

Borderlands Restoration Network

**Groundwater Recharge on
Working Lands by Local Youth
to Enhance Ecosystem Services**

Santa Cruz AMA

Cover Page

WMAP Groundwater Conservation Grant Application Cover Page

Program/Project Title: Groundwater Recharge on Working Lands by Local Youth to Enhance Ecosystem Services

Brief Description: Borderlands Restoration Network youth interns will restore degraded and eroding drainages at T4 Ranch, a working ranch north of Nogales, AZ in a hotspot of threatened biodiversity. Building off past work at T4 Ranch that was extremely successful, youth interns will install loose rock structures, mulch, and pelletized seed to restore hydrological and biological function to a deserving landscape.

<p>Type of Program or Project:</p> <input type="checkbox"/> Water Innovation & Technology <input type="checkbox"/> Infrastructure Water Efficiency <input checked="" type="checkbox"/> Ecological Enhancement <input type="checkbox"/> Public Outreach & Engagement	<p>Your level of commitment to maintenance of project benefits and capital improvements:</p> <input type="checkbox"/> < 5 years <input type="checkbox"/> 5-10 years <input type="checkbox"/> 11-15 years <input checked="" type="checkbox"/> 16-20 years
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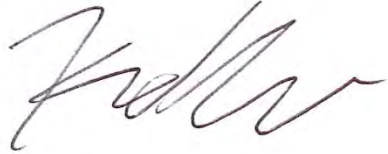
<p>Applicant Information:</p> <p>Name/Organization: Borderlands Restoration Network Address: PO Box 121 City: Patagonia State: Arizona ZIP Code: 85624 Phone: (860) 237-0381 Tax ID No.: XXXXXXXXXX</p>	<p>AMA:</p> <input type="checkbox"/> Phoenix <input type="checkbox"/> Tucson <input type="checkbox"/> Prescott <input type="checkbox"/> Pinal <input checked="" type="checkbox"/> Santa Cruz If the project is located outside of an AMA, it is not eligible for funding.
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<p>Contact Person:</p> <p>Name: Audrey Rader Title: Watershed Restoration Program Manager Phone: (775) 513-4904 e-mail: arader@borderlandsrestoration.org</p>	<p>Does this project meet any of our priority criteria? If so, which?</p> <input checked="" type="checkbox"/> Additional contribution <input checked="" type="checkbox"/> Innovative qualities <input checked="" type="checkbox"/> Demonstrate high impact <input checked="" type="checkbox"/> Demonstrate multiple benefits
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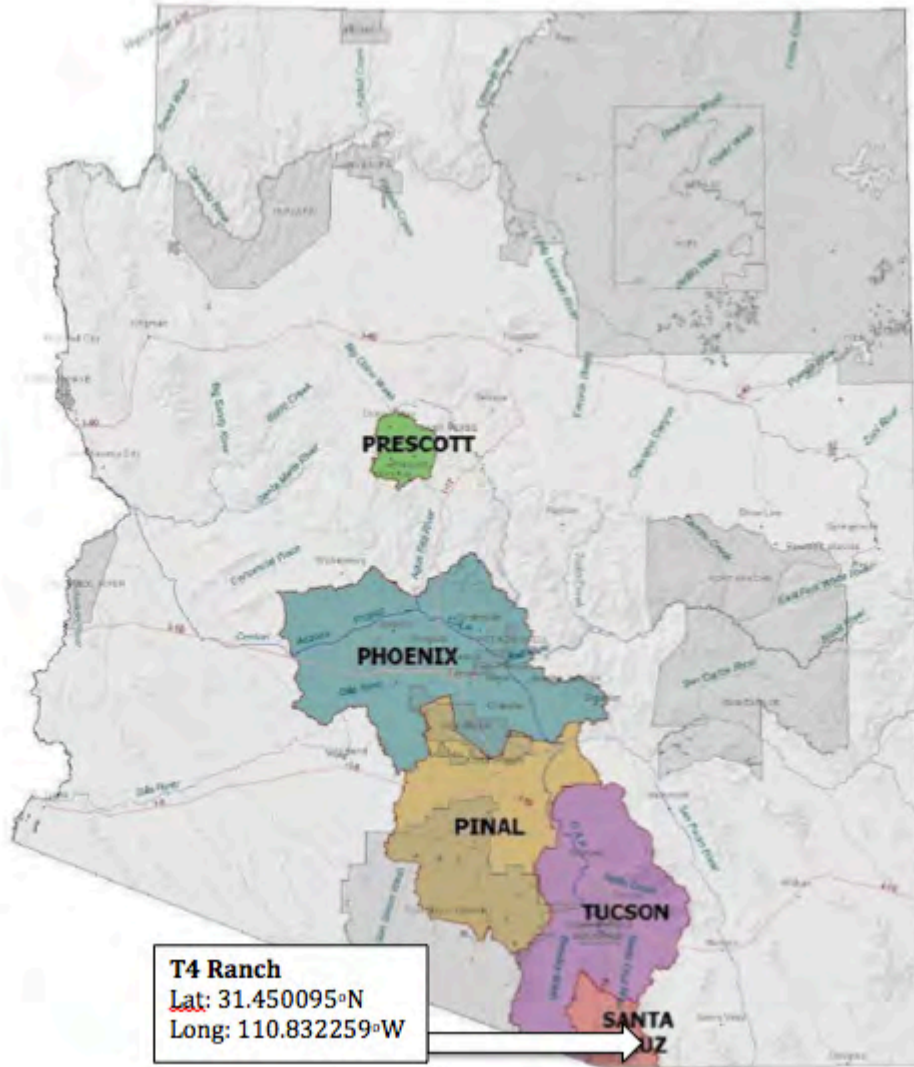
<p>Water Management Assistance Program Grant Amount Requested:</p> <p style="text-align: center;">\$105,290.79</p>	<p>Additional Contribution Obtained and Secured:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;"><u>Applicant/Agency/Organization:</u></th> <th style="text-align: right;"><u>Amount (\$):</u></th> </tr> </thead> <tbody> <tr> <td>1. Applicant</td> <td style="text-align: right;">\$15,930.05</td> </tr> <tr> <td>2. US Forest Service Youth and Veterans Program Fund</td> <td style="text-align: right;">\$28,749.12</td> </tr> <tr> <td>3.</td> <td style="text-align: right;">Total: \$44,679.17</td> </tr> </tbody> </table>	<u>Applicant/Agency/Organization:</u>	<u>Amount (\$):</u>	1. Applicant	\$15,930.05	2. US Forest Service Youth and Veterans Program Fund	\$28,749.12	3.	Total: \$44,679.17
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Signature of the undersigned certifies understanding and compliance with all terms, conditions and specifications in the application. Additionally, signature certifies that all information provided by the applicant is true and accurate. The undersigned acknowledges that intentional presentation of any false or fraudulent information, or knowingly concealing a material fact regarding this application is subject to criminal penalties as provided in A.R.S. Title 13. The ADWR Director may approve Grant Awards with modifications to scope items, methodology, schedule, final products and/or budget.

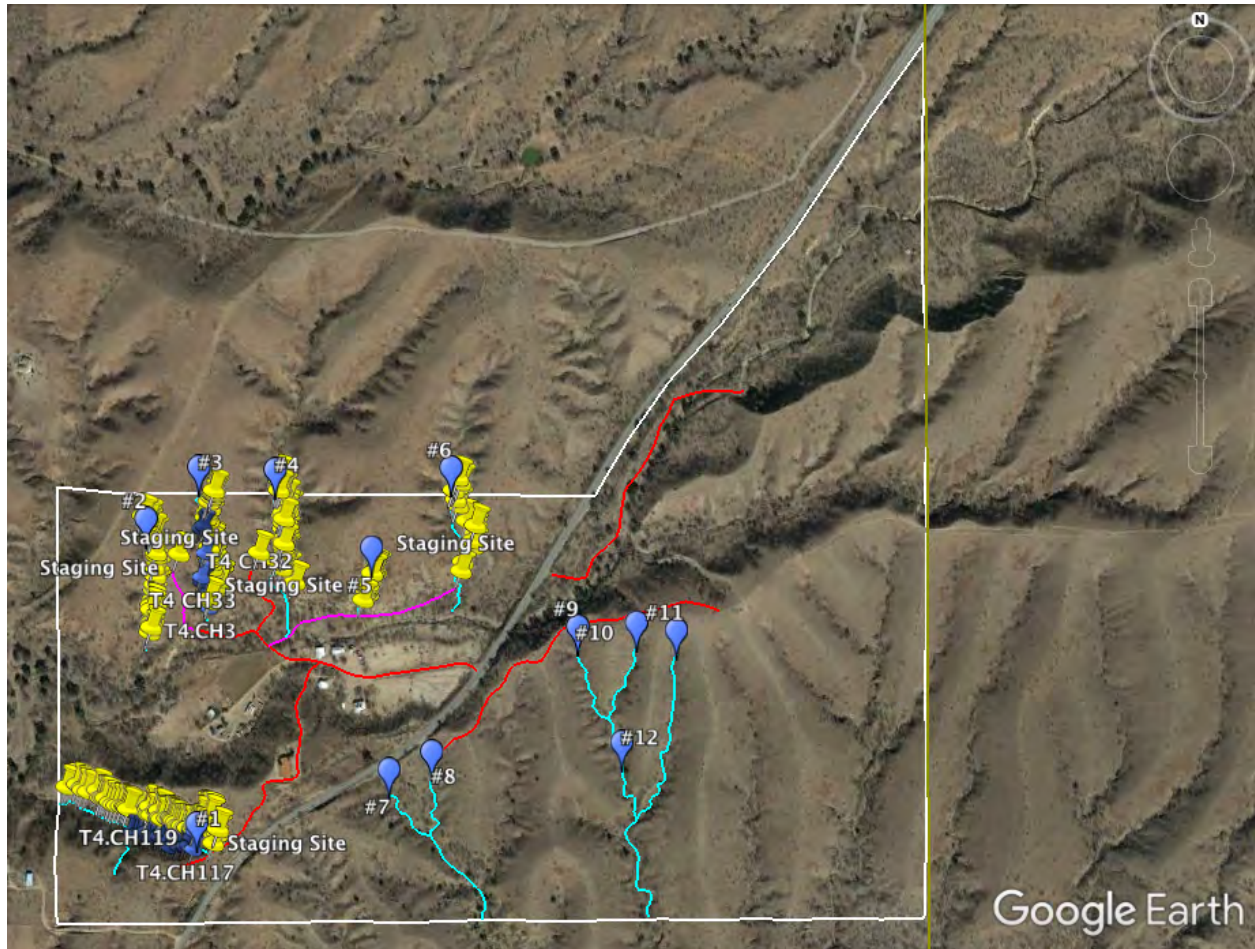
Kurt Vaughn	Executive Director
Name of Applicant / Authorized Representative	Title

(530) 574-8630		2/13/20
Telephone Number	Signature	Date Signed

Project Map



Map 1: Location of T4 Ranch within Santa Cruz AMA



Map 2: Boundary of 300-acre T4 Ranch (white), cleared drainages (blue), cleared roads (red), and 200 existing erosion-control structures (yellow pins)



Map 3: Detail view of Channel #1 at T4 Ranch and the structures within

Executive Summary

Located approximately fifteen miles north of Nogales, AZ, in the U.S.-Mexico border region, T4 Ranch is a working cattle ranch nestled in the Madrean Sky Islands. World renowned as a biodiversity hotspot, this region is home to a vibrant wildlife community including several endangered species of plants and animals. This project represents a continuation of Borderlands Restoration Network's (BRN) long-standing record of engaging regional residents to increase watershed hydrologic resilience and the quality of riparian habitat for improved water quality and quantity in this important region.

Threats to the health of this watershed are significant and increasing. T4 Ranch is located in an ecotone where the Semidesert Grassland and the Madrean Pine-Oak Woodland converge, a region identified by the Critical Ecosystem Partnership Fund as one of the world's most threatened biodiversity hotspots. The headwaters of T4 Ranch are eroding due to large headcuts, severe channelization, and upwards of 40 acres of bare ground. Erosion on the site is limiting water infiltration to the area and potentially contributing to the sedimentation and pollution of waterways downstream of the ranch. In 2018, BRN installed over 200 loose rock structures and planted native vegetation in half the drainages on this ranch to great success. Channelized drainages are refilling, more than 30 tons of sediment have been captured, grasses are returning, and flooding is mitigated. This project is designed to complete BRN's previous work in the area and stabilize the riparian headwaters of T4 Ranch; to stabilize the main drainages within this watershed; and to return vegetative cover to the watershed for the benefit of the landscape's hydrologic cycle.

BRN's work is based on the concept that complex, shared landscapes require complex responses that include both ecological and social dimensions. By treating each structure, arroyo and watershed as educational and empowerment platforms, BRN trains and employs local practitioners in one of the most impoverished counties in Arizona. In one example of this multiple tiered approach, the loose rock structures in T4 Ranch were built by local paid high school interns through our hands-on education program, Borderlands Earth Care Youth Institute (BECY).

We propose to build upon past work and further the landscape-scale restoration effort on T4 Ranch. Our ongoing restoration work to date, accomplished in collaboration with multiple local municipal, state, federal and private partners, is designed to increase surface and base flows, recharge groundwater, stabilize soils, and allow native riparian plants to further secure the ecosystem. Beyond the scope of this project, restoration work in the region will continue to build a strong foundation for future research that has already begun to gather data on potentials for groundwater recharge and balanced water budgets at the urban-rural divide, and the carbon sequestration effects of riparian restoration work in arid lands. As an organization adept at working toward common goals across disciplinary and jurisdictional boundaries, BRN is well-positioned to continue to build upon our successes in this watershed while publicly demonstrating effective work on restoration ecologies.

Project Overview

Groundwater Recharge on Working Lands by Local Youth to Enhance Ecosystem Services

Project Overview

a) Clearly identify the problem and the project area (project area overview/location, need for the work, demonstration of groundwater conservation, etc.)

The Madrean Sky Islands, mountains emerging from the high deserts and grasslands of southern Arizona, serve as a refuge for migrating wildlife, livestock, and people. The Sky Islands together with the northern highlands of Mexico's Sierra Madre Occidental, form a globally heralded center of biological diversity recognized by the International Union for Conservation of Nature and the World Wildlife Fund. This ecoregion supports the highest diversity of pollinators, reptiles, birds and mammals, including the only remaining jaguars, in the United States. This exceptional diversity occurs at the confluence of five great biogeographic domains—the Sonoran Desert to the west, the Chihuahuan Desert to the east, the Sierra Madre Mountains to the south, a Neotropical corridor to the southwest, and the Rocky Mountains to the north. Because of the remote location and rugged topography much of the biological wealth of the region has remained intact, but that is changing rapidly with a recent influx of people and attention.

Landscape-scale aridification is perhaps the greatest threat to life in the Sky Islands. Today only 4% of the historic rivers and streams still flow in Arizona. A 2019 study by Laura Condon of the University of Arizona and the Morrison Institute directly tied the loss of surface water to dropping groundwater levels. According to the study, around seventy percent of the decrease of surface flows is due to groundwater pumping. The rest of the surface water loss is due to land degradation and erosion from historic land mismanagement, such as cattle overgrazing and irresponsible mining practices. Lower aquifer levels result in disappearing rivers and streams, meaning riparian (riverside) tree roots can no longer access year-round water. It's difficult to overstate the importance of riparian habitats, which can produce one hundred times more plant mass than the surrounding areas. The rich habitat of mesquite, oak, ash, cottonwood, sycamore, and other plant life translates into food, nesting sites, and cover for both year-round and migrating wildlife.

Riparian areas aren't the only biomes to have suffered from the landscape-scale dewatering of southern Arizona. Annals of early Spanish settlers describe the grasslands of southern Arizona as seas of grass. After years of massive overgrazing, coupled with the area's drought-prone climate regime, upwards of eight inches of topsoil has been lost from these grasslands. The resulting positive feedback system means both the ecosystem and livestock suffer as water that once infiltrated into the grasslands now sheds off of the bare soil, eroding the landscape and causing downstream flooding.

