Upper Gila Restoration Monitoring Plan

Developed by:

Gila Watershed Partnership

With funding from:

The Walton Family Foundation

Adapted for Arizona Water Protection Fund

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GILA WATERSHED PARTNERSHIP OF ARIZONA

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2. PROJECT METHODOLOGY

2.1 Implementation Strategy

To implement proposed actions, GWP conducted an informal survey of landowners on the Gila River, who own properties within the Gila Valley Restoration Planning area (Appendix H). This survey helped to determine landowner interest in participating in restoration activities. This survey was conducted by:

- Meeting with the local Irrigation Districts
- Meeting with the Gila Valley Natural Resource Conservation District (NRCD)
- Meeting with the Natural Resource Conservation Service (NRCS) District Conservationist
- Meeting with representatives from the Farm Bureau
- Meeting with individual landowners one-on-one at their homes.

To achieve the project's short-term goals, the GWP will use a collaborative approach that incorporates the knowledge and priorities of landowners, land managers (federal, state, local agencies), stakeholders, and scientific professionals. This interdisciplinary approach has three basic components:

1. Use the comprehensive Ecohydrological Assessment to deliver science-based guidance on suitable riparian restoration actions within the ecologically sensitive river corridor. The framework was prepared by a restoration science team led by Stillwater Sciences with contributions from researchers at the Desert Botanical Garden, Northern Arizona University, University of California at Santa Barbara, Utah State University, and U.S. Geological Survey (Appendix H).
2. Engage willing landowners own properties within the parameters identified in the Restoration Framework, meet with them to discuss the project benefits, and determine willingness to participate in riparian restoration efforts.
3. Prioritize the riparian properties according to recommendations made by a group of scientific advisers. These recommendations will be based upon the "Potential Priority Restoration Areas" as outlined in the Restoration Framework for the Upper Gila River, Arizona.

To ensure that annual progress is made toward reaching the short-term ecologic goals of the restoration project, GWP has (and will continue to):

- Defined the total number of acres of the highest restoration potential for implementation sites
- Ranked the remaining sites according to restoration potential for implementation as demonstration sites
- Removed sites from consideration where tamarisk control is not feasible due to lack of accessibility, landowner approval, funding, permits, or capacity issues

- Determined the number of acres appropriate for the proposed project sites
- Developed site-specific restoration techniques for each priority site. These plans will be used to inform project implementation, permitting, access agreements and MOUs, plant materials development, work flow schedules, and acquiring the necessary equipment and supplies for project completion.
- Designed project sites that can be used not only to display the achievement of ecologic goals, but also the social, management, and economic goals of the project (Appendix G).
- Employed best management practices (Appendix D) to ensure that project work is accomplished safely and efficiently. These practices include:
    - Using mechanical, chemical, and cultural weed management strategies to combat invasive species populations.
    - Acquiring and/or supply the necessary training and/or permits to mitigate job hazards relating to restoration activities.
    - Minimizing disturbance to avoid further degradation of the ecosystem.
- Use site-specific monitoring and maintenance protocols to inform adaptive management strategies.
- Share lessons learned through education and outreach events and opportunities.

2.2. Restoration Site Prioritization

Restoration sites for project implementation were determined based on a number of factors. We first considered the Ecohydrological Assessment that was produced by Stillwater Sciences and other scientific advisers to the proejct. This document considers river hydrology, geomorphology, vegetative conditions, soil conditions and salinity, surface and groundwater availability, and SWFL-habitat suitability to identify potential priority sites for restoration within the Gila Valley (Appendix H).

However, in order to assure an effective outcome and long-term viability of the restoration activities, GWP determined in 2014 that a number of social considerations need to be included in the decision making process as well. For example, there are five potential sites that we have included in our assessment of potential sites (Section E) that are not high- or medium-ranked restoration areas in the Ecohydrological Assessment. Three of these sites are located near bridges in Graham County, and are highly visible to the public, and could serve as demonstration sites for the project. Influential local farming families own the other two sites. These inclusions were considered due to the potential to maximize potential collaborating landowners, and increase both the spatial and social scope of the project.

Social considerations used for GWP's ranking of restoration sites:

- **Presence of bridges, canals, or other infrastructure on site.**
  When flooding occurs, woody debris such as tamarisk collects at bridges. This restricts flow, and creates the potential for costly damage to the bridge approaches, and can also restrict or eliminate travel. Adjacent properties, particularly agricultural lands, may be subject to erosion damage. Water conveyance under bridges is an extremely high priority for Graham County.

Figure 1 - Project site located directly downriver of the Pima Bridge

- **Landowner ideology and representation**
  - The landowner should be aligned with the goals of GWP's riparian restoration efforts
  - The landowner is well respected in the community, and their participation may set an example for others to follow
  - The landowner is willing to limit stressors to active re-vegetation efforts (i.e. grazing as a result of escaped cattle)
  - The landowner is either a potential source of funding to support restoration efforts or willing to donate in-kind services
  - The landowners chosen for riparian restoration should adequately represent, as far as is reasonably possible, the citizenry of the Upper Gila Watershed as a whole

- **Potential for expanded collaboration among future stakeholders**
  Strategic geographic locales offer the potential for the land and/or the landowner to display riparian restoration efforts and potentially interest other landowners in future participation.

- **Public visibility**
  To cultivate favor in the community for the project, priority will be placed on highly visible and easy to access demonstration sites.

- **Potential active restoration area**
  To maximize project impact, the proposed sites shall have strong potential for employing active restoration strategies

- **Adjacent to SRP properties**
  There are numerous properties owned by the Salt River Project (SRP) near Fort Thomas. These were established to mitigate losses of SWFL habitat at Roosevelt Lake. An adjacent restoration property may expand the range of these habitats.

- **Additional Potential Funding**
  Various federal and private sources are potentially available for implementing this restoration plan; including, but not limited to:

    - Partners for Fish and Wildlife Program
    - NRCS Environmental Quality Incentives Programs
    - Arizona Water Protection Fund
    - Arizona Game and Fish Department Grants
    - National Fish and Wildlife Foundation Grants
    - Arizona State Forestry Grants
    - Freeport-McMoran Inc. Community Investment Grant

GWP's Restoration Specialist leads GWP's efforts to secure funding for the riparian restoration project, with assistance from other GWP staff and GWP board members. If in the future GWP secures funding to hire dedicated fundraising staff, this responsibility will shift.

- **Supplemental Water Source**
  The presence of an agricultural return flow or other viable source of supplemental water would aid re-vegetation efforts. In this case, GWP would consider potential return flows in site-specific restoration techniques to opportunistically capitalize on this increased availability of surface water.

- **Additional criteria that may be considered**
  - An area that is shared by two influential landowners where restoration can be implemented on both sides of the river to form a partnership between the landowners would promote community stewardship endeavors valued by GWP.
  - Implementing restoration as a tool to stabilize or re-contour stream banks on applicable sites could serve as an example for other landowners to implement similar bioengineering projects as opposed to introducing man-made structures into stream banks.

2.3 Phased Implementation Approach

Successful execution of an active restoration project will require adaptive management in response to challenges that arise due to the unique biotic and abiotic characteristics of each project area. We expect to use four phases of active treatments that may or may not (site conditions determining) overlap with one another.

Phase 1 – Initial Tamarisk Treatment. During the first phase of the project at any project site, our primary action will be mechanical removal of tamarisk biomass through the use of heavy equipment, chainsaws, and an herbicide application. Where possible, a mid-sized excavator with a mulching head attachment will masticate tamarisk trees in place, leaving stumps four to five feet tall in order not to split the stumps. It is important to leave an un-split stump for effective herbicide application. A chainsaw crew will follow this mastication treatment, by cutting the stump to the soil surface and apply an herbicide mix (active ingredient triclpyr) to the cambium layer within five minutes of the low-stump cut. Where tamarisk stumps are not growing vertically, gill slits and other bark treatments will be implemented to reduce herbicide runoff from diagonal and horizontal tamarisk stumps. Emphasis will be placed on this treatment between October and February, as the cut-stump method is most effective during this time period. Where the excavator cannot access, alternative biomass management techniques (such as brush piling) will be used (Appendix F).

Figure 2 - Excavator with mulching head chipping Tamarisk slash piles

Phase 2 – Active Re-vegetation. Once project sites are cleared of tamarisk infestations, locally harvested poles and container stock propagated at the Gila Native Plant Nursery will be planted in strategic planting zones. Planting zones (Appendix H) were established using LiDAR data from 2013 that was confirmed as an accurate proxy for depth to groundwater by the series of piezometers installed by GWP throughout the Safford Valley. By separating target plant species into groups according to their rooting depths, we delineated planting zones that have been uploaded into the MapItFast program available on the GWP field tablets.

Planting will occur during strategic time periods. Pole plantings will occur when cottonwood and willow species are dormant (late November – mid February). Container stock plantings will coincide with bi-modal rains. No supplemental water will be available, so all plantings should occur strategically to take advantage of natural increases in soil moisture. Where access permits, our partnership with the Bureau of Land Management (BLM) offers an opportunity to borrow a water trailer that can be used to water in planted container stock to increase planting survival rates.

Figure 3 - Arizona Conservation Corps crewmembers installing willow bundles in Ft. Thomas

An inundation model (Appendix J) was developed so that we may be able to react to high flow events and use those flows as an opportunity to broadcast seed on inundated and/or scoured soils. These flows are most likely to occur between August and December. By pairing the inundation thresholds with upstream streamflow measurements recorded in live time by the US Geological Survey (USGS) and subscribing to WaterAlerts for the designated inundation thresholds, we should be able to receive instant notifications of high flow events, predict where inundation will occur, and broadcast target species seed more effectively. All planting and seeding will be recorded in our geospatial database so that establishment and survival rates can be monitored and assessed.

In some limited areas, light grading will be conducted to create swale areas and reduce the depth to groundwater. These geomorphic changes to the floodplain will be designed to attempt to reconnect the floodplain to the river, as many of the project sites display channelization as a result of the tamarisk monoculture. A cultural resource specialist will monitor these activities to avoid damage to archaeological artifacts. The active re-vegetation phase may overlap with the next phase.

Phase 3 – Tamarisk Re-treatment and Secondary Weed Treatment. One growing season after the initial tamarisk treatment, sites will be assessed for whether a tamarisk re-treatment is necessary. Tamarisk re-sprouts with a stem diameter greater than 1.5 inches will be cut and an herbicide mix will be re-applied to the cut stump. Foliar sprays with a 10% imazapyr concentration will be used on re-sprouts to limit the time and cost associated with cut-stump applications for re-sprouts. Care will be taken to not spray within 10 m of the active river channel in order to avoid increasing risks associated with drift. Foliar sprays will also likely be

the treatment method applied to most secondary weeds on the project site. Secondary weeds of particular concern include: *Arundo donax, Kochia spp., Salsola tragus, Sorghum halepense, and Xanthium strumarium.* This phase may also include controlled burns of tamarisk slash piles and other invasive species burn piles. This phase should occur at least one growing season, or six months after the tamarisk was initially treated. Specifically, in regard to the burn piles this lag period must occur to allow for the slash piles to cure and dry out to burn more effectively, and can only occur in December or January.

