Petaluma River Watershed Action Plan

Including the Top Ten Identified Projects to be Implemented by the Petaluma Watershed Collaborative

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SONOMA RESOURCE CONSERVATION DISTRICT

Funding provided by:

BUREAU OF RECLAMATION

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Section One: Background and Introduction

This Action Plan for the Petaluma River Watershed prioritizes the most critical projects for watershed sustainability and guides efficient investment of collective resources by watershed stakeholders.

Photo credit Sonoma Mountain Institute

Background

The *Petaluma Watershed Action Plan* (Action Plan) was developed as a complementary document to the 2022 update of the *Petaluma River Watershed Conservation and Enhancement Plan*. The Action Plan was developed to include a list of priority management and restoration projects to be implemented with leadership from the Petaluma Watershed Collaborative (Collaborative).

Through this process, the Collaborative (1) developed criteria to evaluate and prioritize watershed projects (2) solicited project ideas and descriptions from watershed stakeholders and the public and (3) ranked and considered project selection through the developed prioritization criteria. The final ten prioritized projects make up the Top Ten project list. Please see Appendix A for a complete description of the solicitation process, and Appendix B for the project scoring and ranking criteria.

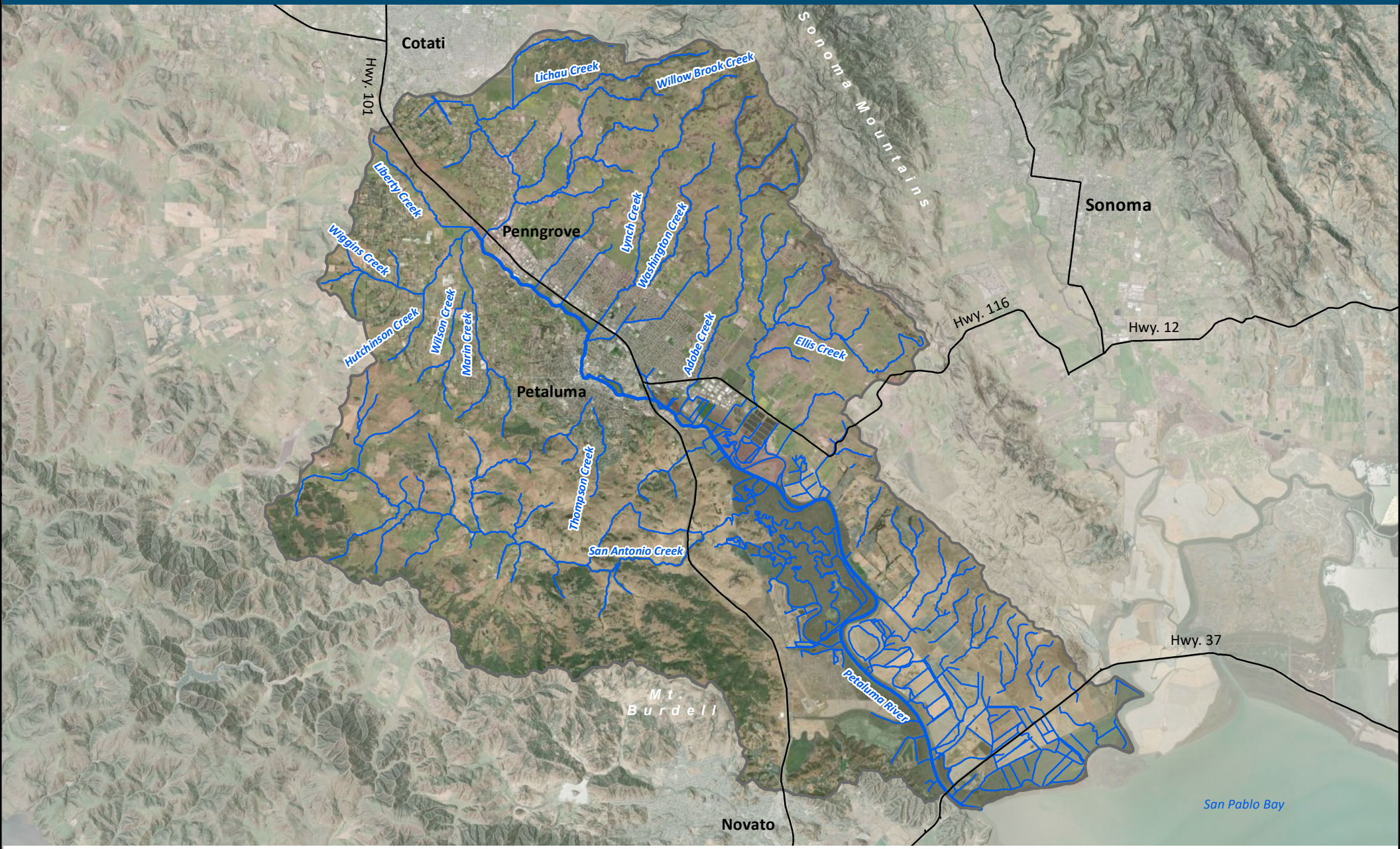
Please see the 2022 *Petaluma River Watershed Conservation and Enhancement Plan* for specific details of the watershed. Figure 1.1 dictates major tributaries and highways of the watershed, and Figure 1.2 outlines subwatersheds within the Petaluma River Watershed.

Introduction

This Action Plan for the Petaluma River Watershed prioritizes the most critical projects for watershed sustainability and guides efficient investment of collective resources by watershed stakeholders.

A total of 70 projects were submitted through the online survey portal from community groups, watershed stakeholders, residents, interested parties, and natural resource practitioners. A wide range of project types (Figure 1.3) and geographic distributions (Figure 1.4) were represented with submitted projects. A range of project ideas were submitted including developed projects, projects with feasibility and designs completed, project concepts and ideas, overall watershed strategies, and wide-scale restoration concepts.

Through the scoring and ranking of submitted projects, reviewers noticed that “ready to go” projects took priority in the scoring and ranking process. While finalizing the Top Ten list, reviewers and stakeholders were committed to making sure that a diversity of project types were represented with a varied geographic distribution. The goals of the Collaborative, Funder, and Action Plan were considered as well.

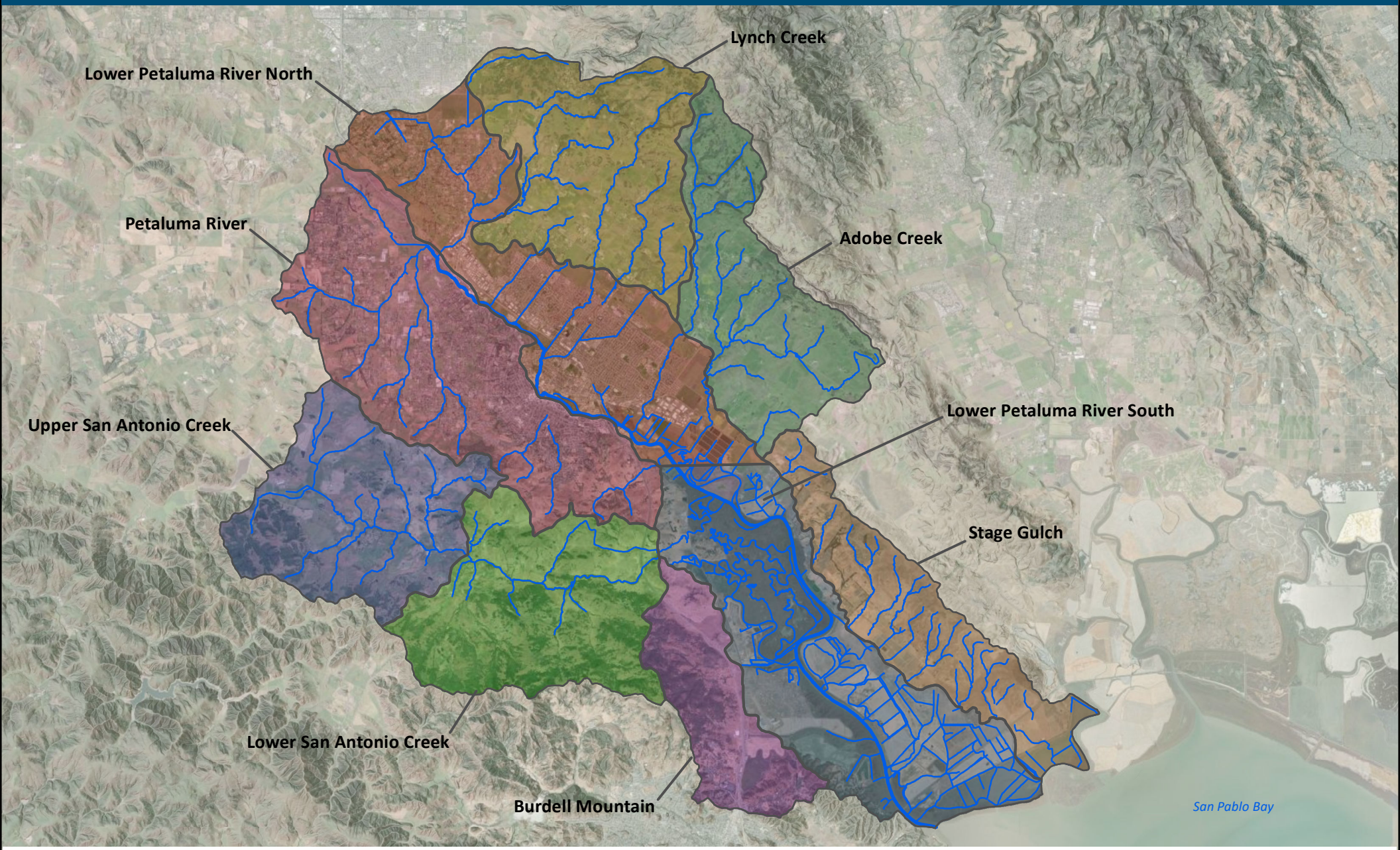


Petaluma River Watershed Boundary
Petaluma River USGS Blueline Creeks
Major Highways

1 inch = 3 miles
0 3 6 Miles
N

SONOMA RESOURCE CONSERVATION DISTRICT
Map created by
Sonoma RCD June 2022

Figure 1.1. Petaluma River Watershed major tributaries and highways.



Petaluma River Watershed Boundary
Petaluma River Watershed Subwatershed Boundaries (various colors)
Petaluma River USGS Blueline Creeks

1 inch = 3 miles
0 3 6 Miles
N

SONOMA RESOURCE CONSERVATION DISTRICT
Map created by
Sonoma RCD June 2022

Figure 1.2. Petaluma River Watershed subwatersheds.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

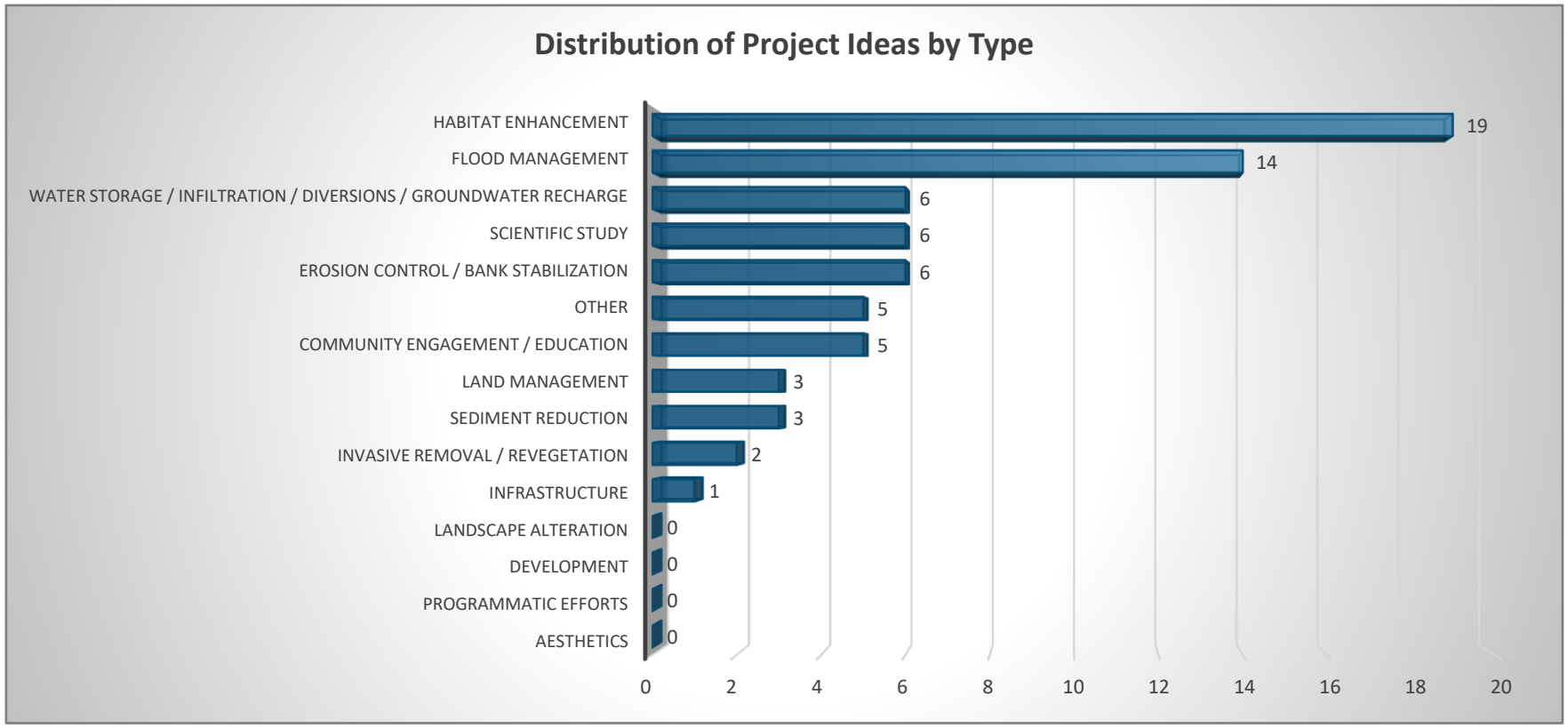
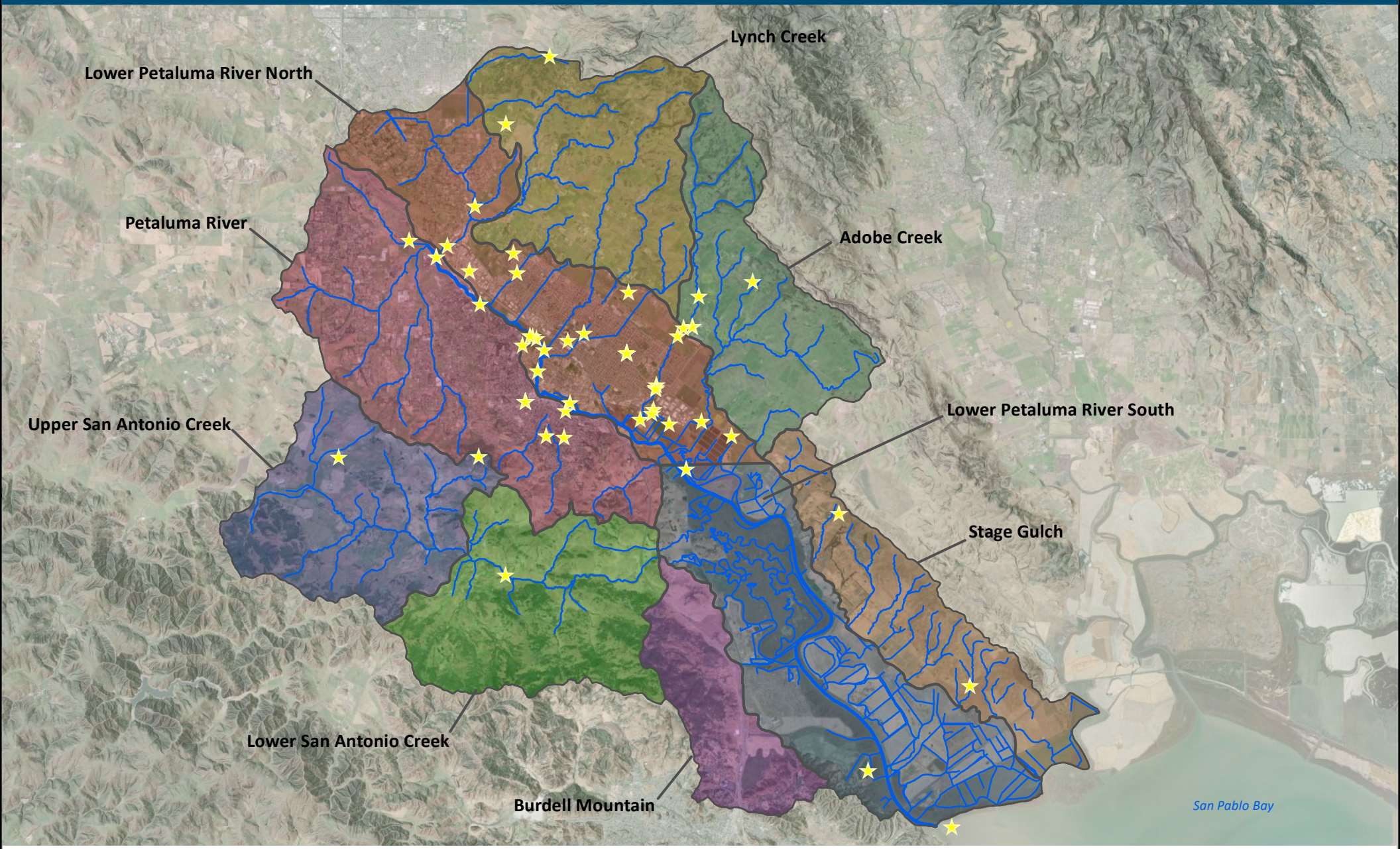


Figure 1.3. Distribution of project ideas by type received through the project solicitation process.



Petaluma River Watershed Boundary
Petaluma River Watershed Subwatershed Boundaries (various colors)
Petaluma River USGS Blueline Creeks
Submitted Project Ideas

1 inch = 3 miles

0 3 6 Miles

N

SONOMA RESOURCE CONSERVATION DISTRICT

Map created by Sonoma RCD June 2022

Figure 1.4. Distribution of project ideas by location received through the project solicitation process.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Section Two: Petaluma River Watershed Top Ten Projects

The top ten projects are outlined in this section as they were ranked.