Borderlands Restoration Network (BRN) works to heal these lands while engaging underserved multicultural youth to solve these ecosystem challenges. Having formed in 2015, BRN fulfills its mission by: fostering economic activity that restores degraded systems by hiring locals to restore habitat across political and jurisdictional boundaries; protecting and restoring international wildlife corridors; hiring culturally diverse youth living on the US/Mexico border to restore their trans-national watersheds through the Borderlands Earth Care Youth (BECY) and *Sudagī o wud doakag* (or 'water is life' in the Tohono O'odham language); offering a suite of educational activities for all ages

dwelling within the borderlands; and by providing restoration-quality native and organically-produced plant materials at the BRN Nursery & Seed Lab to sustain biodiversity.

BRN has learned that the key to fostering a community-wide ethic of environmental appreciation is to engage directly with the local residents, particularly youth and land managers. With a suite of educational programming, BRN empowers and trains the youth of many border communities, including: Patagonia, AZ; Douglas, AZ; Tohono O’odham Nation; and Agua Prieta, Sonora. Collaborative hands-on restoration projects on working lands are developed and implemented in concert with working professionals: ranchers, farmers, conservationists, and agency managers. Borderland youth work alongside land managers, working together to make a brighter future. And this hard work is paying off. After eight years of youth programming, both youth and adults are now taking a leading role in local conservation efforts.

There are countless places across southern Arizona in dire need of groundwater conservation and restoration. However, few lands are fortunate enough to have land managers as dedicated as T4 Ranch in Santa Cruz County. For many years, T4 Ranch has worked to return grassland and riparian health to the 300 acres of their private rangelands. In 2018, youth from two border communities came together to construct over 200 erosion-control structures and plant 100 native pollinator-feeding plants on the ranch. The results of this work are staggering - channelized drainages are refilling, more than 30 tons of sediment have been captured, grasses are returning, and flooding is mitigated. After our collaboration, T4 Ranch managers have used the techniques they learned to heal massive, 20-foot erosion features on their property. T4 Ranch’s strong conservation ethic, along with their history of successful collaborative restoration projects, demonstrates the importance of supporting this partnership.

BRN’s previous success at T4 Ranch is a great motivator in the face of all the restoration work that still needs to be conducted there. The work done in 2018 treated only half of the drainages on this property. The untreated drainages are still marked by channelization and headcuts, contributing to water sluicing off the landscape and taking substantial amounts of soil with it. The erosion of these drainages contributes not only to the loss of fertile land, but also to the potential pollution and sedimentation of waterways downstream of the ranch. Aside from erosion in the stream beds, large swaths of the ranch are bare ground. In these instances, the soil is exposed to environmental stressors such as sun, rain, and wind, which contributes to water and soil loss. Strategic treatment of drainages at T4



Figure 1. Untreated drainages in T4 Ranch with bare ground and channelization issues.

Ranch has proven to work seamlessly in the past, indicating that this project would largely improve water conservation, water quality, and overall ecosystem health. The juxtaposition of the treated and untreated drainages of the 300 acre ranch highlight the need for restoration treatments to promote groundwater conservation.

b) Describe how this project directly or indirectly conserves groundwater and shows significant groundwater saving within the AMA.

To improve the overall water quality and quantity at T4 Ranch, remove *E.coli* contaminants from the watershed, and mitigate erosion, Borderlands Restoration Network proposes a multi-prong approach to restoring T4 Ranch. BRN staff and youth interns will first install loose rock structures. These structures have been proven to conserve and restore surface water and groundwater, stabilize the soil, mitigate erosion, and allow for future plant establishment. After the loose rock structures are installed, BRN staff and interns will mulch native, dead and down woody material and spread it across bare ground soil surface. Native mulch will improve soil functionality, decreasing further surface erosion and water loss and facilitating native plant establishment and health. Lastly, BRN proposes to sow pelletized native seed in the watershed. Native seed is adapted to local conditions, requiring less water and providing better habitat for wildlife in the region and forage for cattle. These combined treatments will address multiple issues at T4 Ranch and ultimately result in a healthier ecosystem that provides both abiotic and biotic benefits for the landscape and its inhabitants.

As an effective and low-cost technique employed around the world for thousands of years, loose rock structures are successful restoration tools in arid regions suffering from ecosystem degradation and the destructive effects of drought, unsustainable land-use, fire, and flooding. Loose rock structures are constructed of several parallel rows of self-reinforcing rocks incorporated into the bed of the eroding channel to be treated. These skillfully placed rocks, often only one-rock high in profile but several rows wide, rest at right angles to the direction of flow and remain passive to overtop flows. This arrangement allows these structures to trap organic-rich sediment upstream while slowing flows and increasing water infiltration into the channel bottom and banks. This practice extends the hydro-period for plant establishment without retaining water. When placed in a coordinated series according to landforms and observed water flows, each individual structure is part of a system that decreases erosive forces, increases water availability, and allows for habitat recovery to begin.

Many of the benefits associated with loose rock structures pertain to conserving groundwater. For instance, erosion control structures decrease peak flows for small to medium flood events (Norman et al., 2015). High peak flows, which result in decreased water infiltration rates and soil loss, are associated with high rainfall intensity, land mismanagement, and antecedent wetting conditions (Panagos, et al., 2015). As rain events for the region are predicted to be more intense, more variable, and occurring over a shorter duration of time (Demaria et al., 2019), using loose rock structures will improve the landscape's resiliency to these environmental stressors by decreasing peak flows and promoting water infiltration. In addition to decreasing peak flows, loose rock structures also increase surface-water availability, extend seasonal flows, and increase water volumes by 28% (Norman et al. 2015). Increased surface-water availability on the landscape lessens the amount of water used by



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ranchers for stock tanks, reducing groundwater withdrawal. Increased surface-water availability will also promote vegetation recovery (Wilson & Norman 2019). At the proposed project site, an increase in vegetation translates to an increase of native forage for both cattle and wild animals, alike. Aside from the direct benefits to the landowners and animals that use the land, increased native vegetation on denuded landscapes similar to the proposed project site also promotes soil stability. Stable, functional soils are generally capable of retaining more moisture and show a marked increase in resiliency to erosive forces. Loose rock structures are capable of restoring many ecological facets of a landscape, including increased vegetation recovery and improved soil structure and moisture. Most notably, these structures improve water quality and quantity in degraded landscapes.

In addition to loose rock structures, BRN proposes covering bare ground surfaces with native mulch. Mulch is an excellent tool for treating degraded areas such as T4 Ranch in that it provides multiple benefits to soil health and functionality as well as plant establishment and health. Mulch insulates the soil from the sun and wind, reducing evaporation and keeping soil temperatures relatively constant. Mulch also aids in protecting the soil surface from erosive forces such as rain and, to a lesser degree, compaction. In addition, mulch can increase organic content in soils. Higher organic matter favors soil microbes that may detoxify contaminants in the soil profile, such as pesticides in fertilizers. The cumulative benefits that mulching provides for soils also benefits plants. Optimum soil temperatures and moisture enable plants to establish and grow consistently.

One of the downfalls of using mulch in a degraded landscape is that, depending upon the source of the mulch, there is potential for the mulch to transport non-native seeds. Introducing non-native seeds to a disturbed landscape can give invasive plants a foothold to take root. As native plants are better adapted to local conditions and oftentimes require less water than their non-native counterparts, it is vital to keep relatively intact, native grasslands such as at T4 Ranch free of invasive plants. Therefore, we propose to use a chipper to chip native, dead and down woody material to provide ground cover in bare ground. To support native plants, BRN will also incorporate pelletized seed into the soil surface during the mulching process. This will encourage more native plants to establish on the previously bare ground, stabilizing the watershed with plants with low water requirements. Mulching

and seeding bare ground patches across T4 Ranch's 300 acres with native materials will sustainably restore the hydrological and biological functions of the landscape.

c) Describe the measurement and monitoring methods that will be used to determine the effectiveness of the project. Examples of metrics might include comparing pre- and post-project water use; water savings; scientific data collections and reporting methods; or pre- and post-program surveys to verify project results.



Figure 2. (Left) With flow direction from bottom of image to top, fine sediment is retained along with organic material that builds soil, while the passive structures allow water to continue flowing downstream. Structures become part of the system's ecological infrastructure and prevent further down-cutting and hydrologic draw-down that de-waters entire watersheds if left unabated. (Right) Approximately 18 inches of sediment and organic material (upper right) captured behind a low structure built into an existing tree and channel banks that were compromised.

In order to address how effectively loose rock structures, mulch, and seeding improve water quality and quantity, BRN will monitor the project site through time series photo points, on-the-ground monitoring, and remote sensing imagery. In order to estimate how well erosion control structures slow erosion and run-off, BRN staff will use a protocol adapted by Dr. Ron Tiller of ADEQ from Diaz, et al. (2007), which indicates the theoretical volume of sediment accumulation behind structures. To acquire these measurements, BRN staff measure the loose rock structures' width, height, and basin lengths. The amount of retained sediment may be used as a proxy for improved water quality. Research underscores the relationship between sediment and *E.coli* in streambeds. Understanding how much sediment the loose rock structures retain will help BRN staff understand how well they are removing contaminants from the watershed, mitigating erosion, and improving soil structure (which may increase soil moisture and infiltration). BRN staff will also take photo points of the loose rock structures, mulch, and seeding treatments. Photo points are a time-tested tool to qualitatively track landscape response to restoration treatments over time. Photo-points also enable staff to disseminate findings easily at research conferences and workshops. To monitor the effectiveness of loose rock structures in relation to water quantity, BRN will use LiDAR-equipped drones provided by ADEQ to quantify proxies of increased water infiltration, such as improved vegetation recovery. BRN already possesses remote sensing imagery of the proposed project area prior to the installation of the 2018 restoration treatments.

Combined, these monitoring methods will provide BRN staff with a thorough understanding of the effectiveness of the program and give ideas on how to continue improving best practices moving forward.

d) Demonstrate how the project is consistent with the management plan and the management goal of the AMA.

The Santa Cruz AMA goals underscore the need to prevent local water tables from experiencing long-term declines, striking a long-term balance between the annual groundwater withdrawn and the annual natural and artificial recharge, and the influence of effluent on water within the Santa Cruz AMA. Researchers at the United States Geological Survey, the University of Arizona, Arizona Department of Environmental Quality, and other organizations have found that loose rock structures address these issues in a significant way. Scientific studies show that loose rock structures restore watersheds on the landscape scale by decreasing peak flows for small to medium flood events, increasing surface water availability at sites up to 5km downstream and up to 1km upstream, extending seasonal flows and increase in-stream volume by around 28%, increasing organic matter (OM) in soils (i.e. carbon sequestration), increasing soil moisture at structures by around 10%, increase sedimentation downstream, decreasing stress in plants, and increasing vegetation health (Smith et al., 2010; Fandel et al., 2014; Norman et al., 2014; Fandel et al., 2015; Norman et al., 2015; Wilson & Norman, 2018; Coy et al. 2019, Wilson & Norman, 2019). Loose rock structures, in combination with mulch and seeding, will also lessen the strain that the ranchers place on groundwater sources for cattle stock tanks, lessening the annual groundwater withdrawn for the 300 acre ranch. Lastly, these restoration treatments will retain soils and prevent soil loss downstream. As contaminants such as *E. coli* commonly attach to sediment, and sediment from ranches is one of the primary sources of *E.coli* contamination in water sources within southeastern Arizona, it is imperative to reduce erosion at T4 Ranch. The loose rock structures have already retained 30 tons of sediment from entering the watershed. Continued work at the project site will further

e) Describe how the proposed project benefits multiple water users and/or stakeholders and, if applicable, provide support letters from individuals and entities that will benefit from the project.

As an organization determined to tend to the most vital and threatened social and ecological features of a shared region experiencing multiple stressors, BRN represents the convergence of a cadre of seasoned scientists, practitioners, and residents intent on continuing to make a difference in-and-for-place, including for those who share it and depend upon its continued resilience. Our approach is simple yet profound—stabilize basic ecosystem processes and services such as soil formation and stability, functional hydrology and water availability, native plant collections and installations that improve habitats, and empowerment of people to earn incomes by caring for the places they live. We continue to benefit from the ongoing commitments of local Patagonia residents, visiting volunteers, and interns, ranchers, permaculture groups, and farms, while contributing to multiple universities and similar educational hubs in the U.S. and Mexico.

Metz Trust, the T4 Ranch landowner, is in support of the project to help restore the Cumero Canyon watershed on T-4 Ranch in collaboration with T-4 Ranch Manager, Bo Simpson. Previous work at the proposed project site has already benefited T4 Ranch. The ranch manager reported less

erosion, increased vegetation recovery, and increased cattle forage on the ranch less than two years after the loose rock structures were installed. In support of the qualitative benefits, the funder of the work, the Arizona Department of Environmental Quality, calculated that around 30 tons of sediment were retained behind the loose rock structures. The WMAP grant will allow BRN staff to return to T4 Ranch and continue restoring this landscape, to the benefit of the ranch and the ranch owners.



Figure 3. BECY interns proud of their loose rock structure, healing an 8-foot headcut.

This project will also directly benefit youth of southeastern Arizona. BRN's Borderlands Earth Care Youth (BECY) Program hires culturally diverse youth living on the U.S.-Mexico border to restore the trans-national watersheds they call home. Working as a team, youth conduct hands-on restoration projects, learning marketable job skills while following a structured ecological restoration curriculum, to advance land stewardship for generations into the future. Learning alongside conservation professionals, youth utilize rock, wood, hands, and hearts to return flowing waters and riparian ecosystem health to the arid borderlands. Since the BECY program started in 2013, more than 130 youth have graduated from the 12-person crews in the Arizona communities of Patagonia, Douglas, and Nogales.

The BECY crews were responsible for the initial installation of loose rock structures at T4 Ranch in 2018. Given the success of the 2018 restoration treatments, returning to this site with new and old BECY interns will encourage stewardship of the watersheds they call home and provide them with the opportunity to build upon their past work. A significant portion of the restoration work necessary for this project will be conducted by BECY youth interns.

f) If applicable, describe if there is a potential to leverage the project with other proposed or ongoing projects and describe if there are cost-sharing opportunities with the applicant or other parties.

The proposed restoration work at T4 Ranch will expand on our existing collaborations to build upon and further the landscape-scale restoration efforts of Borderlands Restoration Network. Our ongoing restoration work to date, accomplished in collaboration with multiple local, municipal, state, federal, and private partners, is designed to stabilize soils, increase surface flows and groundwater recharge, and allow native plants to further stabilize soils and provide habitat to native fauna. This project will contribute data to a larger study being conducted by the Arizona Department of Environmental Quality on loose rock structures and sediment retention across the Sky Island region, reflected in the budget as Borderlands Restoration Network Fellowship hours. BRN fellows will compile and analyze the collected data to incorporate the lessons into future management plans, better-informing restoration activities throughout the region. The success of previous restoration work at T4 Ranch has also made it an optimal demonstration site for educational activities with the Borderlands

Earth Care Youth and for other ranchers who may be interested in engaging with sustainable, conservation practices in the future. Bo Simpson, the ranch manager, has agreed to donate his time and farm equipment (such as his truck to haul rocks) to aid in the construction of the loose rock structures. Arizona Department of Environmental Quality will also contribute time and equipment to fly the drones at the project site and to monitor sediment retention. Lastly, BRN will contribute 10% of the overall budget for forgone administrative costs. As an organization adept at working toward common goals across disciplinary and jurisdictional boundaries, BRN is well-positioned to continue to build upon our successes in this watershed while publicly demonstrating effective restoration work.

g) If the project is a continuation of ongoing projects, describe how the project has been shown to be effective.

