Prescott Creeks Preservation Association
In-Lieu Fee Mitigation Program

Draft Prospectus

Submitted To:

The US Army Corps of Engineers and Interagency Review Team

April 2012

PRESCOTT CREEKS

Prescott Creeks Preservation Association
In-Lieu Fee Mitigation Program – Draft Prospectus
April 2012

Table of Contents **Page #**

1.0 Introduction 3
3.0 Establishment and Operation 3
4.0 Proposed Service Area (s) 4
4.1 Initial Primary Service Area-HUC #15060202 4
A. Initial Mitigation Site-Watson Woods Riparian Preserve Mitigation Area 4
5.0 General Need and Technical Feasibility 9
6.0 Long Term Management Strategy and Ownership Arrangements 9
7.0 Qualifications of the Sponsor and Contact Information 9
8.0 Record Keeping and Financial Management 10
9.0 Compensation Planning Framework 10
A. Service Area 10
B. Existing Threats to Aquatic Resources 11
C. Historic Aquatic Resource Losses 17
D. Current Aquatic Resource Conditions 17
E. Aquatic Resource Goals and Objectives 21
F. Prioritization of Mitigation Areas and Activities 21
G. Use of Preservation 25
H. Stakeholder Involvement 25
I. Long Term Protection and Management 27
J. Monitoring, Adaptive Management, and Reporting 28
10.0 Program Account 28
11.0 Conclusion 29
12.0 References 29

List of Figures **Page #**

***Figure 1*-Verde River Watershed Location Map** **2**
***Figure 2*-Upper Verde River Watershed** **5**
***Figure 3*-Verde River Watershed-Hydrologic Features** **12**
***Figure 4*-Verde River Watershed-Major Groundwater Features** **14**
***Figure 5*-Verde River Watershed 2010 ADEQ Assessment** **19**
***Figure 6*-Verde River Watershed ADEQ Land Ownership** **20**
***Figure 7*-Verde River Watershed Priority Areas** **23**

List of Appendices

***Appendix A*-Watson Woods Riparian Preserve - Maps and Photographs**

***Appendix B*-Watson Woods Riparian Preserve - Recently Documented Animal Species**

***Appendix C*-Watson Woods Riparian Preserve - Jurisdictional Determination**

***Appendix D*-Watson Woods Riparian Preserve - As-Built Drawings**

Prescott Creeks Preservation Association
In-Lieu Fee Mitigation Program-Draft Prospectus
April 2012

1.0 Introduction

Prescott Creeks Preservation Association (Prescott Creeks) is pleased to present to the US Army Corps of Engineers, Los Angeles District (CESPL), and the Interagency Review Team (IRT), this Draft Prospectus for the establishment of the proposed Prescott Creeks In-Lieu Fee Program (ILF), located in central Arizona within the Verde River Watershed.

2.0 Goals and Objectives

The goal of the ILF is to provide compensatory mitigation for unavoidable losses to the aquatic environment (riparian habitats, wetlands, and other waters of the US) as authorized by CESPL permits, by the restoration, establishment, enhancement, establishment, and/or preservation of these aquatic resources within the Verde River Watershed, United States Geological Survey (USGS) Hydrologic Unit Code (HUC) 150602 (Figure 1). In order to obtain this goal, Prescott Creeks is committed to complete the following objectives:

- Identify appropriate mitigation sites/projects and service areas by utilizing a watershed approach;
- Conduct site specific baseline inventories for each mitigation site/project;
- Develop and implement mitigation activities (hydrologic improvements, earthwork, plantings, site protection);
- Provide effective short/long term management, monitoring, and maintenance activities; and
- Educate the community on the importance of aquatic, riparian, and wetland habitats.

3.0 Establishment and Operation

Prescott Creeks shall be the Sponsor, and will establish and operate the ILF in accordance with 33 CFR, Part 332, "*Compensatory Mitigation for Losses of Aquatic Resources,*" April 10, 2008 (Final Rule). Prescott Creeks shall develop a Compensation Planning Framework (CPF) that will be used to select, secure, and implement aquatic resource restoration, establishment, enhancement, and/or preservation activities. The CPF will support a watershed approach to compensatory mitigation, and all specific mitigation projects used to provide compensation for CESPL permits will be consistent with this CPF, which is described in Section 9 of this document. Any modifications to the CPF must be approved as a significant modification to the instrument by the CESPL, after consultation with the IRT.

The review and approval of the ILF is a multi-agency process that will involve any or all of the following federal and state agencies, which make up the Arizona IRT: The CESPL, Region IX of the US Environmental Protection Agency (EPA), US Fish and Wildlife Service (USFWS), Arizona Department of Environmental Quality (ADEQ), Arizona Game and Fish Department (AGFD), Pima County Office of Conservation Science and Environment, Pima County Regional Flood Control District, and the City of Phoenix.

The Prescott Creeks ILF is intended to primarily service the 3 individual watersheds within the Verde River Watershed: Big Chino-Williamson Valley (HUC #15060601), Upper Verde River (HUC #15060202), and the Lower Verde River (HUC #15060203). However, the ILF may service other watersheds within the Lower Colorado Watershed as deemed appropriate by the CESPL. Once the ILF is established, individual mitigation projects will be identified and prioritized based on activities and circumstances in specific areas within the Verde River Watershed. These activities /circumstances may

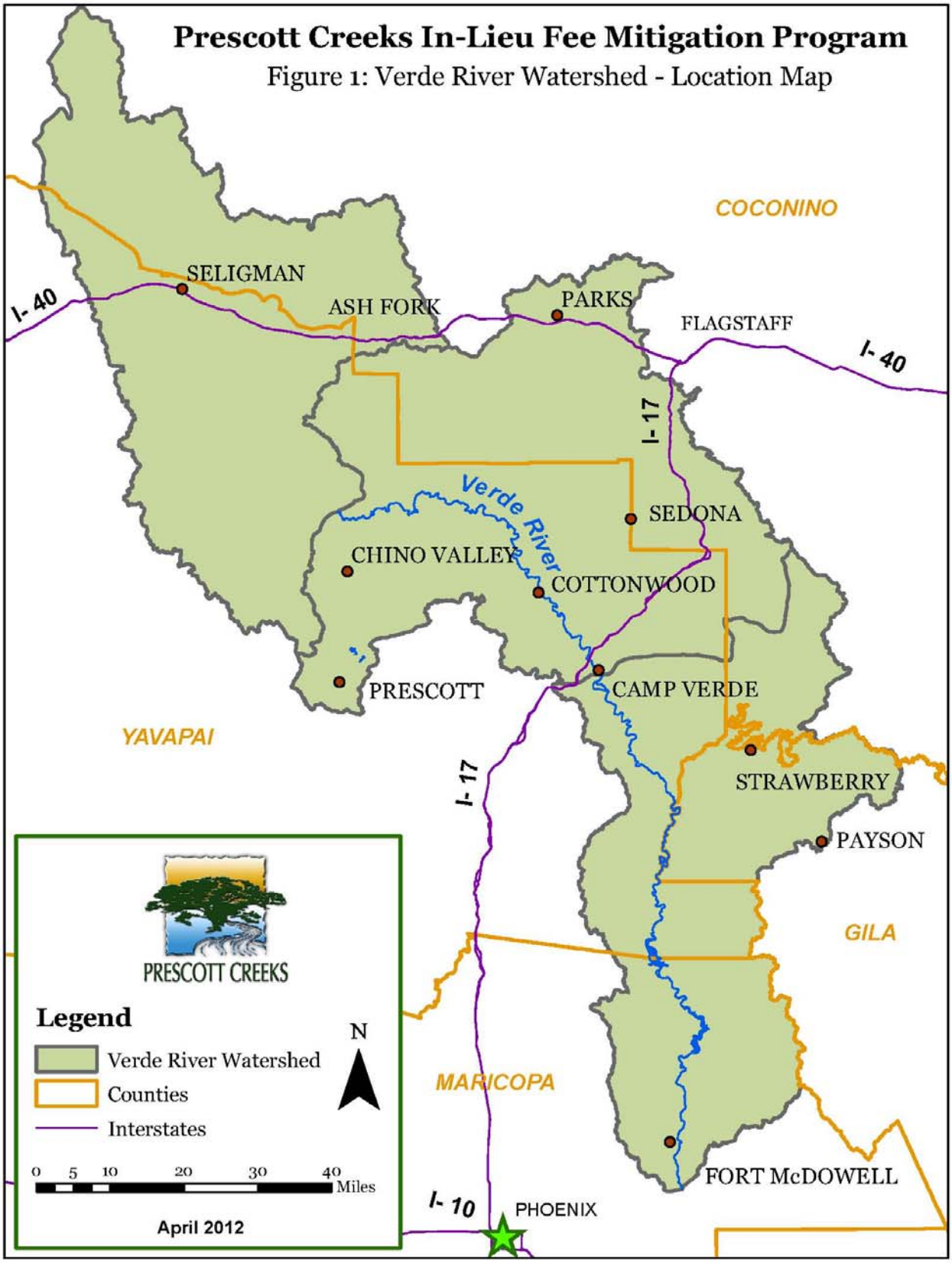


Figure 1-Verde River Watershed Location Map

include development (historic trends and planned projects), current aquatic resource conditions, and foreseeable potential losses to the aquatic environment.

The ILF and final instrument will serve as the "umbrella" beneath which individual mitigation projects within each service area(s) will be established. Each mitigation project will have a separate mitigation plan and CPF signed by Prescott Creeks and the IRT and added as an amendment to the ILF instrument. Mitigation plans will be developed and implemented in accordance with the Final Rule, and will include the following elements:

1. Project Objectives
2. Site Selection
3. Site Protection Instrument
4. Baseline Information
5. Determination of Credits
6. Mitigation Work Plan
7. Maintenance Plan
8. Performance Standards
9. Monitoring Requirements
10. Long-Term Management Plan
11. Adaptive Management Plan
12. Financial Assurances/Long Term Funding Mechanism

The ILF and specific mitigation projects are designed to generate credits for sale or transfer within a designated service area. These shall either be in the form of "advance" or "released" credits, as defined in §332.2:

- *Advance Credits*-means any credits of an approved in-lieu fee program that are available for sale prior to being fulfilled in accordance with an approved mitigation project plan. Advance credit sales require an approved in-lieu fee program instrument that meets all applicable requirements including a specific allocation of advance credits, by service area where applicable. The instrument must also contain a schedule for fulfillment of advance credit sales.
- *Released Credits*-means a determination by the district engineer, in consultation with the IRT, that credits associated with an approved mitigation plan are available for sale or transfer, or in the case of an in-lieu fee program, for fulfillment of advance credit sales. A proportion of projected credits for specific mitigation bank or in-lieu fee project may be released upon approval of the mitigation plan, with additional credits released as milestones specified in the credit release schedule are achieved.

The CESPL is authorized to issue permits pursuant to Section 404 of the Clean Water Act (33 U.S.C 1344) and/or Sections 9 or 10 of the Rivers and Harbors Act of 1899 (33 U.S.C 401, 403). Under these regulations, permittees are required to avoid and minimize adverse impacts to waters of the United States to the maximum extent practicable. Compensatory mitigation may then be required to ensure that an activity requiring a permit complies with the Section 404(b) (1) Guidelines. In order to comply with these aforementioned regulations, permittees may be approved by the Corps to pay monies into the Prescott Creeks ILF Account, in order to provide a funding mechanism for mitigation activities (restoration, establishment, enhancement, and/or preservation).

The Prescott Creeks ILF is intended to provide compensatory mitigation for CESPL Standard/Individual Permits and Nationwide/General Permits. Also, the ILF may provide compensatory mitigation under the Endangered Species Act/Habitat Conservation Plans and other tribal, state, or local wetlands regulatory

programs, along with other federal programs and Department of Defense military construction projects, consistent with the terms and requirements of these programs and provided that all requirements at §332.3(j)(1) are met.

4.0 Proposed Service Area (s)

The Prescott Creeks ILF is intended to service the USGS Accounting Unit HUC 150602 (Verde River), and the following individual Cataloging Units: HUC #15060201-Big Chino-Williamson Valley, HUC #15060202-Upper Verde River, and HUC #15060203-Lower Verde River.

As individual mitigation projects are identified and implemented, the corresponding USGS Cataloging Unit for each of these mitigation projects shall act as the primary service area. Generally, impacts to the aquatic environment authorized by CESPL permits shall be mitigated within the same USGS Cataloging Unit. However, if deemed necessary and appropriate by the CESPL, the 150602 Accounting Unit may act as a secondary service area for individual mitigation projects. Any uses beyond these stated service areas (i.e. Subregion/Region) may only be authorized by the CESPL on a case-by-case basis.

4.1 Initial Primary Service Area-HUC #15060202

The Upper Verde River Watershed, USGS HUC #15060202 (Figure 2) represents the initial primary service area for the ILF. The Upper Verde River Watershed contains the beginning of the Verde River's perennial flow, the Little Chino Aquifer, several perennial waterways, and other significant tributaries. In addition, the watershed contains a relatively large human population in major cities/towns such as Prescott, Chino Valley, Sedona, Cottonwood, Camp Verde, and a growing rural population. In order to provide compensatory mitigation for CESPL-authorized impacts to the aquatic environment within Verde River Watershed, Prescott Creeks proposes to utilize the existing Watson Woods Riparian Preserve as an individual mitigation site, which is currently an approved CESPL mitigation area through Prescott Creeks' existing ILF Memorandum of Agreement.

A. Initial Mitigation Site-Watson Woods Riparian Preserve Mitigation Area

Watson Woods Riparian Preserve Mitigation Area (Watson Woods) is a Fremont cottonwood/red willow riparian gallery forest located along Granite Creek, a mixed perennial/intermittent creek in the Upper Verde River Watershed. The 126-acre preserve is the remaining portion of what was once a 1,000-acre riparian gallery forest near Prescott, AZ (Appendix A contains a series of general maps and recent photographs). On-going ecological management activities within Watson Woods since approximately 1995 have led to significant improvements within Watson Woods. The overall goals of this project are to enhance and restore creek function and riparian habitat and create additional riparian/wetland habitat. Additionally, the project aims to educate and involve the community in the restoration process. The objectives include:

- Restore the stability of the Granite Creek stream channel, while maintaining natural dynamic stream processes; proper hydrologic conditions and functions, stream morphology and channel characteristics, and floodplain function.
- Enhance, restore, and create riparian vegetation and habitat within the Watson Woods Riparian Preserve.
- Educate and involve community members in the restoration process.
- Monitor the biota and abiotic environment to evaluate and communicate project performance
- Provide long-term protection and management

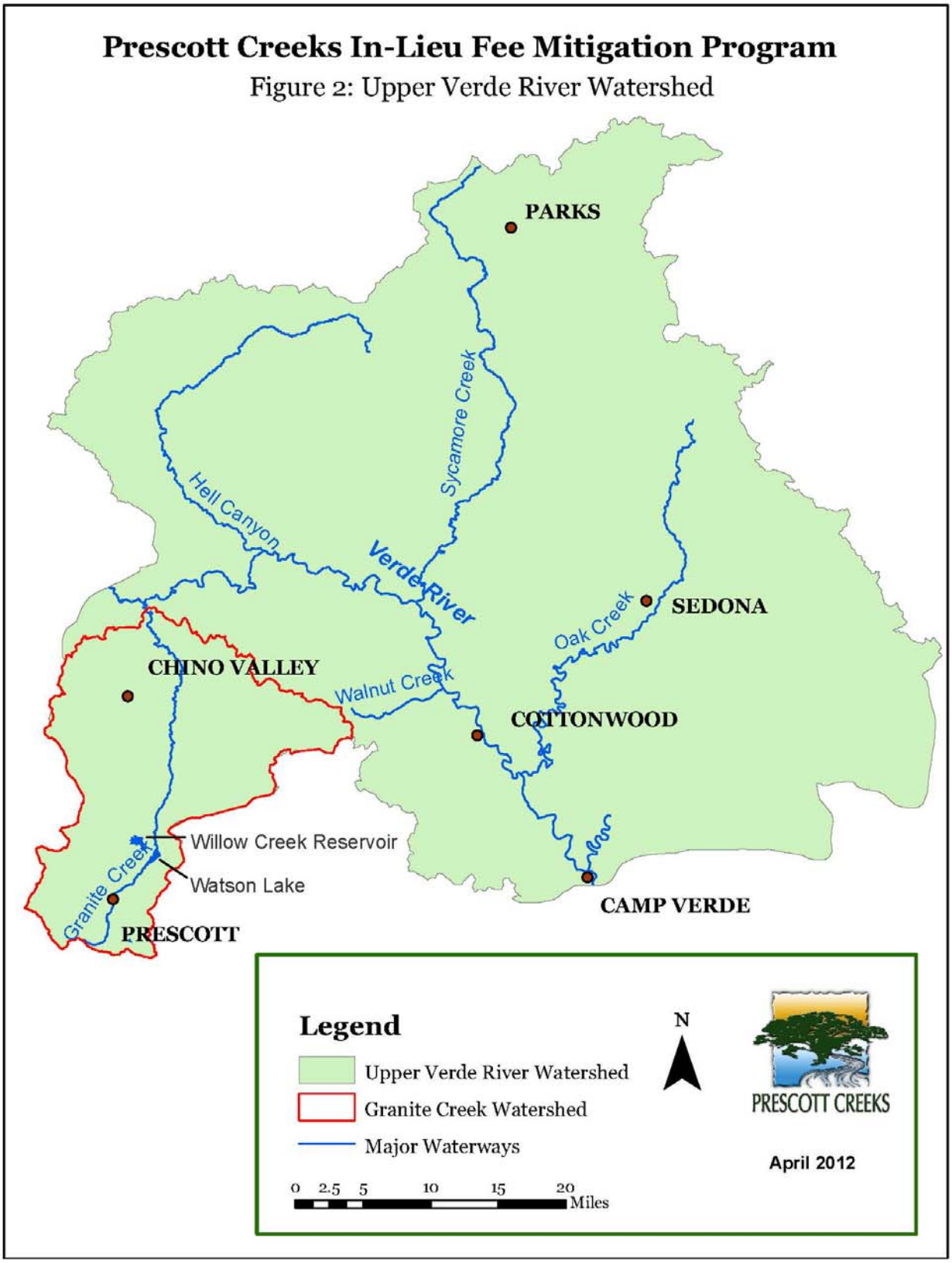


Figure 2-Upper Verde River Watershed

Intended Benefits

Public benefits such as improved water quality, groundwater availability, and outdoor recreational/educational opportunities are examples of what will be realized as a result of the ongoing efforts at Watson Woods. Improved water quality will be achieved by the improved stream channel function of Granite Creek along with associated vegetative plantings in both the riparian corridor and surrounding wetlands. Increased vegetation and expanded flood plain as a result of the channel enhancement/restoration will also promote water retention and improve groundwater recharge. Prescott Creeks is dedicated to improving public awareness of the importance of our aquatic resources by providing non-consumptive recreation, volunteer events, and education programs.

Many animal species will also directly benefit from an improved riparian corridor. These animals may include, but are not limited to bald eagle (*Haliaetus leucocephalus*), black-hawk (*Buteogallus anthracinus*), zone-tailed hawk (*Buteo albonotatus*), southwestern willow flycatcher (*Empidonax trailii extimus*), yellow-billed cuckoo (*Coccyzus americanus*), southwestern toad (*Bufo microscaphus*), narrow-headed garter snake (*Thamnophis rufipunctatus*), Mexican garter snake (*Thamnophis eques*), lowland leopard frog (*Rana yavapaiensis*), and Sonoran mud-turtle (*Kinosternon sonoriense*), bobcat (*Lynx rufus*), and mule deer (*Odocoileus hemionus*). A list of recently documented animal species within Watson Woods is provided in Appendix B.

Site History

As stated above, Watson Woods was once part of a larger 1,000 acre riparian gallery forest, and as late as the 1860s showed both vibrant health and heavy use. A dense riparian forest, consisting of cottonwood (likely *Populus fremontii*), ash (likely *Fraxinus velutina*), willow (likely *Salix laevigata*, *S. lasiolepis* and possibly *S. exigua* and *S. gooddingii*), and chokecherry (likely *Prunus virginiana*) shaded a Granite Creek channel that flowed perennially from south to north above ground in areas with groundwater just a few feet below. The quality of the water at the time was excellent and was utilized by livestock and people alike.

The early to mid-1900s saw continued stock grazing in and along Granite Creek. In addition to grazing, various industries including dam building for irrigation, sand and gravel mining, redistribution of fill, timber harvesting, and sewage disposal have impacted Watson Woods' stream channel, floodplain, terraces, riparian vegetation and water quality. The direct effects of land uses in recent decades in combination with historic impacts from the 1800s have left the riparian area degraded in many ways. The majority of the vegetation found within the Preserve today has developed in the last 30 to 40 years; very few older trees exist, and age class and structural diversity is generally poor.

Existing Hydrology

The primary drainage feature of Watson Woods is Granite Creek, which flows generally in a south-north direction, eventually reaching the Verde River approximately 20 miles downstream. Approximately 3,500 of the channel represents recently restored "reaches", with the other portions of the creek being natural and "braided" in some areas. Flows in Granite Creek are seasonal, with continuous flows during the winter months. During late spring/summer, flows are present only immediately following a rain/storm event.

Zoning and Designated Land Use

Watson Woods is currently zoned by the City of Prescott as "Natural Open Space." According to the Prescott Land Development Code (Amended 2009), Natural Open Space is a passive use recreational district, with intentions to conserve private and public natural and scenic resources of community value. Official "Permitted" uses of Natural Open Space are limited to Parks/Nature Preserves, Minor Utilities, and Utility Installation/Service. One of the "Primary Intents" of the Land Development Code is to "promote natural resource conservation."

Water Rights

The Salt River Project (SRP) currently holds senior water rights over the surface water within Watson Woods and Granite Creek. Granite Creek flows into Watson Lake, which is impounded by the Watson Lake Dam. The City of Prescott is in agreement with SRP to withdraw approximately 3,500 acre-feet of water per year from Watson Lake.

Jurisdictional Determination

A Jurisdictional Determination for Watson Woods was made by the CESPL on August 12, 2008 (CESPL Project #SPL 2007-01294-DE), and is provided in Appendix C.

Methods

To achieve the aforementioned goals, habitat, and species improvement, Prescott Creeks preformed the following activities within Watson Woods, illustrated in the attached "as built drawings." (Appendix D). The following major activities have been conducted:

- *Granite Creek Restoration:* Utilizing heavy equipment (bulldozers, excavators, etc), Prescott Creeks restored 3550 linear feet of the Granite Creek channel within 4 individual "Reaches." Following earth moving/channel realignment, Prescott Creeks installed rock for toe stability, coir logs, erosion control matting, and native herbaceous seed mix where appropriate. In addition, cottonwood and willow pole cuttings (harvest on-site) were installed. Total riparian acreage is approximately 4.1 acres (50ft average riparian zone width). Direct funding for the Granite Creek channel restoration was provided by the major grants-ADEQ and Arizona Water Protection Fund (WPF)
- *Critical Planting Areas:* Prescott Creeks also conducted planting activities within several "critical planting areas" and wetland areas totaling approximately 21 acres. In order to conduct these activities, the planting areas/wetlands were prepared by excavating/filling to achieve a level surface, and planted with cottonwoods and willows harvested from on-site. Direct funding for the critical planting areas was provided by the major grants (ADEQ and WPF)
- *ILF Projects:* With funding from 2 ILF mitigation sales ($32,145 and $17,247.46), Prescott Creeks conducted a 2.5-acre wetland restoration and a 0.4 acre restoration within Watson Woods, respectively. Typical activities such as land leveling/grading and plantings were involved. Also, Prescott Creeks conducted administrative and training activities using ILF funds, with a current balance of $8,946.98 in the ILF account.
- *Other activities:* Additional restoration/enhancement activities throughout Watson Woods included the removal of trash/debris, installation of perimeter fencing, and continuous maintenance/monitoring/management.

Credits and Acreages
Watson Woods encompasses 126 acres. Currently, grant funding programs have directly led to the restoration/enhancement of 25.1 acres (critical planting area, wetlands, and riparian corridor of Granite Creek), while ILF funding has resulted directly in the restoration of 2.9 acres of wetlands.

Prescott Creeks intends to conduct up to 52 acres of additional wetland restoration/enhancement and 49 acres of preservation within Watson Woods directly through the ILF. A specific mitigation plan and CPF for Watson Woods will be provided as described in Section 3.0. Mitigation activities may include vegetative plantings, improved boundary control, additional hydrologic improvements, and removal/management of Siberian elm (*Ulmus pumila*), Salt cedar (*Tamarix*), Spotted knapweed (*Centaurea maculosa*), Scotch thistle (*Onopordum acanthium*), Dalmation toadflax (*Linaria dalmatica*), and Common teasel (*Dipsacus follonum*).

Functions and Values
Prescott Creeks intends for the following wetland/riparian function and values to be achieved by its past/current restoration effort as well as future projected mitigation activities:

- Hydrological and Floodplain Improvements
- Groundwater Recharge
- Proper Stream Geomorphology
- Expanded Riparian and Wetland Habitat
- Improved Water Quality
- Improved Vegetative Species Diversity
- Improved Wildlife Habitat

Ownership and Access
Watson Woods is currently owned by the City of Prescott, with Prescott Creeks as the active land-manager. The current lease agreement is 25 years (beginning in 1995), and discussions with the City to renew this lease and provide a more permanent agreement are underway with a a favorable initial response. Based on current information, it appears the City of Prescott also retains mineral rights within Watson Woods. City of Prescott Contact Information: 201 S. Cortez; Prescott AZ 86303; 928-777-1100.

Pedestrian access is opened to the public, however public use is generally limited when compared to other recreational areas within Prescott. Non-consumptive use will remain a priority for the long-term management of Watson Woods. Vehicular access is limited to Prescott Creeks' personnel and other authorized users (city, utility companies). A wire fence built to USFWS "Game Fence" standards also surrounds the Watson Woods.

Other Funding/Pubic Projects
As stated above, beginning in approximately 1989, several projects at the planning/development to implementation/construction level have been conducted within Watson Woods. Primary funding includes approximately $1,788,162 in major grants from the AZ Department of Environmental Quality and AZ Water Protection Fund, along with other grants/funding from the City of Prescott, Coors Pure Water, River Network, Arizona Community Foundation, and other programs. In total, Watson Woods has been the recipient of approximate $2M+ in grant programs along with ~12,000 volunteer hours (channel maintenance, cleanup events, etc.) recorded.

5.0 General Need and Technical Feasibility

The general need for the Prescott Creeks ILF is primarily evident in the general lack of available compensatory mitigation sites and In-Lieu Fee Programs within the Verde River Watershed. The Verde River is one of the few remaining perennial waterways in Arizona and the southwest. The Verde River Watershed is approximately 6,662 square miles, and contains over 9,037 miles of streams (Arizona NEMO 2005), along with associated wetlands and riparian areas.

Riparian ecosystems are highly valued resources in the southwestern United States owing their high use by Neotropical migratory animals, their high productivity and biodiversity, and their function in stabilizing riverine environments (Ohmart and Anderson 1982). Riparian ecosystems serve as the primary link between upland terrestrial and aquatic ecosystems (Gregory et al 1991), and are the ultimate expression of ground-water and surface-water interactions (Webb and Leake 2005).

As impacts (draining, filling, pollution, groundwater pumping, etc.) continue to impact the Verde River and its associated riparian and wetland ecosystems, there is a strong public need to provide appropriate compensatory mitigation through the Section 404/10 Permitting Program. Prescott Creeks intends to conduct stream, riparian, and wetland mitigation activities, as well as provide effective management, monitoring, and maintenance over the short and long term. In addition, appropriate site protection instruments will be in place for each individual mitigation project, which will ensure that the restored, established, enhanced, and/or preserved aquatic resources are protected in perpetuity. Prescott Creeks has the necessary resources, expertise, track record, and strong community support to successfully develop and implement specific mitigation activities. This ability is evident primarily in the successful construction and on-going management of the existing Watson Woods Mitigation Area, already part of an approved ILF.

A detailed analysis of the existing conditions, general trends, and projected activities that affect the Verde River Watershed are described in Section 9 (Compensation Planning Framework) of this document.

6.0 Long Term Management Strategy and Ownership Arrangements

Prescott Creeks shall be responsible for developing, implementing, and managing mitigation activities under the ILF. The long term management strategy for the ILF is described in Section 9.I of this document. In regard to ownership arrangements, Prescott Creek shall own individual mitigation sites through fee title or shall have a management agreement for publically owned properties. All individual mitigation sites shall have a perpetual conservation easement, deed restriction, or other similar real-estate instrument, with the goals of the ILF and watershed being the primary focus of each protective instrument.

7.0 Qualifications of the Sponsor and Contact Information

Prescott Creeks is a 501(c) (3) nonprofit organization with the mission to promote, protect and celebrate the ecological integrity of riparian systems and associated wetlands in the central Arizona watersheds through conservation, restoration and education. Founded in 1990, Prescott Creeks is an established organization with a proven track record with grant writing and other funds development for project implementation, management, monitoring, and maintenance. Prescott Creeks has successfully operated its current ILF since 2002, and is currently seeking to update this program in accordance with the Final Rule.

Prescott Creeks is managed by a full-time professional staff and volunteer Board of Directors. Michael Byrd, Executive Director of Prescott Creeks, has been with the organization since 1995. The

organization has secured and administered over $2.2 million for the Watson Woods Riparian Preserve project alone and therefore is well positioned to receive and manage ILF Program funds. Completion of many successful projects can be demonstrated through Prescott Creeks' work with the AZ Water Protection Fund, the AZ Department of Environmental Quality-Water Quality Improvement Grant Program, and the City of Prescott. For more information, please visit www.PrescottCreeks.org, or contact: Michael Byrd, Executive Director; PO Box 3004; Prescott AZ 86302; 928-445-5669.

8.0 Record Keeping and Financial Management

Prescott Creeks will maintain accurate records of the ILF transactions including a database identifying monies accepted for each project, CESPL project number, impact location and acreage, type of mitigation required, type of habitat impacted, required mitigation acreage, fee amount, date of CESPL approval, and date monies were received. Records of ILF expenditures will include cost of land acquisitions, project planning, construction, monitoring, maintenance, contingencies, and administration will be identified in the annual report. Also, each individual mitigation project will contain separate accounts and records with the aforementioned information.

Prescott Creeks will establish and maintain a tracking system for the production of credits, credit transactions, and financial transactions between Prescott Creeks and permittees. Credit production, credit transactions, and financial transactions will be tracked by service area and separated for each individual mitigation project.

9.0 Compensation Planning Framework

A. Service Area

Verde River Watershed

The Prescott Creeks ILF is intended to utilize the Verde River Watershed, USGS Accounting Unit #150602 (Figure 1) as its service area. The Verde River Watershed is located in central Arizona, and spans four counties; Coconino, Gila, Maricopa, and Yavapai, with 50% of the watershed being in Yavapai County (Arizona NEMO 2005). The major cities/towns within the Verde River Watershed include Prescott, Sedona, Seligman, Ash Fork, Chino Valley, Camp Verde, and Cottonwood. The Verde River Watershed also contains portions of the Phoenix Metropolitan Area (US Census Bureau 2010), and delivers nearly 40% of the surface water in Phoenix (Verde River Basin Partnership 2012).

The Verde River watershed is located in the Transition Zone between the Colorado Plateau and the Basin and Range physiographic provinces (Springer and Haney 2008), and ranges from 1,323 to 12,617 feet above sea level over its 6,622 square miles (Arizona NEMO 2005). Streamflow in the upper 26 miles of the Verde River is sustained by surface runoff and groundwater discharge from the upper Verde River Springs, and spring discharge is comprised chiefly of water from the Big Chino (80%) and Little Chino (14%) aquifers (Wirt et al 2005). Streamflow in the middle Verde River is sustained by surface runoff, base flow from the upper Verde River, groundwater sources, and contributions from tributaries, where the flow of the river then increases significantly (Springer and Haney 2008) into the lower Verde River.

The Verde River is a tributary to the Salt River in the Colorado River Basin. Its major tributaries are Chino Wash, Williamson Valley Wash, Walnut Creek, Granite Creek, Hell Canyon, Sycamore Creek, Oak Creek, Beaver Creek, and West Clear Creek (Springer and Haney 2008), illustrated in Figure 3. The Verde River is perennial from a group of springs near the confluence

of Granite Creek to the Horseshoe/Bartlett Reservoirs, and "unlike many rivers in the West, most of the watershed is unregulated (no significant dams) and thus retains a natural flood regime (Pearthree 2008)."

The Verde River supports 10 native fish species, including the federally endangered razorback sucker (*Xyrauchen texanus*) and Colorado pikeminnow (*Ptychocheilus Lucius*), along with the threatened spikedace (*Meda fulgida*). Three sensitive riparian herpetofauna species survive in the watershed; the northern Mexican gartersnake, the narrow headed gartersnake, and the lowland leopard frog. The Verde River supports over 200 recorded resident and neo-tropical migratory birds, and species such as the federally endangered southwestern willow flycatcher and the yellow-billed cuckoo depend on the river's woody riparian forests. Finally, the Verde River supports the largest number of bald eagle breeding areas any river in the state, is one of only three rivers in Arizona with population of river otter (*Lontra canadensis*) (Northern Arizona University), and an increasing population of beaver (*Castor canadensis*).

The Verde River Watershed supports a variety of diverse riparian habitats such as cottonwood/willow gallery forests, velvet mesquite (*Prosopis veluntina*) bosques, and mixed broadleaf communities consisting of Arizona sycamore (*Platanus wrightii*), velvet ash (*Fraxinus velutina*), cottonwood, Arizona alder (*Alnus oblongifolia*), Arizona walnut (*Juglans major*), and willows. Upland habitats include Semi-desert Grassland, Great Basin Conifer Woodland, Sonoran Desert scrub (Rivers.gov), Pinyon pine (*Pinus edulis*) and Juniper (*Junipersu sp*) forests, and Ponderosa pine (*Pinus ponderosa*) forests.

The Verde River Watershed is made up of three smaller watersheds (USGS Cataloging Units): HUC #15060201-Big Chino-Williamson Valley, HUC #15060202-Upper Verde River, and HUC #15060203-Lower Verde River (Figure 3). Prescott Creeks shall use a watershed approach and landscape perspective within each of these watersheds to identify types and locations of individual mitigation projects and subsequently design projects to maximize the watershed benefit and offset impacts to aquatic resources caused by CESPL permitted activities.

B. Existing Threats to Aquatic Resources

Essentially, all riparian ecosystems in the Southwest are considered to be at risk for decline (Dobyns 1981). In 2006, American Rivers pronounced the Verde River as the 10th Most Endangered River in the United States (Smith et al 2009). Although this is due primarily to excessive groundwater pumping, other threats to the watershed include population growth and development activities, tourism, agriculture/livestock activities, water control projects, invasive vegetation, and mining.

Groundwater

Major aquifers such as the Big Chino Aquifer and Little Chino Aquifer supply at least 80% and 14% the base flow of the upper Verde River, respectively. All domestic, municipal, and industrial water comes from groundwater pumping in the watershed, and additional irrigation water also comes from groundwater in the Big and Little Chino aquifers, above the Verde River's headwater springs (Northern Arizona University). Current and historical excessive use of these aquifers is a threat to the natural flow of the Verde River and the health of its riparian and wetland areas.

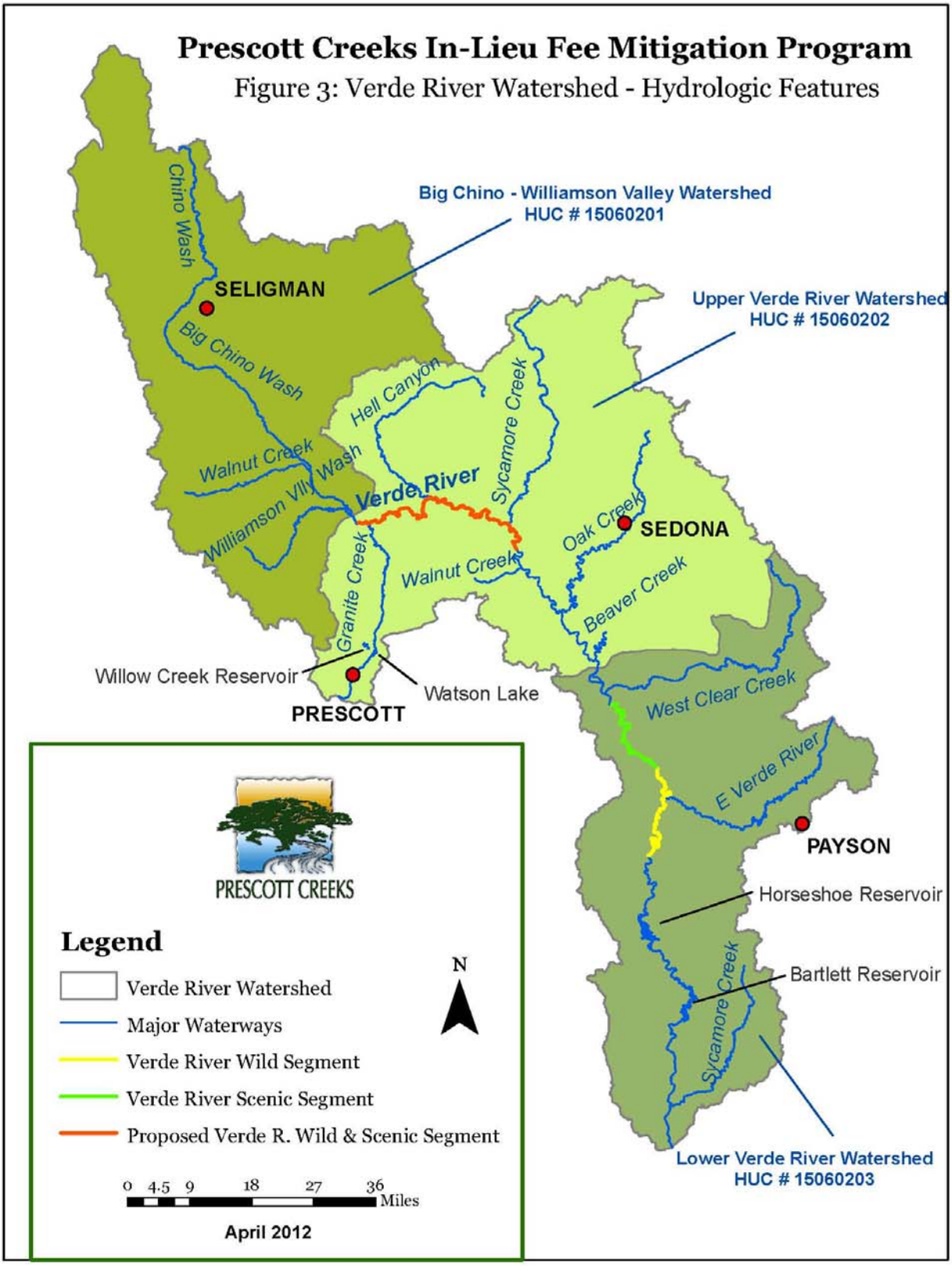


Figure 3-Verde River Watershed-Hydrologic Features

In order to manage the usage of these valuable aquifers, the Prescott Active Management Area (AMA) was created by the 1980 Groundwater Code. Operating under the Arizona Department of Water Resources (ADWR), the AMA includes the municipalities of Prescott, Chino Valley, Prescott Valley, Dewey-Humbolt, and other unincorporated areas of Yavapai County (Figure 4).

