitary sewer capacity and compatibility issues. This reduces the efficiency of the storage facilities as they may not have full capacity available for the next storm event. Pre-treatment to address sediment and trash is also considered in the cost per volume estimates.

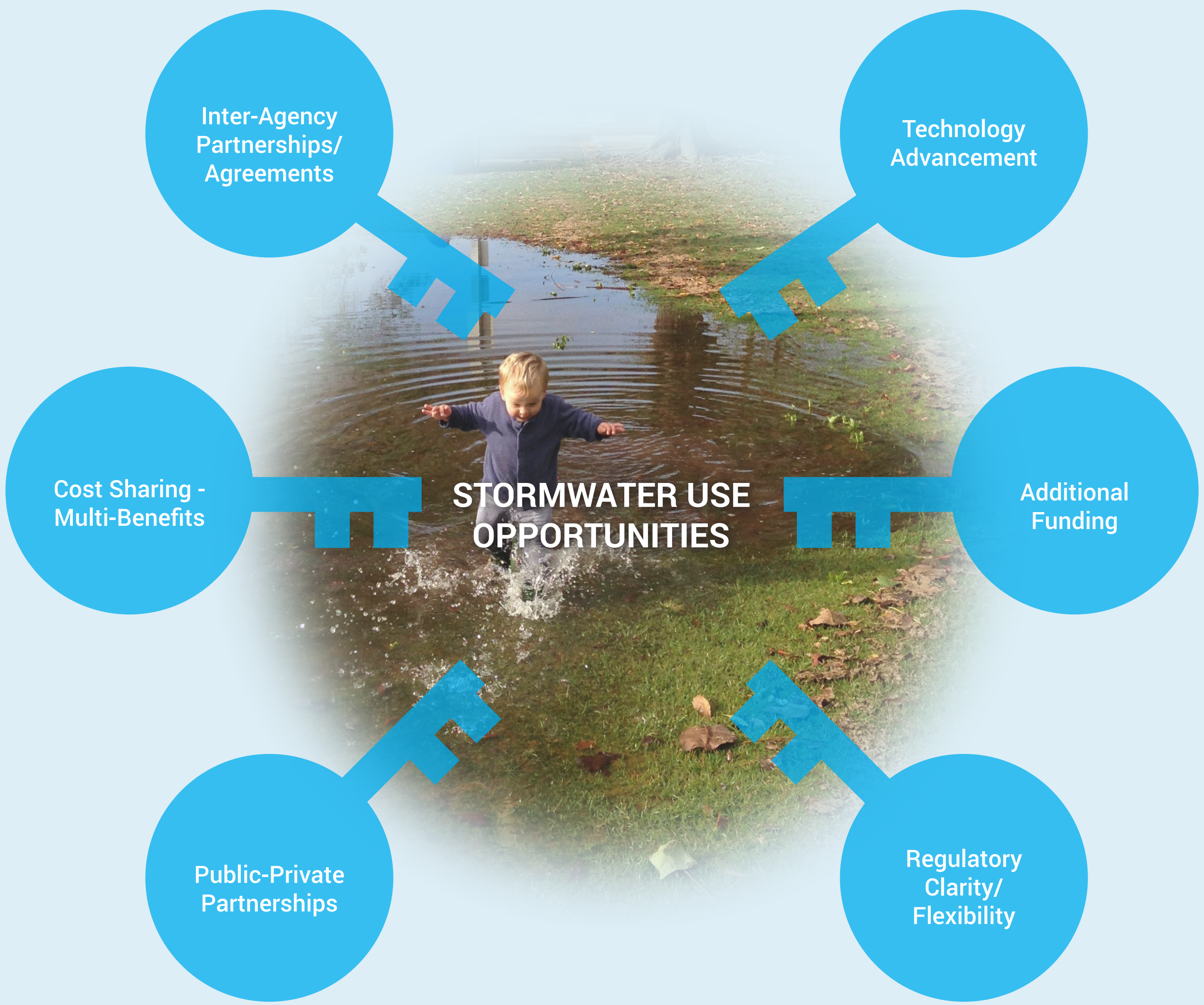


Regional Opportunities

Regional Conclusions

In the assessment and prioritization of use alternatives, some trends have emerged across the San Diego Region. First, there are several stormwater capture and use alternatives that are already being implemented. Technology and need are already present to make infiltration for natural hydrology (i.e. green streets), capture for private on-site use (i.e. rain barrels), wetland treatment systems, diversion of dry weather flows, and infiltration into groundwater basins feasible in some cases, and many projects are already underway. Other alternatives may become feasible in the future with changes in technology, regulatory clarity, inter-agency agreements, partnerships and increased demand for alternative local water supplies.

Second, alternatives that capture dry-weather flows generally score higher than similar alternatives that use only wet-weather flows. Implementing systems or policies that allow more use alternatives to utilize dry-weather flows would allow them to capture and use water year-round, increasing annual capture and use volume and reducing unit cost. These changes would improve the overall feasibility scores for these use alternatives and could make them feasible in a shorter term than they are now. Alternatives may move up the feasible timeline as stormwater quality compliance goals and State-level policies for increased use of local water supplies provide greater regional drivers that "off-set" the higher costs of these alternatives and incentivize inter-agency agreements.



Closed Gate/Wall

Estimated lower end of the range of regional total annual volume of stormwater capture and use under current constraints and use of more feasible public parcels for more short- and mid-term alternatives.

These regional opportunity "keys" open the gate to additional stormwater collection and use

Open Gate

Estimated upper end of the potential range of regional stromwater capture and use with more "gates" opened allowing for a greater number of constrained public parcels to be used for more use alternatives.

Stephanie Gaines
Watershed Protection Program
stephanie.gaines@sdcounty.ca.gov
858-694-3493

ESA

David Pohl
DPohl@esassoc.com
760-497-3318

Brown and Caldwell
Burns and McDonnell
Katz and Associates