In 2018, Borderlands Restoration Network collaborated with T4 Ranch to install loose rock structures in six eroding, denuded drainages across the ranch. Borderlands Earth Care Youth interns installed 205 loose rock structures, which cumulatively retained an estimated 30 tons of sediment on the property according to preliminary data courtesy of the Arizona Department of Environmental Quality. The loose rock structures also aided in revegetating the landscape, which was denuded prior to the restoration treatment installation. Combined with sustainable ranching practices, the loose rock structures stimulated the return of many native grasses, such as *Bouteloua curtipendula*, *Bouteloua gracilis*, *Bouteloua barbata* var *rothrockii*, *Bothriochloa barbinodis*, *Heteropogon contortus*, and other grasses and native forbs. This provided forage for T4 Ranch cattle and increased soil stability within the drainages, forging a healthier watershed. Anecdotally, the ranch manager also noticed periods after rain events where water was temporarily detained behind loose rock structures. This short term surface water not only temporarily alleviated the pressure on groundwater for watering cattle, it also extended the hydro-period for the watershed, promoting infiltration (Norman et al., 2015). Over the course of two years, the loose rock structures installed in 2018 have quantitatively and qualitatively exhibited their efficacy for watershed restoration.

h) Describe any duplication or overlap with work that has previously been performed.

Borderlands Restoration Network installed 205 loose rock structures across six drainages in T4 Ranch to great success in 2018. The WMAP grant represents a unique opportunity to build upon this work, further restoring the landscape and gaining a better understanding of best practices for these ecological restoration techniques. Six drainages are yet to be treated in T4 Ranch. In other instances, there is potential to build new loose rock structures atop the ones that have been sedimented in. This will continue to raise and roughen the stream bed, decreasing channelization and increasing water infiltration. There will be no duplication or overlap with previous work aside from maintaining previously installed loose rock structures. After two monsoon seasons, the loose rock structures have held up remarkably well with little to no need for maintenance. However, to further stabilize hydrologic function and restore the overall riparian ecosystem, if we find a previously installed loose rock structure that requires maintenance, we will repair it.

i) Describe how the project will remain effective and sustainable over time.

Over time, loose rock structures and mulch become embedded features of stability within the watershed. Because they are constructed from native materials, they are intended to remain on the landscape for perpetuity. Loose rock structures function by roughening the soil surface, which in turn retains sediment and slows water. This initiates several ecological processes, which in turn yield improved ecological conditions. Some of these benefits include improved water infiltration rates, soil structure, soil moisture, and soil organic matter, and vegetation recruitment and establishment. As plants establish around and within the structure, their roots stabilize the soil and their aboveground structures provide cover for the soil, attenuating the forces of erosive stressors and encouraging groundwater replenishment. As loose rock structures have been used by humans across the world for millennia, we know loose rock structures will eventually be fully “sedimented-in” and invisible to the eye while the benefits remain. Mulch works in a very similar manner. It is only visible for a brief amount of time before initiating the ideal ecological conditions for vegetation to thrive. Similarly to the erosion control structures, the mulch will improve the soils, increase plant establishment, and begin the process of ecological restoration. The driving force behind all of these restoration techniques is to return the landscape to a trajectory of recovery in the most non-invasive, sustainable manner possible. As stewards of the land, BRN is committed to working with T4 Ranch, who have already committed to repairing the erosion control structures for the past two years and many more to come, to ensure that the loose rock structures are serving their purpose for decades into the future.

j) Describe how this project can be duplicated in other areas within the AMA and throughout the site.

The proposed restoration work at T4 Ranch is only one fraction of Borderland Restoration Network’s mission to restore southern Arizona on the landscape-scale. The restoration methodology that BRN proposes to use WMAP funds for has been used on project sites across southern Arizona. Combining loose rock structures with mulching and seeding treatments have been proven as successful restoration tools in arid regions suffering from ecosystem degradation and the destructive effects of drought, unsustainable land-use, fire, and flooding. Any ranch, private property, or publically-owned land with erosion and land degradation issues would benefit from this methodology.

Citations

Coy, H., Norman, L.M., Wilson, N.R., Debenedetto, G.P., Bennett, A.F., Vogel, J., Swetnam, T., & Austin, J.T. (2019) Assessing the Water Budget around Wetland Restoration “Leaky Weirs” at the Cienega Ranch, SE Arizona, USA. [IP-111264]. Society of Ecological Restoration Southwest Conference, Tucson, Arizona.

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Scope of Work

Groundwater Recharge on Working Lands by Local Youth to Enhance Ecosystem Services

Scope of Work

Task #1: Install 150 erosion-control structures

Purpose/Objective: Untreated drainages at T4 Ranch are marked by channelization and headcuts. Installing 150 loose rock structures will have many effects on the landscape including the following scientifically-researched results: decrease peak flow for small-medium flood events, decrease stress in plants and increase vegetation health, increase surface-water availability at sites up to 5km downstream and 1km upstream, extend seasonal flows and increase volumes of available surface water, increase organic matter in soil as a form of carbon sequestration, increase soil-moisture at structures to support riparian plants, and decrease sedimentation downstream.

Description: Install 150 loose rock structures across 12 eroding drainages on T4 Ranch with native materials gathered on-site over the course of two years. The loose rock structures will be made out of rock and wood gathered from the ranch. Structures will be installed to have the greatest impact in reducing erosion and increasing sedimentation, based upon successes from previously-built structures on the ranch. Structures will include: one-rock dams, media-lunas, trincheras, stick structures, and one log dams.

Responsible Personnel: A two-person restoration crew comprised of local residents will be responsible for constructing these structures in Fall 2020 and Fall 2021. The crew will work with the ranch manager to gather and transport materials to untreated locations. The Watershed Restoration Program Manager will conduct project oversight to document progress, manage personnel, and communicate with the land manager.

Deliverable Description: Install 150 erosion control structures across 12 drainages on T4 Ranch with native materials. Photos and GPS points of each structure will be reported back to ADWR staff.

Deliverable Due Date: December 31, 2021

Task #2: Apply mulch and seed across 40 acres

Purpose/Objective: Aside from erosion in the stream beds, large swaths of the ranch are bare ground. In these instances, the soil is exposed to environmental stressors such as sun, rain, and wind, which contributes to water and soil loss. After years of land mismanagement, coupled with the cyclical climatic regime highlighted by drought and flood, upwards of eight inches of topsoil has been lost from these grasslands. In some places, more bare soil is visible than grass. As a result, both the ecosystem and livestock suffer. And water that once infiltrated into the grasslands now sheds off of the bare soil, eroding the landscape and causing downstream flooding.

Description: Distribute native mulch and native grass seed pellets across bare soil surface in the 40-acre project area. Native grass seed will be harvested, cleaned, and pelletized by locals. Pelletization dramatically reduces the seed loss to bird/ant predation. Pelletized native grass seed will then be cast onto patches of barren soil. Using a chainsaw and a chipper/shredder, the crew will cut and chip dead and down native, woody material, such as native velvet mesquite and Emory oak trees, to cover the native grass seed pellets cast on the bare ground. Mulch promotes soil moisture retention and revegetation of bare ground, further stabilizing the soil surface.

Responsible Personnel: A two-person restoration crew comprised of local residents will be responsible for casting the seed pellets and chipping wood mulch in Fall 2020 and Fall 2021. The crew will work with the ranch manager to gather and transport materials to untreated locations. The Watershed Restoration Program Manager will conduct project oversight to document progress, manage personnel, and communicate with the land manager.

Deliverable Description: Apply native grass seed pellets and native wood mulch to bare soil on 40 acres of working grasslands. Photos and descriptions will be reported back to ADWR staff.

Deliverable Due Date: December 31, 2021

Task #3: Train high school students to build 100 erosion-control structures

Purpose/Objective: BRN has learned that the key to fostering a community-wide ethic of environmental appreciation is to engage directly with the local residents, particularly youth and land managers. With a suite of educational programming, BRN empowers and trains the youth of many border communities, including: Patagonia, AZ; Douglas, AZ; Tohono O’odham Nation; and Agua Prieta, Sonora. Collaborative hands-on restoration projects on working lands are developed and implemented in concert with working professionals: ranchers, farmers, conservationists, and agency managers. Borderland youth work alongside land managers, working together to make a brighter future. And this hard work is paying off. After eight years of youth programming, both youth and adults are now taking a leading role in local conservation efforts.

Description: Inspire and engage the next generation of restoration practitioners by hiring and training local high school interns to restore their home watersheds through the Borderlands Earth Care Youth (BECY) Program. A crew of twelve, comprised of ten high school-aged interns and two adult facilitators, will enact best landscape restoration practices - including both constructing erosion-control structures and applying mulch and seed - on drainages around T4 Ranch for two weeks in Summer 2021 and two weeks in Summer 2022.

Responsible Personnel: The crew of 10 high school interns will be recruited from Patagonia Union High School. The two adult facilitators will lead the crew and be hired from previous graduates of the program. The youth program coordinator will organize and manage programming and work, managing communications with the land manager.

Deliverable Description: Hire and train 10 high school students from Patagonia Union High School in grassland and riparian restoration techniques. Supervise high school students to build 100 erosion-control structure and apply further seed and mulch to grassland uplands.

Deliverable Due Date: July 31, 2022

Task #4: Aerial photography and effectiveness evaluation

Purpose/Objective: In order to address how effectively loose rock structures, mulch, and seeding improve water quality and quantity, BRN will monitor the project site through time series photo points, on-the-ground monitoring, and remote sensing imagery. In order to estimate how well erosion control structures slow erosion and run-off, BRN staff will use a protocol adapted by Dr. Ron Tiller of ADEQ from Diaz, et al. (2007), which indicates the theoretical volume of sediment accumulation behind structures.

Description: Task #4: BRN staff measure the loose rock structures' width, height, and basin lengths. The amount of retained sediment may be used as a proxy for improved water quality. Research underscores the relationship between sediment and *E.coli* in streambeds. Understanding how much sediment the loose rock structures retain will help BRN staff understand how well they are removing contaminants from the watershed, mitigating erosion, and improving soil structure (which may increase soil moisture and infiltration). BRN staff will also take photo points of the loose rock structures, mulch, and seeding treatments. Photo points are a time-tested tool to qualitatively track landscape response to restoration treatments over time. Photo-points also enable staff to disseminate findings easily at research conferences and workshops. To monitor the effectiveness of loose rock structures in relation to water quantity, BRN will use LiDAR-equipped drones provided by ADEQ to quantify proxies of increased water infiltration, such as improved vegetation recovery.

Responsible Personnel: Task #4 will require an estimated 116 hours of work performed by a two-person restoration crew at the hourly rate of \$14.50 (totaling \$3,364.00) with fringe benefits rate of 9.1%. Project management for this task will require an estimated 25 hours performed by the Watershed Restoration Program Manager at the hourly rate of \$23.08, totaling \$577.00 across two years. The oversight will receive 24.0% fringe benefits of the total \$577. A total of 20 round-trips, each 22 miles will be made to the site; at \$0.58/mi, this totals \$255.20 in travel costs.

Deliverable Description: Fly drones over the 12 drainages before and after restoration occurs. Measure erosion-control structures once completed. Take fixed-position photo points of various structures over time. Report results back to ADWR staff.

Deliverable Due Date: December 31, 2022

Budget Breakdown

Budget Breakdown

Budget Breakdown Sheet					
Budget Categories	Tasks: Grant Program, Function, or Activity				Total
	<u>Task 1:</u> Install 150 erosion-control structures	<u>Task 2:</u> Apply mulch and seed across 40 acres	<u>Task 3:</u> Train high school students to build 100 erosion-control structures	<u>Task 4:</u> Aerial photography and effectiveness evaluation	
Personnel	\$34,990.00	\$11,688.64	\$9,352.00	\$3,941.00	\$59,971.64
Fringe Benefits	\$6,123.25	\$2,045.52	\$1,636.60	\$689.68	\$10,495.05
Travel	\$1,595.00	\$638.00	\$319.00	\$255.20	\$2,807.20
Equipment	\$0	\$3,000.00	\$0	\$0	\$3,000.00
Supplies	\$285.00	\$6,510.00	\$250.00	\$0	\$7,045.00
Contractual	\$0	\$0	\$12,400.00	\$0	\$12,400.00
Construction	\$0	\$0	\$0	\$0	\$0
Other	\$0	\$0	\$0	\$0	\$0
Total Direct Charges	\$42,993.25	\$23,882.16	\$23,957.60	\$4,885.88	\$95,718.89
Indirect Charges	\$4,299.33	\$2,388.22	\$2,395.76	\$488.59	\$9,571.90
Totals	\$47,292.58	\$26,270.38	\$26,353.36	\$5,374.47	\$105,290.79
TOTAL PROGRAM BUDGET	\$56,353.23	\$32,059.78	\$55,102.48	\$6,454.47	\$149,969.96

Budget Narrative

Budget Narrative

The total award is proposed to be spent between the tasks as follows, which correspond to the Tasks in the Budget Breakdown Sheet.

- 1) Install 150 erosion-control structures
- 2) Apply mulch and seed across 40 acres
- 3) Train high school students to build 100 erosion-control structures
- 4) Aerial photography and effectiveness evaluation

Task #1: Install 150 erosion control structures across 12 eroding drainages on T4 Ranch with native materials gathered on-site. The erosion control structures will be made out of rock and wood gathered from the ranch. Structures will include: one-rock dams, media-lunas, trincheras, stick structures, and one log dams. Scientific studies show the following landscape impacts of erosion-control structures: decrease peak flows for small to medium flood events, decrease stress in plants and increase vegetation health, increase surface water availability at sites up to 5km downstream and up to 1km upstream, extend seasonal flows and increase in-stream volume by around 28%, increase organic matter (OM) in soils (i.e. carbon sequestration), increase soil moisture at structures by around 10%, increase sedimentation downstream.

Task #1 will require an estimated 928 hours of work performed by a two-person restoration crew receiving an average hourly rate of \$14.50, totaling \$26,912 across two years. The two restoration crew members will accrue receive 17.5% of fringe benefits. Project management for this task will require an estimated 350 hours performed by the Watershed Restoration Program Manager at the hourly rate of \$23.08, totaling \$8,078 across two years. The oversight will receive 17.5% fringe benefits of the total \$8,078. A total of 125 round-trips, each 22 miles will be made to the site; at \$0.58/mi, this totals \$893.20 in travel costs. These tasks will require 2 shovels at \$25 each, 2 pick mattocks at \$30 each, 2 hand picks at \$35 each, 1 digging bar at \$35 each, and 7 pairs of gloves at \$10 each.

ITEM	RATE	QTY	TOTAL
Personnel	\$29.00/hour for crew	928 hours	\$26,912.00
	\$23.08/hour for oversight	350 hours	\$8,078.00
Fringe	17.5% for crew	of \$26,912	\$4,709.60
	17.5% for oversight	of \$8,078	\$1,413.65
Travel	\$0.58 per mile	2,750 miles	\$1,595.00
Equipment			
Supplies	\$25/shovel	2	\$50
	\$30/pick mattock	2	\$60
	\$35/hand pick	2	\$70
	\$35/digging bar	1	\$35
	\$10/gloves	7	\$70



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Contractual			
Construction			
Direct Charges			\$42,993.25
Indirect Charges	10%	of \$42,993.25	\$4,299.33
Other			
Total			\$47,292.58

Task #1 activities will include:

1. Gather underutilized rock and dead wood on site, rancher transports to restoration site.
2. Install 150 erosion control structures across 12 drainages on T4 Ranch with native materials.
3. Report results back to ADWR.

Task #2: Distribute native mulch and native grass seed pellets across bare soil surface in the 40-acre project area. Using a power chipper, chip dead and down native, woody material, such as native velvet mesquite and Emory oak trees, to cover bare ground. Mulch promotes soil moisture retention and revegetation of bare ground, further stabilizing the soil surface. It may also act as a seed refugia for hand-scattered seed pellets, further promoting vegetative recovery and stabilizing the soil surface.

