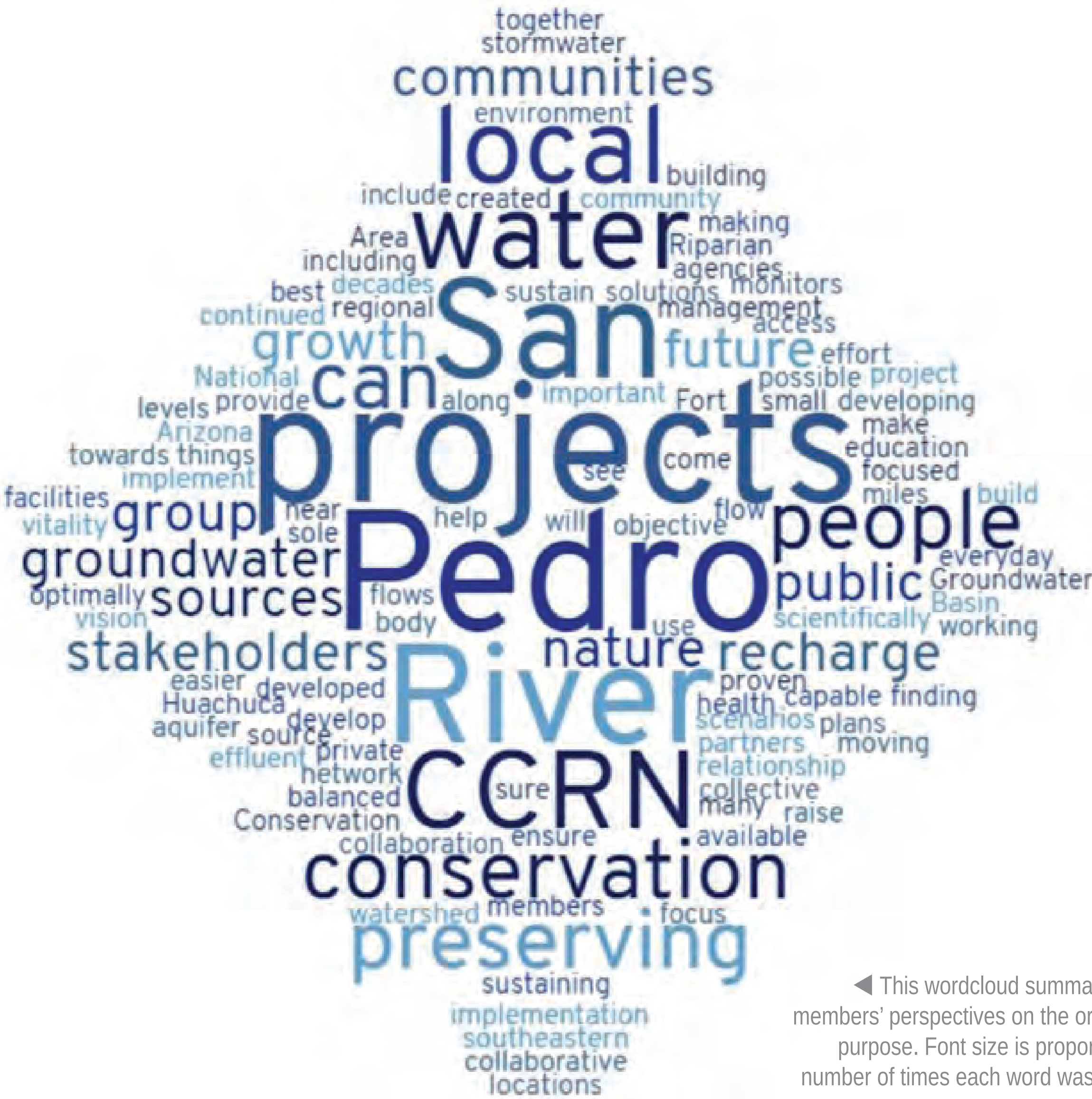
CCRN Cochise Conservation & Recharge Network

ANNUAL REPORT 2021

INSIDE

Ensuring Water Security
What We Do
What We've Accomplished
What Comes Next?
What We're Learning



◀ This wordcloud summarizes CCRN members' perspectives on the organization's purpose. Font size is proportional to the number of times each word was mentioned.

