Arizona Water Protection Fund
Application Cover Page
FY 2019

Title of Project: American Gulch Channel and Riparian Enhancement

Type of Project:
- ☒ Capital or Other
- ☐ Water Conservation
- ☐ Research

Stream Type:
- ☐ Perennial
- ☐ Intermittent
- ☒ Ephemeral

Your level of commitment to maintenance of project benefits and capital improvements:
☐ < 5 years ☐ 5-10 years ☐ 11-15 years ☒ 16-20 years

Applicant Information:

Name/Organization: Town of Payson
Address 1: 303 N. Beeline Hwy.
Address 2:
City: Payson
State: AZ
ZIP Code: 85541
Phone: 928-474-5242
Fax: 928-472-7490
Tax ID No.: [redacted]

Inside an AMA: Yes ☐ No ☒

If yes, which AMA:
- ☐ Phoenix
- ☐ Tucson
- ☐ Prescott
- ☐ Pinal
- ☐ Santa Cruz

Type of Application:
- ☒ New
- ☐ Continuation

Contact Person:

Name: LaRon Garrett
Title: Town Manager
Phone: 928-472-5041
Fax: 928-472-7490
e-mail: lgarrett@paysonaz.gov

Any Previous AWPF Grants:
☐ Yes ☒ No

If yes, please provide Grant #(s):

Arizona Water Protection Fund Grant Amount Requested:

$202,556

If the application is funded, will the Grantee intend to request an advance:
☐ **Yes** ☒ **No**

Matching Funds Obtained and Secured:

Applicant/Agency/Organization:	Amount ($):
1. Applicant	58,468
2.	
3.	

Total: $58,468

Has your legal counsel or contracting authority reviewed and accepted the Grant Award Contract General Provisions?
☒Yes ☐No ☐N/A

Signature of the undersigned certifies understanding and compliance with all terms, conditions and specifications in the attached application. Additionally, signature certifies that all information provided by the applicant is true and accurate. The undersigned acknowledges that intentional presentation of any false or fraudulent information, or knowingly concealing a material fact regarding this application is subject to criminal penalties as provided in A.R.S. Title 13. The Arizona Water Protection Fund Commission may approve Grant Awards with modifications to scope items, methodology, schedule, final products and/or budget.

LaRon Garrett	Town Manager 928-472-5041
Typed Name of Applicant or Applicant's Authorized Representative	**Title and Telephone Number**
Signature	**Date Signed**

ARIZONA WATER PROTECTION FUND GRANT APPLICATION

FY2019

American Gulch Channel and Riparian Enhancement

Town of Payson, Gila County, Arizona

Table of Contents

Executive Summary

As a tributary to the East Verde River, American Gulch forms a major drainage through the town of Payson, AZ. The ephemeral channel through the project area has been highly modified to serve as a stormwater conveyance and currently is sized to contain the FEMA estimated 100-year floodplain. The current channel configuration through the project area is a grass lined, trapezoidal channel bounded by development on one side and a recently built urban trail on the other. The current channel configuration appears to be a major departure from the original landform which was likely a wide swale with a large floodplain. The existing configuration reflects that of an incised and narrowed channel, configured to contain flood flows in a narrow corridor and allow for development. The current channel has evidence of some erosion and aggradation from storm flows and there are signs of encroachment from invasive tree and weed species.

The Town of Payson wishes to improve the aesthetics, and habitat function of the channel while retaining the flood control functions. The new channel shall conform to natural channel design principles as much as practical to improve sediment transport function and the ability of the channel to support appropriate native vegetation.

The project will construct a more natural, stable bankfull (low flow) channel in the bottom of the existing channel and will include stabilization structures including rock cross-vane weirs, rock vanes, toe rock, TRM (turf reinforced matt) and larger natural substrate material. The project is approximately 1000 ft long and construction will take place entirely within the existing channel with the exception of additional native plantings along the edge of the channel and around the urban trail. The entire site including all disturbed areas will be revegetated with both riparian and upland native vegetation (grasses, forbs, shrubs including willows, and trees).

Project Overview

Background

The area known as American Gulch, located in Payson, Arizona is located immediately south of the Town's original Main Street: a gathering place of the late 1880's and the social center for the Town. The ephemeral channel through the project area has been highly modified to serve as a stormwater conveyance and currently is sized to contain the FEMA estimated 100-year flood event. The current channel configuration through the project area is a grass lined, trapezoidal channel bounded by development on one side and a recently built urban trail on the other. The current channel configuration appears to be a major departure from the original landform which was likely a wide swale with a large floodplain. The existing configuration reflects that of an incised and narrowed channel, configured to contain flood flows in a narrow corridor and allow for development. The current channel has evidence of some erosion and aggradation of sediment from storm flows and there are signs of encroachment from invasive tree and weed species. This project aims to restore, enhance, and improve this channelized portion of American Gulch in order to achieve a healthier habitat and watershed.

Goals

The goal of the project is to improve the aesthetics and habitat function of the channel while retaining flood control functions. This project will utilize natural channel design principles with aims to improve sediment transport function and the ability of the channel to support appropriate native vegetation. The natural channel design employed requires features that accommodate the incised nature of the flood control channel and the relatively fine grained sediment that is found in the historical alluvial fill of the floodplain.

Objectives

1. Improve flood control functions while reducing pollution and erosion
2. Improve sediment transport by creating a bankfull channel form in an existing flat bottom trapezoidal channel
3. Improve habitat health and aesthetics by increasing native riparian vegetation

Statement of Problems/Causes

There is evidence that a bankfull channel is beginning to form in the bottom of what was a uniform trapezoidal channel section. The bankfull channel is poorly defined and eroding through a turf reinforcement mat that was placed in the channel bottom, approximately fifteen years ago. The floodplain is constrained by development surrounding the project reach and the channel itself was originally designed to contain the FEMA 100-year flood.

The upstream watershed has a multitude of natural and artificial features as it collects water from a developing urbanized area and is routed through culverts and reaches of poorly defined channels. Combined, these natural and artificial features and the relatively recent age of the constructed channel promote a system that is in a state of adjustment and instability.

Statement of Solutions

A bankfull channel will be constructed and utilize three rock cross-vane weirs to provide grade control, five rock vanes with toe rock to provide bank protection, and riprap for culvert outlet protection. The project area will be revegetated with native grasses, forbs, and will have native trees and shrubs installed along the banks. These improvements will aid in the overall health of the habitat as well as aesthetics for the Main Street area. The earthwork and installations will improve the flood control functions of the channel. As an ephemeral tributary to the East Verde River (six miles downstream), this project will help to conserve water and improve the health of the overall Verde Watershed.

Statement of Project Years of Benefit to the resource and general public

Because this project aims to restore and improve an existing channelized portion of an ephemeral wash, it is expected that the benefits to American Gulch, the Town of Payson, East Verde River, and the Verde Watershed will extend past 20 years.

Project Location & Environmental Contaminant Information
FY 2019

Project Location Information

1. County: Gila	2. Section(s): 9	3. Township: 10N	4. Range: 10E

5. Watershed: Verde
6. 8 or 10 Digit Hydrologic Unit Code (HUC): 15060203
7. Name of USGS Topographic Map where project area is located: Payson South Quadrangle
8. State Legislative District: 06

   (Information available at: http://azredistricting.org/districtlocator/

9. Land ownership of project area: Town, Private
10. Current land use of project area: Ephemeral channel
11. Size of project area (in acres): 2.0 DIRECT
12. Stream Name: American Gulch
13. Length of stream through project area: 1,100 lineal ft.
14. Miles of stream benefited: 1 miles
15. Acres of riparian habitat: 0.85 acres will be:

- ☒ Enhanced
- ☐ Maintained
- ☒ Restored
- ☐ Created

16. General description and/or delineation for the area of impact of the project within the watershed.
The project is located in Payson, Arizona within the town limits in Township 10N, Range 10E, Section 9 at an elevation of 4,900 feet. The project extends through a portion of American Gulch, just south of Main Street, from its intersection with Meadows Street downstream 1000 feet to its intersection with Westerly Road.

17. Provide directions to the project site from the nearest city or town. List any special access requirements:
From Az-87 in Payson, Az, turn west onto W. Main St. and proceed 0.2 mile to north west entrance to Sawmill Center Shopping Center. Project starts at the box culvert crossing American Gulch and extends 1,100 feet downstream, ending appx. 90 ft downstream from the S. Westerly road bridge.

Environmental Contaminant Location Information

1. Does your project site contain known environmental contaminants? ☐ **YES** ☒ **NO** If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants: _____

2. Are there known environmental contaminants in the project vicinity? ☒ **YES** ☐ **NO** If yes, please identify the contaminant(s) and enclose data about the location and levels of contaminants: Tetrachloroethylene (PCE); 0.0019 ppm; located in underground aquifer just south of project site
3. Are you asking for Arizona Water Protection Fund monies to identify whether or not environmental contaminants are present? ☐ **YES** ☒ **NO**

Scope of Work

Prior to the submittal of this grant application, extensive preconstruction work had been completed for this project. A biological assessment, a report on any potential cultural resources that may be affected, a full plan set, and materials for a preliminary jurisdictional delineation within the project area were all completed. In addition, written consent from the two private property owners involved was obtained. These materials, along with additional required documents, were compiled and submitted for a CWA Section 404 permit.

Task 1: Clean Water Act Section 404 permit from the Army Corps of Engineers
Task Description: The Town of Payson, with the help of consultant Natural Channel Design, Inc., has submitted an application to the Los Angeles District of the U.S. Army Corps of Engineers Regulatory Branch for a CWA Section 404 permit for construction of this project. The Town of Payson will continue to work with the ACOE until the permit is approved.
Task Purpose: To comply with all state and federal permit requirements, laws, and regulations.
Deliverable Description: Copies of approved permit, authorizations, clearances and agreements.
Responsible Personnel: Town of Payson with aid from Natural Channel Design, Inc.
Deliverable Due Date: November 30, 2018
Task Cost: $9,640.00 – Paid

Task 2: Construction
Task Description: Construct a more natural, stable bankfull (low flow) channel in the bottom of the existing channel which will include stabilization structures including rock cross-vane weirs, rock vanes, toe rock, TRM (turf reinforced matt) and larger natural substrate material.
Task Purpose: Improve the aesthetics, and habitat function of the channel while retaining the flood control functions. The new channel shall conform to natural channel design principles as much as practical to improve sediment transport function and the ability of the channel to support appropriate native vegetation.
Deliverable Description: Maintenance Agreement, Certificate of Grading Conformance, and Warranty of Improvements/Installations
Responsible Personnel: Town of Payson; Natural Channel Design, Inc.
Deliverable Due Date: June 30, 2019
Task Cost: $192,910.20

Task 3: Final report and oral presentation
Task Description: Prepare, submit, and present a final report and oral presentation to the Arizona Water Protection Fund Commission. These will both summarize the project as a whole, including the outcome of all tasks, final timelines, any changes made, and suggestions and monitoring plans for the future.
Task Purpose: The final report and presentation will analyze the success of the project and pinpoint any changes or future work to be made.
Deliverable Description: Written report submitted to the Commission as well as an oral presentation.
Responsible Personnel: Town of Payson with aid from Natural Channel Design, Inc.
Deliverable Due Date: Within 90 days of the contract termination date
Task Cost: $100.00

Detailed Budget Breakdown

Item	Quantity	Unit	Unit Cost	Total
Rip Rap Related Items				
Install Riprap Outlet Protection (D50=8 in) @ Sta 33+76 left	8	CY	$80.00	$640.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 38+03 right	11	CY	$80.00	$880.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 39+03 left	6	CY	$80.00	$480.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 39+37 left	6	CY	$80.00	$480.00
Install Riprap Outlet Protection (D50=14 in) @ Sta 39+37 left	38	CY	$100.00	$3,800.00
Rock Vane Channel/Bank Protection Items				
Install Rock Vane Channel/Bank Protection	6	EA	$2,000.00	$12,000.00
Install Cross Vane Weir Sta 39+45 (small)	1	LS	$6,000.00	$6,000.00
Install Cross Vane Weir Sta 30+83 (large)	1	LS	$12,000.00	$12,000.00
Install Toe Rock	150	LF	$110.00	$16,500.00
Erosion Control Fabric				
Install Pyramat 75 (downstream of box culvert to first weir)	202	SY	$12.00	$2,424.00
Install Pyramat 25 (across bankfull bench, full length of reach)	2,072	SY	$11.50	$23,828.00
Earthwork				
Cut (excavation and haul-off of excess)	1839	CY	$10.00	$18,390.00
Fill (move material within channel, shape and compact)	182	CY	$8.00	$1,456.00
Place 8-inch minus substrate in Riffle/Run (see plans for gradation)	722	CY	$50.00	$36,100.00
Vegetation				
Install Trees	20	EA	$600.00	$12,000.00
Install Large Shrubs	45	EA	$60.00	$2,700.00
Install Small Shrubs & Forbes	72	EA	$20.00	$1,440.00
Install Shrub Willows	18	EA	$60.00	$1,080.00
Install Grass & Sedge Plugs	110	EA	$5.00	$550.00
Reseeding	2	AC	$4,000.00	$8,000.00
Miscellaneous				
Mobilization/Demobilization	1	LS	$5,000.00	$5,000.00
SWPPP	1	LS	$2,000.00	$2,000.00

(Costs shown are installed costs)	Subtotal:	$167,748.00
	Contingency (15% of subtotal):	$25,162.20
	Estimated Construction Total:	$192,910.20
	Administration (5% of Total):	$9,645.51
	Project Total:	**$202,555.71**

Detailed Matching Funds Breakdown

The chart below depicts the breakdown of the services rendered by Natural Channel Design, Inc. (NCD) for this project. As of the date of this application, all of the tasks listed have been completed by NCD and paid for by the Town of Payson. Copies of the invoices are included in the following pages.

Natural Channel Design, Inc. Services Rendered

Task #	Description	Project Lump sum
1	Field Assessment	$12,452.00
2	Concept Design	$10,632.00
3	60% design	$12,872.00
4	Final Design	$12,872.00
5	Permit Application	$9,640.00
	Total:	**$58,468.00**

460.55451 008594.

ACCOUNT #~~661-5-5451-~~

AMOUNT: 9640

PO# Gulch + Riparian.

APPROVED BY:

OK to pay per Sheila

Natural Channel Design, Inc.

2900 N. West St. Suite 5
Flagstaff, AZ, 86004
928-774-2336

INVOICE

March 12, 2018

No: AG -04

March 12, 2018

Town of Payson

303 N. Beeline Highway
Payson, AZ 85541
Attn: Sheila DeSchaff

Project: **American Gulch Channel and Riparian Enhancement** **P.O. # 202128**

For Services Rendered: February 2018 through March 2018

RECEIVED
MAY 16 2018
TOWN OF PAYSON-FINANCE

Task #	Description	Project Lumpsum	% complete	Previously Billed	*Notes*	Invoice Amount
1	Field assessment	$12,452.00	100%	$12,452.00		$0.00
2	Concept Design	$10,632.00	100%	$10,632.00		$0.00
3	60% design	$12,872.00	100%	$12,872.00		$0.00
4	Final Design	$12,872.00	100%	$12,872.00		$0.00
5	Permit Application	$9,640.00	0%	$0.00		$9,640.00
	Total	$58,468.00	100%	$48,828.00		

Invoice Total **$9,640.00**

Thank you for the opportunity to participate in your project, we appreciate your business. Billing is due upon receipt. Please include invoice number on your check to assure proper posting.
All amounts not paid within 30 days of date of invoice will be subject to interest charges of 1.5% (18% per annum). If you have any questions, please call your project manager at (928) 774-2336. FED ID# 86-0405438.

Natural Channel Design, Inc.

2900 N. West St. Suite 5
Flagstaff, AZ, 86004
928-774-2336

INVOICE
January 4, 2018
No: Payson -03

Town of Payson

303 N. Beeline Highway
Payson, AZ 85541
Attn: Sheila DeSchaff
Project: American Gulch Channel and Riparian Enhancement
P.O. # 202128

For Services Rendered: October 2017 through December 2016

Task #	Description	Project Lumpsum	% complete	Previously Billed	*Notes*	Invoice Amount
1	Field assessment	$12,452.00	100%	$12,452.00		$0.00
2	Concept Design	$10,632.00	100%	$10,632.00		$0.00
3	60% design	$12,872.00	100%	$0.00		$12,872.00
4	Final Design	$12,872.00	80%	$0.00		$10,297.60
5	Permit Application	$9,640.00	0%	$0.00		$0.00
	Total	$58,468.00	79%	$23,084.00		
Invoice Total						**$23,169.60**

RECEIVED
MAR 05 2018
TOWN OF PAYSON-FINANCE

Thank you for the opportunity to participate in your project, we appreciate your business. Billing is due upon receipt. Please include invoice number on your check to assure proper posting.
All amounts not paid within 30 days of date of invoice will be subject to interest charges of 1.5% (18% per annum). If you have any questions, please call your project manager at (928) 774-2336. FED ID# 86-0405438.

ACCOUNT #~~001-5-5451~~ 460.55451.08594
AMOUNT: 23,169.60
PO# Gulch & Riparian Enhance.
APPROVED BY:

Natural Channel Design, Inc.

2900 N. West St. Suite 5
Flagstaff, AZ, 86004
928-774-2336

INVOICE
February 13, 2018
No: AG -03

Town of Payson

303 N. Beeline Highway
Payson, AZ 85541
Attn: Sheila DeSchaff
Project: **American Gulch** **P.O. # 202128**
Channel and Riparian Enhancement

For Services Rendered: October 2017 through February 2018

Task #	Description	Project Lumpsum	% complete	Previously Billed	*Notes*	Invoice Amount
1	Field assessment	$12,452.00	100%	$12,452.00		$0.00
2	Concept Design	$10,632.00	100%	$10,632.00		$0.00
3	60% design	$12,872.00	100%	$12,872.00		$0.00
4	Final Design	$12,872.00	100%	$10,297.60		$2,574.40
5	Permit Application	$9,640.00	0%	$0.00		$0.00
	Total	$58,468.00	84%	$46,253.60		
Invoice Total						**$2,574.40**

Thank you for the opportunity to participate in your project, we appreciate your business. Billing is due upon receipt. Please include invoice number on your check to assure proper posting.
All amounts not paid within 30 days of date of invoice will be subject to interest charges of 1.5% (18% per annum). If you have any questions, please call your project manager at (928) 774-2336. FED ID# 86-0405438.

460.5.5451.00.8594
ACCOUNT ~~#461-5-5451~~
AMOUNT: 2574.-
PO# Trust fund
APPROVED BY:

RECEIVED
FEB 21 2018
TOWN OF PAYSON-FINANCE

Natural Channel Design, Inc.