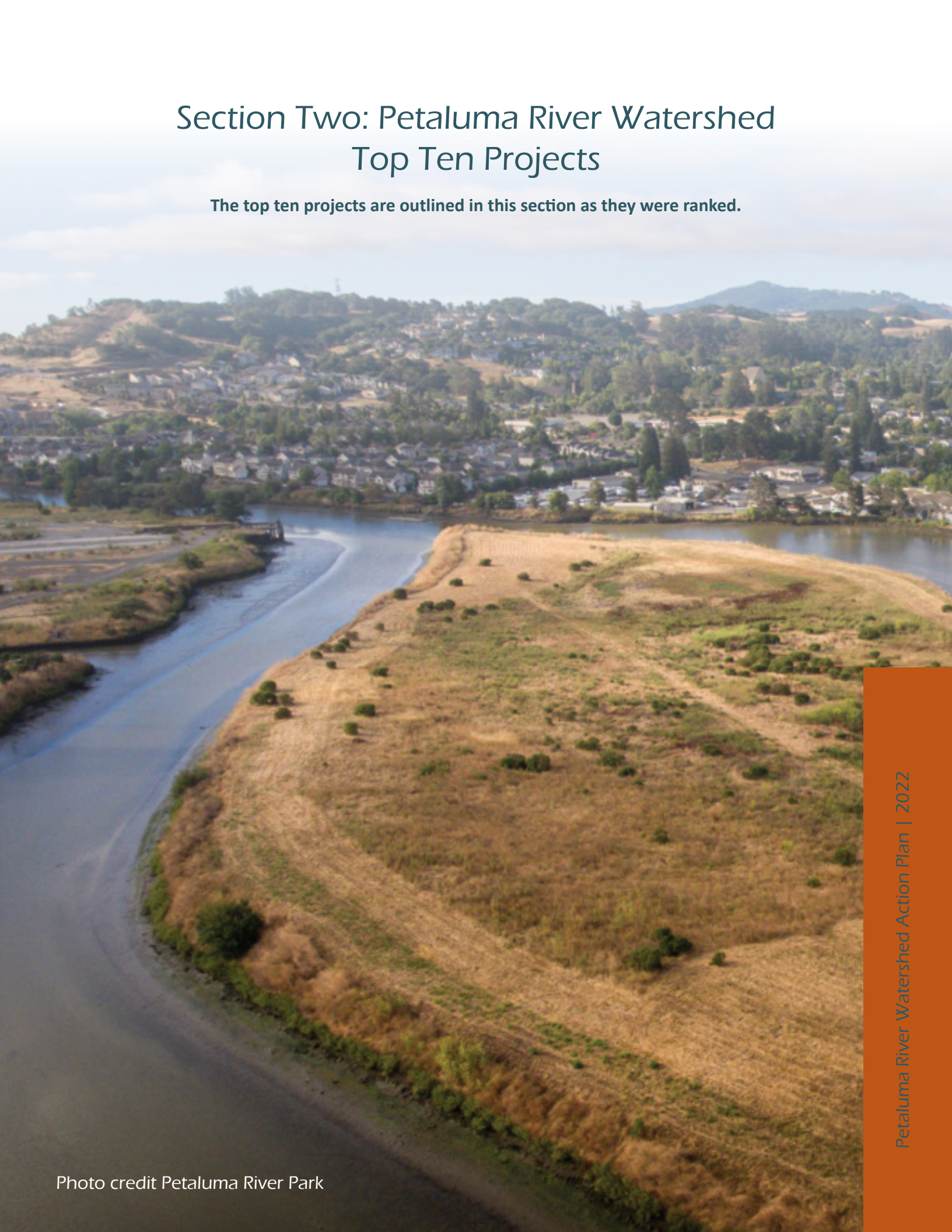


Photo credit Petaluma River Park

Project 1. Petaluma River Sediment Source Analysis and Implementation

Subwatershed: Subwatersheds throughout entire Petaluma Watershed

Location: Watershed-wide, please see Figure 1.2 in Section 1 for a watershed-wide subwatershed map

Project Type: Study/Planning

Current Project Proponents: San Francisco Estuary Institute, Sonoma Water, Sonoma Resource Conservation District, City of Petaluma, California Department of Fish and Wildlife, National Marine Fisheries Service

Project Property Ownership: This study will encompass all lands within the watershed and vary on ownership type. For field work, landowner access would be required to conduct work. Outreach with landowners to secure access agreements will need to be conducted. From previous study and monitoring efforts conducted in the watershed, it is predicted that with the appropriate outreach, permission for access could be obtained. The project will also utilize public, City of Petaluma, County of Sonoma, protected properties, as well as properties owned and managed by local parks departments for additional land access requests in the study area.

Project Outcomes: This study will characterize and identify sources and amount of sediment contributing to erosion and target specific areas and recommended strategies and practices for sediment management across the watershed. Another project outcome is a sediment budget and plan to balance and manage sediment. Providing a comprehensive approach to managing sediment will assist in alleviating flood conditions and enhancing riparian habitat. Identifying the sources and movement of sediment will help to narrow the focus and determine the highest priority areas for restoration and long-term sediment management. Sediment management within the watershed will improve land management for conservation; advance restoration and flood management objectives including salmonid survivability with increased summer base flows and reduction of fine sediments in spawning gravels; reduce riparian related flooding concerns and sediment basin maintenance; improve water quality and quantity; increase groundwater recharge; aid in the restoration and accretion of marshland habitats; and establish points of access to facilitate future sediment management and maintenance efforts. The Petaluma River has long been faced with the accumulation of sediment requiring regular dredging for the maintenance of the channel. The City of Petaluma and United States Army Corps of Engineers have worked to make this regular maintenance possible, often with significant challenges. Having a deeper awareness of sediment sources and movement in the watershed will provide a greater understanding for the benefit of natural resources, community, and commerce.

Project Description: Land clearing and development in the Petaluma River Watershed have led to increased erosion, which has caused excess fine sediment deposition. This project combines field assessments and desktop analyses to determine erosion rates and fine sediment supply throughout the Petaluma River Watershed. Field teams will coordinate with landowners and collect information on erosion rates for features, including channel erosion, hillslope erosion, and gully erosion. Depending on

access, the data collection area could include San Antonio Creek, the Petaluma River, and the river's major tributaries upstream of head of tide. The field data will be brought into GIS to map erosion features visited in the field and conduct analyses to develop erosion rates for those areas not visited. This information will then be synthesized into a summary report that describes the erosion story throughout the watershed and recommends appropriate management actions to decrease the fine sediment supply.

The watershed currently lacks a comprehensive study of sediment sources, sediment transport, and sediment management strategies. A sediment study is a vital management tool for stakeholders to better understand current on-the-ground conditions and to manage for changing conditions into the future. A sediment study needs to be scoped based on collaborative input from science advisors and watershed stakeholders as a first step. Thereafter, technical work will identify sediment sources, transport, erosion rates, and develop priority best management practices and strategies, including utilizing sediment as a precious resource for watershed health and recovery. This study will serve as a foundational next step to guide future restoration and natural resource management practices.

Over 20 years ago, a sediment study was prepared for Adobe Creek in addition to several specific stream reaches to support local water agency stream maintenance efforts. In recent years, stakeholders have discussed the possibility of a new sediment source analysis on Adobe Creek (please see Project #3, Implementation of Flood Detention Basins, Adobe Creek Floodplain Management and Sediment Study). Expanding a study to the whole watershed has been identified as a beneficial tool by various watershed practitioners, as a watershed-wide study will facilitate the identification of the most impactful priority projects for implementation. Without information generated from a sediment analysis, channel restoration and flood-mitigation projects (such as sediment basins) may be placed in areas that will not allow for benefits to reach their full potential. This project will identify high priority erosion areas so that practitioners can develop riparian livestock fencing, riparian planting, stream bank stabilization, flood control, habitat restoration, and water quantity and quality improvement, amongst other types of projects.

Timeline: The project will likely be broken into several phases, using a step-by-step approach. The first phase would focus on landowner outreach and obtaining access permission and the second phase would focus on conducting on-the-ground data collection and desktop analysis. Each phase would span several years. Depending on funding resources and available data, the study may either be completed across the entirety of the Petaluma River Watershed at once or broken into sub-watersheds to be completed individually (thus extending the timeline into many phases and years).

Conceptual Design: SFEI's 2020 *Restoration Vision for the Laguna de Santa Rosa* and Stillwater Science's 2010 *Lagunitas Creek Watershed Sediment Budget* are two efforts that this project would be patterned after, with monitoring and modeling recommendations following the 2020 *Sediment Monitoring and Modeling Strategy* produced by SFEI on behalf of the San Francisco Bay Regional Monitoring Program Sediment Workgroup. Previous efforts through Sonoma Water's Stream Maintenance Program and prior sediment analyses conducted on Adobe Creek may be used as a starting point. Design of this study would begin with consultation and coordination with stakeholders to develop goals, objectives, and study parameters.

Potential Funding: Initial funding for the first step of scoping the study and convening stakeholders to scope the study has been identified for Adobe Creek (please see Project #3 for additional details) in the Sonoma Water 2021 and 2022 Flood Control Zone 2A budgets for a sediment management strategy. Other state funding sources for additional subwatersheds, or a watershed-wide study may include CA Department of Fish and Wildlife Proposition 1 or Fisheries Restoration grant programs, Department of Water Resources, Environmental Protection Agency, and California Wildlife Conservation Board.

Potential Watershed Stakeholders to Pursue Project: Sonoma Water, City of Petaluma, Sonoma Resource Conservation District, San Francisco Estuary Institute, Point Blue Conservation Science, Sonoma Land Trust, Sonoma County Agricultural Preservation and Open Space District, Environmental Science Associates, United Anglers of Casa Grande, Inc.

Figure 2.1. Example sediment source in San Antonio Creek.

Figure 2.2. Example sediment source in San Antonio Creek.

Figure 2.3. Example sediment source in upper Adobe Creek.

Figure 2.4. Example of excess sediment source in lower Adobe Creek post-stream maintenance for flood control efforts.

Project 2. Stormwater Friendly Landscape Transformation

Subwatershed: Various locations dependent on opportunities

Location: Watershed-wide, please see Figure 1.2 in Section 1 for a watershed-wide subwatershed map

Project Type: Implementation

Current Project Proponents: Daily Acts, City of Petaluma.

Project Property Ownership: The projects will be located on properties of Petaluma City schools, churches, community centers, and other public sites.

Project Outcomes: The projects will provide an educational opportunity for residents of the community as it relates to practices of "Slow it. Spread it. Sink it. Store it." through the implementation of swales, rain gardens, and rainwater storage. The under-utilized lawns on these public properties will undergo change of use and management to serve the function of infiltrating groundwater and providing groundwater recharge within the watershed. The outcomes of this project are seen as two-fold, (1) providing an opportunity for community-wide engagement and education and (2) on-the-ground benefits of groundwater infiltration and recharge with potential for stormwater management and peak flow reduction.

Project Description: The intent is to convert under-utilized lawns at Petaluma City schools, churches, community centers, and other public sites into multi-functional, educational landscapes where students can learn and interact with nature. These landscape transformations, where appropriate, will include low-impact development features (such as swales, rain gardens, rainwater catchment, etc.) to slow, spread, sink, and store the rain and stormwater. Daily Acts, a nonprofit with a mission "to inspire transformative action that creates connected, equitable climate resilient communities," will complete the implementation of these projects through hands-on community workdays with support from the City of Petaluma for material costs and staff time. The objective is to educate residents on simple low-impact development practices they can implement on their own landscapes to help reduce stormwater runoff and contribute to groundwater recharge through increased infiltration. The ideal project site will be between 2,500-5,000 square feet, located near a roofline or accessible downspout, experience flooding or runoff, and/or be adjacent to a creek. All techniques applied will enhance groundwater infiltration through the practices outlined in Sonoma Resource Conservation District's 2015 "Slow it. Spread it. Sink it. Store it. Guide to Beneficial Stormwater Management and Water Conservation Strategies" document.

Timeline: Implementation will take place over several years as funding and materials resources are available.

Conceptual Design: There are several concept designs and/or templates readily available for swales and rain gardens, as well as native planting lists, recommendations, and resources for stormwater low-impact design and assistance. The above mentioned "Slow it. Spread it. Sink it. Store it." guide has recommendations and guidance on development of these best management practices. The City of Santa Rosa produced a 2017 "Storm Water Low Impact Development Technical Design Manual" that also provides concept designs and examples for implementation of best management practices noted above. Please see examples in figures below.

Potential Funding: Volunteers, City of Petaluma, stormwater management grants

Potential Watershed Stakeholders to Pursue Project: Daily Acts, City of Petaluma

Rain Gardens

$-$$ E-M

USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF

A **rain garden** is a specialized landscape design that captures stormwater runoff from roofs, driveways, or other impervious surfaces and allows water to SINK back into the ground. It uses plants to remove pollutants and improve infiltration allowing water to soak back into the ground. In soils with low permeability this system may be used to temporarily store water (not completely infiltrate) and remove pollutants before they enter a waterway.

A rain garden design can be as simple as a shallow depression filled with plants that can flourish in both moist and dry conditions. The required size, shape, and depth of the garden depend on how much water you are trying to capture. For large amounts of runoff or areas with insufficient infiltration, there are a full spectrum of engineered features, such as specialized soil mixtures, an aggregate base, and subsurface drains that can be added. These more complex designs are often referred to as bioretention cells.

Plant the center of the garden with species that tolerate wet conditions, such as native sedges and rushes. Around these, put plants suited to occasional standing water, like Yellow Monkeyflower (Mimulus guttatus) or California Aster (Aster chilensis). At the furthermost edges there are a variety of native evergreen and deciduous shrubs that prefer drier soil. Contact your local RCD (page 61) or a local plant nursery knowledgeable in native and drought tolerant species for more suggestions. Rain gardens should be located at least 10 feet from your house and at least 40 feet from a septic system or steep slope. They should also be designed to drain within 72 hours to reduce the risk of standing water and mosquito breeding (see page 21 for more info). Rain gardens are a beautiful way to protect your property from erosion and protect the water quality of local creeks. They can enhance the aesthetic value of a site; be used on small parcels of land, easements, and right-of-ways; and are easily incorporated into existing landscapes or open space.

MAINTENANCE: Routine maintenance is required and can be performed as part of the regular site landscaping program. Weeding and irrigation are essential in the first couple of months while plants become established. Annual pruning and mulching are recommended. Additional irrigation may be necessary during drought years. The use of native, site-appropriate vegetation reduces the need for fertilizers, pesticides, excessive water, and overall maintenance.

DO
- Use California native or drought tolerant plants as appropriate.
- Minimize fertilization to prevent water contamination and try organic options.

DON'T
- Site in soils with high water tables or clay soils without an overflow device.
- Place too close to your home's foundation.

Figure 2.5. Example rain garden concept from page 33 of Sonoma RCD's 2015 "Slow it. Spread it. Sink it. Store it. Guide to Beneficial Stormwater Management and Water Conservation Strategies" document.

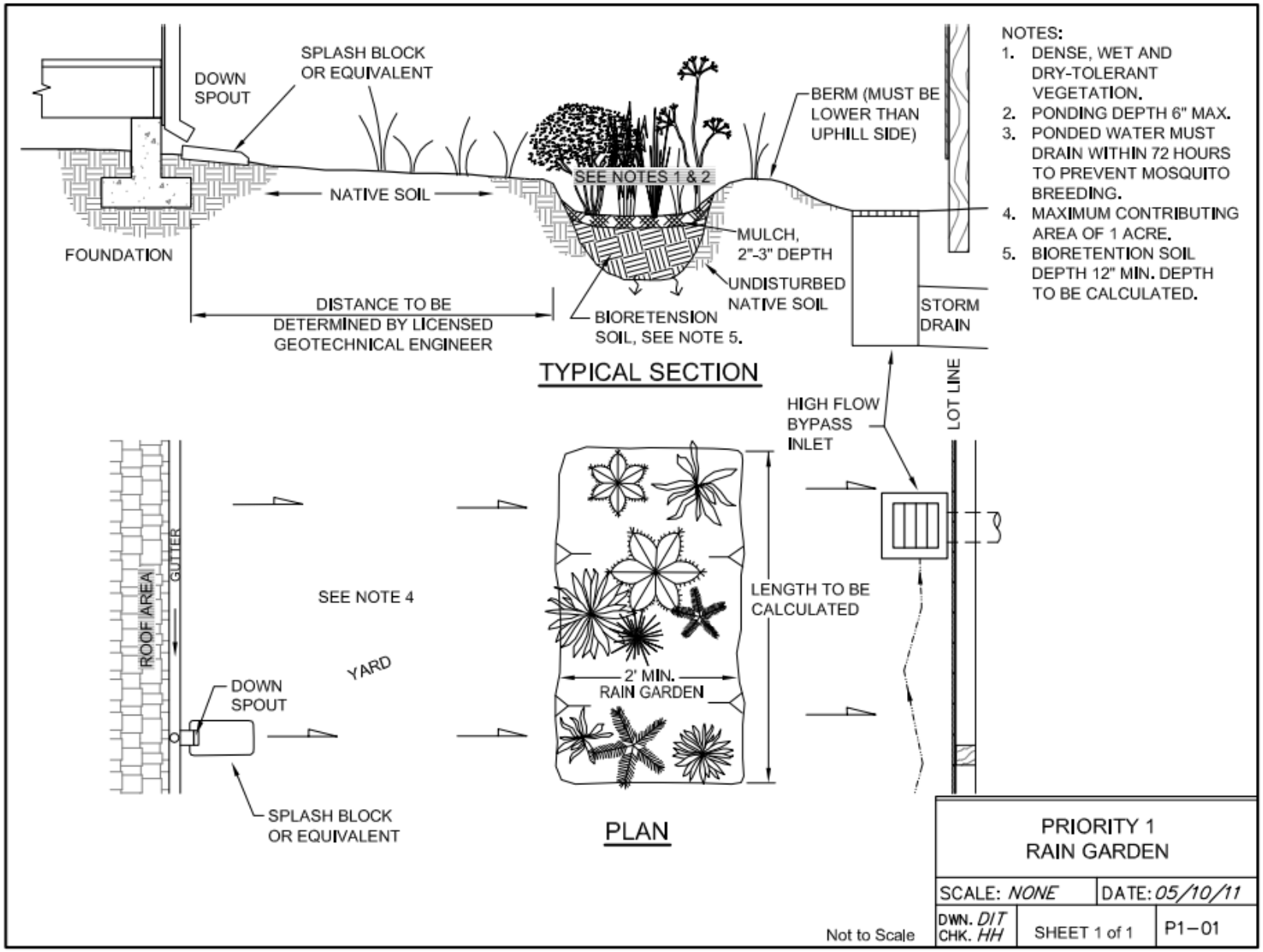
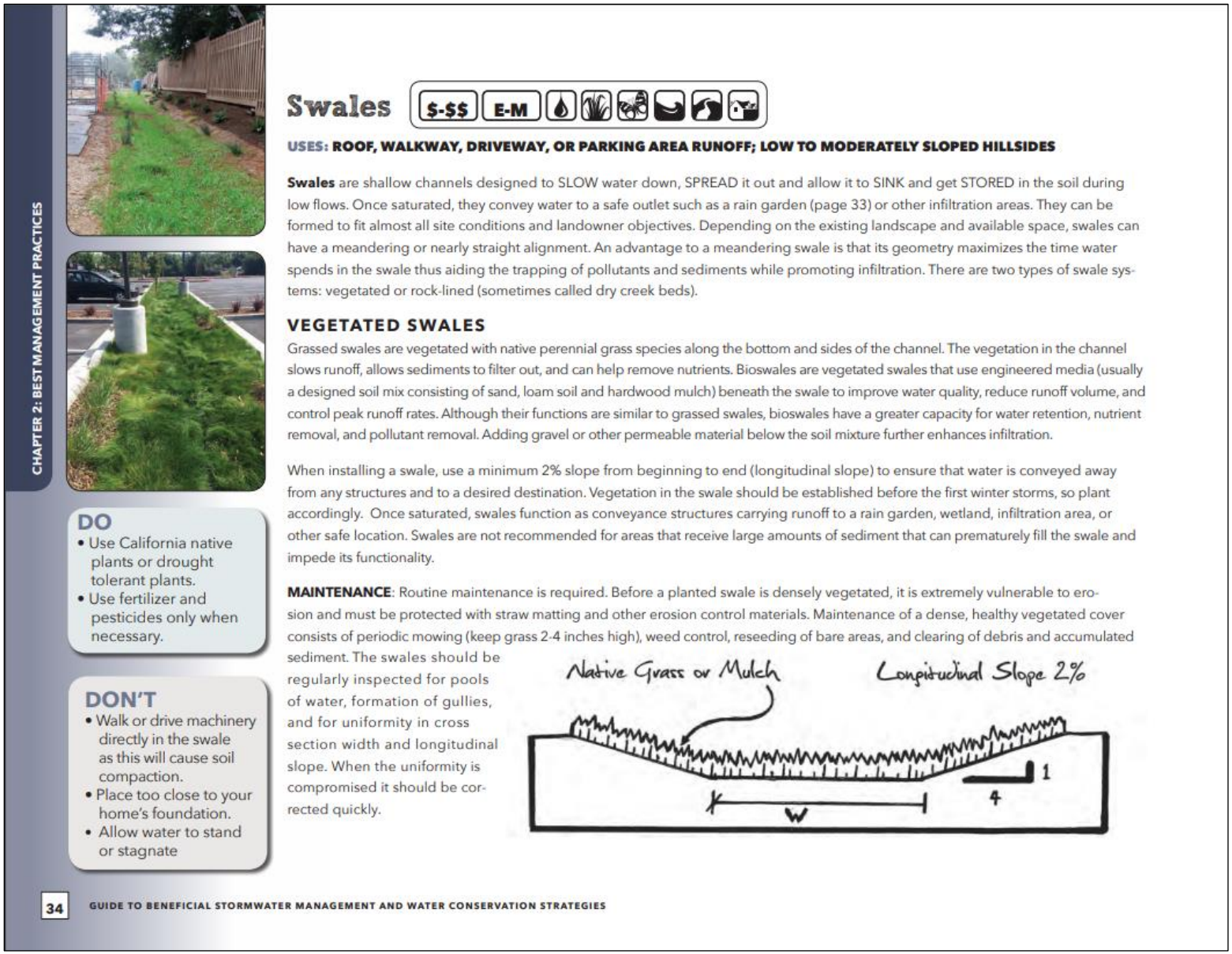


Figure 2.6. Example rain garden concept design from page 68 of Appendices to the City of Santa Rosa's 2017 "Storm Water Low Impact Development Technical Design Manual."