CCRN IMPACT

Total Benefits

41,209

acre-feet (AF)*

Recharge & Retired Pumping
31,709 AF

Precluded Pumping
9,500 AF

*since 2015

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Implementing Projects to Ensure Water Security for People and Nature

The Cochise Conservation and Recharge Network (CCRN) was established in 2015 to implement projects that ensure a healthy San Pedro Riparian National Conservation Area, managed by the U.S. Bureau of Land Management, and provide water security for communities along the Upper San Pedro River in Cochise County, Arizona. The members of CCRN are the Cities of Sierra Vista and Bisbee, Cochise County, Fort Huachuca, The Nature Conservancy, and the Hereford Natural Resource Conservation District. Collaboration, innovation, and science-based decisions are CCRN's guiding principles. CCRN also coordinates closely with other collaborative conservation efforts in the region, including the Upper San Pedro Partnership and Fort Huachuca's Sentinel Landscape Program.

Cochise Conservation & Recharge Network

CCRN MISSION

To implement a regional network of land and water management projects that result in a healthy watershed, flowing San Pedro River, conservation of water resources, and a vibrant local economy.

Guided by a 5-Year Road Map, 2020-2024

GOAL 1

Recharge

Design/construct the Coyote Wash Urban Enhanced Runoff, Riverstone Effluent, and Bisbee Effluent Recharge Projects

Continue the operation, maintenance, and hydrologic monitoring of all existing network sites

GOAL 2

Conservation

Implement conservation and watershed health projects

Continue to use groundwater modeling and other tools to evaluate the overall effectiveness of all projects

What We Do

Water Management Projects

To accomplish recharge and conservation, CCRN designs and builds recharge infrastructure projects and manages land along the Upper San Pedro River. The projects are designed to help ensure the health of the riparian corridor and provide water security for communities. Each CCRN site complements the others in the region, and the projects are individually designed to benefit the aquifer and river through one or more of the following strategies:

- Recharging the aquifer with local water supplies, either stormwater or reclaimed water
- Purchasing land and retiring high volume pumping near the river
- Precluding future pumping on undeveloped land through conservation easements

The network currently has 8 project sites comprising more than 6,000 acres. Visit CCRNSanPedro.org to tour the project sites, view photos and maps, and read the first 5-Year Review and 2020 Annual Report.

Hydrologic Monitoring and Modeling

CCRN relies on predictive hydrologic models and long-term monitoring to *quantify and improve the design and effectiveness of CCRN projects and to address legal and regulatory compliance.* Hydrologic monitoring of precipitation, surface water runoff, and groundwater levels is ongoing at CCRN project sites. Data collection is tailored to each site's features and project goals, and data are evaluated annually to support design, improve operation, and track results.

Predictive models are used by CCRN to forecast how groundwater and surface water will respond to different management scenarios, including the potential location and design of future groundwater recharge facilities. The use of these technical tools helps to ensure that the best investments are made in projects to meet desired goals and objectives. They also help design projects for multiple benefits, such as those that decrease erosion and sedimentation while also increasing groundwater storage and baseflows of the San Pedro River.