Phase 4 – Monitoring and Maintenance. Site monitoring will be conducted throughout each phase, but it is expected that once each of the preceding phases is complete, continued site monitoring and maintenance (updating fencing, supplemental planting, secondary weed abatement, etc.) will continue into the future to ensure the success of the active restoration of ecosystem processes.

2.4 Monitoring

Monitoring is conducted to assess outcomes relative to goals and objectives, to inform adaptive management, to understand what contributes to or constrains progress or success, and to export lessons learned. Monitoring efforts on a restoration site can take many forms. We will use several different monitoring techniques, each to answer specific questions.

The following methods provide an overview of common types of monitoring for restoration sites (Roni, 2013) that we will adapt to our site-specific needs and questions.

Baseline monitoring. Baseline monitoring characterizes the existing conditions and biota for planning or future comparisons. Assessment of any kind to inform planning is a form of baseline monitoring and is useful for evaluating strategies and developing designs. Additionally, baseline monitoring typically measures all of those same parameters that will ultimately be measured for other monitoring purposes. This provides a baseline for comparison of conditions prior to and after restoration actions. For riparian restoration, this may include cover measures of native and invasive plant canopy and open ground, bird counts, planted stock survival and health, stem density and height, topographic measures, groundwater depth, soil salinity, and grazing impacts.

Implementation monitoring. Implementation monitoring is used to determine whether the project was implemented as planned. It may include elements that simply indicate whether plans were carried out, but also establishes a new baseline condition. Implementation monitoring parameters may include many of those used for baseline, such as canopy cover of invasive species and topographic measures, but also numbers of plants planted, miles of fence installed, or other elements of the restoration action. Through the course of this project, Implementation monitoring will likely be referred to as Progress Reporting Monitoring (Appendix I).

Effectiveness monitoring. Effectiveness monitoring determines whether the actions had the desired effects on riparian, water quality, or habitat goals and objectives. Specific parameters measured and assessed are directly related to the stated objectives of the restoration project and are intended to determine whether the project met its stated goals. Equally important, Effectiveness monitoring helps determine which factors contributed to or constrained the outcomes. If a project does not meet goals, monitoring can help understand why. Parameters measured may include rates of natural recruitment and relative canopy of native and invasive plants, bird counts, planted stock survival and health, stem density and height, depth to groundwater, and topographic and geomorphic parameters.

Effectiveness monitoring is also used to inform adaptive management. For this reason, through the course of this project, Effectiveness monitoring will likely be referred to as Adaptive Management Monitoring (Appendix I). Certain parameters can serve as indicators or triggers for management actions. For example, if monitoring indicates that secondary weeds are invading, this can serve as a trigger for weed control maintenance. Or, if cottonwood poles are not sprouting, groundwater depth or soil salinity monitoring may suggest reasons they are not sprouting and trigger corrective actions.

Monitoring protocols are typically developed at the time of site restoration planning (so that baseline monitoring can be conducted), and are formulated around specific questions to be answered. It is important to consider that restoration is a fundamentally experimental venture – outcomes are rarely assured and usually bring surprises. Characterizing project objectives as a hypothesis – suggesting that we expect a given outcome as a result of the planned action – can help articulate questions for monitoring to help answer.

Monitoring can also be characterized by the level of intensity of monitoring implemented, including *Photo Point Monitoring*, *Rapid Monitoring*, and *Long Term Monitoring*. *Photo Point Monitoring* is an easy and effective method of monitoring vegetation and ecosystem change. It is inexpensive, and requires very little equipment or training. This qualitative method of monitoring generally consists of taking repeat photos of a given restoration area or site from select vantage points. Photos are geo-referenced for inclusion in a GIS database, and the point(s) from which the photos are taken are marked and/or documented well so that it is possible for different personnel to replicate photographs at regular intervals.

Rapid Monitoring refers to relatively frequent monitoring of all restoration actions and sites. Rapid monitoring can often be accomplished at a site over a period of a few hours or for very large sites, a few days. It is developed to quickly assess basic trends and outcomes, and sometimes to suggest that more intense monitoring may be necessary to better understand those trends. It may involve both qualitative and quantitative measures and can be very effective for tracking success of management efforts on a site, for informing adaptive management decisions, and for planning for further restoration activities (e.g. secondary weed spraying, planting efforts)

in the coming year. A typical monitoring effort would consist of conducting a survey of the entire site and tracking key vegetation parameters such as size and location of noxious weed populations, native plant recruitment, changes to stream-bank configurations, and establishment success of seeding or planting efforts. Qualitative data may also be collected, ranging from noting signs of wildlife/herbivory to observing the effects of a flooding event. For example, this information can then be used to plan for spraying of newly discovered noxious weed infestations, ordering more plants for replanting, installing more anti-herbivory protection on young plantings, redesigning further restoration efforts based on extent of catastrophic flooding, etc. In conjunction with this type of monitoring (and the below type of monitoring) it can be useful to collect soil samples and determine water table depth on site to inform project planning and provide insight into success or failure of restoration efforts (for example, discovering that a site has highly saline soils or a deep water table may require that original restoration plans be modified).

Long-Term Monitoring is used to assess trends at much broader scales. Long-term monitoring is particularly important for riparian and other riverine restoration actions at a watershed scale to assess outcomes that may take many years to decades to achieve. This degree of monitoring often requires detailed measurements at representative sites throughout a study area or watershed, and is usually conducted according to a statistically rigorous protocol. This form of monitoring is often conducted along transects across the valley floor at numerous cross-sections throughout the watershed area affected by the restoration actions, and may also include "control" transects that are not affected by restoration actions. Long-term monitoring also requires baseline monitoring to evaluate trends relative to conditions before restoration.

Figure 4 - Arizona Conservation Corps and GWP staff conducting annual SWFL surveys

GWP and its scientific advisers have developed the site-specific monitoring protocols (Appendix L) to be used during Upper Gila riparian restoration efforts. The advisers include GWP partners and collaborators, and this group will continue to investigate the best available methodologies to determine best practices specific

to this project. Just as adaptive management is used to improve implementation methods, adaptive management informed by monitoring will be used to continually improve monitoring efforts, so long as data collected remains consistent for comparison across monitoring seasons.

The monitoring plan will use and build upon existing knowledge and expertise cultivated at other southwestern watershed partnerships that are focused on large-scale riparian restoration. The GWP Restoration Specialist and the scientific advisers will interface with these watershed groups to gain insight on what monitoring methods might be adopted and/or modified to best suit the needs of the Upper Gila.

2.5 Targeted Restoration Sites

In 2014, four sites were prioritized for the first phase of implementation: R3, R8, R11, R14, and R18. These sites were chosen according to the factors identified in Section 2.2. Acres from each of those sites were included in the original Section 404 (Clean Water Act) permit, and implementation priority was based primarily upon ease of access to each site. In spring of 2015, work began at R18, with sites R3 and R8 following suit. In fall of 2015, work continued at R8 and began at R14. Fall 2015 also marked the beginning of our re-treatment efforts at R18. Spring of 2016, we continued primary treatments at R18 and began work at R14. In the summer of 2016, we were able to continue work at R18 in a recently burned area, as our permit allowed for the opportunistic treatment of burned areas that no longer qualified as suitable habitat. No work has been initiated yet at R11 due to access issues.

In 2015, an amendment to our Section 404 permit was submitted to add new target restoration sites and expand upon previous sites. Over the next few years, project work will continue at R3 (up to 47 acres), R4 (up to 41 acres), R8 (up to 14 acres), R9/10 (up to 93 acres), R11 (up to 44 acres), R14/15 (up to 89 acres), and R18 (up to 56 acres). We expect to work at sites where restoration work has already occurred first (R3, R8, R14, and R18) in order to continue through the Phased Implementation Approach (Section 2.3) so as to not disturb sites once the ecological rehabilitation process has begun. Funding may dictate the next priority sites, whether BLM funding becomes available to work on the federally-owned acres, or NRCS funding becomes available that is tied to a specific landowner's property, etc.

The following figures and site descriptions illustrate how sites were initially identified through the Restoration Framework study (Orr et al, 2014), and then further investigated for landowner cooperation and ground-truthing site conditions to determine priority. Included in this section are figures that were submitted with the permit application that outline the targeted restoration sites.

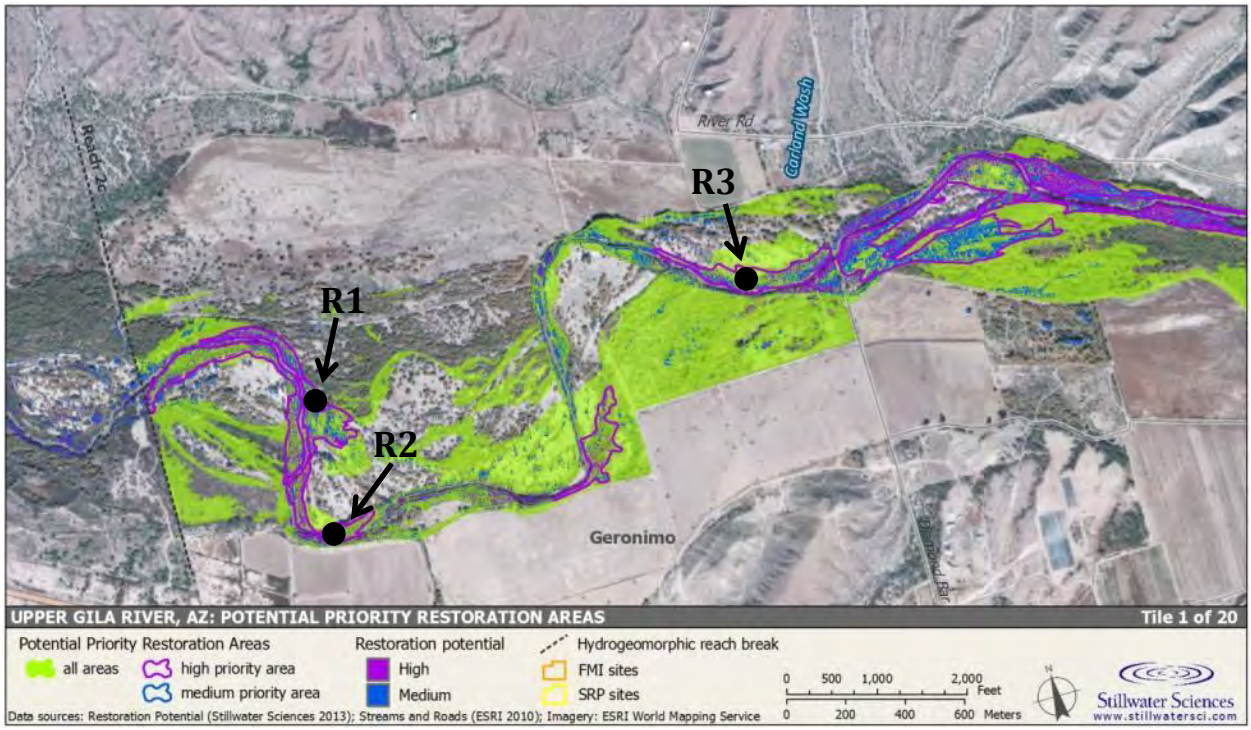

Figure 5 - Potential Restoration Areas between R1 and R3

R1 Bryce/Clairidge

This property is adjacent to the San Carlos Apache Reservation. Legal issues make riparian restoration work on Apache tribal lands impossible in the scope of this project. However, it may serve as an example to the tribe of a successful restoration effort. The landowner also qualifies as a potential recipient for additional funding through the NRCS. However, the channel looks a bit entrenched. Elevations look good. The location - inside of the river bend -- is desirable, as there is less risk of scour, and may be more predictable although the channel may shift a bit in this area during a flood. This site is of high priority, based on its vegetative composition appearing in the mapping to be predominantly made up of tamarisk. This allows for greater potential for active restoration, but field verification is necessary.