CHAPTER 2: BEST MANAGEMENT PRACTICES

Swales

$-$$ E-M

USES: ROOF, WALKWAY, DRIVEWAY, OR PARKING AREA RUNOFF; LOW TO MODERATELY SLOPED HILLSIDES

Swales are shallow channels designed to SLOW water down, SPREAD it out and allow it to SINK and get STORED in the soil during low flows. Once saturated, they convey water to a safe outlet such as a rain garden (page 33) or other infiltration areas. They can be formed to fit almost all site conditions and landowner objectives. Depending on the existing landscape and available space, swales can have a meandering or nearly straight alignment. An advantage to a meandering swale is that its geometry maximizes the time water spends in the swale thus aiding the trapping of pollutants and sediments while promoting infiltration. There are two types of swale systems: vegetated or rock-lined (sometimes called dry creek beds).

VEGETATED SWALES

Grassed swales are vegetated with native perennial grass species along the bottom and sides of the channel. The vegetation in the channel slows runoff, allows sediments to filter out, and can help remove nutrients. Bioswales are vegetated swales that use engineered media (usually a designed soil mix consisting of sand, loam soil and hardwood mulch) beneath the swale to improve water quality, reduce runoff volume, and control peak runoff rates. Although their functions are similar to grassed swales, bioswales have a greater capacity for water retention, nutrient removal, and pollutant removal. Adding gravel or other permeable material below the soil mixture further enhances infiltration.

When installing a swale, use a minimum 2% slope from beginning to end (longitudinal slope) to ensure that water is conveyed away from any structures and to a desired destination. Vegetation in the swale should be established before the first winter storms, so plant accordingly. Once saturated, swales function as conveyance structures carrying runoff to a rain garden, wetland, infiltration area, or other safe location. Swales are not recommended for areas that receive large amounts of sediment that can prematurely fill the swale and impede its functionality.

MAINTENANCE: Routine maintenance is required. Before a planted swale is densely vegetated, it is extremely vulnerable to erosion and must be protected with straw matting and other erosion control materials. Maintenance of a dense, healthy vegetated cover consists of periodic mowing (keep grass 2-4 inches high), weed control, reseeding of bare areas, and clearing of debris and accumulated sediment. The swales should be regularly inspected for pools of water, formation of gullies, and for uniformity in cross section width and longitudinal slope. When the uniformity is compromised it should be corrected quickly.

DO
- Use California native plants or drought tolerant plants.
- Use fertilizer and pesticides only when necessary.

DON'T
- Walk or drive machinery directly in the swale as this will cause soil compaction.
- Place too close to your home's foundation.
- Allow water to stand or stagnate

34 GUIDE TO BENEFICIAL STORMWATER MANAGEMENT AND WATER CONSERVATION STRATEGIES

Figure 2.7. Example vegetated swale concept from page 34 of Sonoma RCD's 2015 "Slow it. Spread it. Sink it. Store it. Guide to Beneficial Stormwater Management and Water Conservation Strategies" document.

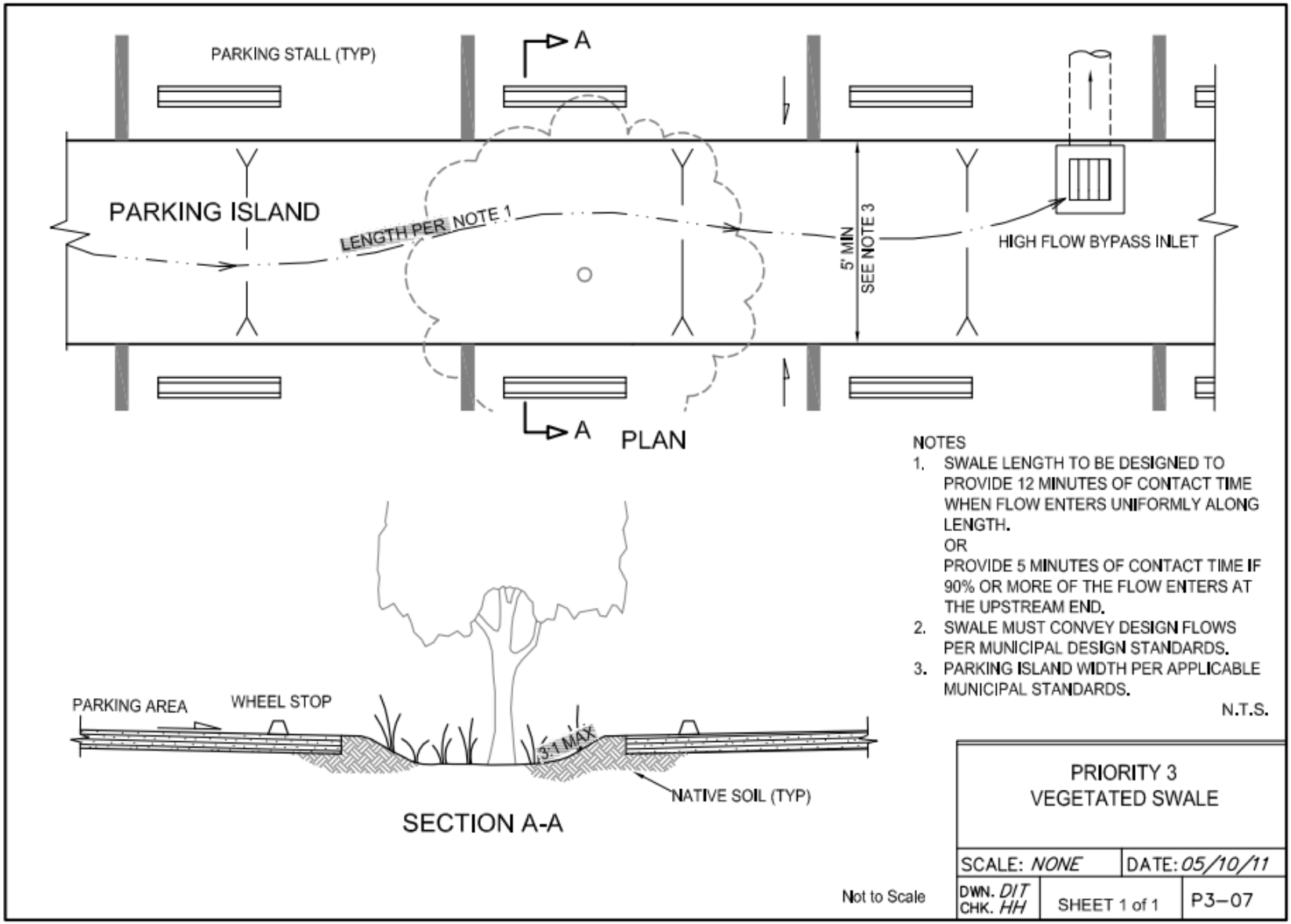


Figure 2.8. Example vegetated swale concept design from page 118 of Appendices to the City of Santa Rosa's 2017 "Storm Water Low Impact Development Technical Design Manual."

Project 3. Implementation of Flood Detention Basins

Subwatershed: Various

Location: Specific locations in the Willow Brook, Adobe, Lichau, and Kelly creeks

Project Type: Design and Implementation

Current Project Proponents: Sonoma Water, Flood Control Zone 2A, City of Petaluma

Project Property Ownership: There are a total of four potential flood detention basins in the Petaluma River Watershed that are under consideration. Each project is in various stages of landowner outreach and securing access/project permissions.

Project Outcomes: The identified detention basins will help reduce flooding of developed areas in Petaluma and capture sediment from navigating through the creek networks and drainage systems. These projects will increase groundwater infiltration, reduce non-point source pollution, improve water quality, and provide flood management.

Project Description: The project will consist of further outreach and designs leading to the implementation of flood detention basins in four watersheds including:

Willow Brook Creek Flood Detention Basin

Create a flood detention basin to catch overflow from Willow Brook Creek to reduce impacts to adjacent Redwood Business Park and other properties further downstream. The basin will be designed to have multiple benefits of flood management, improving water quality, improving water supply through groundwater recharge infiltration, and creating an area of public use with walking trails and creek front access. The proposed project site is currently a privately owned 12.4-acre parcel that is outside city limits. A feasibility study would need to be completed to analyze flood benefits downstream.

Upper Lichau Creek Stormwater Detention

This project will capture run-off from agricultural lands in either the Cold Springs Creek or Lichau Creek drainage areas and provide additional flood detention volume from these drainage areas. The Petaluma River is impaired by bacteria, in part, from run-off from agricultural lands. This project would improve water quality, groundwater supply, and provide flood control benefits through use of an extended detention basin. Copeland Creek overflows in significant rain events (greater than 25-year storms). An overflow volume, estimated between 300 cubic feet per second (cfs) and 1700 cfs, flows into Cold Springs Creek and adds to the flooding experienced along Lichau and Willow Brook creeks, and the Petaluma River downstream. This project would capture some of the peak volume flow and alleviate flooding downstream.

Adobe Creek Floodplain Management and Sediment Study

The purpose of the Adobe Creek Floodplain Management and Sediment Study is to provide a comprehensive approach to sediment management that will assist in alleviating flood conditions during storm events and enhance riparian and instream habitat for salmonids. The project will consist of a feasibility analysis, which may include up to three conceptual alternatives, and cost estimates for a sediment detention or conveyance feature along Adobe Creek between Old Adobe Road and the City of Petaluma limits. The study site is located in a geomorphically dynamic and generally depositional environment, at the intersection of an alluvial fan and the flatter Petaluma Valley plain. The proposed project would be designed to reduce sediment related flood impacts, increase groundwater recharge, and establish points of access to facilitate future sediment maintenance efforts.

This study will propose a project to reduce sediment accumulation, improve water quality, and alleviate flooding around Adobe Creek, contributing to the health of a watershed that is relied on by many members of the community. In addition, Adobe Creek passes along Shollenberger Park, and the outcomes of this study could potentially benefit public access to this well-visited park.

Kelly Creek Enhancements

The Kelly Creek proposed efforts would construct a stormwater detention facility to improve water quality, reduce storm run-off volumes, and increase groundwater recharge through infiltration. This would provide additional channels to carry improved water from the detention facility to the Petaluma River without the degradation of water quality. Sonoma County Flood Control District Zone 2A funds have been allocated to conduct a feasibility study for this project, which is to be executed by the City of Petaluma. This project would likely require acquisition of privately held property and the establishment of easements on other private lands.

Timeline: The projects will likely be completed in two phases. Phase 1 will include design, outreach, and permits, and Phase 2 will be project implementation.

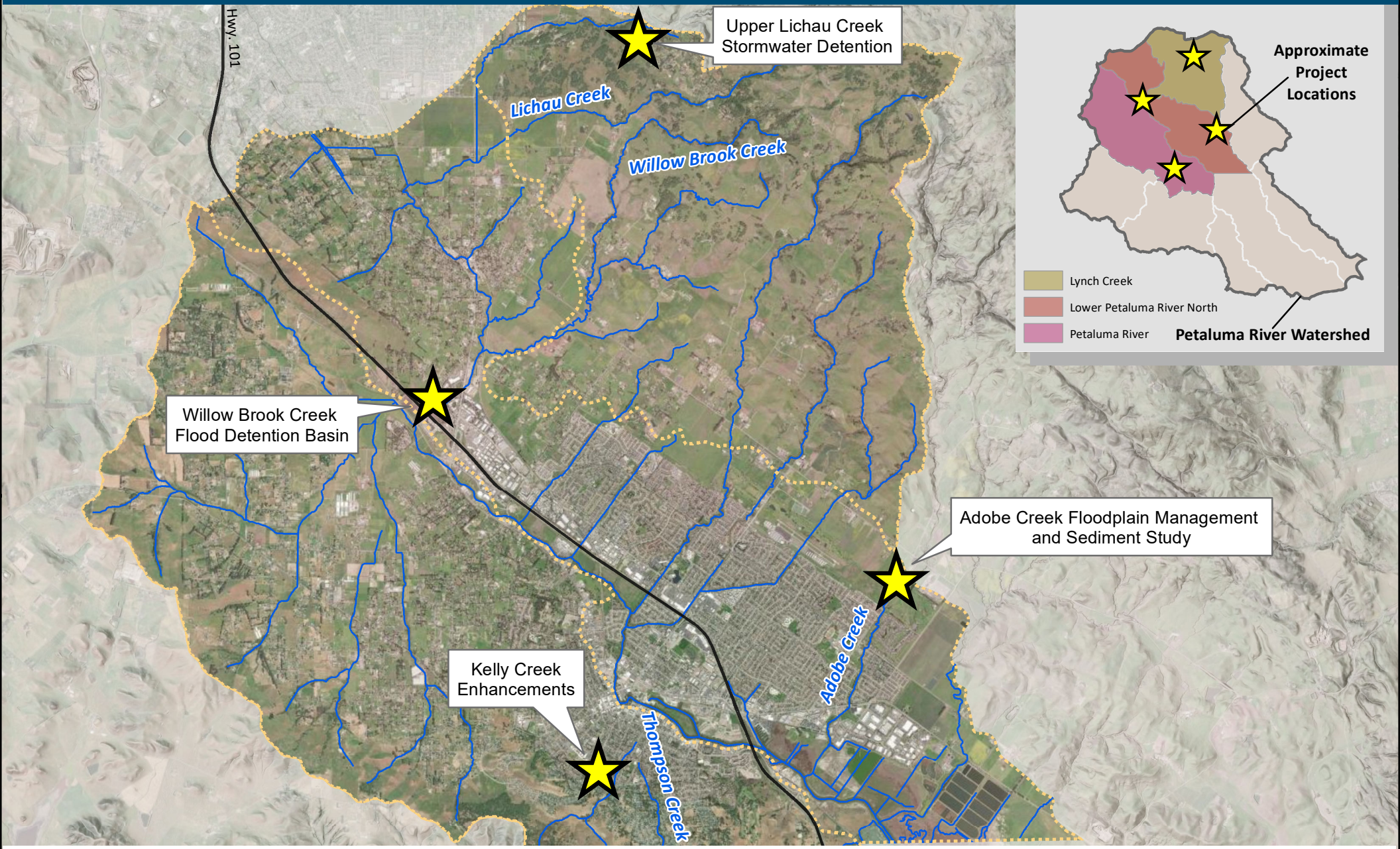
Conceptual Design: Conceptual and project designs exist for the Upper Lichau Creek detention project, developed by Sonoma Water. Other projects require conceptual design development. Some sediment management analyses have also been developed by Sonoma Water for Adobe Creek as part of Sonoma Water's Stream Maintenance Program.

Potential Funding: City of Petaluma, Sonoma County Flood Control District 2A

Potential Watershed Stakeholders to Pursue Project: Sonoma Water, City of Petaluma, Sonoma Land Trust, Sonoma County Agricultural Preservation and Open Space District

Project 3 - Implementation of Flood Detention Basins

Multiple Subwatersheds



Subwatershed Boundaries

Petaluma River USGS Blueline Creeks

Major Roads

Approximate Project Locations

1 inch = 1 miles

0 1 2 Miles

N

SONOMA RESOURCE CONSERVATION DISTRICT

Map created by Sonoma RCD June 2022

Figure 2.9. Approximate locations of Project #3.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Figure 2.10. Adobe Creek crossing on Casa Grande Road where sediment consistently collects and creates concern for flood management during large storm events.

Project 4. Petaluma River Park

Subwatershed: Lower Petaluma River North

Location: McNear Peninsula

Project Type: Design and Implementation

Current Project Proponents: Petaluma River Park Foundation (PRPF), Downtown Streets Team, Sonoma Resource Conservation District, Daily Acts, North Bay Organizing Project, Sonoma Land Trust, Point Blue Conservation Science, Friends of the Petaluma River, Petaluma Community Relations Council, Petaluma Arts Center, Petaluma Health Center, LandPaths, Petaluma Bounty, Café Puente, and City of Petaluma

Project Property Ownership: The project site is owned by Petaluma River Park Foundation.

Project Outcomes: The project will develop a public area into a riverfront park that will create and enhance habitat for wildlife, restore the riparian zone, and provide environmental educational opportunities.

The proximity of Petaluma River Park to the SMART train station and public transit hub, and the opportunity for the park to serve as a missing link for the commuter walking and bike trail, will allow this area to be accessible to a wider audience that may not rely on vehicle transportation.

The proposed park development will provide broad opportunities for onsite education, an outdoor classroom, and ongoing conservation science experiential learning. Visitors to the park will see examples of best practices with stream bank stabilization and habitat restoration. Educational signage will highlight conservation and resilience challenges and encourage understanding and commitment to local efforts to improve water quality.

Project Description: McNear Peninsula was identified as a public park in the 1996 Petaluma River Access and Enhancement Plan that has been part of the City of Petaluma's general plan for 20 years. The purpose of this project is to transform 24 acres of currently fallow open space on the McNear Peninsula into a beautiful riverfront park in fulfillment of a vision formulated over 30 years ago. Using the latest evidence-based conservation and habitat creation and enhancement methods, the project will stabilize and improve significant portions of the riverbank, create new wetland habitat, and establish native plantings of grasses, shrubs, and trees throughout the site.

A network of trails including 2,000 feet of ADA trails, restrooms, a small boat dock/viewing platform, and educational signage will provide access to the public. The mission of the Petaluma River Park is to meet our vital need for shared space that connects people, art, and nature.

Construction of the park will require discretionary approvals from public agencies, and therefore CEQA compliance will be required to obtain the necessary permits and approvals. The City of Petaluma has agreed to serve as CEQA lead agency for the project and PRPF will work closely with the City throughout

the design and planning process to identify and implement a strategy for completing CEQA compliance. Depending on the final designs and plan for park development, the project may qualify for a §15183 exemption as being consistent with the City of Petaluma General Plan's certified EIR and the property's designated land use of the proposed park. However, if the City determines that the project does not qualify for a §15183 exemption, a Mitigated Negative Declaration (MND) is anticipated to be the appropriate level of CEQA review, as the project will be designed to avoid any significant environmental impacts.