Task #2 will require an estimated 337 hours of work performed by a two-person restoration crew receiving an average hourly rate of \$14.50, totaling \$9,773 over two years. The two restoration crew members will accrue receive 17.5% of fringe benefits. Project management for this task will require an estimated 83 hours performed by the Watershed Restoration Program Manager at the hourly rate of \$23.08, totaling \$1,916 over two years. The oversight will receive 17.5% fringe benefits of the total \$8,078. A total of 50 round-trips, each 22 miles will be made to the site; at \$0.58/mi, this totals \$638.00 in travel costs. These tasks will require one 5” diameter Power King Chipper Shredder (at \$3,000), one Stihl MS 391 Farm Boss Chainsaw (at \$600), and 10 pounds of native grass seed (at \$500 per pound, totaling \$5,000.)

ITEM	RATE	QTY	TOTAL
Personnel	\$29.00/hr for crew	337 hours	\$9,773.00
	\$23.08/hr for oversight	83 hours	\$1,915.64
Fringe	17.5% for crew	of \$9,773.00	\$1,710.28
	17.5% for oversight	of \$1,915.64	\$335.24
Travel	\$0.58/mi	1,100 miles	\$638.00



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Equipment	Chipper Shredder	1	\$3,000.00
Supplies	\$600 per Chainsaw	1	\$600.00
	\$30 per pruning saw	2	\$60.00
	\$585 per lb seed	10 pounds	\$5,850.00
Contractual			
Construction			
Direct Charges			\$23,882.16
Indirect Charges	10%		\$2,388.22
Other			
Total			\$26,270.38

Task #2 activities will include:

1. Cut dead and down wood from native trees with chainsaw and hand saws.
2. Work with rancher to transport dead and down wood to bare locations.
3. Cast seed pellets made from native grass seed in barren areas adjacent to restored drainages.
4. Feed dead and down wood into chipper/shredder, creating mulch on bare areas.
5. Report results back to ADWR.

Task #3: Inspire and engage the next generation of restoration practitioners by hiring and training local high school interns to restore their home watersheds through the Borderlands Earth Care Youth (BECY) Program. A crew of twelve, comprised of ten high school-aged interns and two adult facilitators, will be recruited from Patagonia Union High School to enact best landscape restoration practices - including both constructing erosion-control structures and applying mulch and seed - on drainages around T4 Ranch for two weeks in Summer 2021 and two weeks in Summer 2022.

Task #3 will require an estimated 16 days of work performed by the 13-person high school crew with a daily rate of \$1,047, totaling \$16,752. The 10 high school interns receive a total of \$775/day as contractors, the two crew leads receive \$17.00 per hour for 8 hours of work, totaling \$272 per day (in addition to 17.5% fringe). A total of 25 round-trips, each 22 miles will be made to the site; at \$0.58/mi, this totals \$319.00 in travel costs. A youth crew coordinator will work 200 hours at \$25 per hour, totaling \$5,000 (plus 17.5% fringe). The crew will require 25 pairs of gloves at \$10 each.

ITEM	RATE	QTY	TOTAL
Personnel	\$17.00/hr for facilitators	256 hours	\$4,352.00
	\$25.00/hr for oversight	200 hours	\$5,000.00
Fringe	17.5% for crew	of \$4,352.00	\$761.60
	17.5% for oversight	of \$5,000.00	\$875
Travel	\$0.58/mi	550 miles	\$319.00
Equipment			
Supplies	\$10 per pair of gloves	25 pairs	\$250
Contractual	\$775/day	16 days	\$12,400.00
Construction			
Direct Charges			\$23,957.60
Indirect Charges	10%		\$2,395.76
Other			
Total			\$26,353.36

Task #3 activities will include:

1. Hire and train 10 high school students from Patagonia Union High School.
2. Supervise high school students to build 100 erosion-control structures.
3. Supervise high school students to cast seed and mulch.
4. Report results back to ADWR.

Task #4: Monitor the effectiveness of erosion control and mulch restoration treatments with aerial photography and scientific monitoring. Drones will be flown before, during, and after restoration activities to visualize restoration effect on landscape. Using a low-cost, minimal-input monitoring protocol developed by Dr. Ron Tiller of Arizona Department of Environmental Quality (ADEQ), and equipment borrowed from ADEQ, monitor sediment retention behind erosion control structures.

Task #4 will require an estimated 116 hours of work performed by a two-person restoration crew at the hourly rate of \$14.50 (totaling \$3,364.00) with fringe benefits rate of 17.5%. Project management for this task will require an estimated 25 hours performed by the Watershed Restoration Program Manager at the hourly rate of \$23.08, totaling \$577.00 across two years. The oversight will receive 17.5% fringe benefits of the total \$577. A total of 20 round-trips, each 22 miles will be made to the site; at \$0.58/mi, this totals \$255.20 in travel costs.



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ITEM	RATE	QTY	TOTAL
Personnel	\$29.00/hr for crew	116 hours	\$3,364.00
	\$23.08/hr for oversight	25 hours	\$577.00
Fringe	17.5% for crew	of \$3,364.00	\$588.70
	17.5% for oversight	of \$577.00	\$100.98
Travel	\$0.58/mi	440 miles	\$255.20
Equipment			
Supplies			
Contractual			
Construction			
Direct Charges			\$4,885.88
Indirect Charges			\$488.59
Other			
Total			\$5,374.47

Task #4 activities will include:

1. Fly photography drones over 12 drainages before restoration occurs.
2. Measure erosion-control structures after completed.
3. Fly photography drones over 12 drainages after restoration occurs.
4. Report results back to ADWR.

Additional Contribution Breakdown

Additional Contribution Breakdown (Match)

Additional Contribution Breakdown Sheet					
Budget Categories	Tasks: Grant Program, Function, or Activity				Total
	Task 1: Install 150 erosion-control structures	Task 2: Apply mulch and seed across 40 acres	Task 3: Train high school students to build 100 erosion-control structures	Task 4: Aerial photography and effectiveness evaluation	
Personnel	\$3,234.50	\$3,234.50	\$9,352.00	\$400.00	\$16,221.00
Fringe Benefits	\$566.04	\$566.04	\$1,636.60		\$2,768.68
Travel			\$319.00		\$319.00
Equipment	\$3,750.00	\$1,250.00	\$0		\$5,000.00
Supplies			\$250.00	\$500.00	\$750.00
Contractual			\$12,400.00		\$12,400.00
Construction			\$0		\$0
Other			\$0		\$0
Total Direct Charges	\$7,550.54	\$4,824.50	\$23,957.60	\$900.00	\$37,232.64
Indirect Charges	\$1,510.11	\$964.90	\$4,791.52	\$180.00	\$7,446.53
Totals	\$9,060.65	\$5,789.40	\$28,749.12	\$1,080.00	\$44,679.17

Match Narrative

Task 1 Match Sources:

Personnel:

Expert advisory support 40 hours @ \$50/hour. Match from BRN.



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T4 Ranch personnel support 50 hours @ \$24.69/hour. In-kind from T4 Ranch.

Fringe Benefits:

17.5% of Expert advisory support at \$2,000. Match from BRN.

Equipment:

Use of T4 Ranch backhoe 50 hours @ \$75/hour. In-kind from T4 Ranch.

Indirect:

20% of direct costs are actual BRN costs. Match from BRN.

Task 2 Match Sources:

Personnel:

Expert advisory support 40 hours @ \$50/hour. Match from BRN.

T4 Ranch personnel support 50 hours @ \$24.69/hour. In-kind from T4 Ranch.

Fringe Benefits:

17.5% of Expert advisory support at \$2,000. Match from BRN.

Equipment:

Use of T4 Ranch truck 50 hours @ \$25/hour. In-kind from T4 Ranch.

Indirect:

20% of direct costs are actual BRN costs. Match from BRN.

Task 3 Match Sources: All match from an acquired US Forest Service Youth and Veterans Program Fund

Personnel:

Two crew leads receive \$17.00 per hour for 8 hours of work.

Youth crew coordinator will work 200 hours at \$25 per hour.

Fringe Benefits:

17.5% of Expert advisory support at \$2,000.

Travel:

25 round-trips, each 22 miles at \$0.58/mi.

Supplies:



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25 pairs of gloves at \$10 each.

Contractual:

10 high school interns at \$775/day for 16 days.

Indirect:

20% of direct costs are actual BRN costs.

Task 4 Match Sources:

Personnel:

Expert advisory support 8 hours @ \$50/hour. Match from BRN.

Fringe Benefits:

17.5% of Expert advisory support at \$2,000. Match from BRN.

Indirect:

20% of direct costs are actual BRN costs. Match from BRN.

Supplemental Information:

Evidence of Physical and Legal Availability of Water

To Whom It May Concern:

The project entitled “Groundwater Recharge on Working Lands by Local Youth to Enhance Ecosystem Services” does not use nor require water. Therefore, evidence of physical and legal availability of water is not necessary.

Thank you for your time and consideration.

Best,
Audrey Rader
Watershed Restoration Program Manager
arader@borderlandsrestoration.org
(775) 513-4904

Evidence of Control and Tenure of Land



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To Whom It May Concern:

Attached are the shape files for parcels of T4 Ranch where Borderlands Restoration has proposed to conduct restoration activities. These shapefiles are owned by the Santa Cruz County Assessor's Office (<http://gis.santacruzcountyaz.gov/asr/parcel.html>) and prove that T4 Ranch is owned by Metz Trust Agreement.

Parcels South of Highway 82(where structures may be built in the future)

105-40-003

105-40-004

105-40-005

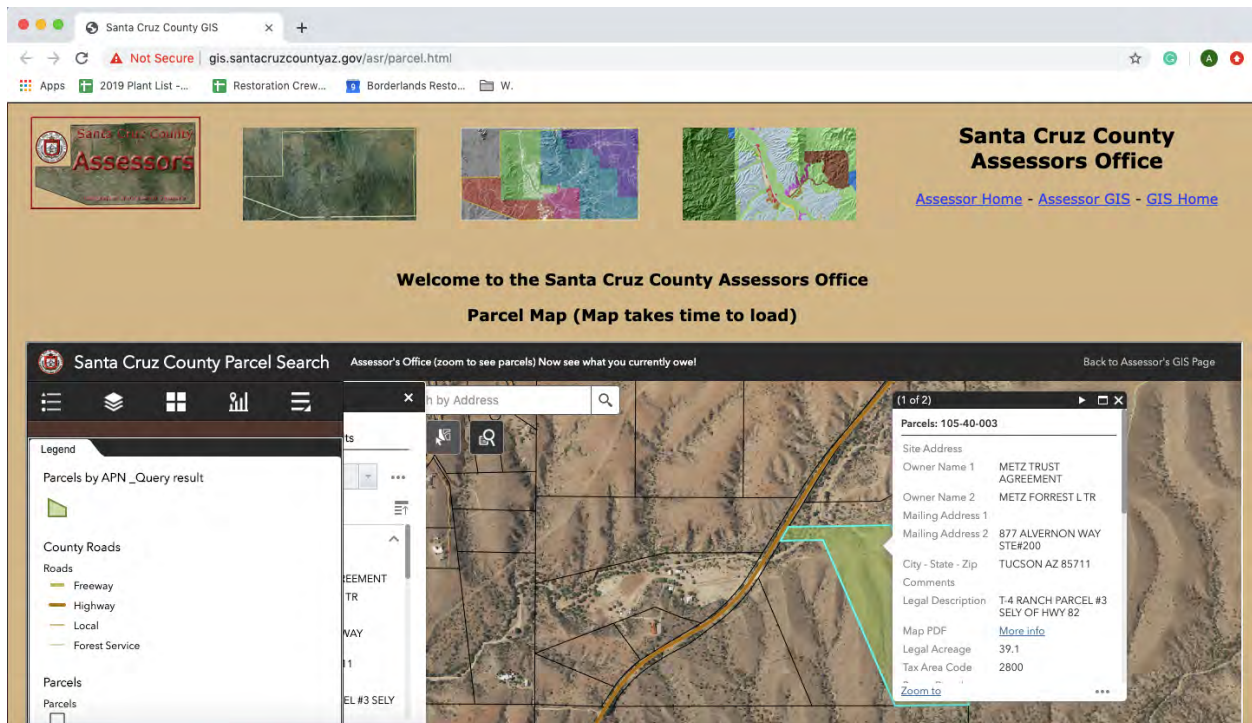
Parcel North of Highway 82(where structures were built in 2018):

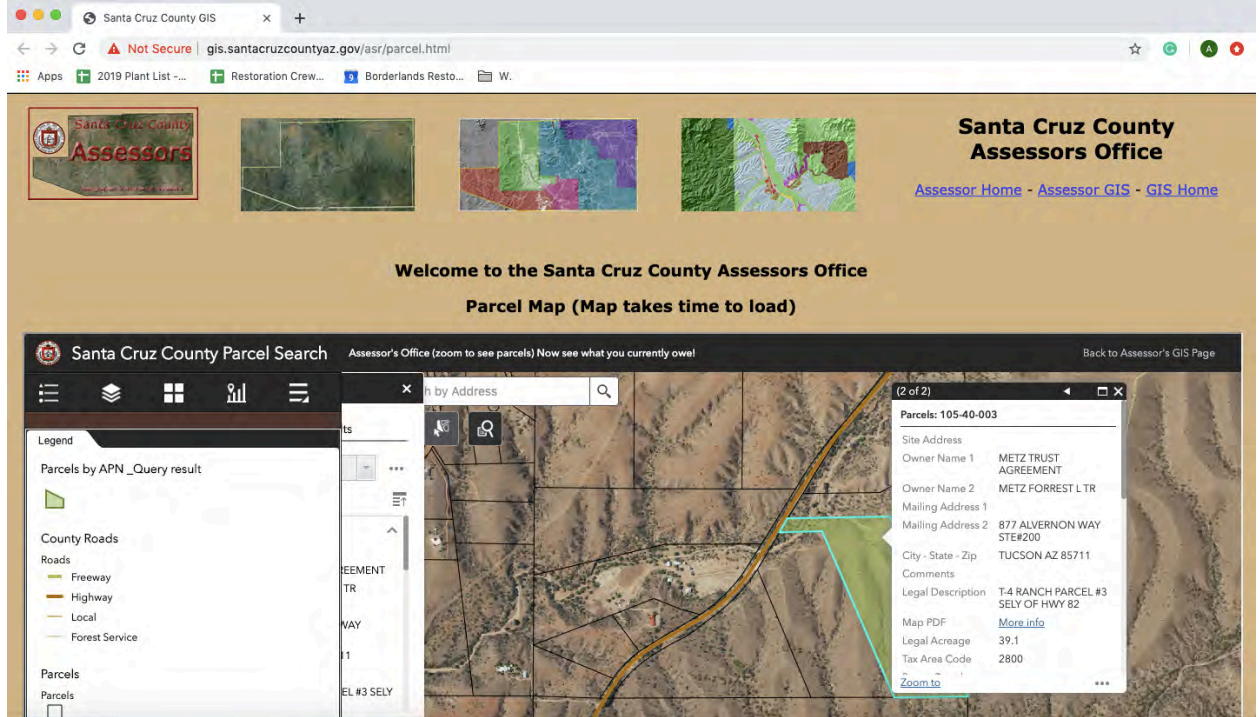
105-38-007

105-39-003

Thank you for your time and consideration.