R2 Langley

This site is also next to the Apache Reservation and is owned by one of the largest landowners and land development corporations in the Gila Valley. Restoration is desirable to the landowner. The reduction in hazardous fuels may be of particular interest to this landowner, as they are a developer. The reduced risks may increase property values and inspire additional support from the landowner. However, stream banks on the property need stabilization and there is some variation in elevation across the site. The existing vegetative community includes some willows and cottonwoods with diverse vegetative structure. There exists no infrastructure on site. This site is of high priority, based on landowner interest and promising native vegetative structure. These factors allow for greater potential of active restoration, but field verification is necessary.

R3 Squire

The landowner is very interested in supporting our efforts and also qualifies as a potential recipient for additional funding through the NRCS. Both sides of the river provide good elevation and easy access. This portion of the river lies near Carland Wash and presents stable geomorphologic conditions. A portion of the parcel was permitted for implementation in early 2015, and the site will be expanded to include monotypic tamarisk stands in future permitting efforts (Figure 12).

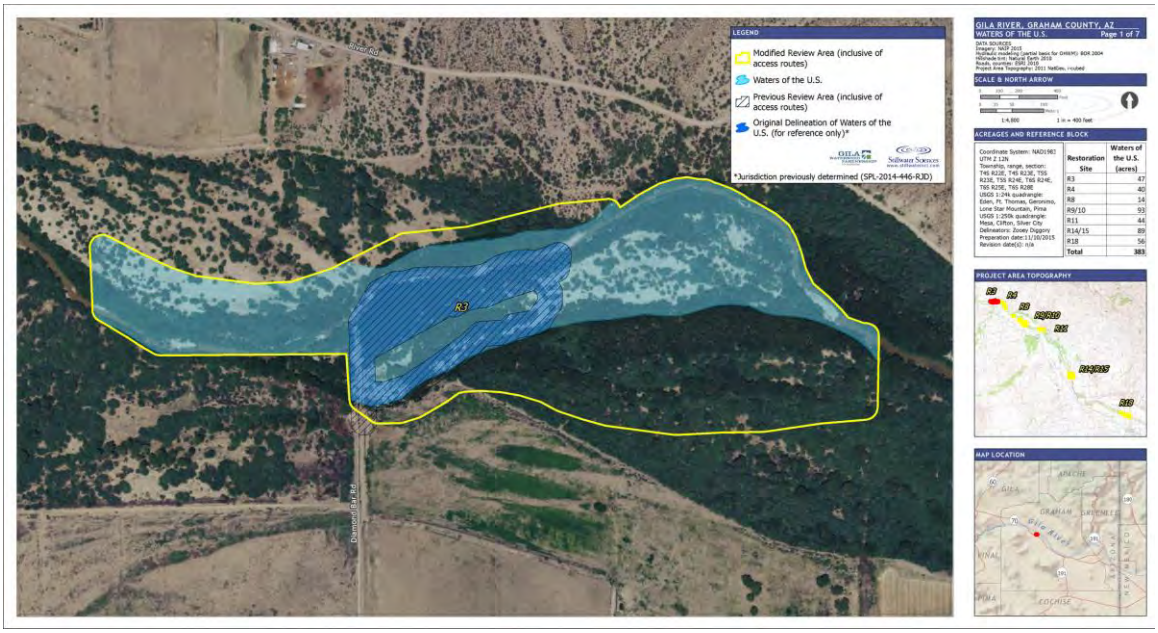

Figure 6 - Restoration Area boundary and Ordinary High Water Mark at Site R3

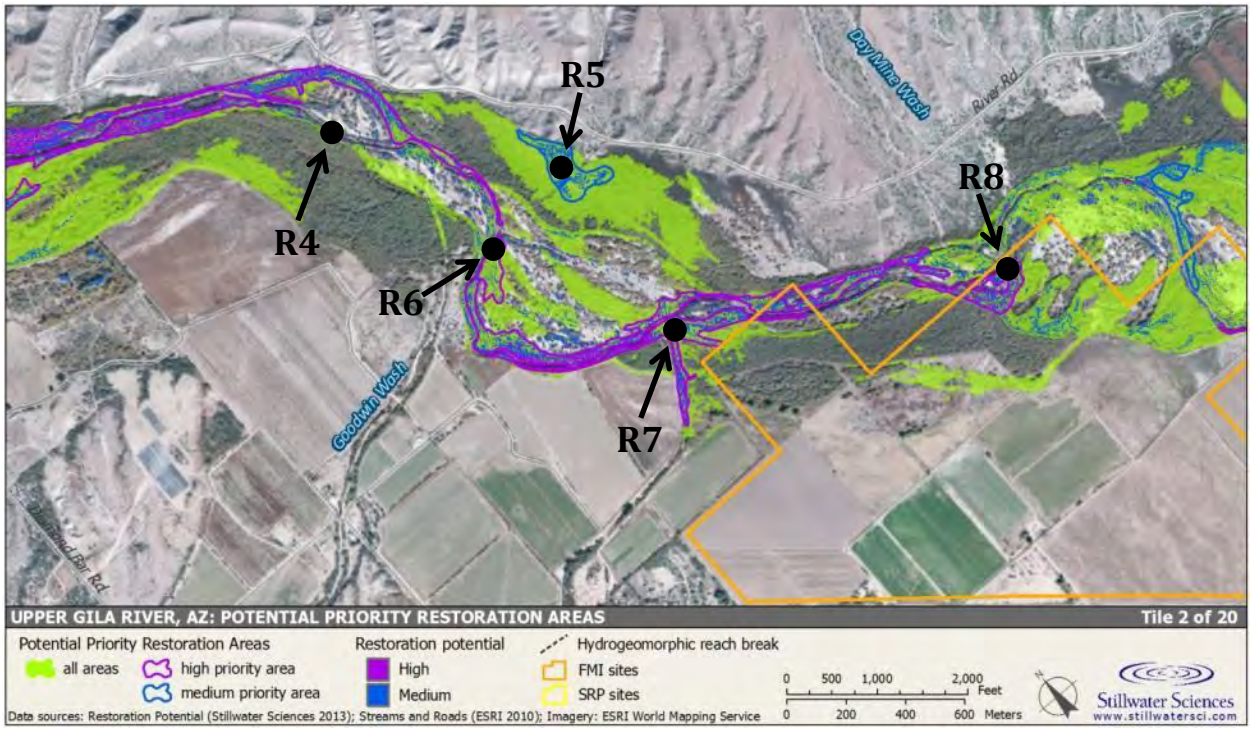

Figure 7 - Potential Restoration Areas between R4 and R8

R4 Garcia

The property is located adjacent to BLM lands to the northeast and its riparian areas are densely vegetated with tamarisk. The BLM lands were included in the 2015 permitting application for inclusion in the project (Figure 14). The southeastern parcel, however, is estimated to support minimal restoration suitability because the site may be too narrow. The landowner is interested in the riverbanks being stabilized. The eastern side of the river is promising, and there may be backwaters to provide additional soil moisture. Site conditions require field verification.

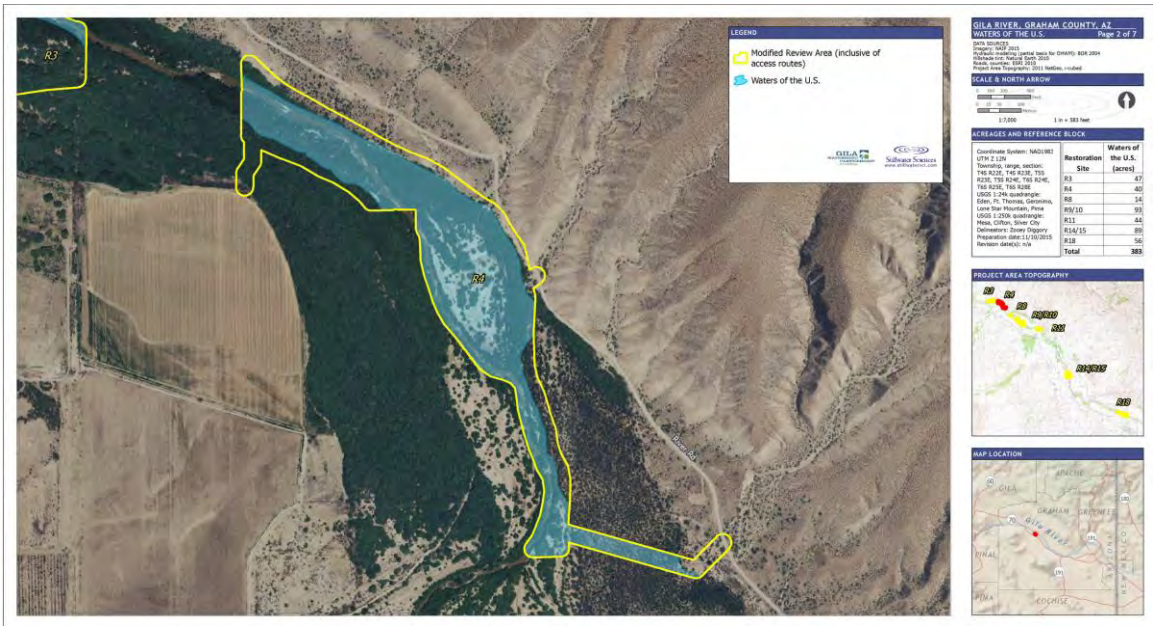

Figure 8 - Restoration Area boundary and Ordinary High Water Mark at Site R4

R5 Hancock Burn

The property is located adjacent to BLM lands to the north and east, which have been included in updated permitting efforts. Wildfires on this site in 2013 reduced much of the tamarisk, making it desirable for restoration. Unfortunately, much of the tamarisk has started to re-sprout in recent years. The property could be used to determine the potential for employing controlled burning as a restoration technique. The private landowner qualifies as a potential recipient for additional funding through the NRCS and is a member of a respected local family with a long established history in the Upper Gila Watershed. This site is of lower priority, as surface water and soil moisture need to be field verified in order to refute assumptions that it will not provide suitable habitat.

R6 Neil Brooks

The property is located adjacent to BLM lands to the north. This landowner is an organic farmer growing diverse crops such as produce and herbs. This site qualifies as a potential recipient for additional funding through the NRCS. Goodwin Wash supplies additional water from an agricultural return. The property presents low risk from a geomorphic perspective. However, this site is of lower priority, as there are significant access limitations in using the excavator. In addition, there are concerns that an organic famer would not be interested in a project with a strong herbicide component. Thus, there is an important need to build a strong relationship with the landowner that currently does not exist. Incorporation of this site is dependent on forging of that new relationship.