The AMA was created to reduce localized groundwater overdraft and achieve a "safe-yield" by 2025. Safe-yield means that the amount of groundwater pumped from the aquifer on an annual basis must not exceed the amount that is natural or artificially recharged (University of Arizona). Current studies, programs, and planning are underway to accommodate and consider the recent growth in urban and suburban areas, climate change, improve water quality, and alternative water supplies.

A major potential threat to the Verde River is the Big Chino Ranch (BCR) Project, a project that was recently created after the ADWR declared that the Prescott AMA was no longer at a safe-yield. This triggered full implementation of the Assured Water Supply Rules, requiring that only renewable or imported water supplies from outside the AMA be utilized. As a result, Prescott and Prescott Valley purchased the BCR (located above the Big Chino Aquifer), with the intentions of building a series of groundwater wells to extract water from the aquifer, and a 30 mile pipeline from the BCR to Paulden and Chino Valley (Figure 4), which would then tie-into the AMA member's current water-supply system. The system would be designed to extract and transport up to 12,400 acre-feet of groundwater per year (City of Prescott).

The construction of a 30-mile pipeline and associated facilities will likely have to traverse wetlands, riparian areas, and/or waters of the US, resulting in direct/indirect and permanent/temporary impacts. In regard to groundwater extraction, as rivers and streams are "dewatered," a succession of plant life overtakes the former riparian corridor. Phreatophytes like cottonwoods and willows are slowly replaced by a succession of upland species. The Verde River is at risk of becoming an intermittent waterway-If that were to happen, biological diversity would plummet, and riparian zones would disappear. Also as floods continue to occur, a lack of riparian areas would lead to severe channelization, bank down-cutting, lateral erosion, and changes in streambed topography (Von Gausig et al 2011) throughout the watershed.

In order to mitigate for historic and future losses due to excessive groundwater extraction and construction impacts, Prescott Creeks shall develop and implement the restoration, establishment, enhancement, and/or preservation of aquatic resources. Riparian and wetland habitat are critical to achieving natural surface flow and contributing to groundwater recharge. In addition, the conservation of water through natural riparian habitats reduces the need to extract groundwater for irrigation, commercial/industrial, or residential use.

Population Growth and Development

The Verde River Watershed contains Yavapai, Maricopa, Gila, and Coconino Counties. According to the US Census Bureau, these 4 counties contained 66% of Arizona's population in 2010. Yavapai County, which makes up 50% of the watershed, has seen a 49% population growth from 1990-2010 (106,895 to 211,033). Also, the Prescott General Plan forecasts that by 2020, the unincorporated areas of Yavapai County are predicted to grow by 53%. Coconino County, another large presence (34%) within the watershed, has experienced a 28% population growth from 1990-2010 (96,591 to 134,421).

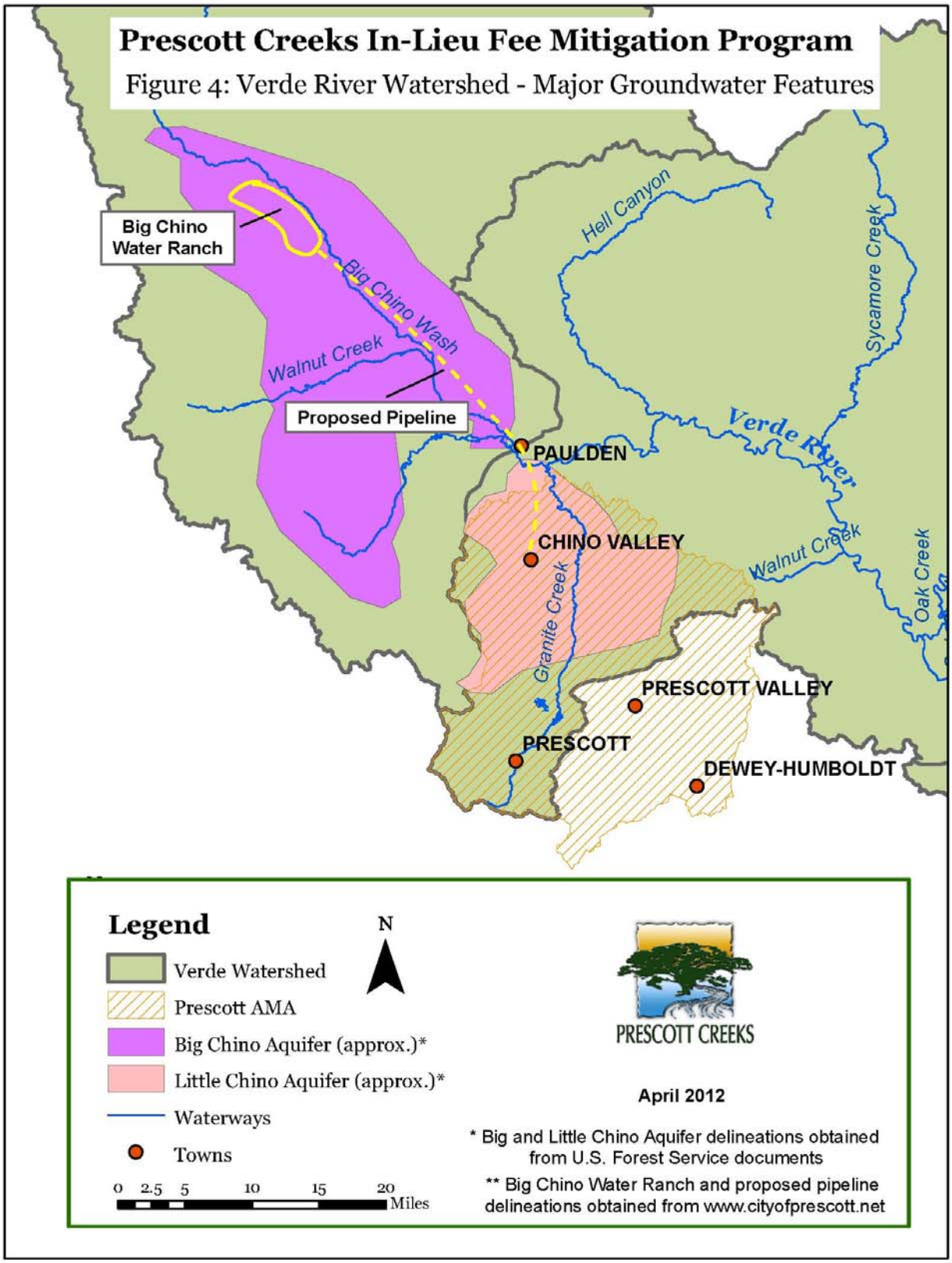


Figure 4-Verde River Watershed-Major Groundwater Features

As population growth in these areas increases, so does the need for additional roads, infrastructure projects, and supporting development activities, which may result in adverse impacts to the aquatic environment. According to City-Data.com, Prescott, AZ was #26 of cities in the United States with the most local government spending on highway construction per resident. The Arizona Department of Transportation (ADOT) has planned $70.2 million worth of highway projects in Yavapai County through 2016; this includes improvements to turnoffs/exits to Sedona, 12 miles worth of improvements to I-40 near Ash Fork, roadway reconstruction projects near Cottonwood, and a widening of 30 miles of I-17 between the new Cordes Junction and Black Canyon City (Journalaz.com). All of these road projects are designed to accommodate historic, current, and projected development growth.

Sewer improvement projects also have the potential to adversely impact riparian and aquatic ecosystems. For example, in Prescott, many of the existing sewer lines are beneath the actual creek/stream bottom and are in need of repair-any replacement/repair activities would require channel excavation and temporary access/storage in wetlands/riparian areas. Also, Prescott has several projects planned such as improvements to the Airport Water Reclamation Facility and new forcemain projects that will likely affect aquatic ecosystems.

Providing appropriate compensatory mitigation for development-related activities is critical to achieving Prescott Creeks' aquatic resource goals and objectives, as this represents a funding mechanism to implement the projects and realize the benefits that will be achieved by aquatic resource restoration, establishment, enhancement, and/or preservation activities. As credits are secured through the ILF, Prescott Creeks will develop and implement mitigation activities commensurate with the impacts to aquatic resources.

Tourism

Because the Verde River represents one of the last perennial waterways in Arizona, many tourists travel from inside and outside Arizona to visit the Verde River and its tributaries for hiking/camping, swimming, boating, and hunting and fishing. According to the Arizona Office of Tourism, in 2006-2007, at least one third of the visitors to the Verde Valley came from Arizona, and that visiting state and national parks and historic places were the most popular activities, along with activities directly related to the natural beauty of the Verde Valley and often directly linked to the Verde River itself (Smith and Haney 2008). Visitors to the Verde Valley bring an estimated total economic impact of $772 million to the area.

Although tourism and water-based recreational activities provide a public benefit, these same activities can adversely impact aquatic ecosystems. Sport fishing and hunting aquatic animals can lead to population declines and affect predator-prey interactions. Off-highway vehicles can lead to habitat destruction and loss of streambank stability and erosion, along with providing access to remote areas, which increases stress and pressure on fish and wildlife in previously inaccessible areas. Pollution from "gray water" and hydrocarbon residues from camping and boating also occurs, which also negatively affects riparian/wetland systems (Regional Aquatics Monitoring Program). Finally, a strong tourism industry increases the need to update/improve road systems and provide additional commercial services-being that the Verde River Valley provides such a significant economic value in regards to tourism, it is likely that new development activities may be located near or at the river itself.

Aquatic resources directly/indirectly impacted by tourism related development shall be compensated by the restoration, establishment, enhancement, and preservation of riparian and wetland areas. Also, mitigation activities will help reduce the amount of pollutants in the water. Finally, education through the ILF program shall increase awareness of how boating, OHV use, and camping can effect aquatic resources, and provide techniques to reduce this impact.

Agriculture and Livestock

Surface water in the Verde Valley is used mostly for irrigation purposes (Arizona Department of Water Resources), which is especially evident in the southern part of the Verde Valley (Owen-Joyce and Bell 1983). Natural waterways are channelized, filled, and diverted to supply this water to farms, which causes erosion, increased sedimentation, loss of natural riparian habitat, and associated water quality issues. High sodium levels from continuous "recycling" of water in the Verde River and its tributaries occur downstream from Camp Verde. Turbidity is also a persistent problem partly due to inadequate range management (AZ Department of Water Resources). Fertilizers also contribute to increased levels of nitrogen, phosphorus, and potassium, which lead to excessive growth of aquatic vegetation, ultimately resulting in low dissolved oxygen levels in the water.

Grazing by domestic animals (i.e. cattle, sheep, goats) has direct and indirect effects on riparian ecosystems (Ohmart 1996). Livestock heavily use riparian areas because of their high productivity of herbaceous species and readily available water and shade (Webb and Leake 2005). Adverse effects to riparian areas include consumption and trampling of native-plant seedlings, soil compaction, destabilization of channel banks, increase in streamflow sediment concentrations; and displacement of wildlife (Lusby et al 1971; Ohmart 1996).

Prescott Creeks will help offset impacts resulting from these threats by restoring/enhancing riparian areas to reduce the level of pollutants in the water and increase stream bank stability. Also, removing livestock from individual mitigation sites, providing effective seasonal management, and/or effective boundary control shall allow for native vegetative regrowth and improve water quality and wildlife habitat.

Water Control Projects

The Verde River Watershed contains several water control projects/features that have the potential to adversely impact the watershed. The major projects include the Watson Lake Dam, Willow Lake Dam, the Barlett Dam, and the Horseshoe Dam. Any change in operation, maintenance projects, or any new construction activities associated with these dams has the potential to directly and/or indirectly affect aquatic resources. As additional riparian areas, wetlands, and/or waterways are filled by additional structures or temporarily impacted for access and construction, securing restored, enhanced, or preserved wetlands/riparian areas at an appropriate ratio shall provide mitigation for these activities.

Invasive Vegetation

Invasive vegetative species in riparian, wetland, and upland buffer areas also represent existing threats to aquatic resources. Invasive species out-compete native grasses, shrubs, and trees, and in some cases can even alter the chemical composition of the soil. Examples of invasive species include, but are not limited to Spotted/Russian Knapweed, Scotch Thistle, Common Teasel, Dalmatian Toadflax, Siberian Elm, and Salt Cedar. Prescott Creeks intends to control/manage invasive vegetation on all mitigation sites through means such as physical removal, herbicides where appropriate, supplemental plantings of native vegetation, and active management.

Mining

The Verde River Watershed and surrounding areas are home to numerous active and abandoned copper, gold, sand/gravel, and other mineral mines. Although current National Pollutant Discharge Elimination Systems (NPDES) permitting programs are now in place, past mining operations have resulted in high levels of sodium, turbidity, boron, mercury, iron, ammonium, and selenium in some areas in the Verde River Watershed (Northern Arizona University). Examples of how mitigation activities will address these threats include the restoration of riparian areas/buffer zones to provide filtration of these pollutants or restoring abandoned mining sites into wetlands.

C. Historic Aquatic Resource Losses

In the United States, the lower 48 states have lost over 50% of its original wetlands; ~220 million acres in the 1600's to 103.3 million acres in the mid-1980s (Dahl and Johnson 1991). Major loss of wetland habitat occurred during the mid-1950s to mid-1970s, but since then the rate of loss has decreased to 70,000 to 90,000 acres annually. In addition to the wetlands that have been completely lost, others have just been degraded by chemical contamination and excessive nutrients, fertilizers, and sediments flow. The increase in flood damages, drought damages, and the declining bird populations are, in part, the result of wetland degradation and destruction (USGS 2003).

According to the USGS (2003), less than 1% (729,600 acres) of Arizona's landscape has wetlands. Since the late 1800's, streams and wetlands throughout Arizona have been modified or drained, resulting in the loss of more than one-third of the state's original wetlands (~2.2 million acres). The most extensive Arizona wetlands are in riparian zones, oxbow lakes, marshes, cinegas, and bosques.

The Verde River Watershed makes up approximately 6% (6,622 square miles) of Arizona's 114,000 square miles. By applying the USGS's 1% wetland figure to 6,622 square miles of the watershed's size, the Verde River Watershed contains approximately 42,380 acres of wetlands. Using this information, Prescott Creeks has developed the following wetland loss analysis:

- In the late 1800's (1890), there were approximately 63,570 acres of wetlands
- Since 1890, the Verde River Watershed has lost 21,190 acres of wetlands
- Since 1890, the Verde River Watershed has lost 174 acres of wetlands per year

D. Current Aquatic Resource Conditions

The Verde River and the Verde River Watershed contain a significant number of aquatic resources when compared to the remainder of Arizona and much of the southwest. As such, the watershed is home to many unique plant species and ecosystems which have great intrinsic value, but also serve as habitat for a number of animal species (Stevens et al 2008). The AGFD identifies 10 types of riparian areas, and Brown, Lowe and Pace (1979) classified vegetation in the watershed into 9 different biotic communities.

Cottonwood-willow areas cover only 0.13% of the riparian area of the watershed, but are among the riparian types that are more widely used in the watershed by non-fish vertebrates, and are highly sensitive to changes in streamflow (Stromberg 2008, Stevens et al 2008, Smith et al 2009). The Verde River seasonally supports over 248 species of birds (Schmidt et al 2005, Stevens et al 2008), 92 species of mammals (Hoffmeister 1986; Feldhamer et al 2003; Schmidt et al 2005; Stevens et al 2008), and 10 native fish species.

Because of the unique ecological attributes of the Verde River, a portion of the river between Beasley Flats and Sheep Bridge is designated as the only "Wild and Scenic" river in Arizona (Smith et al 2009). According to the National Wildland and Scenic Rivers System (2007), this portion of the river corridor contained outstandingly remarkable scenic, fish and wildlife, and historic and cultural values. Also, additional portions of the Verde River are currently being proposed for Wild and Scenic River Designation (Figure 3-page 12).

While the Verde River Watershed contains many aquatic resources that provide habitat for wildlife, these same attributes have attracted many anthropogenic activities in recent times that have adversely impacted the watershed. The Arizona Department of Environmental Quality's 2010 Verde River Watershed Assessment (Figure 5) shows many of the streams, rivers, and lakes are officially designated as "impaired" including major contributing waterways in the Upper Granite Creek Watershed (Willow, Miller, Butte, Manzanita, and Granite Creeks), the East Verde River, and a portion of the Verde River just downstream from the Bartlett Dam-the last major water control structure before the Phoenix Metropolitan Area. However, several waterways such as segments of the Verde River, West Fork Oak Creek, West Clear Creek, and Fossil Creek are listed as "attaining" appropriate water quality standards.

Waterways attaining water quality standards in the Verde River Watershed are evidence that human development activity and the natural environment can successfully share the unique aquatic resources offered by the Verde River. In addition, there are numerous ecologically-based programs throughout the watershed that focus on riparian/wetland restoration/conservation, wildlife habitat, water quality, and education/awareness to maintain and/or further improve the aquatic resource conditions of the Verde River Watershed.

According to the ADWR, the watershed contains 434,000 acres of wilderness areas, and 71% of the watershed is federally owned and managed by the United States Forest Service. Also, 20.2% of the land is private, with a majority of this private land being in the northwestern portion of the watershed, which shares a "checkerboard" pattern with state land (7.4% of the watershed). Because the state/private land contains the most heavily populated and developed areas, the aquatic resources in this portion of the watershed are in the worst condition. Figure 6 illustrates the current land-ownership within the Verde River Watershed.

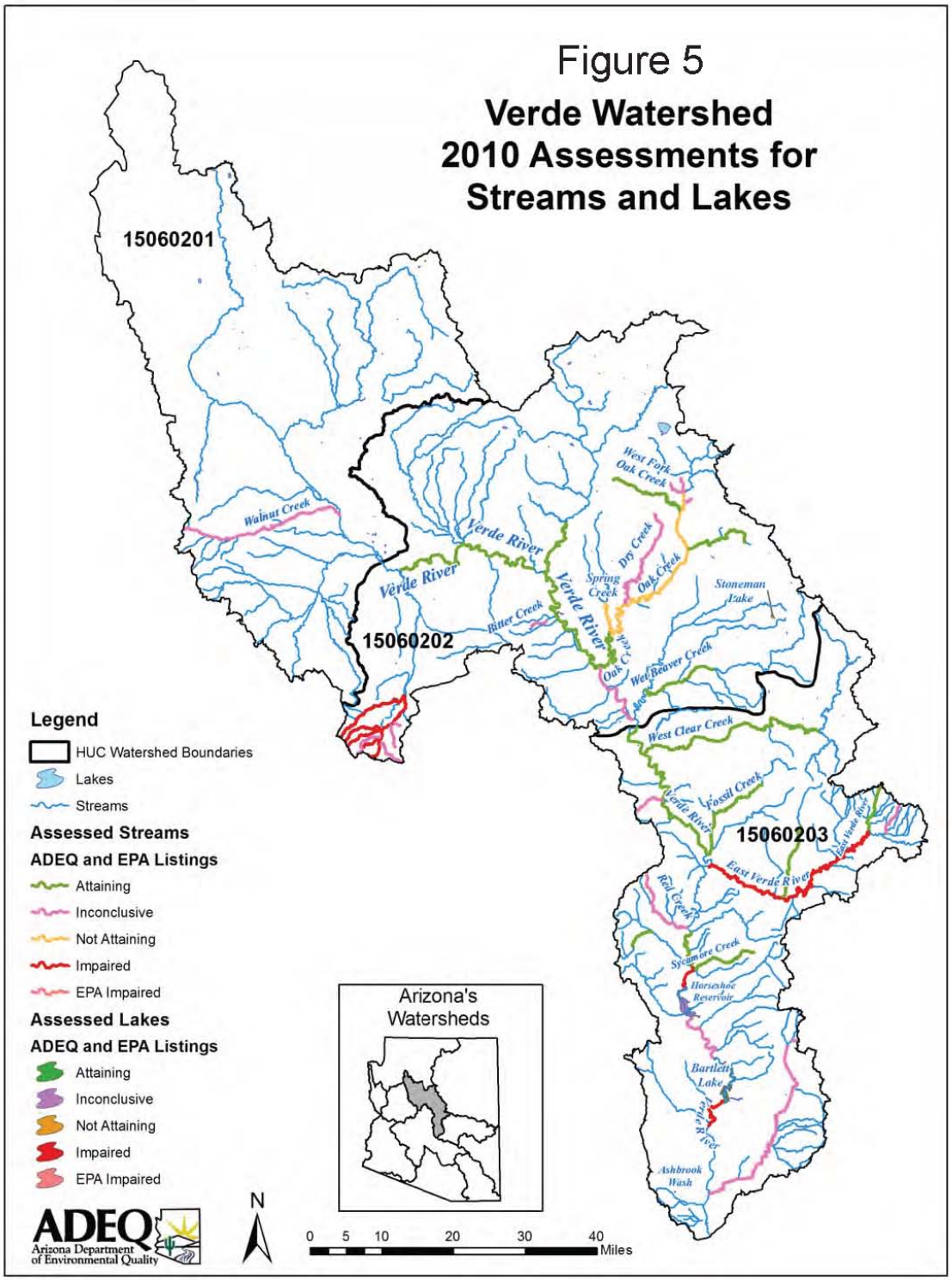


Figure 5-Verde River Watershed 2010 ADEQ Assessment

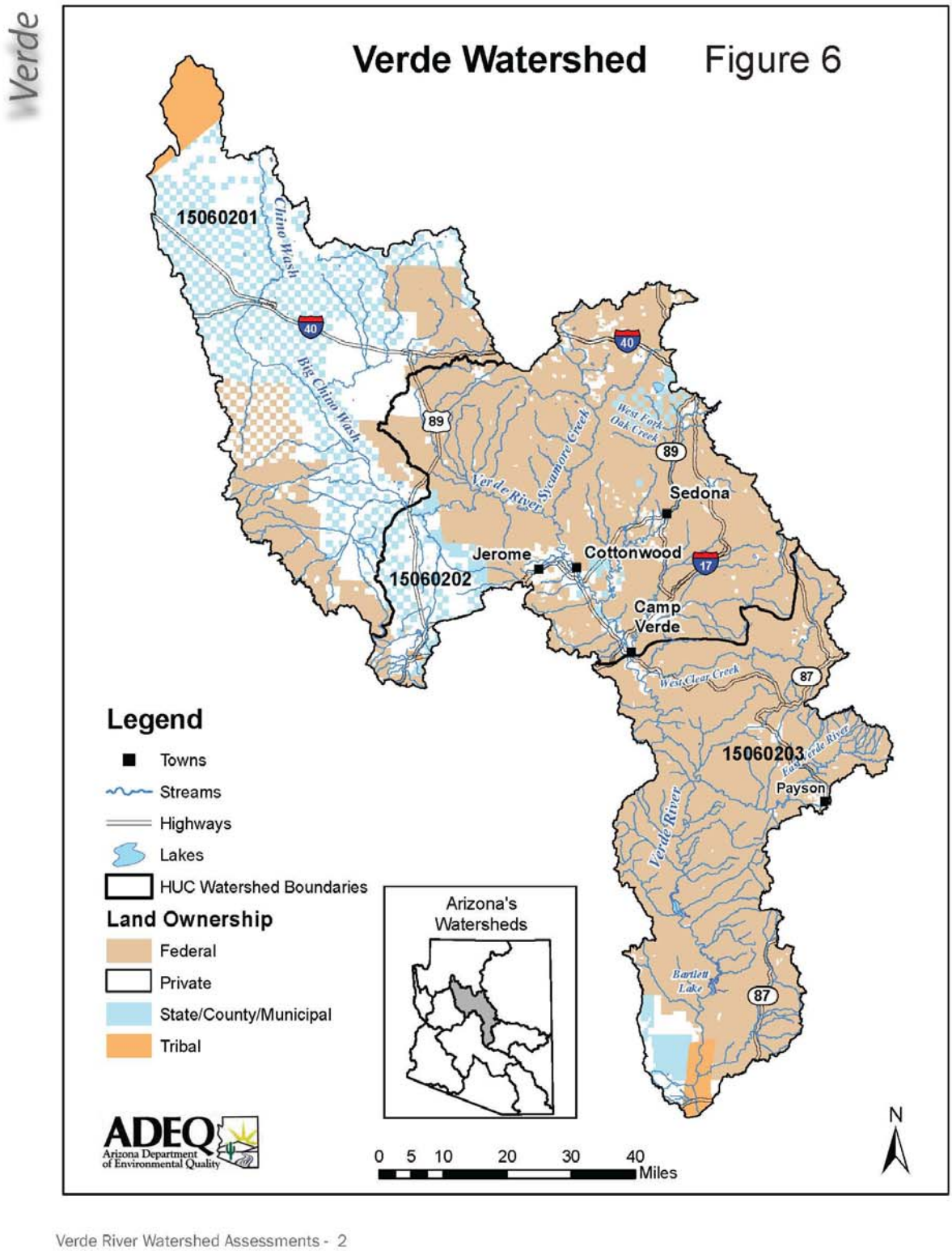


Figure 6-Verde River Watershed ADEQ Land Ownership

E. Aquatic Resource Goals and Objectives

Prescott Creeks has developed a series of goals and objectives within the Verde River Watershed in order to improve the functional capacity of aquatic resources, wetlands, and riparian areas.

1) Meet the national goal of no overall loss of wetlands

- Restore, enhance, establish, and preserve wetlands and riparian areas
- Remove invasive vegetative species to promote native plant growth
- Remove non-native animal species, such as cattle
- Conduct active and adaptive management, maintenance, and monitoring
- Provide long-term protection for mitigation sites

2) Improve water quality and quantity

- Restore wetlands, riparian areas, and associated buffer areas
- Monitor water quality to document wetland/riparian recovery and water quality improvements
- Educate the public on best management practices and the importance of water quality
- Encourage stormwater/surface water management programs to conserve water and promote groundwater recharge

3) Improve wildlife and threatened and endangered species habitat

- Restore wetlands, riparian, and associated buffer areas
- Remove invasive vegetative species
- Remove non-native animal species to reduce competition, predation, and parasitism
- Monitor mitigation sites to document wetland recovery and wildlife usage

4) Promote and celebrate the ecological integrity of riparian systems and wetlands

- Provide educational opportunities for elementary, high school, and college students, as well as adults
- Present informative literature to the public, and provide relevant information at public meetings
- Engage volunteers for cleanup events, water monitoring, maintenance activities, and fundraising events
- Lead guided hikes and tours
- Construct and maintain low impact interpretive trails systems where appropriate

F. Prioritization of Mitigation Areas and Activities

Prescott Creeks will prioritize mitigation activities based on the ecological needs of the watershed and the practicability to secure mitigation sites, implement mitigation plans, and manage/protect these activities for perpetuity. Also, mitigation sites should be located in an area that will provide the most benefit to the public, as humans depend on the aquatic resources in the Verde River Watershed. With these considerations in mind, Prescott Creeks has developed a list of priorities that will be applied to identify and implement mitigation activities.

Priority Areas-Figure 7

1) Granite Creek Watershed

The City of Prescott is located within the Upper Granite Creek Watershed (sub-watershed of the Upper Verde River Watershed), which as stated above has 5 creeks/waterways officially listed as "impaired" by the DEQ. Also, Prescott represents the "hub" of Yavapai County (50% of the watershed) and the 3rd largest metropolitan area in Arizona. Although the presence of humans and associated development activities has historically and will likely continue to impact aquatic resources in this area, the primary state/private land ownership represents a means to implement compensatory mitigation activities that will benefit both the environment and the public.

The confluence of Granite Creek into the Verde River represents the approximate location of the river's perennial flow and convergence of the Big Chino/Williamson and Upper Verde River Watershed. Therefore, restoration and conservation of riparian habitat in this sub-watershed is critical to the overall condition of the Verde River, as this will benefit the downstream portions of the Upper Verde River Watershed, as well as the Lower Verde River Watershed. In addition, the Granite Creek Watershed is located above the Little Chino Aquifer and portions of the Big Chino Aquifer-restoring, enhancing, and/or preserving wetland/riparian habitat in this area will help improve natural hydrology and subsequent groundwater recharge, and will help maintain the Verde River's perennial flow.

Prescott Creeks has recognized the importance of the Granite Creek Watershed and is currently involved with existing programs such as Watson Woods, a 126-acre riparian Preserve which contains Granite Creek and extensive stand of cottonwoods, willows, and riparian habitat. Major funding for this project has come from the Water Protection Fund (WPF), the Arizona Department of Environmental Quality, and CESPL mitigation projects. With many wetland/riparian areas already restored/enhanced, Prescott Creeks intends to conduct an additional 52 acres of restoration/enhancement activities, 49 acres of preservation, along with protecting the entire site in perpetuity.

Prescott Creeks is the chair of the Granite Creek Watershed Improvement Council which is currently identifying sources of water impairment, proposing corrective measures, Best Management Practices, as well as identifying potential riparian improvement areas. In addition, Prescott Creeks hosts an annual "Granite Creek Cleanup" event, which directly removed over 10 tons of trash/debris in 2011 from various waterways in Prescott. Finally, Prescott Creeks is dedicated to providing educational/awareness opportunities from the elementary to college level along with the general public.

2) Lower Big Chino Wash/Williamson Valley Wash Watersheds

The Lower Big Chino Wash and the Williamson Valley Wash Watersheds are sub-watersheds to the larger Big Chino/Williamson Valley Watershed (HUC #15060201). Beneath these 2 watersheds lies the Big Chino Aquifer, which supplies up to 80% of the Verde River's base flow. Therefore, the restoration of wetland and riparian zones in this area is important to maintaining and improving the health of the Verde River. Also, the land in these watersheds is primarily state and privately owned, so it is likely that a mitigation project in this area will be practicable and will provide a public benefit.

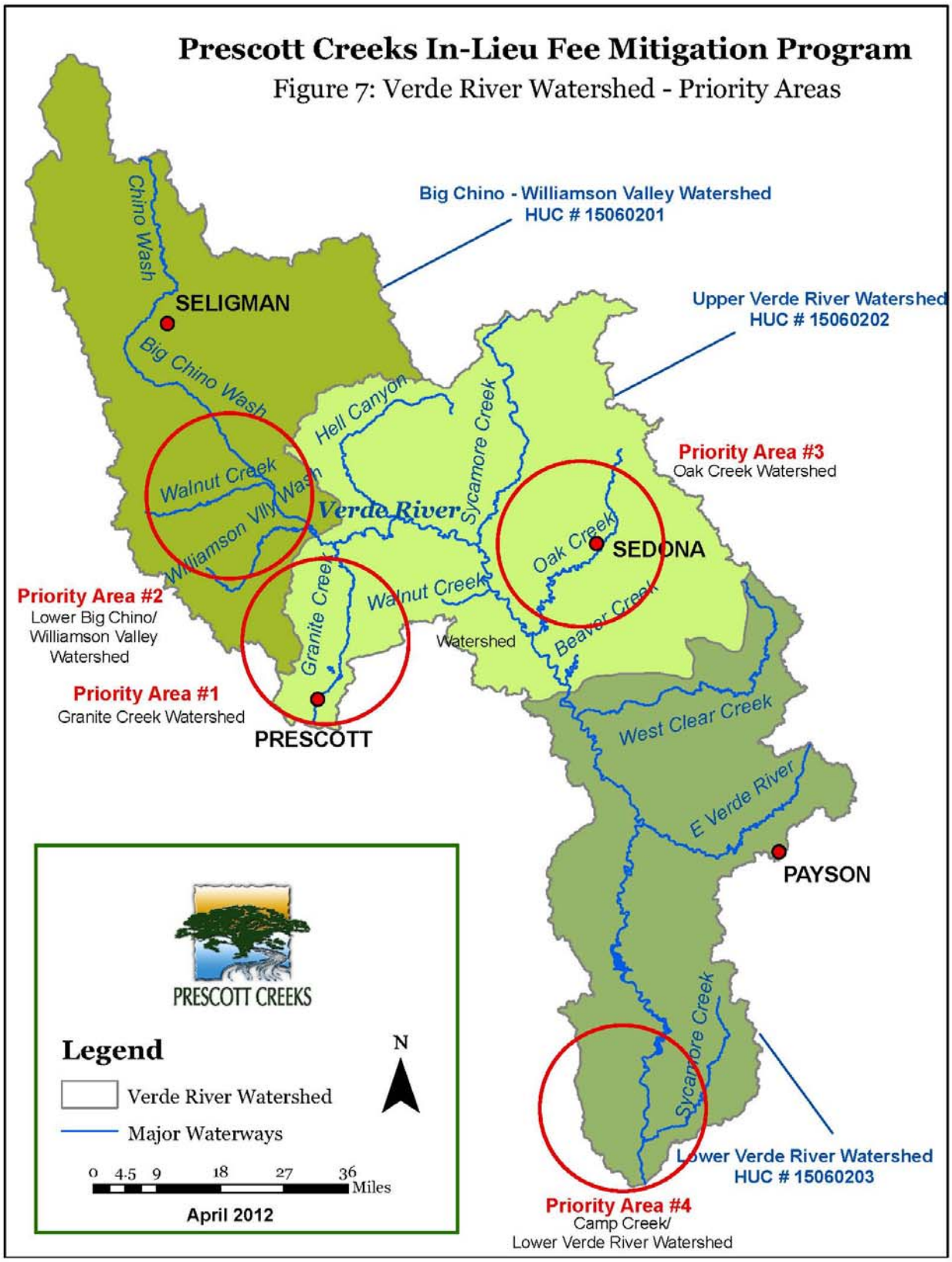


Figure 7-Verde River Watershed Priority Areas

3) Oak Creek Watershed

The Oak Creek Watershed is a sub-watershed of the Upper Verde River Watershed, and contains the city of Sedona, a highly valued area for tourism, natural beauty, and the perennial waterway, Oak Creek. The Oak Creek Watershed is also upstream of Cottonwood and Camp Verde. Oak Creek is officially designated as "not attaining" water quality standards by the ADEQ. Because of frequent human contact with the aquatic resources within this watershed, and this area is considered a high priority because of potential future impairments as well as the potential public benefit that would be achieved by the restoration, establishment, enhancement, and/or preservation of wetland/riparian areas.

4) Camp Creek-Lower Verde River Watershed

The Camp Creek-Lower Verde River Watershed is a sub-watershed of the Lower Verde River Watershed, and contains the community of Rio Verde and portions of Fountain Hills. This watershed is just downstream of the Bartlett Reservoir and contains the segment of the Verde River that is officially classified as "impaired." Also, this watershed contains several agricultural sites that are within the floodplain of the river, which suggests direct loss of riparian and habitat from clearing/filling, ditching, and agricultural planting activities. Landownership in this area is also represented by many state and private interests, so therefore implementing a mitigation project may be practicable.

Priority Activities

1) Cottonwood-Willow Gallery Forests

Cottonwood-willow gallery forests are among the rarest riparian habitat type within the Verde River watershed. As stated previously, this habitat type represents approximately 0.13% of riparian areas, but also is utilized extensively by wildlife. Cottonwoods and willows also stabilize stream banks, provide shade, and allow for increased retention of surface water. Having a stable stream bank/riparian system increases natural biological processes throughout the flood plain of a particular waterway.

As demonstrated in the current Watson Woods Riparian Preserve Mitigation Area, cottonwoods and willow "pole cuttings" can be harvested from the branches of existing, larger trees at a relatively inexpensive cost. Coupled with proper hydrological restoration, this technique has been proven effective at Watson Woods, as a recent fall 2011 monitoring survey showed an approximate 80% survival rate. Through the ILF, Prescott Creeks intends to continue this technique as a priority activity throughout the Verde River Watershed where appropriate.

2) Urban Riparian Areas

The Verde River Watershed contains numerous waterways and riparian areas that provide habitat for many vegetative and animals species. These same attributes have also attracted humans to conduct development activities along these waterways, which has resulted in many degraded aquatic systems within the Verde River Watershed. Restoring, enhancing, or preserving these waterways and riparian areas in an urban setting and providing long term protection will provide numerous public benefits such as improved water quality, air quality, wildlife habitat, and aesthetics that are not currently being realized in many developed areas.

3) Riparian Buffers/Upland Areas

As the buffer area between wetland and terrestrial habitats, grass shrub, and woodland habitats adjacent to riparian zones provide benefits for both wetlands and terrestrial species. They provide rookeries and stopover grounds for migratory birds, foraging habitat, flood refuge, and dispersal corridors for a variety of animal species. As part of the ILF, Prescott Creeks will consider the inclusion of these areas in the development and implementation of its individual mitigation projects.

G. Use of Preservation

Prescott Creeks considers the use of preservation as a key component of the ILF and individual mitigation projects because wetlands and riparian areas occupy such a small percentage of land within the Verde River Watershed. Based on the historical wetland loss (174 acres/year) and numerous studies, wetlands and riparian areas within the Verde River Watershed are under a demonstrable threat. Prescott Creeks intends to use preservation along with specific wetland/riparian restoration, enhancement, and establishment activities in order to provide a suite of functions and values that will benefit the watershed. Preservation may be used to compensate for CESPL permits provided that all of the following criteria are met:

1) The resources to be preserved provide important physical, chemical, or biological functions for the watershed;
2) The resources to be preserved contribute significantly to the ecological sustainability of the watershed;
3) Preservation is determined by the CESPL to be appropriate and practicable;
4) The resources to be preserved are under a demonstrable threat of destruction or adverse modifications; and
5) The preserved site will be permanently protected through an appropriate legal instrument.

H. Stakeholder Involvement

Assembling the diverse interests and talents in the watershed will provide the basis for successful mitigation projects. Stakeholder involvement is a key component of almost any Prescott Creeks effort. The organization has built strong partnerships with federal, state and local governments and agencies (CESPL, Prescott National Forest, AZ Department of Environmental Quality, AZ Water Protection Fund Commission, AZ Department of Transportation, City of Prescott, Yavapai County, Yavapai-Prescott Indian Tribe), Prescott College, community businesses (Prescott Chamber of Commerce, Fann Environmental, Natural Channel Design, etc.), and local community members (e.g.; practicing and retired engineers, administrators, interested citizens). Also, Prescott Creeks chairs the Granite Creek Watershed Improvement Council, which contains many of the aforementioned organizations/individuals, and meets on a monthly basis to discuss watershed-related topics and action items.

In addition to CESPL mitigation projects, Prescott Creeks and its stakeholders have conducted and implemented the following aquatic resource restoration/conservation projects. As stated in §332.3(j) (2), these projects were/are intended to be undertaken in conjunction with and supplemental to the ILF, in order to maximize the overall ecological benefits of the ILF.