In their 1991 report to the City of Petaluma, Economic Research Associates identified: "Petaluma's strongest long term economic development strategy is the...construction of a first-class river park along the banks of the Petaluma River including McNear's Island (Peninsula)." PRPF has contracted with Downtown Street Teams, a workforce development organization, to help maintain the Park. Downtown Street Teams has been invited to participate in our community engagement efforts to envisage ways their clients could be employed, and PRPF's goal is to expand the contract with them to include restoration activities and infrastructure construction and maintenance. PRPF has also employed local community members in contract positions to support park development through marketing and community outreach. Completing the Petaluma River Park will fulfill the longstanding vision for an economic driver - Petaluma's Central Park!

The Petaluma River Park will offer education on watershed and habitat enhancements through signage, outreach, programming, and partnership with local organizations. The Friends of the Petaluma River already operate summer and school year programs on the adjacent City-owned Steamer Landing Park and will be able to expand their offerings to the full peninsula. Petaluma Wetlands Alliance also conducts education programs and looks forward to the new opportunities the Park will provide. PRPF has also invited Point Blue Conservation Science to conduct STRAW (Students and Teachers Restoring a Watershed) program activities as part of the overall resource enhancement plan.

Timeline: Several years for design and implementation with a potential of two different phases.

Conceptual Design: The biological inventory is complete for the site with the preliminary site conditions analysis in process. A concept design and community engagement plan are in draft. The City of Petaluma is acting as the lead agency for CEQA analysis.

Cities such as Memphis and St. Louis have taken long neglected river fronts and created vibrant parks that encourage citizens to interact with each other in community and with nature. Examples such as these are being considered in the current design and planning process.

Early plan designs for Petaluma River Park offerings, enhancement, and restoration can be seen in the photos section.

Potential Funding: PRPF has raised $1.05 million for debt free acquisition of the property and a subsequent $1 million matching grant from the Sonoma County Agricultural Preservation and Open Space District. PRPF has also raised over $750,000 for ongoing operations and development needs. The Peter E Haas Jr Family Foundation has contributed $90,000 for Community Engagement Planning as well as other capacity building funding. Over 400 individual donors have contributed to these efforts. PRPF has applied for a $680,000 Measure AA funding grant and Coastal Conservancy funding is anticipated to be available in the coming fiscal year. Other funding opportunities through community foundations, habitat restoration grants, and community improvement grants will be sought as well.

Potential Watershed Stakeholders to Pursue Project: Petaluma River Park Foundation in collaboration with watershed stakeholders

Lower Pet. River N. Subwatershed Boundary

Petaluma River USGS Blueline Creeks

Major Roads

Approximate Project Location

1 inch = 1 miles

0 0.5 1 Miles

N

SONOMA RESOURCE CONSERVATION DISTRICT

Map created by Sonoma RCD June 2022

Figure 2.11. Approximate location of Project #4.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

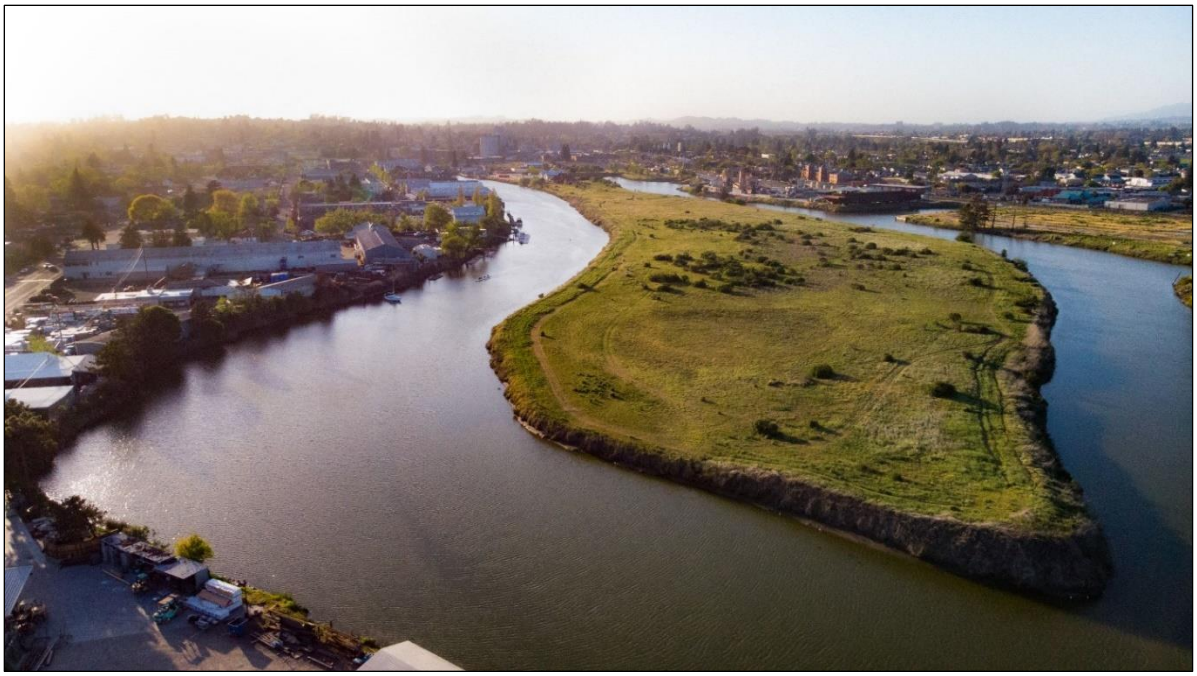


Figure 2.12. Current view of Peninsula.

Figure 2.13. Streambank restoration opportunities for sediment reduction and habitat creation on Peninsula.

Figure 2.14. Current view of McNear Peninsula with park sites and opportunities for restoration and development.

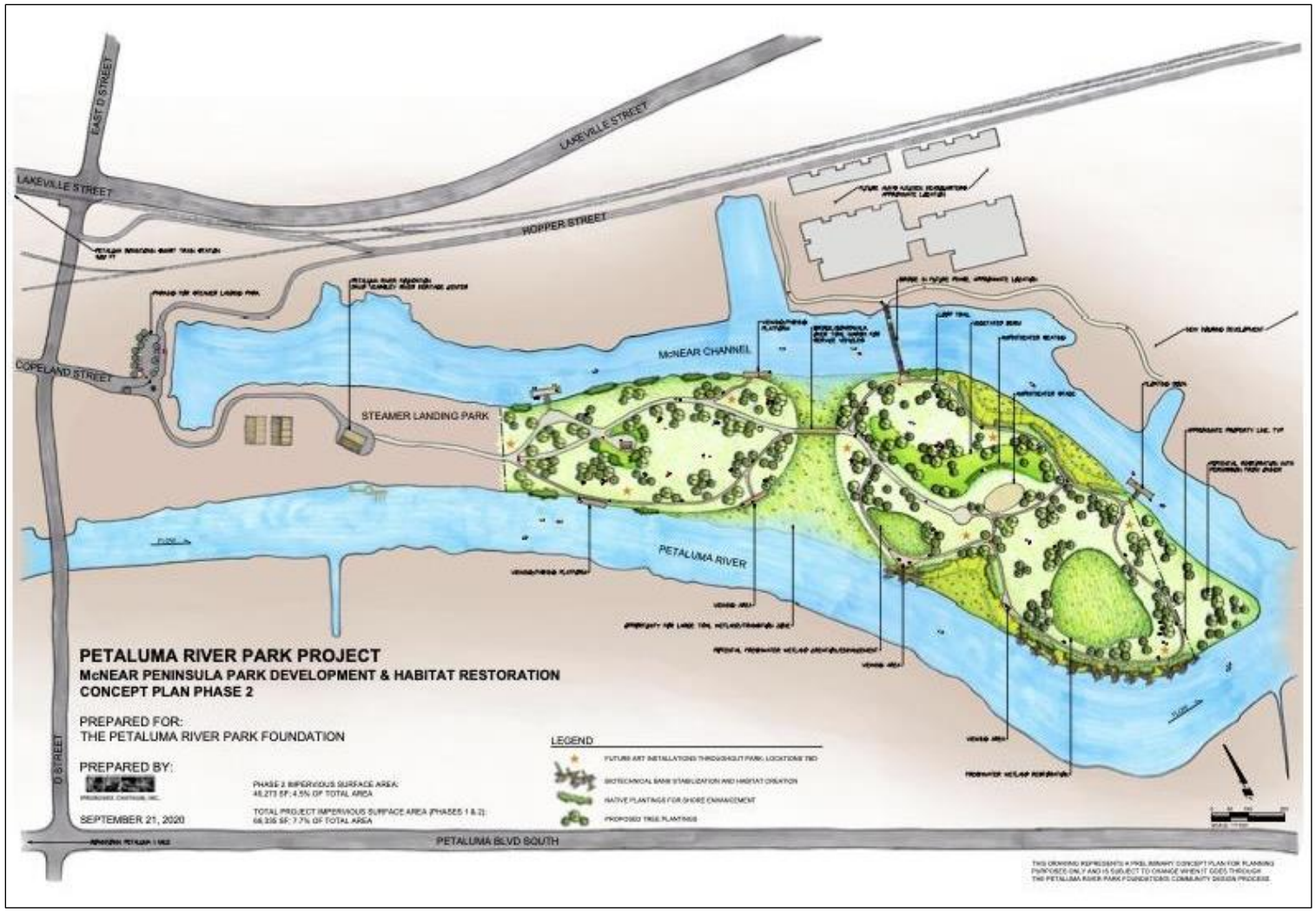


Figure 2.15. Concept plan for Petaluma River Park.

Project 5. King Creek Wetland Enhancement

Subwatershed: Upper San Antonio Creek Watershed

Location: Private property near Spring Hill Road, Petaluma

Project Type: Implementation for sediment reduction, riparian planting enhancement, wetland development

Current Project Proponents: Permaculture Artisans, Sonoma Resource Conservation District, Point Blue STRAW (Students and Teachers Restoring a Watershed)

Project Property Ownership: The project resides on private property, and the landowner has previously expressed support of the project.

Project Outcomes: The developed wetland will slow runoff from a cow pasture and allow nutrients to be infiltrated, rather than running through the tributary to San Antonio Creek. The wetland area will provide wildlife habitat with new plantings as well as riparian planting along the creek. Some of the plantings could be strategically placed and designed as wind breaks for farm benefit and/or as hedgerows for wildlife and pollinator habitat. This area is identified as a historic wetland in the *Petaluma Historical Hydrology and Ecology Study* and this project may be the first step to restoring parts of the natural laguna at the headwaters of San Antonio Creek.

Project Description: The property has previously undergone management changes for riparian enhancement, including a small native nursery for riparian plants. San Antonio Creek is high in excessive nutrients and this project will assist in preventing excessive nutrients and sediment from entering the creek. The wetland will also provide "Slow it. Spread it. Sink it. Store it." management practices and benefits. The King Creek tributary will be planted providing a riparian buffer and enhancement to the wildlife corridor along the creek.

The purpose of this project is to slow the storm surge during the rainy season along King Creek, a tributary to San Antonio Creek, by creating a wetland area to increase groundwater infiltration and recharge, and enhance the riparian corridor with native riparian plants. This project would involve creating a complex wetland system that will minimize downstream peak-flow and velocities, as well as increase groundwater infiltration and enhance habitat for wildlife. This project would serve as a demonstration project for the "Slow it. Spread it. Sink it. Store it." method for managing stormwater. This project takes place on a working farm and the landowners have worked with Permaculture Artisans and the Natural Resources Conservation Service to plant hedgerows, create wind breaks that support wildlife corridors, plant diversified crop areas, and utilize rotational grazing for their cattle to enhance pasture management. The landowners are committed to enhancing King Creek and the local watershed.

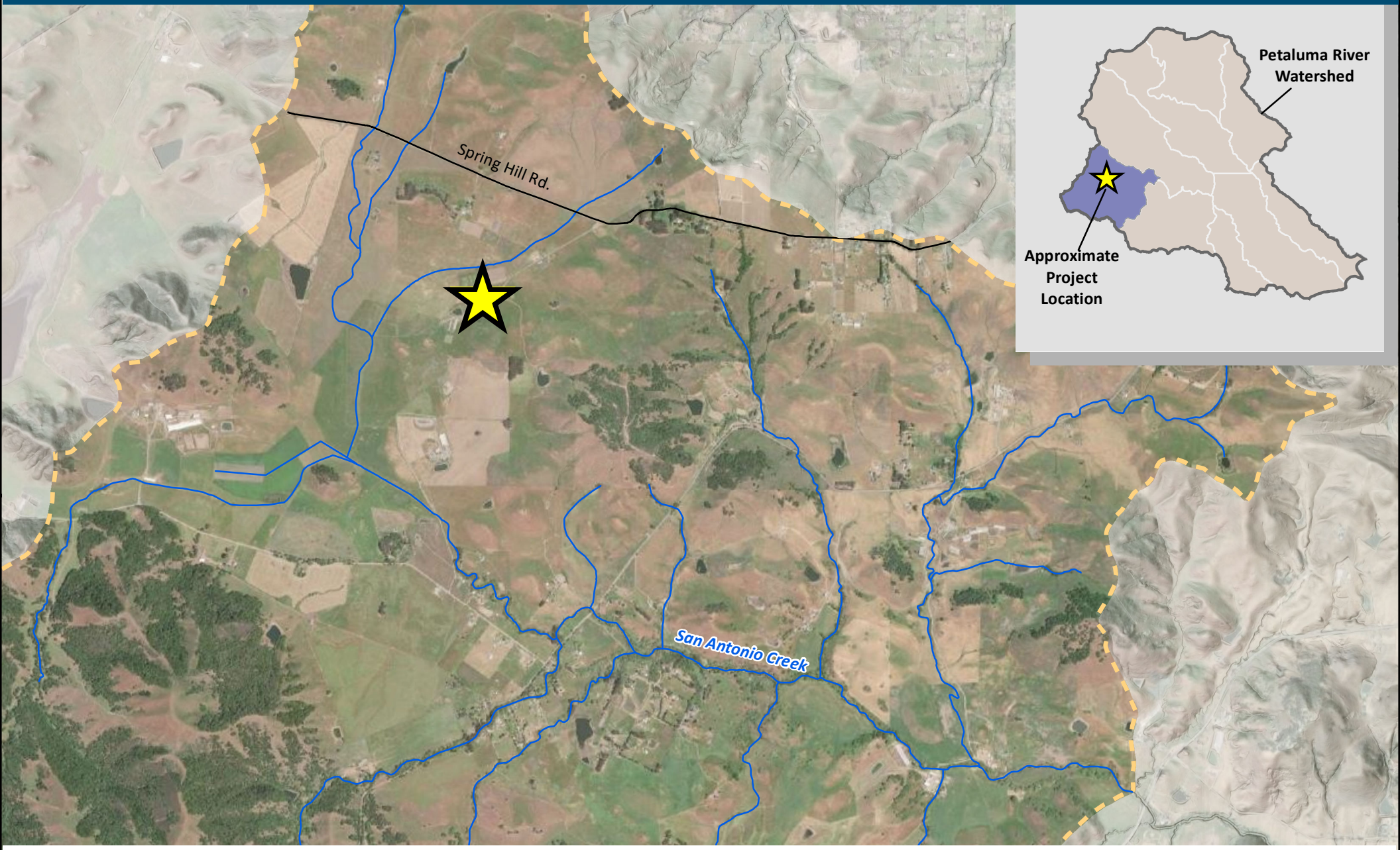
Although this project is located on a single property, it would indirectly benefit other community members in the San Antonio Creek watershed by reducing peak flows during storm surges and increasing infiltration into shared groundwater resources. This project has a high potential to spur continued restoration of wetland and riparian enhancement subwatershed-wide, across San Antonio Creek.

Timeline: The project will need 1-2 years of planning and design work as a first phase, with permits and landowner permissions secured. A second phase will implement the project and would likely result in 1-2 years of on-the-ground work.

Conceptual Design: Permaculture Artisans has a conceptual design for the property. Revisiting this plan and reevaluating the onsite property conditions and goals related to current management will determine if these designs can be updated or a new design completed. This project was identified as a Tier A project in the Southern Sonoma County Stormwater Resources Plan as well.

Potential Funding: Natural Resources Conservation Service EQIP, California Department of Fish and Wildlife, State Coastal Conservancy

Potential Watershed Stakeholders to Pursue Project: Permaculture Artisans, Point Blue STRAW (Students and Teachers Restoring a Watershed), Sonoma Resource Conservation District



Upper SA Creek Subwatershed Boundary
Petaluma River USGS Blueline Creeks
Major Roads
Approximate Project Location

1 inch = 1 miles
0 0.5 1 Miles
N

SONOMA RESOURCE CONSERVATION DISTRICT
Map created by Sonoma RCD June 2022

Figure 2.16. Approximate location of Project #5.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Figure 2.17. View A of King Creek wetland restoration opportunity in San Antonio Creek watershed.

Figure 2.18. View B of King Creek wetland restoration opportunity in San Antonio Creek watershed.

Figure 2.19. View C of King Creek wetland restoration opportunity in San Antonio Creek watershed.

Project 6. Acquisition for Conservation

Subwatershed: Various locations dependent on opportunities

Location: Watershed-wide, please see Figure 1.2 in Section 1 for a watershed-wide subwatershed map

Project Type: Acquisition

Current Project Proponents: Sonoma Land Trust, San Francisco Estuary Institute, Ducks Unlimited, Point Blue Conservation Science, Sonoma County Agricultural Preservation and Open Space District, Petaluma Wetlands Alliance, Friends of Petaluma River

Project Property Ownership: Through the 2022 *Petaluma River Baylands Strategy* (Baylands Strategy) effort to identify and prioritize opportunities in areas of the lower watershed, several properties are in the early stages of negotiations with local land protection entities which may include the development of conceptual projects. Properties will remain anonymous until details are publicly released, or explicit permission is given by the current landowner.

Several other areas (within and outside of the Baylands Strategy effort) are not yet in any stage of development and/or communication or expressed willingness to work with local land acquisition entities. Many of these areas need initial funding and effort generated to conduct outreach, opportunity and constraints analysis, priority habitat identification, and evaluation of areas with the greatest potential for beneficial and substantial conservation outcomes.

This project only promotes or supports acquisition where sellers are willing, partnerships are respectful and engaged, and where future transactions remain objective and honest to all parties involved.

Project Outcomes: These projects will assist in the conservation and restoration of vital, remaining open space lands within the watershed that play a key role in maintaining healthy watershed processes, provide habitat for endangered and threatened species, contribute to the quality of water, provide a place for groundwater infiltration and recharge, and are a remaining buffer against the forecasted changes associated with a changing climate and weather patterns.

Project Description: Pursue acquisition opportunities with willing sellers of undeveloped land in the Petaluma River Baylands, along the mainstem of Petaluma River upstream of the Payran Street bridge, and other riparian corridors (especially within City limits). Priority areas for acquisition are those that, if preserved, will provide multiple community benefits including flood protection and sea level rise mitigation, riparian habitat protection, wildlife corridors, and the restoration of natural riparian ecological processes. Additional emphasis should be given to acquisitions that provide an opportunity to expand equitable recreation access, or link other areas of open space within City limits or contain threatened or endangered species.

Specifically, in the Petaluma River Baylands regions, the recent *Petaluma River Baylands Strategy* has identified acquisition and land management consistent with conservation efforts as a high priority to

mitigate the future of sea level rise, infrastructure failure due to flooding (effects of peak-storm flows combined with rising sea level and king tide events), and loss of marshland by implementing conservation and/or restoration of upland, riparian, seasonal wetland, transition zone, and tidal habitats, especially where connections can be made between habitat types and where marsh migration space is present.