2900 N. West St. Suite 5
Flagstaff, AZ, 86004
928-774-2336

INVOICE
October 16, 2017
No: Payson -03

Town of Payson

303 N. Beeline Highway
Payson, AZ 85541
Attn: Sheila DeSchaff

Project: **American Gulch** **P.O. # 202128**
Channel and Riparian Enhancement

For Services Rendered: July 13 through October 13, 2017

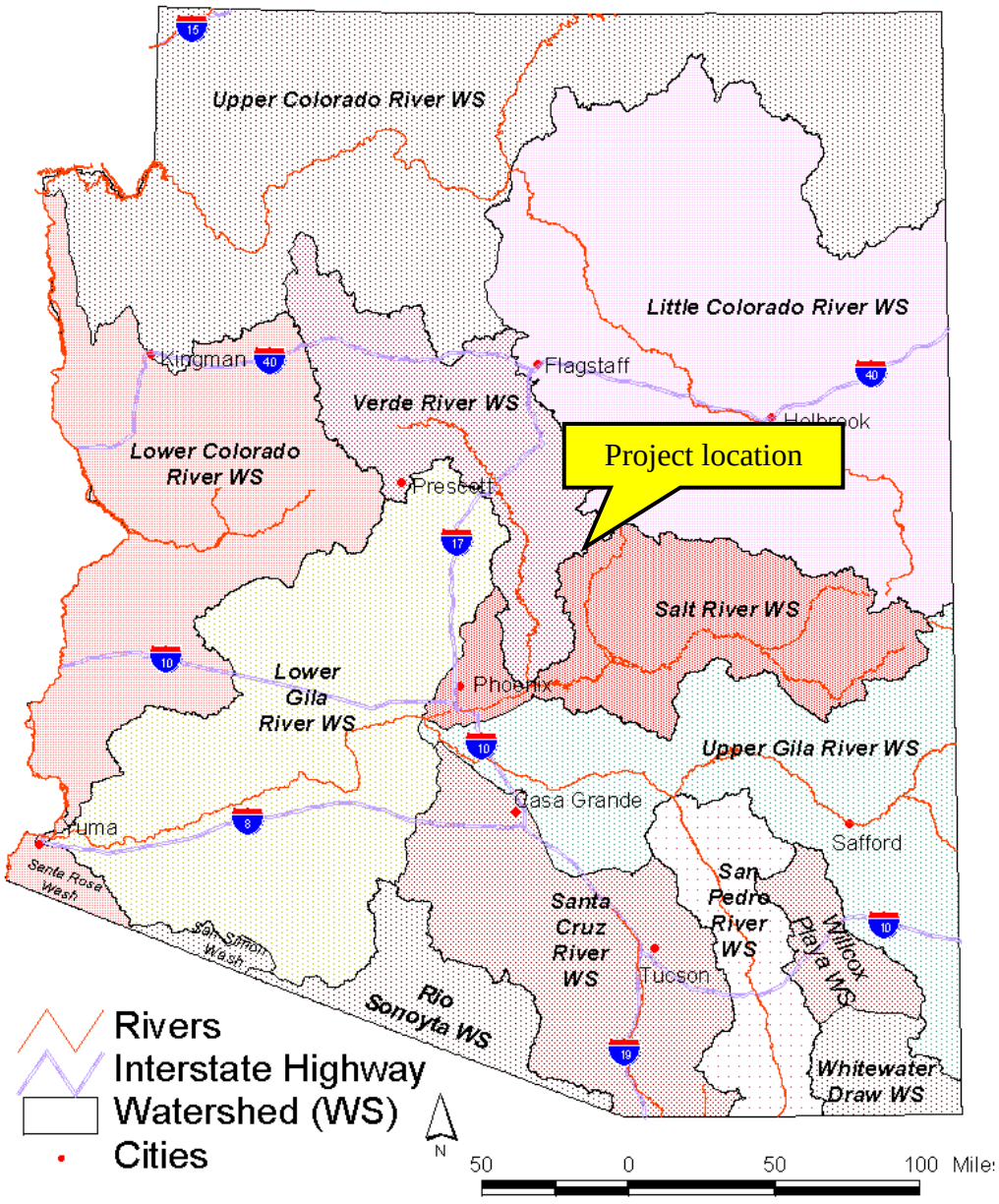
Task #	Weed	Project Lumpsum	% complete	Previously Billed	*Notes*	Invoice Amount
1	Field assessment	$12,452.00	100%	$0.00		$12,452.00
2	Concept Design	$10,632.00	100%	$0.00		$10,632.00
3	60% design	$12,872.00	0%	$0.00		$0.00
4	Final Design	$12,872.00	0%	$0.00		$0.00
5	Permit Application	$9,640.00	0%	$0.00		$0.00
	Total	$58,468.00	39%	$0.00		
Invoice Total						**$23,084.00**

Thank you for the opportunity to participate in your project, we appreciate your business. Billing is due upon receipt. Please include invoice number on your check to assure proper posting.
All amounts not paid within 30 days of date of invoice will be subject to interest charges of 1.5% (18% per annum). If you have any questions, please call your project manager at (928) 774-2336. FED ID# 86-0405438.

ACCOUNT # 460.5.5451.008594
AMOUNT: American Gulch
P.O.: 23084.00
APPROVED BY:

RECEIVED
OCT 18 2017
TOWN OF PAYSON-FINANCE

Project Maps and Schematic
Arizona Watershed Map
FY 2019



Title of Project: **American Gulch Channel and Riparian Enhancement**

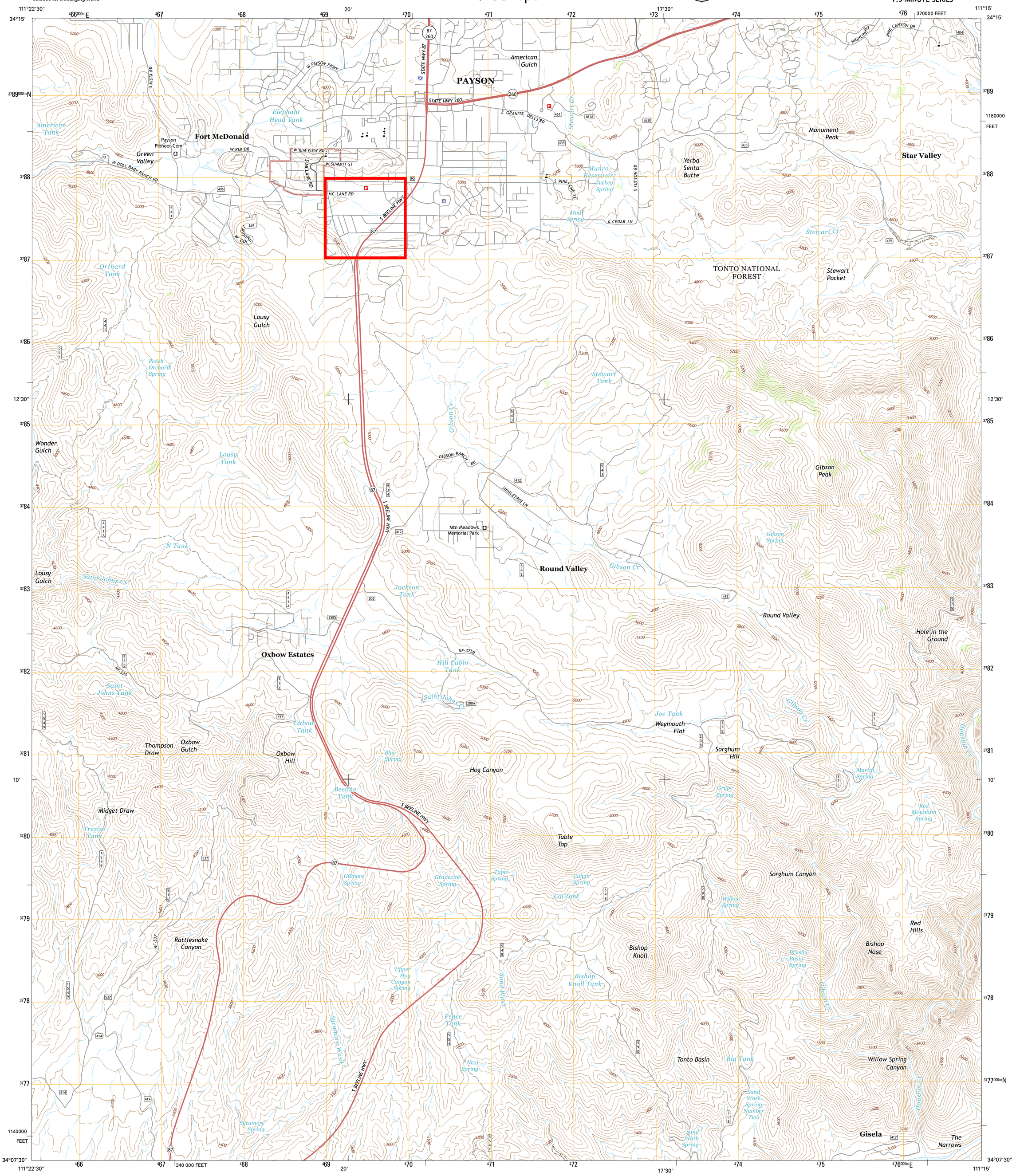
Location (include UTM's & Township/Range/Section)**:** **N34.23008 deg, W111.33007 deg; S9 T10N R10E**

(Location must include at least one Section delineation for large scale projects)

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

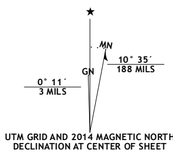
PAYSON SOUTH QUADRANGLE
ARIZONA-GILA CO.
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 12S
10 000-foot ticks: Arizona Coordinate System of 1983 (east zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2013
Roads..... HERE, ©2013
Roads within US Forest Service Lands.....FSTopo Data with limited Forest Service updates, 2013
Names.....GNIS, 2013
Hydrography.....National Hydrography Dataset, 2013
Contours.....National Elevation Dataset, 2003
Boundaries.....Multiple sources; see metadata file 1972 - 2014
Public Land Survey System.....BLM, 2011



UTM GRID AND 2014 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000-m Square ID
VC
Grid Zone Designation
12S

SCALE 1:24 000

1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.16

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

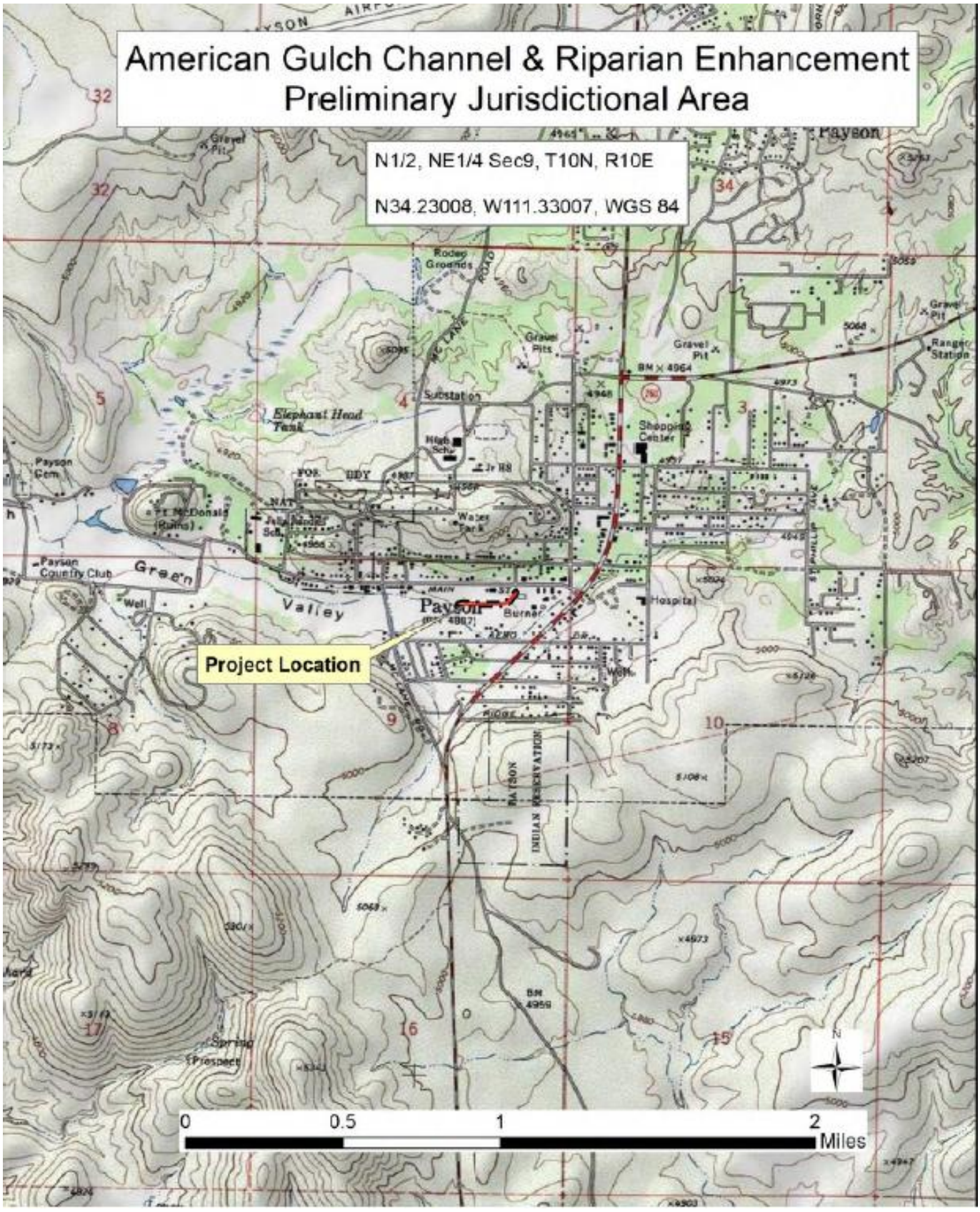
ADJOINING QUADRANGLES
1 Buckhead Mesa
2 Payson North
3 Diamond Point
4 North Peak
5 McDonald Mountain
6 Mazatzal Peak
7 Gisela
8 Sheep Basin Mountain

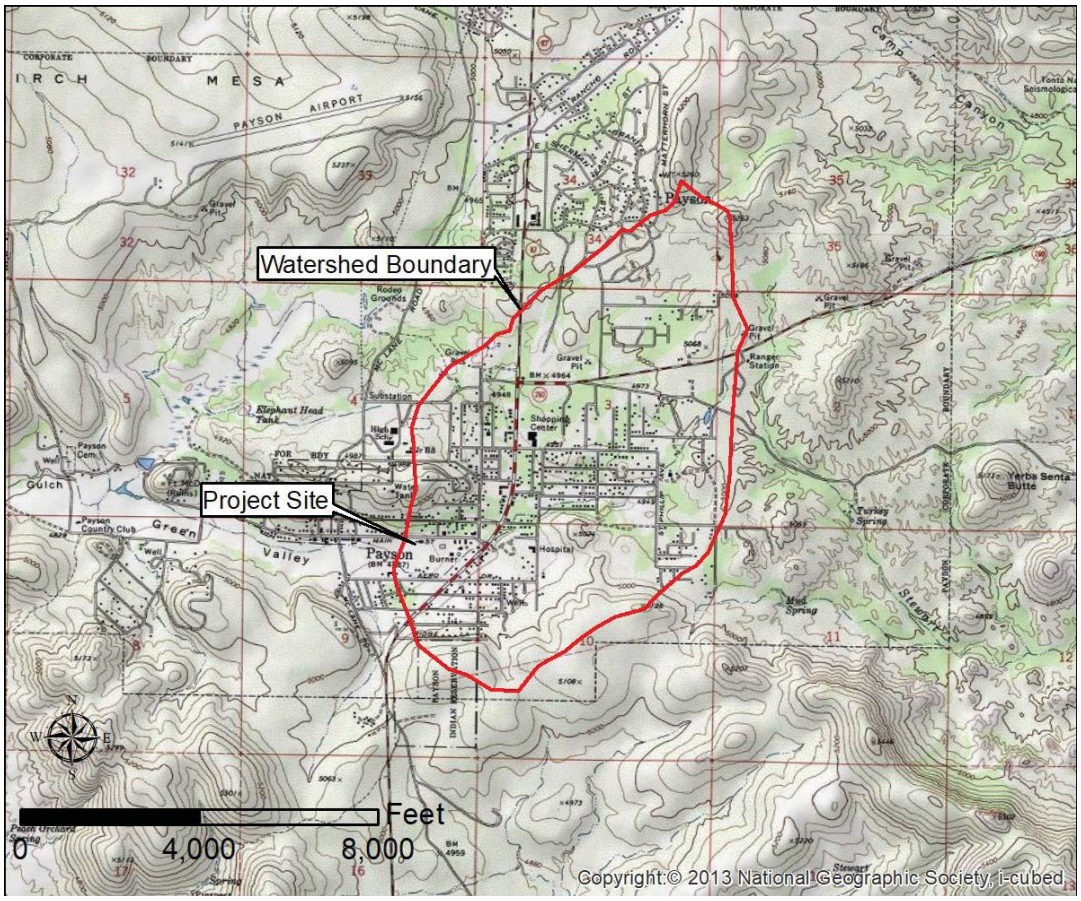
ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route
FS Primary Route
FS Passenger Route
FS High Clearance Route

Check with local Forest Service unit for current travel conditions and restrictions.