1) *Watson Woods Riparian Preserve* (Prescott Creeks 2008-present) Purpose: To restore 4 reaches of Granite Creek and critical planting areas/wetlands to improve wildlife habitat and water quality. Project Cost: $2+M. Major Funding: ADEQ and AZ WPF

2) *Watershed Improvement Plan* (Prescott Creeks, 2009-Present) Purpose: To identify sources of impairment to water quality and promote watershed management activities that can be implemented by municipalities and individuals to improve watershed health. Project Cost: $500,000. Funding: ADEQ

3) *Granite Creek Cleanup* (Prescott Creeks 1989-Present) Purpose: To engage the community to beautify their creeks by removing trash and debris from local waterways. Project Cost: ~$4,000/year. Funding: Corporate Sponsors and private donations

4) *Rambling River* (Prescott Creeks 2009) Purpose: To educate the community through interaction with a stream table/watershed model. Project Cost: $67,875. Funding ADEQ

5) *Yavapai County Stormwater Quality Improvement Project at Pioneer Park* (Yavapai County 2009) Purpose: To reduce/remove pollutant input from Granite Creek and promote groundwater recharge. Project Cost: $620,000. Funding: ADEQ

6) *Stormwater Detention Basin, Prescott Lakes Parkway* (Prescott Creeks 2007) Purpose: to manage runoff from a recently constructed four lane roadway that drains into Granite Creek, Watson Woods, and Watson Lake. Project Cost: $123,000. Funding: ADEQ

7) *Storm Drain Markers* (Prescott Creeks 2007). Purpose: To educate the public on the connection of stormwater to local water bodies. Project Cost: $15,000. Funding: ADEQ

8) *Yavapai Reservation Slaughterhouse Gulch Wetland Restoration* (Yavapai-Prescott Tribe 2000). Purpose: to restore wetland habitat along Granite Creek. Project Cost: $88,000. Funding: EPA

9) *Creek Signing Project* (Prescott Creeks 2000-Present) Purpose: Increase public awareness regarding the existence of creeks. Project Cost: $12,000 Funding: Private donations and the City of Prescott

Prescott Creeks also solicits stakeholder involvement through the use of watershed residents' social surveys and provides an interactive website that is updated regularly to provide resources and information to the public. Also, community volunteers typically accomplish riparian and/or wetland restoration, establishment, enhancement, and preservation tasks in the field for Prescott Creeks, which further increases public awareness of the importance of aquatic resources.

In regards to the Verde River Watershed as a whole, the Verde River Basin Partnership (VRBP) consists of a number of non-profit organizations, local businesses, water managers, and federal, state, and local agencies which have invested in the scientific understanding and protection of the Verde River. The VRBP organizes research, outreach, and talent among these groups. As a group, the VRBP agrees on "The Verde River Guiding Principles" to guide research, education, and decision making for the benefit of the Verde River and fellow citizens (VRBP 2012). As a member of the VRBP, Prescott Creeks agrees to incorporate these principles into the operation and management of the ILF and individual mitigation projects:

The Verde River Guiding Principles

1) Water makes earth habitable; fresh water, a finite resource, is essential for all life on land.
2) The Verde River and its tributaries, seeps, and springs, are interconnected – to each other, the Colorado River system, and ultimately to the Ocean via the Sea of Cortez.
3) Groundwater and surface water are interconnected and affect each other; groundwater depletion ultimately depletes surface flows and surface waters depletion can potentially impact groundwater recharge.
4) Climate and drought have an impact on the Verde River, including the amount of water available for riparian habitat, wildlife, and human use.
5) The Verde River and its perennial tributaries support a broad diversity of life and ecosystems and provide a rare and important corridor for migrating species.
6) The Verde River is one of the last perennial river systems in Arizona and has the state's longest stretch of continuous interconnected riparian habitat. The value of the riparian habitat and flows are beyond calculation and must be protected.
7) The Verde River system is a regional, state, and national treasure. The river and humans within its watershed are inextricably interconnected. The river is socially, economically, environmentally, and culturally important.
8) The Verde River system is a national asset. More than two-thirds of its watershed is managed by federal agencies on behalf of the American public.
9) Research to date provides a basic understanding of the Verde River system, yet more remains to be learned, and unbiased science is crucial to water and growth policy and decision making. Providing the public with scientific information about the Verde River system give them a stronger voice in the decision-making process.
10) Collaborative decision-making amongst all stakeholders is crucial to protecting the interests of all who depend on the Verde River.

I. Long Term Protection and Management

To ensure permanent protection of each individual mitigation site, Prescott Creeks and/or a qualified organization shall execute in-perpetuity conservation easements, deed restrictions, or other similar protective instruments which shall be recorded in the Yavapai County Courthouse or other appropriate county registry. Prescott Creeks ensures that the holder of these conservation easements/protective instruments shall be an environmental and/or conservation – based 501(c)(3) non-profit or government organization to be determined. The easement/deed restriction will inure and run with the property title, and will prohibit activities such as clear cutting, unapproved fill discharges, cattle grazing, or other surface development that would diminish the quality or quantity of wetland, riparian, and associated buffer areas.

Prescott Creeks shall be responsible for the long-term management of each individual mitigation project and the ILF to ensure long-term viability as functional aquatic resources. Although each individual mitigation project shall be designed to require little or no long-term management efforts once performance standards have been achieved, Prescott Creeks shall maintain responsibility unless the long-term management responsibility is formally transferred to a long-term manager with IRT approval. The long-term management plan developed for each project will include a description of the anticipated management needs with annual cost estimates and an identified funding mechanism such as non-wasting endowments, escrow accounts, trusts, contractual arrangements with future responsible parties, or other appropriate financial instruments.

J. Monitoring, Adaptive Management, and Reporting

Prescott Creeks shall be responsible for mitigation monitoring and shall provide annual monitoring reports for a minimum of five years from the date of the initiation of mitigation activities at each individual mitigation site. The monitoring reports shall contain, at minimum, a documentation of relative success of each mitigation activity as it pertains to stated performance standards, geomorphology reporting, survivorship of planted species, evidence of natural vegetative growth, and photographic documentation. Specific monitoring plans for each individual mitigation site shall be submitted as part of each individual mitigation plan.

Prescott Creeks shall employ an adaptive management plan for the ILF and individual mitigation projects in order to ensure that the needs of the watershed are met. If any information or circumstances are discovered during regular monitoring and management that may interfere with these needs, or if the needs of the watershed change, Prescott Creeks shall implement corrective measures to address these unforeseen situations. All adaptive and corrective measures will be coordinated with the IRT prior to implementation, and the ILF Program and individual mitigation plans shall be revised as necessary to ensure long term sustainability and protection of these corrective measures.

Prescott Creeks shall maintain accurate records for the expenditure of ILF funds and documentation of restored areas, including the date restoration work began at each individual mitigation site, the total number of acres restored, and all annual monitoring reports. Prescott Creeks shall provide the CESPL with an annual financial report containing a detailed account of how all monies from the ILF fund were expended or collected during the preceding year. The report shall be submitted to the IRT by March 1st of each year.

10.0 Program Account

Prescott Creeks will establish an ILF account and individual mitigation project accounts at a financial institution that is a member of the Federal Deposit Insurance Corporation (FDIC). All interests and earnings accruing to the program will remain in that account for use by the ILF for the purposes of providing compensatory mitigation. The CESPL shall have the authority to direct those funds to alternative compensatory mitigation projects in cases where Prescott Creeks does not provide compensatory mitigation in accordance with a specified time frame. The CESPL shall have the authority to audit all programs accounts associated with the ILF at any time. All reports associated with the program account will be prepared and submitted in accordance with Section 9.J of this document.

11.0 Conclusion

The Prescott Creeks ILF Program has the potential to effectively compensate for CESPL authorized impacts to the aquatic environment within the Verde River Watershed. By utilizing a watershed-approach, Prescott Creeks will develop and implement appropriate mitigation projects that will benefit the public and provide improved wetland and riparian habitat. Also, Prescott Creeks is committed to protecting and managing these mitigation projects in perpetuity.

12.0 References

Arizona Department of Environmental Quality. 2010. Verde River Watershed Assessment. www.azdeq.gov. Accessed January 2012

Arizona Department of Water Resources. 2008. "Verde River Watershed" www.azwater.gov. Accessed January 2012

Arizona NEMO. 2005 Watershed Based Plan, Verde Watershed. http://www.srnr.arizona.edu/nemo Accessed January 2012

Arizona Office of Tourism. 2008. Verde Valley Tourism Survey. Prepared for the Arizona Office of Tourism by Arizona Hospitality Research and Resource Center, the Center for Business Outreach, and the W.A. Franke College of Business, Northern Arizona University, Flagstaff, AZ

Big Chino Ranch Project. City of Prescott, Arizona. www.cityofprescott.net/services/water/chino.php. Accessed February 2012.

Brown, D.E., C.H. Lowe, and C.P. Pace. 1979. A Digitized Classification System for the Biotic Communities of North America, with Community (Series) and Association Examples for the Southwest. Journal of the Arizona-Nevada Academy of Sciences 14

City of Prescott, Community Development Department. Land Development Code. Amended 5.12.2009

Dahl, T.E., and Johnson, C.E., 1991, Wetlands--Status and trends in the conterminous United States, mid-1970's to mid-1980's: Washington, D.C., U.S. Fish and Wildlife Service

Dobyns, H.F. 1981. From fire to flood: Historic human destruction of Sonoran Desert riverine oases. Ballena Press, Socorro, N.M.

Feldhamer, G.A., B.C. Thompson, J.A. Chapman. 2003. *Wild Mammals of North America: Biology, management and conservation.* John's Hopkins University Press. Baltimore, MD.

Gregory, Stanley V., Frederick J. Swanson, W. Arthur McKee, and Kenneth W. Cummins. 1991. An Ecosystem Perspective of Riparian Zones: Focus on links between land and water. Bioscience, 41(8):540-549.

Haney, J.A., D.S. Turner, A.E. Springer, J.C. Stromberg, L.E. Stevens, P.A. Pearthree, and V. Supplee. 2008. Ecological Implications of Verde River Flows. A report by the Verde River Basin Partnership, Arizona Water Institute, and The Nature Conservancy.

Hoffmeister, D. 1986. Mammals of Arizona. University of Arizona Press, Tucson, AZ.

Lineberger, Mark. 2011. Preliminary ADOT Plan Slates $70M To Be Spent In County. JournalAZ.com www.journalaz.com. Accessed February 2012

Lusby, G.G.; Reid, V.H.; Knipe, O.D. 1971. Effects of grazing on the hydrology and biology of the Badger Wash Basin in western Colorado, 1953-1966. Hydrologic effects of land use. Geological Survey Water-Supply Paper 1532-D. United States Government Printing Office, Washington

National Wildland and Scenic Rivers System. 2007. http://www.rivers.gov/wsr-verde.html

Northern Arizona University. 2011. Upper Verde River. Arizona Heritage Waters. www.azheritagewaters.nau.edu/loc_verderiver.html. Accessed December 2011

Ohmart, R.D. and B.W. Anderson. 1982. North American desert riparian ecosystems. Reference Handbook on the Deserts of North America.

Ohmart, R.D., 1996. Historical and present impacts of livestock grazing on fish and wildlife resources in western riparian habitats. In: Krauseman, P.R. (Ed.), Rangeland Wildlife. Society of Range Management, Denver, CO

Owen-Joyce, S.J., and C.K. Bell. 1983. Appraisal of water resources in the Upper Verde River area, Yavapai and Coconino Counties, Arizona: Arizona Department of Water Resources Bulletin 2

Pearthree, P.A. 2008. Chapter 3. Background: Falluvial Geomorphology and Flood History of the Verde River. Pp 15-32 in Haney, J.A., D.S. Turner, A.E. Springer, J.C. Stromberg, L.E. Stevens, P.A. Pearthree, V. Suplee. 2008. Ecological Implications of Verde River Flows. A report by the Arizona Water Institute, The Nature Conservancy, and the Verde River Basin Partnership.

Potential Effects from Tourism and Recreation on Aquatic Ecosystems. Regional Aquatics Monitoring Program. www.ramp-alberta.org/resources/tourism/wildlife.aspx. Access January 2012

Prescott, Arizona. City-Data.com. www.citydata.com. Accessed November 2011

Smith, D.H, West, and Auberle. 2009. Valuing the Verde River Watershed: An Assessment. Working Paper Series – 09-03. Northern Arizona University, The W.A. Franke College of Business

Schmidt, C.A., B.F. Powell, and W.L. Halvorson. 2005. Vascular Plant and Vertebrate Inventory of Tuzigoot National Monument. U.S. Geological Survey Open-File Report 2005-1347

Springer, A.E., J.A. Haney. 2008. Chapter 2. Background: Hydrology of the Upper and Middle Verde River. Pp 5-14 in Haney, J.A., D.S. Turner, A.E. Springer, J.C. Stromberg, L.E. Stevens, P.A.

University of Arizona. 2004. Prescott Active Management Area. Managing Arid and Semi-Arid Watersheds. www.ag.arizona.edu/oals/watershed/highlands/Prescott.html

Verde River Basin Partnership. 2012. The Verde River Guiding Principles. http://VRBP.org

Von Gausig, Doug, Becky O'Bannon, Casey Rooney. 2011. Verde River Economic Development Study. Final Report for Public Distribution. Presented to The Walton Family Foundation. Clarkdale, AZ

Webb, Robert, S.A. Leake. 2005. Ground-water surface-water interactions and long-term change in riverine riparian vegetation in the southwestern United States. USGS. Journal of Hydrology 320 (2006) 302-323.

Wirt, L., E. DeWitt, and V. E. Langenheim, eds. 2005. Geologic Framework of Aquifer Units and Ground-water Flow Paths, Verde River Headwaters, North-central Arizona. U. S. Geological Survey Open-File Report 204-1411.

Wolfe, Ed. 2011. The Verde River-A Cautionary Tale of Two Streamgages

Yuhas, Roberta. 2003. Loss of Wetlands in the Southwestern United States. US Geological Survey Water Supply Paper 2425, National Water Summary on Wetland Resources. 1996. www.water.usgs.gov. Accessed January 2012

Appendix A

Watson Woods Riparian Preserve
Maps and Photographs

Prescott Creeks In-Lieu Fee Mitigation Program
Watson Woods Riparian Preserve
April 2012

Maps/Aerial Images

Figure 1-Vicinity Map

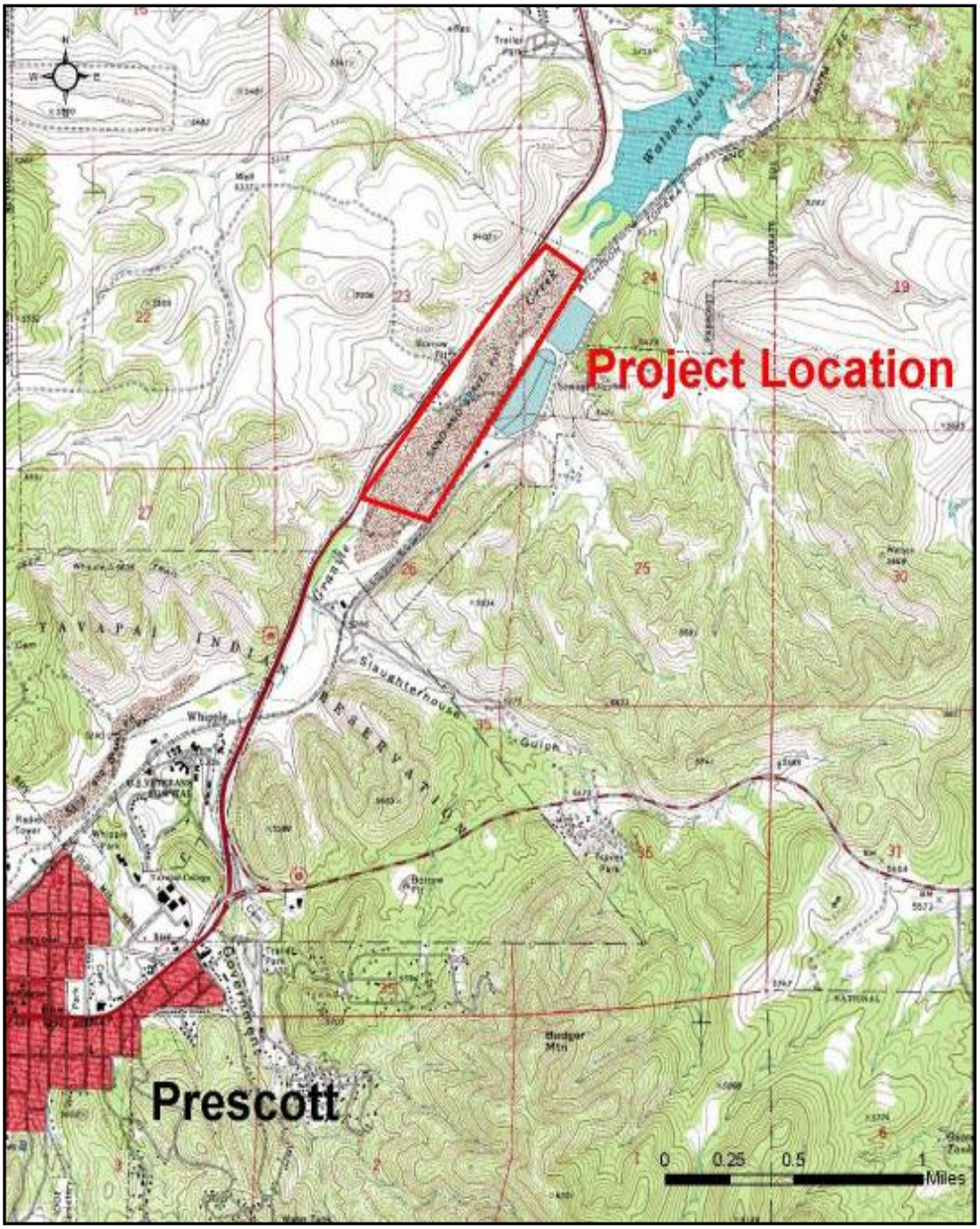
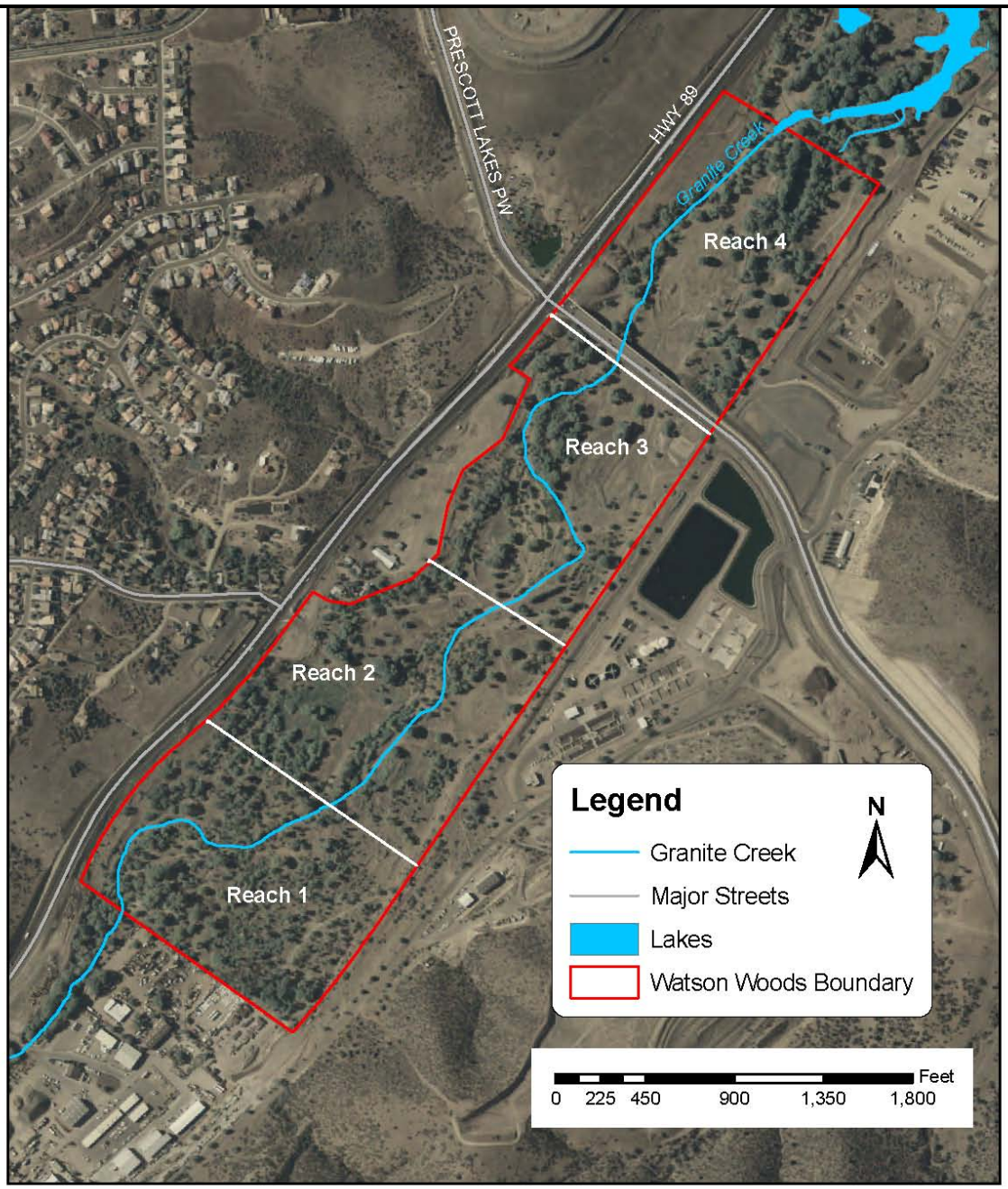


Figure 2-1972 Aerial

Figure 3-2010 Aerial



Photographs (all photos taken Fall 2011)

Photo # 1-Typical Growth of Planted Cottonwoods and Willows (Reach 4)

Photo # 2-Typical Herbaceous Growth and Planted Cottonwoods and Willows (Reach 4)

Photo #3-Typical Stream Restoration and Vegetative Growth-Note Vegetative Matting, Brush Revetment, and Coir Logs (Reach 3)

Photo #4-Typical Growth of Planted Cottonwoods and Natural Vegetative Growth (Reach 3)

Photo #5-Existing Mounds from Historic Mining (Reach 2)

Photo #6-Typical Vegetative Growth (Reach 2)

Photo #7-Typical Vegetative Growth with Installed Rock (Reach 1)

Photo #8-Mature Cottonwood Stand (Reach 1)

Appendix B

Watson Woods Riparian Preserve
Recently Documented Animal Species

Prescott Creeks In-Lieu Fee Mitigation Program
Watson Woods Riparian Preserve
Recently Documented Animal Species
April 2012

Birds*

Canada goose (*Branta canadensis*)
American Wigeon (*Anas Americana*)
Common goldeneye (*Bucephala clangula*)
Sharp-shinned hawk (*Accipiter striatus*)
Ring-billed gull (*Larus delawarensis*)
White-winged dove (*Zenaida asiatica*)
Great-horned owl (*Bubo virginianus*)
Acorn woodpecker (*Melanerpes formicivorus*)
Hammond's flycatcher (*Empidonax hammondii*)
Dusky flycatcher (*Empidonax oberholseri*)
Gray flycatcher (*Empidonax wrightii*)
Cordilleran flycatcher (*Empidonax occidentalis*)
Tree swallow (*Tachycineta bicolor*)
Juniper titmouse (*Baeolophus ridgwayi*)
Northern mockingbird (*Mimus polyglottos*)
Crissal thrasher (*Toxostoma crissale*)
Black-throated gray warbler (*Dendroica nigrescens*)
Green-tailed towhee (*Pipilo chlorurus*)
Brewer's sparrow (*Spizella breweri*)
House sparrow (*Passer domesticus*)

*Data collected November 2010-November 2011 by the Prescott Audubon Society

Amphibians**

Tiger Salamander (*Ambystoma tigrinum)*
Arizona Toad (*Bufo microscaphus)*
Woodhouse's Toad (*Bufo woodhousii)*
Bullfrog (*Rana catesbeiana)*

Lizards**

Gila Spotted Whiptail (*Cnemidophorus flagellicauda)*
Desert Grassland Whiptail (*Cnemidophorus uniparens)*
Plateau Striped Whiptail (*Cnemidophorus velox*(*innotatus*))
Madrean Alligator Lizard (*Elgaria* (*Gerrhonotus*) *kingii)*
Greater Short-horned Lizard (*Phrynosoma hernandesi)*
Plateau (Eastern Fence) Lizard *(Sceloporus* (*undulatus*) *tristichus)*
Ornate Tree Lizard (*Urosaurus ornatus)*

Snakes**

Common Kingsnake (*Lampropeltis getula)*
Gophersnake (*Pituophis catenifer)*
Groundsnake (*Sonoran semiannulata)*
Western Terrestrial Gartersnake (*Thamnophis elegans)*
Black-necked Gartersnake (*Thamnophis cyrtopsis)*

Turtles**
Pond Slider (*Trachemys scripta)*
Spiny Softshell (*Trionyx spinifera)*

Mammals**
Rock Squirrel (*Citellus variegatus)*
Western Harvest Mouse (*Reithrodontomys megalotis)*
Silky Pocket Mouse (*Perognathus flavus)*
Apache Pocket Mouse (*Perognathus apache)*
Deer/White-footed Mouse (*Peromyscus maniculatus/leucopus)*
Unknown Peromyscus Mouse (*Peromyscus eremicus or P. boylei)*
White-throated Woodrat (*Neotoma albigula)*
Mexican Vole (*Microtus mexicanus)*
Pocket Gopher (*Thomomys bottae)*
House Mouse (*Mus musculus)*
Desert Shrew (*Notiosorex crawfordi)*
Cottontail Rabbit (*Sylvilagus* spp.)
Mule Deer (*Odocoileus hemoinus)*
Fox species (*Vulpes vulpes* or *Urocyon cinereoargenteus)*
Northern Raccoon (*Procyon lotor)*

Fish**
Mosquitofish (*Gambusia affinis)*
Golden shiner (*Notemigonus crysoleucas)*
Bluegill (*Lepomis macrochirus)*
Green Sunfish (*Lepomis cyanellus)*
Largemouth Bass (*Micropterus salmoides)*
Smallmouth Bass (*Micropterus dolomieui)*

**Data collected 2009-2011 by Northern Arizona University

Appendix C

Watson Woods Riparian Preserve Jurisdictional Determination

DEPARTMENT OF THE ARMY

Department of the Army
Los Angeles District, Corps of Engineers
Arizona-Nevada Area Office
3636 North Central Avenue, Suite 900
Phoenix, Arizona 85012-1939

August 12, 2008

REPLY TO
ATTENTION OF
Office of the Chief
Regulatory Division

Michael Byrd
Executive Director
Prescott Creeks
PO Box 3004
Prescott, Arizona 86302

File Number: SPL-2007-01294-DE

Dear Mr. Byrd:

Reference is made to your letter, dated June 24, 2008 in which you inquired as to the jurisdictional limits of Section 404 of the Clean Water Act for Granite Creek within Section 24, T14N, R2W, Prescott, Yavapai County, Arizona ("Watson Woods Preserve Restoration").

The enclosed aerial photograph or map delineates the waters of the United States, including wetlands, regulated by the Corps of Engineers pursuant to Section 404 of the Clean Water Act. **This approved jurisdictional determination will remain in effect through August 12, 2013**. During this period the Corps of Engineers reserves the authority to either retain the original jurisdictional determination or revise the original jurisdictional delineation if new information is received indicating a revision is warranted.

Each water of the United States delineated herein is an interstate water or is a tributary to an interstate water (See 33 CFR Part 328 for definitions of these terms). The Section 404 jurisdictional limits for any interstate water and any tributary to an interstate water is determined by the presence of an ordinary high water mark and/or the limits of a jurisdictional wetland. The ordinary high water mark is determined by the presence of the indicators stated in the definition of ordinary high mark at 33 CFR 328.3(e). The limit of a jurisdictional wetland is determined by completing two steps. First, the wetland boundary is delineated using the Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West dated December 2006. Second, an administrative determination is made using all current Corps of Engineers' policies and relevant court decisions to delineate the limits of the jurisdictional wetland. Note that not all wetlands with wetland boundaries are jurisdictional wetlands. The basis of this jurisdictional determination is shown on the enclosed checklist.

Any discharge of dredged or fill material within the designated jurisdictional area requires a Section 404 permit from the Corps of Engineers. The Corps of Engineers emphasizes avoidance of the delineated jurisdictional area. Please review this delineation and evaluate your proposed activity to ensure that avoidance of the jurisdictional area is given full consideration in your design. If all discharges of dredged or fill material occur outside the

designated jurisdictional area, no Section 404 permit is required. If avoidance is not practicable, please reference File Number SPL-2007-01294-DE when submitting your Section 404 permit application to the Corps of Engineers. Please be advised that your application needs to substantiate that avoidance of designated jurisdictional areas is not practicable and substantiate that impacts to waters of the United States have been minimized.

This approved jurisdictional delineation may not be valid for the wetland conservation provisions of the Food Security Act of 1985, as amended. If you or your tenant are United States Department of Agriculture (USDA) program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

If you accept the approved jurisdictional delineation you are required to take no further action and you may use the approved jurisdictional determination to support any Section 404 permit application.

If you object to the approved jurisdictional delineation and wish to supply new information you may request that I reconsider my decision. I will reconsider your request if I receive it at the letterhead head address within 60 days of the date on this letter, or by October 10, 2008. If this "Day 60" is a traditional non-working day (e.g. a holiday or a weekend), the 60 day timeframe specified by regulation will be extended to the next business day. In response to your request I will consider any new information so submitted and I will send you a written response within 60 days. I will either revise the approved jurisdictional determination, if appropriate, or reissue the approved jurisdictional determination without any changes. If you exercise this option you will receive a response with an approved jurisdictional determination and an additional 60 day period in which you can submit an appeal as described in the following paragraph.

If you object to this decision and wish to submit an appeal, without supplying any new information, you may request an administrative appeal under Corps of Engineers regulations at 33 CFR Part 331. Enclosed you will find the consolidated Notification of Appeal Process (NAP) and Request for Appeal (RFA) form. If you request an appeal of this decision you must complete the enclosed NAP/RFA form and submit it to:

Tom Cavanaugh
Administrative Appeals Review Officer
U.S. Army Corps of Engineers, CESPD-PDS-O
1455 Market Street, Room 2042B
San Francisco, California 94103-1399

(Telephone 415-503-6574, FAX 415-503-6646)

In order for the appeal to be accepted by the Corps of Engineers, the Corps of Engineers must determine that it is complete, that it meets the criteria for appeal under 33 CFR Part 331.5, and that it has been received by the Division Office within 60 days of the date on the NAP/RFA form. Should you decide to submit an NAP/RFA form, it must be received at the above address within 60 days or by October 10, 2008. When the preceding "Day 60" is a traditional non-working day (e.g. a holiday or a weekend), the 60 day timeframe is extended to the next business day.

The receipt of your letter is appreciated. If you have questions, please contact Daisy Eldridge at (602) 640-5385, x268.

Sincerely,

Cindy Lester

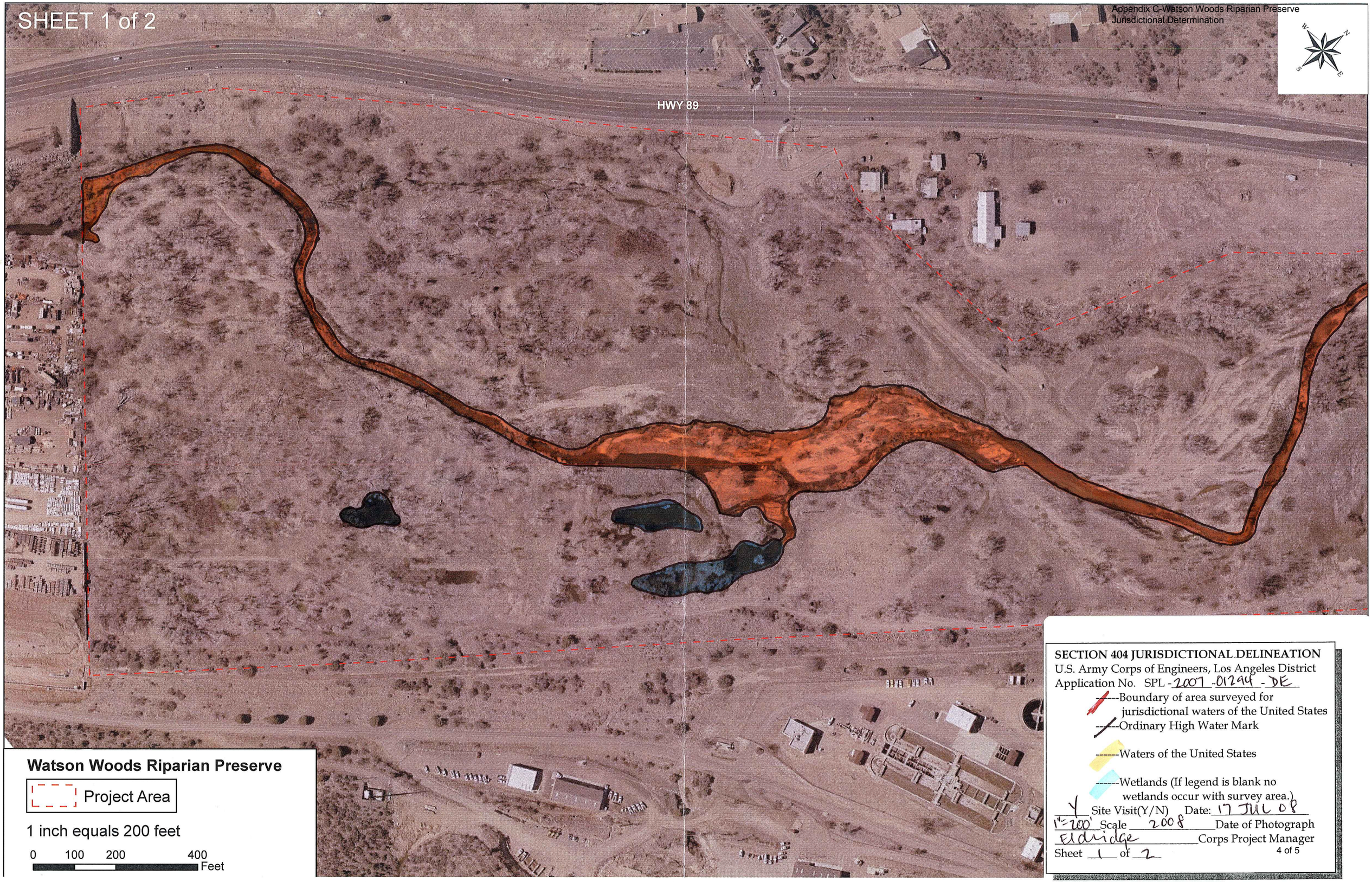
Cindy Lester, P.E.
Chief, Arizona Branch
Regulatory Division

Enclosures
1. Basis of Jurisdictional Determination
2. Consolidated NAP/RFA Appeal form
3. Administrative Appeal Process flowchart (Appendix C)
4. Jurisdictional Delineation map(s)

Copy Furnished:
(Without Enclosures)

Tom Moody
Natural Channel Design, Inc.
3410 South Cocopah Drive
Flagstaff, Arizona 86001

SHEET 1 of 2



Watson Woods Riparian Preserve

Project Area

1 inch equals 200 feet

0 100 200 400 Feet

SECTION 404 JURISDICTIONAL DELINEATION
U.S. Army Corps of Engineers, Los Angeles District
Application No. SPL-2007-01294-DE

-----Boundary of area surveyed for jurisdictional waters of the United States

-----Ordinary High Water Mark

------Waters of the United States

------Wetlands (If legend is blank no wetlands occur with survey area.)

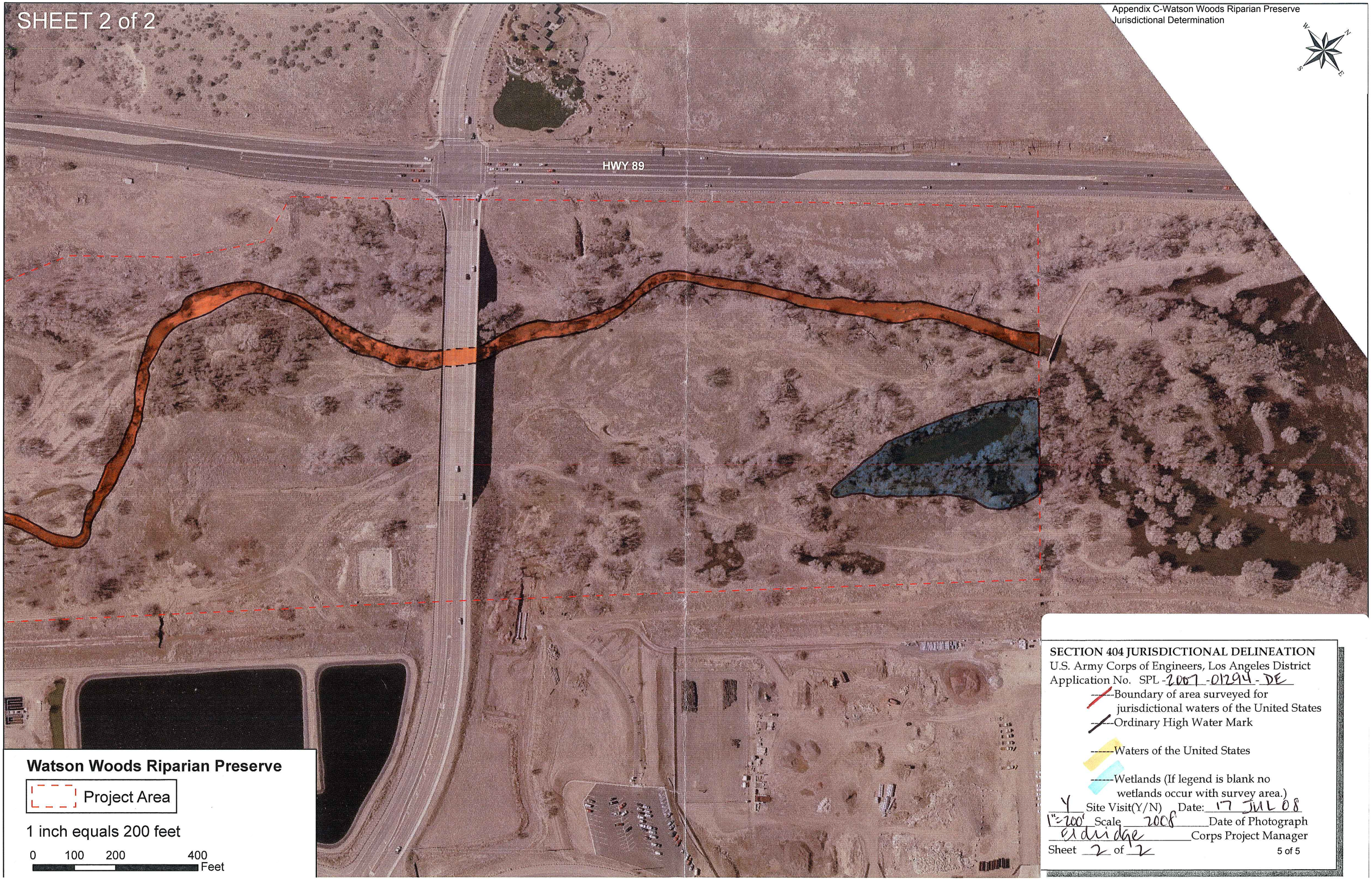
Y Site Visit(Y/N) Date: 17 JUL 08

1"=200' Scale 2008 Date of Photograph

Eldridge Corps Project Manager

Sheet 1 of 2

SHEET 2 of 2



Watson Woods Riparian Preserve

Project Area

1 inch equals 200 feet

0 100 200 400 Feet

SECTION 404 JURISDICTIONAL DELINEATION
U.S. Army Corps of Engineers, Los Angeles District
Application No. SPL-2007-01294-DE

-----Boundary of area surveyed for jurisdictional waters of the United States
-----Ordinary High Water Mark

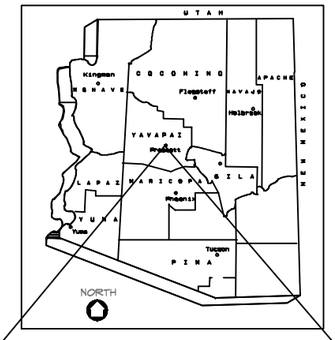
-----Waters of the United States

-----Wetlands (If legend is blank no wetlands occur with survey area.)