Timeline: This work is needed immediately in areas that will be most affected by sea level rise and a changing climate such as wetlands, marshes, area available for marshland transition, habitat conservation and preservation, and restoration efforts that can assist in mitigating the negative effects of a changing climate and weather patterns. Realistically, the acquisition of property (from funding to agreement on terms and conditions of sale) and any following efforts will take years to complete. The sooner these projects are acted upon, the more immediately the results will be seen.

Conceptual Design: Due to the confidential nature of conservation easements, property acquisitions, and restoration opportunities, completed designs for these properties will not be shared publicly.

Potential Funding: Sonoma Land Trust, Sonoma County Agricultural Preservation and Open Space District, Measure AA, marsh restoration funds

Potential Watershed Stakeholders to Pursue Project: Friends of Petaluma River, Sonoma Land Trust, Sonoma County Agricultural Preservation and Open Space District

Project 7. Studies for Increased Knowledge and Identification of Next Steps

Subwatershed: Various

Location: Watershed-wide, please see Figure 1.2 in Section 1 for a watershed-wide subwatershed map

Project Type: Study

Current Project Proponents: Redwood Empire Trout Unlimited, United Anglers of Casa Grande, Inc., Sonoma Water, Sonoma RCD, Sonoma County Regional Parks, CA State Parks

Project Property Ownership: Studies could cover the entire watershed with a focus on tributaries with anadromous fish species or endangered/threatened species. Most of the properties are privately owned and will need outreach and coordination to receive landowner access permission. Some important properties for access may be on public, City of Petaluma, County of Sonoma, and State Parks properties.

Project Outcomes: Project outcomes include understanding streamflow mechanics, current water quality and quantity parameters, factors influencing or inhibiting water quality and quantity, opportunities and constraints for restoration, and biological components of the creek. The studies will create a 'road map' to target focus areas for optimal restoration work in the watershed. Current conditions and biological inventory reports are severely outdated, making prioritization and acquisition of project funds difficult in the watershed.

Project Description: Several outdated studies have been conducted on tributaries, namely San Antonio and Adobe creeks. Below are examples of the studies that are needed for watershed-wide restoration and health, and will be considered and developed further for the Petaluma River Watershed under these project efforts:

a. Biological Inventory and Stream Assessment of Tributaries

b. San Antonio Creek Restoration Feasibility

c. Streamflow Monitoring

d. Riparian Restoration Feasibility, Access, and Opportunities

These studies will assist agencies and local watershed practitioners in understanding the problems, benefits, and reaches of the creeks and tributaries to focus on for restoration. The studies will guide grant funded project activities to gain the biggest 'bang for the buck'. These studies are critical to guide restoration efforts and assist in determining what those priority restoration efforts will be.

Timeline: Some of the studies may take several years to gain landowner participation/access and to collect data. Several have pre-existing data and efforts that can be expanded and used to assess current conditions and watershed needs. First steps would be to apply for funding to conduct outreach and begin information gathering of current conditions and needs. Once access permission is identified, funding for the study(ies) should be applied for.

Conceptual Design: Previous studies conducted on San Antonio and Adobe creeks are now outdated.

Potential Funding: CA Department of Fish and Wildlife Proposition 1, Fisheries Restoration Grant Program

Potential Watershed Stakeholders to Pursue Project: Sonoma Resource Conservation District and Redwood Empire Trout Unlimited partnering with stakeholders such as United Anglers of Casa Grande High School, National Marine Fisheries Service, CA State Parks, Sonoma County Regional Parks, and Environmental Science Associates

Project 8. Sonoma Mountain Institute Rainwater Catchment

Subwatershed: Adobe Creek

Location: Private property near Manor Lane, Petaluma

Project Type: Implementation for Rainwater Catchment, Streamflow Enhancement, and Stormwater Management

Current Project Proponents: Sonoma Resource Conservation District, National Fish and Wildlife Foundation, Natural Resources Conservation Service

Project Property Ownership: The project is on private property; a landowner implementation agreement will need to be finalized before pursuing the project further.

Project Outcomes: A 200,000-gallon rainwater catchment system will be constructed to supply water for cattle grazed on the property, allowing for a reduction of groundwater extracted. Keeping groundwater resources intact allows for continued streamflow through the dry summer months when extraction is at its most detrimental to riparian systems. The project will also reduce the peak of the local hydrograph by capturing rainwater from an impervious surface and storing it in a tank rather than contributing to peak-flows.

When fully implemented, the project would reduce the need for the Sonoma Mountain Institute (SMI) to use a water trailer to haul water to cattle in the dry season. The estimated reduction in energy use and GHG emissions is 750 kwh/yr and 1300 lbs/yr, respectively. Additionally, by capturing stormwater during heavy rainfall, this project would slow peak flows and limit the sediment load entering local waterways.

Project Description: Sonoma RCD conducted a site visit at the property to discuss potential rainwater catchment storage in 2018. A 100% design was completed in 2019 using National Fish and Wildlife Conservation Partners Program funds. This project will update the designs to be construction-ready, and procure the funds needed for implementation of the project.

Currently, the cattle ranch operated by SMI uses a water trailer to haul about 1,000 gallons of water per day in the dry season for the cattle. Capturing rainwater into a 200,000-gallon tank will provide water for the cattle throughout the entirety of the dry season and reduce groundwater extraction. Overflow from the system (during wet winter months) will be directed to an underground infiltration sump that will allow for water percolation into the soil, contributing to groundwater recharge rather than sheet flow during storm events.

SMI has participated in and hosted various community events and soil health demonstrations on the 351-acre Petaluma property in the last 5 years and continues to promote public awareness of land use matters such as soil-building and carbon farming, rangeland management, and water management while operating as a cattle ranch.

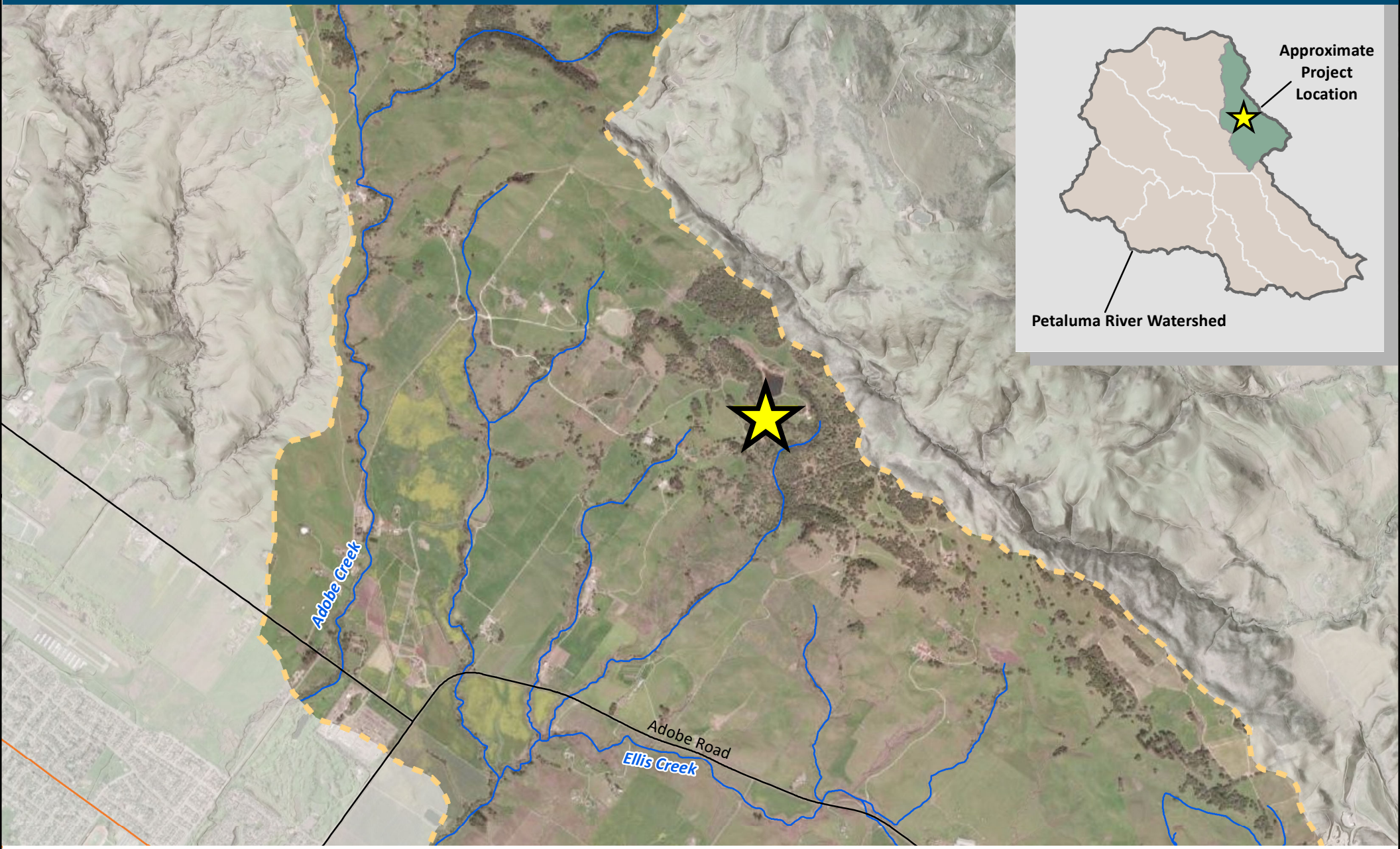
When implemented, the rainwater catchment system on this property may serve as a demonstration site for the Petaluma Watershed and be an example of stormwater management and water conservation efforts that should be implemented on working landscapes watershed-wide.

Timeline: Once funded, the construction phase of the project could be completed in one construction season. The project may require a timeline of at least 2 years as a building permit will need to be obtained through the County of Sonoma prior to implementation.

Conceptual Design: Sonoma Resource Conservation District has completed a 100% engineered design for the project. The landowner, Sonoma Mountain Institute, supports the project based on the completed design. The project budget and completed designs would need to be reviewed and updated prior to applying for funding, and once funding was received, the contractor bidding process and on-the-ground work will proceed.

Potential Funding: Department of Conservation, Natural Resources Conservation Service EQIP (an application for NRCS EQIP funds was previously submitted, but this project was not selected during that funding round)

Potential Watershed Stakeholders to Pursue Project: Sonoma Resource Conservation District



Adobe Creek Subwatershed Boundary
Petaluma River USGS Blueline Creeks
Major Roads
Approximate Project Location

1 inch = 1 miles
0 0.5 1 Miles
N

SONOMA RESOURCE CONSERVATION DISTRICT
Map created by Sonoma RCD June 2022

Figure 2.20. Approximate location of Project #8.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Figure 2.21. Rainwater catchment system location at Sonoma Mountain Institute.

Figure 2.22. Rainwater catchment surface at Sonoma Mountain Institute.

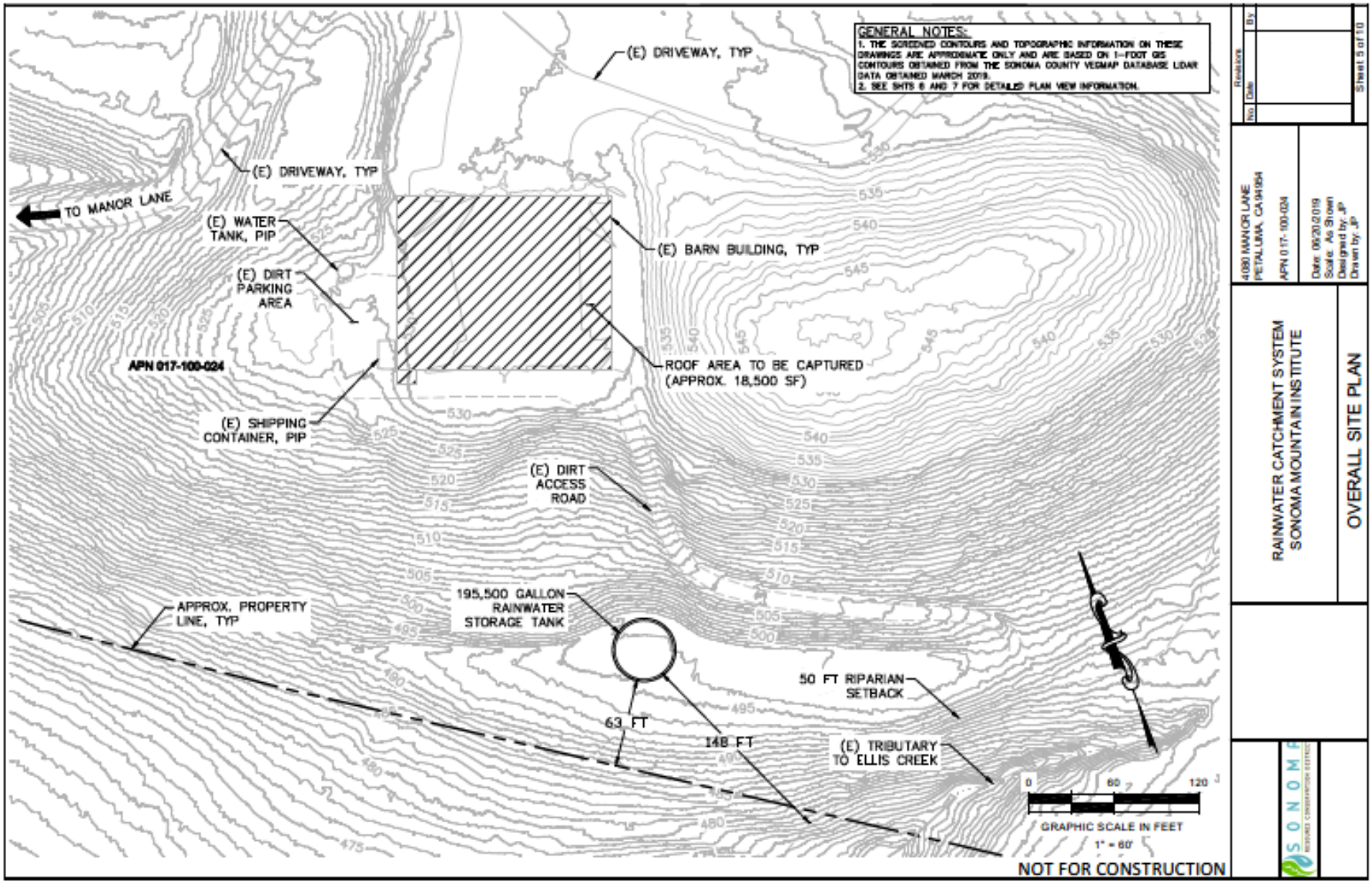


Figure 2.23. Site plan from 100% engineered designs for project.

Project 9. Washington Creek Enhancement

Subwatershed: Washington Creek

Location: Washington Creek from Sonoma Mountain Parkway to confluence of East Washington Creek

Project Type: Design and Implementation

Current Project Proponents: City of Petaluma, Sonoma Water

Project Property Ownership: The property is owned by Sonoma Water and the City of Petaluma.

Project Outcomes: The project will increase stormwater capacity and storage volumes in the channel to provide additional capacity for flooding events. Riparian plantings will provide habitat, canopy cover for the creek, reduction in fine sediment transport and erosion, and contribute to improved water quality and summer base flows. The bike/pedestrian path will provide access to the public in addition to community awareness of urban creek channels and waterways that are essential to maintaining watershed processes and native flora and fauna.

Project Description: This project aims to enhance Washington Creek from Sonoma Mountain Parkway to the confluence of East Washington Creek by completing cross-sectional modifications to increase storage volume in the channel, planting native tree species at top of bank to create riparian habitat and shade for creek waters, and adding a bike and pedestrian path along the corridor.

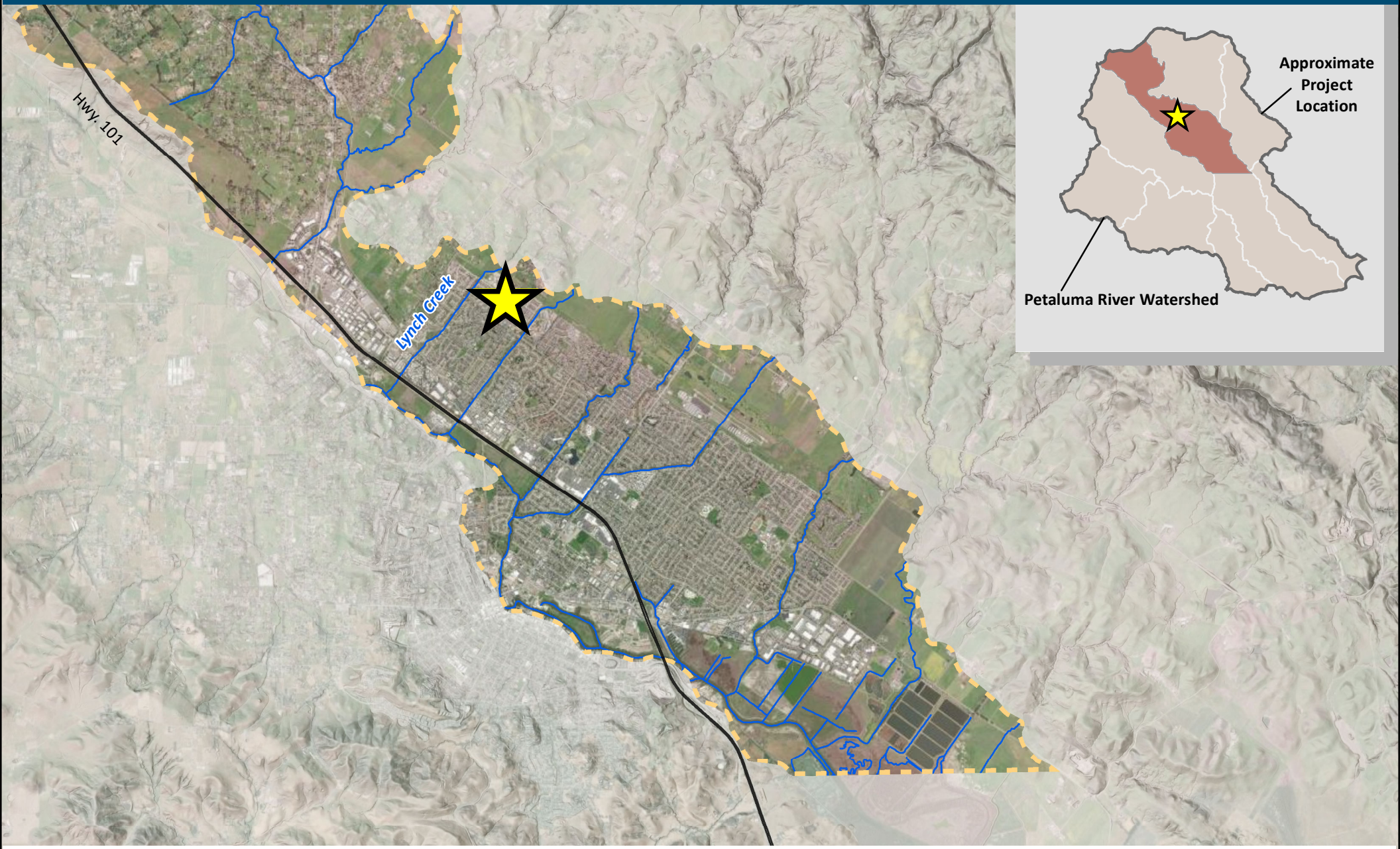
During storm events, these modifications to the channel could increase available volume in the channel, aiding in flood concerns and storm intensity mitigation. This project could increase filtration and treatment of low flow run-off with the creation of low flow meandering channels in the bottom of the trapezoidal channel planted with native grasses. Riparian habitat will be enhanced in areas of sparse canopy coverage.