R7 Brooks Return

The property is located adjacent to FMI lands to the east and south. Much of the site is owned by the same landowner as R6, with the additional benefit of a side drainage to provide additional

soil moisture. This return, with restoration, could result in potential additional flow on the Gila River. The landowner also qualifies as a potential recipient for additional funding through the NRCS. Elevation may be a little high for depth to groundwater. It is a very narrow site and thus not promising from an ecologic perspective. However, since it is close to the FMI site, it may still be desirable. This site was determined to be of lower priority due to the high depth to groundwater and the narrowness of the channel.

R8 FMI

The property is located adjacent to BLM lands to the north and east. The largest employer in both Graham and Greenlee County owns this land. They are currently involved in restoration and environmental mitigation programs, and are planning to expand upon this site in future years. GWP has a strong working relationship with this landowner and has received funding for many previous projects and programs. The existing willows on the eastern side offer great habitat opportunities. The site offers stable geomorphic conditions for restoration. Very dense tamarisk stands allow for active restoration throughout much of the site. A portion of the parcel was permitted for implementation in early 2015, and the site will be expanded to include monotypic tamarisk stands in pending permitting efforts (Figure 15).

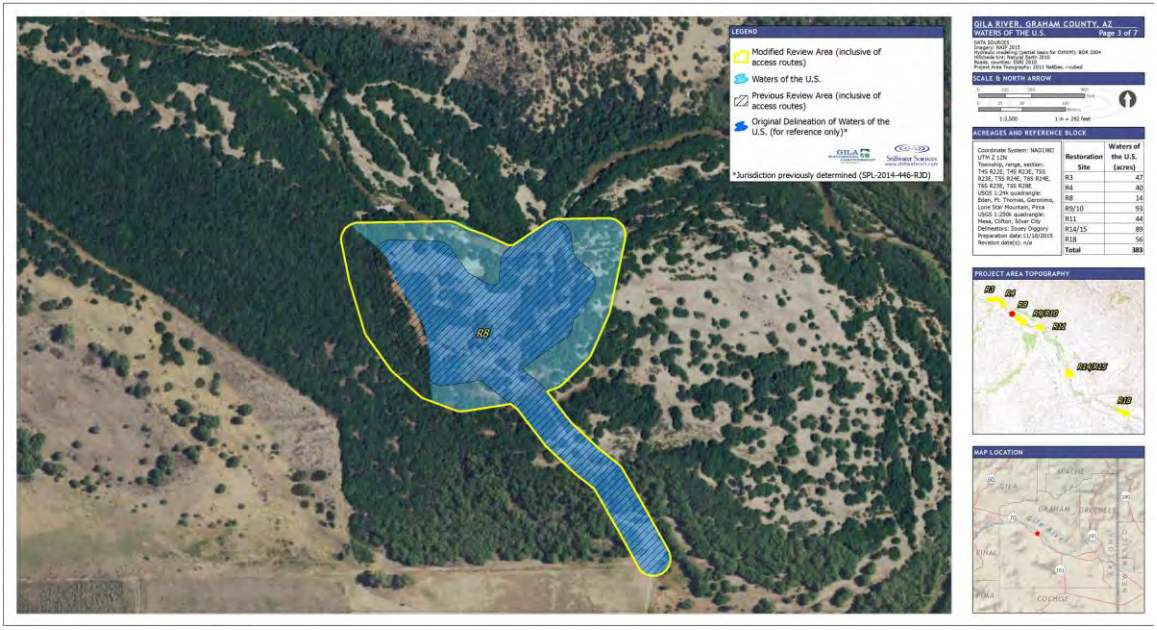

Figure 9 - Restoration Area boundary and Ordinary High Water Mark at Site R8

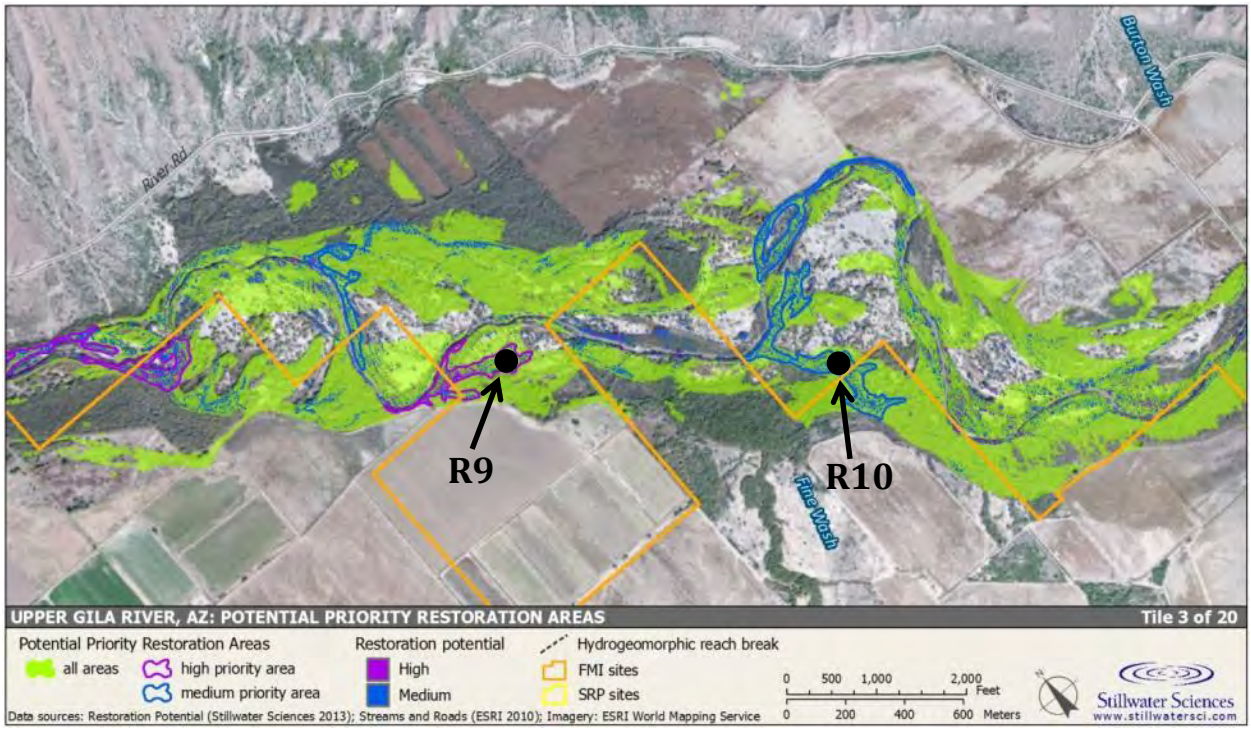

Figure 10 - Potential Restoration Areas between R9 and R10

R9 Langley

The property is located adjacent to BLM lands to the north, and to FMI parcels to the west and east. This is the same landowner as R2, one of the largest landowners and land development corporations in the Gila Valley. This site is of moderate priority, as much of the parcel does not include the high- and medium-rated potential areas, but would offer continuity between R8 and R10. Such continuity may provide greater incentive to push BLM permitting along, as the BLM parcel borders both R8 and R9. The existing native vegetation offers a good opportunity for passive restoration, but would not provide for a demonstration of active restoration techniques.

R10 Langley/FMI

The property is located adjacent to FMI parcels to the west and south. This site is particularly important as it is shared by owners of R8 and R9, two of the largest corporations in the Upper Gila Watershed. The potential benefit of collaboration between these parties (due to the inherently different nature of their respective enterprises) is significant, as it has the potential of generating high support for continuing and increased riparian restoration. The site presents ideal elevation, backwater flows, and some existing native vegetation stands. This site is of high priority, as there is an existing landowner agreement with FMI, and it could be linked with several neighboring parcels. As such a portion of these properties were included in the 2015 permitting application for inclusion in the project (Figure 17).