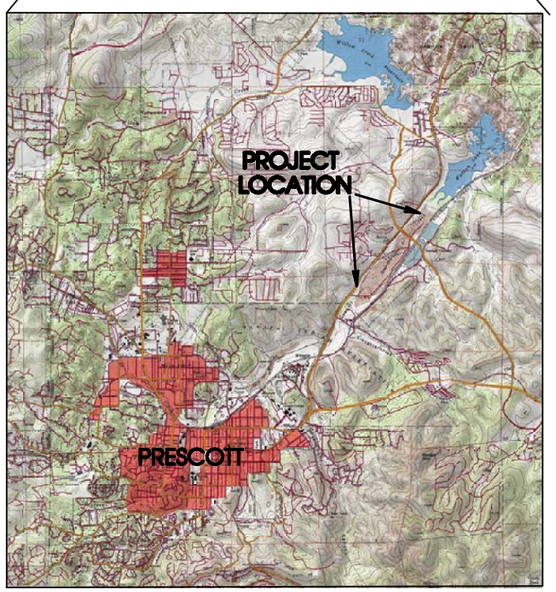
Y Site Visit(Y/N) Date: 17 JUL 08
1"=200' Scale 2008 Date of Photograph
Eldridge Corps Project Manager
Sheet 2 of 2

Appendix D

Watson Woods Riparian Preserve
As-Built Drawings



LOCATION MAP



Sections 23 - 24, T14N, R2W
Prescott, Yavapai County, Arizona

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Watson Woods Riparian Preserve Restoration Project

Arizona Water Protection Fund Rroject 08-158 WPF

Prepared for: Prescott Creeks
119 Grove Ave
Prescott, AZ 86301

Prepared by: Natural Channel Design, Inc.

AS BUILT DRAWINGS

Granite Creek - Prescott, Arizona

Stream Project Length: 6,000 feet (1.1 sq mi)

Construction Period: March 2 to April 8, 2009
Contractor: Prescott Creeks
Subcontractors: Natural Channel Design, Inc
Fann Environmental, LLC
Rob Overacker Contracting LLC
American Conservation Experience

INDEX OF DRAWINGS

SHEET NO.	TITLE
1	COVER SHEET: Location, Index, Materials
2	GENERAL NOTES
3	CONSTRUCTION SPECIFICATIONS: Earthwork & Structures
4	CONSTRUCTION SPECIFICATIONS: Revegetation Plan
5	CONSTRUCTION SPECIFICATIONS: Seeding, Mulching, & Fabric
6	PROJECT SITE: Control, Access, Spoil Areas
7	SITE PLAN: Reaches 1 and 2 with Aerial Photo
8	SITE PLAN: Reaches 3 and 4 with Aerial Photo
9	PLAN VIEW: Reach 1 STA 0+00 to 12+00
10	PROFILE and CROSS-SECTIONS: Reach 1
11	PLAN VIEW: Reach 2 STA 12+00 to 28+00
12	PROFILE and CROSS-SECTIONS: Reach 2
13	PLAN VIEW: Reach 3 STA 28+00 to 48+00
14	PROFILE and CROSS-SECTIONS: Reach 3
15	CROSS-SECTIONS: Reach 3 and Reach 4
16	PLAN VIEW: Reach 4 STA 48+00 to 64+00
17	PROFILE and CROSS-SECTIONS: Reach 4
18	DETAILS: Typical Channel & Vegetation Cross-Sections
19	DETAILS: Erosion Fabric & Log, Road Access & Stream Crossing
20	DETAILS: Toe Rock & Brush Trench and Brush Revetment
21	DETAILS: Dormant Pole, Cluster, and Post Plantings
22	DETAIL: Vertical Bundles

MATERIAL LIST

EARTHWORK	
Channel Excavation	8,285 cy
Wetland Excavation	18,570 cy
Fill (floodplains)	14,070 cy
Road Realignment	770 cy
Landscaping (Spoils)	12,015 cy
STRUCTURES	
Toe Rock	420 ft (210 cy)
Temporary Stream Crossing Culvert	1ea-24 in. dia CMP
Brush Revetment	615 ft
Erosion Logs	540 ft (54 logs)
TRM Fabric	70 ft (8 ft width)
VEGETATION	
Willow Cuttings (Aroyo, Coyote)	10440 ea
Cottonwood Posts	215 ea
Seeding	17 ac
Erosion Control Fabric	111 rolls (8'x112')

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard
DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

COVER SHEET: Location, Index, Materials

Watson Woods Riparian Preserve
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

FILE NAME: Watson Woods.pro
DATE: December 20, 2006
PROJECT NO: 05-106-01AZ
SHEET: 1 of 22

AS BUILT DRAWINGS

GENERAL NOTES

1. Topographic maps were prepared in 2005 by Shephard–Wesnitzer by overlaying terrestrial ortho images produced by aerial photography. Some eleavation discrepancies may exist due to tree canopy.
2. Project survey data provides the most accurate representation of site topographic conditions. All existing conditions are to be verified in the field prior to construction. Any adjustments from the drawings to be made as directed by the ENGINEER.
3. All stationing refers to base line of construction and is measured horizontal distance.
4. No representation is made as to the existence or nonexistence of any utilities, public or private. Absence of utilities on these drawings IS NOT assurance that no utilities are present. The existence, location and depth of any utility must be determined by the contractor prior to any excavation. Call before you dig, 1–800–STAKE–IT.
5. Construction activities will be conducted in a manner consistent with all safety regulations and requirements of Sections 404, 401, and 402 of the Clean Water Act (ACOE), and other permitting required by the City of Prescott, Yavapai County (grading permit), etc.
6. Installation shall be constructed to the lines and grades as shown on the drawings or as staked in the field by the ENGINEER, recognizing there is variation in nature.

CONSTRUCTION MANAGEMENT

Construction is timed to allow for the driest conditions, the lowest chance of flood flows, to provide the least disturbance to wildlife and the optimum establishment of native plant species. Earthwork and revegetation activities will be completed in as quick a time frame as possible, reducing the time of disturbance and maximizing the healing of disturbed areas and establishment of native vegetation.

Construction Supervision

Supervision shall be provided for the earthwork, structural and revegetation tasks. Supervisory personnel shall have an understanding of the natural channel design as applied to stream and wetland restoration.

Construction Equipment

The following equipment are expected to be utilized during the construction:

- Backhoe/Trackhoe/Excavator with thumb: Channel and wetland excavation, channel filling, bank sloping, and rock installation.
- Backhoe/Front End Loader: Moving structure rock and various fill
- Dozer: Land smoothing, moving fill and wetland excavation
- Dump Truck: Miscellaneous hauling

Permitting Requirements

No construction shall begin until all necessary permits are obtained.

PROJECT DESCRIPTION

The project design includes enhancing and restoring the channel function of Granite Creek and (re)creating riparian habitats within the Watson Woods Riparian Preserve. The Preserve was historically impacted from gravel mining operations in the mid–twentieth century. The feasibility study identifies treatments such as reshaping of the channel and floodplain, realignment where beneficial, stabilizing banks where appropriate, and establishment of native plant communities along the river corridor where they are now absent.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Construction Sequence

The following is a recommended construction sequence:

1. Coordinate with Prescott Creeks for scheduling of construction activities.
2. Relocate utilities where necessary
3. Improve access routes where necessary; reposition 450 ft of access road starting at parking area off of Highway 89 (see SHEETS 3,7,19).
4. Construct temporary stream crossing at STA 28+25 (see SHEETS 3,13,19).

REACH 1:

5. Excavate new channel alignment (800 ft) starting from downstream working upstream (see SHEETS 3, 6, 9, 10, 18).
6. Partially fill old channel (250 ft near STA 0+50) at upstream end to direct stream flow into new channel alignment. Install toe rock (70 ft) and brush trenches (180 ft). (see SHEETS 3, 4, 7, 9, 10, 18)
7. Install revegetation practices (see SHEETS 4, 5, 9, 10, 18, 19, 20, 21, 22).

REACH 2:

8. In coordination with the City of Prescott Solid Waste Division, remove and dispose of properly all trash and debris near proposed Wetland No. 1 (see SHEET 3).
9. Excavate new channel alignment (950 ft) starting from downstream working upstream (see SHEETS 3, 6, 11, 12, 18).
10. Partially fill old channel at upstream end (200 ft near STA 13+15) to direct stream flow into new channel alignment. Install toe rock (110 ft at STA 13+00) and brush trenches (190 ft). (see SHEETS 3, 4, 7, 11, 12, 18)
11. Partially fill old channel at upstream end (100 ft near STA 18+10) to direct stream flow into new channel alignment. Install toe rock (35 ft at STA 18+05) and brush trenches (75 ft). (see SHEETS 3, 4, 7, 11, 12, 18)
12. Excavate Wetland No. 1 (see SHEETS 3, 11, 12, 18).
13. Install revegetation practices (see SHEETS 4, 5, 11, 12, 18, 19, 20, 21, 22).

REACH 3:

14. Excavate new channel alignment (650 ft) starting from downstream working upstream (see SHEETS 3, 6, 13, 14, 15, 18).
15. Partially fill old channel (300 ft near STA 29+15) at upstream end to direct stream flow into new channel alignment. Install toe rock (75 ft) and brush trenches (215 ft). (see SHEETS 3, 4, 7, 13, 14, 15, 18)
16. Excavate Wetland Nos. 2 and 3 w/ outlets (see SHEETS 3, 13, 14, 15, 18).
17. Install revegetation practices (see SHEETS 4, 5, 13, 14, 15, 18, 19, 20, 21, 22).

REACH 4:

18. Excavate new channel alignment (1470 ft) starting from downstream working upstream (see SHEETS 3, 6, 15, 16, 17, 18).
19. Partially fill old channel (150 ft near STA 45+15) at upstream end to direct stream flow into new channel alignment. Install toe rock (70 ft) and brush trenches (120 ft). (see SHEETS 3, 4, 7, 15, 16, 17, 18)
20. Excavate Wetland Nos. 4, 5, and 6 w/ outlets (see SHEETS 3, 15, 16, 17, 18).
21. Install revegetation practices (see SHEETS 4, 5, 16, 17, 18, 19, 20, 21, 22).

22. Complete floodplain/terrace smoothing and shaping.
23. Implement Revegetation Plan for Critical Planting Areas
    - Seed all disturbed areas and designated critical planting areas
    - Plant dormant cottonwood posts and willow poles in higher flood plain and terrace zone, approximately 3 posts and poles to a hole.
    - See SHEETS 5, 6, 7, and 8 for critical plantings areas.

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	5/3/07	SNY	Construction Notes
3	1-5-10	MW	As-Built

GENERAL NOTES

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

AS–BUILT DRAWINGS
Construction Period
3–2–09 to 4–8–09

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05–106–01AZ

SHEET: 2 of 22

CONSTRUCTION SPECIFICATIONS

AS BUILT DRAWINGS

POLLUTION CONTROL and RESOURCE PROTECTION

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution are minimized and held within legal limits. The measures and works shall include, but are not limited to, the following:

1. Diversions: Standard best management practices will be used to temporarily divert water away from work areas within the active channel. Such diversions shall be temporary and shall be removed and the area restored to its near original condition immediately upon completion of work within the active channel or when permanent measures are installed (i.e. realignment of channels).
2. Equipment Access and Staging Areas: Transportation routes for materials, personnel, and equipment to, from, and within the project area shall be limited to access areas located on the drawings or determined in the field. Equipment access to Reach 1 is from the south parking area upstream of project. Access to Reaches 2, 3, and 4 is from the northwest Parking Area following designated routes to each stream reach.
3. Revegetation: Impacts to existing vegetation and habitats shall be minimized. All disturbed areas shall be replanted with native vegetation.
4. Stream Crossings: Stream crossing points shall be minimized and shall be removed and the area restored to its near original condition when crossings are no longer required.
5. Equipment Use in Streams: When stream channel work is necessary, every effort will be made to enter and exit the channel in locations without important vegetation and where impacts do not result in stream bank instability. The use of heavy equipment in the stream will be kept to an absolute minimum.

TEMPORARY STREAM CROSSING

A temporary stream crossig shall be constructed near STA 28+25 to the extent that construction operations can be performed under stable conditions. See SHEET 19 for Detail.

- Instll one 24-inch diameter culvert in the channel at STA 28+25
- Prior to back-filling, the pipe shall be firmly and uniformly bedded.
- Place excavated material from Wetland No. 2 over culvert to a depth of 1 ft
- At completion of restoration activities, remove placed material and culvert. Restore to original condition .

STRUCTURES PLAN

Structures shall consist of installing toe rock, brush revetments, and erosion control logs.

Toe Rock with Willow Brush Trench: This structural bank stabilization practice consists of graded angular rock placed along bank sections where the abandoned channel leaves the new channel alignment. Height of rock is about 3 ft above and 2 ft below the channel bed. The bioengineering practice, Willow Brush Trench, is placed behind the toe rock.

- The work shall consist of excavation, delivery of rock, and installation of rock for rock riprap as shown on the drawings or staked in the field by the authorized representative.
- The rock shall be well graded from a minimum of six inches to a maximum size of 12 inches with greater than 50% by weight being larger than 9 inches.
- The rock shall be angular, dense, sound and free from cracks, seams, or other defects conducive to accelerated weathering. The least dimension of an individual rock shall not be less than one-half the greatest dimension.
- The rock source shall be approved by the ENGINEER or authorized representative and have a bulk specific gravity of not less than 1.7 per ASTM C127.
- See SHEET 20 for Detail.

Brush Revetment: Revetment is constructed from whole trees that are wired together and anchored by earth anchors or fence posts. Brush or trees are secured to the streambanks to protect the toe of the bank by slowing velocities and diverting the current away from the bank edges. The revetment also traps sediment from the stream. See SHEET 20 for Detail.

Erosion Control Logs: These flexible logs are made of Coir, Straw, Aspen Excelsior, or other natural materials are installed to protect the streambank by stabilizing the toe of the slope and by trapping sediment. Cuttings and herbaceous riparian plants can be planted into the log and behind it. Secure the logs with 24 to 36 inch long wedge-shaped stakes at 5 foot intervals. Stakes can be driven through center of log or both sides of log and tied with twine.

EARTHWORK

The earthwork shall consist of channel and wetland excavation, channel filling, bank sloping, and floodplain smoothing. See SHEETS 9 through 18. Place spoil as shown on SHEET 6.

Excavation

Excavation shall be limited to the channel realignment, wetland and landscaping as shown on the drawings or as staked in the field. All finished surfaces shall be generally smooth and pleasing in appearance. Disturbance of existing native vegetation shall be minimized to the greatest extent possible during excavation.

Excavated material shall be placed in abandoned sections of the old channel and designated spoil areas (Parking Area, other) as shown on the drawings, SHEET 6, or as staked in the field. Place excess spoil material outside of jurisdictional areas and use in the Watson Woods landscaping master plan. See Table, SHEET 5, for earthwork volume estimates.

Earthfill

Materials: All fill materials shall be obtained from the required excavations and/or approved borrow sources. Fill shall not contain sod, brush, roots, perishable or frozen materials.

Placement: The placement of fill materials shall follow these guidelines:

- Any vertical bank shall be sloped to a minimum of 1:1 before placement of fill material.
- Material when placed shall contain sufficient moisture so that a sample taken in the hand and squeezed shall remain intact when released.
- The placing and spreading of fill material shall be started at the lowest point and the fill brought up and compacted to obtain a density similar to the surrounding ground. Compacted horizontal layers shall not exceed: six (6) inches of loose fill for wheel compaction and four (4) inches of loose fill for dozer compaction. Construction equipment shall be operated over the areas of each layer of fill to insure that the required compaction is obtained.
- Fill shall not be placed on frozen soil, snow or ice.
- Channels designated for filling and re-contouring shall be filled as close as possible to the historic natural ground surface, and smoothed and shaped to blend with the surroundings.
- All finished surfaces shall be generally smooth and pleasing in appearance and blend into surrounding terrain.

Road Realignment

A portion of access road will be realigned starting at the parking area off of Highway 89 traveling east for about 450 feet as shown on SHEETS 6, and 7. The road fill shall be from excess channel and/or wetland excavation. Road material shall be placed in horizontal lifts not exceeding 6 inches of loose fill for wheel compaction and 4 inches for dozer compaction. See SHEET 19 for typical road section Detail.

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	5/3/07	SNY	Construction Notes
3	1-5-10	MW	As-Built

CONSTRUCTION SPECIFICATIONS

Earthwork & Structures

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 3 of 22

AS BUILT DRAWINGS

REVEGETATION PLAN

Revegetation Plan includes native grass seeding (with mulching & fabric), wetland plugs (sedges & rushes), shrubs & tree plantings. Use local native material where appropriate & feasible. Supplemental irrigation (supplied by existing City of Prescott 12" potable water main) may be needed for several years for plant establishment. Irrigating for at least two years will ensure that all woody species and nursery plants will become established and reach the water table (for cottonwood and willow species), and that seeded species germinate successfully.

PLANT MATERIAL PROCUREMENT and HANDLING

Woody Plant Materials:

All woody species shall be native and collected from designated local sources. Coyote willow (Salix exigua) and Arroyo willow (Salix lasiolepis) will be planted in the Bank and lower Overbank Zone. Red willow (Salix laevigata) will be planted in the upper Overbank Zone. Fremont cottonwood (Populus fremontii) will be planted in the upper Overbank Zone.
Dormant unrooted hardwood cuttings can be taken after leaf fall and before bud burst in the spring. Never remove more than 1/3 of any single donor plant during harvesting. The best rooting success is from cuttings that are disease-free, green plants that are 2-10 years old. The best diameters for pole planting, vertical bundles, and trenches are 1/2 to 1 inch and 2 to 3 inches for post plantings. Cutting length varies depending on the application. it shall be long enough to reach 6 to 8 inches into the lowest water level of the year and high enough to expose at least two to three buds.
Cuts shall be made with clean, sharp tools. The bottom end of the stem cutting shall be cut to a 45-degree angle and the tip end shall be cut square across or horizontal to the stem. Trim off all side branches and the terminal bud (bud at the growing tip) so energy will be rerouted to the lateral buds for more efficient root and stem sprouting. Do not trim terminal bud from cuttings for vertical bundles and willow trench until after planted. Trimmed tip ends shall be sealed by dipping in light-colored latex, water-based paint.

Submerge cuttings in water for 3 to 7 days prior to planting to maximize water retention. Do not allow the roots to emerge from the bark. See figure this sheet for riparian planting zones.

INSTALLATION OF WOODY PLANTS

Installation of vegetation shall start when the general excavation operations are being completed.

POLE PLANTINGS and POLE CLUSTERS:

Pole cuttings are placed in the ground deep enough to reach the lowest water table of the year and high enough to expose at least two to three buds. Root primordia will develop when good soil-to-stem contact is made and exposed sections of the cutting will sprout stems and leaves.
Dormant cuttings can be planted with a digging bar, auger, water-jet, or if the soil is saturated, they may be pushed into the soil. Pole Plantings are planted in the Bank and Overbank Zone and shall be spaced 4 feet apart in the row. In multiple row plantings, spacing between rows shall be staggered with respect to those in adjacent rows. See SHEETS 21 & 22 for Detail.

POST PLANTINGS

This practice involves planting of larger limbs (2 to 3 inches diameter) in clusters of three at 10 foot centers in designated areas. Cottonwood posts will be placed in holes in the Floodplain Zone, excavated to groundwater elevation and backfilled with wet mud. See SHEET 21 for Detail.

BRUSH TRENCH

Brush trench uses bundles of willow cuttings in a buried trench along the top of a bank. This willow "fence" filters runoff before it enters the stream and will help to stabilize the filled channel section. Brush trench shall be installed at or above floodplain elevation behind the toe rock and then every 50 feet within a channel fill section. See SHEET 20 for Detail.

VERTICAL BUNDLES

Vertical bundles are placed in shallow trenches vertically up the slope. It will protect the Bank and Floodplain Zones. Vertical bundle diameters should be from 3 to 6 inches (typically 3 to 6 stems). Bundle heights should be tall enough to extend from about 8 inches into the water table to about 1 foot above the top of the bank. Vertical bundles can be installed on 4 foot centers between waters edge and top of bank. Cuttings are stripped of side branches, tied into bundles, and soaked. See SHEET 22 for Detail.

PLANT MATERIAL PROCUREMENT and HANDLING

Wild Transplant or Nursery Collection

Wetland plants are readily transplanted because of their well developed root systems and the remaining plants will fill in the harvest hole rapidly. One rule of thumb is to dig no more than 1 sq ft of plant material from a 4 sq ft area. It is not necessary to go deeper that 5 to 6 inches. This will get enough root mass to ensure good establishment at the project site. It will also retain enough of the transplants' root system below the harvest point to allow the plants to grow back into the harvest hole.

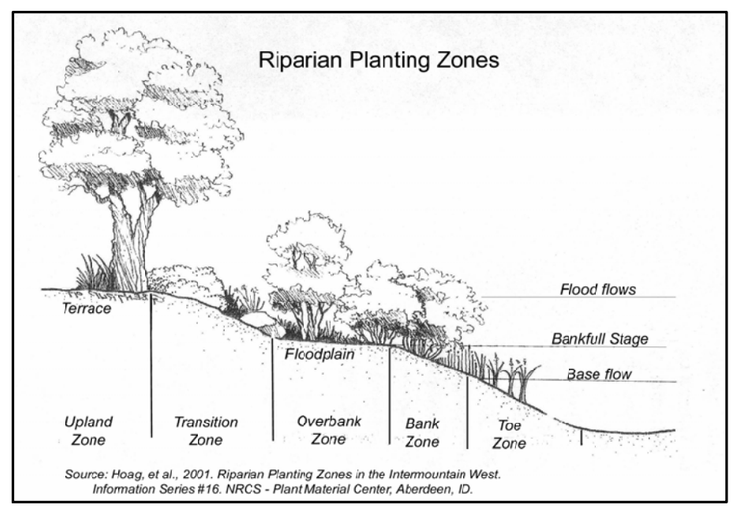
Transplants can be taken at almost any time of the year. Cut the top growth to about 4 to 5 inches above the potential standing water height or 10 inches whichever is higher. If one sq ft of plant material is harvested, it is possible to get 4 to 5 individual plant plugs from the larger plug.

Leaving the soil on the plug increases the establishment rate by about 30%. Beneficial organisms that are typically found on the roots of the wetland plants are important in the nitrogen and phosphorous cycles. These organisms may not be present at the new site. Leaving soil on the plug, however, will increase the volume of material that needs to be transported. There is a chance that weed seeds could be transported in the soil if collected from a weed-infested area. Washed plugs reduce weed seed transport and can be inoculated with mycorrhizae purchased from dealers.

Make sure the length of the plug is related to the saturation zone at the planting site. The bottom of the plug needs to be in contact with the saturation zone. Match the amount of water with the wetland plant species. (Hoag et al 2003). Where possible, plugs and sod shall be grown and harvested locally.

INSTALLATION OF WILD TRANSPLANTS or NURSERY COLLECTION

TRANSPLANT PLUGS: Plant plugs by flooding the planting site. Saturated soil is much easier to plant in than dry soil. The soil should be super saturated so that a hole can be easily dug with a bare hand. Hand planting is more successful with fine soils than with coarse soils. Take the plug trays and place them in a Styrofoam cooler. Cover the roots with water while in transit. At the planting site, drain off most of the water so the cooler will float. Use the cooler to move the plugs around the area as you plant. Plant plugs in the Toe Zone. The plugs can either be chopped with a shovel very rapidly or the plugs can be cut with a small saw so they will easily fit into a predrilled, set diameter hole. To get the right length of plug, lay the large plug on its side on a sheet of plywood and use a saw to cut the bottom off level and to the desired length. After this, stand the plug up and slice smaller plugs off like a cake.



Source: Hoag, et al., 2001. Riparian Planting Zones in the Intermountain West. Information Series #16. NRCS - Plant Material Center, Aberdeen, ID.

CALL TWO WORKING DAYS BEFORE YOU DIG 263-1100 1-800-STAKE-IT (OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	5/3/07	SNY	Construction Notes
3	1-5-10	MW	As-Built

CONSTRUCTION SPECIFICATIONS

Revegetation Plan

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 4 of 22

AS BUILT DRAWINGS

SEEDING and MULCHING

Disturbed areas will be seeded with native grasses. Prepare seedbed where needed. Seed can be drilled or broadcast by hand. Seed shall be incorporated into the soil, but not more than 1-inch deep. Reseeding may be required for successful plant establishment.

Seed shall be purchased from a reliable supplier. The grass seed mix will consist of the following species as available. The seeding rates below are for broadcast planting. Native grass seed will be applied at a rate of 20 pounds to the acre. Forbs (wildflowers) can be added to seed mix to increase diversity and improve aesthetics. Forbs (wildflowers) that have low maintenance, high survival rate, cold hardy, beautiful colors, and ecologically appropriate (non-invasive) are listed. Estimated area of disturbance is 20 acres.

NATIVE GRASS SEED MIX

Purple three-awn	*(Aristada purpurea)*	1.0	lb/ac PLS
Blue grama	*(Bouteloua gracilis)*	3.0	lb/ac PLS
Sideoats grama	*(Bouteloua curtipendula)*	3.0	lb/ac PLS
Prairie junegrass	*(Koeleria macrantha)*	1.0	lb/ac PLS
Alkali sacaton	*(Sporobolus airoides)*	0.5	lb/ac PLS
Bottlebrush squirreltail	*(Elymus elymoides)*	1.0	lb/ac PLS
Blue wildrye	*(Elymus glaucus)*	2.0	lb/ac PLS
Western wheatgrass	*(Pascopyrum smithii)*	4.0	lb/ac PLS
Sand dropseed	*(Sporobolus cryptandrus)*	0.5	lb/ac PLS
Muttongrass	*(Poa fendleriana)*	1.0	lb/ac PLS
Vine mesquite	*(Panicum obtusum)*	3.0	lb/ac PLS
Spike dropseed	*(Sporobolus contractus)*	0.5	lb/ac PLS
		20.5	lb/ac PLS

FORBS/HERBS (WILDFLOWERS)

Showy goldeneye	*(Heliomeris multiflora)*
Arroyo lupine	*(Lupine succulentus)*
Eaton's penstemon	*(Penstemon eatonii)*
Globe mallow	*(Sphaeralcea coccinea)*
Yellow evening primrose	*(Oenothera elata)*
Evening primrose	*(Oenothera lamarkiana)*

Straw Mulch

On gentle to moderate slopes, straw mulch can be applied by hand broadcasting to a uniform depth of 2 to 3 inches. On steep slopes, the straw should be blown onto the slope to achieve the same degree of cover. When applied properly,approximately 20-40 percent of the original ground surface can be seen. The application rate per acre should be about 2 tons (or one 74 pound bale per 800 square feet). Straw should be clean rice, barley, or wheat straw. Mulch containing noxious weeds is not permitted. Straw mulch material shall be stabilized by hand punching, roller punching, crimper punching or equivalent anchoring tool.

Hydroseeding and Hydromulching

A tank mounted truck equipped with a special pump and continuous agitation system is used. The pump forces the slurry through a top mounted discharge nozzle or hose. Tank capacities range from 1000 to 3000 gallons. Water is added first and then the cellulose or wood fiber, tackifier (if used), fertilizer (if used), and seeds. Seed should not be added to the slurry until immediately prior to beginning the operation and not remain in the tank more than 30 minutes. Single application hydroseeding uses 1500 to 2000 pounds of fiber mulch per acre with the seed and fertilizer. Split application hydroseeding uses 500 pounds of fiber mulch per acre with the seed and fertilizer in the first pass followed by an application of 1500 to 2000 pounds of fiber mulch per acre and tackifier (if used). Most tackifiers are applied at 100 pounds of dry ingredients per acre.

Erosion Control Fabric

Fabric made of Jute, Coir, Straw, Coconut or other natural material is laid and anchored over seeding to reduce soil erosion and provide a good environment for vegetative regrowth. Fabric shall be installed for slope protection and seed germination enhancement. See figure on this Sheet 19 for fabric installation.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

EARTHWORK VOLUME TABLE

	Excavation (cy)	Fill (cy)	Spoil (cy)
Reach 1	1500	870	630
Reach 2	1485	1000	485
Reach 3	1000	1030	-30
Reach 4	4300	970	3330
Wetland 1	2970	5	2965
Wetland 2 & Outlet	3390	205	3185
Wetland 3 & Outlet	8870	9905	-1035
Wetland 4 & Outlet	895	20	875
Wetland 5 & Outlet	1945	50	1895
Wetland 6 & Outlet	500	15	485
Road Realignment	(450 ft)	770	-770
TOTAL	26,855	14,840	12,015

See SHEET 3 for Earthwork Construction Specifications and SHEETS 6 -17 for PLAN VIEW, PROFILES, and CROSS-SECTIONS.

CRITICAL PLANTING AREAS

Critical Planting Area	Seed Area (ac)	Cottonwood Posts	Willow Poles
1	2.8	140	140
2	1.2	60	60
3	2.5	125	125
4	2.0	95	95
5	1.0	50	50
Total	9.5	470	470

Critical Planting Areas

These are areas outside of the main channel construction where little riparian vegetation currently exists. (SHEETS 6,7,8) These areas may receive mechanical smoothing and/or spoils placement. They are to be seeded and planted with cottonwood posts and willow poles with average spacings of 50 cottonwood posts and 50 willow poles per acre.

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

CONSTRUCTION SPECIFICATIONS

Seeding, Mulching, & Fabric

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

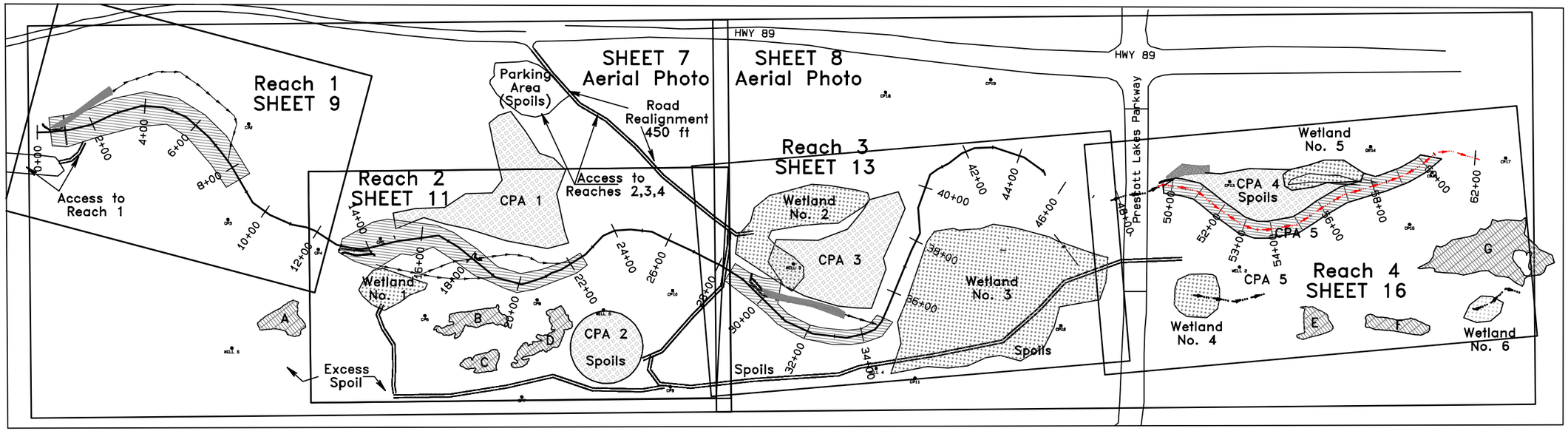
FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 5 of 22

AS BUILT DRAWINGS



NOTES
1. See SHEETS 7 and 8 for project site layout over aerial photography.
2. REACH 1: See SHEET 9 for Plan View, SHEET 10 for Profile and Cross-Sections.
3. REACH 2: See SHEET 11 for Plan View, SHEET 12 for Profile and Cross-Sections.
4. REACH 3: See SHEET 13 for Plan View, SHEETS 14 and 15 for Profile and Cross-Sections.
5. REACH 4: See SHEET 16 for Plan View, SHEETS 15 and 17 for Profile and Cross-Sections.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

CONTROL POINTS

	Northing	Easting	Elevation	Notes
CP1	1298783.04	542791.37	5204.4	1/2" Rebar, NCD Yellow Cap
CP2	1299121.63	543030.59	5195.0	1/2" Rebar, NCD Yellow Cap
CP3	1298852.39	543253.47	5194.9	1/2" Rebar, NCD Yellow Cap
CP4	1299039.82	543536.53	5191.3	1/2" Rebar, NCD Yellow Cap
CP5	1299238.02	543643.42	5199.6	1/2" Rebar, NCD Yellow Cap
CP6	1299192.69	543958.08	5190.5	1/2" Rebar, NCD Yellow Cap
CP7	1299285.48	544400.21	5202.9	1/2" Rebar, NCD Yellow Cap
CP8	1299542.88	544161.34	5189.4	1/2" Rebar, NCD Yellow Cap
CP9	1299724.57	544699.23	5187.6	1/2" Rebar, NCD Yellow Cap
CP10	1299943.31	544434.63	5192.3	1/2" Rebar, NCD Yellow Cap
CP11	1300430.15	545215.12	5191.4	1/2" Rebar, NCD Yellow Cap
CP12	1300955.47	545389.92	5184.2	1/2" Rebar, NCD Yellow Cap
CP13	1301747.21	545358.51	5174.6	1/2" Rebar, NCD Yellow Cap

CONTROL POINTS

	Northing	Easting	Elevation	Notes
CP14	1302220.12	545571.20	5162.3	1/2" Rebar, NCD Yellow Cap
CP15	1302157.65	545875.91	5171.6	1/2" Rebar, NCD Yellow Cap
CP16	1302336.20	545779.52	5166.5	1/2" Rebar, NCD Yellow Cap
CP17	1302573.89	545901.49	5163.9	1/2" Rebar, NCD Yellow Cap
CP18	1300978.67	544347.86	5189.0	1/2" Rebar, NCD Yellow Cap
CP19	1301301.57	544545.14	5192.9	1/2" Rebar, NCD Yellow Cap
WELL 2	1301586.25	545619.90	5171.0	Top center of well cap
WELL 3	1300341.17	544626.71	No Elev	Top center of well cap
WELL 4	1300342.75	545102.54	5181.9	Top center of well cap
WELL 5	1299706.37	544336.46	5185.8	Top center of well cap
WELL 6	1298579.35	543623.05	5194.1	Top center of well cap

LEGEND

- Channel Thalweg
- Backwater Channel
- A — Existing Wetland
- No. # — Design Wetland

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

PROJECT SITE

Control, Access, Spoil Areas

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

HORIZ SCALE: 1" = 400'

400 0 400

FILE NAME: Watson Woods.pro

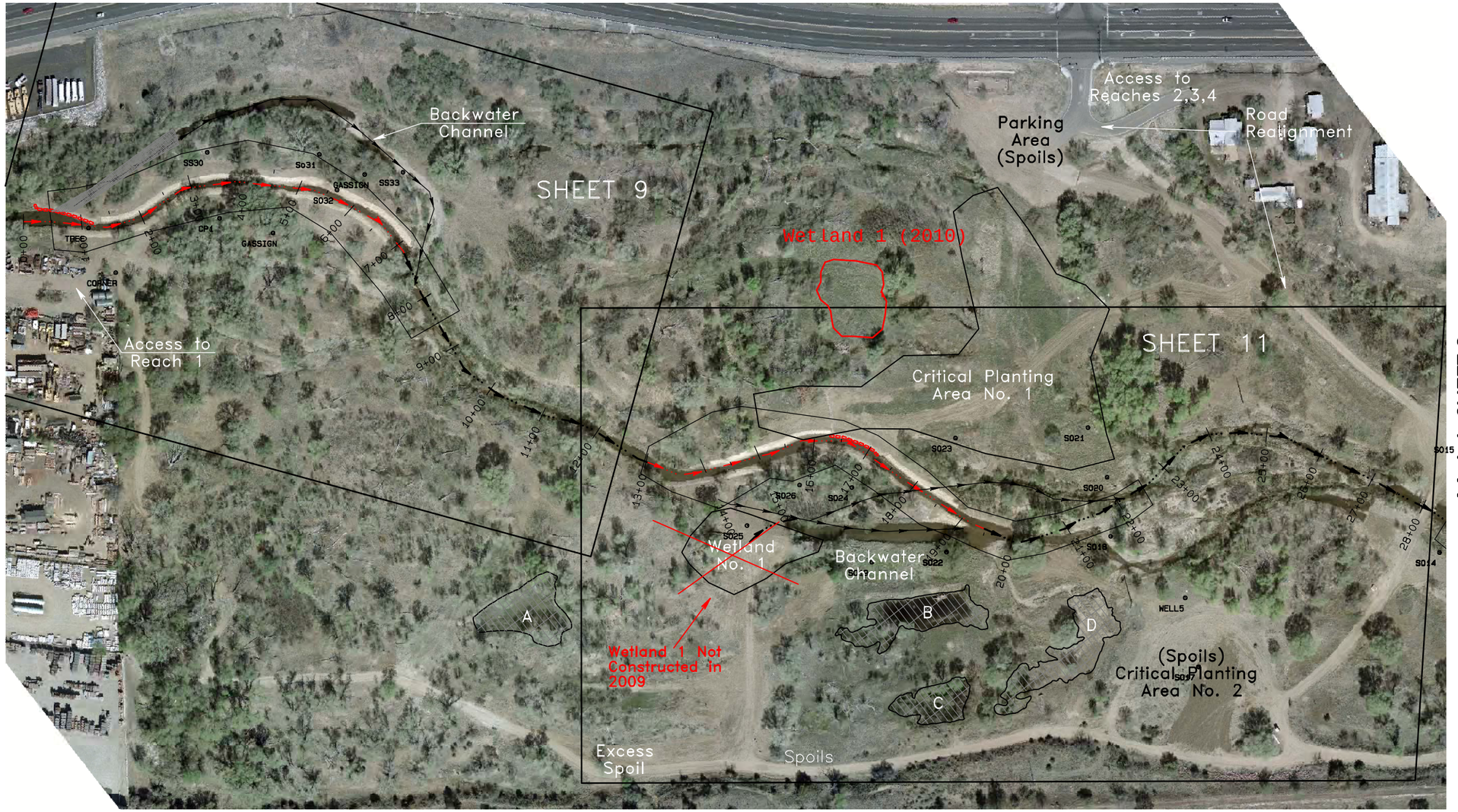
DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 6 of 22

AS BUILT DRAWINGS

Construction Period
3-2-09 to 4-8-09



LEGEND

- Channel Thalweg
- Backwater Channel
- Existing Wetland
- Design Wetland
- Toe Rock
- Channel Fill
- Channel Excavation

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Photo Date May 2009

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.prescottcreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

SITE PLAN

Reaches 1 and 2 with Aerial Photo

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

HORIZ SCALE: 1" = 200'