Timeline: The project will need several phases including a design and permit phase, followed by an implementation phase. Each phase may take several years and be subject to regulatory permitting and public review.

Conceptual Design: Enhancement of this urban creek segment, including the construction of a bike and pedestrian trail along the corridor, is supported by the City of Petaluma's General Plan. Sonoma Water and the City of Petaluma own the parcels on which this project will take place. Funding for a feasibility study is sought from Sonoma County Flood Control Zone 2A.

Potential Funding: Feasibility funding is currently being pursued through Sonoma County Flood Control District 2A funding. Design and Implementation funding would need to be applied for from stormwater prevention and riparian restoration funding programs.

Potential Watershed Stakeholders to Pursue Project: Sonoma Water, City of Petaluma



Lower Pet. River N. Subwatershed Boundary
Petaluma River USGS Blueline Creeks
Major Roads
Approximate Project Location

1 inch = 1 miles
0 1 2 Miles

N

SONOMA RESOURCE CONSERVATION DISTRICT
Map created by Sonoma RCD June 2022

Figure 2.24. Approximate location of Project #9.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Project 10. Tolay Lake Regional Park Gully Restoration

Subwatershed: Stage Gulch

Location: The project location lies on the border of the Petaluma River Watershed, but the effects of the project, including the storm water runoff and sediment resulting from erosion, directly flow into downstream properties that are adjacent to the Petaluma River. Sediment and runoff from this project site ultimately are deposited into the Petaluma River.

Project Type: Implementation of Sediment Reduction

Current Project Proponents: Sonoma County Regional Parks, Sonoma RCD, Point Blue STRAW (Students and Teachers Restoring a Watershed)

Project Property Ownership: The project is located on the property of Sonoma County Regional Parks (Parks). Tolay Park is located on the lands of the Coast Miwok. Sonoma County Regional Parks (fee owners of the Tolay Park land) works closely with the Federated Indians of Graton Rancheria (Graton Rancheria) to ensure work performed on this land is in accordance with the goals, values, and desires of Graton Rancheria. Graton Rancheria will therefore be consulted and included within project development. Downstream of the Parks property and identified gullies are several privately owned properties affected by the erosion and increased sedimentation from these gullies resulting in the water infrastructure on these properties becoming inhibited and water quality of stormwater exiting the properties impacted. These private landowners may be interested in restoration efforts to reduce sediment inputs on their properties, which lead to the Petaluma River. The project will require landowner access agreements from all parties involved with identification of additional sites for exclusionary livestock fencing, bioengineering, riparian planting, brush packing, and erosion control management techniques.

Project Outcomes: The main outcome of the project is erosion control and sediment reduction to reduce the amount of sediment contributions to downstream neighboring properties and to improve the water quality of stormwater and runoff entering the Petaluma River. Enhanced vegetation in the gully will not only improve the riparian condition, but also assist with the main goal of decreased erosion and sedimentation. This project will serve as a potential demonstration project for park visitors and interested parties to observe and learn about natural resource management and restoration techniques that can be applied at other gully sites across the watershed.

Project Description: The project consists of a single, large gully with numerous headcuts and slumping banks. This main gully includes side gullies eroding through the Tolay Lake Regional Park. This property historically has been managed as working grazed land. Current practices of hands-off rangeland management via contractual cattle grazing services have contributed to the expedited erosion of gullies and lack of riparian vegetation cover.

Regional Parks invited the Sonoma Resource Conservation District (SRCD) to conduct a site visit and evaluation of potential improvements of these areas during September 2019. After touring the potential project site with Regional Parks and neighboring landowners, SRCD suggested (and all parties agreed) that seeking funding to complete a project design for this area will be an appropriate next step

to address identified erosion and sediment concerns. The design will include riparian livestock fencing, planting of riparian vegetation, and incorporation of potential bioengineering techniques and/or light rock work (grade stabilization).

Located at a public park site, the project will be a great opportunity to demonstrate methods to address eroding gullies. There are numerous gullies in the Petaluma Watershed, all contributing sediment to Petaluma Watershed streams, and ultimately the Petaluma River which result in decreased water quality and summertime surface water availability. Reducing erosion and sedimentation, revegetation of riparian areas, and controlling livestock access to drainages will enhance our creeks providing habitat for wildlife and improved water quality.

Timeline: The project may need two phases; the first phase will be a design and acquiring any appropriate permits (1-2 years), including time for Parks and Graton Rancheria to review and provide input on the designs. The second phase will be applying to funding for implementation of work, engaging with local contractors to complete identified work, and implementation of the project (1-2 years).

Conceptual Design: To date, there has not been any conceptual designs completed or funding allocated for design work.

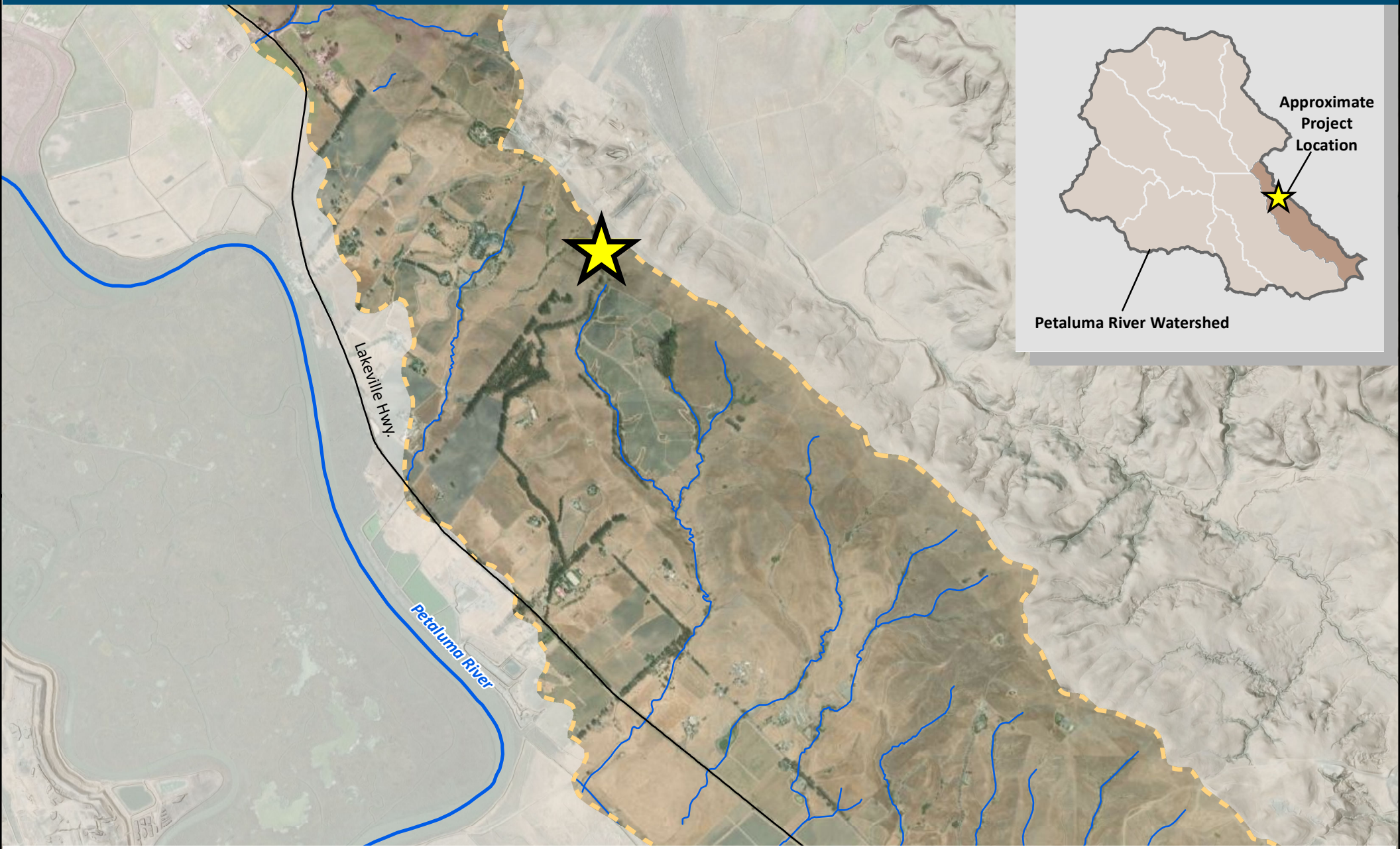
Potential Funding: Funding may be difficult due to the gullies entering a pond, and not directly entering the Petaluma River or its tributaries. Runoff and sediment from these gullies do impact the Petaluma River, but they are upland of the River and affect several adjacent parcels before directly reaching the River itself. However, there may be potential for Natural Resources Conservation Service EQIP funding for the landowners. Other funding programs may include the Department of Conservation, State Coastal Conservancy, or Bureau of Reclamation WaterSMART.

Potential Watershed Stakeholders to Pursue Project: To complete this project, a partnership between Sonoma County Regional Parks, Federated Indians of Graton Rancheria, Sonoma Resource Conservation District (RCD), and Point Blue STRAW (Students and Teachers Restoring a Watershed), will likely form.

Sonoma RCD will likely pursue funding opportunities, contracting with a subcontractor for design, obtaining permits, and obtaining and holding landowner access agreements. Point Blue may lead restoration efforts and oversight. Sonoma RCD and Parks may provide project management and subcontractor coordination as needed.

Project 10 - Tolay Lake Regional Park Gully Restoration

Stage Gulch



Stage Gulch Subwatershed Boundary

Approximate Project Location

Petaluma River USGS Blueline Creeks

Major Roads

1 inch = 1 miles

0 0.5 1 Miles

N

SONOMA RESOURCE CONSERVATION DISTRICT

Map created by Sonoma RCD June 2022

Figure 2.25. Approximate location of Project #10.

Data Source: Subwatershed boundaries from CalWater with modifications by SRCD.

Figure 2.26. Top view of example gully at project site.

Figure 2.27. View looking into example gully at project site.

Section Three: *Additional Project Recommendations*

The following projects ranked as projects 11-20 in the Top Ten project selection process. Reviewers and stakeholders agree that these projects would also serve as beneficial in the watershed and are being considered as strong alternates.

Photo credit Sonoma Resource Conservation District

Petaluma River Watershed Additional Projects

The following projects ranked as projects 11-20 in the Top Ten project selection process. Reviewers and stakeholders agree that these projects would also serve as beneficial in the watershed and are being considered as strong alternates.

11 - Shollenberger Levee Planting

Point Blue Conservation Science's STRAW (Students and Teachers Restoring a Watershed) program will design, implement, maintain, and monitor a climate-smart marsh upland transition zone habitat restoration project in Shollenberger Park. For more than 14 years, Point Blue's STRAW program has worked in San Pablo Bay National Wildlife Refuge on restoring salt marsh to upland transition zone habitat. STRAW aids the USFWS in meeting habitat restoration goals for endangered species for both the Ridgeway's Rail (formerly California Clapper Rail) and the salt marsh harvest mouse.

The project will consist of densely planted native grasses, forbs, and woody species along degraded levees. This project will build on previous revegetation efforts over the past 2 years and aims to install up to 3,000 plants. Restoration teams, including students, teachers, and their families, will plant native species using best installation practices to restore transition zone habitat. Working with both in-house and local independent nurseries, STRAW will propagate locally sourced, watershed appropriate native plants according to state and regional plans, using Point Blue's climate-smart planting tool to create resilient habitat at the project site.

STRAW will propagate and plant locally sourced native plants according to the restoration guidelines of the USFWS Recovery Plan for California Tidal Marshes and the California Department of Fish and Wildlife's California Wildlife Action Plan to create habitat for state and federal species of concern. The native vegetation installed will provide high tide refuge habitat for the endangered Ridgway's Rail as well as increase cover and value to wildlife.

STRAW will engage students in watershed science, culminating in the habitat restoration project at Shollenberger Park. Student participation and community involvement increases volunteers' awareness of and experience with stewardship, raises support for partners from the communities they aim to engage, and reduces project costs. Connecting students with nature will magnify the impact of our restoration and education work with a ripple effect through friends, families, and communities. Completing these tasks will increase climate resiliency at the sites in the face of increased flooding, drought, and heat while ensuring young students are inspired about and engaged in environmental stewardship.

Restoration at Shollenberger Park will improve urban watershed health through the creation of climate-smart habitat and increased sea-level rise resilience. The work plan consists of a three-fold approach to address climate change impacts now and in the future. STRAW will: (1) cast teachers, students, and their families as ecological stakeholders – engaging them actively in the improvement of natural areas in their community, (2) increase resiliency of marsh transition zone habitat through critical restoration work, and (3) ensure long-term restoration success through monitoring and maintenance.

12 - Beneficial Reuse of Dredge Material

The Petaluma River was dredged by the United States Army Corps of Engineers (USACE) in the summer of 2020 after a 13 year wait. Typically, the Petaluma River requires reoccurring maintenance dredging on a four-year cycle to keep the waterways navigable and to minimize increased flooding risk to the City of Petaluma. Material removed from the river during the 2020 dredging was placed at Shollenberger Park, a dredge material disposal site operated and maintained by the City. The City is also responsible for removing decanted spoils from the site to create additional volume for future maintenance dredging events. In addition to the Petaluma River, the Petaluma Marina and the Payran Reach Flood Control Project also require sediment removal and reoccurring maintenance dredging to maintain recreational use and flood capacity, respectively. The material removed from these areas can be beneficially reused within the watershed to enhance subsided tidal wetlands and address sea-level rise impacts. Examples of areas that could potentially beneficially reuse dredged material include the Sonoma County tidal marshes, such as Skaggs Island, Parcel B (the marsh south of Shollenberger), and Cullinan Ranch.

13 - Trash Capture Device Projects

This project is currently partially funded by the City of Petaluma with a feasibility study completed to identify effective small and large full trash capture device install locations throughout the City. This project would either be a pilot project or a permanent project to install a small or large full trash capture device in the City's storm drainage system. The main benefit of this project will be improved water quality by collecting trash from streets and roadways where the device is installed. Once the initial project is complete, there will be the option (if successful) to install additional small and/or large full capture devices to collect trash in multiple areas throughout the City for great benefit to the Petaluma River Watershed.

14 - Bahia Wetlands Restoration

Point Blue Conservation Science is revegetating a levee that is lacking in native vegetation and sufficient cover. The levee is along a marsh that is habitat for the endangered Ridgway's Rails. Point Blue is currently monitoring the rail population at this site. The revegetation will provide cover during times of high tide and storm events and serve as an area of refugia. Currently, most of the levee has annual weeds that are sparse and do not provide cover most of the year, leading to high instances of predation.

Point Blue was awarded a Measure AA Grant in 2017 to restore habitat with community engagement through their Students and Teachers Restoring a Watershed program. Marin Audubon Society is also committed to getting native plants on their property, and specifically their levees, to provide multiple benefits. The project partners (Marin Audubon Society and San Francisco Bay Restoration Authority) have expressed support for this as a project that would benefit Ridgway Rail habitat and is a prime location for revegetation efforts.

15 - Lakeville Creek Restoration

Lakeville Creek is a deeply incised and heavily impacted seasonal stream located on Sonoma Land Trust's (SLT) Sears Point Ranch in the lower Petaluma River Watershed. Its historic condition consisted of multiple small channels across its alluvial valley populated by dense assemblages of rush and sedge, and occasional willow sausals. Today, the single channel is deeply incised, devoid of riparian vegetation, and entirely disconnected from its floodplain. The water table has dropped, making establishment of riparian vegetation difficult and reducing the hydroperiod of historic seasonal wetlands. SLT will restore the creek using a Stage 0 approach in which the stream setting is reset to original condition to enable natural processes to govern its function. Riparian fencing will be erected to block cattle access. The upper portion of the creek flows through the property of Sonoma Raceway, a partner on this project.

Lakeville Creek historically drained into a broad alluvial fan characterized by biologically diverse seasonal wetlands that marked a transition from the upland environment to the tidal wetlands of the San Francisco Bay. Eventually, SLT hopes to restore those tidal wetlands and the creek's place adjacent to them. Functioning ecosystems benefit all the Bay's residents by providing groundwater recharge, clean water, habitat for plants and wildlife, and sequestering and storing carbon.

This will be the first Stage 0 project in the Bay Area. This approach has been successfully implemented throughout the Pacific Northwest and far northern California. Because no Stage 0 projects have been done in the region, SLT's design team developed a Technical Working Group composed of regulatory and resource agencies to get a jump start on permitting and to receive feedback on design components. SLT completed the restoration design in March 2022 and received a CEQA Statutory Exemption for Restoration Projects, part of California's Cutting the Green Tape initiative.

16 - Rainwater Harvesting Program

Rainwater storage can play a key role in reducing residential water consumption. If paired with watershed-wise landscaping practices, it can also help redirect storm runoff, recharging aquifers rather than swelling streams. This project consists of the following steps, 1) Identify a project lead, 2) Encourage local rainwater tank manufacturer or distributor to partner with community-based natural resource organizations to obtain tanks at a large-quantity rate, 3) Support community-based technical service providers in acquiring supplemental funding for system installation and technical resources to assist homeowners with rainwater collection systems. Working with landowners that are also willing to alter their landscape to accommodate overflow for groundwater recharge/storm runoff and water conservation practices would allow the program to achieve multiple benefits with each system.

This project aims to reduce the prohibitive cost of more residents (including those in urban areas) pursuing capturing rainwater during the wet-winter months for dry-season use to offset current water source(s). Currently, sizable rainwater capture systems are cost prohibitive for most residents without supplemental funding or technical resources. The goal is to increase multi-benefits by utilizing a combination of widespread rainwater catchment, landscape infiltration opportunities, lessen the effects of storm peak-flows, and promote best management practices within the watershed that directly support water quality, quantity, and security in a changing climate.

17 - 10,000 Trees for Petaluma

Funding for trees tends to be restrictive, therefore efforts have been broken into smaller projects to qualify for funds. Several specific projects have already been developed for this initiative.

ReLeaf Petaluma is a new organization creating strong partnerships and bolstering their relationship with the city government and council. Currently managed by a committee and 40 members, ReLeaf Petaluma is actively pursuing funding and ways to increase the tree canopy within the City of Petaluma. Sensitive to our climate emergency, biodiversity emergency, and trends leaning towards water scarcity, ReLeaf Petaluma is working with the most fundamental and successful strategies to engage with the community and complete the mission of “re-leafing” the City.

"10,000 Trees for Petaluma" will add 10% to the tree canopy of the city and immediate surroundings (currently at 0-25%) by infilling native canopy trees and large shrubs throughout the city. Development of a small urban forestry department will be proposed with a goal of partnering with the City on recommended updates to Petaluma's Tree Ordinance that would support efforts in preserving existing canopy. A Tree Steward Program will identify sites for new trees including concrete removal, assisting landowners with obtaining trees at low or no cost, educating site owners in tree care, and providing care including pruning for the first 5 years.

With strong carbon sequestration scores and drought tolerance due to species selection, the project is currently partnering with the City initiative "Cool Cities" to include a residential tree planting component.

A 10% increase in Petaluma’s urban tree canopy will cool both land and water supply. ReLeaf’s initiative will stress the use of reclaimed water and drip irrigation for frugal maintenance in the early years until the trees are established. Then, thanks to the use of drought tolerant natives, the urban forest will have very low water use. ReLeaf’s grassroots promotion of native trees and shrubs to the community will accelerate the trend of residential re-landscaping away from grass to native low-water, no-emissions plantings.