Parcel 105-40-003:





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Parcel Map (Map takes time to load)

Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

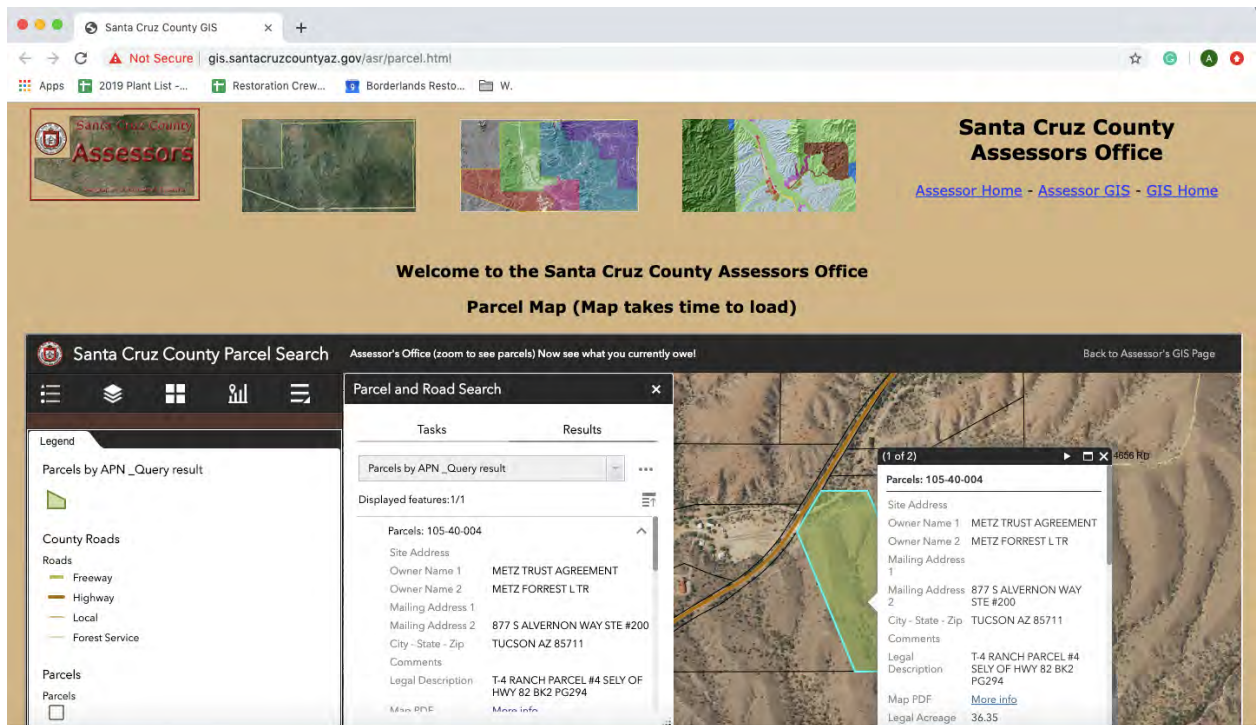
Search by Address: [Search Box]

Parcels: 105-40-003

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORREST L TR
Mailing Address 1	
Mailing Address 2	877 ALVERNON WAY STE#200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #3 SELY OF HWY 82
Map PDF	More info
Legal Acreage	39.1
Tax Area Code	2800

[Zoom to](#)

Parcel 105-40-004:



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Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

Parcel and Road Search

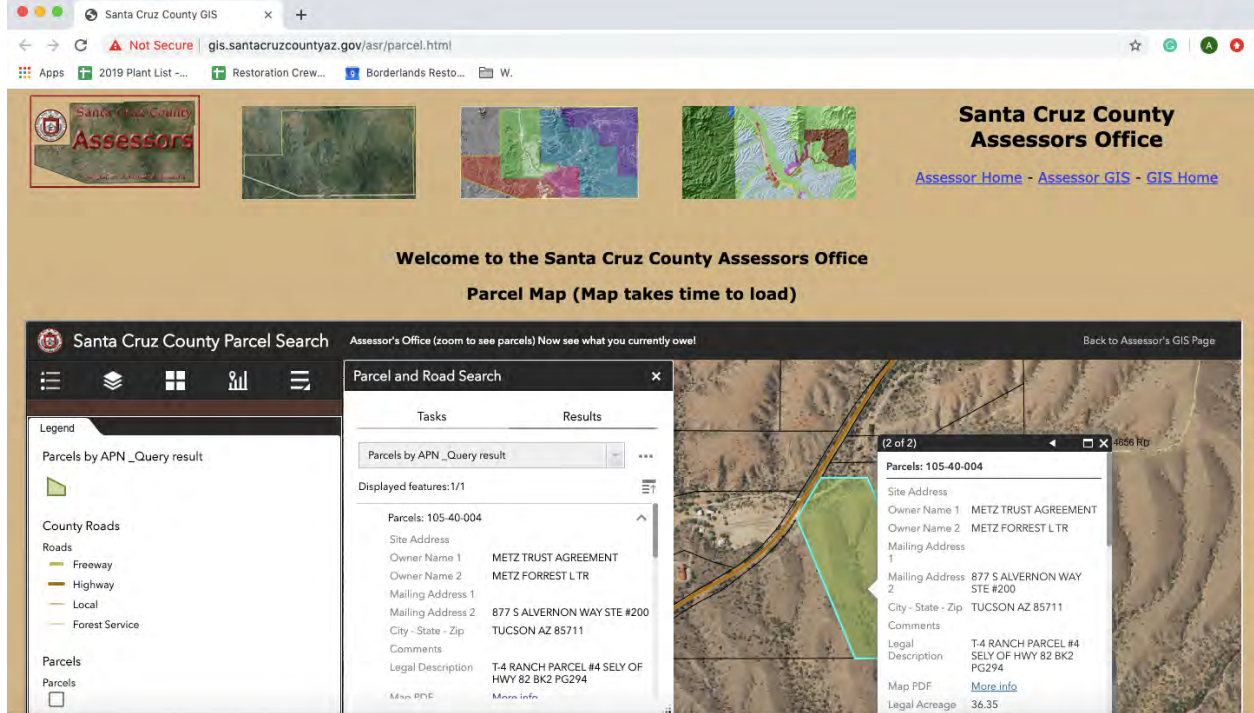
Tasks Results

Parcels by APN_Query result

Displayed features: 1/1

Parcels: 105-40-004

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORREST L TR
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY STE #200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #4 SELY OF HWY 82 BKZ PG294
Map PDF	More info
Legal Acreage	36.35



Santa Cruz County GIS

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Parcel Map (Map takes time to load)

Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

Parcel and Road Search

Tasks Results

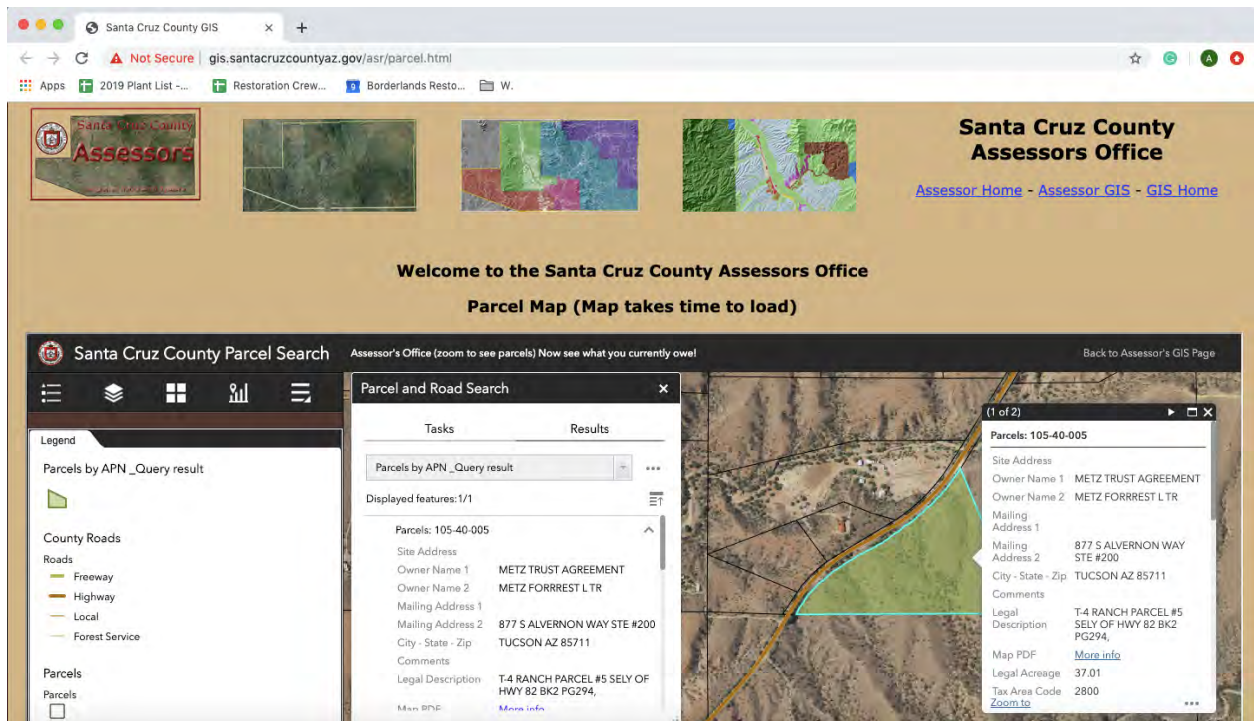
Parcels by APN_Query result

Displayed features: 1/1

Parcels: 105-40-004

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORREST L TR
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY STE #200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #4 SELY OF HWY 82 BK2 PG294
Map PDF	More info
Legal Acreage	36.35

Parcel 105-40-005:



Santa Cruz County GIS

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Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

Parcel and Road Search

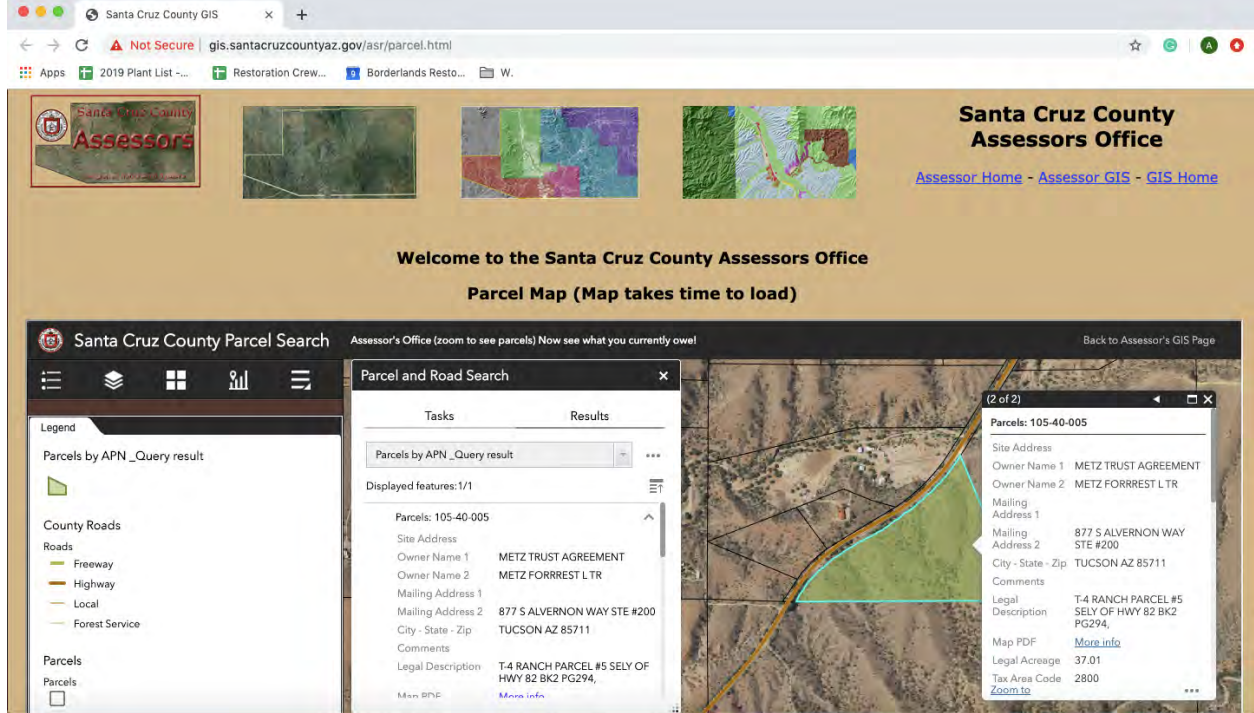
Tasks Results

Parcels by APN_Query result

Displayed features: 1/1

Parcels: 105-40-005

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORREST L TR
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY STE #200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #5 SELY OF HWY 82 BK2 PG294
Map PDF	More info
Legal Acreage	37.01
Tax Area Code	2800
Zoom to	



Santa Cruz County GIS

gis.santacruzcountyaz.gov/asr/parcel.html

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Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

Legend: Parcels by APN_Query result, County Roads (Freeway, Highway, Local, Forest Service), Parcels

Parcel and Road Search

Tasks: Parcels by APN_Query result

Results: Displayed features: 1/1

Parcels: 105-40-005

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORRREST LTR
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY STE #200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #5 SELV OF HWY 82 BK2 PG294.

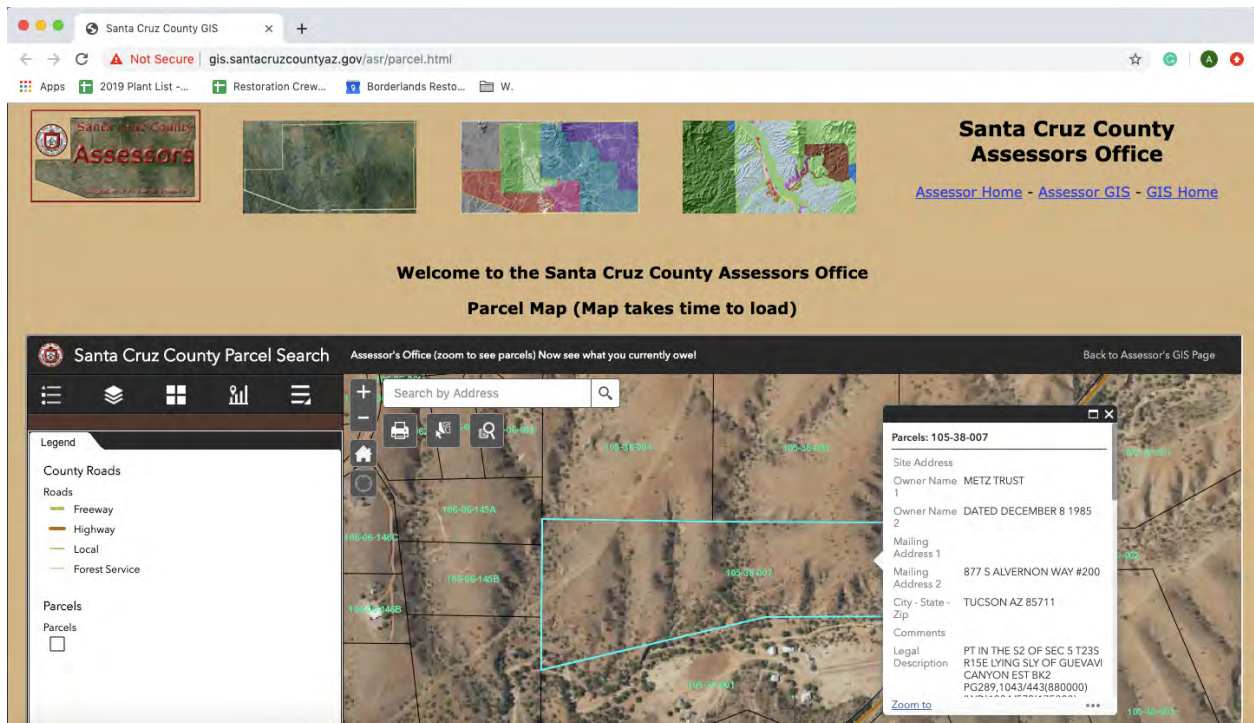
Map PDF: [More info](#)

Legal Acreage: 37.01

Tax Area Code: 2800

[Zoom to](#)

Parcel 105-38-007:



Santa Cruz County GIS

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Santa Cruz County Parcel Search Assessor's Office (zoom to see parcels) Now see what you currently owe!