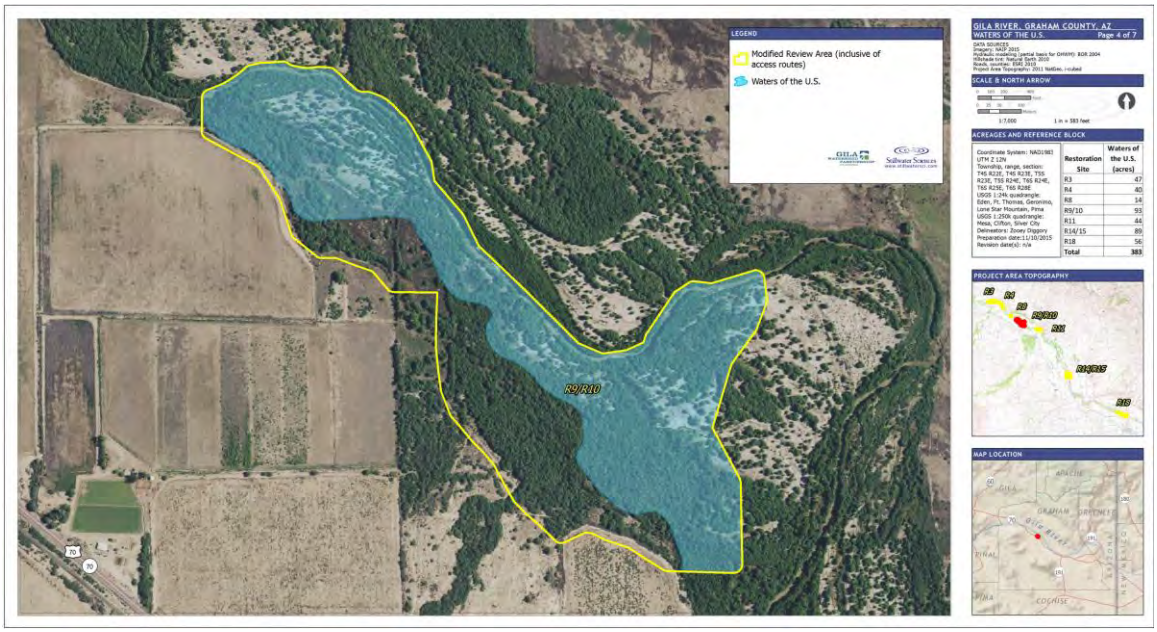

Figure 11 - Restoration Area boundary and Ordinary High Water Mark at Site R9/10

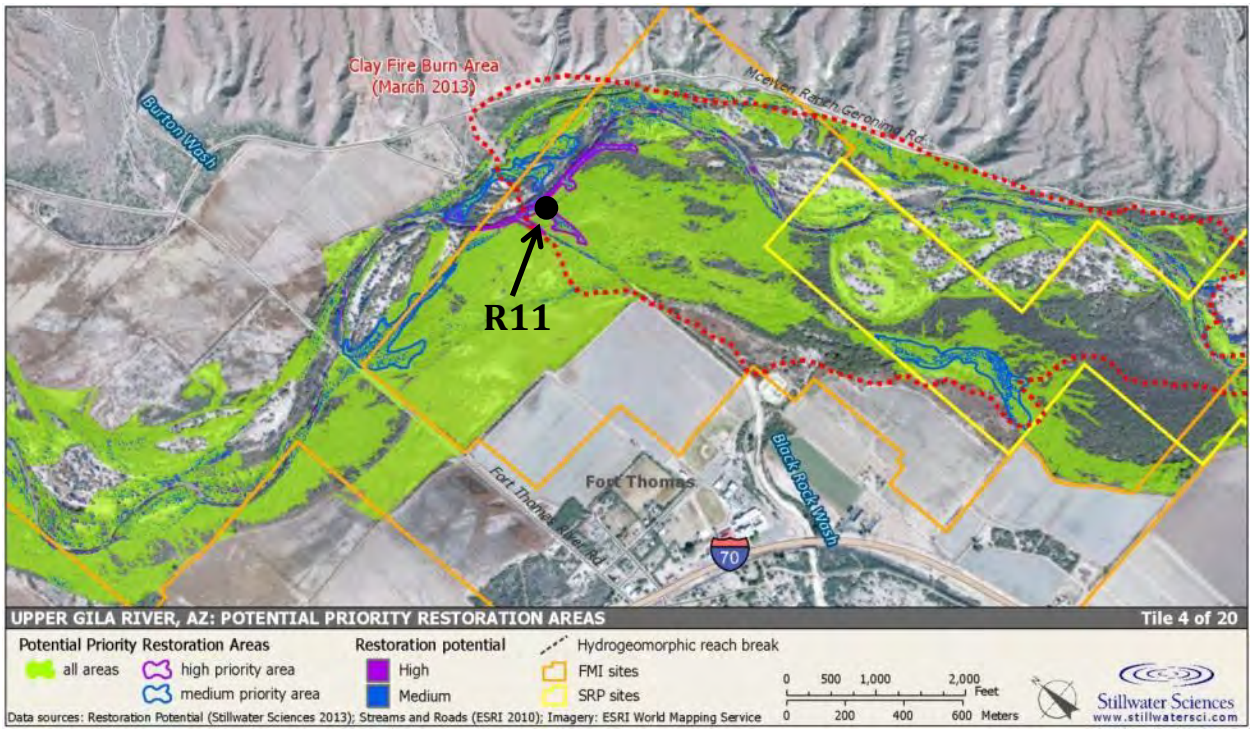

Figure 12 - Potential Restoration Areas near R11

R11 FMI Black Rock

The property is located adjacent to BLM lands to the north and east, and was burned in 2013 by the Clay Fire. This landowner is the same as R8. This site has a secondary channel that has the potential for additional flow from the river and groundwater. The recent wildfire on this site has eliminated much of the tamarisk making it very desirable for restoration, thus the property has a

strong potential for prescribed burning. A portion of the parcel was permitted for implementation in early 2015, and the site will be expanded to include monotypic tamarisk stands in pending permitting efforts. Project work did not occur in early 2015 due to access issues, so northward and southward expansion is necessary in the updated permit (Figure 19).

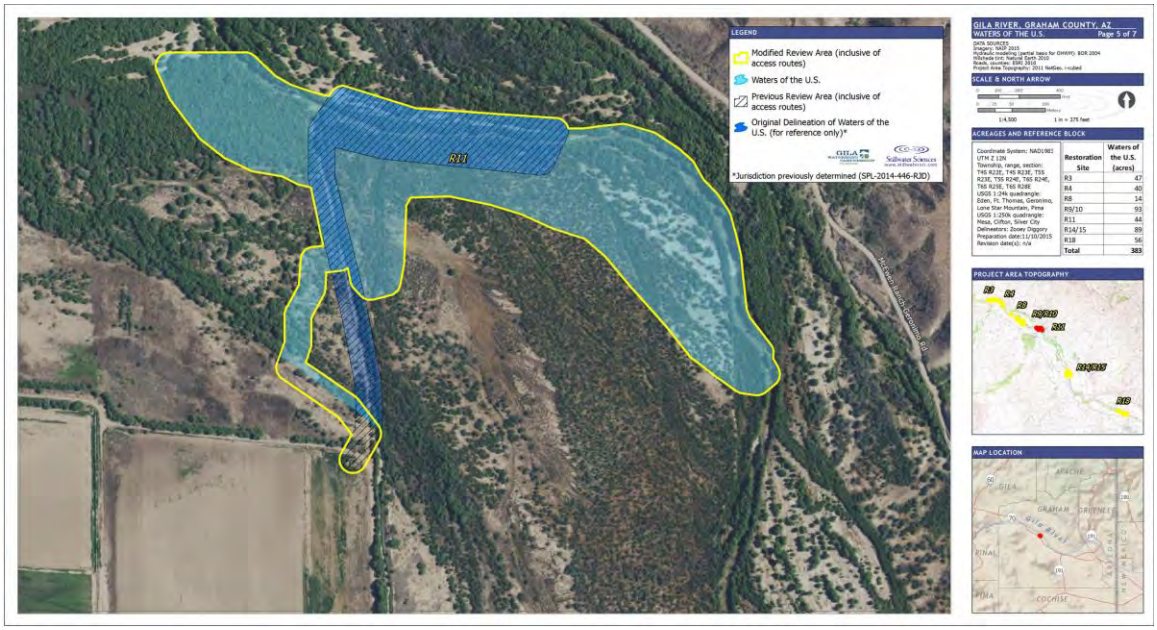

Figure 13 - Restoration Area boundary and Ordinary High Water Mark at Site R11

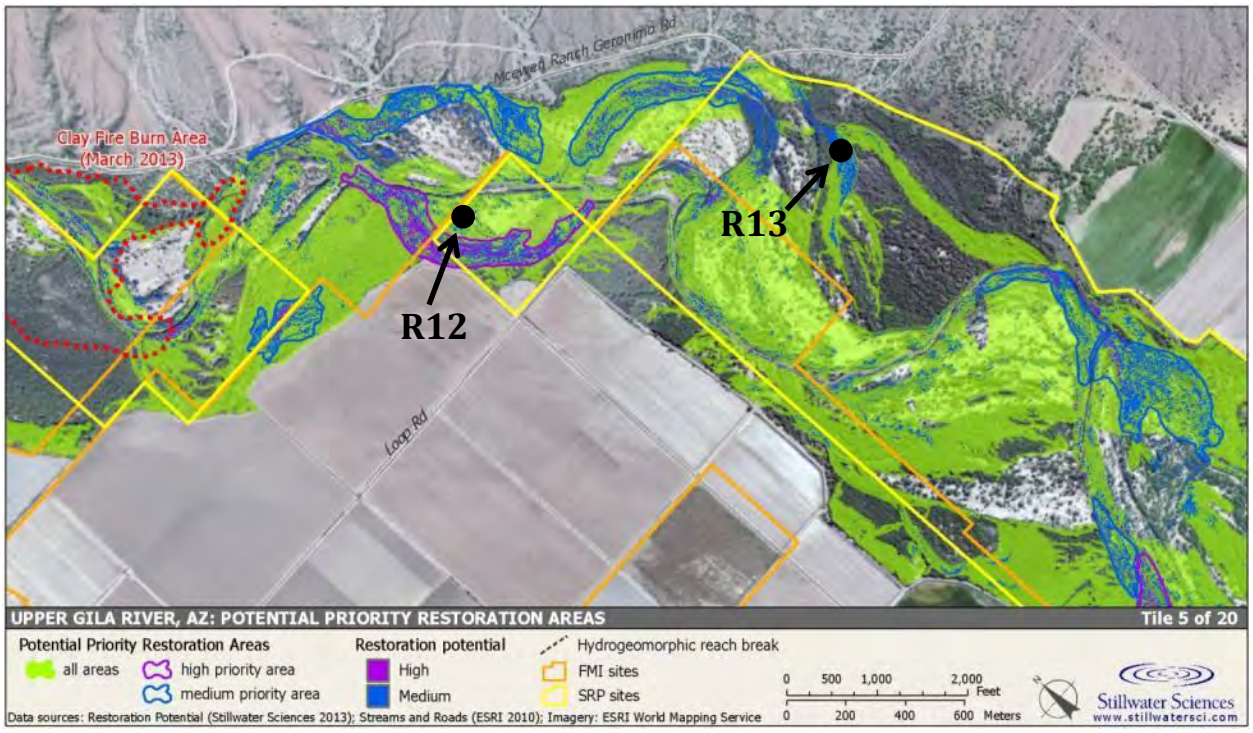

Figure 14 - Potential Restoration Areas between R12 and R13

R12 Cortez
The property is located adjacent to BLM lands to the north and east. The landowner wants stream bank stabilization. However, this site is adjacent to, and is primarily composed of SRP lands. This site is of lower priority, as most of the suitable restoration areas lie on SRP's project site.

R13 Rizley
The property is located adjacent to BLM lands to the north and FMI and SRP properties to the west and south. The local landowner is new to the Gila Valley and interested and supportive of riparian restoration work. The site has potential for prescribed burning. However, this location appears to be located within an SRP-managed property, and is far away from the channel. As a result, this site is of lower priority, because most of the suitable restoration areas lie on SRP's project site.

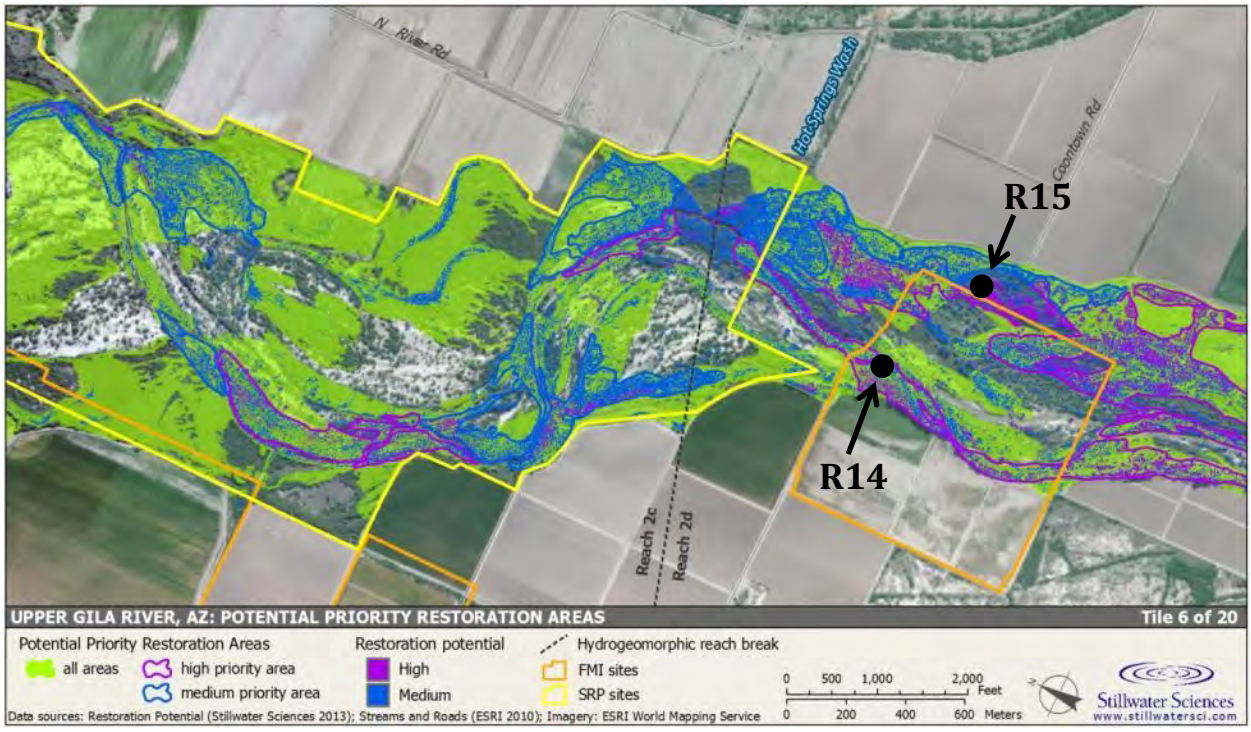

Figure 15 - Potential Restoration Areas between R14 and R15

R14 FMI
The largest employer in both Graham and Greenlee County owns R14. They are currently involved in restoration and environmental mitigation programs. GWP has a strong working relationship with this landowner and has received funding for many previous projects and programs. The site presents good elevation for restoration work. A portion of parcel was permitted for implementation in early 2015, and site will be expanded to include monotypic

tamarisk stands in future permitting efforts. Project work at this site began in the fall of 2015. Access may be limited by the western back channel so eastward expansion into R15 is necessary (Figure 22).