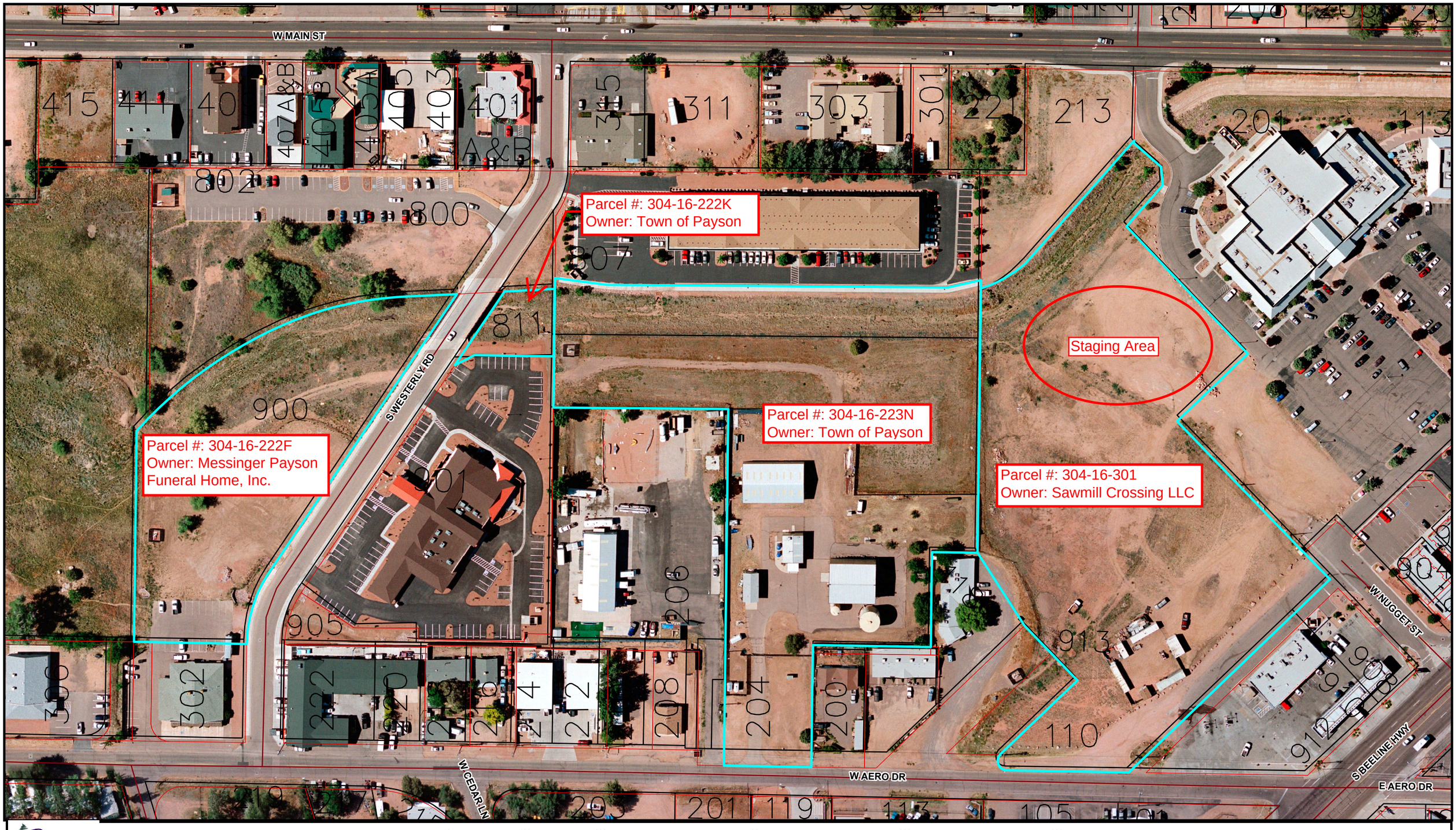
PAYSON SOUTH, AZ
2014

NSN. 7643016354807
NGA REF NO. USGSX24K34501


American Gulch Channel & Riparian Enhancement
Preliminary Jurisdictional Area
N1/2, NE1/4 Sec9, T10N, R10E
N34.23008, W111.33007, WGS 84
Project Location
Payson
Elephant Head Tank
Payson Country Club
Green Valley
Shopping Center
Hospital
Ranger Station
Gravel Pit
Rodeo Grounds
Water Tank
Ft. McDonald (Ruins)
Spring
Prospect
0
0.5
1
2
Miles


Watershed Boundary
Project Site
Feet
0
4,000
8,000
Copyright © 2013 National Geographic Society, i-cubed


American Gulch Project Area
Project extent from Westerly Road upstream to Meadows Street
Legend
Project Area
W Main St
Payson
S Westerly Rd
W Aero Dr
E Aero Dr
W Cedar Ln
E Cedar Ln
N
800 ft



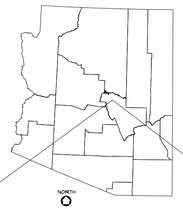
Payson
303 North Beeline Highway
Payson, Arizona 85541
(928) 474-5242 www.paysonaz.gov

1:1,384 0 100 200 400 600 800 Feet

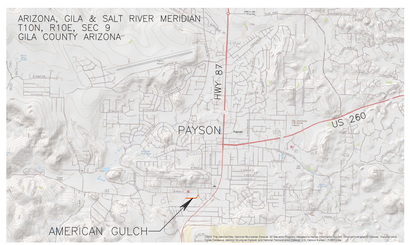
This map has been provided for informational purposes only and is not accurate for engineering design. Every effort has been made to ensure this map is as accurate as possible. The Town of Payson shall assume no liability for the base information contained in this map.

N

AMERICAN GULCH
CHANNEL AND RIPARIAN ENHANCEMENT
SAWMILL CROSSING TO WESTERLY ROAD
GILA COUNTY, ARIZONA



VICINITY MAP:



CALL ARIZONA BLUE STAKE TWO WORKING DAYS BEFORE YOU DIG DIAL 8-1-1

ANY UNDERGROUND UTILITIES LOCATIONS DEPICTED ON THE PLANS ARE TO BE CONSIDERED APPROXIMATE ONLY. THE UTILITY LOCATIONS (IF SHOWN) WERE PLOTTED FROM A COMBINATION OF FIELD DATA, RECORD DATA, LANDOWNER INFORMATION, AND UTILITY MAPS PROVIDED BY OTHERS, AND MAY NOT REFLECT ALL EXISTING UTILITIES OR THE EXACT LOCATION. LOCATION OF ALL EXISTING UTILITIES SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF AND ANY DAMAGE TO EXISTING UTILITIES. CALL BEFORE YOU DIG (DIAL "811" OR "1-800-STAKE-IT").

PLAN LEGEND:

EXISTING FEATURES

- PARCEL BOUNDARY (APPROX)
- EXISTING MAJOR CONTOUR (5 FT)
- EXISTING MINOR CONTOUR (1 FT)
- PROPOSED MAJOR CONTOUR (5 FT)
- PROPOSED MINOR CONTOUR (1 FT)
- ROAD EDGES (APPROX)
- EXISTING GROUND
- RIP RAP
- ROCK VANE
- CROSS VANE WEIR
- EXISTING CULVERT
- PYRAMAT 25
- PYRAMAT 75

ABBREVIATIONS:

~	APPROXIMATELY	LF	LINEAR FEET
@	AT	LS	LUMP SUM
AB	AGGREGATE BASE	LWC	LOW WATER CROSSING
AC	ACRE	MAX	MAXIMUM
ACP	ASPHALT CONCRETE PAVEMENT	M.E.	MATCH EXISTING
APPROX	APPROXIMATELY	MIN	MINIMUM
BNK	BANKFULL	MISC	MISCELLANEOUS
BOP	BOTTOM OF POOL	MPT	MALE PIPE THREAD
BOR	BOTTOM OF RIFFLE	N/A	NOT APPLICABLE
BOT	BOTTOM OF TRENCH	NCD	NATURAL CHANNEL DESIGN, INC.
CC	CENTER TO CENTER	NO.	NUMBER
CFS	CUBIC FEET PER SECOND	NTS	NOT TO SCALE
CL	CENTER LINE	OC	ON CENTER
CLSM	CONTROLLED LOW STRENGTH MATERIAL	PE	LOW DENSITY POLYETHYLENE
CMP	CORRUGATED METAL PIPE	PROP.	PROPOSED
CONC	CONCRETE	PSI	POUNDS PER SQUARE INCH
CP	CONTROL POINT	PVC	POLYVINYL CHLORIDE
CY	CUBIC YARD	R	RADIUS
DIA	DIAMETER	REQD	REQUIRED
DIPS	DUCTILE IRON PIPE SIZE	RC	ROCK CLUSTER
DR	DIMENSION RATIO	SCH	SCHEDULE
DTL	DETAIL	SF	SQUARE FEET
DWG	DRAWING	SHT	SHEET
EA	EACH	SS	STAINLESS STEEL
ELEV	ELEVATION	STA	STATION
EX	EXISTING	STD	STANDARD
FG	FINISHED GRADE ELEVATION	SY	SQUARE YARD
FL	FLOWLINE ELEVATION	SYMM	SYMMETRICAL
FPT	FEMALE PIPE THREAD	TBD	TO BE DETERMINED
FT	FEET	TOCV	TOP OF CROSS VANE
FTG	FITTING	TOG	TOP OF GLIDE
GA	GAUGE	TOP	TOP OF POOL
GALV	GALVANIZED	TOR	TOP OF RIFFLE
GB	GRADE BREAK	TOT	TOP OF TRENCH
GPM	GALLONS PER MINUTE	TN	TONS
H	HEIGHT	TRIB	TRIBUTARY
HDPE	HIGH DENSITY POLYETHYLENE	TYP	TYPICAL
IE	INVERT ELEVATION	VLV	VALVE
IN.	INCH	W	WIDTH
IPS	IRON PIPE SIZE	W/	WITH
L	LENGTH	WCS	WATER CONTROL STRUCTURE
LB	POUNDS	WSE	WATER SURFACE ELEVATION

PREPARED FOR:

TOWN OF PAYSON
ENGINEERING DEPARTMENT
303 N. BEELINE HIGHWAY
PAYSON, AZ 85541

PREPARED BY:

NATURAL CHANNEL DESIGN, INC.
2900 N. WEST STREET #5
FLAGSTAFF, AZ 86004
PHONE: (928) 774-2336

SHEET INDEX:

MATERIALS QUANTITY ESTIMATE

MATERIAL	QUANTITY	UNIT
30 IN. FEATURE ROCKS	128	EA
24 IN. FEATURE ROCKS	75	EA
18 IN. FOOTER ROCKS	301	EA
D50 14 IN. RIP RAP	68.1	CY
D50 8 IN. RIP RAP	20.3	CY
CHANNEL SUBSTRATE	722	CY
GEOTEXTILE FABRIC	325	SY
PYRAMAT75	202	SY
PYRAMAT25	2072	SY
TREES	17	EA
LARGE SHRUB	43	EA
SMALL SHRUBS & FORBS	72	EA
SHRUB WILLOW	22	EA
GRASS & SEDGE PLUGS	100	EA
RESEEDING	2	ACRE
EARTHWORK CUT	1839	CY
EARTHWORK FILL	182	CY

PROJECT GENERAL NOTES

1. Site survey data was collected by NCD in August, 2017. Topographic survey was limited to the channel bottom, side slopes and along the top of bank from approximately Meadows St. to Westerly Road.
2. All stationing shown refers to baseline of construction along the new thalweg of the channel bottom and is measured horizontal distance.
3. 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 utilities are not present. The existence, location and depth of any utility must be determined by the contractor prior to any excavation. CALL BEFORE YOU DIG, Arizona Blue Stake at 811 or 1-800-STAKE-IT.
4. Construction activities will be conducted in a manner consistent with all safety regulations, and other permitting required by the Town of Payson, Gila County, the USACOE and others.
5. Installation shall be constructed to the lines and grades as shown on the drawings.
6. The project is located within a dynamic river system and changes may have occured between the time of design and the beginning of construction. As such, the contractor shall familiarize himself with the plans and immediately report variances between these plans and conditions at the project site to the engineer for resolution prior to construction and be responsible for discrepancies not so reported and resolved.
7. Unless otherwise specifically noted within the plans or details herein, all materials and workmanship shall comply with the current "M.A.G. Uniform Standard Specifications and Details for Public Works Construction". All work and materials which do not conform to the standards and specifcation are subject to removal and replacement at the contractor's expense. Where conflict exists between MAG specifications and notes or specification, contractor shall contact the engineer for clarification.
8. Contractor shall coordinate with the project owner (Town of Payson) for location of temporary construction yards and use of the property outside the limits of construction depicted within these plans.
9. Construction contractor shall, in accordance with generally accepted construction practices, assume sole and complete responsibility for the job site conditions during the course of construction of the project, including safety of all persons and property. This requirement shall be made to apply continuously and not be limited to only the normal working hours.

EARTHWORK

> The earthwork activities shall consist of excavation for channel shaping, bank sloping, over-excavation related to the installation of new rock vane/weir structures, for toe rock bank protection and for riprap outlet protection at existing CMP pipes.

Excavation

> Excavation shall include earth removal for shaping bankfull channel, and trenching in preparation for rock structures and for riprap areas. Disturbance of existing native vegetation shall be minimized to the greatest extent possible. All finished surfaces shall be generally smooth and pleasing in appearance.

Earthfill

> Materails: All fill materials shall be obtained from the required excavations and/or approved borrow sources and comply with MAG Specifcations and the requirements provided in the geotechnical report for this project.

Excess Excavation (Export Materails)

> The contractor shall be responsible for locating a suitable site for disposal of excess excavation materials. consult with Town of Payson for appropriate disposal and dispose of said materials in full compliance with provisions with any applicable permits for this project. Any costs associated with hauling and disposing of excess materials shall be included in the unit costs of cut/fill.

Topsoil

> Topsoil is called for within these plans for seedbed preparation over Pyramat turf reinforcement mat. Topsoil shall be imported to the site and meet the requirements as specificed within MAG Section 795. The purpose of the topsoil layer is to provide a suitable seedbed on top of the TRM prior to placement of final hydroseed treatment.

Topsoil shall be spread with hand tools across the TRM and provide approximately 1 inch of cover over the artificial TRM surface. Care shall be taken when spreading topsoil not to damage TRM or loosen stakes or securing pins.

Volume Estimates

> Estimated earthwork volumes provided within the quantity summary do not account for over-excavation as may be required for below grade rock structures or rip rap excavations. Excavation costs related to the construction of those items shall be considered incidental to the specific item and accounted for in the unit costs thereof.

> Overall earthwork quantities provided account for: channel excavation and shaping to finished grades.

> No accounting is made in volume estimates for the shrink or swell of earthwork between excavation and filling or stockpiling. Contractor shall be aware of this and make adjustments as necessary for hauling estimates or other related costs.

Material Quantities Estimate

An estimate of material quantities is included on this sheet for the convenience of the contractor. As this project is within a dynamic stream channel, subject to change in a natural environment and that naturally sourced, inexact materials (rocks, boulders, etc.) are to be used in the construction of in-stream features, the quantities provided are to be regarded as approximate only.

TURF REINFORCEMENT MAT

> Turf Reinforcement Mat (TRM) has been specified to be placed in portions of the project to provide stability to the bankfull bench area and prevent scour during larger flow events. TRM shall be 'Pyramat 75' and 'Pyramat 25' as shown within the included plans and details.

> Details are included herein relative to the installation of the TRM. All other aspects of installation no specifically shown or detailed witin these plans shalll be per the manufacturer's recommendations and installation details.

> Quantity of TRM fabric does not include anchor trenching and overlapping. Check with manufacturer before ordering to obtain the correct amount of fabric.

RIPRAP AND FEATURE ROCK AT IN-STREAM STRUCTURES

The work associated with the construction of the riprap scour pads at storm pipe outlets, rock vane weirs, rock vanes and and toe rock shall consist of furnishing all materials and installing loose rock and filter fabric where specified.

> Non-woven geotextile shall be placed behind the rock. Fabric shall have the properties as specified in Table 796-3 in MAG Section 796. The geotextile shall be placed per MAG Section 220.4. Securing pins shall be installed as necessary to prevent undue slippage or movement of the geotextile. Pins shall be 3/16-inch steel bars, pointed on one end and fabricated with a head to retain a steel washer. (1.5-inch diameter). Pin length shall be not less than 18 inches. U-shaped pins of said length are also acceptable.

> Rock shall be angular, dense, sound and free from cracks, seams, or other defects conducive to accelerated weathering and meet the requirements of MAG Section 703. The least dimension of an individual rock shall not be less than one-third the greatest dimension. Rock source shall be approved by the ENGINEER or authorized Town of Payson representative and have a bulk specific gravity of not less that 2.5 per ASTM C127. Rock shall be well graded with a D50 dimension as specified within the constrcution call-out note for each location.

> Rock placement shall begin at the bottom of slopes. Rock shall not be dropped more than 3 feet onto geotextile.

> Rock rip-rap used in the construction shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

> All erosion control rock shall be keyed-in such that finish rock surfaces conform to the plan sections and details included herein. Local surface irregularities of the erosion protection on the scour pad and bank slopes from the planned elevations shall not vary by more than 3 inches. The depth of erosion control material shall be no less than 24" as measured at right angles from the subgrade surface slope.

POLLUTION CONTROL/BMPs

> Total disturbance area related to the improvements shown herein is estimated to be less than 1.0 acre. As such, a SWPPP plan is not included herein nor is it anticipated to be required through ADEQ. Regardless, the contractor will still be required to adhere to industry standards of practice and employ Best Management Practices (BMPs) as necessary to minimize erosion and ensure that air and water pollution are minimized and held within legal limits. Any cost associated with the use of BMP's shall be considered incidental to the project as a whole.

> Transportation routes for materials, personnel, and equipment to, from, and within the project shall be limited to existing roads, the work areas identified with these plans and as otherwise approved by the Town of Payson at the time of construction. The contractor will coordinate with the Town of Payson to ensure that access across any adjacent properties is approved by a cooperating property owner, prior to utilizing that access.

> Contractor shall be responsible for all costs associated with the implementation of BMPs associated with storage and/or disposal of excess excavation materials if necessary. Such costs shall be considered incidental to the project as a whole.

> Contractor shall ensure that vehicles and equipment leaving the site and entering Town, County or State governed roads are clean and free of excess mud and debris and that loads are properly covered. Contractor will be responsible for installing track-out pads, if necessary and depending upon the soil moisture condition at the time of construction, to prevent tracking of mud onto those public roads.

WORK AREA & LEGAL ACCESS

> The work presented within these plans extends across Town of Payson property and into adjacent, privately held parcels. It will be the responsibility of the Town of Payson to secure the necessary agreements and/or temporary construction easements, and/or permanent easements, as necessary to perform the work outside of town-held properties. Contractor shall coodinate with the Town of Payson to verify legal access to any areas not identified as Town of Payson property. Approximate parcel lines are shown within the included plans.