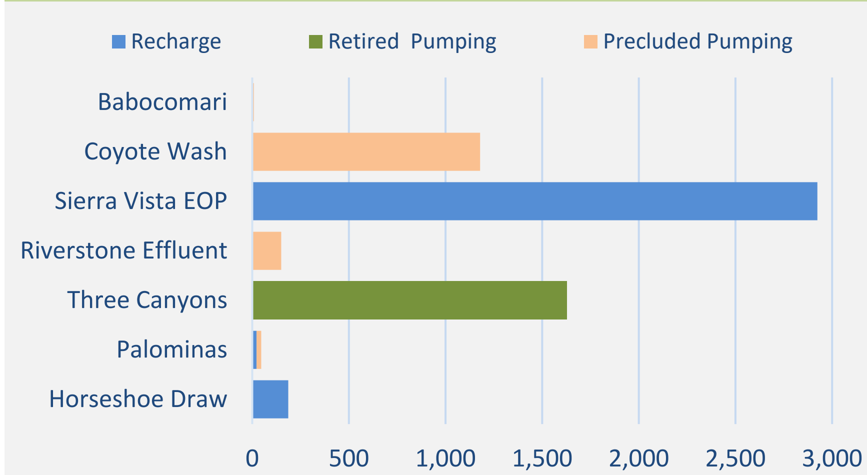
What We've Accomplished

CCRN projects provided more than 6,000 acre-feet (AF) of water benefits in 2021 and a total of more than 41,000 AF since 2015. CCRN tracks the cumulative water benefits as recharge, retired historical pumping, and precluded future pumping. Other projects being pursued by individual members are not reflected on the list tracked by CCRN.

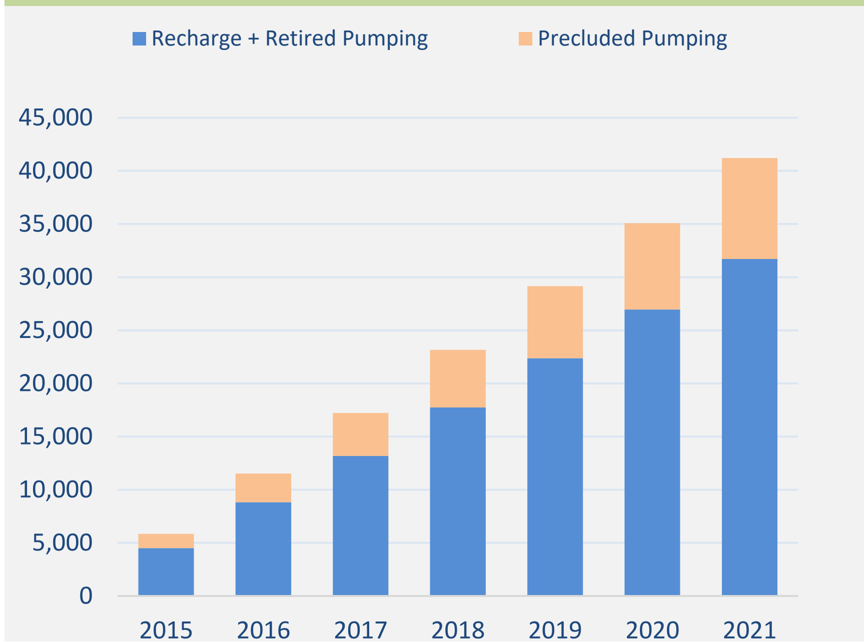
Among the 8 sites, the Sierra Vista Environmental Operations Park (EOP) Effluent Recharge project and Three Canyons Conservation Site are responsible for nearly 80% of the calculated water benefits accrued by the network through recharge and retired pumping, respectively.

> Since 2015, CCRN project benefits total 41,209 acre-feet (AF) with 31,709 AF of recharge and retired pumping and 9,500 AF of precluded pumping.