200 0 200

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

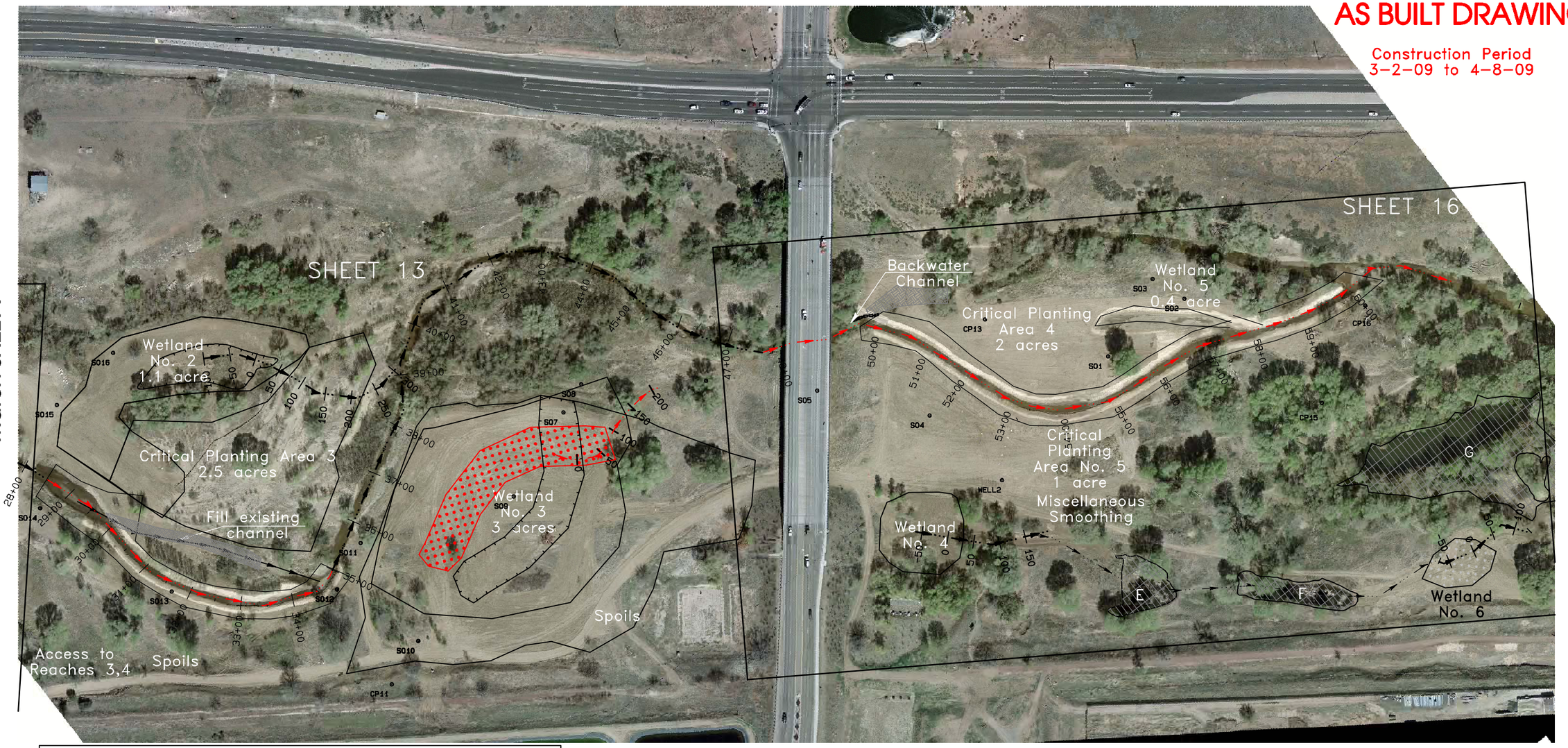
PROJECT NO: 05-106-01AZ

SHEET: 7 of 22

AS BUILT DRAWINGS

Construction Period
3-2-09 to 4-8-09

Match SHEET 7



LEGEND

- Channel Thalweg
- Backwater Channel
- Existing Wetland
- Design Wetland
- Rock Sill
- Channel Fill
- Channel Excavation

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Photo Date May 2009

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

SITE PLAN

Reaches 3 and 4 with Aerial Photo

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-5-10
ARIZONA, U.S.A.
Expires 3-31-2011

HORIZ SCALE: 1" = 200'
200 0 200

FILE NAME: Watson Woods.pro

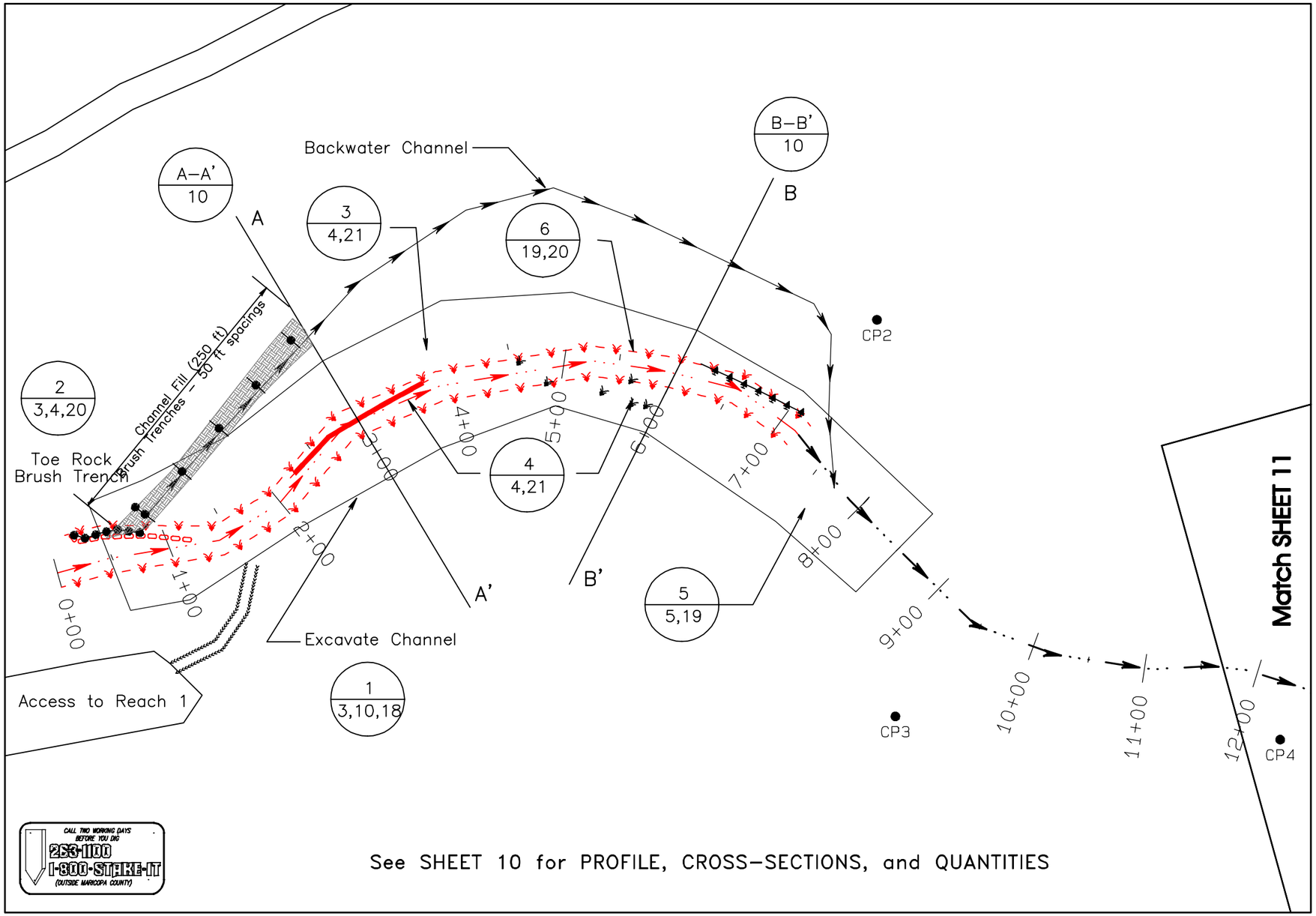
DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 8 of 22

AS BUILT DRAWINGS

Construction Period
3-2-09 to 4-8-09



NOTES

1. STA 0+50 to 7+25 620 ft Channel Excavation
   Place spoil as shown on SHEET 6.
2. STA 0+25 to STA 1+80 Inlet Protection
   Backfill channel, Install Toe Rock and
   Brush Trenches
3. Vertical Bundles/Pole Clusters
   STA 1+00 to STA 7+50 (LEFT) 650 ft
   STA 0+50 to STA 3+00 (RIGHT) 250 ft
   STA 6+00 to STA 8+50 (RIGHT) 250 ft
4. Install Floodplain Pole Clusters
   STA 3+00 to STA 6+00 (RIGHT) 300 ft
5. Fabric over Seed
   STA 1+25 to STA 7+20 (LEFT) 600 ft
   STA 0+50 to STA 7+00 (RIGHT) 640 ft
6. STA 1+40 to 2+40 (R) 100 ft Brush Revetment
   STA 6+10 to 7+25 (L) 120 ft Brush Revetmen
   STA 2+20 to STA 3+00 (R) 80 ft Erosion Log

SHEET Notes

/ #, # — Note No. / Ref SHEET

Cross-Section

Z-Z' / # — XS Label / Ref SHEET

LEGEND

- Channel Thalweg
- Backwater Channel
- Existing Wetland
- Design Wetland
- Brush Revetment
- Toe Rock
- Erosion Log
- Brush Trench
- Vertical Bundles
- Pole Clusters
- Fabric over Seed
- Channel Fill

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

PLAN VIEW: Reach 1

STA 0+00 to STA 12+00

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

HORIZ SCALE: 1" = 100'

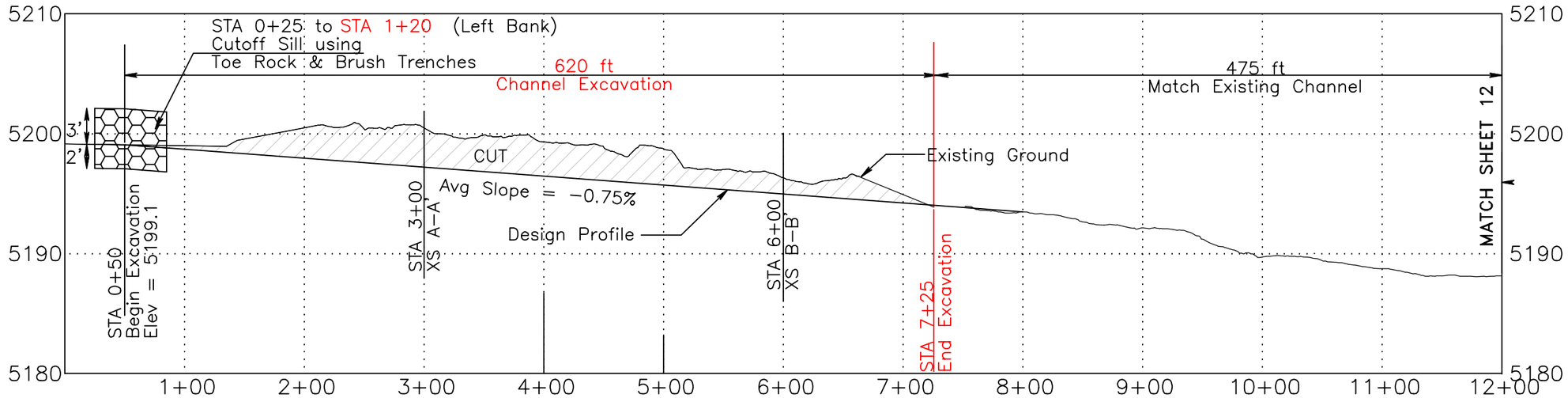
100 0 100

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 9 of 22



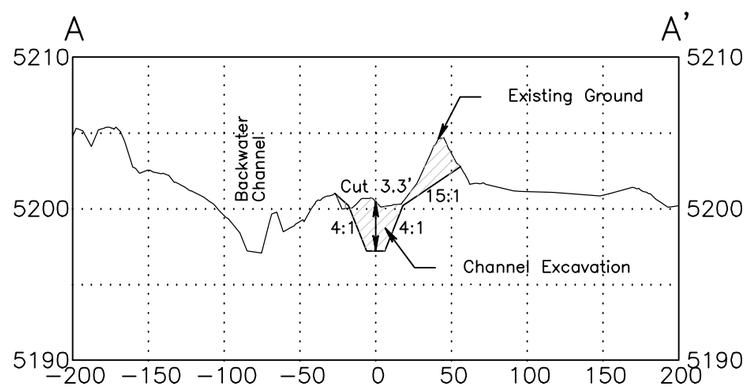
PROFILE: STA 0+00 to STA 12+00 (REACH 1)

AS BUILT DRAWINGS

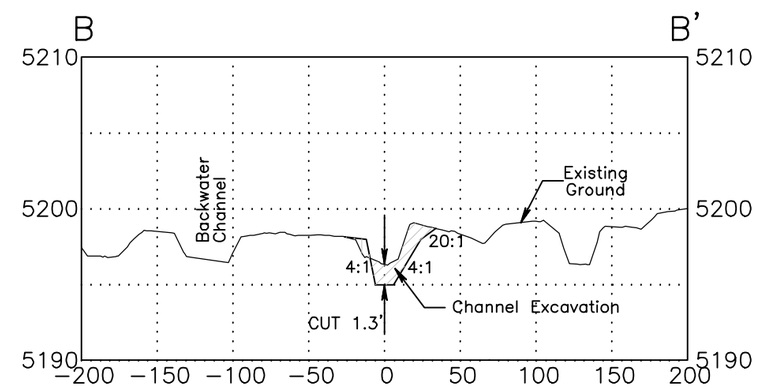
Construction Period
3-2-09 to 4-8-09

REACH 1: MATERIAL QUANTITIES

Toe Rock:	40 cy
Willow Clusters:	533 ea
Vertical Bundles:	65 ea
Seeding:	2 acres
Fabric:	20 Rolls
Brush Revetment:	220 ft
Erosion Log:	80 ft



XS A-A' (STA 3+00)



XS B-B' (STA 6+00)

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

See SHEET 9 for PLAN VIEW and NOTES

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

PROFILE and CROSS-SECTIONS
Reach 1

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-5-10
ARIZONA, U.S.A.
Expires 3-31-2011

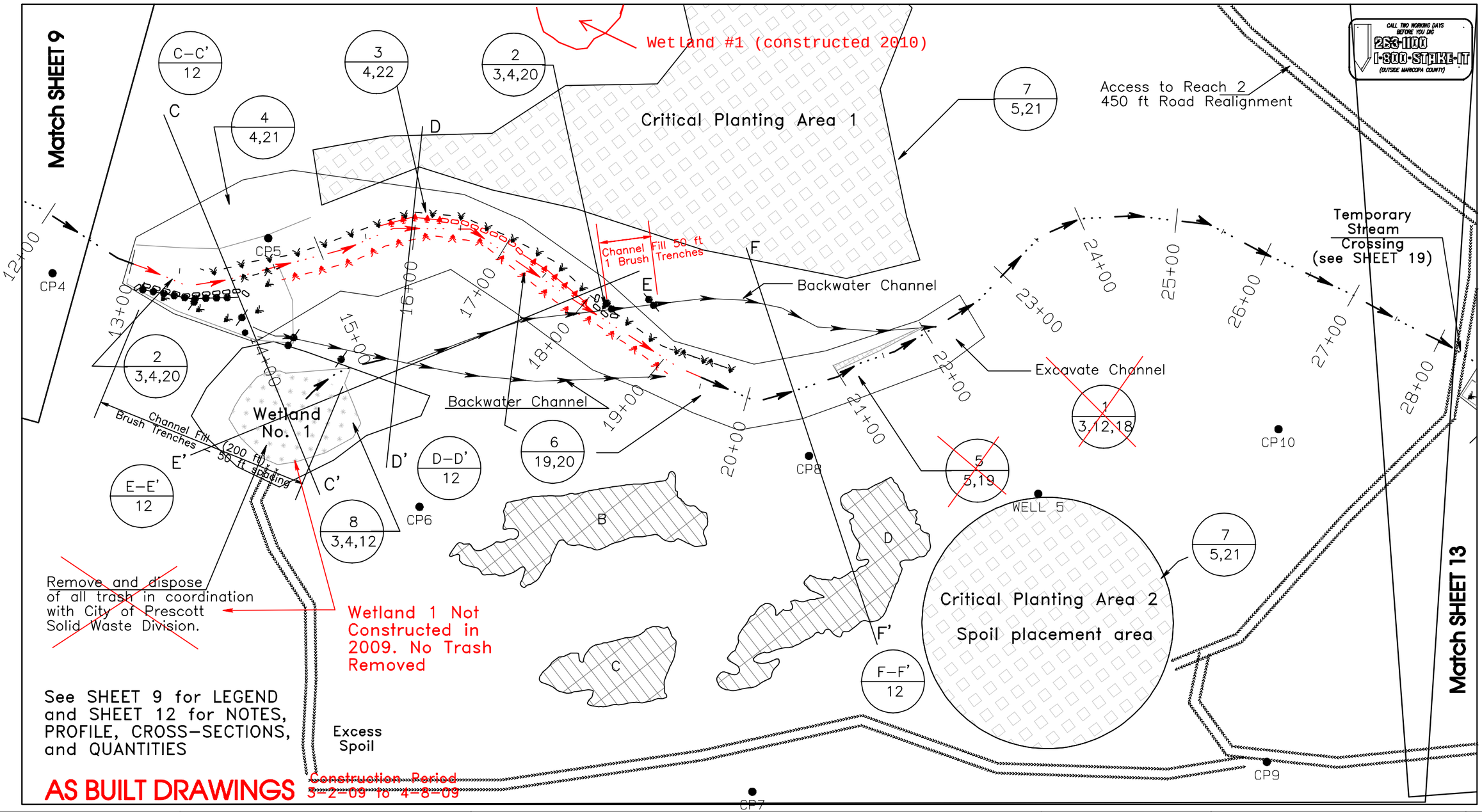
HORIZ SCALE: 1" = 100'
VERT SCALE: 1" = 10'
100 0 100

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 10 of 22



Natural Channel Design, Inc

3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard			
DESIGNED BY: T.Moody, M.Wirtanen, C. Helton			
REV	DATE	BY	REVISION
1	5/3/07	SNY	Trash Note & Crossing
3	1-5-10	MW	As-Built

PLAN VIEW: Reach 2

STA 12+00 to STA 28+00

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

HORIZ SCALE: 1" = 100'

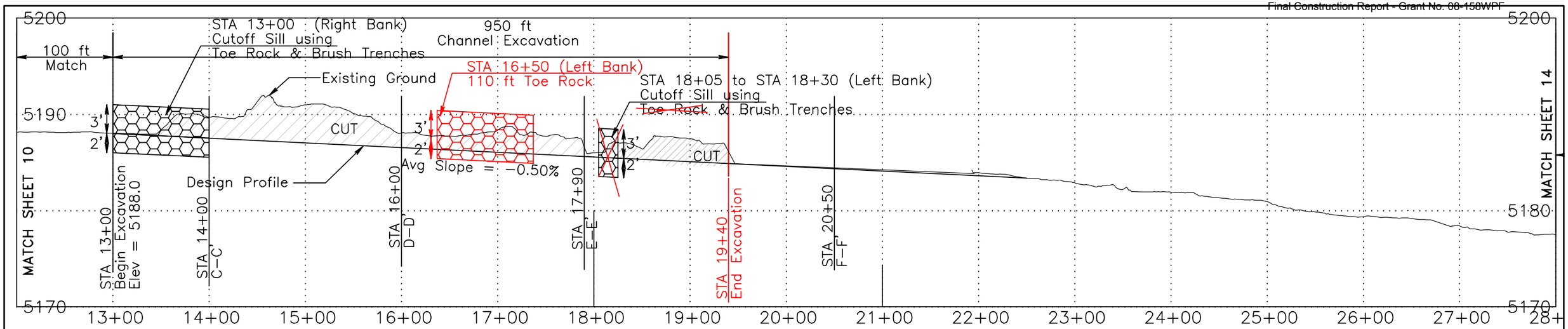
100 0 100

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 11 of 22



NOTES

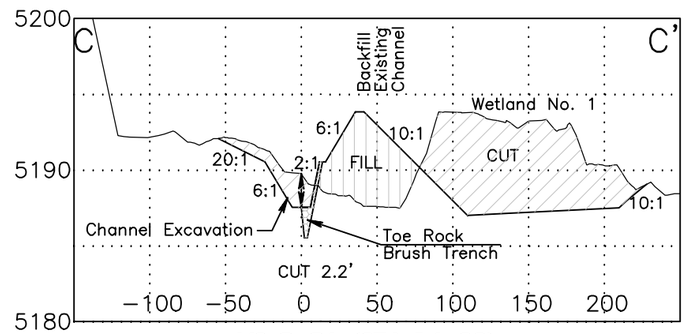
1. STA 13+00 to 19+40 640 ft Channel Excavation.
2. STA 13+00 Rt (80 ft) Inlet Protection
   STA 16+50 Lf (110 ft) toe rock.
   STA 18+05 to STA 18+30 (35 ft) Inlet Protection
   Backfill channel, Install Brush Trenche
3. STA 13+00 to STA 19+50 RIGHT & LEFT) 650 ft
   Install Vertical Bundles & Pole Clusters,
4. STA 14+00 to 14+50 (RIGHT) 50 ft
   Install Floodplain Pole Clusters
5. STA 13+00 to STA 19+50 (RIGHT & LEFT)
   Install fabric over seed.
6. STA 14+10 Rt (40 ft) −Brush Revetment
   STA 17+20 Rt (70 ft) −Brush Revetment
   STA 15+75 Lf (70 ft) −Erosion Log
7. Critical Planting Areas −
   Plant Cottonwood/Willow Posts (Spring 2010)

REACH 2: MATERIAL QUANTITIES

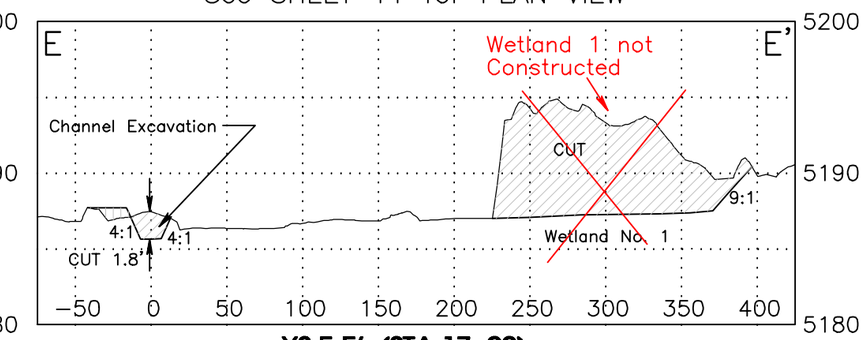
Toe Rock:	95 cy
Willow Clusters:	312 ea
Vertical Bundles:	32 ea
Seeding:	6 acres
Fabric:	14 rolls
TRM Fabric:	70 ft
Brush Revetment:	110 ft
Erosion Log:	70 ft

PROFILE: STA 12+00 to STA 28+00

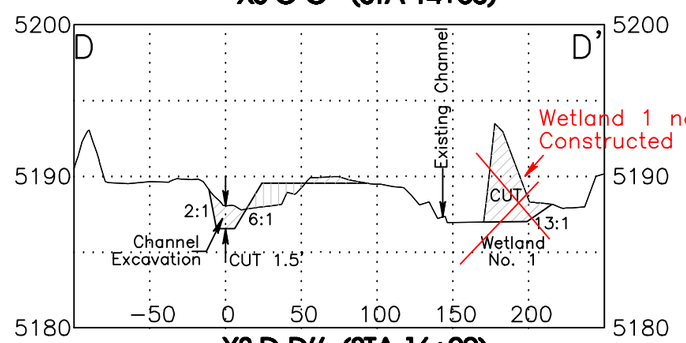
See SHEET 11 for PLAN VIEW



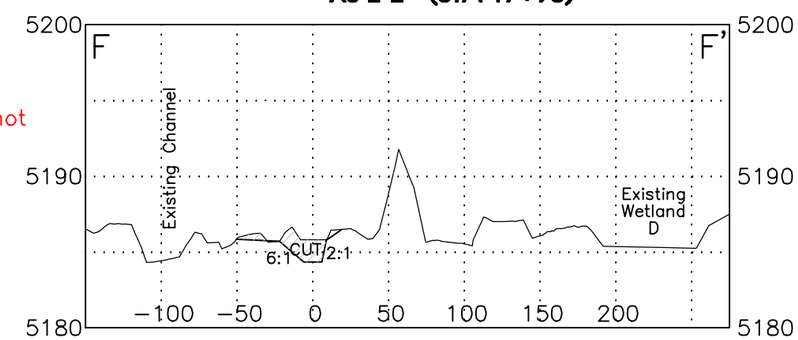
XS C-C' (STA 14+00)



XS E-E' (STA 17+90)



XS D-D'' (STA 16+00)



XS F-F' (STA 20+50)

AS BUILT DRAWINGS Construction Period 3-2-09 to 4-8-09

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

PROFILE and CROSS-SECTIONS
Reach 2

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

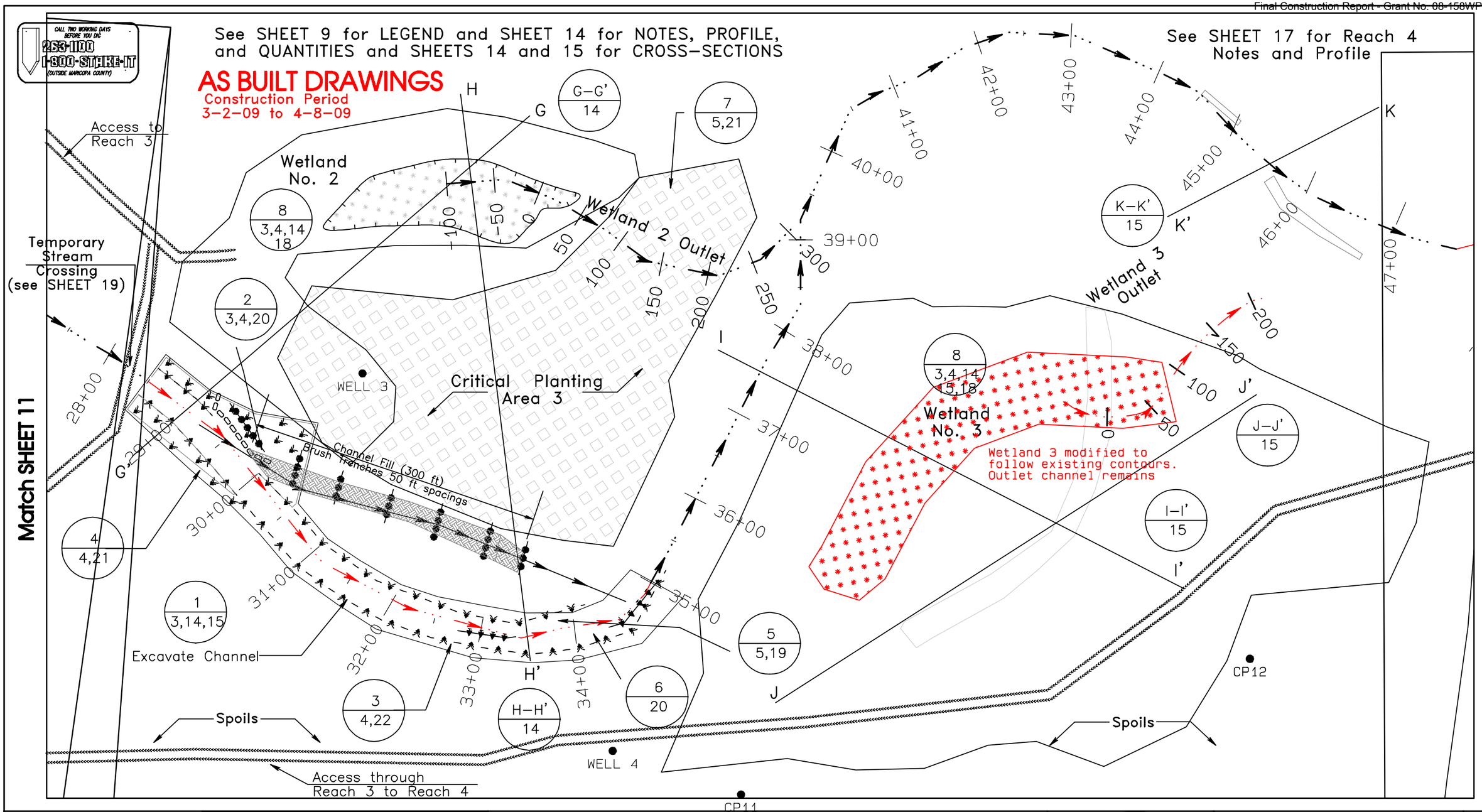
HORIZ SCALE: 1" = 100'
VERT SCALE: 1" = 10'
100 0 100

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 12 of 21



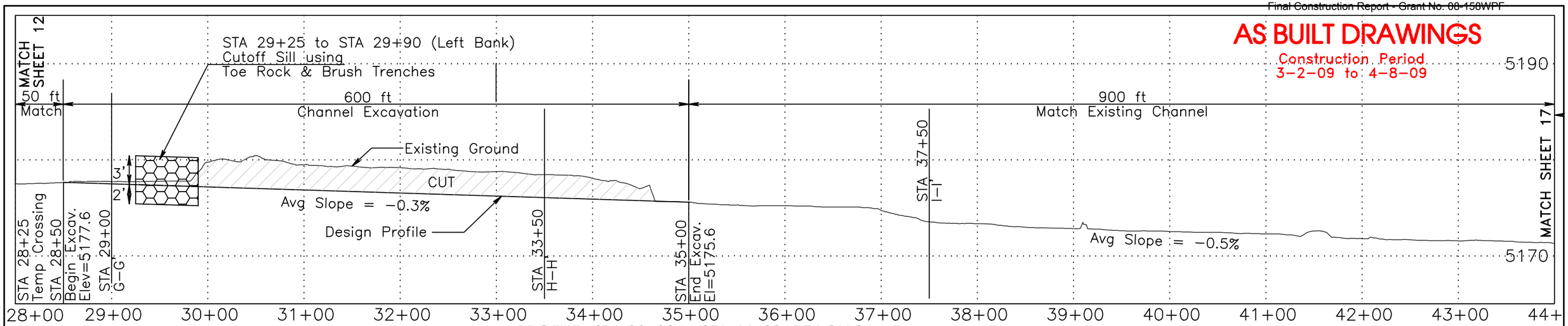
Natural Channel Design, Inc 3410 S. Cocopah Dr. Flagstaff, Arizona 86001 (928) 774-1178 www.PrescottCreeks.org	DRAWN BY: M.Wirtanen, S.Yard DESIGNED BY: T.Moody, M.Wirtanen, C. Helton	PLAN VIEW: Reach 3 STA 28+00 to STA 48+00 Watson Woods Riparian Preserve Project #: 08-158 WPF	HORIZ SCALE: 1" = 100' 100 0 100

REV	DATE	BY	REVISION
1	5/3/07	SNY	Notes and Crossing
2	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

FILE NAME: Watson Woods.pro
DATE: December 20, 2006
PROJECT NO: 05-106-01AZ
SHEET: 13 of 22

AS BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09



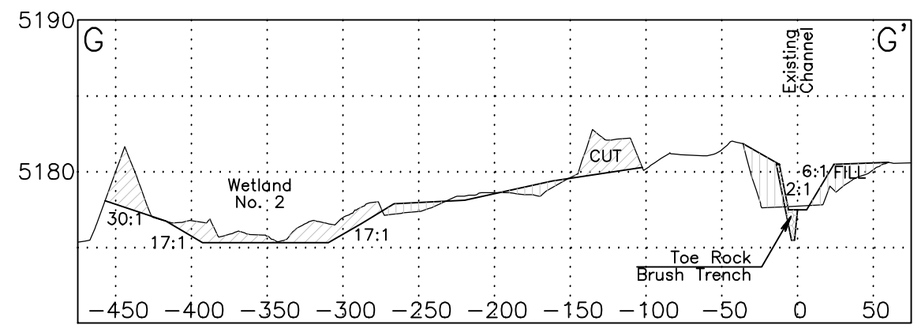
PROFILE: STA 28+00 to STA 44+00 (REACH 3) See SHEET 13 for PLAN VIEW

NOTES

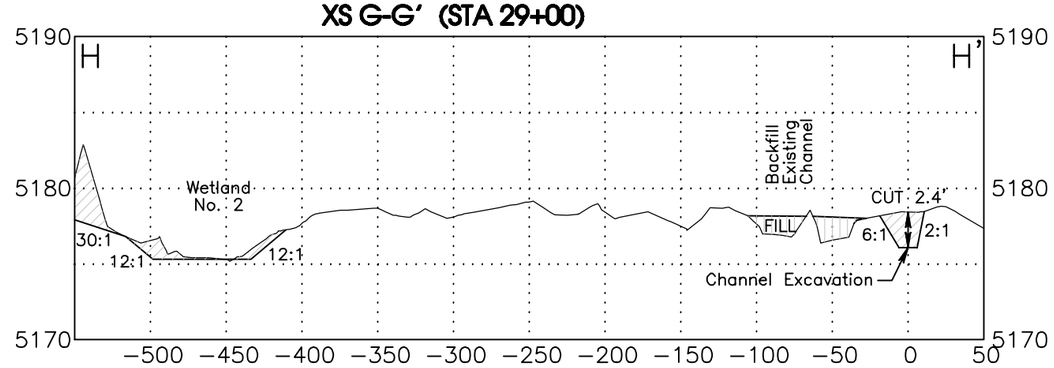
1. STA 28+50 to 34+50 600 ft Channel Excavation. Place spoil as shown on SHEET 6.
2. STA 29+25 to STA 29+90 (80 ft) Backfill channel, Install Toe Rock and Brush Trenches
3. STA 28+50 to 29+25 & STA 30+00 to 31+00 (LEFT) 175 ft, STA 28+50 to 35+00 (RIGHT) 650 ft. Install Vertical Bundles & Pole Clusters
4. STA 28+50 to STA 30+50 (LEFT & RIGHT) 200 ft. Install Floodplain Pole Clusters
5. STA 28+50 to STA 35+00 (RIGHT & LEFT) Install fabric over seed.
6. STA 29+80 (LEFT) 40 ft Brush Revetment. STA 32+70 (RIGHT) 60 ft Brush Revetment. STA 34+50 (RIGHT) 50 ft Brush Revetment.
7. Critical Planting Area (Spring 2010)
8. Excavate Wetland Nos. 2 and 3, with Outlet Channels.