Search by Address

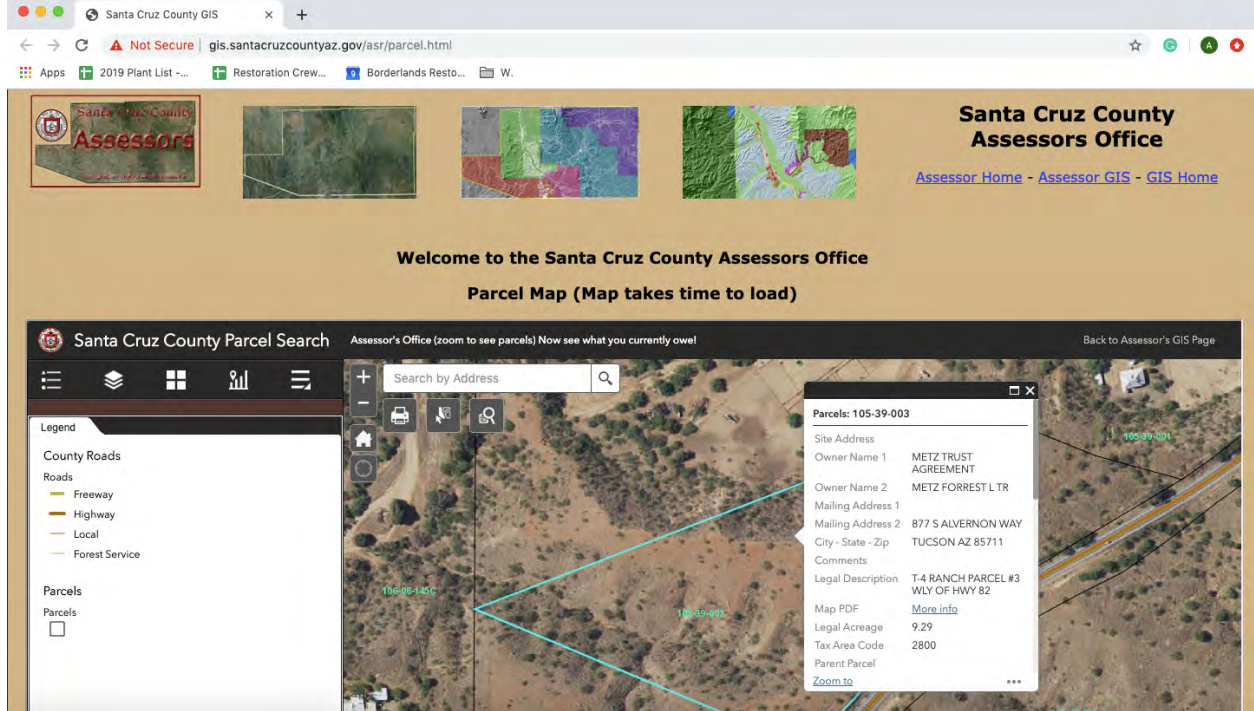
Legend: County Roads (Freeway, Highway, Local, Forest Service), Parcels

Parcels: 105-38-007

Site Address	
Owner Name 1	METZ TRUST
Owner Name 2	DATED DECEMBER 8 1985
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY #200
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	PT IN THE S2 OF SEC 5 T23S R15E LYING SLY OF GUEVAI CANYON EST BK2 PG289, 1043/4+2(880000)

[Zoom to](#)

Parcel 105-39-003:



The screenshot shows a web browser window with the URL `gis.santacruzcountyaz.gov/asr/parcel.html`. The page header includes the Santa Cruz County Assessors Office logo and navigation links: [Assessor Home](#), [Assessor GIS](#), and [GIS Home](#). A welcome message reads: "Welcome to the Santa Cruz County Assessors Office Parcel Map (Map takes time to load)".

The main content area is titled "Santa Cruz County Parcel Search" and features a search bar with the text "Search by Address". A legend on the left lists "County Roads" (Freeway, Highway, Local, Forest Service) and "Parcels" (with a checkbox). The map displays an aerial view with several parcels outlined in cyan. A pop-up window titled "Parcels: 105-39-003" provides the following details:

Site Address	
Owner Name 1	METZ TRUST AGREEMENT
Owner Name 2	METZ FORREST L TR
Mailing Address 1	
Mailing Address 2	877 S ALVERNON WAY
City - State - Zip	TUCSON AZ 85711
Comments	
Legal Description	T-4 RANCH PARCEL #3 WLY OF HWY 82
Map PDF	More info
Legal Acreage	9.29
Tax Area Code	2800
Parent Parcel	
Zoom to	***

February 11, 2020

Arizona Department of Water Resources
RE: Water Management Assistance Program
1110 West Washington Street, Suite 310
Phoenix, AZ 85007

**RE: Groundwater Recharge on Working Ranch by
Local Youth to Enhance Ecosystem Services**

Dear Water Management Assistance Program
Representatives:

Metz Trust (the "Landowner") is in support of the project to help restore the Cumero Canyon watershed on the T-4 Ranch (the "Project"), led by Borderlands Restoration Network ("Borderlands") in collaboration with T-4 Ranch Manager, Bo Simpson.

Borderlands anticipates working on the Project between June 2020 and June 2022. Landowner will be able to provide support to Borderlands to stage Project materials. Landowner understands that representatives from Borderlands will also survey the restoration area during and after the project, with Landowner consent. As part of a long-term monitoring effort to understand the impact of the work, representatives from Borderlands would like to access the property on an annual basis up to five years after the Project is completed.

Borderlands shall provide evidence of insurance coverage, including comprehensive liability insurance, to the satisfaction of Landowner prior to the commencement of the Project. Borderlands also understands that all access to the T-4 Ranch property, work and monitoring prior, during and after the Project, requires advance written approval from the Landowner.

Sincerely,
Metz Trust

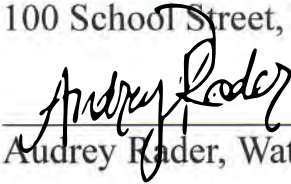


Richard W. Hammel, Trustee

Accepted By:

Borderlands Restoration Network

100 School Street, Patagonia, AZ 85624



Audrey Rader, Watershed Restoration Program Manager

**State Historic
Preservation Office
(SHPO) Review Form**

Appendix D. State Historic Preservation Office (SHPO) Form

Any ADEQ action, including grant projects paid in-part with ADEQ funds, on state, federal, or private lands that may impact historic properties (i.e., any prehistoric or historic-period district, site, building, structure, or object included in, or eligible for inclusion in the State Register of Historic Places) require consultation with the State Historic Preservation Office (SHPO) pursuant to the State Historic Preservation Act (ARS 41-861 to 864). ADEQ is legally responsible for making determinations and findings.

In order to make informed decisions and facilitate consultation with SHPO, ADEQ requires applicants to provide the project related information requested below. By working together, we can seek out ways that "the historical and cultural foundations of this state can be preserved as a living part of our community life and development" (State Historic Preservation Act).

For Each On-the-ground Project Site

Please prepare and answer the following questions pertaining to historic properties and preservation. Use multiple forms as needed. Add map(s), drawings and pictures where appropriate. When complete, copy and paste this information into your grant application in the requested area.

1. Project Location

Indicate the location of the project sites, including:

- County,
- Township, range and section
- Nearest Town or City

Describe the conditions of the land in the project area. Attach a copy a USGS topographic map with the project area clearly marked. On the map, please specify the area(s) where impacts will occur.

Provide project location information (use as much space as needed)
Santa Cruz County, AZ near Nogales and Patagonia.

2. Project Description:

Describe the buildings or structures within project area and their age. Describe any ground-disturbing activities. Indicate whether the proposed project could impact historical properties, should they be present.

Provide project description (use as much space as needed)
The only structures present on the properties are barbed-wire fences that appear relatively recent. Ground-disturbing activities will be limited to dumping rock next to established dirt roads; carrying rock into arroyos by wheelbarrow and limiting that movement to agreed-upon paths; using shovels to dig approx 8in into the arroyo channel bottom, and building one-rock structures with the rock. It is possible that historical properties could be present along the arroyos and roads, and we look forward to identifying said properties and avoiding them per SHPO instructions.

3. Steps Taken to Identify Historic Properties

- Indicate whether the project area has been previously surveyed to determine the presence or absence of historic properties? If it has, attach a report.
- Are buildings, structures, or objects 50 years old or older present in the project area? If yes, include description.
- Are any prehistoric or historic-period archaeological sites present? If yes, please list and briefly describe.
- What does the state or federal land manager, if any, say about historic properties present in the project area? Attach letter, if applicable.
- What efforts, if any, would be reasonable to determine the presence or absence of historic properties?

Provide synopsis of steps taken to identify historic properties (use as much space as needed)

We, the landowner Wildlife Corridors, and USFS are unaware of historical properties or objects that meet the required criteria for clearance. We have had cultural resource surveys at the corridor property and the determination was made that our work would not impact sites (old roads, in this case, but not in the proposed project area). Based on past experience with multiple funders and SHPO, it seems likely that a short survey of the specific areas where we will work will suffice to provide clearance, and we will determine the exact areas where we hope to work and be able to provide that information to the cultural resource expert and SHPO very soon after receiving an award for the project.

4. Potential for Historic Impacts

In the applicant's opinion, which determination listed below is appropriate for this project based on the information presented above:

- No impacts/ historic properties not present
- No impacts/ historic properties present. Describe how historic properties will be avoided or protected.
- Negative impacts to historic properties. Suggest treatment measures.
- Positive impacts to historic properties. Describe any positive impacts to historic properties that could be attributed to the proposed project.

Describe how any negative impacts to historic properties will be avoided and describe potential positive impacts (use as much space as needed)

On a similar project underway now at Sands Ranch, the cultural resource survey determined that our erosion control work in the vicinity of, but not negatively affecting, cultural resources would positively impact the site by stabilizing soils and encouraging sediment to accumulate and protect it. If historic properties are found in the areas we hope to work, we will adjust our methods to avoid them as have done many times in the past, and/or shift our work to other sites under the guidance of resource experts and SHPO.

SHPO-2017-1408 (139555)

For SHPO Use Only - Record of Consultation

SHPO advises ADEQ on the completeness of identification effort, determination of effect, and any proposed treatment measures.

Concur with determination

Do not concur with determination

Request More Information

Recommend that the project area be surveyed to determine the presence or absence of historic properties by a qualified professional

Additional comments attached

Signed: Mary-Ellen Walsh Date: 10/19/17

a qualified archaeologist should conduct a Class III survey and submit a report to SHPO for review & comment prior to ground-disturbing activities

A Cultural Resources Survey of Erosion Control Structures for Habitat Restoration Southwest of Patagonia, Santa Cruz County, Arizona

Deborah L. Swartz

Reviewed by

Patricia Castalia
Desert Archaeology, Inc.
3975 N. Tucson Boulevard
Tucson, Arizona 85719

Submitted to

Caleb Weaver
Borderlands Restoration
P.O. Box 1191
Patagonia, Arizona 85624



Project Report No. 18-113
Desert Archaeology, Inc.
Project No. 18-125

3975 North Tucson Blvd., Tucson, AZ 85716 • May 11, 2018

SHPO REPORT ABSTRACT

Report Title: A Cultural Resources Survey of Erosion Control Structures for Habitat Restoration Southwest of Patagonia, Santa Cruz County, Arizona

Project Name: T4 Ranch Survey

Project Location: Southwest of Patagonia, Arizona

Project Locator UTM: UTM locator 515711 E 3480000 N, Zone 12, NAD83

Project Sponsor: Borderlands Restoration

Sponsor Project Number(s): N/A

Lead Agency: Arizona Department of Environmental Quality (ADEQ)

Other Involved Agencies: State Historic Preservation Office

Applicable Regulations: Arizona State Historic Preservation Act of 1982 (ARS §41-861 et seq., as amended), Arizona Antiquities Act, ARS §41-865

Funding Source: ADEQ

Description of the Project: ADEQ is funding installation of erosion control structures for habitat restoration within the project area.

Area of Potential Effects (APE): The APE includes 11 drainages, 3 access roads, and 3 staging areas. It also includes any historic properties that would be affected by the construction project.

Legal Description: The project is in Section 5, Township 23 South, Range 15 East (Gila and Salt River Base and Meridian) on the 1996 USGS 7.5-minute topographic quad Cumero Canyon, Arizona (AZ EE:9:[NE]).

Land Jurisdiction: Private

Total Acres: 7

Consultant Firm/Organization: Desert Archaeology, Inc.

Project Number: 18-125

Permit Number(s): None

Date(s) of Fieldwork: May 4, 2018

Number of IOs Recorded: None

Number of Sites Recorded: None

Eligible Sites: 0

Ineligible Sites: 0

Unevaluated Sites: 0

Sites Not Relocated: None

Comments: A cultural resources survey of 11 drainages, 3 access roads, and 3 staging areas on private property has been completed. No cultural resources were identified within the APE, and therefore, it is recommended the project proceed as planned with a finding of "no historic properties affected." In the event that buried archaeological/historical remains are encountered in the area as the erosion control structures are being constructed, work should be temporarily halted until an archaeologist can assess the findings. Additionally, if ground-disturbing work boundaries extend outside the APE during this project, consultation will be required to determine if any previously unevaluated areas would be impacted, and additional archaeological investigation may be required.

TABLE OF CONTENTS

SHPO REPORT ABSTRACT.....	2
LIST OF FIGURES.....	5
LIST OF TABLES.....	6
PROJECT DESCRIPTION.....	7
PROJECT LOCATION.....	7
PREVIOUS RESEARCH / RECORDS SEARCH.....	7
PHYSIOGRAPHIC CONTEXT.....	7
CULTURAL HISTORY.....	10
History of the Project Area.....	14
SURVEY METHODS.....	14
SURVEY FINDINGS.....	16
RECOMMENDATIONS.....	16
REFERENCES CITED.....	17

LIST OF FIGURES

1. Location of the project area	8
2. Reproduction of the 1996 USGS 7.5-minute topographic quad Cumero Canyon, Arizona (AZ EE:9:[NE]), showing the location of the project area.....	9
3. Photograph of an example erosion control feature.....	10
4. Detail map of the surveyed areas	11
5. Map of previously recorded cultural resources surveys and archaeological sites within 1 mile of the project area.....	12
6. Location of the project area on the 1914 General Land Office supplemental plat of Township 23 South, Rangeh 15 East.....	15
7. Photograph of drainage 4	16
8. Photograph of vegetation along drainage 6.....	16

LIST OF TABLES

1. Previous cultural resources surveys within 1 mile of the project area13
2. Previously recorded archaeological sites within 1 mile of the project area13

A CULTURAL RESOURCES SURVEY OF EROSION CONTROL STRUCTURES FOR HABITAT RESTORATION SOUTHWEST OF PATAGONIA, SANTA CRUZ COUNTY, ARIZONA

PROJECT DESCRIPTION

Borderlands Restoration, with funding from the Arizona Department of Environmental Quality (ADEQ), is planning to conduct habitat restoration along washes on private property southwest of Patagonia, Santa Cruz County, Arizona (Figure 1). The scope of work will include the installation of erosion control structures (what archaeologists commonly call checkdams) along the course of 11 drainages. Three access roads and three staging areas are also included as part of the restoration project (Figure 2). The erosion control structures will be constructed completely within the wash channels using available loose sticks and rocks (Figure 3). If material is not available near its placement within the drainage, rocks will be brought in by a 9-ft-wide front-end loader on existing and new access roads to specific staging areas adjacent to the drainages. All activities will be confined to the areas surveyed or existing roads. The cultural resources survey reported here was conducted to meet requirements of the Arizona State Historic Preservation Act of 1982 (ARS §41-861 et seq., as amended) and the Arizona Antiquities Act, ARS §41-865. Deborah Swartz of Desert Archaeology conducted an archaeological field survey on May 4, 2018.

The current project area includes approximately 3 km of 10-m-wide right-of-way along 11 small drainage channels. Additionally, three 5-m-wide access roads and three 10-m-diameter staging areas were surveyed (Figure 4). The APE also includes any historic properties that would be indirectly affected by installation of the erosion control structures.