Annual Water Benefits, 2021 (acre-feet)



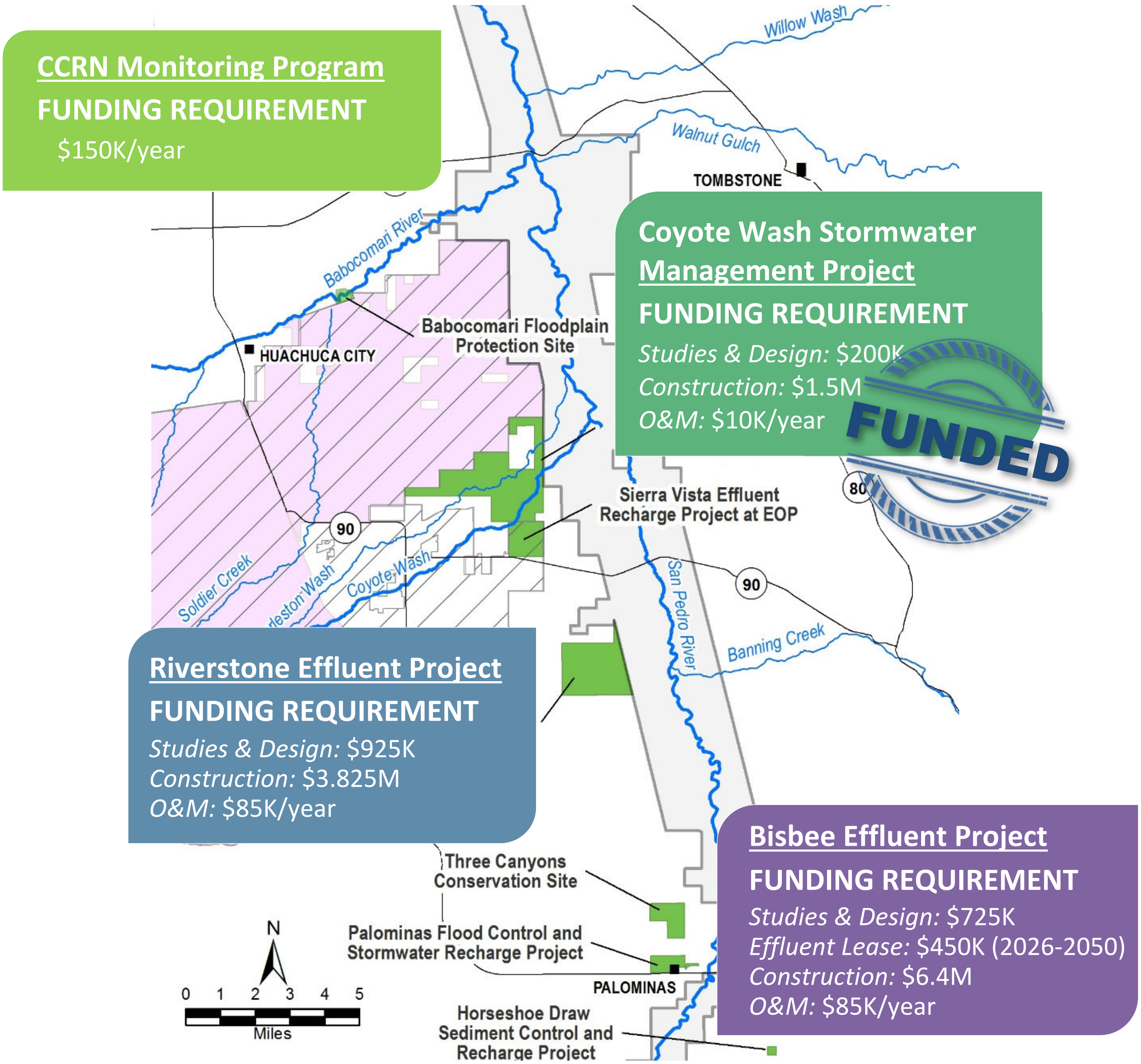
Cumulative Water Benefits (acre-feet)



The CCRN methodology for calculating the water benefits is generally consistent with the 2014 Biological Opinion for Fort Huachuca. Precluded pumping is calculated from the zoning density of the parcel with an average of 2.5 people per household, at a per capita usage of 118 gallons. Retired pumping is based on acres retired with a water duty of 3.4 AF/acre. (Note this number was revised retroactively in 2021.)

What Comes Next?