CALL ARIZONA BLUE STAKE TWO WORKING DAYS BEFORE YOU DIG DIAL 8-1-1

DRAWING NUMBER: CVR01

SHEET NUMBER: 1 OF 10

UNAUTHORIZED CHANGES & USES: THE ENGINEER PREPARING THESE PLANS FOR THIS PROJECT IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

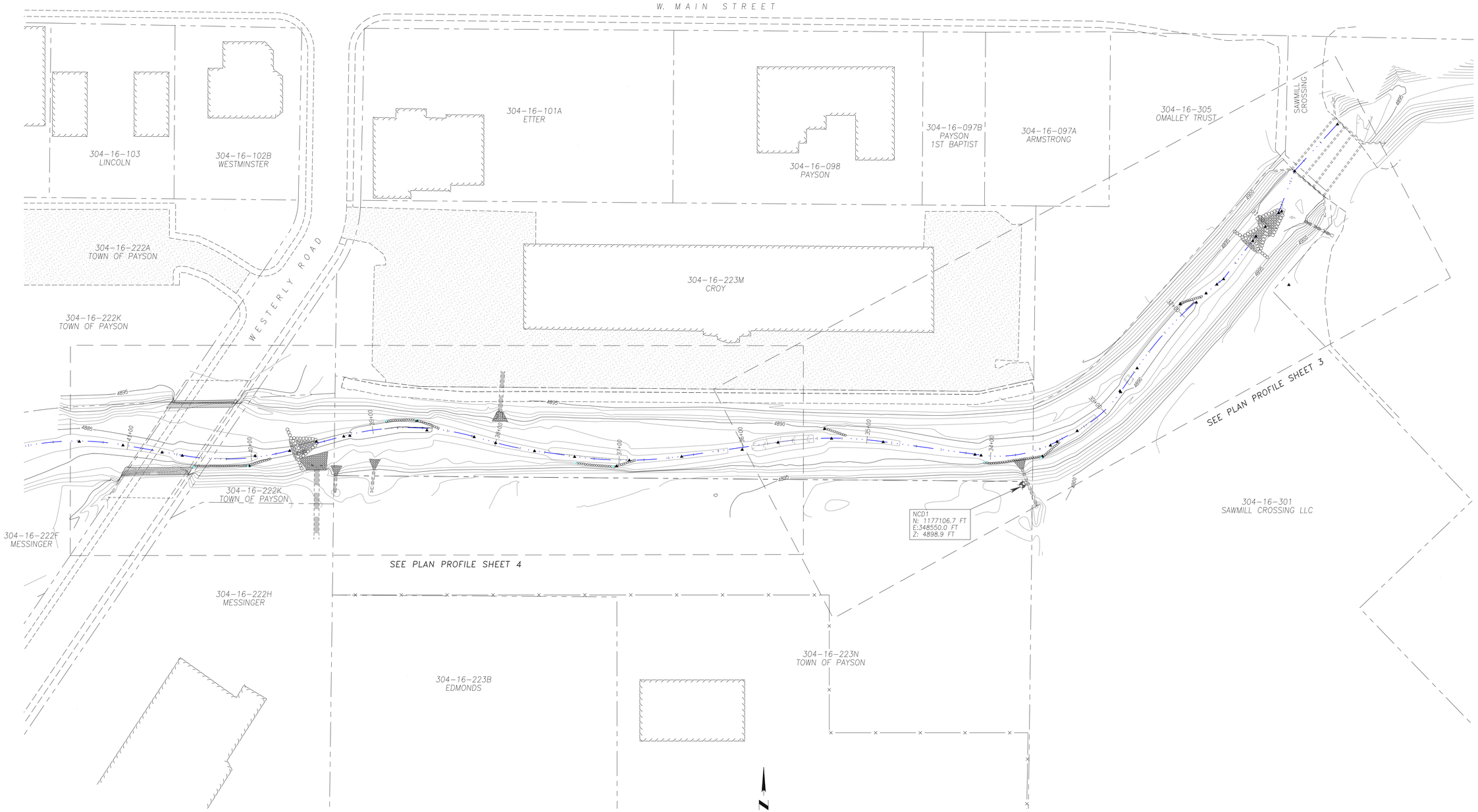
DRAWN BY: CS, JF, MW, AH
DESIGNED BY: MK, AH
CHECKED BY: MK, AH

NO.	DATE	BY	REVISION

COVER, LOCATION MAP, SPECIFICATIONS AND LEGEND

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



PROJECT OVERVIEW AND SURVEY CONTROL

HORIZONTAL SCALE 1"=40'
0 20 40

1. Site survey data was collected by NCD in August, 2017. Topographic survey was limited to the channel bottom, side slopes and along the top of bank from approximately Meadows St. to Westerly Road.
2. All stationing shown refers to baseline of construction along the new thalweg of the channel bottom and is measured horizontal distance.

SURVEY INFORMATION

DATUM & COORDINATE GRID INFORMATION

COORDINATE PROJECTION:	NORTH AMERICAN DATUM 1983 (NAD83)
HORIZONTAL DATUM:	ARIZONA STATE PLANE ARIZONA EAST, SURVEY FEET
VERTICAL DATUM:	NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)
GEOID MODEL:	GEOID09 (CONUS)

CONTROL POINT LIST

NAME	NORTHING	EASTING	ELEVATION	DESCRIPTION
ES0281	1177259.1	350049.0	4919.7	DISC SET IN BOULDER [1,3]
ES0743	1172983.4	347609.5	5008.20	GS DISC IN BEDROCK [1,3]
NCD1	1177106.7	348550.0	4898.9	3/8" REBAR W/ YELLOW CAP [2]

[1] NGS BENCHMARK
[2] YELLOW CAP MARKED "NATURAL CHANNEL"
[3] NOT SHOWN / OUTSIDE LIMITS OF PLAN VIEW SHOWN.

NOTE: LAYOUT CONTROL FOR CHANNEL IMPROVEMENTS AND STRUCTURE ARE PROVIDED ON SHEET 6. GENERAL SURVEY INFORMATION IS PROVIDED ABOVE.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER WHO PREPARED THE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

SHEET NAME: OVR01

SHEET NUMBER: 2 OF 10

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

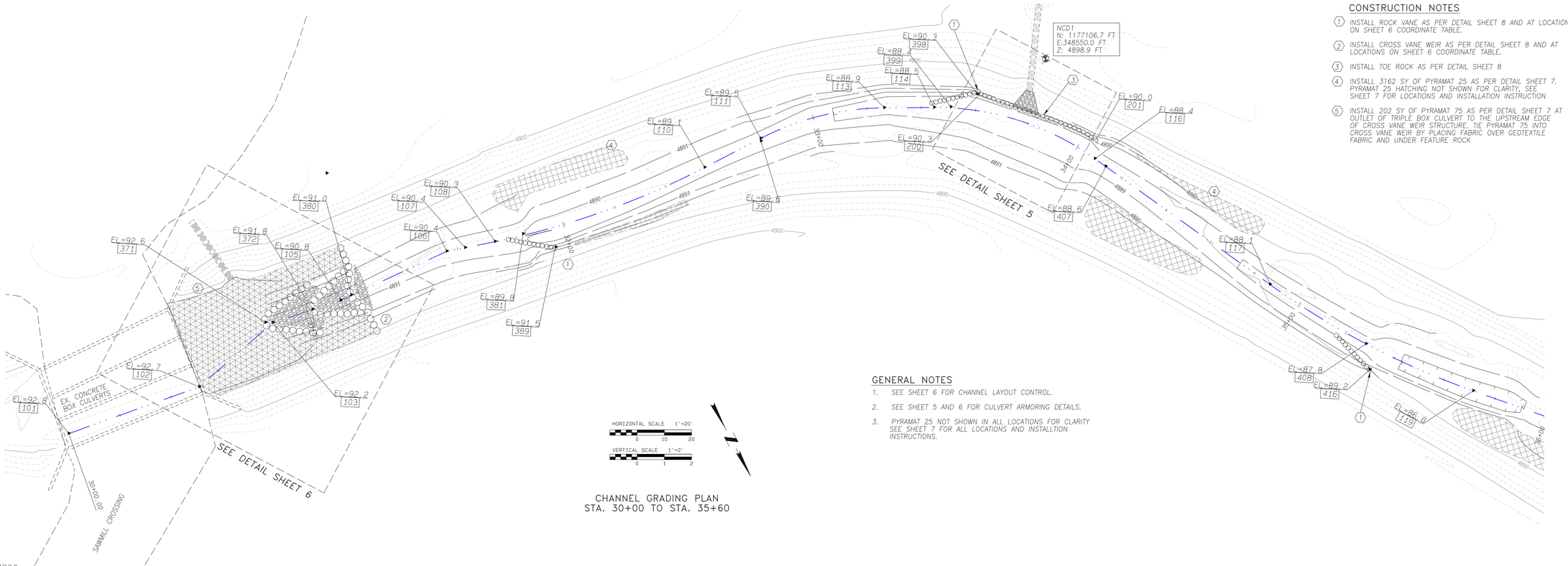
PROJECT OVERVIEW

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: CS, JF, MW
DESIGNED BY: MK
CHECKED BY:

NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



CHANNEL GRADING PLAN
STA. 30+00 TO STA. 35+60

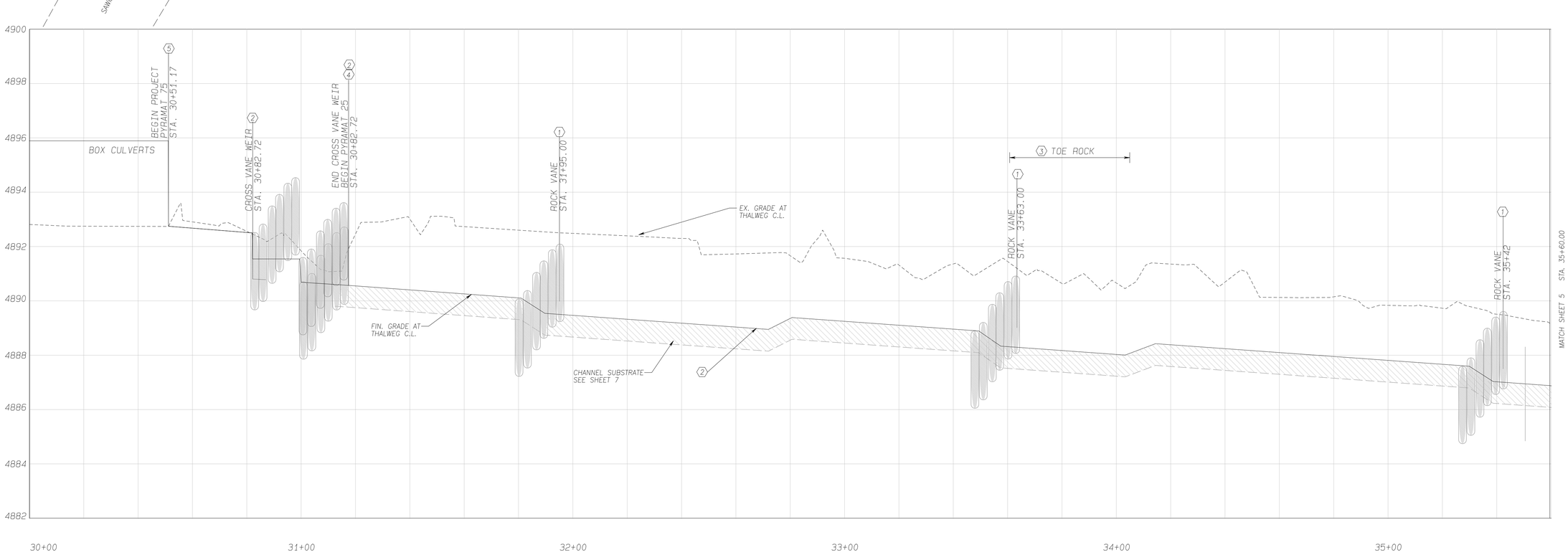
HORIZONTAL SCALE 1"=20'
0 10 20
VERTICAL SCALE 1"=2'
0 1 2

CONSTRUCTION NOTES

1. INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.
2. INSTALL CROSS VANE WEIR AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.
3. INSTALL TOE ROCK AS PER DETAIL SHEET 8
4. INSTALL 3162 SY OF PYRAMAT 25 AS PER DETAIL SHEET 7. PYRAMAT 25 HATCHING NOT SHOWN FOR CLARITY, SEE SHEET 7 FOR LOCATIONS AND INSTALLATION INSTRUCTION
5. INSTALL 202 SY OF PYRAMAT 75 AS PER DETAIL SHEET 7 AT OUTLET OF TRIPLE BOX CULVERT TO THE UPSTREAM EDGE OF CROSS VANE WEIR STRUCTURE. TIE PYRAMAT 75 INTO CROSS VANE WEIR BY PLACING FABRIC OVER GEOTEXTILE FABRIC AND UNDER FEATURE ROCK

GENERAL NOTES

1. SEE SHEET 6 FOR CHANNEL LAYOUT CONTROL.
2. SEE SHEET 5 AND 6 FOR CULVERT ARMORING DETAILS.
3. PYRAMAT 25 NOT SHOWN IN ALL LOCATIONS FOR CLARITY SEE SHEET 7 FOR ALL LOCATIONS AND INSTALLTION INSTRUCTIONS.



CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR.

DATE: **15 DECEMBER 2017**

SHEET NAME: **PLN01**

SHEET NUMBER: **3** OF **10**

NCD PROJECT NUMBER: **17-283AZ**

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

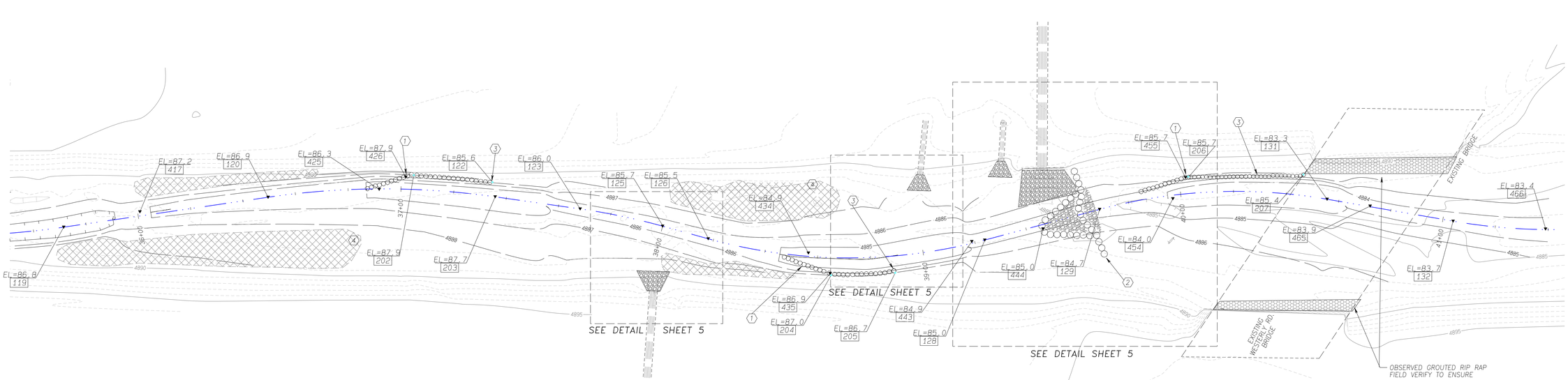
CHANNEL PLAN & PROFILE STA.30+00 TO 35+60

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

NO.	DATE	BY	REVISION

DRAWN BY: CS, JF, MW, AH
DESIGNED BY: **MK**
CHECKED BY: MK, AH

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



CHANNEL GRADING PLAN
STA. 35+60 TO STA. 41+63.74

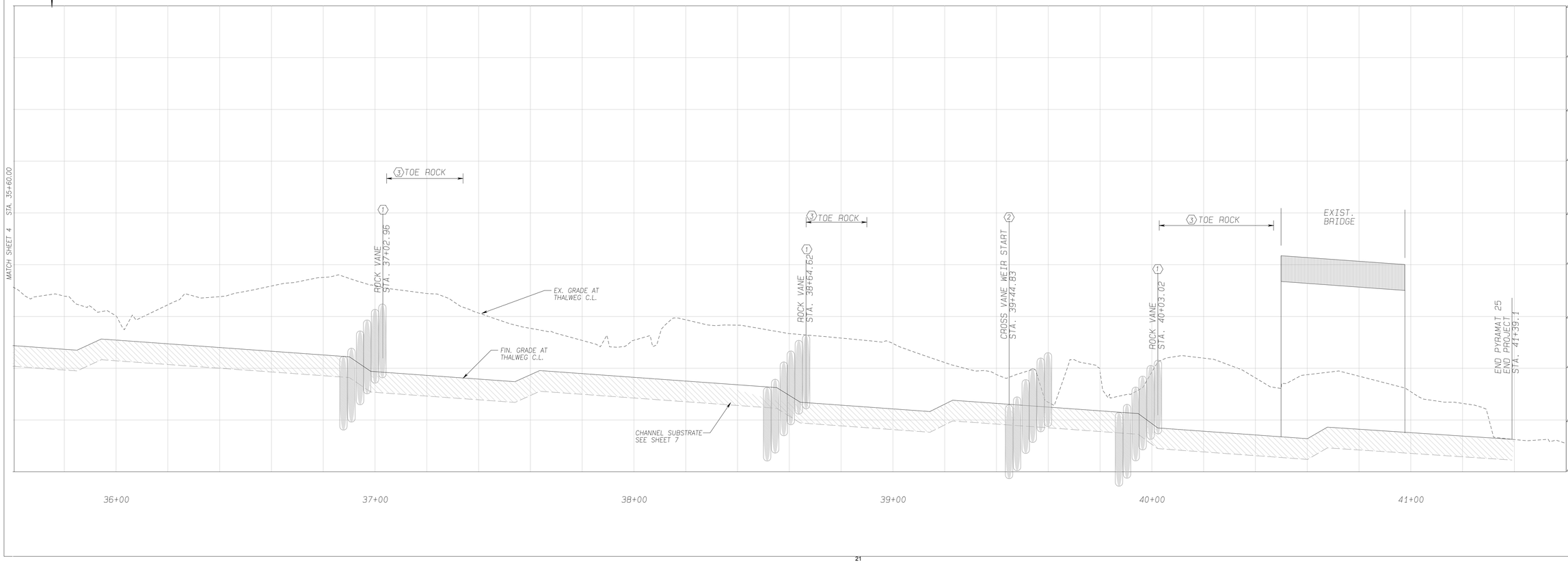
HORIZONTAL SCALE 1"=20'
0 10 20
VERTICAL SCALE 1"=2'
0 1 2

CONSTRUCTION NOTES

1. INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE
2. INSTALL CROSS VANE WEIR AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE
3. INSTALL TOE ROCK AS PER DETAIL SHEET 8
4. INSTALL 3162 SY OF PYRAMAT 25 AS PER DETAIL SHEET 7. PYRAMAT 25 HATCHING NOT SHOWN FOR CLARITY, SEE SHEET 7 FOR LOCATIONS AND INSTALLATION INSTRUCTION

GENERAL NOTES

1. SEE SHEET 6 FOR CHANNEL LAYOUT CONTROL.
2. SEE SHEET 5 AND 6 FOR CULVERT ARMORING DETAILS.
3. PYRAMAT 25 NOT SHOWN IN ALL LOCATIONS FOR CLARITY SEE SHEET 7 FOR ALL LOCATIONS AND INSTALLTION INSTRUCTIONS.



CALL ARIZONA BLUE STAKE 811 OR 1-800-782-5348 BEFORE YOU DIG
8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL SUCH CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR.