R15 Palmer

The largest farming family in the valley owns most of R15. The properties on opposite sides of the narrow channel of the river present an opportunity for collaboration between landowners. This site has destabilized stream banks and landowners want re-vegetation for stream bank stabilization. The site presents good elevation for restoration work, and contains dense, monotypic tamarisk stands that are ideal for active restoration. These dense stands collect debris due to the narrowness of the channel downstream of the bridge. Project work occurring there may provide equity for the community in working to solve a problem that many locals are concerned about. This site is of higher priority, as project work there would provide continuity with R14, and the opportunity to work with an interested landowner. As such, portions of these parcels were included in the 2015 permitting application for inclusion in the project (Figure 22).

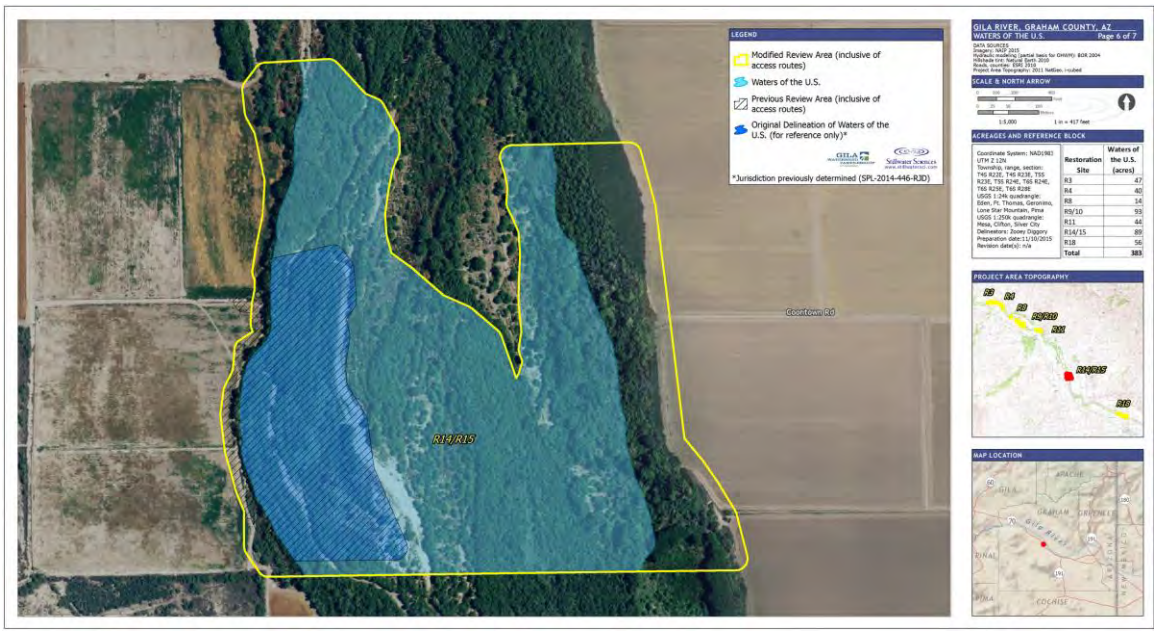

Figure 16 - Restoration Area boundary and Ordinary High Water Mark at Site R14/15

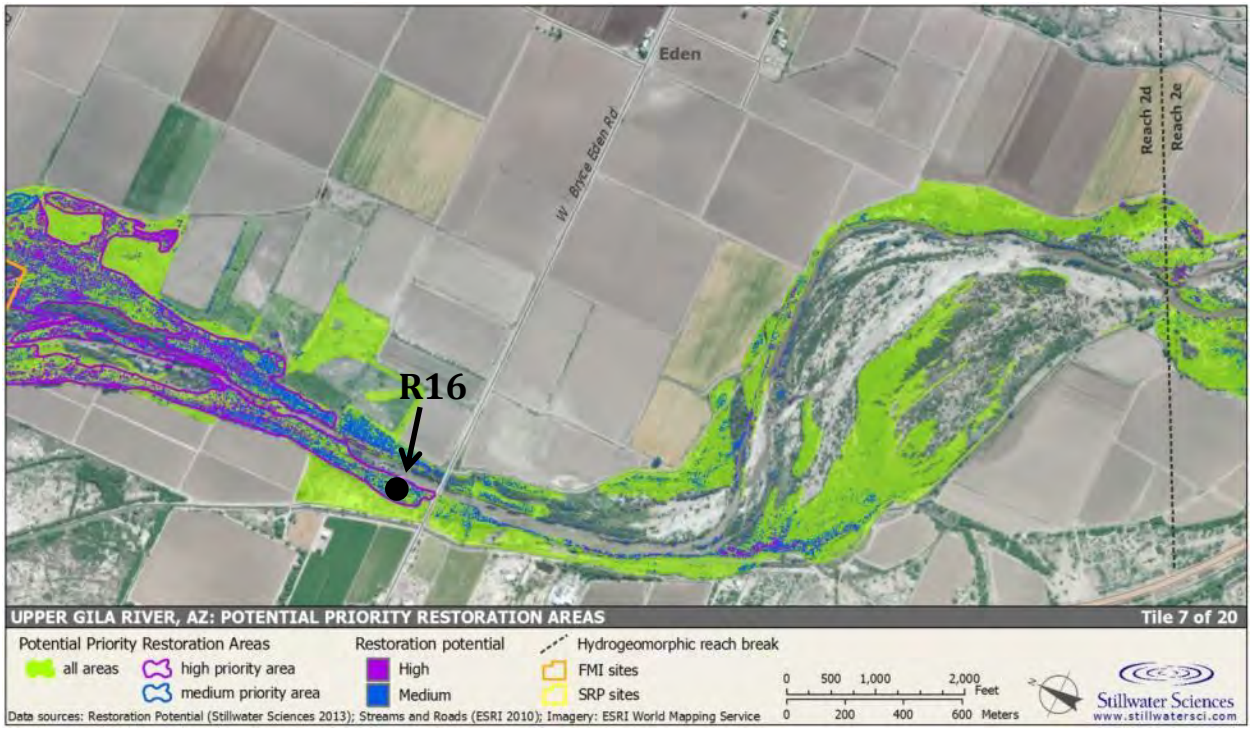

Figure 17 - Potential Restoration Areas near R16

R16 Clonts East side/Colvin West side

The site is located at the Eden Bridge and is highly visible to the public. The landowner on the East side is eligible for added funding through NRCS. This property is important to Graham County because it is adjacent to the Eden Bridge, the only passage over the Gila River in this area. Damage or destruction to the bridge would be devastating to the community. However, the construction of the bridge has narrowed this area, and it appears that the river has been artificially straightened. This site is of lower priority, as it is too narrow for restoration work, and as seen in early February 2015, will wash out under even moderate flow events.

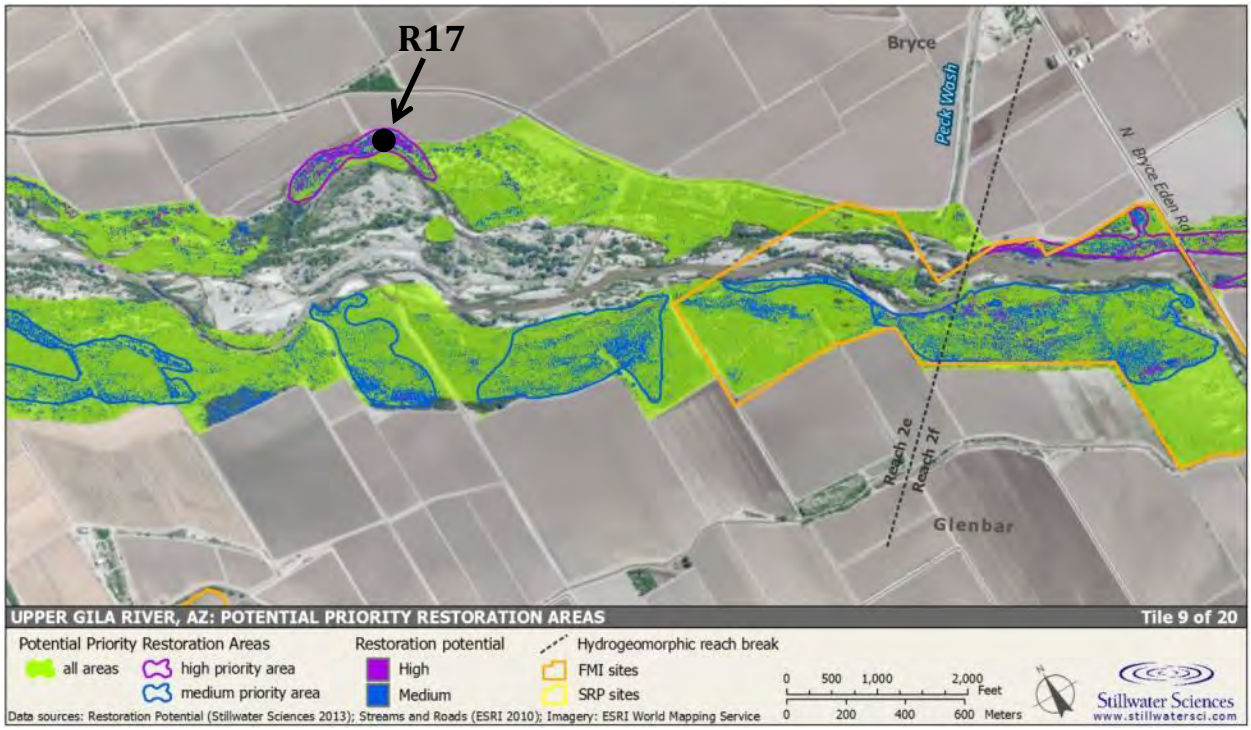

Figure 18 - Potential Restoration Areas near R17

R17 Welker

This site has destabilized stream banks and needs re-vegetation for stream bank stabilization. Landowners are also eligible for added funding through NRCS. The property also has potential for prescribed burning. There are a lot of cottonwoods here, but the landowner has constructed a levee. Unless he wants to remove the levee, project work here will not be possible. This site is of lower priority based on the presence of the levee and the great distance from the active flow channel.