PROJECT LOCATION

The project area is located approximately 7 miles southwest of Patagonia, Santa Cruz County, Arizona in Section 5, Township 23 South, Range 15 East (Gila Salt River Baseline and Meridian), on the 1996 USGS 7.5-minute topographic quad Cumero Canyon, Arizona (see Figure 1). Its UTM locator is 515711 E 3480000 N, Zone 12, NAD83. The entire survey area is on private land.

PREVIOUS RESEARCH / RECORDS SEARCH

Background research was conducted at the Arizona State Museum (ASM) on May 3, 2018, and by accessing online AZSITE (the state's electronic inventory of cultural resources) and General Land Office (GLO) survey plats. Three cultural resources surveys have been conducted within 1 mile of the survey area, including one along State Route 82 that passes between surveyed portions of the project (Figure 5; Table 1). Two archaeological sites have been located outside of the project area but within a 1-mile radius of the survey area (see Figure 5; Table 2).

PHYSIOGRAPHIC CONTEXT

The project area is located approximately 0.2 miles south of Sonoita Creek on the bajada of the Patagonia Mountains. The seasonal drainage through the project area flows into the Santa Cruz River approximately 5 miles to the southwest. The project area contains flora typical of the Semidesert grasslands

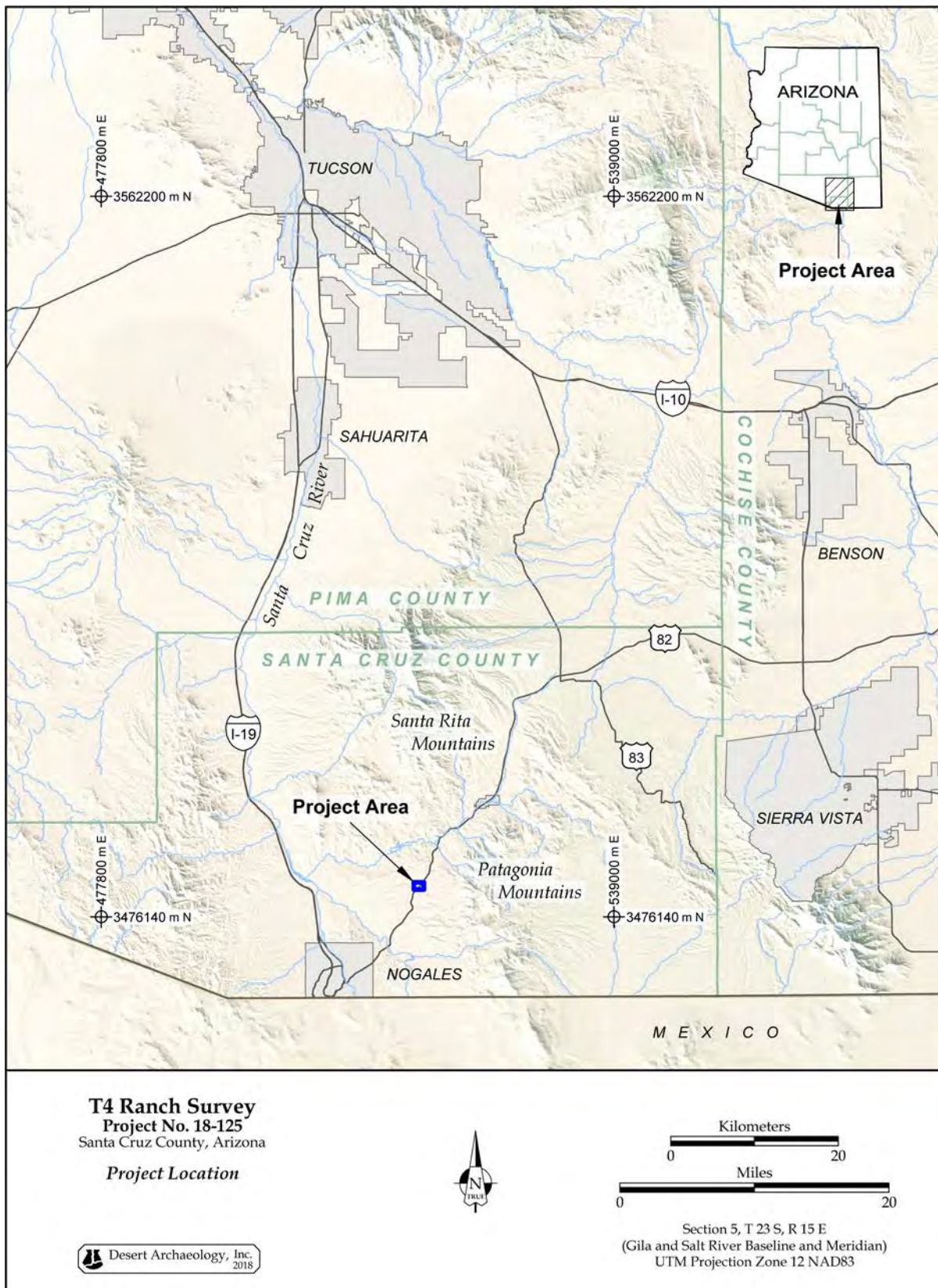


Figure 1. Location of the project area.

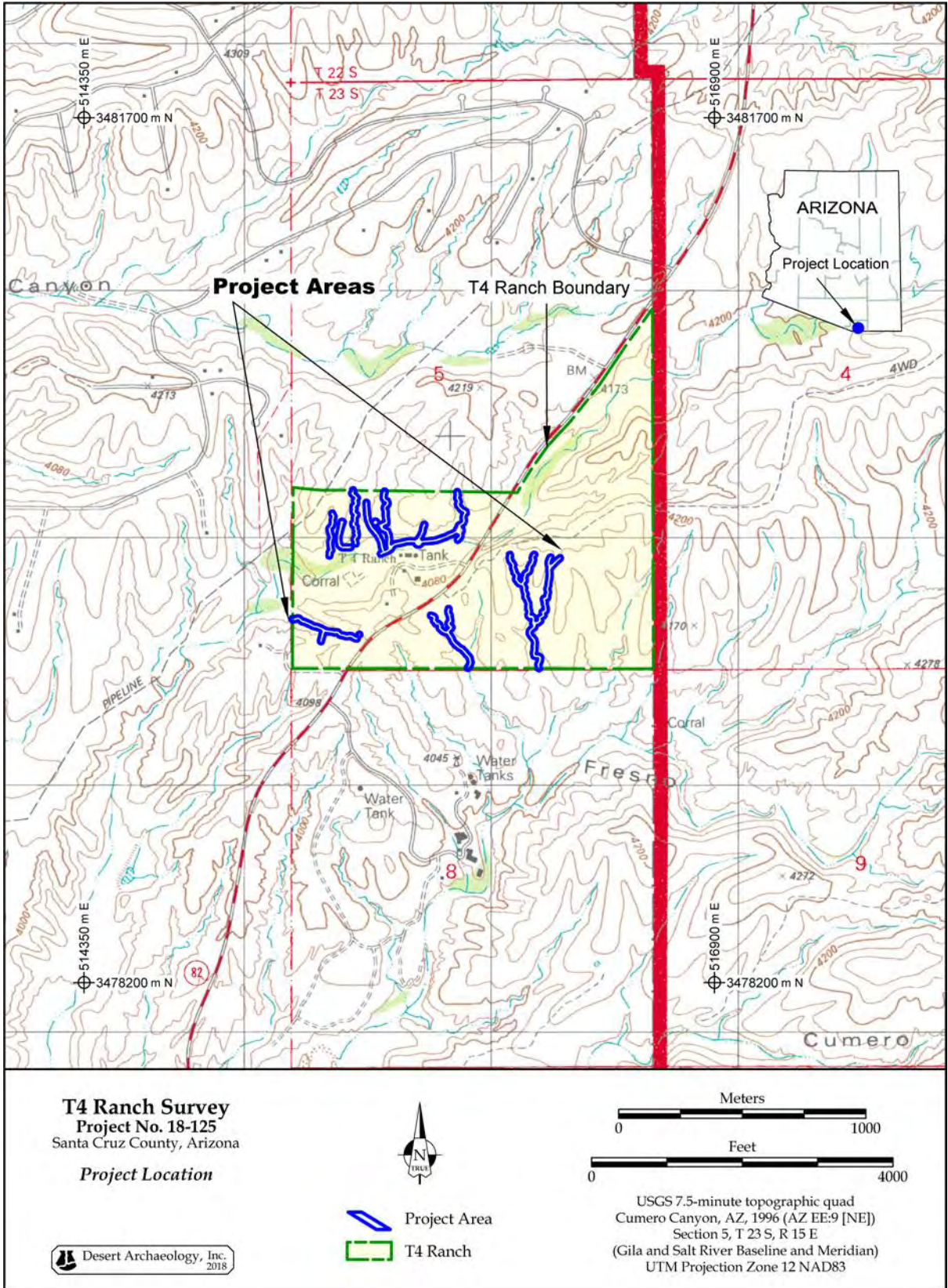


Figure 2. Reproduction of the 1996 USGS 7.5-minute topographic quad Cumero Canyon, Arizona (AZ EE:9:[NE]), showing the location of the project area.

(Brown 1994:123). Vegetation is predominantly mesquite trees, oak trees, and various grasses in the drainages. Scattered flora across the grassy ridges includes ocotillo, cholla cacti and yucca. The exposed substrate consists of sedimentary rocks and consolidated conglomerates (Arizona Geological Survey 2000). Elevations within the project area range from approximately 4,050 to 4,150 ft above sea level.



Figure 3. Photograph of an example erosion control feature (courtesy of Borderlands Restoration).

CULTURAL HISTORY

The history of the Southwest is marked by a close relationship between people and the natural environment. Environmental conditions have strongly influenced subsistence practices and social organization, and social and cultural changes have, in turn, made it possible to more efficiently exploit environmental resources. Through time, specialized adaptations to the arid region distinguished people living in the Southwest from those in other areas. Development of cultural and social conventions also became more regionally specific, and by AD 650, groups living in one part of the Southwest can be readily differentiated from those living in other areas of the Southwest. Today, the harsh desert climate is no longer isolating, but life remains closely tied to the unique resources of the Southwest.

Southern Arizona has been almost continuously occupied since the Paleoindian period (9500–8500 BC), the time when big-game hunters of the late Pleistocene and early Holocene preyed on now-extinct large game such as mammoth and bison. A handful of Paleoindian sites are found in southern Arizona, including several well-known mammoth kill sites in the San Pedro River Valley east of the project area. The Pleistocene hunters were followed by people from what is referred to as the Archaic lifeway. Archaic peoples maintained a seasonally mobile existence, utilizing the various natural resources available in upland and lowland environments. This subsistence strategy of intensive wild plant gathering and the hunting of small game persisted for nearly 6,000 years (8500–2800 BC).

During the Late Archaic/Early Agricultural period (2800 BC–AD 50), domesticated crops such as corn, beans, squash, cotton, amaranth, and tobacco were added to the suite of wild plants used by peoples of the region. The late Archaic/Early Agricultural lifestyle is best described as a fusion of farming and foraging, with some groups shifting toward reduced residential mobility. Substantial sites are located along the floodplains of perennially flowing streams, and are characterized by pithouse settlements focused on farming, food resource processing, and grain storage activities. Optimal upland settings, such as mountain passes and canyon mouths, much like the setting of the project area, were often used as seasonal base camps where intensive resource processing activities took place.

Beginning around AD 50, the region was inhabited by pottery-manufacturing, sedentary agriculturalists that lived in hamlets and villages, often with clusters of substantially built pithouses forming discrete courtyard groups. Plain ware pottery and other material culture, architecture, and settlement patterns were rather uniform across much of southern and central Arizona during the Early Ceramic period (AD 50–500). At this time, the region witnessed the development of new trade networks in shell, turquoise, obsidian, and other material goods.

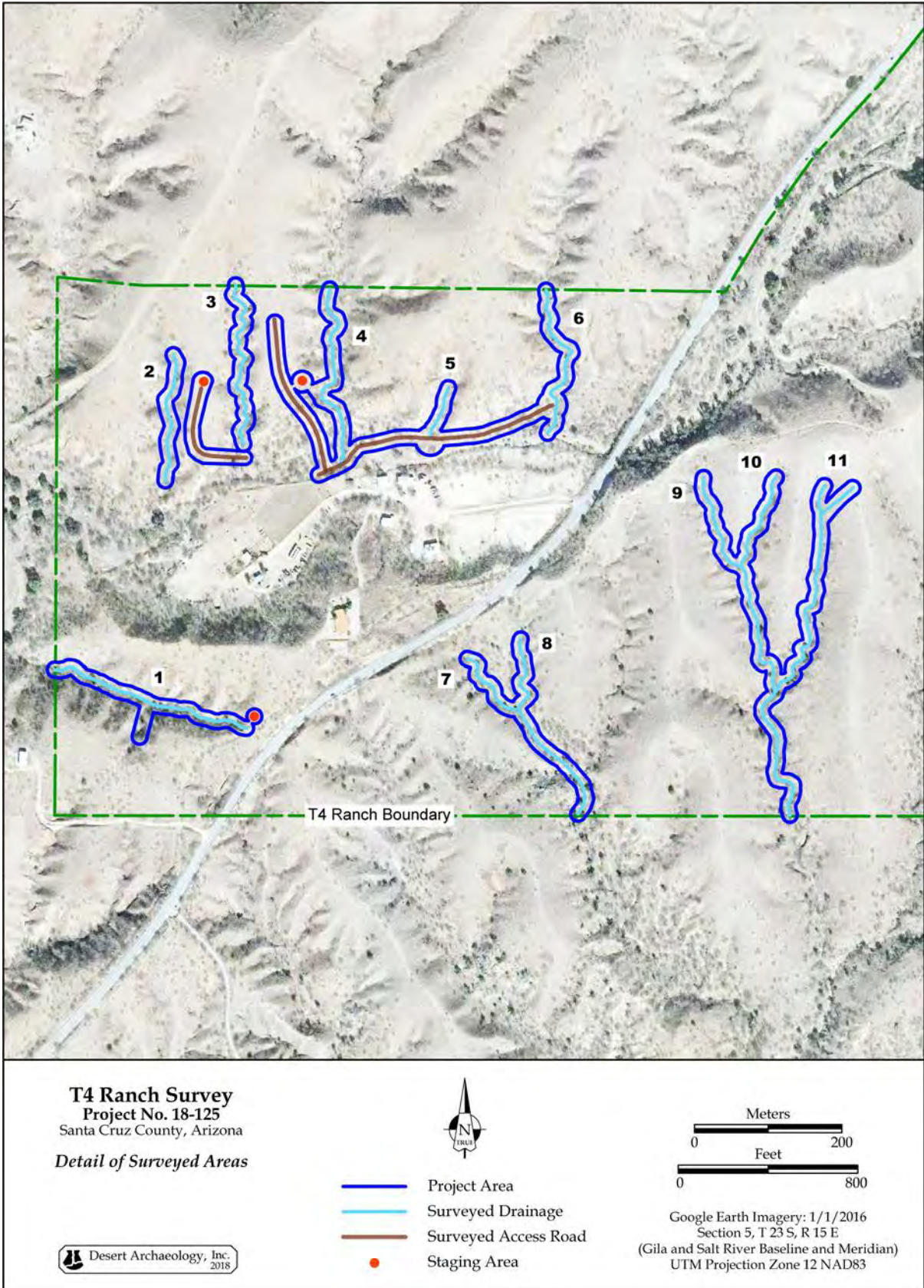


Figure 4. Detail map of the surveyed areas.