DATE: 15 DECEMBER 2017

SHEET NAME: PLN02

SHEET NUMBER: 4 OF 10

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

CHANNEL PLAN & PROFILE STA.35+60 TO 41+63.74

AMERICAN GULCH CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT

TOWN OF PAYSON

DRAWN BY: CS, JF, MW, AH
DESIGNED BY: MK, AH
CHECKED BY: MK, AH

NO.	DATE	BY	REVISION

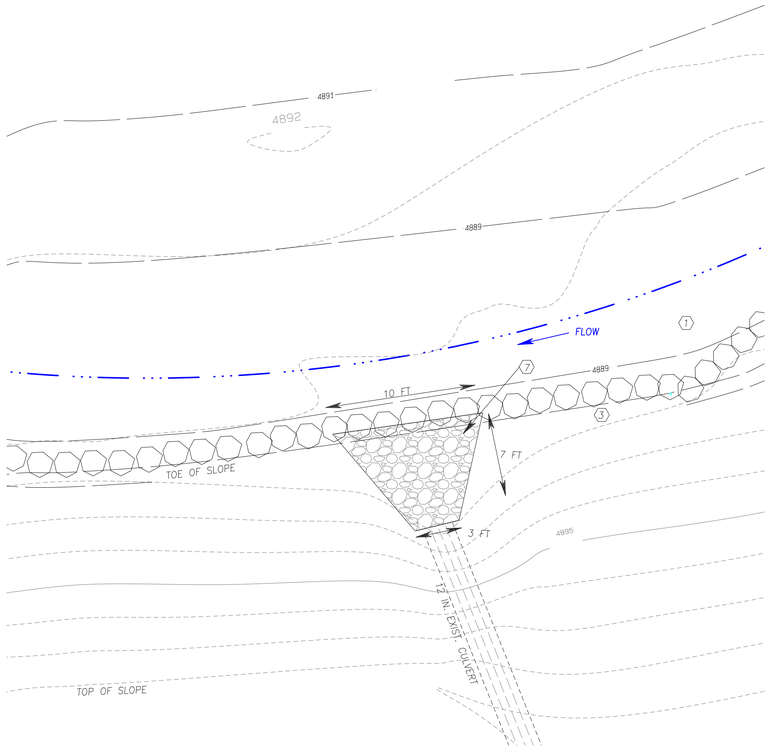
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

RIP RAP CULVERT OUTLET PROTECTION STA 33+76 LEFT

(1) INSTALL ROCK VANE AS PER DETAIL SHEET 9 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE

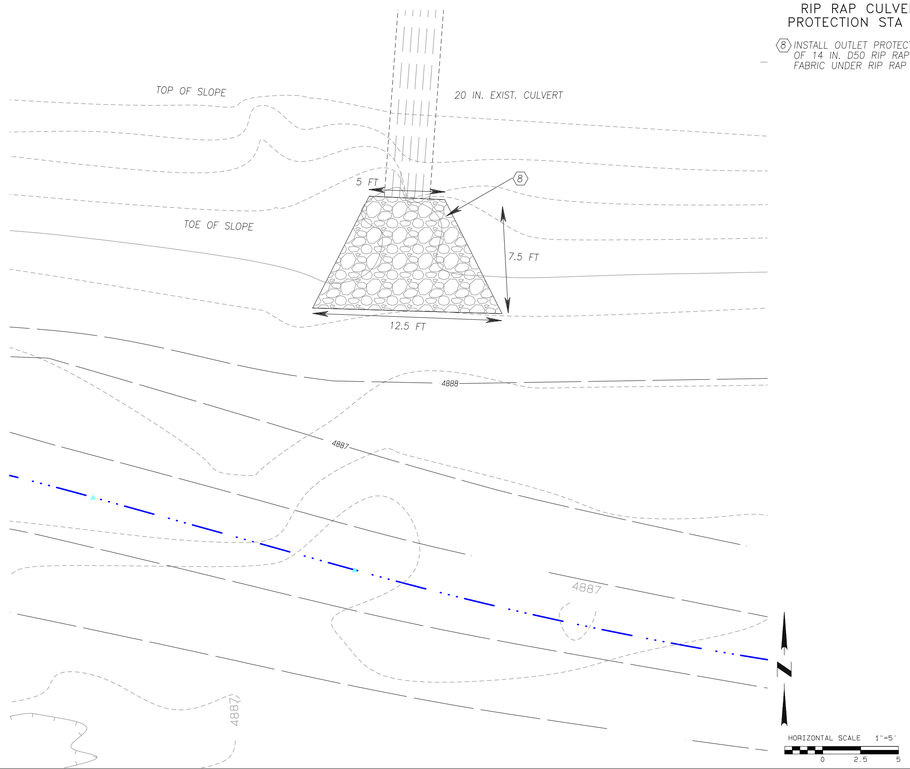
(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(7) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 8 CY OF 14 IN. D50 RIP RAP AND PLACE 5 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 38+03 RIGHT

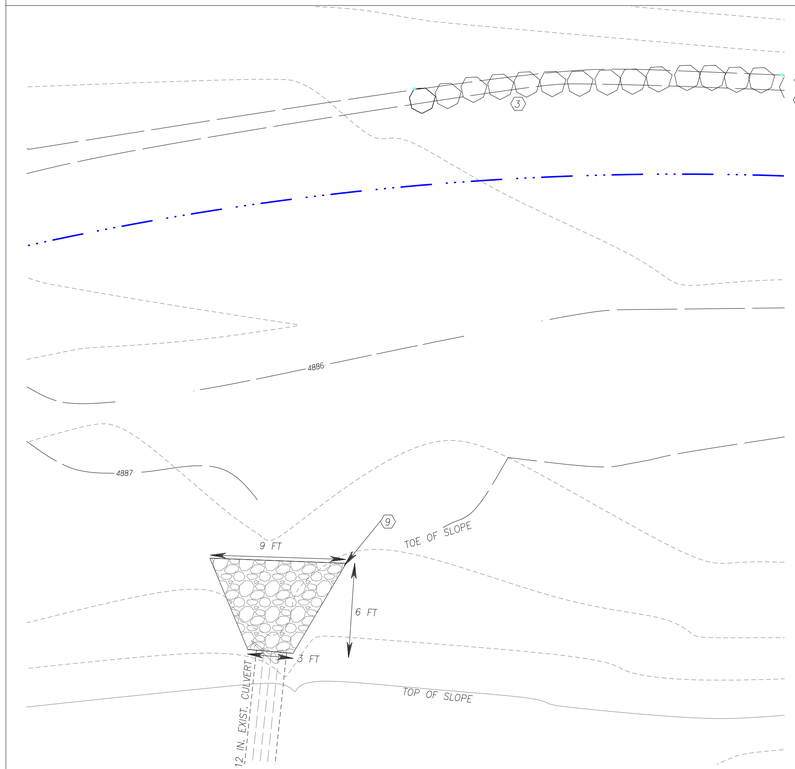
(8) INSTALL OUTLET PROTECTION FOR 18 IN. PIPE USING 11 CY OF 14 IN. D50 RIP RAP AND PLACE 7 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 39+03 LEFT

(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(9) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 6 CY OF 14 IN. D50 RIP RAP AND PLACE 4 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 39+37 LEFT

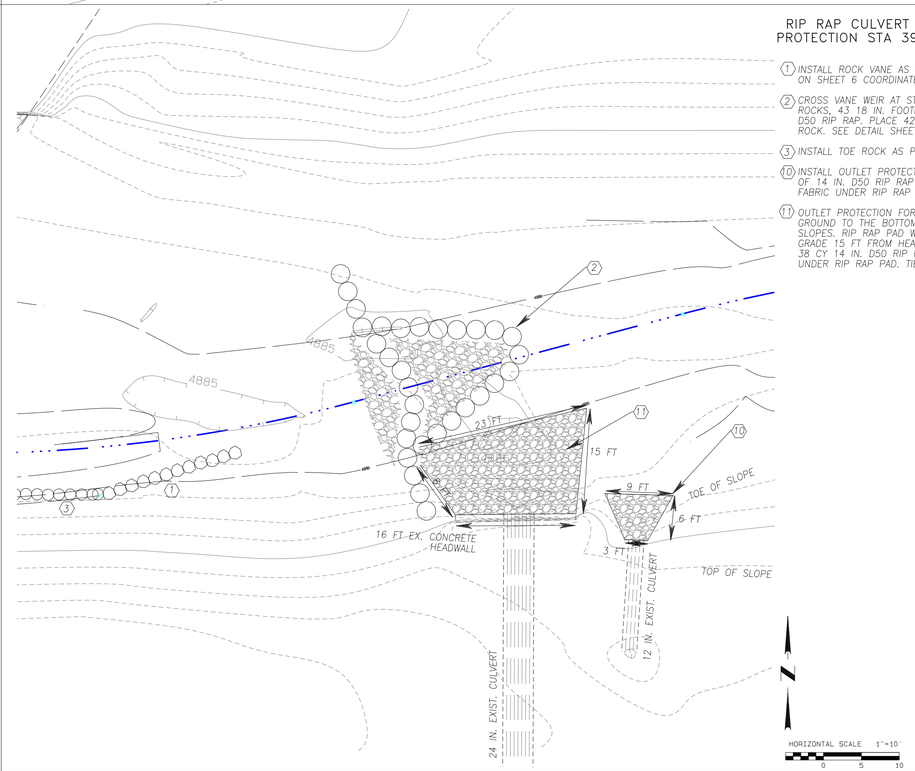
(1) INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.

(2) CROSS VANE WEIR AT STA. 39+45, 26 30 IN. FEATURE ROCKS, 43 18 IN. FOOTER ROCK AND 12 CY OF 8 IN. D50 RIP RAP. PLACE 42 SY OF GEOTEXTILE FABRIC UNDER ROCK. SEE DETAIL SHEET 8.

(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(10) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 6 CY OF 14 IN. D50 RIP RAP AND PLACE 4 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.

(11) OUTLET PROTECTION FOR ARCH CULVERT. FILL FROM EXISTING GROUND TO THE BOTTOM OF THE HEADWALL AND TIE TO SIDE SLOPES. RIP RAP PAD WILL EXTEND INTO CHANNEL AND TIE TO GRADE 15 FT FROM HEADWALL INTO THE CHANNEL. FILL USING 38 CY 14 IN. D50 RIP RAP. PLACE 25 SY GEOTEXTILE FABRIC UNDER RIP RAP PAD. TIE TO WEIR WHERE THERE IS OVERLAP.



CALL ARIZONA BLUE STAKE BEFORE YOU DIG 811 8-1-1

SHEET NAME: CLVT01

SHEET NUMBER: 5 OF 10

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

CULVERT PROTECTION

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

NO.	DATE	BY	REVISION

DRAWN BY: CS, JF, MW
DESIGNED BY: MK
CHECKED BY:

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

CONSTRUCTION NOTES

(2) CROSS VANE WEIR AT STA. 30+83. 45 30 IN. FEATURE ROCKS, 74 18 IN. FOOTER ROCK AND 9 CY OF 8 IN. D50 RIP RAP. PLACE 73 SY OF GEOTEXTILE FABRIC UNDER ROCK. SEE DETAIL SHEET 8

(5) OUTLET PROTECTION FOR BOX CULVERT INSTALL 1815 SY OF PYRAMAT 75 AS PER DETAIL SHEET 8 AT OUTLET OF TRIPLE BOX CULVERT TO THE UPSTREAM EDGE OF CROSS VANE WEIR STRUCTURE. TIE PYRAMAT 75 INTO CROSS VANE WEIR BY PLACING FABRIC OVER GEOTEXTILE FABRIC AND UNDER FEATURE ROCK IF RIP RAP IS ALREADY PRESENT IN CHANNEL, TIE CROSS VANE WEIR INTO EXISTING RIP RAP IN CHANNEL BOTTOM.

NOTE:
IT IS UNKNOW IF AN EXISTING RIPRAP SCOUR PAD IS IN PLACE AT THE OUTLET OF THE BOX CULVERT. IF ONE IS ENCOUNTERED, DURING CONSTRUCTION, THEN THE PYRAMAT 75 PRODUCT LISTED IN CONSTRUCTION NOTE #5 MAY NOT BE NECESSARY. CONTRACTOR SHALL VERIFY THE PRESENCE OR ABSENCE OF RIPRAP BELOW THE SEDIMENT PRIOR TO ORDERING PYRAMAT 75 AND CONTACT THE ENGINEER IF A RIPRAP SCOUR PAD IS FOUND.

CHANNEL LAYOUT CONTROL

NOTE: CONTROL PROVIDED THIS TABLE IS FOR THE HORIZONTAL/VERTICAL LAYOUT OF THE CHANNEL CENTERLINE. SEE STRUCTURE/GEOMORPHIC GRADING TABLE (BELOW) FOR COORDINATES OF ROCK VANES, WIERS, POOLS, ETC.

PT# / STATION / BEARING	NORTH / DISTANCE	EAST	ELEV
101			
30+00.00	1177396.4	348802.6	4892.8
S42 23'21"W	50.92ft		
102			
30+50.92	1177358.8	348768.3	4892.7
S20 59'26"W	35.91ft		
158 36'05" AR			
103			
30+86.83	1177325.3	348755.4	4891.5
S43 56'35"W	26.23ft		
105			
31+13.06	1177306.4	348737.2	4890.6
S37 15'37"W	42.94ft		
106			
31+56.00	1177272.2	348711.2	4890.4
S51 11'40"W	6.86ft		
107			
31+62.86	1177267.9	348705.9	4890.2
S50 33'05"W	11.24ft		
108			
31+74.10	1177260.8	348697.2	4890.1
RADIUS POINT:	109	1177032.6	348884.9
RADIUS:	295.49ft		
DELTA:	15 52'45" LEFT		
110			
32+56.00	1177200.7	348641.9	4889.0
S34 40'20"W	23.19ft		
111			
32+79.19	1177181.6	348628.7	4889.3
RADIUS POINT:	112	1177238.5	348546.5
RADIUS:	100.00ft		
DELTA:	27 02'49" RIGHT		
113			
33+26.39	1177150.5	348593.9	4889.0
S61 43'10"W	18.34ft		
114			
33+44.73	1177141.8	348577.7	4888.9
RADIUS POINT:	115	1177229.8	348530.3
RADIUS:	100.00ft		
DELTA:	36 05'27" RIGHT		
116			
34+07.72	1177130.8	348516.7	4888.1
N82 11'24"W	79.23ft		
117			
34+86.95	1177141.5	348438.3	4887.9
RADIUS POINT:	118	1176844.3	348397.5
RADIUS:	300.00ft		
DELTA:	16 08'46" LEFT		
119			
35+71.49	1177141.1	348354.0	4886.8
S81 39'50"W	78.11ft		

PT# / STATION / BEARING	NORTH / DISTANCE	EAST	ELEV
120			
36+49.61	1177129.8	348276.7	4886.9
RADIUS POINT:	121	1177426.6	348233.2
RADIUS:	300.00ft		
DELTA:	16 27'27" RIGHT		
122			
37+35.78	1177129.7	348190.8	4885.6
N81 52'43"W	32.46ft		
123			
37+68.24	1177134.2	348158.7	4886.0
RADIUS POINT:	124	1177379.0	348193.6
RADIUS:	247.28ft		
DELTA:	7 22'52" RIGHT		
125			
38+00.09	1177140.8	348127.5	4885.7
N74 29'51"W	17.90ft		
126			
38+17.99	1177145.5	348110.3	4885.5
RADIUS POINT:	127	1176953.9	348057.1
RADIUS:	198.91ft		
DELTA:	30 28'56" LEFT		
128			
39+23.82	1177146.0	348005.7	4885.0
S75 01'13"W	44.96ft		
129			
39+68.78	1177134.4	347962.3	
RADIUS POINT:	130	1177327.6	347910.6
RADIUS:	200.00ft		
DELTA:	24 51'40" RIGHT		
131			
40+55.56	1177130.6	347876.3	4883.3
N80 07'08"W	48.34ft		
132			
41+03.90	1177138.9	347828.6	4883.7

STRUCTURE / GEOMORPHIC GRADING POINT COORDINATES

Coordinate Table

Pt #	North	East	Elev	Sta	Descriptor
200	1177128.8	348564.9	4890.3	33+61.13	START TOE ROCK
201	1177125.2	348519.7	4890.0	34+04.24	end toe rock
202	1177121.5	348221.6	4887.9	37+04.66	start toe rock
203	1177124.1	348191.9	4887.7	37+33.99	end toe rock
204	1177159.3	348063.8	4887.0	38+65.32	start toe rock
205	1177158.4	348039.6	4886.7	38+88.83	end toe rock
206	1177122.0	347928.8	4885.7	40+03.41	start toe rock
207	1177121.2	347885.2	4885.4	40+45.53	end toe rock
371	1177326.5	348757.8	4892.6	30+84.84	weir start
372	1177314.2	348744.8	4891.8	31+02.20	weir start 2
380	1177302.9	348734.7	4891.0	31+17.38	weir step
381	1177253.5	348689.4	4889.8	31+84.75	top pool
389	1177252.2	348676.5	4891.5	31+55.05	vane tie
390	1177182.5	348628.2	4889.6	32+78.80	pool end
398	1177130.0	348566.0	4890.3	33+59.81	vane tie
399	1177138.8	348572.4	4888.4	33+50.83	pool start
407	1177131.4	348511.9	4888.6	34+12.62	pool end
408	1177144.3	348396.9	4887.8	35+28.48	pool start
416	1177152.1	348391.3	4889.2	35+33.89	vane tie
417	1177135.3	348325.2	4887.2	36+00.86	pool end
425	1177126.8	348234.7	4886.3	36+91.78	pool start
426	1177122.2	348224.6	4887.9	37+01.70	vane yie
434	1177150.9	348072.4	4884.9	38+56.42	pool start
435	1177159.7	348064.2	4886.9	38+64.95	vane tie
443	1177146.6	348010.6	4884.9	39+18.91	pool end
444	1177141.8	347983.7	4885.0	39+46.20	weir start
454	1177130.4	347934.6	4884.0	39+96.84	pool start
455	1177122.4	347929.8	4885.7	40+02.37	vane tie
465	1177133.2	347860.0	4883.9	40+72.02	pool end
466	1177141.8	347793.7	4883.4	41+39.05	tie to ex. channel
476	1177267.6	348763.6	4902.6	31+27.97	hydrant

NOTE:
> SEE SHEETS 3 AND 4 FOR GRAPHICAL REPRESENTATION OF LOCATIONS OF CONTROL COORDINATES ALONG CHANNEL ALIGNMENT
> ELEVATIONS PROVIDED REFERENCE FINISHED TOP OF ROCK IF A ROCK STRUCTURE OR THALWEG IF REFERENCING A POOL.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND APPROVED BY THE ENGINEER OF RECORD PRIOR TO THE CHANGE.