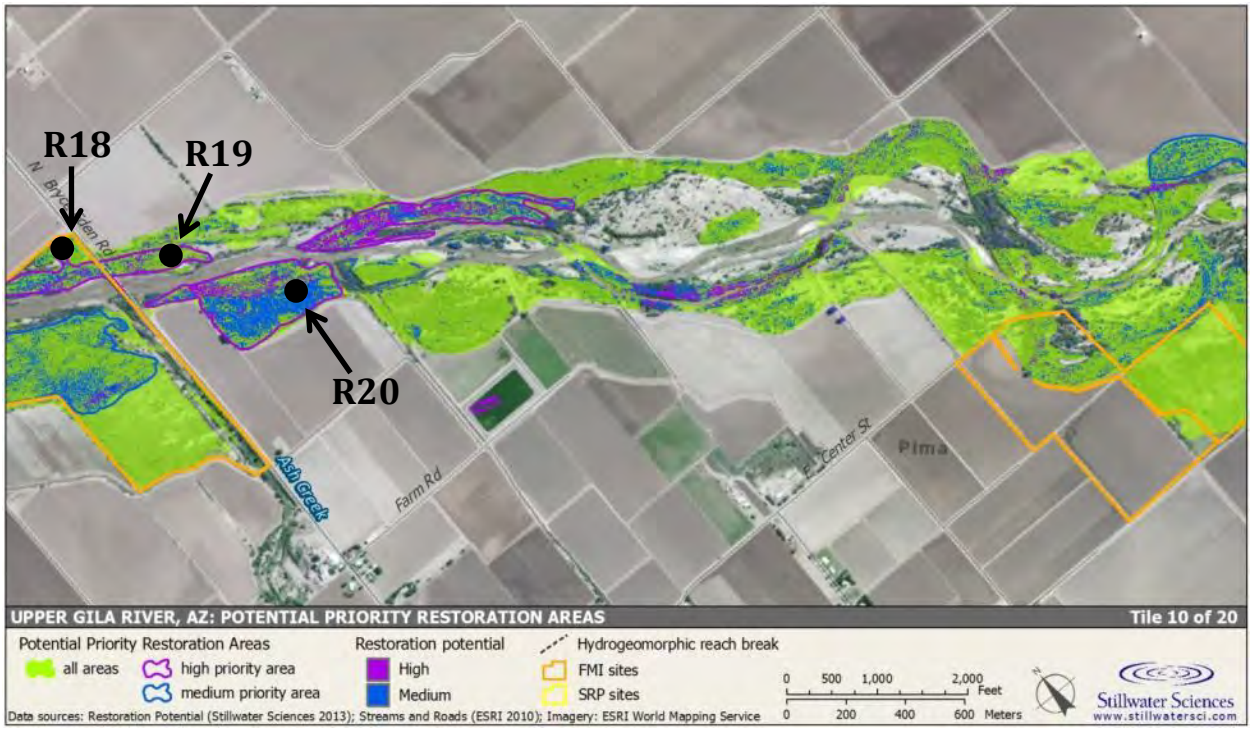

Figure 19 - Potential Restoration Areas between R18 and R20

R18 FMI Pima Bridge

This site is highly accessible and visible, as it is located near the Pima Bridge. Properties near bridges are important to the Town of Pima and Graham County, which rate water conveyance at bridges as a top priority. The largest corporation in the valley owns R18. The East side of the site is constrained by other private properties. On the west side are dense, monotypic tamarisk stands ideal for active restoration, access is easy, and the elevation is good. A portion of the parcel was permitted for implementation in early 2015, and the site will be expanded to include monotypic tamarisk stands in pending permitting efforts. Coordinating with neighboring landowners must occur for site expansion to be allowed on the north bank on the west side, but there is plenty of room on the south bank to expand into dense tamarisk stands (Figure 26).

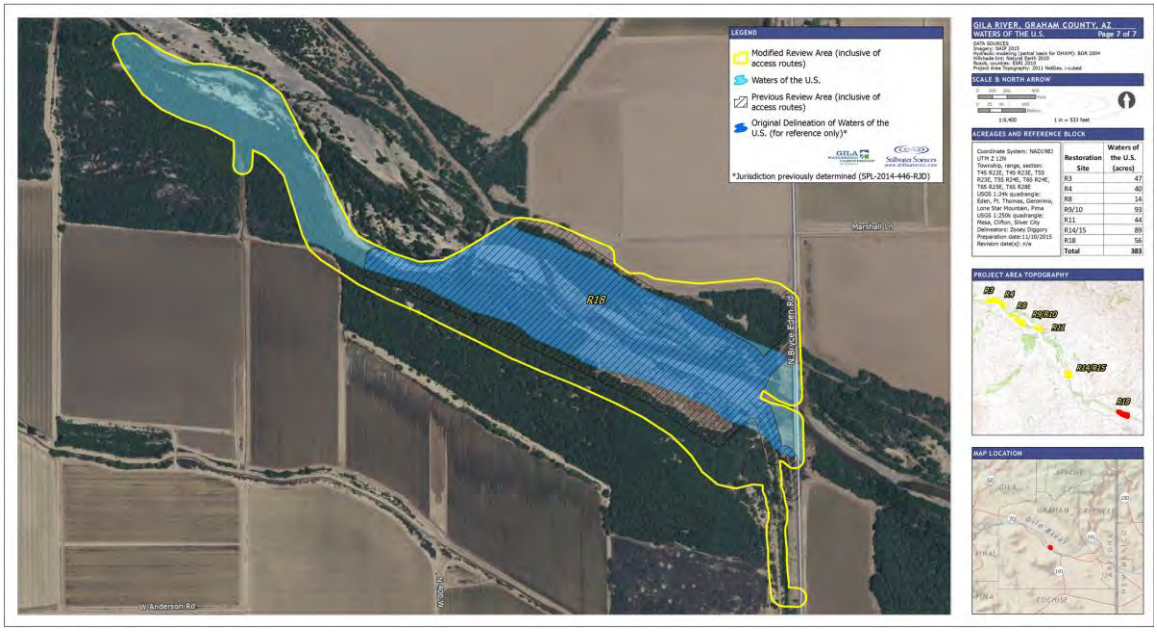

Figure 20 - Restoration Area boundary and Ordinary High Water Mark at Site R18

R19 Welker Pima Bridge

R19 is too narrow and the landowner has built a levee, which, unless it is removed, makes this site not a good candidate for restoration. However, the owner of R19 is also eligible for added funding through NRCS. This property is priority to the Town of Pima and the community as they are near the town's sewer ponds. In addition, this property may benefit from inflow from Cottonwood Wash. This site is of moderate priority due to high community visibility and continuity with R18. However, the site is narrow, and safe access over/around the box-car armoring should be investigated further. Also, the current listed landowner has been dead for many years, so determining ownership may provide an additional obstacle.

R20 Mattice Pima Bridge

R20 has some willows on the east side of river and other native vegetation. This may be a good site for passive restoration or semi-passive restoration. This site is of higher priority due to high community visibility and continuity with R18 and R19. However, there remain questions about the land ownership. The most recent investigation indicated that the current owners were looking to sell the property.

Figure 21 - Potential Restoration Areas between R21 and R22

R21 Gary Bryce

This property includes an agricultural return, which has potential for increased flow beneficial to restoration vegetation. This site has destabilized stream banks and needs re-vegetation for stream bank stabilization. The site presents potential for controlled burn operations. The landowner has influence in the agricultural community, and is also one of the original families to settle the Gila Valley, which may influence other farmers to consider restoration on their properties. There is a levee here, which presents a philosophical challenge for restoration, as it represents a human-introduced structure that limits natural geomorphic processes. This site is of moderate priority, but significant gains in the community could be reaped by the relationship with the landowner, if cultivated.

R22 Howard Family Thatcher Bridge

This property is located at the Thatcher Bridge (N. Reay Lane) and is highly accessible and visible to the community. Any work should be concentrated within existing tamarisk stands positioned well away from the active channel bed. This is due to the high potential flood-scour disturbance expected during flood events, and to take advantage of agricultural return flows along the floodplain margin. This property is important to the Town of Thatcher and the community, as it is near the Thatcher Bridge. However, it is unlikely that this site would be able to thrive without supplemental irrigation. This site is of low priority, as it is too high in elevation, and not located in medium- or high-rated potential restoration areas. It also has very low vegetative coverage, and is not located in modeled SWFL habitat.

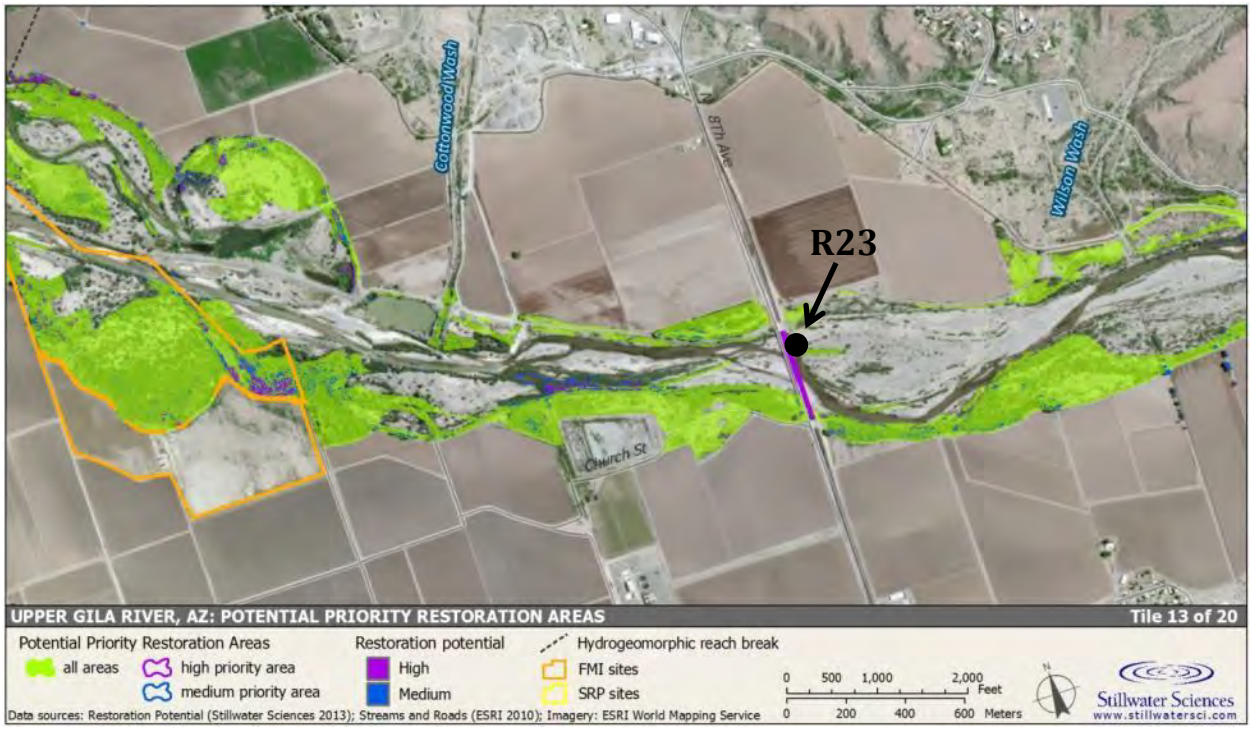

Figure 22 - Potential Restoration Areas near R23

R23 City of Safford

This site is located immediately downstream of the Safford Bridge (N. 8th Avenue). The property has been estimated to support low restoration suitability, and any work should be concentrated within existing tamarisk stands positioned well away from the active channel bed. This is due to the high potential flood-scour disturbance expected during flood events, and to take advantage of agricultural return flows along the floodplain margin. However, despite these limitations, this site has a number of positive attributes: It is highly visible, just north of the heart of Safford, and spans the river. The City of Safford is one of the landowners that has given approval for restoration. The northern parcels are positioned behind a levee, which provides additional protection from flood-scour potential. The landowner of the northern parcels is an active, experienced collaborator in riparian restoration, and an NRCD and FSA advisor. The landowner to the east of R23 has significant influence in the community. The parcels on the upstream side and along the south riverbank have some high- and medium-rated restoration potential, but also appear highly susceptible to future residential/commercial development, which may make restoration unsustainable. This site is of moderate priority, as it is scoured and may be at risk of development in the near future. There is a portion on the western boundary of the parcel that contains modeled SWFL habitat, and the willingness of the landowner is attractive.