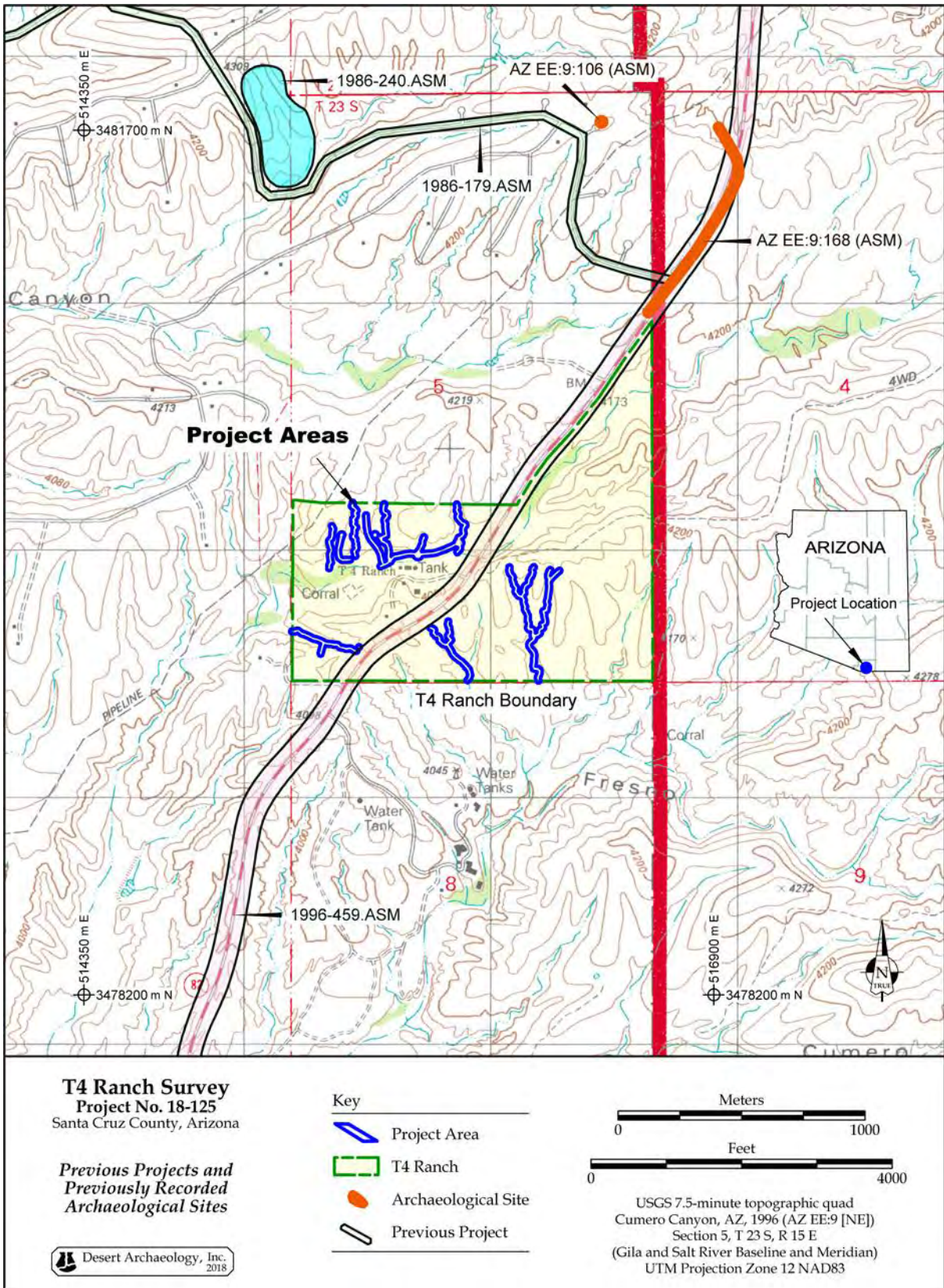


Figure 5. Map of previously recorded cultural resources surveys and archaeological sites within 1 mile of the project area.

Table 1. Previous cultural resources surveys within 1 mile of the project area.

Agency No.	Project Name	Organization	Report Author and Year
1986-240.ASM	Patagonia State Park Access Road	Gutierrez-Palmenberg, Inc.	Gutierrez-Palmenberg, Inc. 1987
1986-179.ASM	Patagonia State Park Access Road	Gutierrez-Palmenberg, Inc.	Smithwick 1986
1996-459.ASM	SR 82, Nogales-Sonoita-SR 90	Archaeological Research Services	Hathaway 1996

Table 2. Previously recorded archaeological sites within 1 mile of the project area.

Site No.	Site Type	Year Recorded	National Register Eligibility	Report Author and Date
AZ EE:9:106 (ASM)	Prehistoric lithic scatter and rock feature	1986	Not evaluated, recorder	Smithwick 1986
AZ EE:9:168 (ASM)	Nogales to Tombstone/Lowell Highway	1996	Eligible individually, SHPO	Hathaway 1996

From about AD 650 to 1450, population increased, and the agricultural economy expanded. Permanent villages became common, growing in size and complexity. Integrative features, such as ballcourts and platform mounds, served as links among communities within the Hohokam system. The Hohokam are known for their finely made pottery, elaborately carved stone palettes, carefully crafted shell jewelry, and fired clay figurines (Haury 1976).

The Trincheras culture developed at the same time as the Hohokam culture. Found in northern Sonora and southern Arizona, the Trincheras culture is less well understood, due to the lack of reported excavations. Cultural traits for the Trincheras culture include polished purple-on-red pottery, inhumation and cremation burial, and, during the Trincheras IV period (AD 1300–1450), construction of defensible hillside settlements (Whittlesey and Ciolek-Torrello 1992:16). These sites contained walled terraces that were used for habitation and agricultural fields (Downum et al. 1994).

The period when the Hohokam and Trincheras cultures were thriving to the north and south is represented by small farmsteads and habitation sites along the major drainages and one large village site, Paloparado, AZ DD:8:2 (ASM) (Di Peso 1956), west of the project area, along the Santa Cruz River.

Due to the paucity of historic documents and archaeological research, little can be said about use of the region from AD 1450 to 1691, when the Father Kino Expedition first encountered Piman-speaking villagers during their travels through the area. Drawing from the earliest historical accounts, the Sobaipuri inhabited the lush valleys of the San Pedro and Santa Cruz Rivers, while the Tohono O’Odham inhabited the more arid southwestern Arizona desert. Like the late Classic period prehistoric villages, Sobaipuri villages were positioned at prime agricultural spots adjacent to portions of rivers that contained surface water or where the bedrock was close enough to the surface to make the excavation of wells profitable. Subsistence was based on floodplain agriculture, with canal-irrigated fields supplying corn, beans, squash, melons, and cotton.

At contact with Europeans, the Sobaipuri were engaged in conflict with groups of Apaches and allied themselves with the Spanish, who brought presidios and visitas to the Santa Cruz River valley in the seventeenth and eighteenth centuries. In 1762, after decades of raiding by Apaches and other groups, as well as intragroup conflict, the Sobaipuri joined other Piman-speaking groups at San Cayetano del Tumacacori, San Xavier del Bac, San Agustín del Tucson, and other villages along the upper Santa Cruz.

Miners and ranchers came to the area in search of wealth. The period from about 1790 to 1821 was relatively peaceful and prosperous in the area, fostered by the policy of pacifying the Apaches with food and money and by active policing by Spanish troops (Mattison 1967:72). Mining and ranching have continued into the modern period, although neither is as important as they once were.

Upon acquisition of the area by the United States after the Gadsden Purchase, Mexican and Euro-American settlers reentered the area, attracted to the readily available surface water of the rivers and their tributaries, the lush grasslands well-suited for grazing livestock, and the ore deposits in the mountains. The completion of the railroads in the 1880s, and the end of raiding by the Chiricahua Apache through the surrender of Geronimo in 1886, opened the floodgates to settlement in the region. The railroad supplied the region with the commodities it could not produce locally, and ore and concentrates were hauled from local mines and smelters. Numerous cattle ranches were established throughout the area, with the heyday of homesteading in the Patagonia-Sonoita region occurring in the early twentieth century.

Although not as prolific as in the past, cattle ranching continues to impact the economy of the area. Tourism also plays a major role in the regional economy, with visitors drawn to the region for its beauty, including hiking and birding in the Santa Rita Mountains and the San Pedro Natural Conservation Area. The history of the area at places such as Patagonia, Tubac, and Tumacacori also draws tourists.

History of the Project Area

The earliest detailed maps of the project areas are the township maps drafted for the U.S. GLO in 1910. At that time, there was no development shown within Section 5. The Baca Float No. 3 was depicted to the west in Section 7. The 1914 Supplemental GLO Plat depicts the project area as part of a parcel owned by John R. Sorrel, whose house is shown on the east side of the Nogales to Patagonia Highway (Figure 6).

The nearby Baca Float No. 3 was one of several large area Spanish land grants given to Don Luis Maria de Baca in the early nineteenth century for services to the Spanish crown. Confusion over the exact location of the float years later by some of Don Luis' descendents and claimants resulted in the float not being confirmed until 1914. Additional legal wrangling continued for many years over the exact location of the various floats and claims. Sheridan (2006) provides a comprehensive history of the Baca Float.

One of the ranch buildings on the property is thought to have originally been constructed in 1890 as an outbuilding of the Oak Bar Ranch (Bo Simpson, personal communication 2018). However, this building is not depicted on the GLO plat maps or historical USGS maps of the area. The Oak Bar Ranch claims to have been established in the 1930s, but there is no mention of the current project area being a part of that ranch (Oak Bar Ranch 2018). The T4 Ranch currently runs 250 head of cattle on nearby leased Coronado National Forest land (Bo Simpson, personal communication 2018).

SURVEY METHODS

Field survey of the current project area was conducted on May 4, 2018, by Project Director Deborah Swartz of Desert Archaeology. Each drainage was covered by walking the wash bottom and inspecting both sides, all cutbanks, and any open areas in the dense vegetation. The drainage bottoms ranged in width from 30 cm to 1 m (Figure 7). The 5-m-wide access roads and the 10-m-diameter staging areas were also each inspected with a single transect. Dense tall grass provided limited visibility across the surveyed areas.

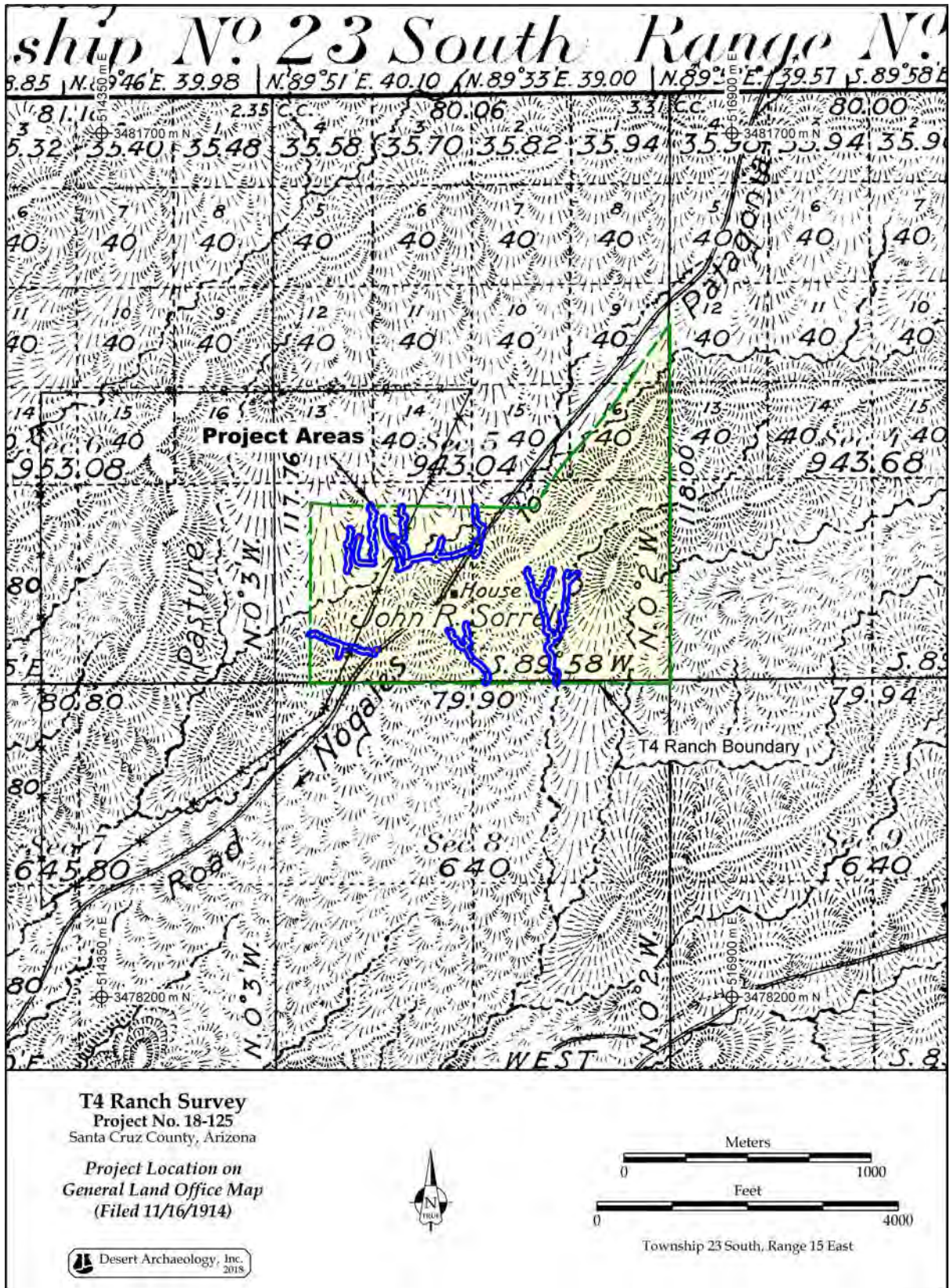


Figure 6. Location of the project area on the 1914 General Land Office supplemental plat of Township 23 South, Range 23 East.

SURVEY FINDINGS

Within the survey area, ground visibility was limited (Figure 8). All open areas were examined. No archaeological resources were found in the project area.

The ranch building, thought to have been constructed in the 1890s, is of sufficient age to be considered eligible for inclusion in the National Register of Historic Places (National Register); however, its integrity has been compromised by modifications and expansions to the original structure. It was a minimum of 150 m away from the current project area and will not be affected by the proposed erosion control installation activities.

RECOMMENDATIONS

Borderlands Restoration, with funding from the ADEQ, is planning to conduct habitat restoration on the T4 Ranch, southwest of Patagonia in Santa Cruz County, Arizona. The scope of work includes construction of numerous erosion control structures in small drainages using available nearby loose materials or rocks brought in on existing and new access roads to staging areas adjacent to the drainages. The work will involve localized ground disturbance within the bottom of the drainages. There is no evidence of cultural resources within the area of potential effects (APE).

Although one of the ranch buildings is of sufficient age to potentially be eligible for inclusion in the National Register, modifications throughout the years have compromised its integrity. Therefore, the proposed erosion control structures would not have any adverse effects on the built environment. It is recommended that the construction proceed.

There is no indication that cultural resources are present within the project area; however, if any cultural resources are encountered in the area as construction proceeds, work should be temporarily halted until an archaeologist can assess the findings. If human remains are encountered during ground-disturbing activities, all work must immediately cease within 30 m (100 ft) of the discovery and the Arizona State Museum must be notified of the discovery within 24 hours. All discoveries will be treated in accordance with Arizona Antiquities Act, ARS §41-865 and work must not resume in this area without proper authorization.



Figure 7. Photograph of drainage 4.



Figure 8. Photograph of vegetation along drainage 6.

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Application Checklist

ARIZONA DEPARTMENT OF WATER RESOURCES
WMAP Groundwater Conservation Grant Application Checklist

- Project Proposal
 - Cover Letter
 - Executive Summary
 - Project Overview
 - Scope of Work
 - Budget Breakdown & Narrative
 - Additional Contribution Breakdown (if applicable)
 - Project Map
 - Supplemental Information
 - Evidence of physical and legal availability of water
 - Evidence of Control and Tenure of Land
 - State Historic Preservation Office Review Form