DATE: 15 DECEMBER 2017

SHEET NAME: C1VT02

SHEET NUMBER: 6 OF 10

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

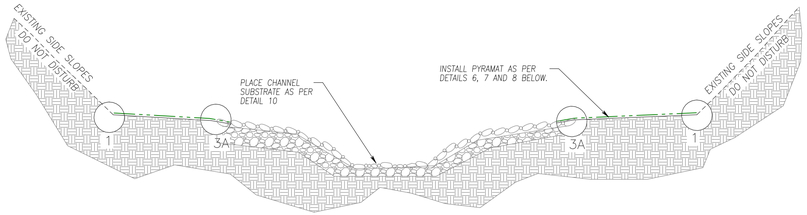
SAWMILL CROSSING BOX CULVERT PROTECTION AND PROJECT LAYOUT CONTROL

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

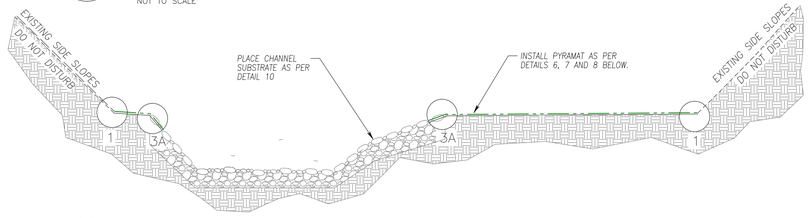
DRAWN BY:	CS, JF, MW
DESIGNED BY:	MK
CHECKED BY:	

NO.	DATE	BY	REVISION

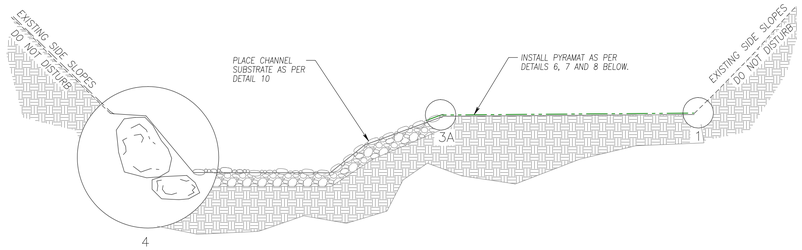
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



A/8 STA 30+87 TO 31+81, 32+80 TO 33+60, 34+14 TO 35+30, 35+97 TO 36+89, 37+64 TO 38+58, 39+23 TO 39+95, 40+68 TO 41+46
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE

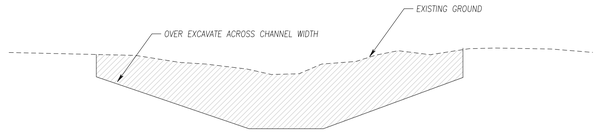


B/8 STA 33+61 TO 34+05, 36+89 TO 37+55, 39+37 TO 40+60
TYPICAL POOL CROSS SECTION
NOT TO SCALE

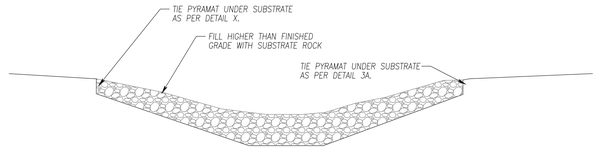


B/8 STA 33+61 TO 34+05, 37+04 TO 37+52, 38+64 TO 38+96, 40+06 to 40+46
TYPICAL TOE ROCK POOL CROSS SECTION
NOT TO SCALE

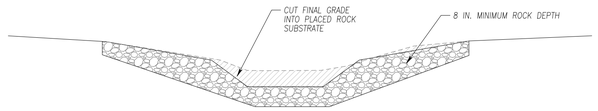
SUGGESTED CONSTRUCTION SEQUENCE



STEP 1: OVEREXCAVTE TO PREPARE FOR SUBSTRATE

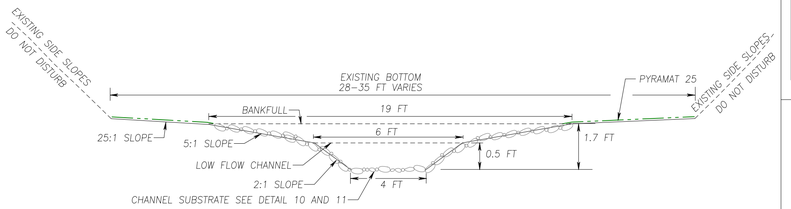


STEP 2: PLACE SUBSTRATE IN CUT CHANNEL BOTTOM

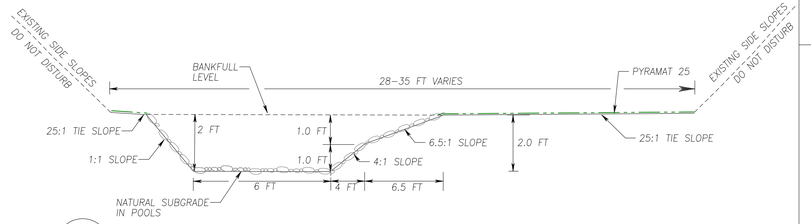


STEP 3: CUT FINAL CHANNEL INTO PLACED SUBSTRATE

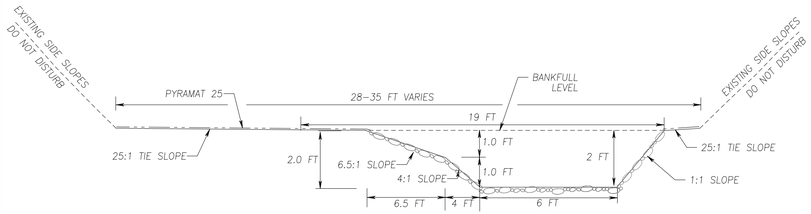
NOTE: FOR ADDITIONAL PYRAMAT INSTALLATION INSTRUCTION SEE MANUFACTURERS RECCOMENDATION



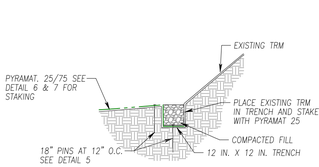
A/8 STA 30+87 TO 31+81, 32+80 TO 33+49, 34+14 TO 35+30, 35+94 TO 36+89, 37+64 TO 38+58, 39+23 TO 39+95, 40+68 TO 41+46
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE



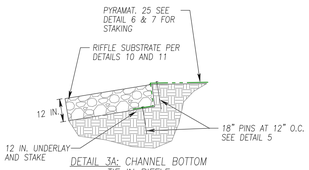
B/8 STA 33+57 TO 34+03, 36+97 TO 37+55, 40+01 TO 40+60
TYPICAL POOL CROSS SECTION
NOT TO SCALE



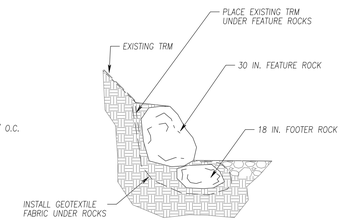
C/8 STA 31+89 TO 32+72, 35+38 TO 35+85, 38+64 TO 39+15
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE



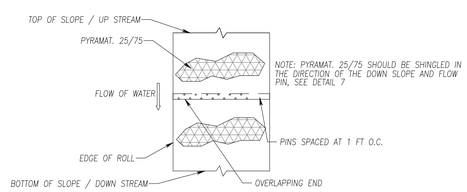
DETAIL 1: CHANNEL BOTTOM TIE IN RIFFLE



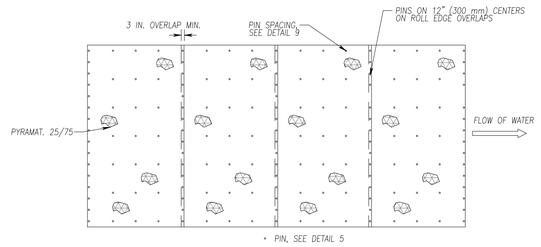
DETAIL 3A: CHANNEL BOTTOM TIE IN RIFFLE



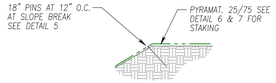
DETAIL 4: TOE ROCK FABRIC



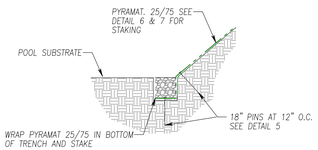
DETAIL 6: OVERLAP AT ROLL END DETAIL PLAN VIEW



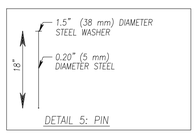
DETAIL 7: PIN PATTERN PLAN VIEW



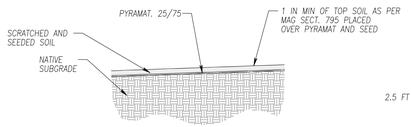
DETAIL 2: BREAK IN SLOPE INTERFACE PROFILE VIEW



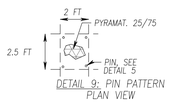
DETAIL 3B: CHANNEL BOTTOM TIE IN POOL



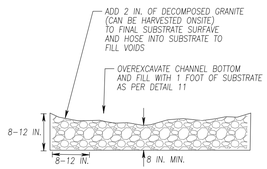
DETAIL 5: PIN



DETAIL 8: VEGETATION ESTABLISHMENT PROFILE VIEW



DETAIL 9: PIN PATTERN PLAN VIEW



DETAIL 10: RIFFLE SUBSTATE INSTALLATION SECTION VIEW

d	Lower Limit (in)	Upper Limit (in)
100	4.8	8
85	4.7	6.8
75	4.4	6.4
50	3.8	5.4
30	3.0	4.5
15	1	3.6

DETAIL 11: SUBSTRATE GRADATION

CALL ARIZONA BLUE STAKE 811 OR 1-800-782-5348 BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR TO IMPLEMENTATION.

DATE: 15 DECEMBER 2017
NCD PROJECT NUMBER: 17-283AZ
SHEET NAME: DTL01
SHEET NUMBER: 7 OF 10

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

DRAWN BY: CS, JF, MW, AH
DESIGNED BY: CS, JF, MW, AH
CHECKED BY: MK, AH

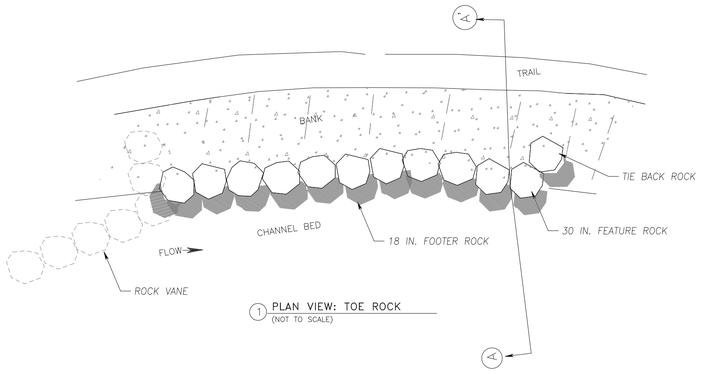
NO.	DATE	BY	REVISION

DETAIL SHEET

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

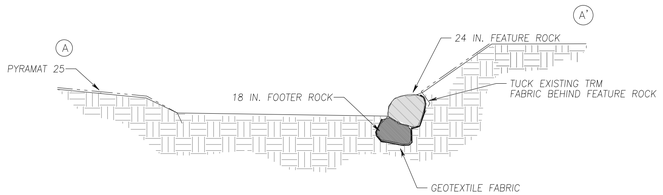
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

TOE ROCK



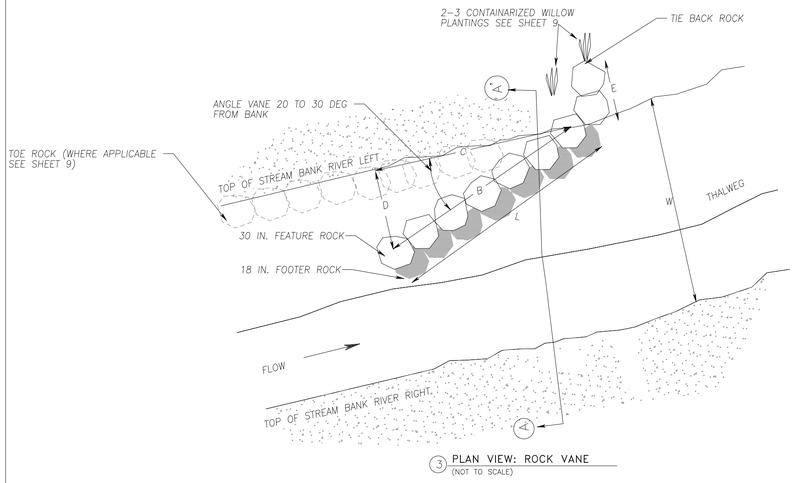
1 PLAN VIEW: TOE ROCK
(NOT TO SCALE)

TOE ROCK NOTES
1. TOE ROCK TO BE INSTALLED AT BASE OF EXISTING BANK OR SHAPED BANK AS SPECIFIED BY ENGINEER OR REPRESENTATIVE.
2. FEATURE ROCKS TO BE INSTALLED SO TOP OF ROCK IS AT BANKFULL ELEVATION.
3. PLACE GEOTEXTILE FABRIC UNDERNEATH FOOTER AND FEATURE ROCKS.
4. FEATURE ROCKS PLACED ON TOP OF FOOTER ROCK SO ROCK LOCKS TOGETHER.
5. FEATURE ROCKS TO BE PLACED TO MINIMIZE GAPS AND HAVE A GENERALLY SMOOTH FACE.

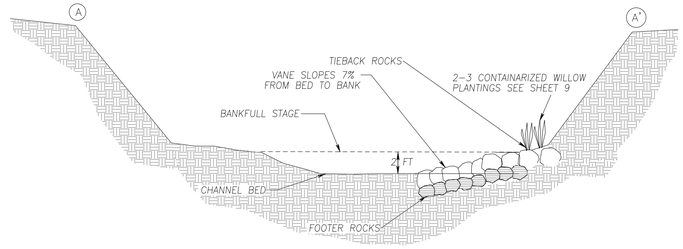


2 SECION VIEW: TOE ROCK
(NOT TO SCALE)

ROCK VANE WITH WILLOW TRANSPLANTS



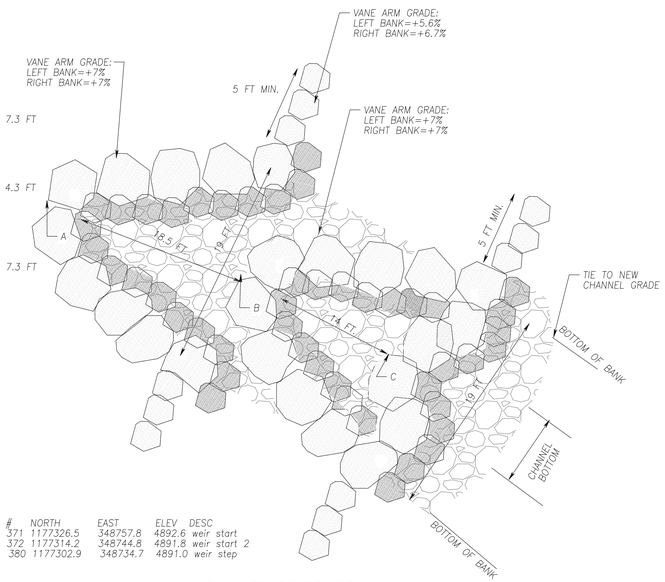
3 PLAN VIEW: ROCK VANE
(NOT TO SCALE)



3 SECTION VIEW: ROCK VANE
(NOT TO SCALE)

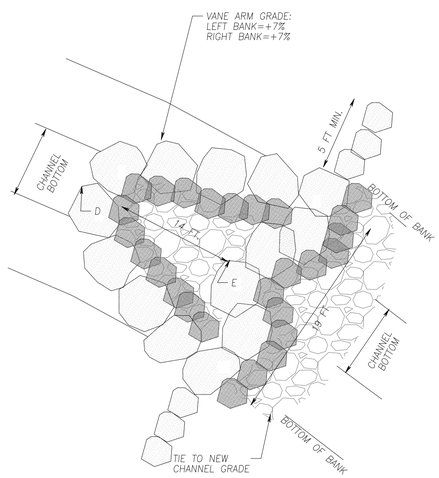
DIMENSIONS	
W =	19 ft
B =	18.4 ft
C =	17.3 ft
D =	6.3 ft
E =	5 ft

ROCK VANE NOTES
1. VANE MEASUREMENTS ARE BASED ON CENTERLINE OF ROCK
2. THE ROCK VANE IS UTILIZED TO SLOW VELOCITIES ALONG THE OUTSIDE OF A BEND AND RE-CENTER THE HIGHEST VELOCITIES TOWARDS THE CENTER OF THE STREAM.
3. ROCKS ARE SIZED ACCORDING TO THE SHEAR FORCES EXERTED ON THEM AT EACH FLOW. ROCK SHALL BE ANGULAR WITH A SPECIFIC GRAVITY GREATER THAN 2.5.