Additional funding is required to complete 3 critical projects by 2024: **Coyote Wash Stormwater Management**, **Riverstone Effluent**, and **Bisbee Effluent**. When the network is complete, CCRN's science-based approach and innovative water management projects will help sustain the aquifer and the river long into the future. Ongoing hydrologic monitoring will continue to be an essential part of tracking and ensuring project success before, during, and after construction of all CCRN projects.



The above figure highlights the estimated funding requirements for design, construction, and annual operations and maintenance for each project.

CCRN: Past, Present, & Future

A History of Collaboration

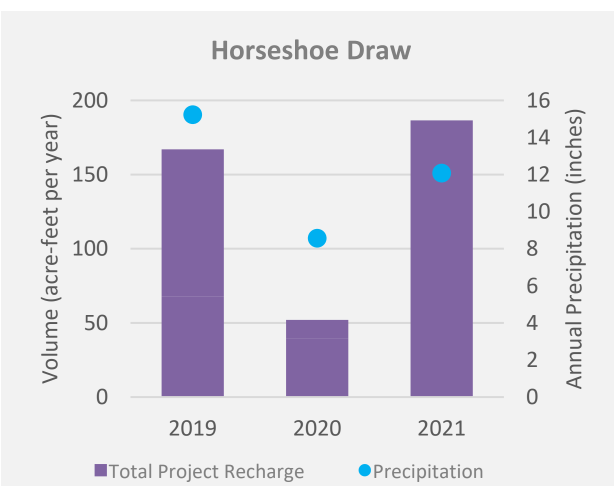
In 1988, Congress designated the San Pedro Riparian National Conservation Area, or SPRNCA, as the nation's first Riparian National Conservation Area to protect this area's unique natural and cultural resources. Spanning 43 miles along the river and managed by the U.S. Bureau of Land Management (BLM), the SPRNCA is in Cochise County, near the City of Sierra Vista and the U.S. Army post Fort Huachuca. CCRN's efforts are focused along 25 miles of the SPRNCA and align with BLM and Fort Huachuca water management objectives.

What We're Learning

After 7 years, the hydrologic monitoring and modeling of CCRN projects have provided interesting insights into their engineering design, construction, and maintenance.

Stormwater Runoff in a Changing Climate

We know that wetter soils at the onset of a storm lead to more runoff, and drier soils result in less runoff. At CCRN sites, less runoff is being measured in recent years than has been predicted, which is due in part to increasingly drier soils over time. The 3-year Horseshoe Draw comparison below illustrates the relationship between annual precipitation and runoff. We expected less runoff in 2020 than 2019 because of less rain. However, in 2021, there was more runoff despite having less rain than 2019. A major difference was that more frequent storms kept the soils comparatively wetter during the monsoon season in 2021 compared to less frequent storms that resulted in drier soils in 2019.



The relationship between rainfall and the amount of runoff also depends on several additional factors including topography; degree of urbanization and/or channelization; precipitation intensity, duration, and seasonality; and the distribution of precipitation within the watershed relative to monitoring locations.

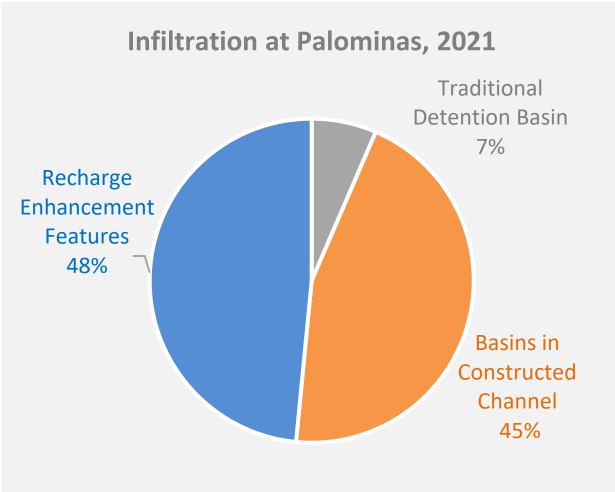
Some of these factors vary year to year at Horseshoe Draw, and others remain constant. Ongoing monitoring will help to clarify which of these are most important for runoff volumes. Nonetheless, changing precipitation patterns will influence annual recharge rates for stormwater recharge projects. The lessons we are learning from monitoring sites like Horseshoe Draw allows us to design projects that take advantage of new climate patterns to meet recharge objectives.