REACH 3: MATERIAL QUANTITIES

Toe Rock:	40 cy
Willow Clusters:	262 ea
Vertical Bundles:	69 ea
Seeding:	7.5 ac
Fabric:	18 ea
Brush Revetment:	160 ft
Erosion Log:	120 ft

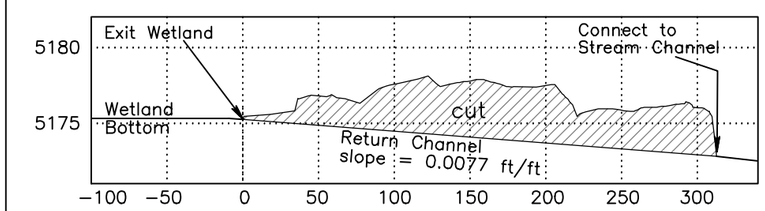


XS G-G' (STA 29+00)

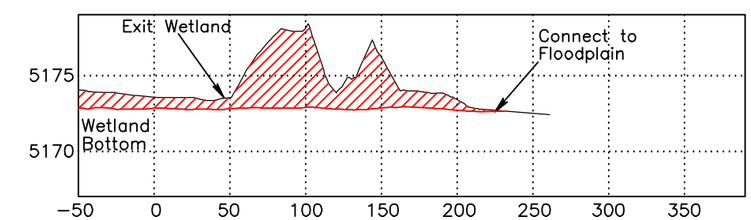


XS H-H' (STA 33+50)

Wetland Outlet Channel Profiles



Outlet Channel Profile Wetland 2



Outlet Channel Profile Wetland 3

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

PROFILE and CROSS-SECTIONS
Reach 3

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

HORIZ SCALE: 1" = 100'
VERT SCALE: 1" = 10'
100 0 100

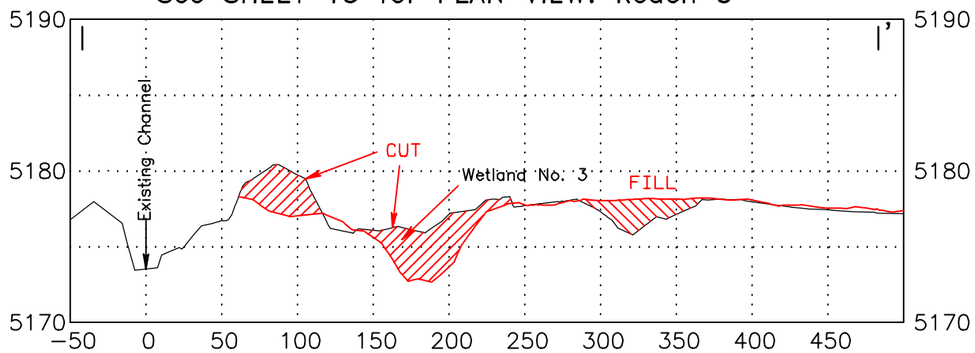
FILE NAME: Watson Woods.pro

DATE: December 20, 2006

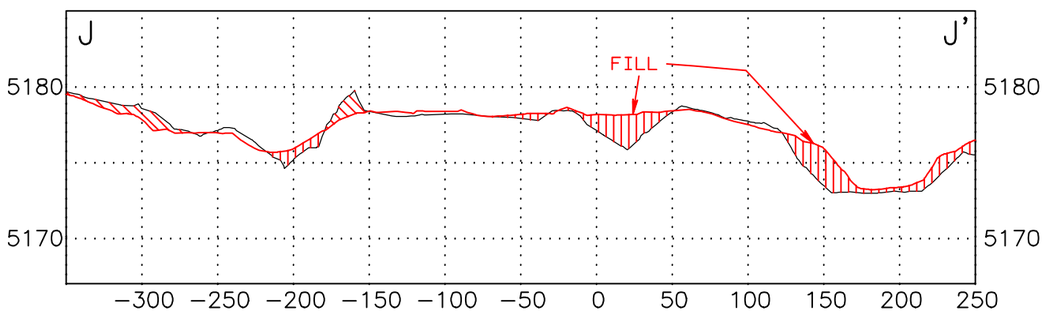
PROJECT NO: 05-106-01AZ

SHEET: 14 of 22

See SHEET 13 for PLAN VIEW: Reach 3

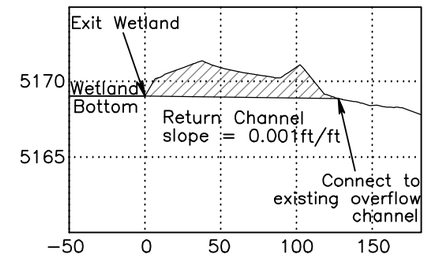


XS I-I' (STA 37+50)

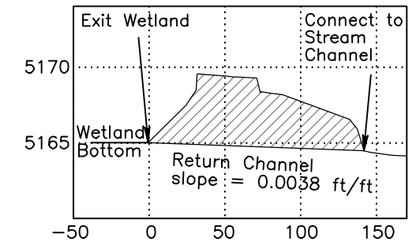


XS J-J' (Wetland No. 3)

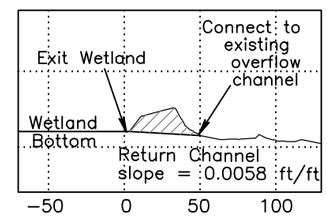
Wetland Outlet Channel Profiles



Outlet Channel Profile Wetland 4



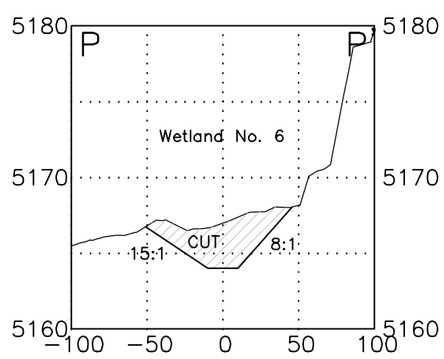
Outlet Channel Profile Wetland 5



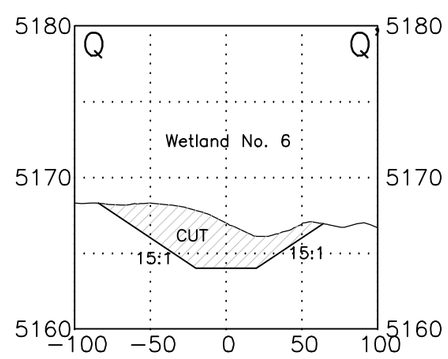
Outlet Channel Profile Wetland 6

AS BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

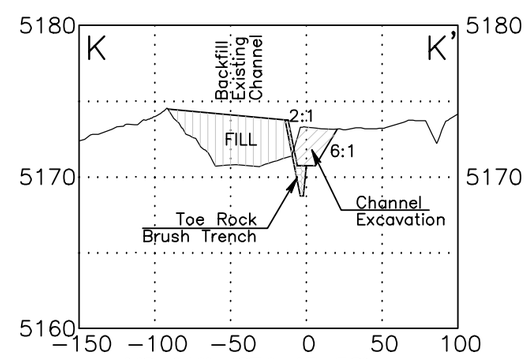
See SHEETS 13 and 16 for PLAN VIEW: Reach 4



XS P-P'



Wetland No. 6 XS Q-Q'



XS K-K' (STA 45+50)

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

CROSS-SECTIONS
Reach 3 and Reach 4
Watson Woods Riparian Preserve
Project #: 08-158 WPF

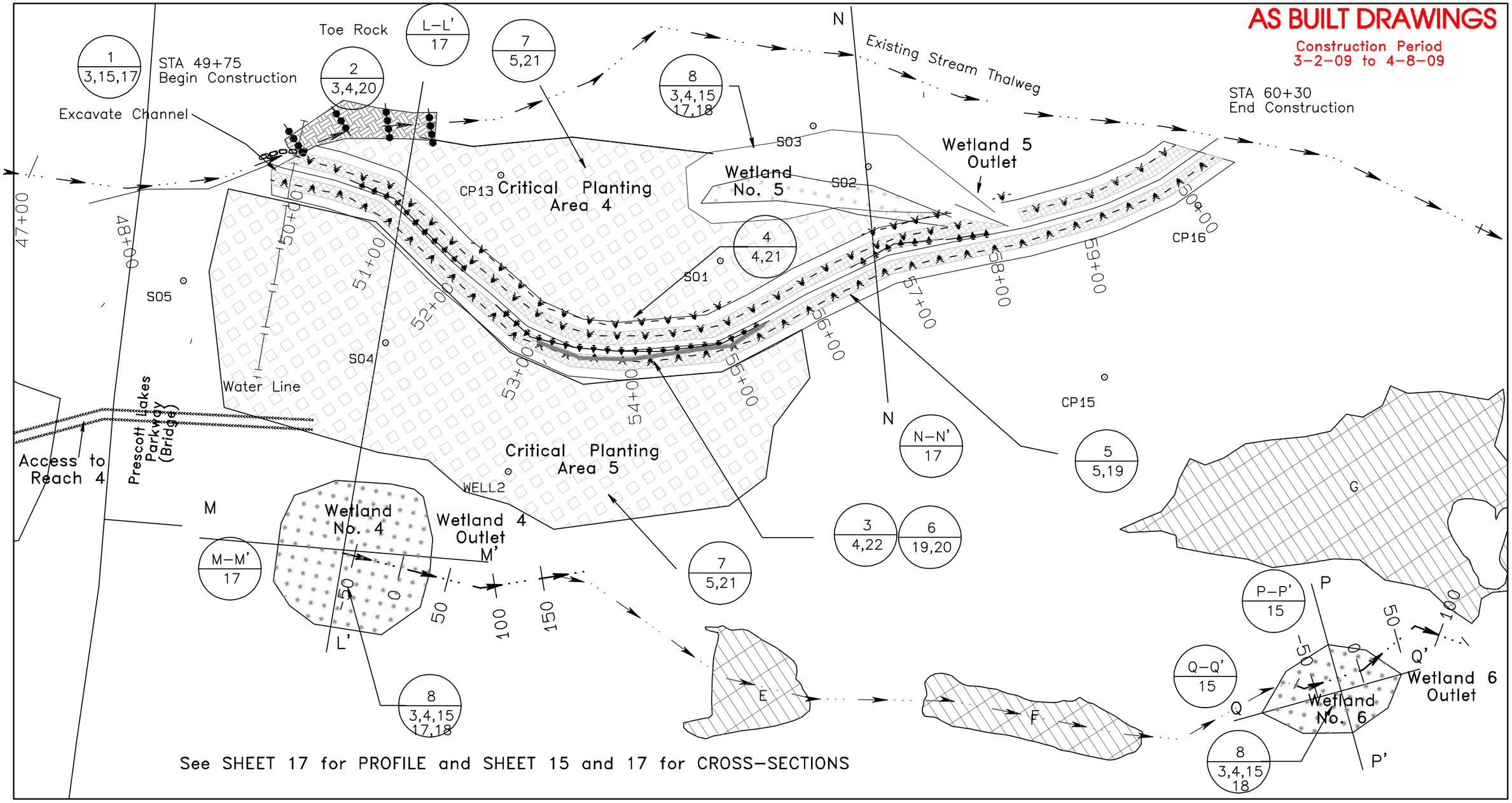
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

HORIZ SCALE: 1" = 100'
VERT SCALE: 1" = 10'
100 0 100

FILE NAME: Watson Woods.pro
DATE: December 20, 2006
PROJECT NO: 05-106-01AZ
SHEET: 15 of 22

AS BUILT DRAWINGS

Construction Period
3-2-09 to 4-8-09



Natural Channel Design, Inc

3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen,

DESIGNED BY: S Yard, M.Wirtanen

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
2	3-11-09	MW	Realignment
3	1-5-10	MW	As-Built

PLAN VIEW: Reach 4

STA 49+75 to STA 60+30

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-5-10
ARIZONA, U.S.A.
Expires 3-31-2011

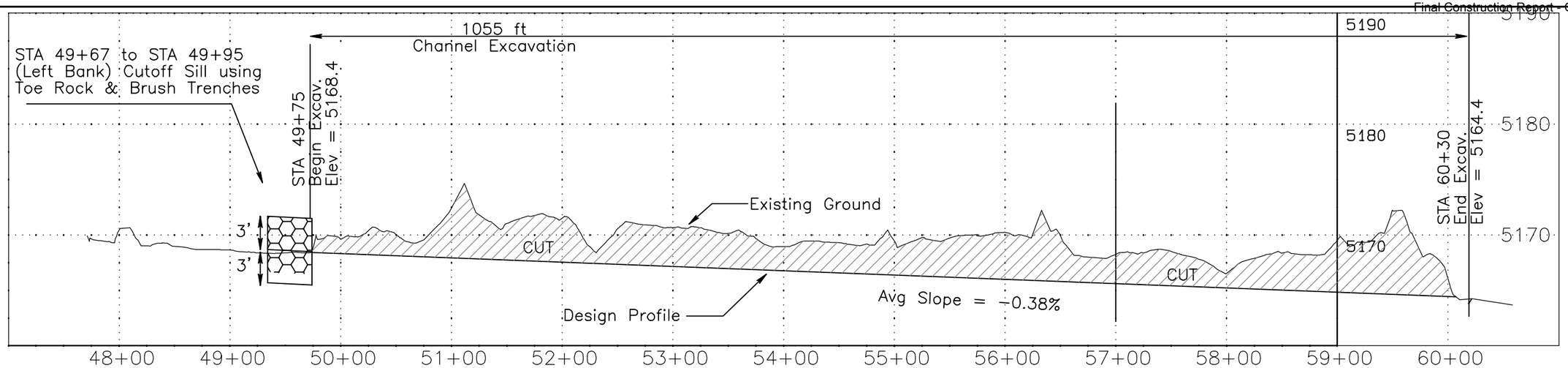
HORIZ SCALE: 1" = 100'
100 0 100

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

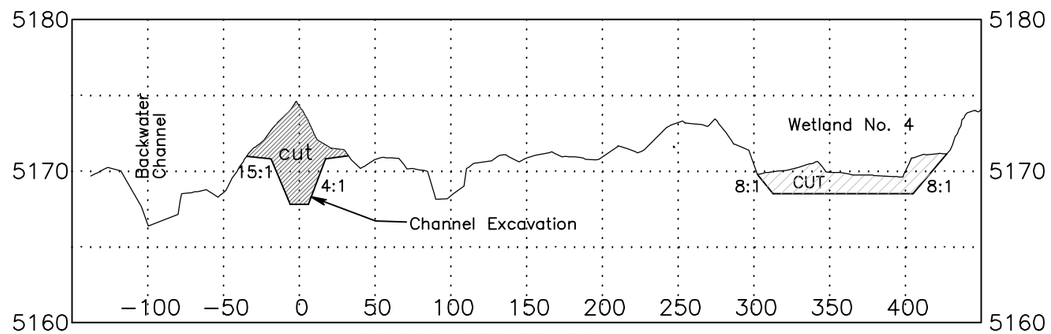
SHEET: 16 of 22



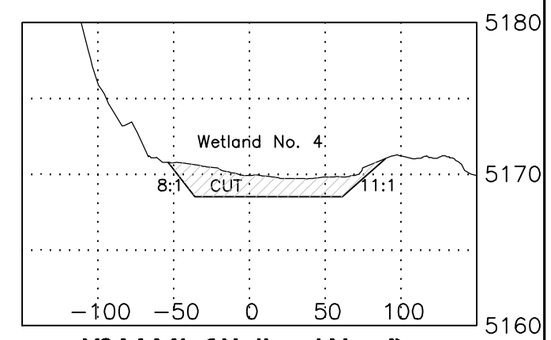
PROFILE: STA 44+00 to STA 60+00 (REACH 4)

NOTES

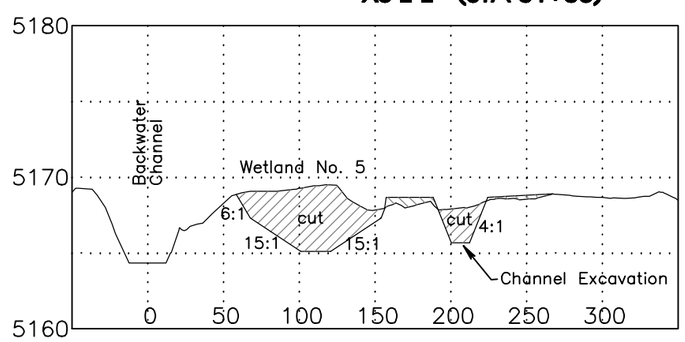
1. STA 49+75 to 60+30 1055 ft Channel Excavation. Place spoil as shown on SHEET 6.
2. STA 49+67 to STA 49+95 (70 ft) Backfill channel, Install Toe Rock and Brush Trenches
3. STA 49+75 to STA 60+30 Right and Left Install Vertical Bundles & Pole Clusters
4. STA 52+00 to 55+00 Left Install Floodplain Pole Clusters
5. STA 49+75 to STA 60+30 (RIGHT & LEFT) Install fabric over seed.
6. STA 53+10 (230 ft) – Coir Log
   STA 56+75 (75 ft) – Brush Revetment
   STA 57+50 (50 ft) – Brush Revetment
7. Critical Planting Area (4 ac) -scheduled for 2010
8. Excavate Wetland Nos. 4, 5 and 6 with Outlet Channels. Plant wetland plugs and seed -scheduled for 2010



XS L-L' (STA 51+50)



XS M-M' (Wetland No. 4)



XS N-N' (STA 57+00)

REACH 3: MATERIAL QUANTITIES

Toe Rock:	35 cy
Willow Clusters:	821 ea
Vertical Bundles:	199 ea
Seeding:	2 ac
Fabric:	33 ea
Brush Revetment:	125 ft
Erosion Log:	230 ft

See SHEET 16 for PLAN VIEW

AS BUILT DRAWINGS

Construction Period
3-2-09 to 4-8-09

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen

REV	DATE	BY	REVISION
1	3-11-09	MW	Realignment
3	1-5-10	MW	As-Built

PROFILE and CROSS-SECTIONS
Reach 4

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.
Expires 3-31-2011

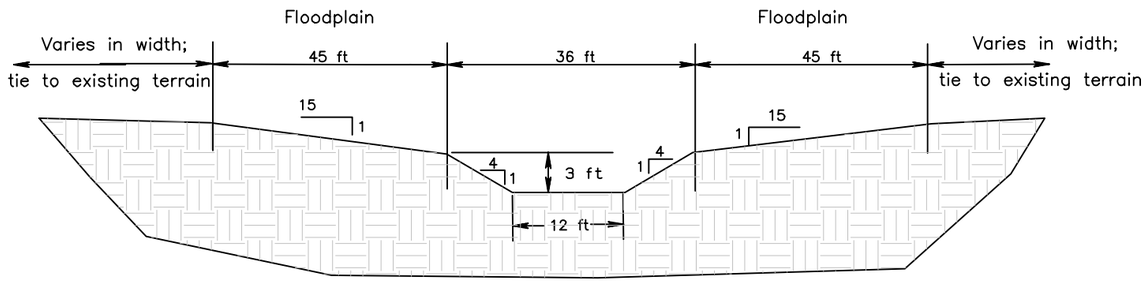
HORIZ SCALE: 1" = 100'
VERT SCALE: 1" = 10'
100 0 100

FILE NAME: Watson Woods.pro

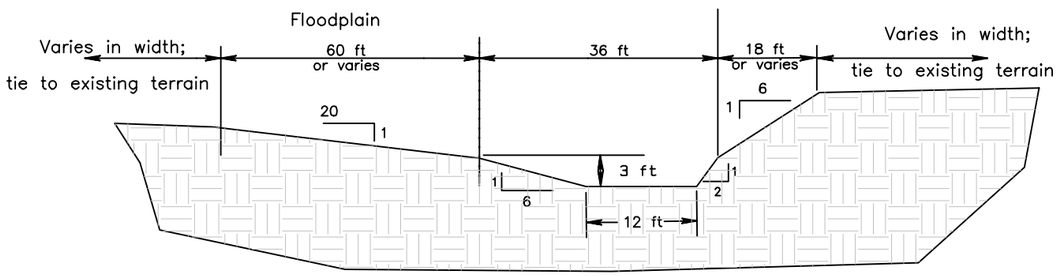
DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

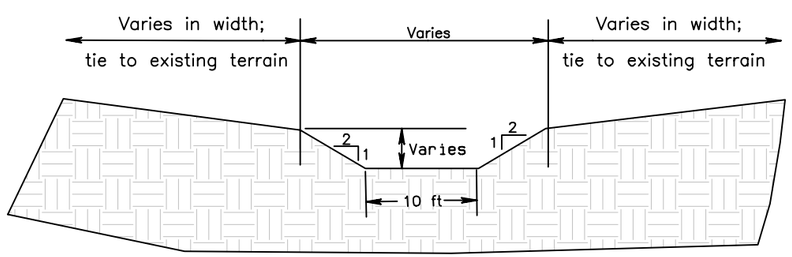
SHEET: 17 of 22



BANKFULL CHANNEL CROSS-SECTION
Riffle Section
(Not to Scale)

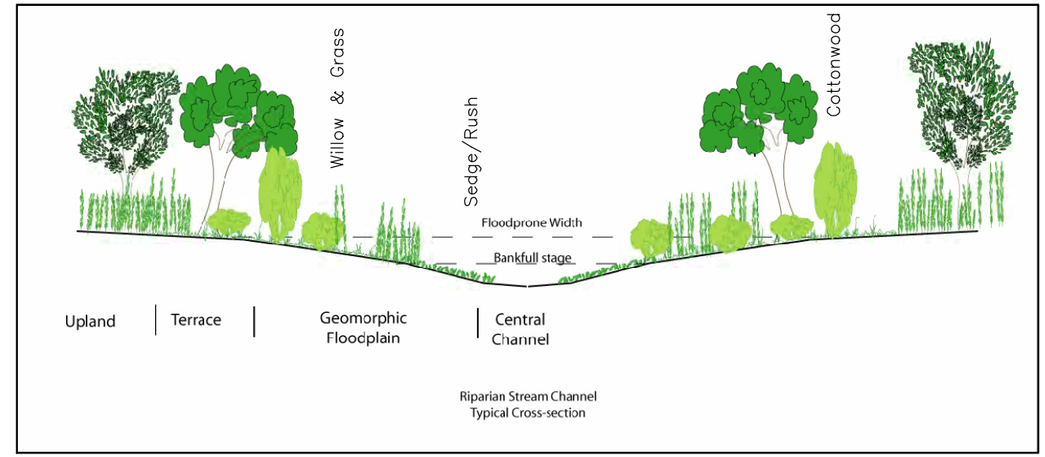


BANKFULL CHANNEL CROSS-SECTION
Meander Section
(Not to Scale)

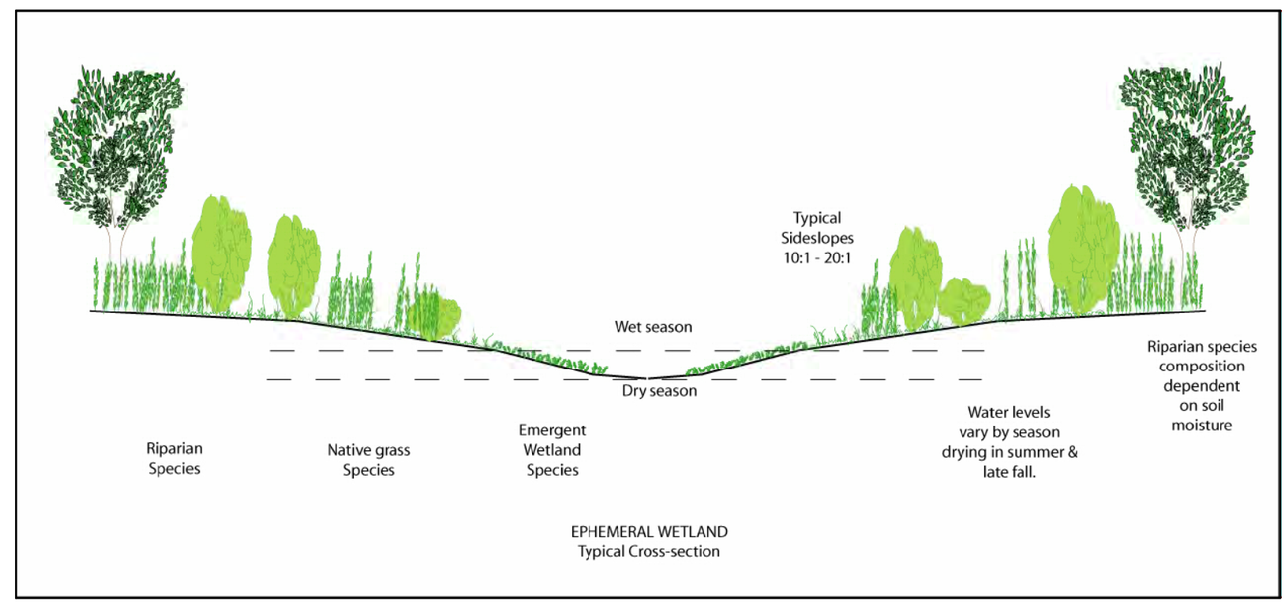


WETLAND OUTLET CHANNEL CROSS-SECTION

(Not to Scale)



Typical Channel Vegetation Zone Cross-Section



Typical Wetland Vegetation Zone Cross-Section

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

See SHEETS 3 & 4 for Earthwork and Revegetation Construction Specifications

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
1	12/10/08	MW	Wetland Outlets
3	1-5-10	MW	As-Built

DETAILS:
Typical Channel & Vegetation X-Sects

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-5-10
ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT
DRAWINGS
Construction Period
3-2-09 to 4-8-09

FILE NAME: Watson Woods.pro

DATE: December 20, 2006

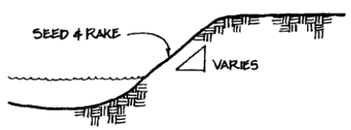
PROJECT NO: 05-106-01AZ

SHEET: 18 of 22

See SHEET 5 for Construction Specifications

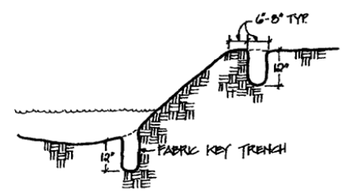
Procedure for Erosion Control Fabric

Seed the streambank with native herbaceous seed and rake in to ensure good seed-soil contact. Slope varies-See "How to Install".



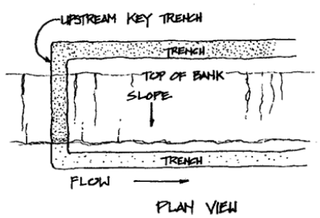
Step One: Seeding

Excavate two trenches as shown.



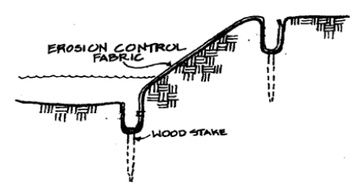
Step Two: Excavate Trench

Excavate an upstream key trench perpendicular to flow.



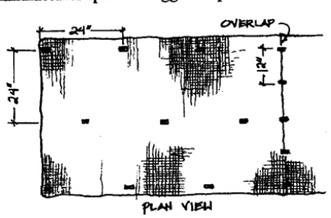
Step Three: Upstream Key Trench

Place fabric on streambank and in trenches and secure with a wedge-shaped wooden stake.



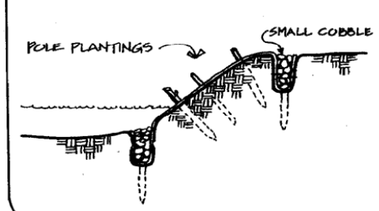
Step Four: Fabric Placement

After laying out the blanket, secure the fabric with wedge-shaped wooden stakes according to manufactures specs or suggested pattern.



Step Five: Suggested Stake Layout

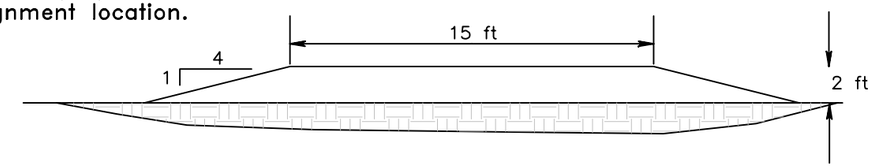
Backfill all trenches with excavated soil or small cobble and compact it.



Step Six: Backfill

INTERAGENCY RIPARIAN/WETLAND PROJECT USDA-NRCS Plant Materials Center Aberdeen, ID 83210

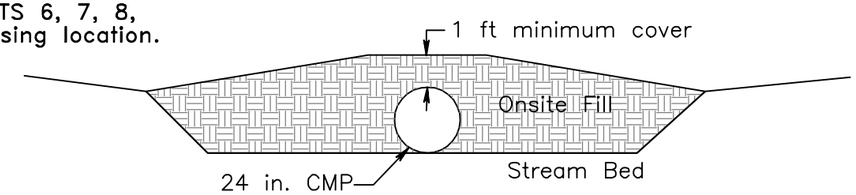
See SHEET 3 for Construction Specifications and SHEETS 6, 7, and 11 for Road Realignment location.



TYPICAL ROAD CROSS-SECTION

(Not to Scale)

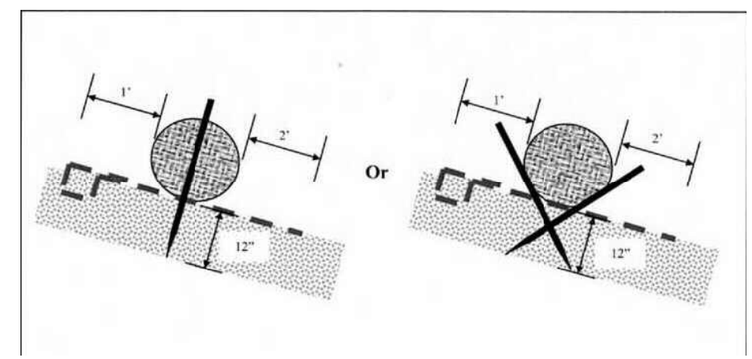
See SHEET 3 for Construction Specifications and SHEETS 6, 7, 8, 11, 13 for Stream Crossing location.



TEMPORARY STREAM CROSSING

(Not to Scale)

EROSION CONTROL LOG INSTALLATION



See SHEET 3 for Construction Specifications and SHEETS 9–17 for Erosion Control Log locations.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

DETAILS:

Erosion Fabric & Log, Road Access & Stream Crossing

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 1-5-10 ARIZONA, U.S.A.

Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

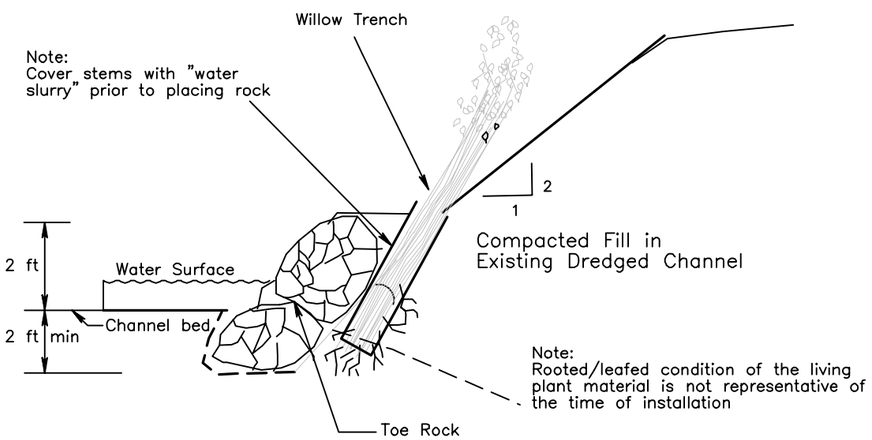
FILE NAME: Watson Woods.pro

DATE: December 20, 2006

PROJECT NO: 05-106-01AZ

SHEET: 19 of 22

See SHEET 3 for Construction Specifications



TYPICAL TOE ROCK SECTION
(Not to Scale)

SPECIFICATIONS FOR TOE ROCK

Use well-graded, angular rock with bulk specific gravity greater than 1.7

Rock Riprap Rocks: Dmin = 6 in.
D50 = 9 in.
Dmax = 12 in.

TOE ROCK VOLUME

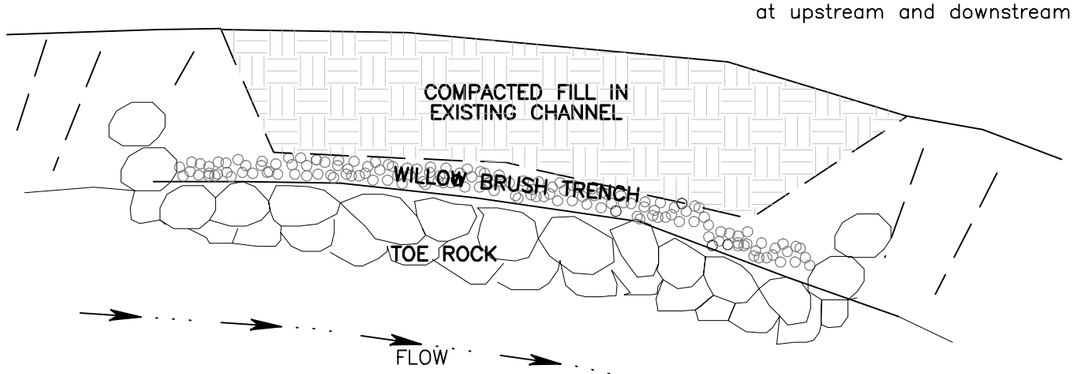
0.5 cubic yards per linear foot
Total Distance = 420 ft

TOTAL VOLUME = 210 CY

TOE ROCK LOCATIONS

STA	DISTANCE
0+25 to 0+85 (left)	80 ft
13+00 to 14+00 (right)	80 ft
16+35 to 17+30 (left)	110 ft
29+25 to 29+90 (left)	80 ft
49+66 to 50+25 (left)	70 ft

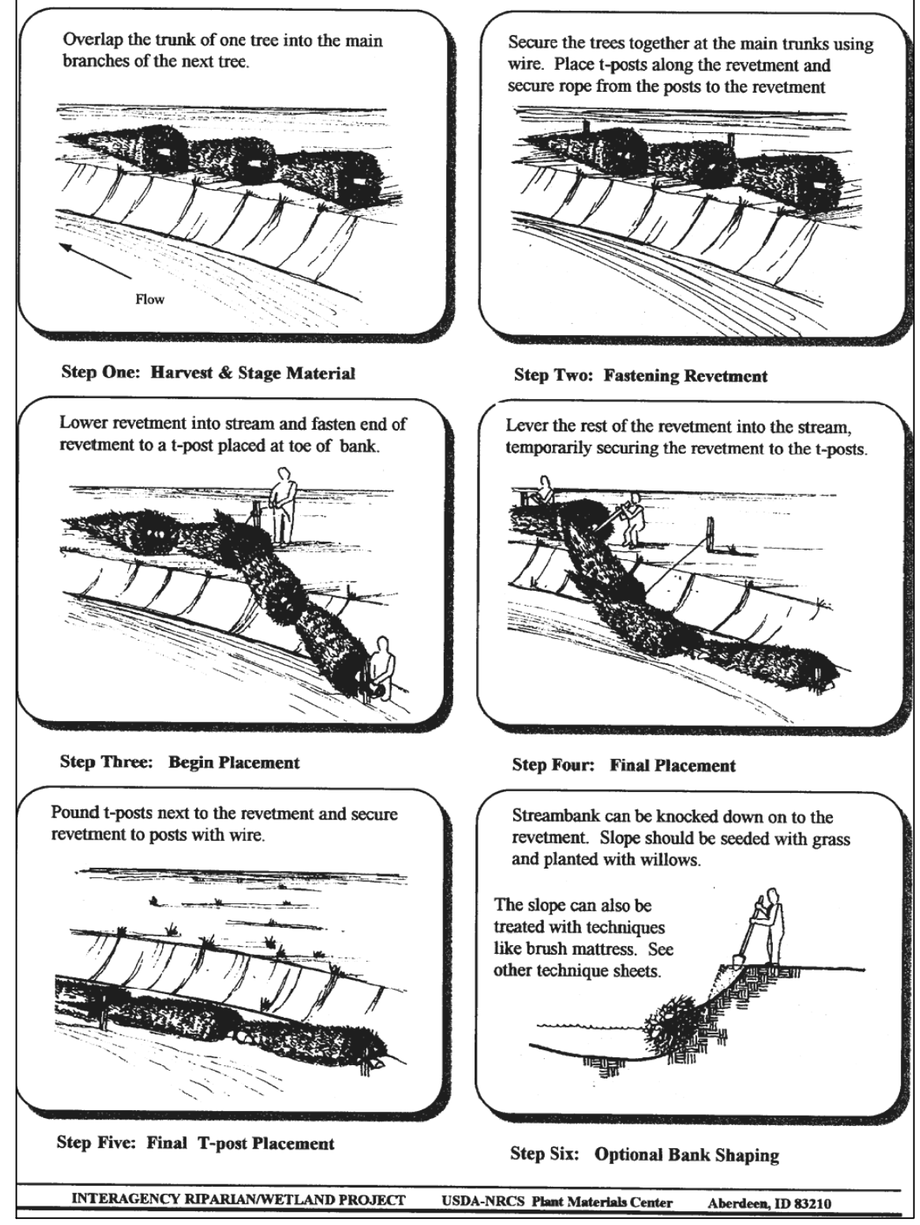
NOTE: Toe rock shall be tied a minimum of 5 feet into bank at upstream and downstream ends.



PLAN VIEW
(Not to Scale)

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Procedure for Brush or Tree Revetment



Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.prescottcreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

DETAILS:
Toe Rock & Brush Trench, Brush Revetment

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-5-10
ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWINGS
Construction Period
3-2-09 to 4-8-09

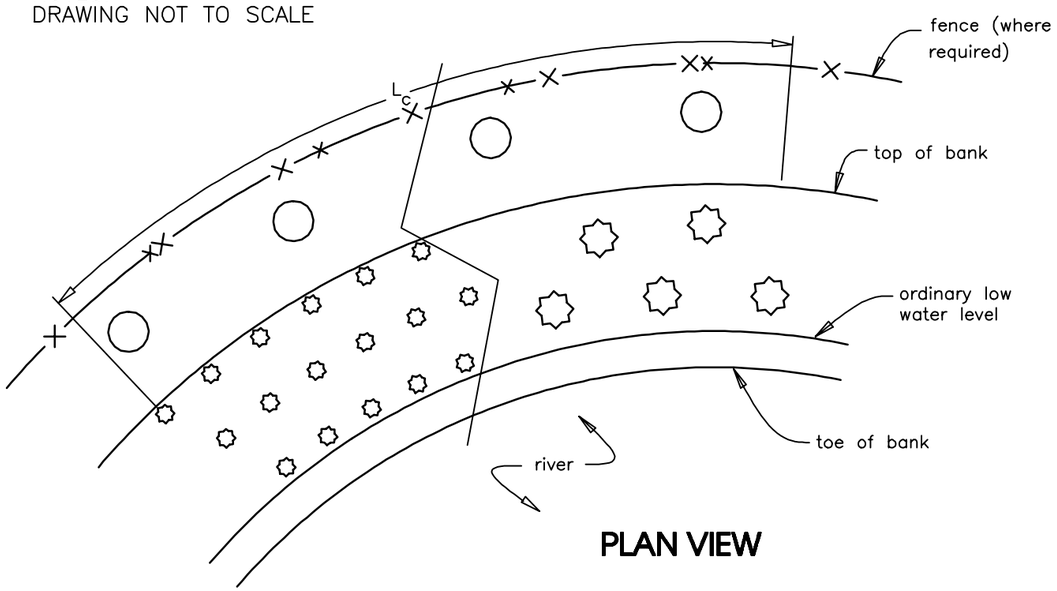
FILE NAME: Watson Woods.pro

DATE: December 20, 2006

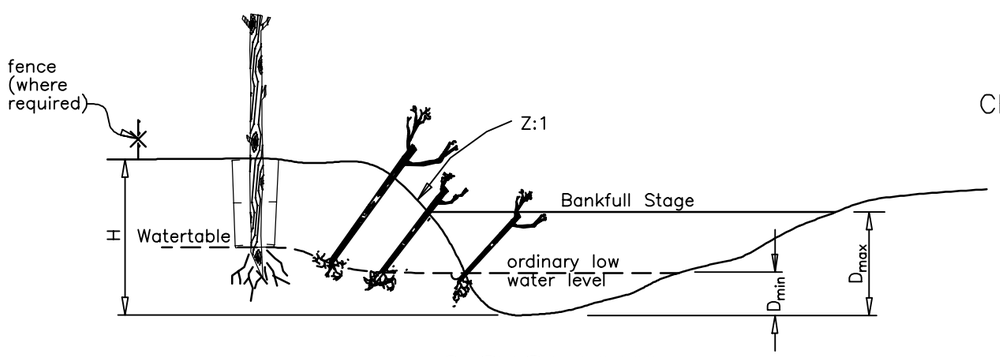
PROJECT NO: 05-106-01AZ

SHEET: 20 of 22
32

NOTES:
DRAWING NOT TO SCALE



PLAN VIEW



SECTION VIEW

See SHEETS 4 & 5 for Revegetation Specifications

BANK PLANTINGS

POLE PLANTINGS

Staggered 4 ft. x 4 ft. placement of dormant native stakes or poles.

Species Willows
Dia 3/4 to 2 in.
Length 2 to 4 ft.

POLE CLUSTERS
(see also SHEET 22)

Dormant native poles placed in cluster holes at 4 ft spacings (8 ft when planted between vertical bundles)

Species Willows
Dia 3/4 to 2 in.
Length 2 to 4 ft.

POST PLANTINGS

Native dormant posts at 10 ft spacings.

Species Cottonwood
Dia 2 to 3 in.
Length 6 to 8 ft.

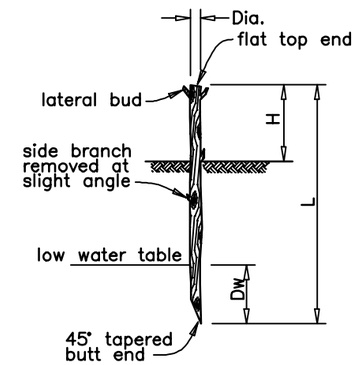
CRITICAL PLANTING AREAS

POLE PLANTINGS

Staggered 50 ft. x 50 ft. placement of dormant poles either singly or in clusters

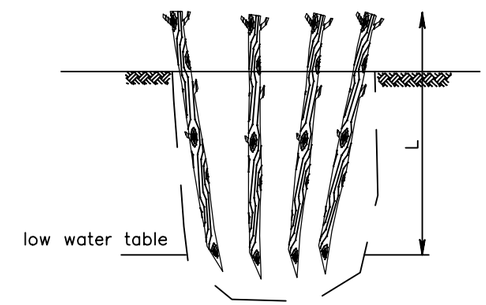
POST PLANTINGS

Staggered 50 ft. x 50 ft. placement of dormant poles in clusters of three



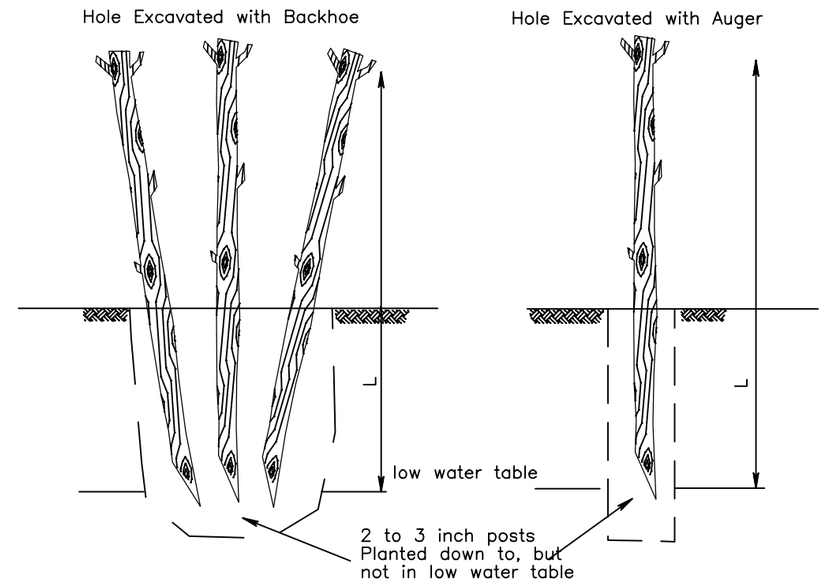
POLE PLANTING DETAIL

NOTES
Use 1/2 to 3/4 in. cuttings
Plant cutting perpendicular to the bank.
Holes around poles filled with dirt/water slurry.