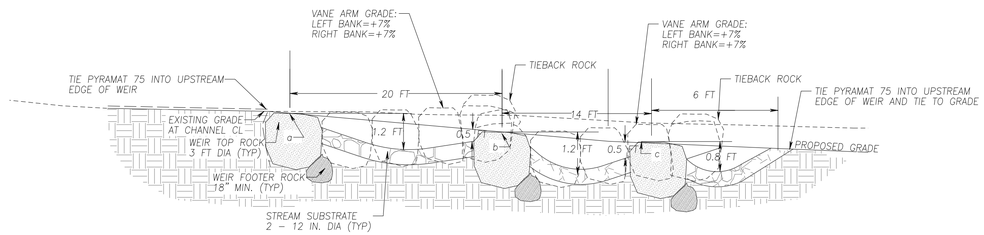
PT	#	NORTH	EAST	ELEV	DESC
A	371	1177326.5	348757.8	4892.6	weir start
B	372	1177314.2	348744.8	4891.8	weir start 2
C	380	1177302.9	348734.7	4891.0	weir step

1 PLAN VIEW: DOUBLE WEIR
(NOT TO SCALE)

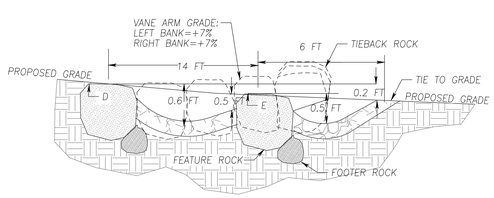


D 444 1177141.8 347983.7 4885.0 weir start

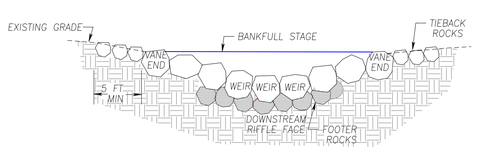
2 PLAN VIEW: SINGLE WEIR
(NOT TO SCALE)



3 PROFILE VIEW: DOUBLE WEIR
(NOT TO SCALE)



4 PROFILE VIEW: SINGLE WEIR
(NOT TO SCALE)



5 SECTION VIEW: WEIR FACE
(NOT TO SCALE)

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 811 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS ASSUMES NO RESPONSIBILITY FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

SHEET NAME: DTL02
SHEET NUMBER: 8 OF 10
DATE: 15 DECEMBER 2017
NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

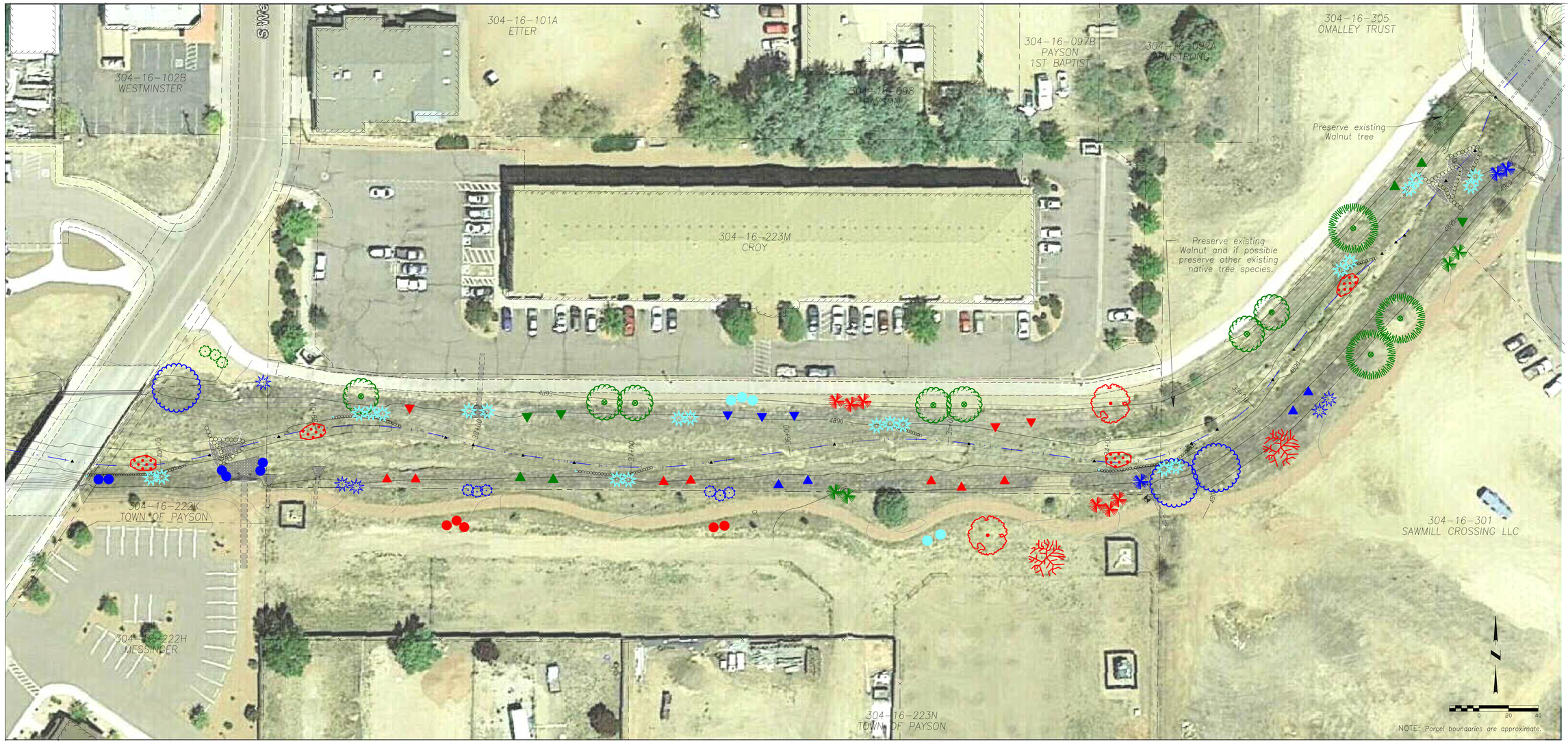
DETAIL SHEET

CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
AMERICAN GULCH
TOWN OF PAYSON

DRAWN BY: CS, JF, MW
DESIGNED BY: MK
CHECKED BY:

NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



TREES

MINIMUM SIZE:
10 GAL. CONTAINER

- *Fremont Cottonwood*
- *Arizona Cypress*
- *Velvet Ash*
- *Emory Oak*
- *Alligator Juniper*

SHRUBS

MINIMUM SIZE:
3 GAL. CONTAINER

- *Fremont Mahonia*
- *Arroyo Willow*
- *False Indigobush*
- *Wright's Silktassel*
- *Stansbury Cliffrose*
- *Pointleaf Manzanita*
- *Alder-leaf Mountain Mahogany*
- *Redosier Dogwood*
- *Fernbush*
- *Rubber Rabbitbrush*

SMALL SHRUBS AND FORBS

MINIMUM SIZE: 1 GAL. CONTAINER

- *Fendler's Ceanothus (group of 3)*
- *Colorado Four O'Clock (group fo 3)*
- *Beargrass (group of 3)*

SEDGE/RUSH PLUGS

- *Sedge Plugs (group of 25)*

VEGETATION REMOVAL NOTE:

Native and non-native trees to be removed from existing channel bottom except as noted.
Non-native trees and shrubs to be removed from existing channel sides and top terrace except as noted.

LOCATION NOTE:

Locations shown are approximate. Exact locations for planting shall be determined in the field with approval of NCD.

RIPARIAN AREA PLANTING LIST*

	TREES	
3	*Fremont Cottonwood (Populus fremontii)*	
7	*Velvet Ash (Fraxinus velutina)*	
2	*Emory Oak (Quercus emoryi)*	
2	*Alligator Juniper (Juniperus deppeana)*	
3	*Arizona Cypress (Cupressus arizonica)*	
		17 Total
	LARGE SHRUBS	
3	*False Indigobush (Amorpha fruticosa)*	
6	*Redosier Dogwood (Cornus sericea)*	
6	*Rubber Rabbitbrush (Ericameria nauseosa)*	
3	*Fernbush (Chamaebatiaria millefolium)*	
5	*Pointleaf Manzanita (Arctostaphylos pungens)*	
5	*Alder-leaf Mountain Mahogany (Cercocarpus montanus)*	
6	*Wright's Silktassel (Garrya wrightii)*	
4	*Stansbury Cliffrose (Fallugia paradoxa)*	
5	*Fremont's Mahonia (Berberis fremontii)*	
		43 Total
	SMALL SHRUBS & FORBS	
21	*Fendler's Ceanothus (Ceanothus fendleri)*	
30	*Colorado Four O'Clock (Mirabilis multiflora)*	
21	*Beargrass (Nolina microcarpa)*	
		72 Total
	SHRUB WILLOWS	
22	*Arroyo Willow (Salix lasiolepis)*	
		22 Total
	SEDGE/RUSH PLUGS	
100	*Mountain Rush (Juncus arcticus ssp. littoralis) preferred*	
	-or- Common Spikerush (Eleocharis palustris)	
		100 Total

* SPECIES NOTE:

If any plant species are unavailable, consult NCD for acceptable replacement prior to substitution.

Coyote Willow may NOT be substituted for Arroyo Willow.

GRASS AND FORB SEED

The entire site (including undisturbed slopes) is approximately 2 acres. The disturbed area along the channel bottom is approximately 1 acre. All disturbed areas shall be seeded with the specified native grasses and forbs (see below for details).

The undisturbed areas that are lacking in native vegetation shall be seeded with the specified native grass and forb seed mixes (see below), approximately 0.5 acres.

Seed must be spread evenly and if broadcast, the seed must be incorporated into the soil but not more than 0.5 inches.

There are three phases of seeding:

Phase 1: Following finish subgrade, but prior to placement of Pyramat, the disturbed area shall be seeded with Grass Mix 1 and Grass Mix 2 (approximately 1 acre). We recommend broadcast seeding by hand but seed does not need to be incorporated.

Phase 2: Following finish grade, after placement of Pyramat and layer of topsoil, the disturbed area shall be shall be seeded with Grass Mix 1, Grass Mix 2, and the Forb Mix (approximately 1 acre). Seed may be broadcast or hydroseeded. If broadcast, seed must be incorporated into the soil without disturbing the Pyramat or the overall depth of the added topsoil layer.

Phase 3: At the same time as Phase 2 or following completion of construction, the undisturbed areas shall be seeded with Grass Mix 1 and the Forb Mix (approx. 0.5 acre). Only the areas lacking in native vegetation, either bare, lightly vegetated or areas dominated by weedy annual species should be seeded. Seed should be broadcast by hand and incorporated into the soil.

Seed should be purchased from a reliable supplier to ensure that it is weed-free. Native grass and forb seed is sold as Pure Live Seed (PLS). If any of the grass or forb species are unavailable, consult NCD for suitable replacements.The recommended grass seed and forb mixes consists of the following species and rates:

Grass Mix 1

Native Grass Species (2.5 acres total):		*Seed Mix (lbs PLS/ac)*
Blue Grama	*(Bouteloua gracilis)*	*1.0*
Sideoats Grama	*(Bouteloua curtipendula)*	*2.0*
Purple Three-Awn	*(Aristida purpurea)*	*2.0*
Muttongrass	*(Poa fendleriana)*	*1.0*
Western Wheatgrass	*(Pascopyrum smithii)*	*3.0*
Prairie Junegrass	*(Koeleria macrantha)*	*0.5*
Squirreltail	*(Elymus elymoides)*	*1.5*
		11 lbs/ac

Grass Mix 2

Native Grass Species (2 acres total):		*Seed Mix (lbs PLS/ac)*
Deergrass	*(Muhlenbergia rigens)*	*2.0*
*Vine Mesquite ***	*(Panicum obtusum)*	*1.5*
		3.5 lbs/ac

Forb Mix

Native Forb Species (1.5 acres total):		*Seed Mix (lbs PLS/ac)*
Rocky Mountain Penstemon	*(Penstemon strictus)*	*0.25*
Blanketflower	*(Gaillardia sp.)*	*0.25*
Horsetail Milkweed	*(Asclepias subverticillata)*	*0.25*
Tufted Evening Primrose	*(Oenothera caespitosa)*	*0.25*
Globemallow	*(Sphaeralcea sp.)*	*0.25*
California Poppy	*(Eschscholzia californica ssp. mexicana)*	*0.25*
		3.0 lbs/ac

*** Vine Mesquite can be difficult to find. A possible source is Curtis & Curtis Seed out of Clovis, NM.*

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED BY THE ENGINEER OF RECORD PLANS.

DATE: **15 DECEMBER 2017**

NCD PROJECT NUMBER: **17-283AZ**

SHEET NAME: **VEG01**

SHEET NUMBER: **9** OF **10**

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

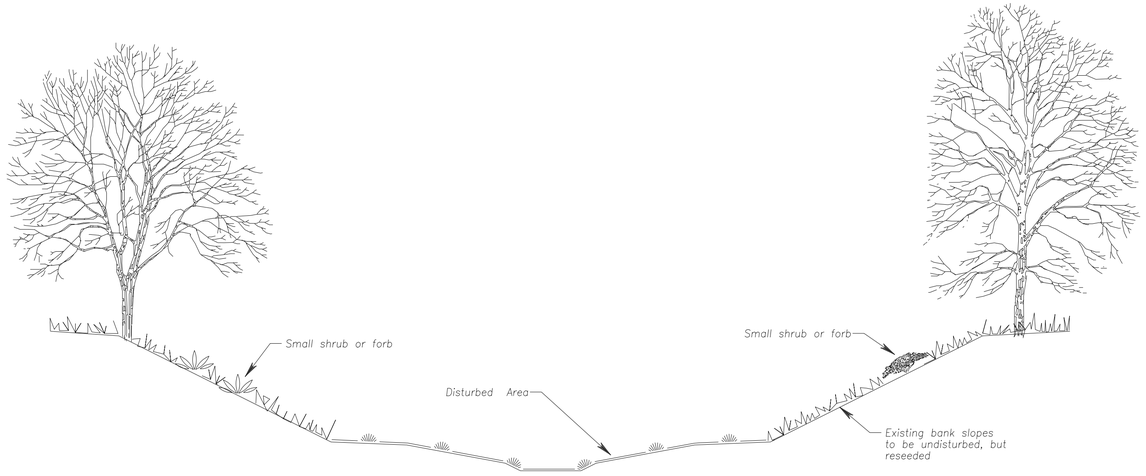
PLANTING PLAN VIEW

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: CS
DESIGNED BY: CS AH
CHECKED BY:

NO.	DATE:	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

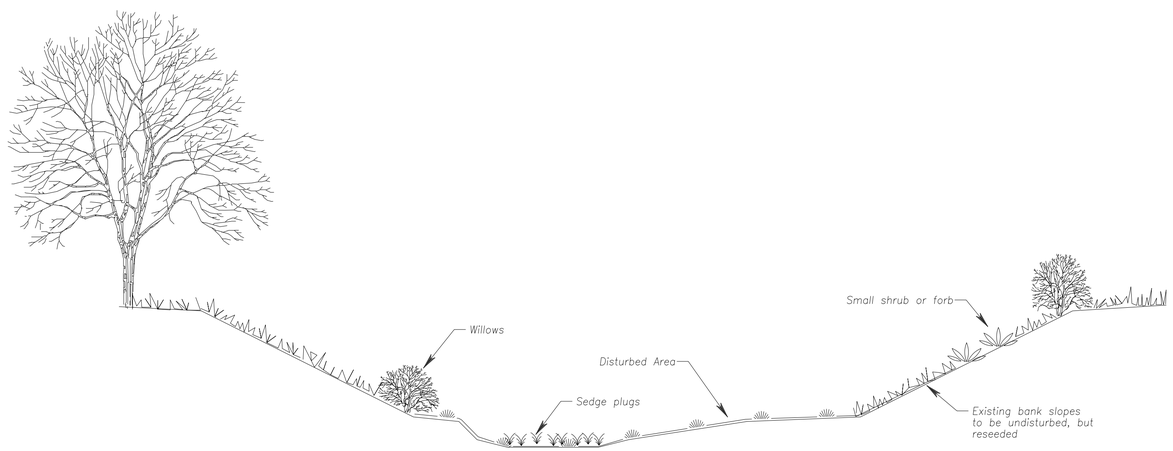


TYPICAL RIFFLE CROSS SECTION

NOT TO SCALE

NOTES:

- *In order to maintain channel capacity, there should be very little woody vegetation in the channel.*
- *No large woody vegetation, except willows, may be planted more than ~ 2 feet below top of bank.*
- *Small shrubs may be planted up to halfway down the bank.*
- *Disturbed areas shall be seeded with a mixture of native grasses and forbs.*



TYPICAL POOL CROSS SECTION

NOT TO SCALE

NOTES:

- *The majority of willows will be planted on the outside of the bend to protect bank from ersosion, near the end of the rock vanes. The willows should be planted near the bottom of the steep slope, just high enough to avoid interfering with the Pyramat.*
- *Sedge plugs shall be planted in bottom of some pools where water collects and is likely to persist for longer periods of time, per Planting Plan, Sheet 9.*
- *No other large woody vegetation should be planted more than ~2 feet below the top of bank.*
- *Small shrubs may be planted up to halfway down the bank.*
- *Disturbed areas shall be seeded with a mixture of native grasses and forbs.*

PLANTING NOTES:

IRRIGATION:

All containerized plants shall require temporary irrigation including willows and plugs for 3 years or until established. Irrigation installation is understood to be per Town of Payson.

SEDGE PLUGS:

With 2–3 advanced notice, sedge plugs can be grown out in a nursery. They can also be harvested in the wild from local sources. See below for details on harvesting sedge plugs. Plugs should be planted at 2 ft on center.

WILLOW PLANTS:

With 3–4 months advanced notice, willow poles can be collected from a local source and grown out at a nursery.

EXISTING SPECIES:

All Arizona Walnut trees shall be marked prior to construction and shall be preserved in place. Other native tree species shall be preserved if possible. Remove all non–native tree species, especially Tree of Heaven, from around the preserved trees.

INVASIVE SPECIES:

We recommend treating noxious and highly invasive species prior to start of construction. At a minimum we recommend treating Tree of Heaven (Ailanthus altissima) and Johnsongrass (Sorghum halepense) and any other species on the Arizona Noxious Species List. Much of the Johnsongrass will be removed during construction since it primarily grows in the channel bottom but some will remain on the undisturbed slopes.

HARVESTED WETLAND PLUGS: COLLECTION, HANDLING AND PLACEMENT

Wetland plugscollected from the wild, plugs should be harvested locally. Harvested plugs are readily transplanted because of their well developed root systems. Remaining plants at the harvest site will rapidly fill in the hole. Dig no more than 1 sq ft of plant material from a 4 sq ft area. It is not necessary to go deeper than 5 to 6 inches. This will provide enough root mass to ensure good establishment at the project site. It will also retain enough of the root system below the harvest point to allow the plants to grow back into the harvest hole.

Transplants can be harvested at almost any time of the year. The top growth may be cut to about 5 to 6 inches. If one sq ft of plant material is harvested, it is possible to cut the larger plug into 6 to 9 individual plant plugs. Cover the roots with water while in transit, do not allow plugs to dry out.

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 plant suppliers.

The plugs can be chopped quickly with a shovel or they can be cut with a small saw so they will fit easily into a predrilled, set diameter hole. Plugs should be planted at 2 ft on center. Tamp plugs into ground carefully.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND APPROVED BY THE ENGINEER OF RECORD PLANS.

DATE: **15 DECEMBER 2017**

SHEET NAME: **VEG02**

NCD PROJECT NUMBER: **17-283AZ**

SHEET NUMBER: **10** OF **10**

PRELIMINARY
NOT FOR
CONSTRUCTION
60% SUBMITTAL

PLANTING CROSS SECTIONS

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: CS			
DESIGNED BY: CS AH			
CHECKED BY:			
NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774–2336

STATE HISTORIC PRESERVATION OFFICE
Review Form

In accordance with the State Historic Preservation Act (SHPO), A.R.S. 41-861 *et seq*, effective July 24, 1982, each State agency must consider the potential of activities or projects to impact significant cultural resources. Also, each State agency is required to consult with the State Historic Preservation Officer with regard to those activities or projects that may impact cultural resources. Therefore, it is understood that **recipients of state funds are required to comply with this law** throughout the project period. All projects that affect the ground-surface that are funded by AWPF require SHPO clearance, **including those on private and federal lands.**

The State Historic Preservation Office (SHPO) must review each grant application recommended for funding in order to determine the effect, if any, a proposed project may have on archaeological or cultural resources. To assist the SHPO in this review, the following information MUST be submitted with each application for funding assistance:

- A completed copy of this form, and
- A United States Geological Survey (USGS) 7.5 minute map
- A copy of the cultural resources survey report if a survey of the property has been conducted, and
- A copy of any comments of the land managing agency/landowner (i.e., state, federal, county, municipal) on potential impacts of the project on historic properties.
  NOTE: If a federal agency is involved, the agency must consult with SHPO pursuant to the National Historic Preservation Act (NHPA); a state agency must consult with SHPO pursuant to the State Historic Preservation Act (SHPA),
  OR
- A copy of SHPO comments if the survey report has already been reviewed by SHPO.