18 - Adobe Creek Fish Ladder

This project has been identified as a NMFS Recovery priority for ESA-listed threatened steelhead trout. In the 1990’s, a low flow fish ladder was installed inside the culvert at the Adobe Road crossing, just south of the Casa Grande Road intersection. A series of rock weirs were installed outside of the ladder downstream. Undersized weir rocks were used so they could be moved through the culvert from the upstream staging area. They were then cabled together with epoxy anchors.

The ladder and weirs are now in disrepair. The concrete in the fish ladder and the floor of the culvert are significantly eroded with exposed rebar and the ladder is nearly full with sediment. The exposed rebar is a safety hazard for salmonid passage and work crews. There is now a 3-foot vertical jump into the ladder which is a fish passage barrier for returning anadromous fishes when flows are not high in the fall and winter, and consequently blocks the downstream outmigration of juvenile salmonid passage during spring and summer.

These factors are important as the stream channel downstream of the culvert regularly dries up completely in the summer and only the habitat upstream is viable for over-summer survival of salmonids. Fish rescues occur here regularly.

The ladder, weirs and floor of the culvert need replacement. National Marine Fisheries Service, CA Department of Fish and Wildlife, Sonoma Resource Conservation District, and CA State Parks agree that this project is needed to sustain fish passage for salmonids in Adobe Creek.

19 - Lynch Creek Mouth Barrier Removal

The mouth of Lynch Creek at the Petaluma River confluence is a fish passage barrier during low tides, and a constant barrier when flows are low in the watershed. Currently, this barrier is impeding the movement of both outmigrating steelhead juveniles and adult steelhead returning to spawn. This project would address the barrier so that it is not impassable, as well as the restoration of native vegetation from the reach spanning the mouth of Lynch Creek to the freeway, where applicable.

20 - Petaluma Municipal Well Groundwater Recharge Project

The City of Petaluma currently relies on surface water from Sonoma County Water Agency (Sonoma Water) for its water supply. Sonoma Water is the wholesale water supplier for the City of Petaluma and other municipal water contractors in Sonoma and Marin Counties. Sonoma Water obtains most of its water from the Russian River. Like other surface water resources in California, the Russian River is a vulnerable source that is under threat from the changing climate and droughts.

In addition to surface water supply, the City of Petaluma has a few municipal groundwater wells that are used for emergency backup water supply during periods of water shortages. Due to ongoing drought conditions, groundwater in the Petaluma Valley faces the potential for decline as withdrawals exceed the rate that our aquifers can naturally replenish.

The City of Petaluma's reliance on a surface water supply that is susceptible to drastic reductions in availability makes response to droughts unpredictable and at times requires severe restrictions on water customers. As we face ongoing drought conditions throughout the state, the City is engaging in planning efforts to transform its approach to water resources management and to diversify its water portfolio to include a strategy known as groundwater banking, or aquifer storage and recovery (ASR).

The City of Petaluma received $450,000 in grant funding from the Department of Water Resources to evaluate the use of ASR in Petaluma and develop an ASR Plan. The City's ASR Plan will study the artificial recharge of municipal wells, including ASR which is a method that would take surplus surface water in wet winter years and store it in a deep underground aquifer in the Petaluma Valley groundwater basin for use as an emergency backup water supply.

The Petaluma Valley Groundwater Sustainability Agency (GSA) was created in 2017 to comply with the Sustainable Groundwater Management Act (SGMA). The GSA recently adopted its groundwater sustainability plan (GSP). Water conservation and groundwater ASR projects are identified in the plan as critical groundwater management initiatives that help to protect water supply in the Petaluma Groundwater Basin.

The ASR Plan will identify artificial well recharge practices and infrastructure projects that the City may implement for the Petaluma Municipal Well Groundwater Recharge Project.

Section Four: Stakeholder Identified Strategies

The following Strategies to Pursue are outlined as categories related to the areas that the strategies would be most applicable to implement and pursue funding and resources for within the watershed.

Photo credit Sonoma Resource Conservation District

Background

The *2022 Petaluma River Watershed Conservation and Enhancement Plan* outlines and identifies information and needs on a watershed-wide scale in addition to documenting considerable background knowledge, scientific references, and recent studies for each of the below topics of interest. The *Stakeholder Identified Strategies* are intended to recognize the need for specific, actionable strategies with the goal of providing support for next steps that lead to implementation-focused efforts.

Although support for these strategies was indicated by the Petaluma Watershed Collaborative, these strategies (and the supporting information that accompanies them) are an inventory of observations and ideas submitted by individuals, and do not represent a consensus amongst all participating individuals and organizations.

The *Stakeholder Identified Strategies* section is intended as a watershed-wide expansion to the Top Ten Project list that was the original target of the Petaluma River Watershed Action Plan. The below identified strategies were expressed as priority actions by stakeholders participating in the Petaluma Watershed Collaborative, community members, local organizations, and interested parties through the effort of project solicitation. Concern was shared that although the Top Ten Projects fulfill the original objective of the Action Plan, implementation of additional actions remains imperative in addressing and mitigating effects of a changing climate, sea level rise, and security of water quality and quantity across all areas of the watershed, including those areas historically underserved and underfunded. These strategies stood apart from projects garnering a high score as they are not *discretely identified projects* that have Action Plan goal-specific benefits in pre-identified locations.

Rather, they are *strategies* needed for the long-term health and resilience of healthy communities and watersheds. Therefore, these strategies are needed in widespread areas and will require continued coordination amongst watershed partners and landowners (whether public or private) to see that they are pursued. It became clear to several of the project reviewers, combined with feedback from community members, that these strategies should be identified even if they were not able to be isolated into a specific project for the Top Ten list. This *Stakeholder Identified Strategies* section documents the feedback received and existing needs in the watershed to complement the identified Top Ten watershed projects.

While some strategies below denote working with willing landowners, it is important to acknowledge that any strategy carried out on private land will not be possible without the voluntary participation of the landowner.

Stakeholder Identified Strategies

The following "Strategies to Pursue" are outlined as categories related to the areas that the strategies would be most applicable to implement and pursue funding and resources for within the watershed.

Climate Change

Impacts of Climate Change include increasing global air temperatures, sea level rise, changes in ocean chemistry and currents, and changes in hydrologic cycle including intense drought and severe storms, which in turn increase wildfire severity and flooding. The City of Petaluma has adopted the goal of carbon neutrality by 2030 with focus on reducing emissions from transportation and increasing building energy efficiency. Climate actions will need to be robust, comprehensive, and multi-faceted.

Watershed and Community Concerns:

- Atmospheric rivers causing erosion and flooding
- Long term drought causing water supply shortages and ecosystem function decline
- Sea level rise causing loss of the historic Petaluma Marsh
- Saltwater intrusion into groundwater
- Exacerbated flooding potential during storm events coinciding with king tides
- Heat Island effect in urban areas, especially in under-resourced neighborhoods
- Need for increased protection from wildfires
- Achieving carbon neutrality by 2030

Agricultural and Rural Areas

The Petaluma River Watershed supports several agricultural industries including dairies, vineyards, poultry, equestrian, hay, flower, cannabis, and market crops. Like many cities within Sonoma County, Petaluma's Urban Growth Boundary limits the potential of urban sprawl into adjacent farmland and open spaces, allowing for the ongoing cooperation with County policy makers to prevent development on the greenbelts, agricultural land, and open spaces surrounding the city.

The below strategies are intended to highlight practices and changes in management that not only benefit watershed processes but may also serve to sustain production and profitability of the agricultural community.

Strategies to Pursue:

1. Continue outreach and technical assistance to landowners for the management and protection of riparian areas.
2. Provide support for rural residential landowners and agricultural producers to implement beneficial management practices to improve stream health.
3. Provide support regarding nutrient management.
4. Assist landowners to eradicate non-native pest insects, pathogens, and invasive weeds.

5. Provide technical and financial incentives for agricultural producers to transition management practices that will be affected by climate change.
6. Support regenerative agriculture, community farms, and local food supply.
7. Provide technical and financial incentives for agriculture to continue sustainable and best management practices that aid in carbon sequestration, including:
    - transitioning to organic, biodynamic, and/or regenerative systems
    - improving soil health
    - incorporating trees, shrubs, and hedgerows into rangeland or farm landscapes, including in riparian areas
    - reducing tillage or transitioning to no-till practices
    - increase practice of rotational grazing
    - restoring grassland forage communities
7. Provide technical and financial incentives for riparian livestock fencing and alternate water source development.
8. Provide technical and financial incentives for the prevention and control of soil erosion processes.

Riparian Enhancement

Initial focus of riparian restoration and erosion control efforts may be focused on river reaches and tributaries that currently, or potentially can, support steelhead and Chinook. Although these actions should be considered and pursued on all tributaries for overall watershed health and the benefit to water quantity, quality, and ecosystem services.

<u>Strategies to Pursue:</u>

1. Revegetate riparian sites with cooperative landowners.
2. Create habitat and wildlife paths along main corridors designated in the city General Plan, primarily along Petaluma River, Washington Creek, and Lynch Creek. Include other tributaries, when possible, e.g., Lakeville and Ellis creeks.
3. Support ecological enhancement within all riparian efforts, mainly combining with sediment and erosion reduction projects.
4. Encourage native vegetation at multiple heights: groundcover, shrubs, and trees. In riparian areas, encourage a patchwork of habitats and install plant species with climate changing adaptability.
5. Leave old and dead trees in place if they do not threaten structures. Remove trash and debris in all tributaries, especially within city urban boundaries, e.g., old car removal from Corona Creek.
6. Restore Petaluma riverbanks with native vegetation, especially in the downtown area, as well as creating floodwalls where needed.

Marshlands

Recent data from the IPCC predicts a 20-inch rise in sea level over the next 50 years and the San Francisco Estuary and Watershed Science journal predicts a sea level rise of 16 inches by mid-century and 50 inches by the end of the century. Efforts need to start now, over the next 10-20 years, to save the San Francisco Bay shorelines including San Pablo Bay and areas of the Petaluma Marsh.

Regional planning documents such as the SFEI San Francisco Bay Shoreline Adaptation Atlas, the Baylands Ecosystem Habitat Goals Science Update, Petaluma River Baylands Strategy, and Sediment for Survival: A Strategy for Resilience of Bay Wetlands and the Lower San Francisco Estuary all recognize the need to apply a multi-faceted approach to the impacts of sea level rise.

Methods currently recommended for the entire SF Bay region to prepare our wetlands for rising sea levels include:

- restore estuary-watershed connections
- design complexity and connectivity into the Baylands landscape
- restore and conserve complete tidal wetlands systems
- restore Baylands to full tidal action prior to 2030
- plan for Bayland and marshland migration
- actively recover, conserve, and monitor wildlife populations
- develop and implement a comprehensive regional sediment management plan
- invest in planning, policy, research, and monitoring
- develop regional transition zone assessment programs
- improve carbon management, increase organic matter accumulation, reduce greenhouse gas emissions, and sequester more carbon

Habitat types will naturally shift over time due to sea-level rise, salinity changes, and restoration. To ensure that the habitat needs of waterbirds and marshland species are being met, a large-scale, long-term planning and monitoring effort across the bay, delta, and Central Valley (and ideally the rest of coastal California) is needed. The reliance of Pacific Flyway waterbirds on Bayland habitats is partly due to the extensive loss of wetlands in the Central Valley (particularly the delta) and other parts of coastal California.

Innovative approaches to making managed ponds and marshes more resilient should be pursued for restoring existing diked Baylands or while constructing new water management infrastructure. These might include designs for more flexible water-control structures or water management configurations that can accommodate changes in sea level. Pursuing and implementing pilot projects for alternate means of water management, such as ways to allow the bathymetry of managed ponds and marshes to rise with sea levels by capturing sediment which could ameliorate the need for reinforcing levees and pumping water, could provide multi-benefit solutions in areas with various land uses and priorities.

<u>Strategies to Pursue:</u>

1. Restore large patches of tidal marsh along the entire shoreline of San Pablo Bay, particularly near the mouths of sloughs and major streams.
2. Allow natural processes, such as flooding, to lay down new layers of sediment.
3. Bury large logs to create mini dikes that break wave action and provide the backside with habitat protection.
4. Move dikes back to “retreat” and allow room for restoration and natural migration processes.

5. Build horizontal levees where sediments are loaded onto the land to create a gradual long slope.
8. In wetlands, reduce development in low-lying areas, behind levees, or adjacent to the bay/coast and prevent or reduce other stressors that reduce the ability of the wetland ecosystem to respond.
9. Complete large wetland restoration projects to serve as buffers to tidal flooding as well as sea level rise.
10. Where possible, enhance marsh/upland transition zones and provide buffers.
11. Manage, restore, and monitor tidal marsh habitat to promote the recovery of listed species and the long-term conservation of species of concern.
12. Conduct research necessary to the recovery of listed species and long-term conservation of species of concern and other tidal marsh species.
13. Test various planting palettes and methods for restoring marsh edges and dikes.
14. Prepare and distribute information to the public about the habitat needs of marshland-reliant species and how watershed residents can help with recovery efforts.
15. With willing landowners in the Petaluma Marsh:
    - establish managed marsh or enhanced seasonal pond habitat (especially for shorebirds) on agricultural Baylands that are not restored to tidal marsh
    - create small diked ponded areas adjacent to levees where possible
    - for levee landowners, provide resources to assist in best management practices of dike and levee maintenance and alternate means of land protection
    - provide resources for alternative dike and levee construction such as, moving the levee back and grading the land in front with a gradual slope that breaks wave action and provides space for marsh habitat that slows water energy from reaching the main dike

Fish and Wildlife

Some of the highest ranked stressors noted in the watershed for fish and wildlife species include increased sediment transport and stream incision; alterations to the estuary from straightening and dredging; changes to floodplain connectivity and degradation to the wetlands; impaired water flow through increased residential and agricultural water use pressures; lack of riparian cover due to land use changes affecting water temperatures, water quality, and lack of instream complexity including spawning gravel, shelter and deep pools, increased fish passage barriers, and increased water pollution from both urban and rural sources.

The fragmentation of natural areas around Petaluma and throughout Sonoma County due to development patterns can limit the ability of animal populations to move to areas they need for food, shelter, and breeding. The protection and enhancement of existing habitat connectivity linkages is essential to the future health of local wildlife species in and around Petaluma. For example, the Helen Putnam Park Extension is in the planning phase and will convert an old dairy farm into a multi-use park with emphasis on human interaction with nature as well as protecting wildlife.

Strategies to Pursue:

1. Conduct studies for increased knowledge (Project 7) including:
    a. Conduct surveys for species of concern throughout the watershed, and support instream monitoring and survey efforts of salmonid and wildlife populations.

   b. Conduct genetic testing on Chinook salmon to understand origins and patterns of movement.
   c. Conduct assessments of potential fish passage barriers and remove on priority streams.
   d. Work with CA Department of Fish and Wildlife, United Anglers of CGHS, and National Marine Fisheries Service to conduct surveys for threatened species and species of concern to include but not limited to pond-breeding and stream breeding amphibians throughout the watershed and support on-going monitoring and survey efforts of salmonids and wildlife populations.
2. Rehabilitate and reclaim historic tidal wetland/slough estuarine habitat for rearing steelhead.
3. Create more pool connectivity and increased summertime baseflow for salmonids.
6. Work with willing landowners to revegetate high and medium priority riparian sites.
7. Focus riparian restoration and erosion control efforts on tributaries that do, or potentially can, support steelhead trout and Chinook salmon.
8. Increase riparian canopy cover to 70% and install livestock exclusion fencing within key reaches of major tributaries.
9. Implement specialized local projects such as improve fish ladder on Adobe Creek (Project 18) and remove Lynch Creek Mouth Barrier (Project 19).
10. Investigate the possibility of using Adobe Creek as an urban reference site.
11. Improve Wildlife Corridors south of the city and along Lynch, Washington, and Ellis creeks and coordinate with the Sonoma Valley Wildlife Corridor Project.
12. Support the Helen Putnam Park Extension as a Wildlife Corridor.

Urban, Park, and Open Space Ecosystems

Trees in both the open space and urban environments provide economic, environmental, health, traffic, social, psychological, and community benefits. The City is seeking funding for development of an Urban Forest Management Plan and reworking of ordinances to protect trees, and a local nonprofit has started the 10,000-tree planting initiative to increase canopy by 10% (Project 17). The General Plan is being updated to include greater effort to purchase land for open space, flood management, catchment basins, trails, and parks (Project 6). Tree planting and open space ecosystem conservation and restoration in all these areas will be a major undertaking.

<u>Strategies to Pursue:</u>

1. Develop an Urban Forest Management Plan and pursue projects that increase tree canopy, species biodiversity, wildlife habitat, and wildlife corridors.
2. Convert vacant and undervalued land into “pocket forests” with native species.
3. Include native bunch grasses in various urban and rural landscapes to sequester carbon.
4. Increase urban parks along and near Petaluma River (including Project 4) and tributaries that also provide multiple benefits for community benefits, native species, water catchment, and other trails in City plans.
5. Along roads, agricultural lands, open space, and in forestlands survey and monitor invasive species and apply control methods where needed.
6. Assess pest insects and disease, invasive species, and dying trees in forestlands and parks properties.

Water Conservation

The City of Petaluma and Sonoma Water have a robust water conservation initiative to help residential and commercial customers conserve water. The initiative includes programs, rebates, resources, and other incentives to help Petaluma residents save water. The Petaluma Valley Groundwater Sustainability Plan prioritizes voluntary conservation programs in rural areas to mirror those programs offered to municipal users. Reducing water demand through domestic water conservation is an impactful way to mitigate drought conditions.

The City of Petaluma water system distributes recycled water for agricultural, golf course, and landscape irrigation. Tertiary recycled water is used onsite at Ellis Creek Water Recycling Facility for flushing toilets, process water, and landscape irrigation. The City is planning an expansion of the urban recycled water system to deliver recycled water to more agricultural customers outside of the City's current service area.

Strategies to Pursue:

1. Implement the City Water Conservation Plan that incorporates conservation measures beyond the beneficial management practices developed by the California Urban Water Conservation Council such as low water landscaping, water saving appliances and fixtures, and greywater re-use to improve water use efficiency and offset potable water demand for both urban and rural landowners.
2. Collaborate and seek funding for multi-benefit watershed-wide efforts involving surface and groundwater storage, rainwater harvesting, and use of recycled water. Example: Petaluma Municipal Well Groundwater Recharge Project (Project 20)
3. Develop a roof water catchment program (Project 16) and demonstration project for both residential and agricultural landowners, such as through City Hall (Project 2) and projects such as the Sonoma Mountain Institute Rain Catchment System (Project 8).
4. Provide resources to landowners on the benefits of restoring groundwater and methods for increasing groundwater recharge in upland areas through small landowner meetings.
5. Outreach to agricultural producers to determine if there are opportunities to increase water use efficiency or implement alternative water sources for irrigation, frost protection, and other water-intensive ag systems.
6. Support collaboration and outreach efforts to assist agricultural land managers during drought and times of water scarcity. Water hauling, access to water and water supply availability are critical issues affecting rural landowners in the Petaluma Watershed.

Hydrology, Stormwater, and Flood Management

Over many years, multiple factors have caused large-scale changes to the Petaluma River streambed changing the water-carrying capacity and navigability of the waterway. Many of the Petaluma Watershed's natural channels and creeks have been altered, changing the natural drainage of the landscape.

Historically, many creeks did not drain directly into the river, rather fanning out into freshwater wetlands, vernal pool systems, and a complex network of Baylands. Floodplains that once offered stormwater dissipation are no longer present. The loss of floodplains coupled with channelization of the natural channels has increased flow intensity and decreased water holding capacity of creeks.

Flooding is usually the result of, or is exacerbated by, weather events and can cause substantial damage to structures, landscapes, and utilities as well as life safety issues. Low-lying areas of the City of Petaluma, riverside parcels, and some critical habitat areas are susceptible to various types of flooding including riverine, localized flooding resulting from heavy precipitation in a short span of time, and levee failure.