Minimizing Losses to Evaporation

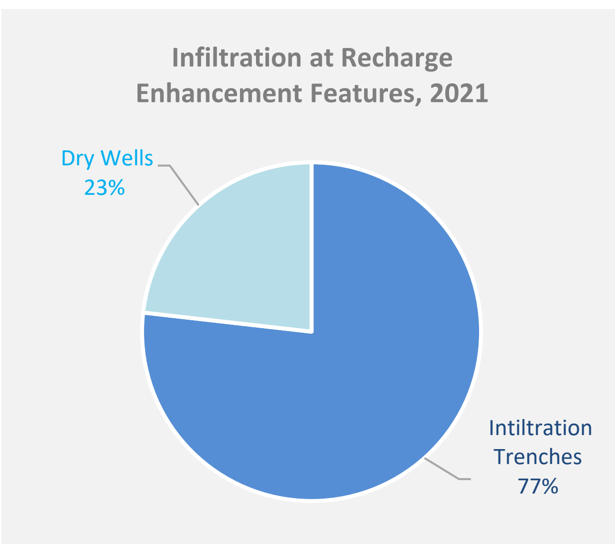
Minimizing the evaporative losses of stormwater runoff presents a tremendous opportunity for increasing regional water supplies. Monitoring data over 5 years at 3 CCRN project locations show that less than 1% of precipitation that falls in a watershed runs off as stormwater and nearly all the water is lost to evaporation.

The Palominas Flood Control and Stormwater Recharge Project was designed with recharge enhancement structures to reduce the evaporative losses of stormwater by getting runoff back into the ground faster and increasing infiltration rates.

As the following figure shows, in 2021 nearly half of the infiltration of stormwater at the Palominas recharge facility was due to the recharge enhancement structures, including 6 dry wells and 2 infiltration trenches. Most of the remaining infiltration occurred within the one-half-mile constructed channel, which also recharged significantly more water than the traditional 10-acre detention basin located upstream.



Comparing the 2 types of recharge enhancements in the figure below, the 2 infiltration trenches infiltrated 7.25 AF, compared to only 2.19 AF within 6 dry wells.

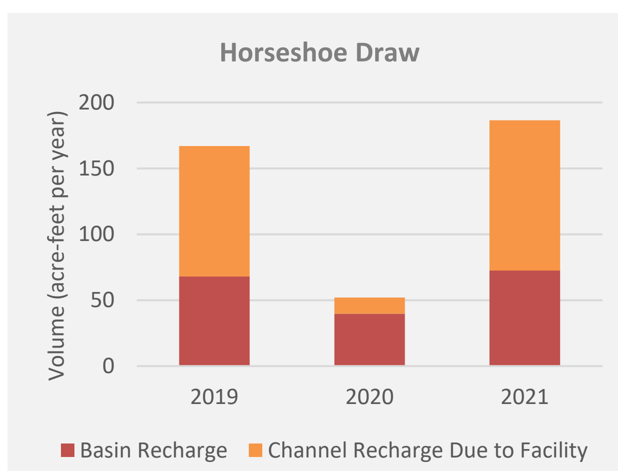


These results suggest that there can be large differences in the performance of different types of stormwater recharge structures at individual projects. Some of this variation is likely due to differences in soil characteristics and surface water availability. For example, infiltration trenches are most effective for penetrating near-surface low permeability layers, whereas dry wells are best suited for deeper, sub-surface restrictive layers. Infiltration trenches can function effectively in response to flashy stormwater runoff events given their greater surface area and large capture volume but require relatively more maintenance compared to dry wells. Learning which types of structures are best suited for different types of sites through careful monitoring leads to improved project performance and cost savings for construction and maintenance over the long term.