POLE CLUSTER DETAIL

NOTES
Use 1/2 to 3/4 in. cuttings.
In holes excavated with a backhoe, place around 8 to 10 cuttings in hole to maximize sprouting success per effort.
Holes are backfilled with excavated material and watered.



POST PLANTING DETAIL

NOTES:
Use 2 to 3 in. cuttings.
Holes are backfilled with excavated material and watered.

REFERENCES:
Practical Streambank Bioengineering Guide (1998–NRCS ID PMC)
Streambank and Shoreline Protection, EFH–16 (1996–NRCS)
USDA NRCS Oregon Standard Drawing No. OR–A–533A1
USDA NRCS Oregon Standard Drawing No. OR–A–520A
USDA NRCS Washington Standard Drawing No. WA–BIO–0030

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard
DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1–5–10	MW	As–Built

DETAILS:
Dormant Pole, Cluster, and Post Plantings

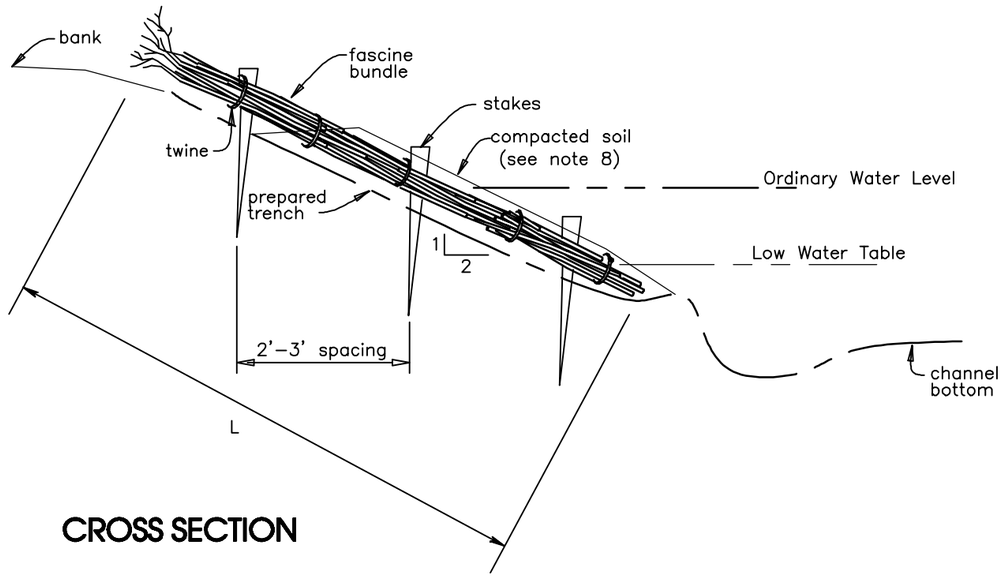
Watson Woods Riparian Preserve

Project #: 08-158 WPF

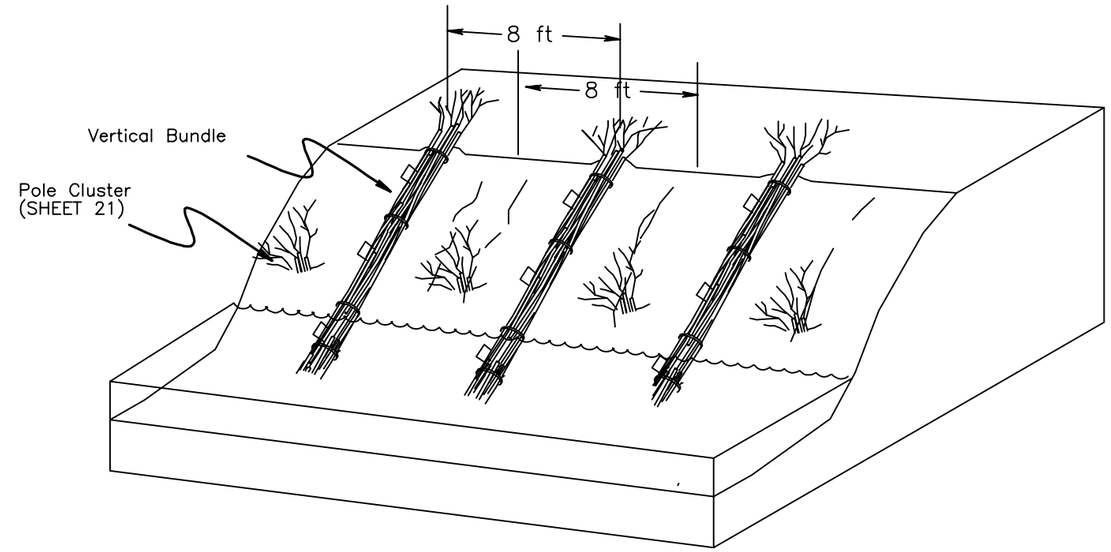
REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed
ARIZONA, U.S.A.
Expires 3-31-2011

AS–BUILT DRAWINGS
Construction Period
3–2–09 to 4–8–09

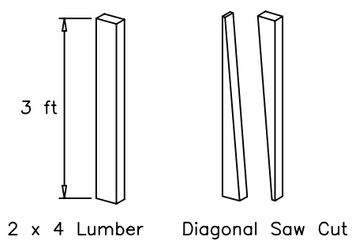
FILE NAME: Watson Woods.pro
PROJECT NO: 05–106–01AZ
DATE: December 20, 2006
SHEET: 21 of 22



CROSS SECTION



ISOMETRIC VIEW



DEAD STOUT STAKES

NOTES

1. Cuttings shall be dormant, stripped of side branches, and soaked 3 to 7 days.
2. Cuttings shall be 3/4 to 2 inches in diameter and typically 3–6 stems per bundle.
3. Bundles shall be tied with untreated twine about every 2 feet.
4. Excavate a vertical trench with a slope of 2:1 or more in the streambank. Make sure the bottom of the trench will still be under water during low flows.
5. The trenches should be excavated on 8 foot centers with pole clusters inserted in between to ensure adequate protection and to encourage rapid growth to fill in between the bundles. (Trenches on 4 foot centers when planted without pole clusters).
6. Place bundle in the trench with the cut ends in the water.
7. Secure bundles to back of trench with wooden stakes at about 3 foot spacings.
8. "Muddy" in bundles with water and soil (covering the bundles 1 to 2 inches deep)
9. Leave approximately 30 percent of upper branches exposed.
10. Tops of cuttings are cut off after placement.

See SHEETS 4 & 5 for Revegetation Specifications

REFERENCES:
Practical Streambank Bioengineering Guide (1998–NRCS ID PMC)
Streambank and Shoreline Protection, EFH–16 (1996 – NRCS)
USDA NRCS Oregon Standard Drawing No. OR–A–520A
USDA NRCS Washington Standard Drawing No. WA–BIO–0066

DRAWING NOT TO SCALE.
DRAWING MUST BE ADAPTED TO THE SPECIFIC SITE.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, S.Yard

DESIGNED BY: T.Moody, M.Wirtanen, C. Helton

REV	DATE	BY	REVISION
3	1-5-10	MW	As-Built

DETAIL: Vertical Bundles

Watson Woods Riparian Preserve

Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed ARIZONA, U.S.A.

Expires 3-31-2011

AS–BUILT DRAWINGS
Construction Period
3–2–09 to 4–8–09

FILE NAME: Watson Woods.pro

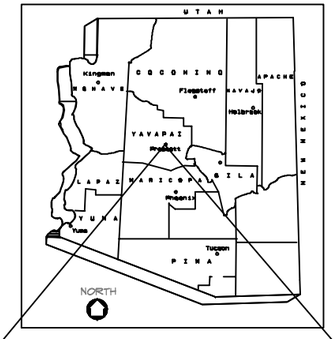
DATE: December 20, 2006

PROJECT NO: 05–106–01AZ

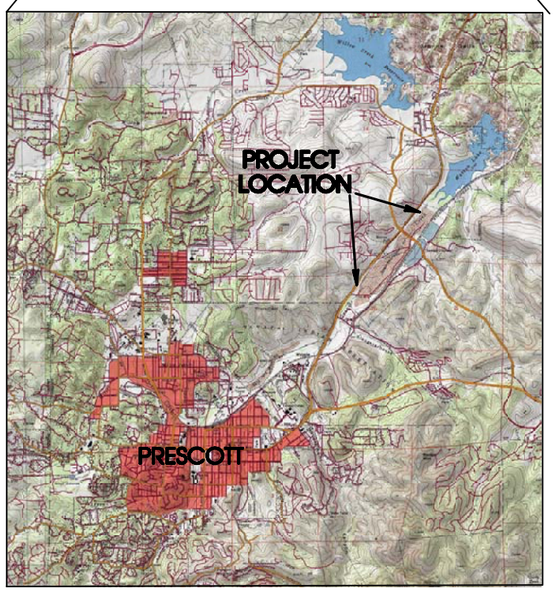
SHEET: 22 of 22

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)

Arizona Water Protection Fund Rroject 08-158 WPF



LOCATION MAP



Sections 23 - 24, T14N, R2W
Prescott, Yavapai County, Arizona

Prepared for: Prescott Creeks
119 Grove Ave
Prescott, AZ 86301

Prepared by: Natural Channel Design, Inc.

AS BUILT DRAWINGS

Granite Creek - Prescott, Arizona

Stream Project Length: 6,000 feet (1.1 sq mi)

Construction Period: Nov 8 – Dec 8, 2010
Subcontractors: Fann Contracting
American Conservation Experience

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

INDEX OF DRAWINGS

SHEET NO.	TITLE
1	COVER SHEET: Location, Index, Materials
2	General Notes & Construction Specifications
3	CONSTRUCTION SPECIFICATIONS: Earthwork, Structures and Revegetation Plan
4	CONSTRUCTION SPECIFICATIONS: Revegetation Plan Continued
5	PROJECT SITE: Control, Access, Spoil Areas
6	PLAN VIEW, PROFILE & CROSS SECTIONS: Reach 1
7	PLAN VIEW & CROSS SECTIONS: Reach 2
8	PLAN VIEW & CROSS SECTIONS: Reach 3 DETAILS: Willow Plantings
9	DETAILS: Typical Channel Cross Sections, Bank Sloping Coir Log & Erosion Control Fabric Installation
10	DETAILS: Toe Rock & Temporary Stream Crossing
11	DETAILS: Brush Revetment & Log Sill

MATERIAL LIST

REACH 1		
EARTHWORK		
Channel Excavation, Bank Sloping		460 cy
STRUCTURES		
Toe Rock		30 cy
Non-Woven Geotextile		67 sq yd
Log Sills (18–24" logs, 15–20 ft long)	2–30 ft, 2–20 ft	4 ea
VEGETATION		
Willow Cuttings (Aroyo, Coyote)		1224 ea
Seeding		0.6 ac
Erosion Control Fabric –Single Net		9 ea (8'x96' rolls)
Erosion Control Fabric –Double Net		8 ea (8'x96' rolls)
REACH 2		
EARTHWORK		
Mound Excavation		1500 cy
Bank Sloping		65 cy
STRUCTURES		
Toe Rock		40 cy
Non-Woven Geotextile		77 sq yd
~~Temporary Stream Crossing Culvert~~	~~1ea–24 in x 12ft CMP~~	
Log Sill (18–24" logs, 30 ft long)		1 ea
VEGETATION		
Willow Cuttings (Aroyo, Coyote)		970 ea
Cottonwood Posts		158 ea
Seeding		0.5 ac
Erosion Control Fabric –Single Net		2 ea (8'x96' rolls)
Erosion Control Fabric –Double Net		6 ea (8'x96' rolls)
REACH 3		
EARTHWORK		
Bank Sloping		250 cy
STRUCTURES		
Toe Rock Repair		1 cy
Coir Log (12"x10' logs)		15 ea
Brush Revetment (1 tree/4 ft, 6 ft trees min)		40 ea
VEGETATION		
Willow Cuttings (Aroyo, Coyote)		250 ea
Seeding		0.5 ac
Erosion Control Fabric –Single Net		2 ea (8'x96' rolls)
Erosion Control Fabric –Double Net		6 ea (8'x96' rolls)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman
DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION
1	3–3–11	mw	As–Built

COVER SHEET: Location, Index, Materials

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 3-3-11
ARIZONA, U.S.A.
Expires 3-31-2011

AS–BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 design.pro
DATE: March 22, 2010
PROJECT NO: 08–158WPF
SHEET: 1 of 11

GENERAL NOTES

1. Topographic maps were prepared in 2009 by Vertical Mapping Resources, Inc. with additional topographic survey in February 2010 by Natural Channel Design, Inc.
2. Project survey data provides the most accurate representation of site topographic conditions. All existing conditions are to be verified in the field prior to construction. Any adjustments from the drawings to be made as directed by the ENGINEER.
3. All stationing refers to base line of construction and is measured horizontal distance.
4. No representation is made as to the existence or nonexistence of any utilities, public or private. Absence of utilities on these drawings IS NOT assurance that no utilities are present. The existence, location and depth of any utility must be determined by the contractor prior to any excavation. Call before you dig, 1-800-STAKE-IT.
5. Construction activities will be conducted in a manner consistent with all safety regulations and requirements of Sections 404, 401, and 402 of the Clean Water Act (ACOE), and other permitting required by the City of Prescott, Yavapai County (grading permit), etc.
6. Installation shall be constructed to the lines and grades as shown on the drawings or as staked in the field by the ENGINEER, recognizing there is variation in nature.

CONSTRUCTION MANAGEMENT

Construction is timed to allow for the driest conditions, the lowest chance of flood flows, to provide the least disturbance to wildlife and the optimum establishment of native plant species. Earthwork and revegetation activities will be completed in as quick a time frame as possible, reducing the time of disturbance and maximizing the healing of disturbed areas and establishment of native vegetation.

Construction Supervision

Supervision shall be provided for the earthwork, structural and revegetation tasks. Supervisory personnel shall have an understanding of the natural channel design as applied to stream and wetland restoration.

Construction Equipment

The following equipment are expected to be utilized during the construction:

- Backhoe/Trackhoe/Excavator with thumb: Channel and wetland excavation, channel filling, bank sloping, and rock installation.
- Backhoe/Front End Loader: Moving structure rock and various fill
- Dozer: Land smoothing, moving fill and wetland excavation
- Dump Truck: Miscellaneous hauling

Permitting Requirements

Ensure necessary permits have been obtained.

PROJECT DESCRIPTION

The project design includes the second years construction and post flood repair of Granite Creek and (re)creating riparian habitats within the Watson Woods Riparian Preserve. Granite Creek experienced a large flood event of approximately 6,200 cfs (40 yr event) in January 2010 that deposited sediments in the existing channel, re-routed the channel allignment, removed sections of toe rock and caused overbank scour.

Construction Sequence

The following is a recommended construction sequence:

1. Coordinate with Prescott Creeks for scheduling of construction activities and crews.

REACH 1: See SHEETS 5 & 6 for Locations

2. Excavate new channel alignment in main channel (260 ft) starting from downstream working upstream (SHEET 9 for typcial cross section).
3. Install Log Sills on Overflow Channel at STA 3+50 (SHEET 11 for Details)
4. STA 2+60 to 6+40 Remove sediment from Overflow Channel & use spoils to fill between log sills.
5. Repair Toe Rock at STA 0+57 (SHEET 10 for Details)
6. Recontour additional banks as needed or directed. Install revegetation practices (SHEETS 3 & 4 for Specifications and 8 & 9 for Details)

REACH 2: See SHEETS 5 & 7 for Locations.

7. Install temporary channel crossing at STA 14+00 (SHEET 10 for Details)
8. Repair 45 ft of Toe Rock (STA 13+75 to 14+10) (SHEET 10 for Details)
9. Remove mound (left), place unused spoils at Rosser St. Parking Area.
10. Fill in scour downstream from toe rock utilizing mound material (STA 14+10).
11. Reslope cutbank and fill scoured area at STA 16+50 to 17+60.
12. Plant four willow trenches in scoured area.Install other revegetation practices (SHEETS 3 & 4 for Specifications and 8 & 9 for Details)
13. Rehab ingress/egress routes by ripping, smoothing and seeding.

REACH 3: See SHEETS 5 & 8 for Locations

13. Remove abandoned culverts at STA 28+00 and dispose. Smooth approaches of existing road to allow for a low water crossing. Harden road base with cobble/gravel material from on site.
15. STA 27+50 to 29+00 (left & right) Smooth banks and prep for re-vegetation. Install willow clusters and seed; install erosion control fabric. (SHEETS 8 & 9 for Details)
17. STA 29+15. Repair toe rock by replacing rock over a 4 ft section of exposed fabric.
18. STA 32+75 to 34+50 (right) reslope eroding bank. Install coir logs, brush revetments and install revegetation practices (see SHEETS 3 & 4 for Specificatons and 8, 9 &11 for Details)
19. Rehab ingress/egress routes by ripping, smoothing and seeding.

CONSTRUCTION SPECIFICATIONS

POLLUTION CONTROL and RESOURCE PROTECTION

Construction operations shall be carried out in such a manner and sequence that erosion and air and water pollution are minimized and held within legal limits. The measures and works shall include, but are not limited to, the following:

1. Diversions: Standard best management practices will be used to temporarily divert water away from work areas within the active channel. Such diversions shall be temporary and shall be removed and the area restored to its near original condition immediately upon completion of work within the active channel or when permanent measures are installed (i.e. realignment of channels).
2. Equipment Access and Staging Areas: Transportation routes for materials, personnel, and equipment to, from, and within the project area shall be limited to access areas located on the drawings or determined in the field. Equipment access to Reach 1 is from the Fann Contracting yard upstream of project. Access to Reaches 2 & 3 is from the Rosser St. Parking area, following designated routes to each stream reach.
3. Revegetation: Impacts to existing vegetation and habitats shall be minimized. All disturbed areas shall be replanted with native vegetation.
4. Stream Crossings: Stream crossing points shall be minimized and shall be removed and the area restored to its near original condition when crossings are no longer required.
5. Equipment Use in Streams: When stream channel work is necessary, every effort will be made to enter and exit the channel in locations without important vegetation and where impacts do not result in stream bank instability. The use of heavy equipment in the stream will be kept to an absolute minimum.

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

General Notes & Construction Specifications

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 - Dec 8, 2010

FILE NAME: Feb 10 design.pro

DATE: March 22, 2010

PROJECT NO: 08-158WPF

SHEET: 2 of 11

TEMPORARY STREAM CROSSING

A temporary stream crossing shall be constructed near STA 14+00. See SHEET 10 for Details.
. Install one 24-inch diameter culvert in the channel near STA 14+00
. Prior to back-filling, the pipe shall be firmly and uniformly bedded.
. Place excavated material from Mound over culvert to a depth of 1 ft.
. At completion of restoration activities, remove placed material and culvert. Restore to original condition.
. Remove abandoned culverts near STA 28+00 and dispose. Re-establish a low water crossing.

STRUCTURES PLAN

Structures shall consist of installing toe rock, brush revetment, erosion control logs and log sills.

Toe Rock: This structural bank stabilization practice consists of graded angular rock placed along bank sections where flood waters removed rock previously installed. Height of rock is about 3 ft above and 2 ft below the channel bed. See SHEET 10 for Details.

. The work shall consist of excavation, delivery of rock, and installation of rock for rock riprap as shown on the drawings or staked in the field by the authorized representative.
. The rock shall be well graded from a minimum of six inches to a maximum size of 12 inches with greater than 50% by weight being larger than 9 inches.
. The rock shall be angular, dense, sound and free from cracks, seams, or other defects conducive to accelerated weathering. The least dimension of an individual rock shall not be less than one-half the greatest dimension.
. The rock source shall be approved by the ENGINEER or authorized representative and have a bulk specific gravity of not less than 1.7 per ASTM C127.
. See SHEET 10 for Detail.

Erosion Control Logs: These flexible logs are made of Coir, Straw, Aspen Excelsior, or other natural materials are installed to protect the streambank by stabilizing the toe of the slope and by trapping sediment. Cuttings and herbaceous riparian plants can be planted into the log and behind it. Secure the logs with 24 to 36 inch long wedge-shaped stakes at 5 foot intervals. Stakes can be driven through center of log or both sides of log and tied with twine. See SHEET 9 for Details.

Brush Revetment: Revetment is constructed from whole trees that are wired together and anchored by earth anchors or fence posts. Brush or trees are secured to the streambanks to protect the toe of the bank by slowing velocities and diverting the current away from the bank edges. The revetment also traps sediment from the stream. See SHEET 11 for Details.

Log Cutoff Sill: This structural stabilization practice consists of logs placed in the scoured channel for grade stabilization. Two 18 to 24 inch logs will be stacked horizontally and placed to a depth of approximately 1.5 feet below exising ground elevation. Fill will be placed between and around the logs to a height equal to the top of the logs. Willow cluster trenches shall be planted on the far side of the logs. See SHEETS 11 for Details.

EARTHWORK

The earthwork shall consist of channel and mound excavation, channel filling, bank sloping, and floodplain smoothing. See SHEETS 6 through 8 for earthwork locations. Place excess spoil as shown on SHEET 5. See SHEET 9 for Typical Channel Cross Section and Bank Sloping Details.

Excavation

Excavation shall be limited to the channel realignment, wetland and landscaping as shown on the drawings or as staked in the field. All finished surfaces shall be generally smooth and pleasing in appearance. Disturbance of existing native vegetation shall be minimized to the greatest extent possible during excavation.

Excavated material shall be placed in scoured areas on floodplains or designated spoil areas (Parking Area, other) as shown on the drawings, SHEET 5, or as designated in the field. Place excess spoil material outside of jurisdictional areas.

Earthfill

Materials: All fill materials shall be obtained from the required excavations and/or approved borrow sources. Fill shall not contain sod, brush, roots, perishable or frozen materials.

Placement: The placement of fill materials shall follow these guidelines:
. Any vertical bank shall be sloped to a minimum of 1:1 before placement of fill material.
. Material when placed shall contain sufficient moisture so that a sample taken in the hand and squeezed shall remain intact when released.
. The placing and spreading of fill material shall be started at the lowest point and the fill brought up and compacted to obtain a density similar to the surrounding ground. Compacted horizontal layers shall not exceed: six (6) inches of loose fill for wheel compaction and four (4) inches of loose fill for dozer compaction. Construction equipment shall be operated over the areas of each layer of fill to insure that the required compaction is obtained.
. Fill shall not be placed on frozen soil, snow or ice.
. Channels designated for filling and re-contouring shall be filled as close as possible to the historic natural ground surface, and smoothed and shaped to blend with the surroundings.
. All finished surfaces shall be generally smooth and pleasing in appearance and blend into surrounding terrain.

REVEGETATION PLAN

Revegetation Plan includes native grass seeding with fabric and willow plantings. Use local native material where appropriate & feasible. Supplemental irrigation (supplied by existing City of Prescott 12" potable water main) may be needed for several years for plant establishment. Irrigating for at least two years will ensure that all woody species and nursery plants will become established and reach the water table (for cottonwood and willow species), and that seeded species germinate successfully.

PLANT MATERIAL PROCUREMENT and HANDLING

Woody Plant Materials:

All woody species shall be native and collected from designated local sources. Coyote willow (Salix exigua) and Arroyo willow (Salix lasiolepis) will be planted in the Bank and lower Overbank Zone. Red willow (Salix laevigata) will be planted in the upper Overbank Zone. Fremont cottonwood (Populus fremontii) will be planted in the upper Overbank Zone.
Dormant unrooted hardwood cuttings can be taken after leaf fall and before bud burst in the spring. Never remove more than 1/3 of any single donor plant during harvesting. The best rooting success is from cuttings that are disease-free, green plants that are 2-10 years old. The best diameters for pole planting, vertical bundles, and trenches are 1/2 to 1 inch and 2 to 3 inches for post plantings. Cutting length varies depending on the application. it shall be long enough to reach 6 to 8 inches into the lowest water level of the year and high enough to expose at least two to three buds.
Cuts shall be made with clean, sharp tools. The bottom end of the stem cutting shall be cut to a 45-degree angle and the tip end shall be cut square across or horizontal to the stem. Trim off all side branches and the terminal bud (bud at the growing tip) so energy will be rerouted to the lateral buds for more efficient root and stem sprouting. Do not trim terminal bud from cuttings for vertical bundles and willow trench until after planted. Trimmed tip ends shall be sealed by dipping in light-colored latex, water-based paint.

Submerge cuttings in water for 3 to 7 days prior to planting to maximize water retention. Do not allow the roots to emerge from the bark.

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman
DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

CONSTRUCTION SPECIFICATIONS

Earthwork, Structures and Revegetation Plan

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 - Dec 8, 2010

FILE NAME: Feb 10 design.pro
DATE: March 22, 2010
PROJECT NO: 08-158WPF
SHEET: 3 of 11

INSTALLATION OF WOODY PLANTS

Installation of vegetation shall start when the general excavation operations are being completed.

POLE PLANTINGS and POLE CLUSTERS:

Pole cuttings are placed in the ground deep enough to reach the lowest water table of the year and high enough to expose at least two to three buds. Root primordia will develop when good soil–to–stem contact is made and exposed sections of the cutting will sprout stems and leaves.
Dormant cuttings can be planted with a digging bar, auger, water–jet, or if the soil is saturated, they may be pushed into the soil. Pole Plantings are planted in the Bank and Overbank Zone and shall be spaced 4 feet apart in the row. In multiple row plantings, spacing between rows shall be staggered with respect to those in adjacent rows. See SHEET 8 for Details.

POST PLANTINGS

This practice involves planting of larger limbs (2 to 3 inches diameter) in clusters of three at 10 foot centers in designated areas. Cottonwood posts will be placed in holes in the Floodplain Zone, excavated to groundwater elevation and backfilled with wet mud.

BRUSH TRENCH

Brush trench uses bundles of willow cuttings in a buried trench along the top of a bank. This willow "fence" filters runoff before it enters the stream and will help to stabilize the filled channel section. Brush trench shall be installed at or above floodplain elevation behind the toe rock and then every 50 feet within a channel fill section. See SHEET 8 for Details.

SEEDING and MULCHING

Disturbed areas will be seeded with native grasses. Prepare seedbed where needed. Seed can be drilled or broadcast by hand. Seed shall be incorporated into the soil, but not more than 1–inch deep. Reseeding may be required for successful plant establishment.

Seed shall be purchased from a reliable supplier. The grass seed mix will consist of the following species as available. The seeding rates below are for broadcast planting. Native grass seed will be applied at a rate of 10 pounds to the acre. Forbs (wildflowers) can be added to seed mix to increase diversity and improve aesthetics. Forbs (wildflowers) that have low maintenance, high survival rate, cold hardy, beautiful colors, and ecologically appropriate (non–invasive) are listed. Estimated area of disturbance is 2 acres.

NATIVE GRASS SEED MIX				
Purple three–awn	*(Aristada purpurea)*	0.5	lb/ac	PLS
Blue grama	*(Bouteloua gracilis)*	1.5	lb/ac	PLS
Sideoats grama	*(Bouteloua curtipendula)*	1.5	lb/ac	PLS
Prairie junegrass	*(Koeleria macrantha)*	0.5	lb/ac	PLS
Alkali sacaton	*(Sporobolus airoides)*	0.5	lb/ac	PLS
Bottlebrush squirreltail	*(Elymus elymoides)*	0.5	lb/ac	PLS
Blue wildrye	*(Elymus glaucus)*	0.5	lb/ac	PLS
Western wheatgrass	*(Pascopyrum smithii)*	2.0	lb/ac	PLS
Sand dropseed	*(Sporobolus cryptandrus)*	0.5	lb/ac	PLS
Muttongrass	*(Poa fendleriana)*	0.5	lb/ac	PLS
Spike dropseed	*(Sporobolus contractus)*	0.5	lb/ac	PLS
		10.0	lb/ac	PLS

FORBS/HERBS (WILDFLOWERS)				
Showy goldeneye	*(Heliomeris multiflora)*	0.5	lb/ac	PLS
Arroyo lupine	*(Lupine succulentus)*	1.0	lb/ac	PLS
Eaton's penstemon	*(Penstemon eatonii)*	0.5	lb/ac	PLS
Globe mallow	*(Sphaeralcea coccinea)*	0.25	lb/ac	PLS
Evening primrose	*(Oenothera lamarkiana)*	0.25	lb/ac	PLS
		2.5	lb/ac	PLS

Erosion Control Fabric

Biodegradable erosion control fabric made of Jute, Coir, Straw, Coconut or other natural material shall be placed over the seed on banks for protection. Fabric is laid and anchored over seeding to reduce soil erosion and provide a good environment for vegetative regrowth. Fabric shall be installed for slope protection and seed germination enhancement along the stabilized bank. Two types of fabric will be installed. Coconut and straw matting (Western Excelsior CS3 or comparable) will be installed along the lower bank. Straw matting (Western Excelsior SR1 or comparable) will be installed above the toe rock and above the coconut straw matting (CS3). See SHEET 9 for fabric installation.

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

CONSTRUCTION SPECIFICATIONS

Revegetation Plan Continued

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 3-3-11
ARIZONA, U.S.A.
Expires 3-31-2011

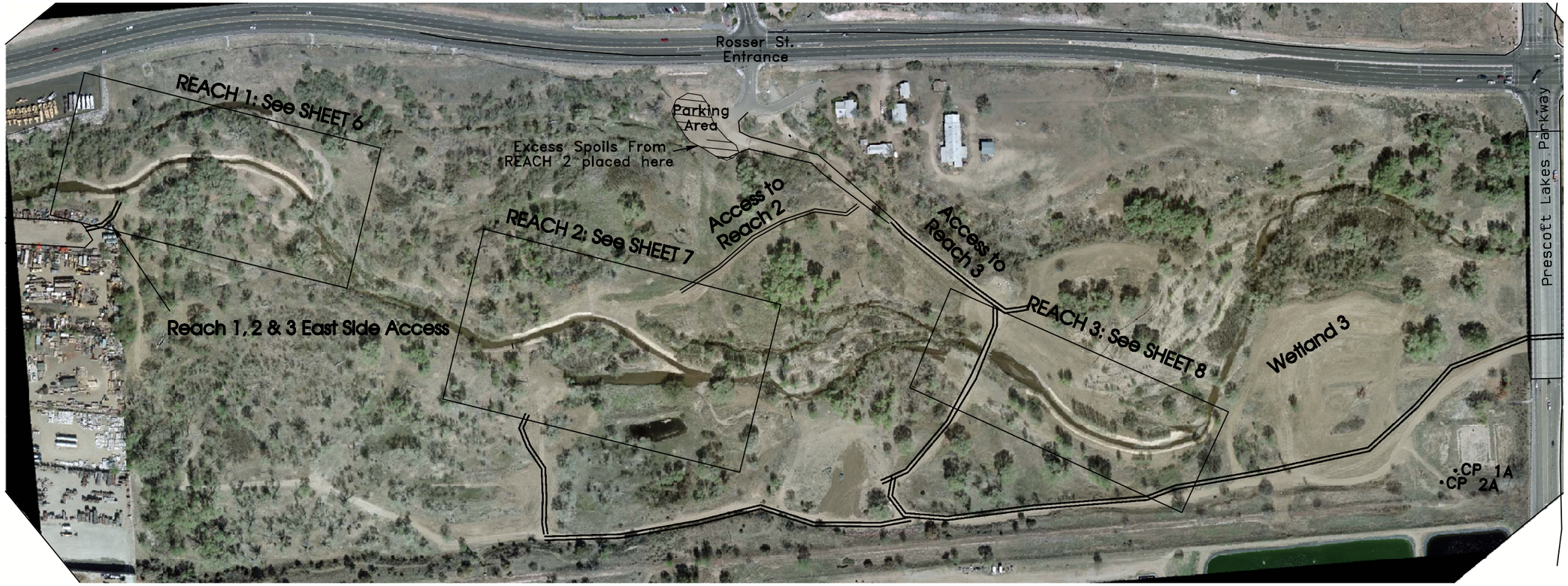
AS–BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 design.pro

DATE: March 22, 2010

PROJECT NO: 08–158WPF

SHEET: 4 of 11



CONSTRUCTION NOTES:

REACH 1: Repair 30 feet of toe rock by reinstalling new rock; reslope/recontour cut banks in old channel as needed and plant willow clusters; install two log sills and four brush trenches; construct 150 feet of new channel to eliminate headcut and install willow clusters.

REACH 2: Remove mound and use spoils as fill for repair further downstream; Reslope cut bank and fill with spoils from mound, install 80 ft of coir logs and plant willow clusters; Plant two rows of willow trenches. Repair upstream toe rock by reinstalling new rock.

REACH 3: Remove culverts, reslope banks as neccessary and plant willow clusters; reslope cutbank at downstream end of reach, install coir logs and plant willow clusters.

CONTROL POINTS

Point	Northing	Easting	Elev.	Description
CP 1A	1300852.5090	545494.2700	5188.91	NCD CAP
CP 2A	1300899.9090	545493.5630	5186.69	NCD CAP

Additional control to be established prior to construction.

HORIZ SCALE: 1" = 300'

300 0 300

CALL TWO WORKING DAYS BEFORE YOU DIG
263-1100
1-800-STAKE-IT
(OUTSIDE MARICOPA COUNTY)

Natural Channel Design, Inc
3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

PROJECT SITE

Control, Access, Spoil Areas

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 2-3-11
ARIZONA, U.S.A.
Expires 3-31-2011

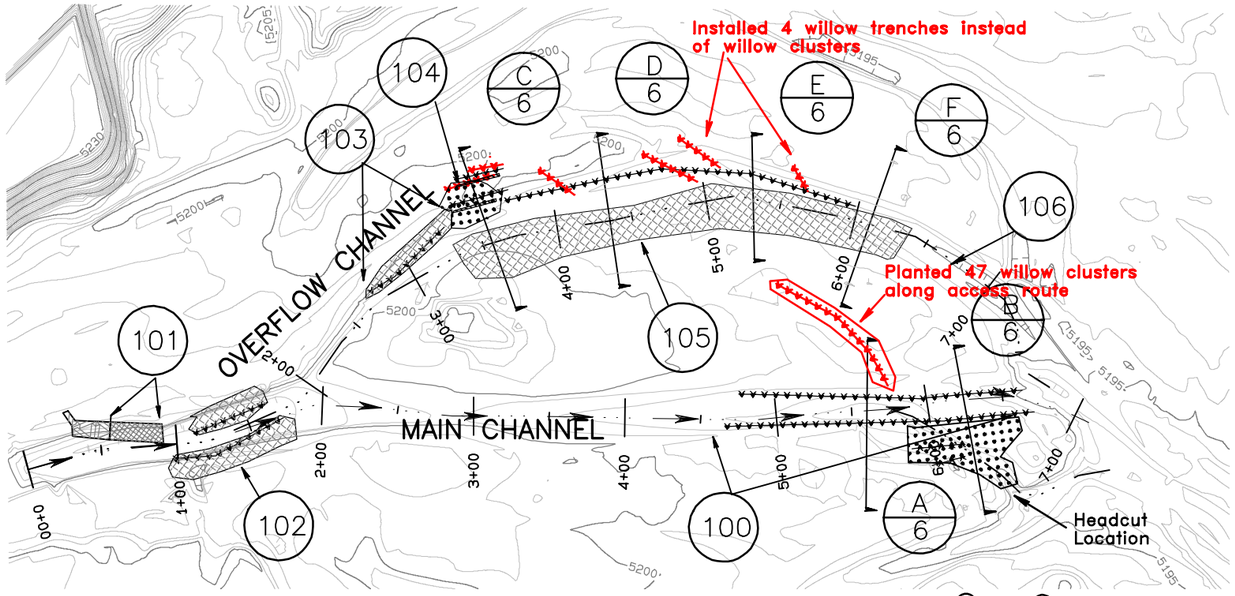
AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

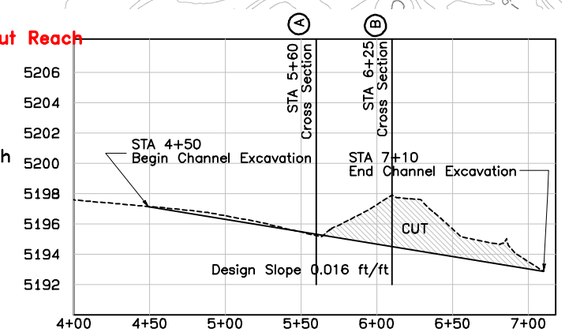
FILE NAME: Watson Woods.pro

March 22, 2010

PROJECT NO: 08-158WPF

SHEET: 5 of 11





Main Channel Profile
STA 4+00 to 7+10

CONSTRUCTION NOTES

100 STA 4+50 to 7+10 (Main Channel). Realign channel to eliminate headcut near STA 6+50. (130 cy). Use spoils to fill channel leading to headcut. Install two 30 ft willow trenches in channel leading to headcut. Plant willow clusters along both banks. Seed and install erosion control fabric (both banks, 440 ft total double and single nets).
See SHEET 9 for Typical Channel Cross Section and Fabric Installation; SHEET 8 for Willow Cluster and Trench Details

101 STA 0+57 to 0+87 (Main Channel, Left Bank) Repair 30 ft of toe rock (30 cy). See SHEET 10 for Toe Rock details.

102 STA 1+00 to 1+75 (Main Channel, up to 100 ft) Reslope/ recontour both banks as needed or directed. Plant willow clusters. Seed and install 164 feet of double and singe net erosion control fabric. See SHEET 9 for Bank Sloping and Fabric Installation; SHEET 8 for Willow Cluster Details

103 STA 2+65 to 3+40 (Overflow channel, left bank) Reslope 65 ft . of cut bank. Plant willow clusters. Seed and install 110 ft of double and single net fabric. See SHEET 9 for Bank sloping and Fabric; SHEET 8 for Willow Cluster Details

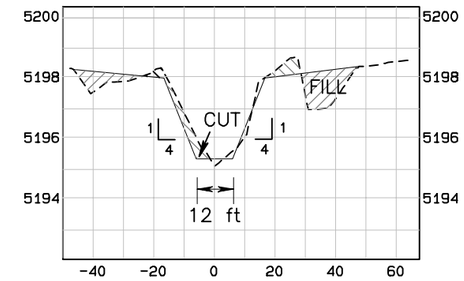
104 STA 3+50 Install two 30 ft log sills and two 30 ft brush trenches. See SHEET 11 for Log Sill Detail, SHEET 8 for trenches.