The Payran neighborhood and adjacent areas are severely impacted by flooding. Previous significant floods include those of 1982 and 2005, which resulted in millions of dollars in damage and losses. In 2019, heavy rains flooded a section of Industrial Avenue, which delayed traffic and caused minor damage but is indicative of more frequent similar events as climate change causes more concentrated heavy rainfall.

<u>Strategies to Pursue:</u>

1. Support the City of Petaluma, County of Sonoma, and Sonoma Water flood management efforts (including Project 3).
2. Perform hydrology modeling to inform surface water, groundwater, and stormwater management decisions.
3. Assist individual rural and urban landowners to install "Slow It. Spread It. Sink It. Store It!" practices such as rain gardens, rain capture systems, downspout outlet protection, and pervious hardscapes (see Project 2 for more information on practices).
4. Support the goals and practices of the City of Petaluma Stormwater Management Plan.
5. Support planning measures that consider hydrology, stormwater, and flooding.
6. Preserve open space and agricultural lands (see Project 6).
7. Implement the City of Petaluma's Floodplain Management Plan.
8. Continue annual stream and creek channel maintenance in accordance with established programs of City of Petaluma, Sonoma Water (Zone 2A), and other regulatory requirements.
9. Monitor and update the City's stream level gauge system and expand as needed to maximize the use and effectiveness of the data in the operation of the Flood Alert System.
10. Encourage local, State, and Federal agencies to fund stream maintenance programs and pursue such opportunities for increasing flow capacity in conjunction with stream enhancement projects.

Sea Level Rise

In its sea level rise assessment, the Local Hazard Mitigation Plan finds that many potential impacts from sea level rise occur within the 6.6 feet of sea level rise scenario, recommending the redesign of critical infrastructure, long-lifespan projects, and projects with little opportunity for future adaptation to sea level rise being completed by 2100 (in anticipation of sea level rise being a threat under a high-risk aversion scenario).

Strategies to Pursue:

1. Use the science and data of climate change as a basis for restoration and management projects to understand how global events affect local geology, biology, and hydrology.
2. Study the growing impact of sea level rise on the Petaluma Marsh, Baylands, and San Pablo Bay marshlands and develop methods to preserve.
3. Plan for the modeled anticipation of increasing drought severity, storm intensity, and wildfire frequency in combination with the effects of sea level rise.

Water Quantity and Quality

With human and natural resources crucially dependent on water, overall quality and sufficient quantity of water sources are imperative to community health and watershed efforts.

Strategies to Pursue:

1. Conduct studies for increased knowledge (Project 7) including:
    a. Increase flow monitoring to better interpret water quality data focusing on critical creeks that support wildlife and create habitat for spawning and movement.
    b. Due to current habitat conditions, investigate the possibility of using Adobe Creek as an "urban reference site".
    c. Monitor and investigate groundwater and surface water interactions.
    d. Monitor creeks for toxic pollutants.
2. Encourage landowners and managers to implement practices to reduce pollutants from entering the waterway in both urban and rural settings.
3. Assist residents in working with Permit Sonoma on well and septic installation and management to protect ground and surface water quality.
4. Develop LandSmart ranch and farm water quality plans and implement beneficial management practices to decrease pollutant loads.
5. Promote education efforts and initiatives to encourage people in the watershed to keep the river clean by reducing pollutants entering through storm drains.
6. Support marina owners and operators to increase "no dumping" education for boat owners.
7. Support the City of Petaluma, CalTrans, and other public landowners in the watershed in the creation of a plan to prevent human waste discharges into storm sewer systems from homeless encampments on public lands.
8. Support and increase efforts to cleanup and mitigate negative effects of abandoned housing areas, marinas, and submerged boats along the river and within marsh areas.

Erosion and Sediment Sources/Impacts

Although the precise sources of sedimentation are less readily identifiable than the effects, they can be separated into those attributable to the natural sediment load of the watershed and those attributable to the additional loads created by current and ongoing human activities.

Strategies to Pursue:

1. Implement management actions to reduce erosion and sediment from entering streams.
2. Concentrate erosion control activities in the high priority sub-watersheds of the Willow Brook, Lynch, Adobe, Ellis, and San Antonio creeks.
3. Repair gullies in drainages of all tributaries, including planting native species and erosion control best management practices.
4. Maintain drainage ditches, spillways, culverts, etc. to avoid overtopping and delivery of sediment to the streams.
5. Support erosion and sediment control efforts such as the development of LandSmart ranch and farm water quality plans and implement beneficial management practices to decrease sediment loads.
6. Manage livestock access to creeks and gullies, with consideration for seasonal conditions.
7. Provide educational and technical assistance for "do-it-yourself" erosion control on small farms and pasture management.
8. Assist landowners and pursue funding to repair eroding banks, install riparian fencing, and revegetate banks.

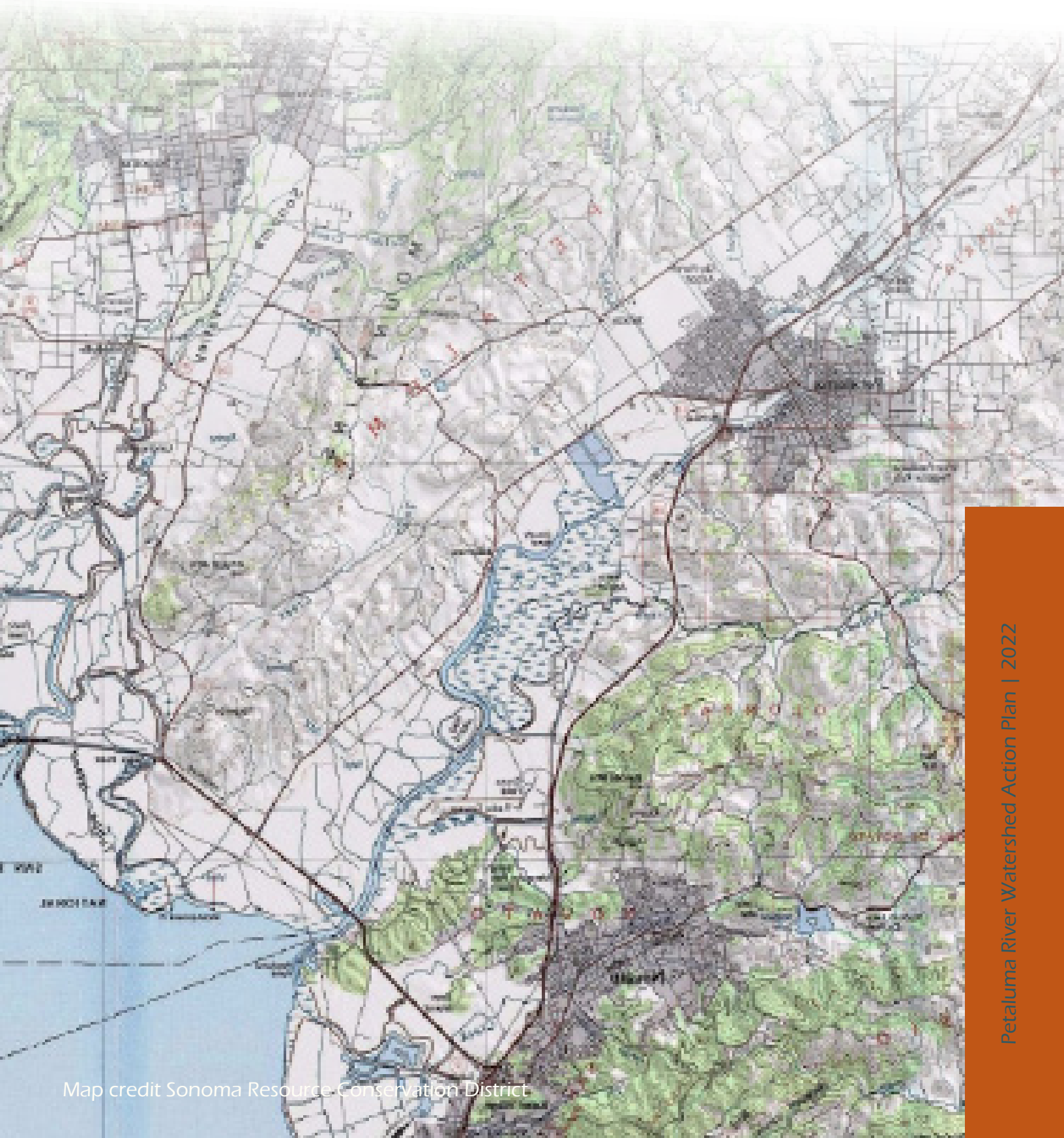
Wildfire Hazard

Petaluma will see a continuation of wildfire risk in the coming decades as climate change exacerbates wildfire conditions. While much of the city is currently in the "moderate" Fire Hazard Severity Zone, the pattern in the overall region suggests that fires will increase everywhere. Even if wildfire threat does not increase in the Petaluma Watershed, the indirect impacts of nearby fires such as community exposure to poor air quality and smoke will be more severe.

Strategies to Pursue:

1. Maintain open space and agricultural lands surrounding Urban Growth Boundary as a fire buffer.
2. Prepare community wildfire plans for protection and evacuation.
3. Work with local fire departments, Fire Safe Councils, CalFire, and other community resource groups to disseminate information on fire preparedness/prevention best practices, and to apply for funding and implement best management practices for defensible space, forest management, and fuel reduction.

Appendices



Map credit Sonoma Resource Conservation District

Appendix A. Action Plan Development Procedure

Project Solicitation

The Petaluma Watershed Collaborative (Collaborative) collectively produced an online survey to collect information required to score and rank projects within the Petaluma Watershed for development of the Top Ten list of recommended projects to be included within the Petaluma Watershed Action Plan (Action Plan). The Collaborative extended the survey to nonprofit organizations, local community groups, both federal and state agencies, as well as local tribes, special districts, land preservation organizations, and volunteer groups in addition to the community at large to solicit project descriptions and ideas to be submitted for ranking and possibly included within the Action Plan. The Collaborative engaged in outreach efforts to connect to as broad of an audience as possible to capture recommendations from a diverse group of individuals across the Petaluma Watershed. An informational video was produced on our efforts to solicit feedback, as well as an outreach flyer written in both English and Spanish to advise community members and local entities of opportunities for participation.

Ranking System

The Project Selection Criteria was created based around the model utilized in development of the Southern Sonoma County Storm Water Resources Plan and several other project ranking systems frequently used by partnering natural resource organizations. The ranking system is broken into five benefit categories (Environmental Preservation and Protection, Water Quality, Community, Flood Management, and Water Supply) to capture the many aspects surrounding watershed and community health alike.

During development of the ranking system, input and review was incorporated from a group of diverse Stakeholders participating within the Collaborative efforts (please see the 2022 Petaluma Watershed Restoration and Enhancement Plan for further details of Collaborative efforts and participating Stakeholders). Stakeholders provided comments, edits, and modifications to the ranking system before it was finalized and approved for use by a motion passed by majority vote.

Submitted projects had to first pass through the initial Qualifying Questions to proceed through to the scoring and ranking process. Please refer to the Qualifying Questions and Project Selection Criteria included as Appendix B.

Top Ten Project Selection Guidelines

Submitted projects were scored based on the information provided within the project submission survey, in addition to any follow up information gathered by a representative Stakeholder of the Collaborative.

A volunteer subcommittee of Collaborative Stakeholders participated in the ranking process. Submitted projects were assigned to rankers at random after determining that the ranker did not have a direct tie

to the project. The Collaborative coordinator facilitated an initial review of submitted projects, compiled projects for review, and coordinated ranking of submitted projects with the subcommittee.

Projects were scored blindly (reviewers and rankers did not have the associated submitter nor identifying project details) and the projects were sorted in order of ranking score. The subcommittee held several meetings to review and re-score projects as needed to make sure that scores were assigned fairly and projects receiving the highest ranking were indeed appropriate for these efforts.

A draft list of projects was reviewed and discussed by the Collaborative, where considerations for project fairness, equity, and diversity of project type and scope were discussed. Modifications were made with considerations shared from this meeting.

The final list of projects was determined by the subcommittee of stakeholders with facilitation provided by Sonoma RCD. The final list of Top Ten projects ultimately took project equity, feasibility, project readiness, site owner interest, community engagement, natural resource benefit, education, funding opportunities, and watershed partnership into consideration.

Project Descriptions and Conceptual Designs

Once the top ten ranking projects were determined, stakeholders and the Sonoma RCD worked to create project descriptions to include within the Action Plan. These projects serve as priority actions for members of the Collaborative, local organizations, and resource agencies to support and pursue funding when suitable resources for implementation of project activities become available.

Disclaimer

Stakeholders and grantee of Bureau of Reclamation funding to coordinate these efforts (Sonoma Resource Conservation District) reserved the right to deny, remove, or rescore projects that did not align with the agreements outlined in the funding contract, promote activities that are inequitable, did not conform with regulatory guidance, and/or are outside of the scope of work for identifying key projects within the Petaluma River Watershed.

Appendix B. Qualifying Questions and Project Selection Criteria

Please see following pages.

Project Ranking for Top Ten Projects to be included in the Petaluma Watershed Action Plan: Submitted projects will be ranked by the following criteria with the ten highest ranking projects included within the Petaluma Watershed Action Plan. Examples of project types include (but are not limited to) "on-the-ground" or implementation projects (such as habitat restoration, fish passage barriers, addressing erosion/sediment concerns, vegetation management or revegetation, flood control), educational programs, community service and engagement projects, planning efforts that address a watershed-related concern, scientific studies, habitat mapping, etc. For simplicity, "project" hereafter refers to any concept submitted for consideration within this ranking process. "Project addresses" encompasses any project activity that is implemented by a physical/on-the-ground (for example construction), educational, data collection, community engagement, modeling, and/or planning based approach.

Action Plan Goal: To establish a "Top Ten" list of priority management and restoration projects within the Petaluma River Watershed to be implemented with leadership from Stakeholders that participate as members of the Petaluma Watershed Collaborative.

Qualifying Questions:		**Y/N**	
a	Does this project geographically reside within the Petaluma River Watershed?		
b	Is this project feasible?		
c	Does this project have support from the landowner (whether private, public, or not applicable*)? *n/a counted as "yes" answer		
d	Does this project yield at least two main benefits (Environmental Preservation and Protection, Water Quality, Community, Flood Management, Water Supply)?		
e	Does this project fit within standard regulatory compliance or permitting process?		
	If project received 5 "yes" responses, it is eligible to proceed through the ranking process.		

Selection Criteria:		**Score** **0 = none, 1 = low, 2 = medium, 3 = high**	**Notes**
General			
1	Project has pre-existing support from the community, regulatory agencies, nonprofits, and/or local organizations?		
2	Work has already occurred on the project?		
3	Is the proposed project influenced by site availability, time sensitivity, and/or other factors of significant need that contribute to urgency of completion?		
4	Is there a known funding source that this project could feasibly be funded by?		
5	Does this project fit into the goals of the Action Plan and overall mission of the Petaluma Watershed Collaborative?		
	Total =	0	

Environmental Preservation and Protection			
1	Project addresses conservation, creation or enhancement of wetlands, aquatic, and/or riparian habitat?		
2	Project addresses low streamflow conditions and/or provides an anticipated increase in streamflows (by means of groundwater quantity, surface flow, direct diversions, infiltration, habitat improvement, erosion control/sediment reduction strategies, etc.) during low flow season for benefit of habitats and endangered/threatened species survival?		
3	Project addresses the creation or protection of urban green space, open space, or working lands?		
4	Project provides direct benefits to sensitive, threatened, endangered, or species of special interest?		
5	Project addresses water temperature improvement for benefit of habitats and endangered/threatened species?		
6	Project addresses reduction in energy use or CHG emission, or increase in carbon sinks?		
7	Project was previously identified in a conservation, restoration, watershed management plan, etc.?		
8	Project directly addresses or provides awareness surrounding environmental preservation and protection-related benefits?		
	Total =	0	
Water Quality			
1	Project addresses water quality through increasing infiltration and/or decreasing evaporation?		
2	Project addresses enhancement to groundwater quality?		
3	Project addresses the reduction of non-point source pollution (such as fertilizers, herbicides, insecticides, toxic chemicals, sediment, etc. carried by runoff)?		
4	Project addresses the reestablishment of natural water drainage and treatment?		
5	Project addresses saltwater intrusion and/or erosion/sedimentation concerns?		
6	Project addresses water quality concerns on developed landscapes?		
7	Project incorporates strategy(ies) or BMP(s) previously identified in locally-relevant water quality planning document or area specific guidance manual(s)?		
8	Project directly addresses or provides awareness surrounding water quality-related benefits?		
	Total =	0	

Community			
1	Project addresses potential job creation?		
2	Project addresses the creation or enhancement of recreational and public use areas?		
3	Project addresses community involvement, volunteer opportunities, and/or improves equity or inclusivity through project actions?		
4	Project addresses land development within the community (either land development directly OR practices, best management, proactive measures surrounding sustainable development)?		
5	Project highlights local community history, addresses inequitable access to public natural resources to under-resourced populations, and/or promotes environmental justice.		
6	Project incentivizes behavior or actions within the community that are consistent with Petaluma Watershed Collaborative goals?		
7	Project directly addresses or provides awareness surrounding public health and/or community-related benefits?		
8	Project was previously identified in a community, recreational, education, development, job opportunity and/or watershed-based plan?		
	Total =	0	
Flood Management			
1	Peak flood flow and/or volume reduction is apparent?		
2	Potential to reduce flooding problem known or anticipated to occur locally?		
3	Project addresses conservation of lands?		
4	Project addresses vegetation management?		
5	Project addresses debris and/or sedimentation in creeks, flood channels, or other drainages?		
6	Project addresses flooding impacts resulting from and/or improves community resilience to factors resulting from climate change and sea level rise.		
7	Project was previously identified to reduce flood risk in local flood management plan, master plan, watershed plan, etc.?		
8	Project directly addresses or provides awareness surrounding flood management-related benefits?		
	Total =	0	

Water Supply			
1	Project addresses the collection and storage of water above ground for offsetting dry-season water use?		
2	Project addresses direct diversions?		
3	Project addresses water infiltration directly into a water supply aquifer?		
4	Project enhances water supply reliability through means other than storage, diversion, or infiltration of water and/or stormwater (e.g., water conservation practices)?		
5	Project produces increased water use efficiency?		
6	Project previously identified as a water supply/conservation project in any watershed planning document?		
7	Project directly addresses or provides awareness surrounding water supply-related benefits?		
8	Project addresses the re-establishment of the natural hydrograph (slowing in timing of peak flow, conversion of impervious area to pervious, groundwater infiltration, reducing flashiness of streams)		
	Total =	0	
	TOTAL SCORE PER SITE (Max. Score = 135)	0	
Bonus Points (used to break ties in project scoring)		**Score (0 = no, 1 = yes)**	**Notes**
i	Project reduces impacts to watershed processes?		
ii	A cost/benefit analysis has been completed on the project and results are reasonable to practitioner's understanding of feasibility constraints.		
	Bonus Points (Max. Bonus Points = 2)	0	
Stakeholder informal assessment (aka "gut check") for project priority (high/medium/low project):			
Notes:			
DISCLAIMER: Stakeholders and grantee of funding awarded by Bureau of Reclamation to coordinate these efforts reserve the right to deny, remove, or re-score projects that do not align with the agreements outlined in the funding contract, promote activities that are inequitable, do not conform with regulatory guidance, and/or are outside of the scope of work for identifying key projects within the Petaluma River Watershed.			

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RESOURCE CONSERVATION DISTRICT