Using Natural Channels for Recharge

Detention basins within natural channels may be a comparatively low maintenance, efficient, and cost-effective design concept to increase infiltration for recharge projects in areas with excess runoff.

CCRN monitoring data shows that stormwater detention basins located within ephemeral channels result in significantly more infiltration downstream of a basin that would not have occurred otherwise within the channel. This increase is due to the combination of naturally high infiltration rates in channels and the extended duration of streamflow that results from a constructed detention basin. This type of project is best suited to watersheds that experience accelerated runoff, so that even with detention of some stormwater, relatively natural flood flows are still able to pass through a recharge facility.



At Horseshoe Draw, the amount of recharge in the channel was more than double that which occurred in the detention basin alone, especially during larger storm events

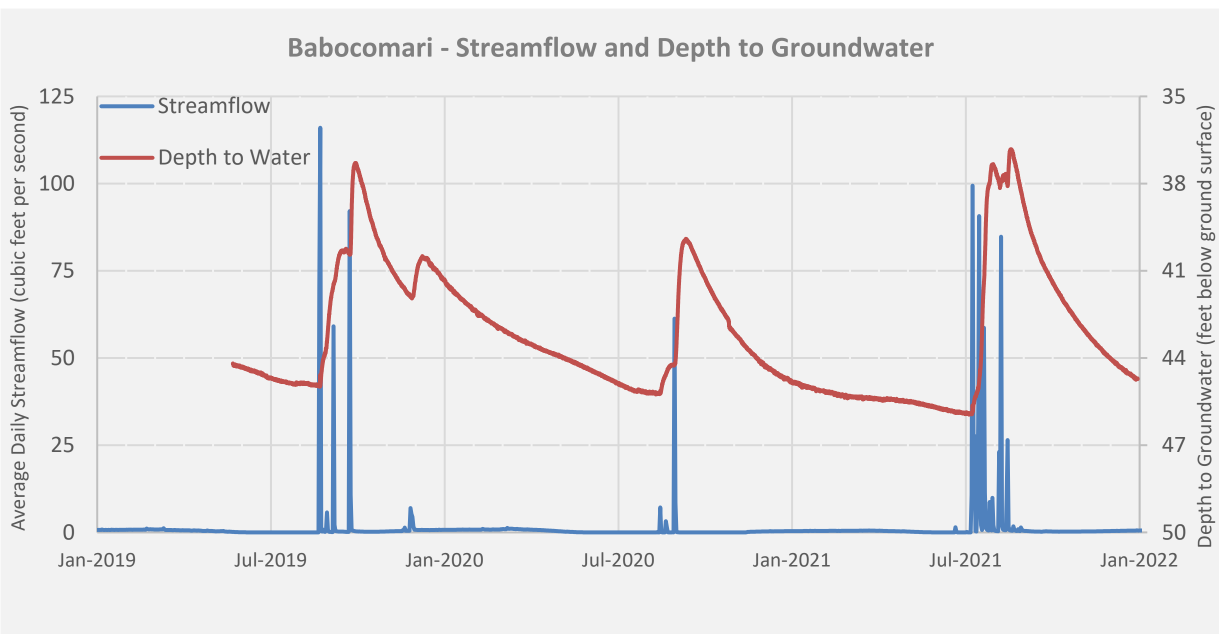
Importance of Natural Floodplain Recharge

At the CCRN Babocomari River site, groundwater levels increase dramatically during monsoon season flood events, as shown in the hydrograph below. Similar floodplain recharge processes also occur along the San Pedro River. The San Pedro and its tributaries are one of the last relatively large, undammed river systems that still experiences natural floods in the Southwest, and these flood flows are not only essential ecologically, but also have a direct beneficial influence on groundwater storage for months after they occur.