105 STA 2+60 to 6+40 (Overflow channel)
Widen channel to remove 333 cy fill from old channel alignment. Use spoils to fill between the log sills. ~~Install 300 ft single net fabric over right bank.~~ See SHEET 9 for Bank Sloping and Fabric Installation. Install four 20 to 40 foot willow trenches on floodplain adjacent to channel

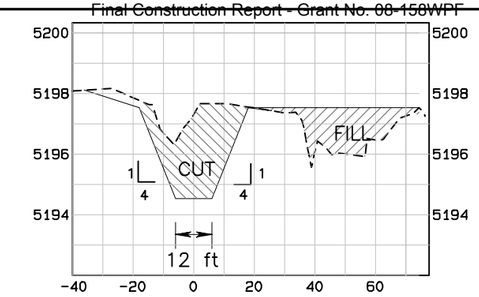
106 STA 6+75 (Overflow Channel)
Remove Debris Dam and spread over flood plain.

VERT SCALE: 1"= 10 '
HORIZ SCALE: 1"= 100'
100 0 100

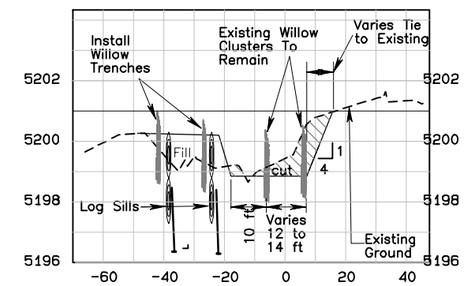
LEGEND
- Willow Planting
- Bank Resloping
- Floodplain Fill
- Toe Rock Repair
- Existing Toe Rock



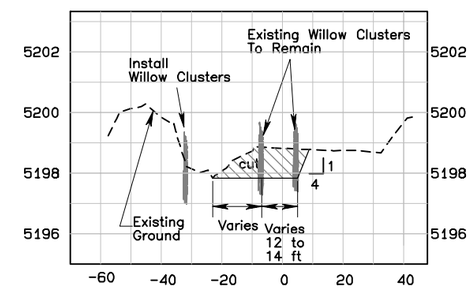
A/6 MAIN CHANNEL CROSS SECTION
STA 5+60



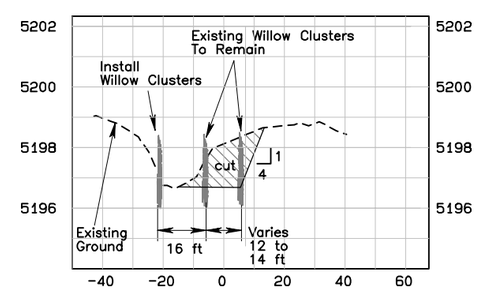
B/6 MAIN CHANNEL CROSS SECTION
STA 6+25



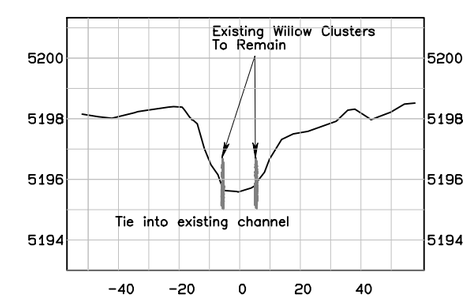
C/6 OVERFLOW CHANNEL CROSS SECTION
STA 3+56



D/6 OVERFLOW CHANNEL CROSS SECTION
STA 4+37



E/6 OVERFLOW CHANNEL CROSS SECTION
STA 5+32



F/6 OVERFLOW CHANNEL CROSS SECTION
STA 6+10

VERT SCALE: 1"= 5 '
HORIZ SCALE: 1"= 50'
50 0 50

Natural Channel Design, Inc
3410 S. Elden St.
Flagstaff, Arizona 86001
(928) 774-2336
www.prescottrivers.org

DRAWN BY: M.Wirtanen
DESIGNED BY: M.Wirtanen, R.Lyman

REV	DATE	BY	REVISION
1	3-3-11	mw	As-Built

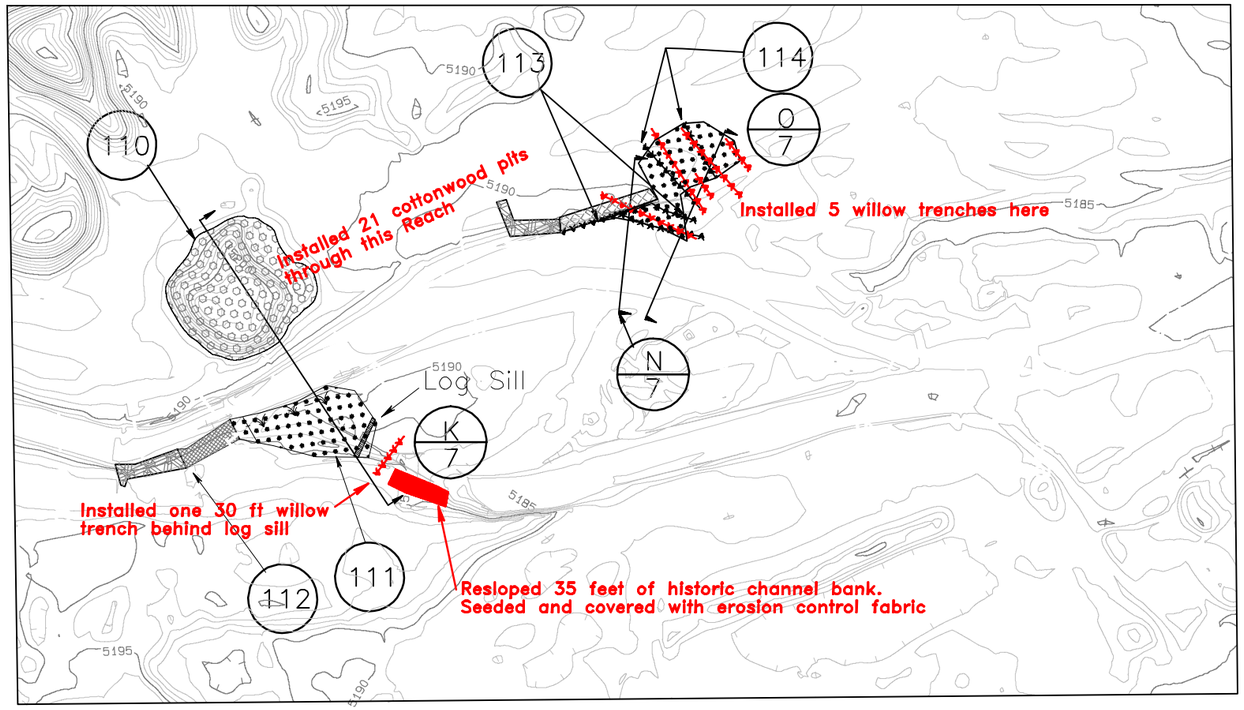
PLAN VIEW, PROFILE & CROSS SECTIONS
Reach 1

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 Design.pro
DATE: March 22, 2010
PROJECT NO: 08-158WPF
SHEET: 6 of 11
40



HORIZ SCALE: 1"= 100'

100 0 100

LEGEND

- Willow Planting
- Bank Resloping
- Fill
- Toe Rock Repair
- Existing Toe Rock
- Mound Removal

CONSTRUCTION NOTES

110 STA 14+10 to 15+00 (Left) Remove mound (1500 cy) and use spoils as fill at STA 14+10 to 14+80 (right) and 16+80 to 17+60 (left). Excess spoils placed at Rosser Street Parking Area (SHEET 5) Plant Cottonwood Posts ~~on 12 ft spacings.~~ as directed on ground Seed disturbed area with native seed mix. 21

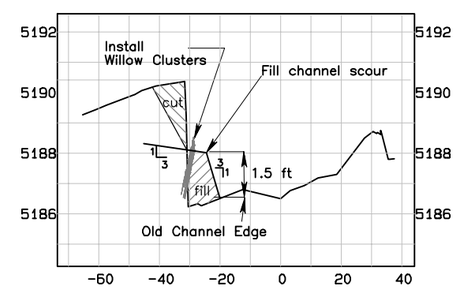
111 STA 14+50 ~~Install temporary stream crossing with culvert (SHEET 10 for Details)~~ not needed STA 14+10 to 14+80 (Right) Fill scoured area downstream from existing toe rock with approx 125 cy of material from mound. Install one log sill; install willow clusters; seed disturbed area with native seed mix. See SHEET 8 for Willow Cluster Details and SHEET 11 for Log Sill Details Resloped 35 feet of historic channel bank. Seeded and covered with erosion control fabric

112 STA 13+75 to 14+10 (Right) Install 45 ft toe rock (40 cy) downstream from existing toe rock See SHEET 8 for Toe Rock Details.

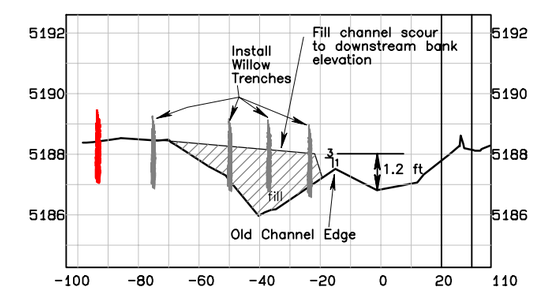
113 STA 16+50 to 17+60 (Left) Reslope 75 ft of cut bank (63 cy). Plant willow clusters on slope, seed and cover with 50 ft of single and double net erosion control fabric. See SHEET 9 for Bank Sloping and Fabric Installation, SHEET 8 for Willow Cluster/Trench Details

114 Fill scoured area with five spoils from mound excavation. Cover with 120 ft of double net erosion control fabric. Plant ~~four~~ rows of willow trenches (approx 50 ft ea). See SHEET 9 for Fabric Installation, SHEET 8 for Willow Trench Details

K/7 MAIN CHANNEL CROSS SECTION AT MOUND
STA 14+70



N/7 MAIN CHANNEL CROSS SECTION
STA 17+14



O/7 MAIN CHANNEL CROSS SECTION
STA 17+40

VERT SCALE: 1"= 5 '
HORIZ SCALE: 1"= 50'

50 0 50

Natural Channel Design, Inc
206 S. Elden St.
Flagstaff, Az 86001
928-774-2336
www.FlagstaffCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION
1	3-3-11	mw	As-Built

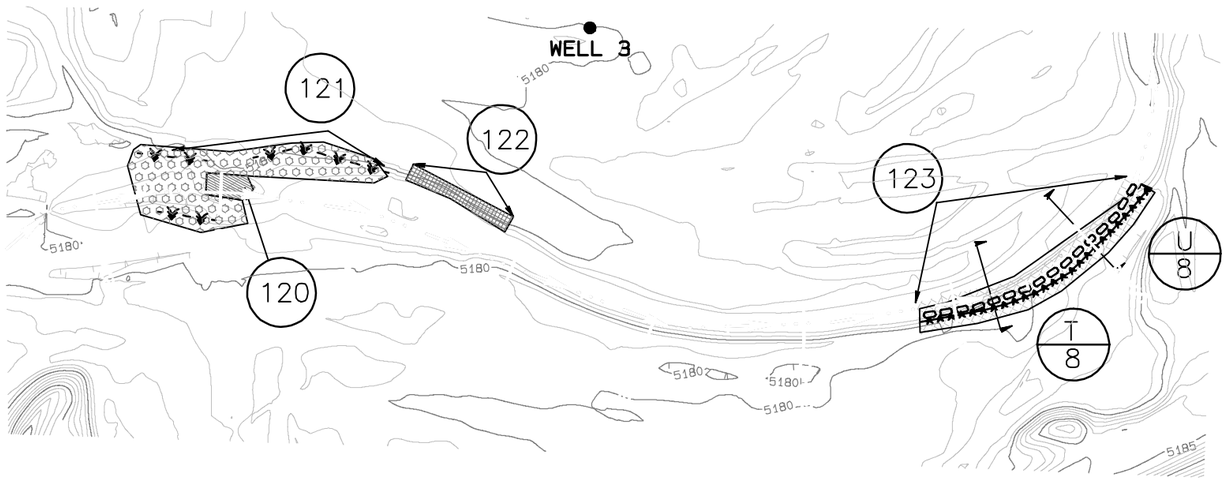
PLAN VIEW & CROSS SECTIONS
Reach 2

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Watson Woods.pro
DATE: March 22, 2010
PROJECT NO: 08-158WPF
SHEET: 7 of 11



LEGEND
- Willow Planting
- Coir Log
- Bank sloping
- Culvert Removal
- Ground Shaping

HORIZ SCALE: 1" = 100'
100 0 100

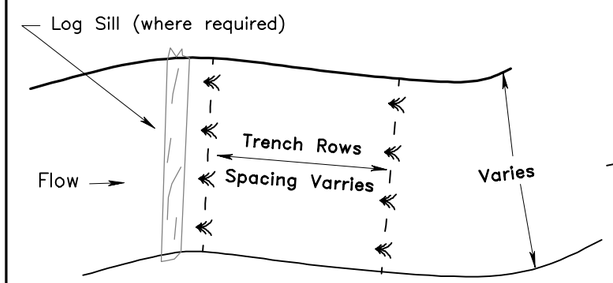
NOTES

120 STA 28+00 Remove four culverts left in stream. Re-establish low water crossing.

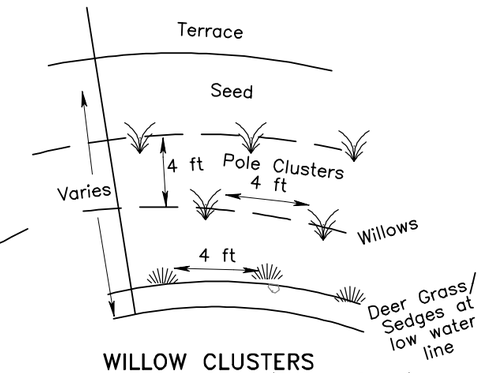
121 STA 27+50 to 29+00 (170 ft left, 50 ft right) Smooth both banks to eliminate scour marks. Install willow clusters. Seed and install double and single net erosion control fabric. See SHEET 9 for Fabric Details, SHEET 8 for Willow Planting Details.

122 STA 29+15 to 29+90 (Left Bank) Repair rock riprap as required (approx 4 linear ft, 1 cy) See SHEET 10 for Details

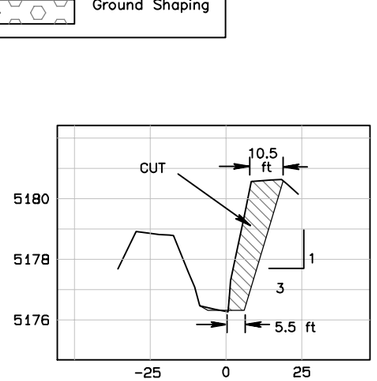
123 STA 32+75 to 34+50 (Right Bank)– ~~175~~ 190 ft Bank Sloping (SHEET 9 for Bank Sloping Detail)
STA 33+30 to 34+50 – (Right Bank) Install ~~120~~ 150 ft coir log with brush revetment. See SHEETS 9 and 11 for Details.
STA 32+75 to 34+50 – (Right Bank) Install Willow Clusters on 4 ft staggered spacings. Seed and install 185 ft of double and single net erosion control fabric. See SHEET 9 for Coir log & Fabric Details, SHEET 8 for Willow Cluster Details.
Spread spoils on disturbed ground ~~at Wetland 3 (See SHEET 2 for Location)~~ on top of bank



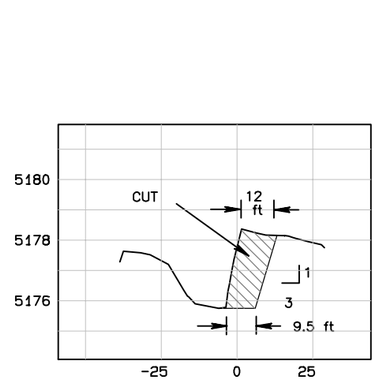
WILLOW TRENCH
PLAN VIEW (Not to Scale)



WILLOW CLUSTERS
PLAN VIEW (Not to Scale)

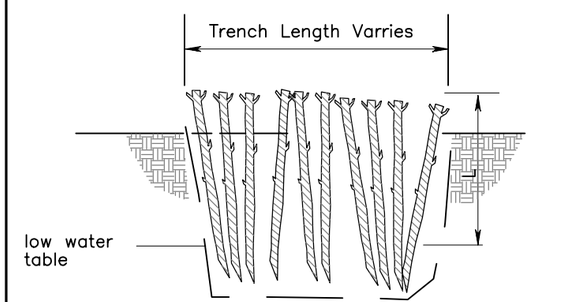


T 8 CHANNEL CROSS SECTION
STA 33+25



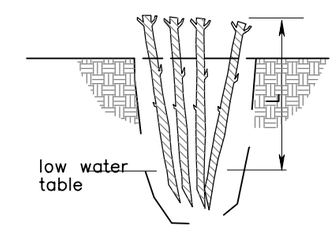
U 8 CHANNEL CROSS SECTION
STA 40+00

HORIZ SCALE: 1" = 50'
VERT SCALE: 1" = 5'
50 0 50



WILLOW TRENCH DETAIL
(Not to Scale)

NOTES
Use 1/2 to 2 in. cuttings.
Trenches excavated with backhoe or mini-excavator down to watertable elevation. A continuous row of willow cuttings (approx 4/foot) are installed. Trench is then backfilled with excavated material and watered.



POLE CLUSTER DETAIL
(Not to Scale)

NOTES
Use 1/2 to 2 in. cuttings.
In holes excavated with an auger, place approximately 3 to 4 cuttings in hole to maximize sprouting success per effort. Holes are backfilled with excavated material and watered.

Natural Channel Design, Inc
206 S. Elden St.
Flagstaff, Az 86001
928-774-2336
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman
DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION
1	3-3-11	mw	As-Built

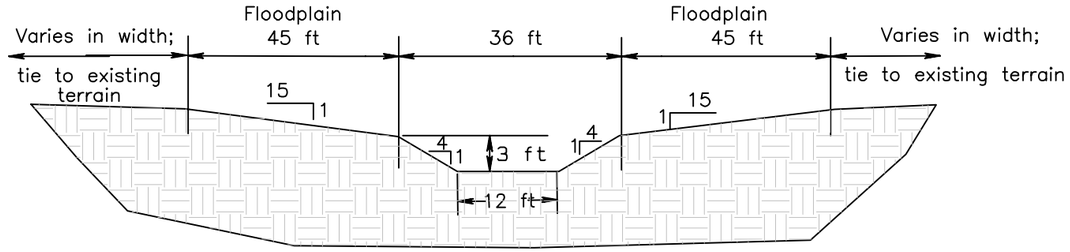
PLAN VIEW & CROSS SECTIONS: Reach 3
DETAILS: Willow Plantings

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

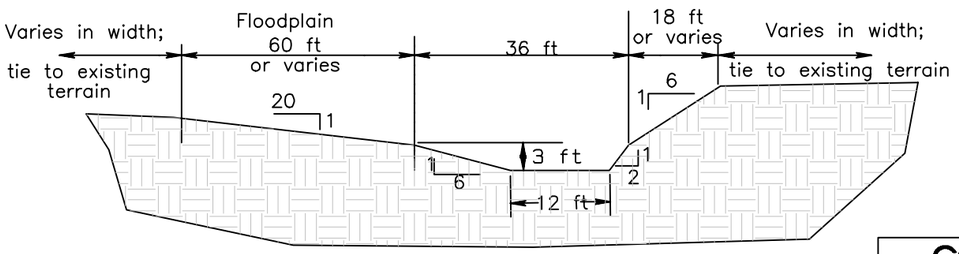
REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

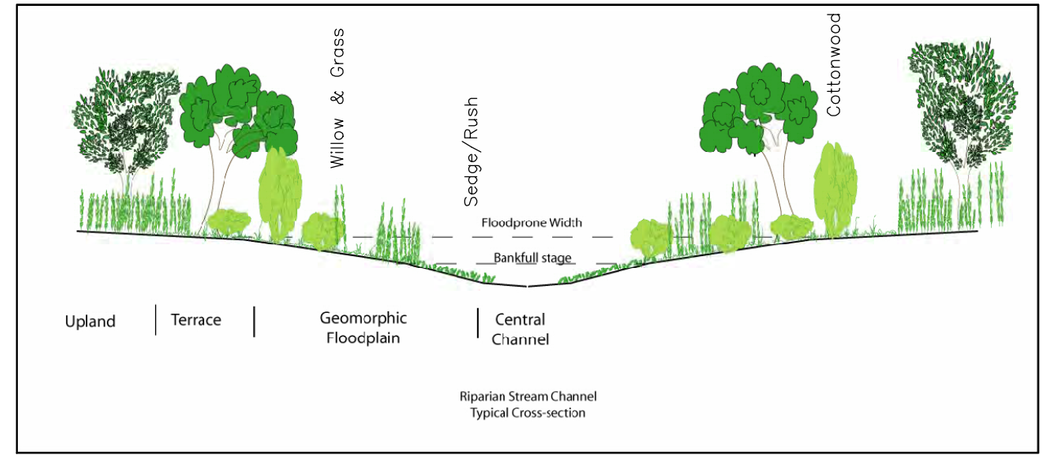
FILE NAME: Feb 10 design.pro
DATE: March 22, 2010
PROJECT NO: 08-158WPF
SHEET: 8 of 11



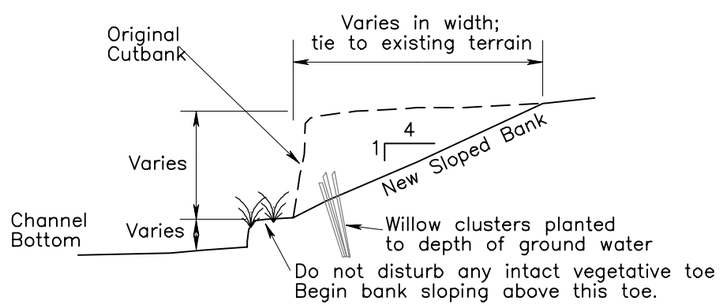
BANKFULL CHANNEL CROSS-SECTION
Riffle Section
(Not to Scale)



BANKFULL CHANNEL CROSS-SECTION
Meander Section
(Not to Scale)

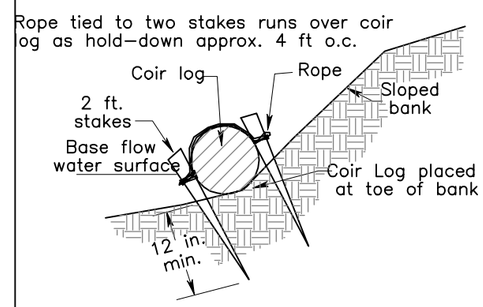


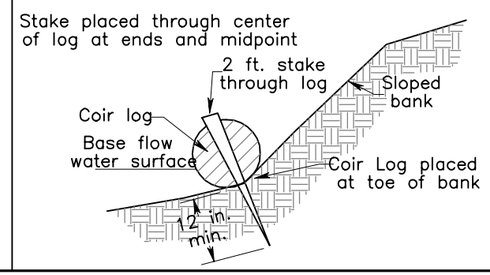
Typical Channel Vegetation Zone Cross-Section

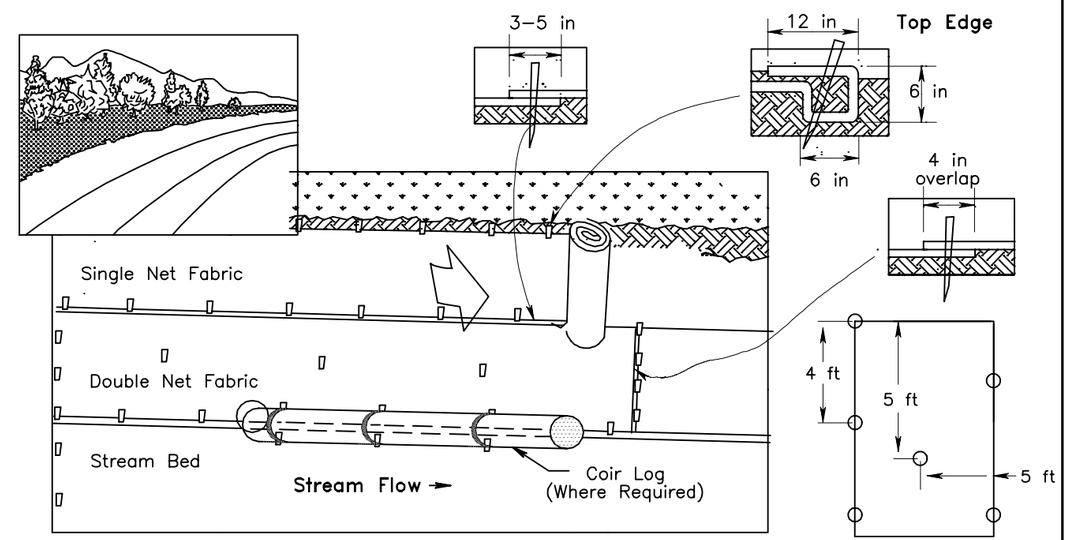


BANK SLOPING SECTION VIEW
(Not to Scale)

COIR LOG INSTALLATION
Section Views
(Not to Scale)







EROSION CONTROL FABRIC: INSTALLATION
NOT TO SCALE

STAKE PATTERN

Natural Channel Design, Inc

3410 S. Cocopah Dr.
Flagstaff, Arizona 86001
(928) 774-1178
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen, R.Lyman

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

DETAILS: Typical Channel Cross Sections, Bank Sloping Coir Log & Erosion Control Fabric Installation

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 1-28-10
ARIZONA, U.S.A.
Expires 3-31-2011

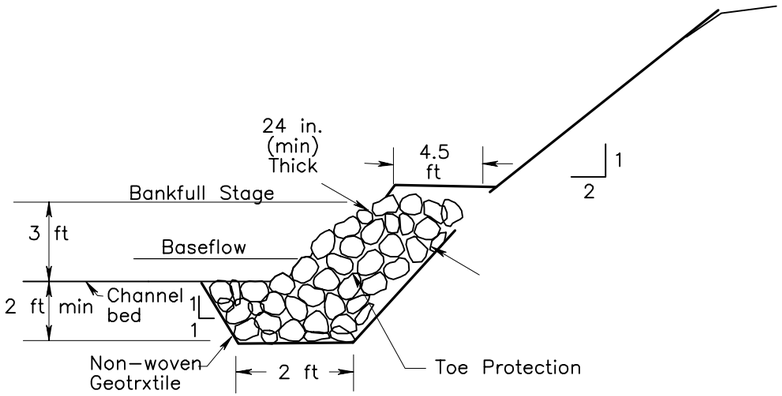
AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 design.pro

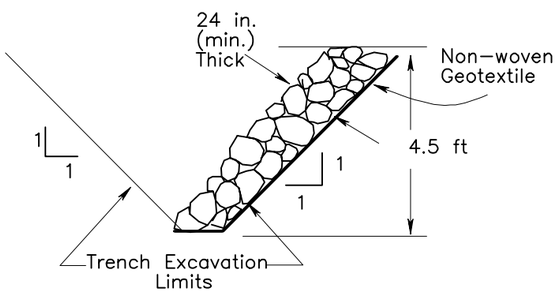
DATE: March 22, 2010

PROJECT NO: 08-158WPF

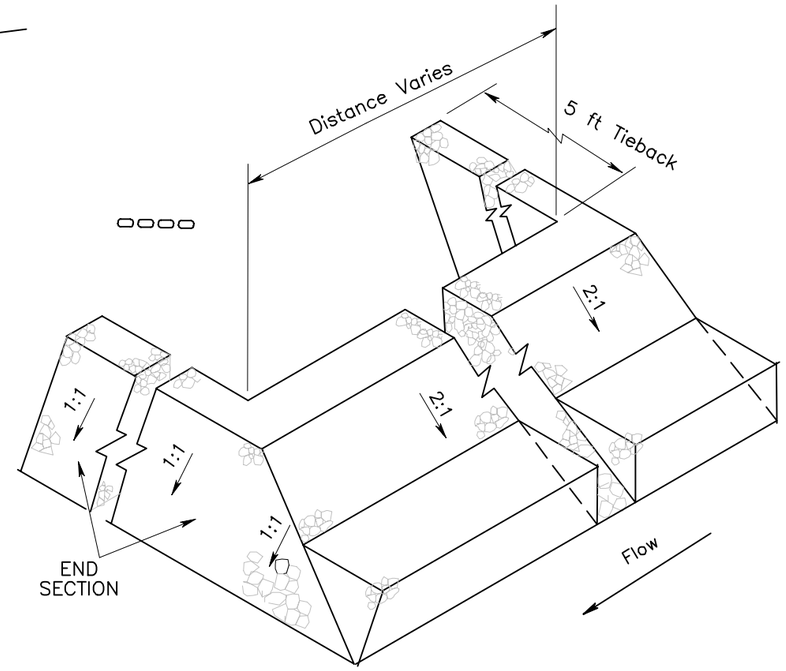
SHEET: 9 of 11



TYPICAL TOE ROCK SECTION
(Not to Scale)



TYPICAL TIEBACK SECTION
(Not to Scale)



ISOMETRIC VIEW
(Not to Scale)

GEOTEXTILE
15 ft wide x 300 ft long rolls
Total Distance = 75 ft
(incl. tiebacks)

TOTAL FABRIC = 0.25 roll

GEOTEXTILE SPECIFICATIONS

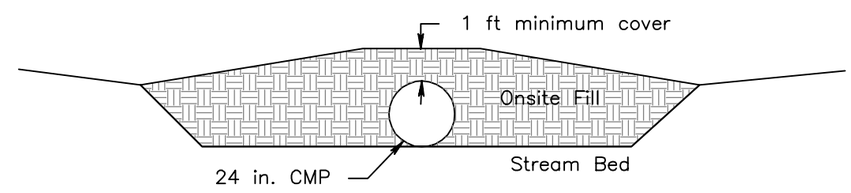
Geotextile shall be a non-woven fabric with a minimum tensile strength of 120 lb, greater than 50% elongation at failure, a minimum of 65 lb puncture strength, and UV resistance of 70%.

Geotextile shall be joined by overlapping a minimum of 18 inches.

Geotextile shall be anchored in a trench with rock along the top edge of bank.

Geotextile shall be secured against the underlying foundation material. Securing pins shall be installed as necessary to prevent undue slippage or movement of the geotextile.

See SHEET 3 SHEET 13 for Stream Crossing location.



TEMPORARY STREAM CROSSING
(Not to Scale)

ROCK SPECIFICATIONS
Use well-graded, angular rock with bulk specific gravity greater than 1.7
Rock installed @ rate of 0.8 cy/ft

Rock Riprap Rocks: Dmin = 6 in.
D50 = 9 in.
Dmax = 12 in.

RIPRAP ROCK LOCATION & VOLUME

STA	DISTANCE	VOLUME
REACH 1		
0+57 to 0+87 (left)	35 ft (w/ tieback)	30 cy
REACH 2		
13+75 to 14+10 (right)	45 ft (w/ tieback)	40 cy
REACH 3*		
29+15 (left)	4 ft	1 cy

* Reach 3 rock is intact, but a four foot section requires additional rock on top to recover fabric

Natural Channel Design, Inc
206 S. Elden St.
Flagstaff, Az 86001
928-774-2336
www.PrescottCreeks.org

DRAWN BY: M.Wirtanen

DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

DETAILS:
Toe Rock & Temporary Stream Crossing

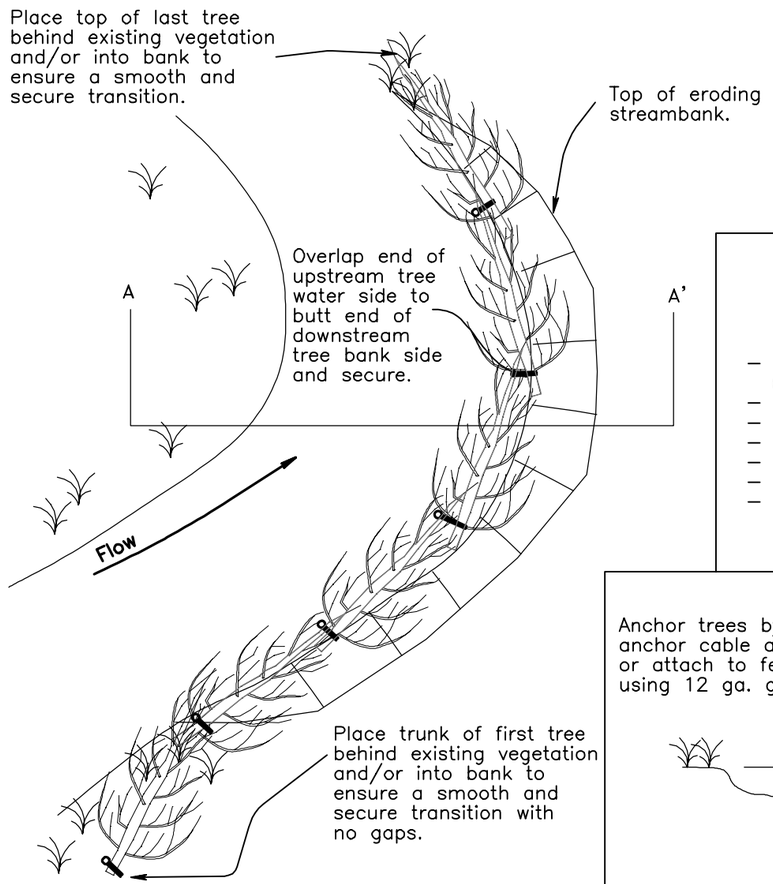
Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL)
CERTIFICATE NO. 26889
STEPHANIE N. YARD
Date Signed 3-3-11
ARIZONA, U.S.A.
Expires 3-31-2011

AS-BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 design.pro
March 22, 2010
PROJECT NO: 08-158WPF
SHEET: 10 of 11
44

1. Start revetment at the downstream end of the treatment area, a minimum of one tree length past the area being treated and tie into the bank. Place tree stump pointing upstream and tops pointing downstream.
2. Overlap each additional tree trunk into the main branches of the preceeding tree by 1/3 to 1/2. There should be no gaps or holes in the coverage of the bank. Each upstream tree trunk shall be placed to the river side of the preceeding tree in a shingle fashion. Tightly wire the overlap sections with 12 gauge galvinized wire.
3. Trees need to be well anchored to withstand the force of the river. Each tree shall be anchored with an earth anchor, fence post, or rock bolster. Anchor points include each end of the revetment and at each overlap section at a minimum. Earth anchors shall be angled into bank.
4. Plant willows behind revetment to provide permanent cover and roots.
5. Remove fencepost in 2–3 years once toe is stable.

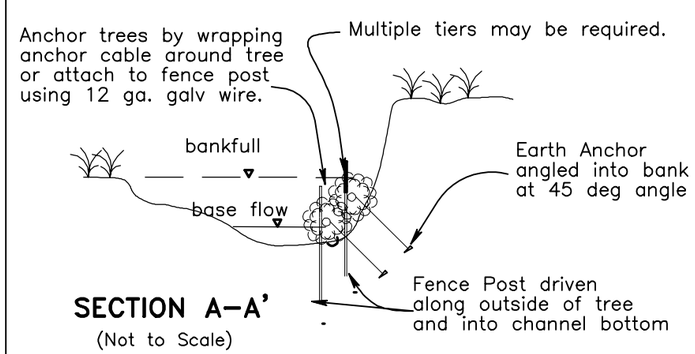


PLAN VIEW
(Not to Scale)

BRUSH REVETMENT

MATERIALS & EQUIPMENT

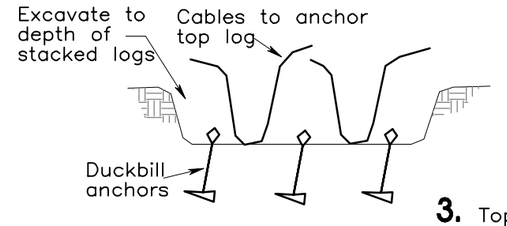
- dead/live brush or trees with dense branching (e.g. junipers) min. 6 to 8 ft length or longer
- 12 gauge galvinized wire
- 6ft fence t–posts
- earth anchors & installation rod
- wire cutters
- post pounder
- chainsaw



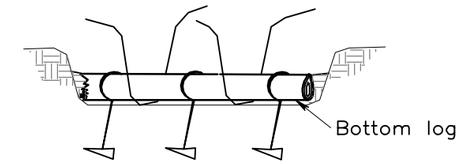
SECTION A–A'
(Not to Scale)

LOG SILL

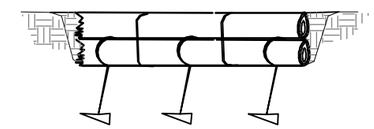
1. Excavate trench, install duckbill anchors, and place cables for top log anchors.

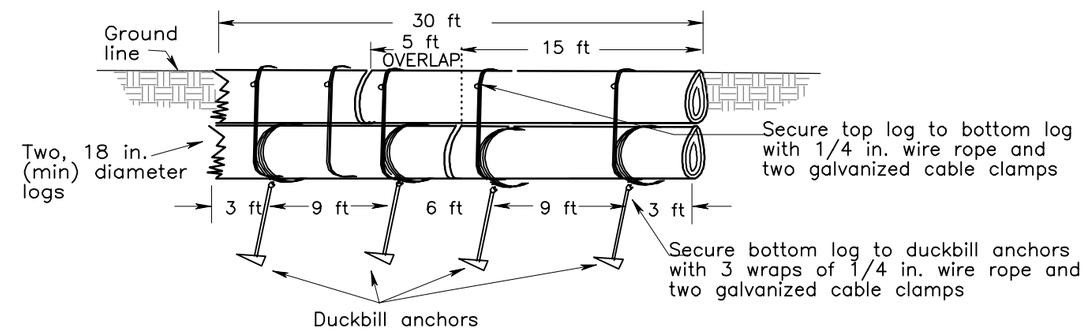


2. Place bottom log, anchor to duckbills, and backfill to top of log.



3. Top log placed, anchored with cables and backfilled





SECTION VIEW
(Not to Scale)

GENERAL NOTES

1. Excavate trench to depth of stacked logs and install duckbill anchors. Place cables for securing top log in trench with loose ends out to sides of trench.
2. Install and secure bottom log to duckbill anchors with a minimum of three wraps of the 1/4–in. wire rope and two cable clamps or joiners. Always remove bark at the point of contact between the cable and the log because bark will cause rot, resulting in slack in the anchoring cable. Backfill to top of log before placing next log.
3. Place top log and anchor to bottom log with pre–installed 1/4 inch wire rope and secure with two cable clamps or joiners. Backfill above anchors and cables shall be compacted to the same density as the surrounding ground.

Materials for Log Sill includes:
18–in diameter (min.) x 30–ft logs
6–inch duckbill anchors
1/4–inch diameter galvanized non–greased, wire rope
Galvanized cable clamps

Natural Channel Design, Inc
206 S. Elden St.
Flagstaff, Arizona 86001
(928) 774-2336
www.PrescottRivers.org

DRAWN BY: M.Wirtanen, R.Lyman
DESIGNED BY: M.Wirtanen, A.Haden

REV	DATE	BY	REVISION

DETAILS: Brush Revetment & Log Sill

Watson Woods Riparian Preserve Restoration Project
Post Flood Repair (January 2010)
Project #: 08-158 WPF

REGISTERED PROFESSIONAL ENGINEER (CIVIL) CERTIFICATE NO. 26889 STEPHANIE N. YARD Date Signed 3-3-11 ARIZONA, U.S.A.
Expires 3-31-2011

AS–BUILT DRAWNGS
Construction Period
Nov 8 – Dec 8, 2010

FILE NAME: Feb 10 design.pro
DATE: March 22, 2010
PROJECT NO: 08–158WPF
SHEET: 11 of 11