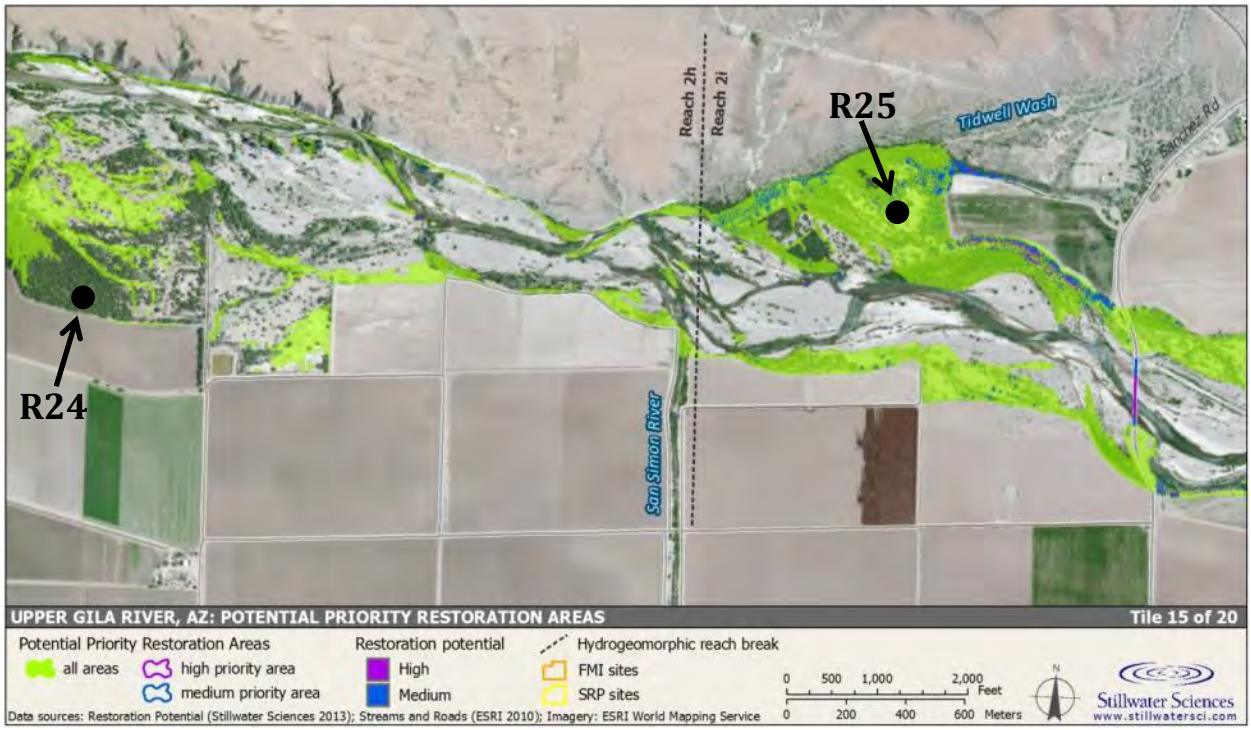

Figure 23 - Potential Restoration Areas between R24 and R25

R24 Claridge

This site has been estimated to support some low restoration potential, and any work should be concentrated within existing tamarisk stands positioned well away from the active channel bed. This is due to the high potential flood-scour disturbance expected during flood events, and to take advantage of agricultural return flows along the floodplain margin, just east of the site location. The property needs bank stabilization, has controlled burn potential, and is eligible for added funding through NRCS. It is owned by an influential farming family with deep roots in the valley. This site is of low priority, as it is too high in elevation, not near the river, does not contain high- or medium-rated potential restoration areas, and does not capture any areas modeled for SWFL habitat.

R25 Palmer

This site is located across and slightly upstream from the San Simon River confluence. The property has been estimated to support some medium-rated restoration suitability. This property may benefit from San Simon return flow as well as water from neighboring fields which crosses the property. This would ensure the success of our re-vegetation efforts. In addition, R25 is across from the Graham Diversion, and near the Solomon Bridge. The landowner is eligible for added funding through NRCS. The landowner is largest farmer in the Valley (R15). The site is located next to some of the most conservative farmers in the valley, and successful participation on this site may serve as a catalyst for collaboration with adjacent farmers in future riparian restoration efforts. However, this site is of low priority due to the lack of modeled SWFL habitat, and the high elevation. There is potential due to the tributary and runoff water that could support

riparian or upland plants, but neither high nor medium-rated potential areas lie within this property.

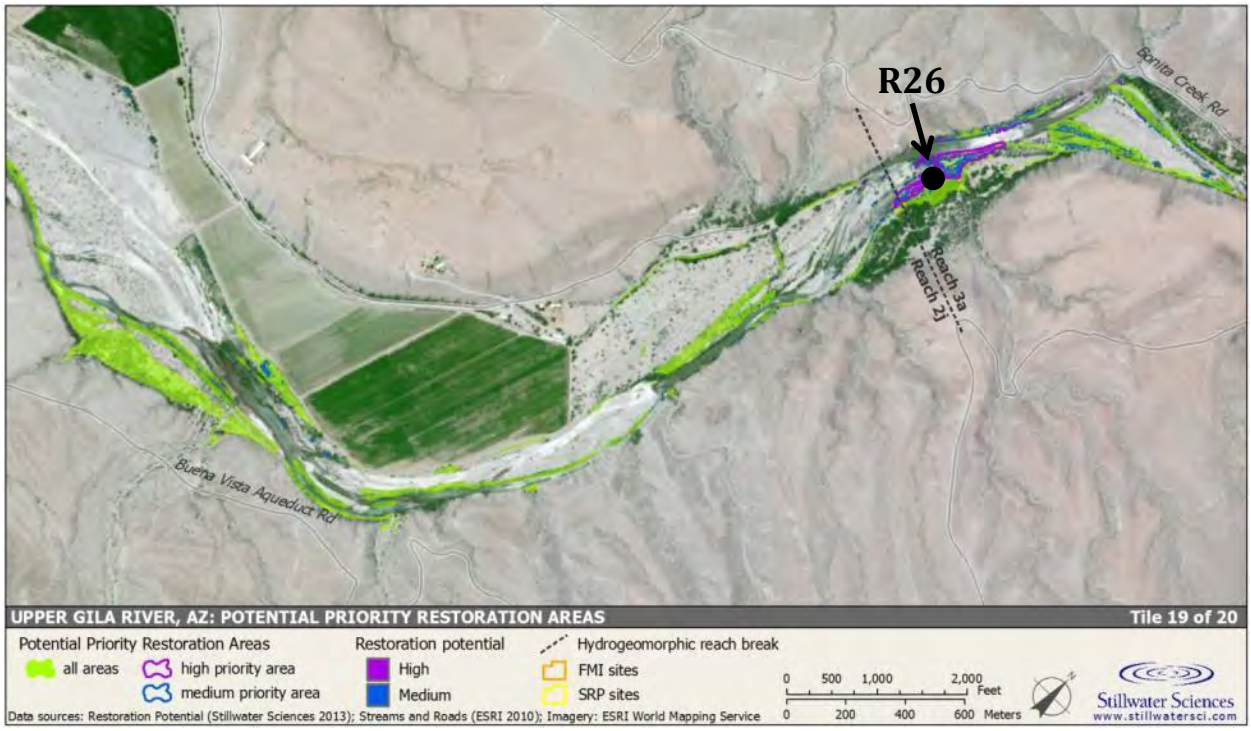

Figure 24 - Potential Restoration Areas near R26

R26 Brown Canal

This site is located at a highly visible and well-travelled scenic overlook of BLM lands at the Brown Canal diversion. The property has been estimated to support high- and medium-rated restoration potential. The site also needs additional vegetation for stream bank stabilization. The site represents the only site with high potential for restoration on the eastern side of the Gila Valley. However, this site is of moderate priority, due to obstacles related to permitting on BLM lands, and coordinating with the Brown Canal, which could take at least three years. If permits are acquired, this would be a great demonstration site for collaboration between GWP and BLM.

R27 Duncan

The Duncan area is noted for having significant Southwestern willow flycatcher habitat, but has not been evaluated for restoration potential. We have identified a landowner outside the town of Duncan who has a large farm with river frontage that includes dense flycatcher habitat. This site is of high priority, but the Ecohydrological assessment does not include properties in Greenlee County. There are considerable tracts of land that qualify as critical habitat, and are captured by the SWFL habitat model that should be incorporated into future planning and implementation efforts.

3. REFERENCES

Cullinane Thomas, Catherine; Huber, Christopher; Skrabis, Kristin; and Sidon, Joshua. 2016. *Estimating the economic impacts of ecosystem restoration—Methods and case studies*. U.S. Geological Survey Open-File Report 2016–1016.

Doyle, Mary. 2008. *Introduction: The Watershed-Wide, Science-Based Approach to Ecosystem Restoration, Large-Scale Ecosystem Restoration – Five Case Studies from the United States*. Society for Ecological Restoration International, Island Press.

Orr, B. K., G. T. Leverich, Z. E. Diggory, T. L. Dudley, J. R. Hatten, K. R. Hultine, M. P. Johnson, and D. A. Orr. 2014. *Riparian restoration framework for the upper Gila River in Arizona*. Compiled by Stillwater Sciences in collaboration with Marine Science Institute at U.C. Santa Barbara, Columbia River Research Laboratory of U.S. Geological Survey, Desert Botanical Garden, and Colorado Plateau Research Station at Northern Arizona University. Prepared for the Gila Watershed Partnership of Arizona.

Roni, P. M. Liermann, S. Muhar, and S. Schmutz. 2013. *Monitoring and Evaluation of Restoration Actions. In: Stream and Watershed Restoration: A Guide to Restoring Riverine Processes and Habitats.* Editors, Philip Roni and Tim Beechie. Wile-Blackwell.

Society for Ecological Restoration Science & Policy WorkingGroup. 2002. The SER Primer on Ecological Restoration. www.ser.org/.

University of Arizona Cooperative Extension. 2007. *Understanding Arizona's Riparian Areas.* The University of Arizona.

US EPA Assessment and Watershed Protection Division. 2005. *National Management Measures to Restore and Protect Wetlands and Riparian Areas for the Abatement of Nonpoint Source Pollution*. US EPA.