Importance of Maintenance at Recharge Facilities

Hydrologic monitoring is important for many reasons, including its role in informing the maintenance requirements of stormwater recharge facilities. For example, at the Palominas recharge facility, monitoring data shows that infiltration rates decreased by 30%-70% in infiltration trenches over 8 years due to sedimentation.

Monitoring data can be used to define acceptable performance standards and quantitative thresholds that trigger the need for specific maintenance functions such as sediment removal. In general, CCRN projects are targeted for maintenance to improve performance when infiltration rates drop below 20% of the initial rate due to sedimentation or other factors .



How Recharge Benefits Rivers & Riparian Areas

CCRN's water management approach focuses on ways to ensure the right amount of water is available in the right locations at the right times.

Aquifer recharge is a process for storing water underground. In the case of the San Pedro River, recharge projects using stormwater or reclaimed water increase groundwater levels in key locations, where it is needed the most. See the figure at right and the corresponding explanations below.

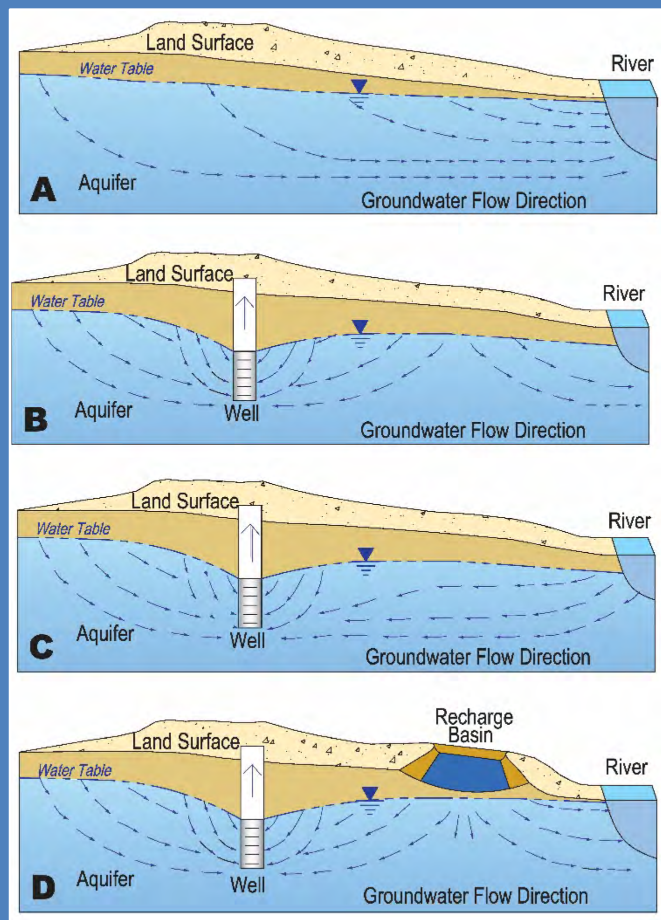
A Groundwater is connected to streamflow in the river.

B Groundwater pumping creates a "cone of depression" in the water table, increasing the depth to groundwater around large pumping centers. A cone of depression can initially reduce streamflow by intercepting groundwater that is flowing toward the river.

C Over time, as the cone of depression expands toward the river, it can reverse water flow direction and "capture" or take water out of the river.

D By recharging water into the ground in key areas between a cone(s) of depression and the river, recharge basins can stabilize or even increase groundwater levels, minimizing pumping impacts on the river.

Conceptual representation of groundwater-surface water connection and groundwater recharge project



Source: USGS, modified by CCRN

The CCRN recharge projects are helping nature replenish groundwater by storing high quality effluent and accelerated stormwater runoff underground in these key locations where they can most benefit the flows of the river and the regional groundwater aquifer.

Prepared by The Nature Conservancy and Montgomery & Associates in cooperation with the CCRN