Please answer the following questions:

1. Grant Program: Arizona Water Protection Fund

2. Project Title: American Gulch Channel and Riparian Enhancement

3. Applicant Name and Address: Town of Payson; 303 N. Beeline Hwy. Payson, AZ 85541

4. Current Land Owner/Manager(s): Town of Payson

5. Project Location, including Township, Range, Section: SEC 9 T10N R10E

6. Total Project Area in Acres (or total miles if trail): 2.0

7. Does the proposed project have the potential to disturb the surface and/or subsurface of the ground?
   ☒ YES ☐ NO

8. Please provide a brief description of the proposed project and specifically identify any surface or subsurface impacts that are expected: Construct a more natural, stable bankfull (low flow) channel in the bottom of the existing channel which will include stabilization structures including rock cross-vane weirs, rock vanes, toe rock, TRM (turf reinforced matt) and larger natural substrate material.

9. Describe the condition of the current ground surface within the entire project boundary area (for example, is the ground in a natural undisturbed condition, or has it been bladed, paved, graded, etc.). Estimate

horizontal and vertical extent of existing disturbance. Also, attach photographs of project area to document condition: The ephemeral channel through the project area has been highly modified to serve as a stormwater conveyance and currently is sized to contain the FEMA estimated 100-year floodplain. The current channel configuration through the project area is a grass lined, trapezoidal channel bounded by development on one side and a recently built urban trail on the other.

10. Are there any known prehistoric and/or historic archaeological sites in or near the project area? ☐ YES ☒ NO

11. Has the project area been previously surveyed for cultural resources by a qualified archaeologist? ☒ YES ☐ NO ☐ UNKOWN

    If YES, submit a copy of the survey report. Please attach any comments on the survey report made by the managing agency and/or SHPO

12. Are there any buildings or structures (including mines, bridges, dams, canals, etc.), which are 50-years or older in or adjacent to the project area? ☐ YES ☒ NO

    If YES, complete an Arizona Historic Property Inventory Form for each building or structure, attach it to this form and submit it with your application.

13. Is your project area within or near a historic district? ☐YES ☒ NO

    If YES, name of the district:

Please sign on the line below certifying all information provided for this application is accurate to the best of your knowledge.

_____	/ _____	_____
Applicant Signature	/Date	Applicant Printed Name

FOR SHPO USE ONLY
SHPO Finding: ☐ Funding this project will not affect historic properties. ☐ Survey necessary – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*) ☐ Cultural resources present – further GRANTS/SHPO consultation required (*grant funds will not be released until consultation has been completed*)
SHPO Comments:
For State Historic Preservation Office: Date:

STATE OF ARIZONA
HISTORIC PROPERTY INVENTORY FORM

Please type or print clearly. Fill out each applicable space accurately and with as much information as is known about the property.

PROPERTY IDENTIFICATION

For properties identified through survey: Site No. _____ Survey Area: _____

Historic Names (e*nter the name(s), if any that best reflect the property's historic importance*): _____

Address: _____

City or Town: _____ ☐ Vicinity County: _____ Tax Parcel No.: _____

Township: _____ Range: _____ Section: _____ Quarters: _____ Acreage: _____

Block: _____ Lot(s): _____ Plat (Addition): _____ Year of plat (addition): _____

UTM Reference – Zone: _____ Easting: _____ Northing: _____

USGS 7.5' quadrangle map: _____

ARCHITECT: _____ ☐ not determined ☐ known Source: _____

BUILDER: _____ ☐ not determined ☐ known Source: _____

CONSTRUCTION DATE: _____ ☐ known ☐ estimated Source: _____

STRUCTURAL CONDITION

☐ Good (*well maintained; no serious problems apparent*)
☐ Fair (*some problems apparent*) Describe: _____
☐ Poor (*major problems; imminent threat*) Describe: _____
☐ Ruin/Uninhabitable

USES/FUNCTIONS

Describe how the property has been used over time, beginning with the original use: _____

Sources: _____

PHOTO INFORMATION

Date of photo: _____
View Direction (looking towards): _____

Attach a recent photograph of property in this space. Additional photographs may be appended.

SIGNIFICANCE
To be eligible for the National Register, a property must represent an important part of the history or architecture of an area. The significance of a property is evaluated within its historic context, which are those patterns, themes, or trends in history by which a property occurred or gained importance. Describe the historic and architectural contexts of the property that may make it worthy of preservation.

A. HISTORIC EVENTS/TRENDS – *Describe any historic events/trends associated with the property:* _____

B. PERSONS – *List and describe persons with an important association with the building:* _____

C. ARCHITECTURE – Style: _____ ☐ no style

Stories: _____ ☐ Basement Roof Form: _____

Describe other character-defining features of its massing, size and scale: _____

INTEGRITY
To be eligible for the National Register, a property must have integrity (i.e. it must be able to visually convey its importance). The outline below lists some important aspects of integrity. Fill in the blanks with as detailed a description of the property as possible.

Location - ☐ Original Site ☐ Moved: Date: _____ Original Site: _____

DESIGN
Describe alterations from the original design, including dates: _____

MATERIALS
Describe the materials used in the following elements of the property:

Walls (structure): _____

Walls (sheathing): _____

Windows: _____

Roof: _____

Foundation: _____

SETTING
Describe the natural and/or built environment around the property: _____

How has the environment changed since the property was constructed? _____

WORKMANSHIP
Describe the distinctive elements, if any, of craftsmanship or method of construction: _____

NATIONAL REGISTER STATUS (*if listed, check the appropriate box*)
☐ Individually Listed; ☐ Contributor; ☐ Non-contributor to _____ Historic District

Date Listed: _____ ☐ Determined eligible by Keeper of National Register (date: _____)

RECOMMENDATIONS ON NATIONAL REGISTER ELIGIBILITY (opinion of SHPO staff or survey consultant)

Property ☐ is ☐ is not eligible individually.

Property ☐ is ☐ is not eligible as a contributor to a listed or potential historic district.

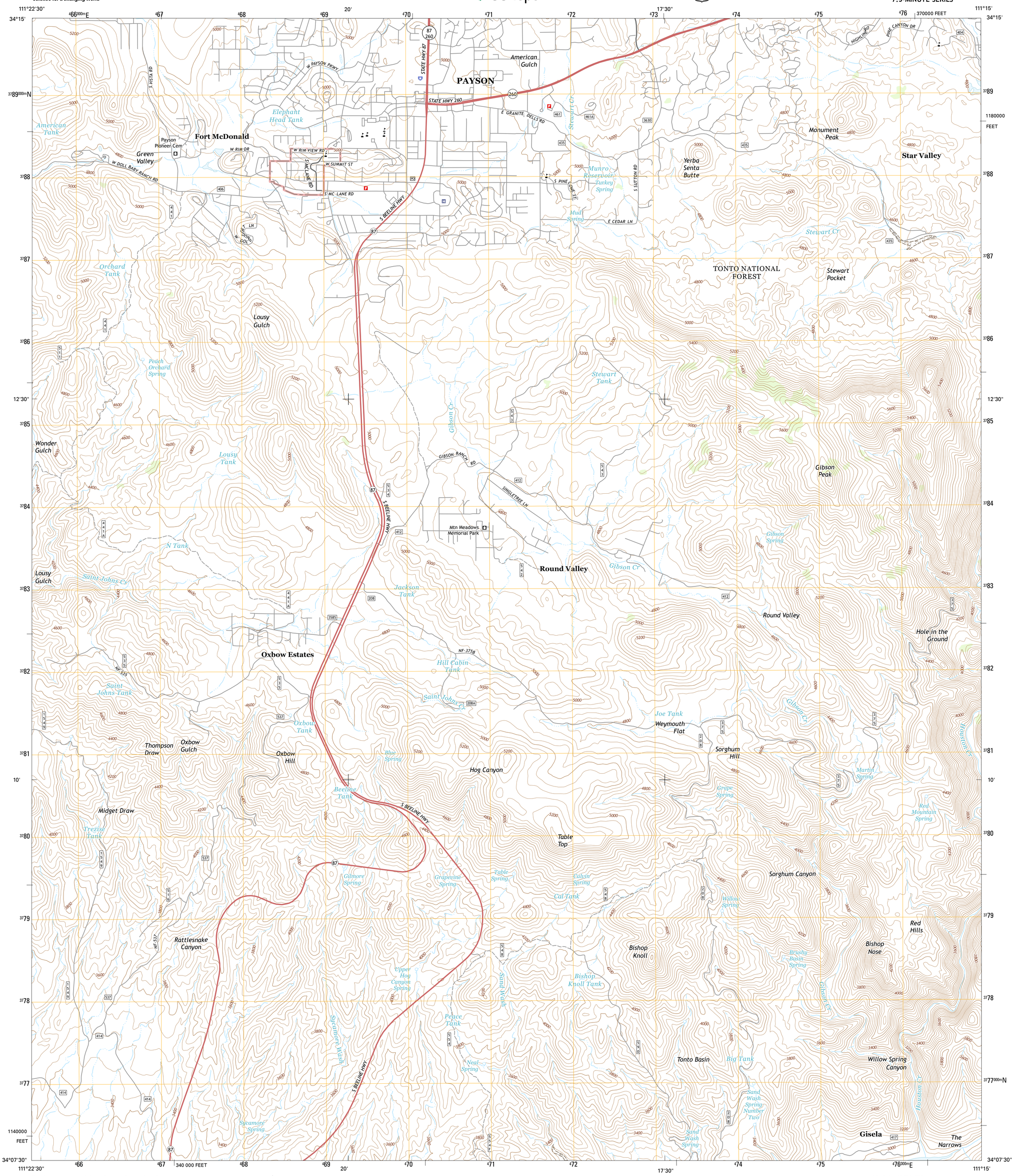
☐ More information needed to evaluate.

If not considered eligible, state reason: _____

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map US Topo

PAYSON SOUTH QUADRANGLE
ARIZONA-GILA CO.
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and
1 000-meter grid: Universal Transverse Mercator, Zone 12S
10 000-foot ticks: Arizona Coordinate System of 1983 (east zone)

This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery.....NAIP, June 2013
Roads..... HERE, ©2013
Roads within US Forest Service Lands.....FSTopo Data with limited Forest Service updates, 2013
Names.....GNIS, 2013
Hydrography.....National Hydrography Dataset, 2013
Contours.....National Elevation Dataset, 2003
Boundaries.....Multiple sources; see metadata file 1972 - 2014
Public Land Survey System.....BLM, 2011

UTM GRID AND 2014 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET
MN 10° 35' 188 MILS
GN 0° 11' 3 MILS

U.S. National Grid
100,000-m Square ID
VC
Grid Zone Designation
12S

SCALE 1:24 000
1 0.5 0 KILOMETERS 1 2
1000 500 0 METERS 1000 2000
1 0.5 0 1
MILES
1000 0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000
FEET

CONTOUR INTERVAL 40 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard, 2011.
A metadata file associated with this product is draft version 0.6.16

ARIZONA
QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

ADJOINING QUADRANGLES
1 Buckhead Mesa
2 Payson North
3 Diamond Point
4 North Peak
5 McDonald Mountain
6 Mazatzal Peak
7 Gisela
8 Sheep Basin Mountain

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route
FS Primary Route
FS Passenger Route
FS High Clearance Route

Check with local Forest Service unit for current travel conditions and restrictions.

PAYSON SOUTH, AZ
2014

NSN. 7643016354807
NGA REF NO. USGSX24K34501

SWCA®
ENVIRONMENTAL CONSULTANTS
Sound Science. Creative Solutions.®

Archaeological Survey of 2.5 Acres for the Proposed American Gulch Loop Trail Project in Payson, Gila County, Arizona

Prepared for

Town of Payson

Prepared by

SWCA Environmental Consultants

June 2015 (Revised August 2015)

ARCHAEOLOGICAL SURVEY OF 2.5 ACRES FOR THE PROPOSED AMERICAN GULCH LOOP TRAIL PROJECT IN PAYSON, GILA COUNTY, ARIZONA

Prepared for

Town of Payson
303 North Beeline Highway
Payson, Arizona 85541
Attn: Shelia DeSchaaf
(928) 474-5242

Prepared by

David M. R. Barr

SWCA Environmental Consultants
343 West Franklin Street
Tucson, Arizona 85701
(520) 325-9194
www.swca.com

Arizona Antiquities Act Blanket Permit No. 2015-017bl

SWCA Project No. 33603

SWCA Cultural Resources Report No. 15-313

June 2015 (Revised August 2015)

I. REPORT TITLE

Report Title: Archaeological Survey of 2.5 Acres for the Proposed American Gulch Loop Trail Project in Payson, Gila County, Arizona

Report Author(s): David M. R. Barr

Date: June 17, 2015 (Revised August 3, 2015)

Report No.: 15-313

☒ Check if this submittal is SRSF for Negative Survey

II. AZSITE & SHPO INFORMATION

ASM Accession Number: 2015-0335.ASM

AAA Permit No.: 2015-017bl

SHPO-20__:

Project Locator UTMs: 469612 mE 3787722 mN **Zone:** 12 **NAD 83**

USGS 7.5' Quadrangle Name: Payson South, Arizona

III. CONSULTING FIRM INFORMATION

Organization/Consulting Firm: SWCA Environmental Consultants

Internal Project Number: 33603

Contact Name: David M. R. Barr

Address: 343 West Franklin Street

Phone: (520) 325-9194

Email: dbarr@swca.com

IV. AGENCY/PROJECT INFORMATION

Lead Agency/Project Number: Arizona Game and Fish Department

Agency Project Name/Number:

Route, Mileposts Limits (ADOT projects): N/A

Nearest City/Town & County: Payson, Gila County, Arizona

Address:

Project Sponsor: Town of Payson

Funding Source(s) (Federal, State, and/or Private): State

Other Permitting/Land Agencies & Permit Numbers: N/A

ASLD Lease Application No.: N/A

V. PROJECT DESCRIPTION

The Town of Payson is proposing to construct the American Gulch Loop Trail project in Payson, Gila County, Arizona. The American Gulch Loop Trail project will connect the existing American Gulch South section with the existing American Gulch North section. The project will be constructed using Heritage Funds from the Arizona Game and Fish Department (AGFD) for the development of non-motorized trails. The Town of Payson contracted SWCA Environmental Consultants to conduct an archaeological survey of the 2.5-acre project area to aid the Town and AGFD in complying with the Arizona Antiquities Act (Arizona Revised Statutes [ARS] §81-841, et. seq.) and the Arizona State Historic Preservation Act
(ARS §41-861-865).

VI. AREA OF POTENTIAL EFFECTS (APE)/PROJECT AREA DESCRIPTION

The APE for the proposed loop consists of a 2.5-acre area; however, the ultimate area that would be impacted is unknown at this time, but would be contained entirely within the APE considered for this undertaking.

VII. PROJECT AREA INFORMATION

Total Acres: 2.5 acres (1.9 acres Town of Payson; 0.6 acre private)

NAD 83; Zone: 12

Meridian: Gila and Salt River Baseline and Meridian

Justification for areas not surveyed (identify land jurisdiction):

Project Location

Land Jurisdiction	Legal Description (T, R, Q, S)	Acres Surveyed	Acres Not Surveyed
Private	T10N, R10E, NE¼, S9	0.6	—
Town of Payson	T10N, R10E, NE¼, S9	1.9	—

VIII. INVENTORY CLASS COMPLETED

☐ Class I Inventory only

☒ Class III Intensive Field Survey (includes Class I inventory)

☐ Other: Identify and provide justification.

IX. CLASS III SURVEY PERSONNEL AND METHODS

Field Personnel

Project Principal Investigator: S. Jerome Hesse

Project Director/Field Supervisor: David M. R. Barr

Crew: N/A

Date(s) of Fieldwork: June 10, 2015

Methods & Area Surveyed

Linear Miles: N/A **Transect intervals:** N/A **Coverage:** N/A

Acres Block Survey 2.5 acres **Transect intervals:** <20m apart **Coverage:** 100%

Site recording criteria used: Arizona State Museum

Ground Surface Visibility: 90 percent

Integrity of Survey Area: Fair

X. CULTURAL RESOURCES

☒ No cultural resources identified

☐ Isolated occurrences only; Number of IOs recorded:

☐ Archaeological sites present; site summary table attached

Number of Previously Recorded Sites:

Number of Newly Recorded Sites:

Number of Sites Not Re-located:

☐ Historic period buildings/structures etc. documented/evaluated; historic property inventory forms attached

RECOMMENDATIONS

Recommended Finding of Project Effect

☒ No Historic Properties Affected

☐ No Adverse Effect

☐ Adverse Effect

Final Draft Report Reviewed By (Consultant):

Reviewer's Name	Title	Years Experience
Adrienne M. Tremblay	**Project Manager/Principal Investigator**	**10**

CONSULTANT CERTIFICATION

I certify the information provided herein has been reviewed for content and accuracy and all work meets applicable agency standards.

06/17/15

Signature Date

Project Manager/Archaeologist

Title

PROJECT DESCRIPTION

The Town of Payson is proposing to construct the American Gulch Loop Trail project in Payson, Gila County, Arizona (Figure 1). The American Gulch Loop Trail project would connect the existing American Gulch South section with the existing American Gulch North section. The project would be constructed using Heritage Funds from the Arizona Game and Fish Department (AGFD) for the development of non-motorized trails. The Town of Payson contracted SWCA Environmental Consultants (SWCA) to conduct an archaeological survey of the 2.5-acre project area to aid the Town of Payson and AGFD in complying with the Arizona Antiquities Act (Arizona Revised Statutes [ARS] §81-841, et. seq.) and the Arizona State Historic Preservation Act (ARS §41-861-865).

PROJECT LOCATION

The project is located in downtown Payson, just south of Main Street (see Figure 1). It is in Section 9, Township 10 North, Range 10 East in Payson, Gila County, Gila and Salt River Baseline and Meridian, on the U.S. Geological Survey (USGS) Payson South, Arizona, 7.5-minute quadrangle (Figure 2). A total of 2.5 acres (1.9 acres Town of Payson and 0.6 acre private) was surveyed for this project.

The Universal Transverse Mercator (UTM) location for the survey area is 469612E, 3787722N, Zone 12, North American Datum (NAD) 1983.

PREVIOUS RESEARCH

Archaeological Records Search

Before fieldwork, SWCA consulted the AZSITE database to identify previously conducted surveys and previously recorded sites in the project area and within a 0.5-mile radius of the project area. SWCA also consulted the records of the Tonto National Forest for sites within a 0.5-mile radius of the project area.

The records search showed that seven archaeological projects have been conducted within 0.5 mile of the project area (Table 1, Appendix A). None of these surveys have overlapped with the current project area. The majority of the surveys were conducted for road and distribution line improvements, telecommunications sites, and small residential development.

Twelve archaeological sites have been documented within a 0.5-mile radius of the project area (Table 2; see Appendix A). Nine of the sites are prehistoric manifestations and three sites are historic manifestations. The prehistoric sites consist of field houses, habitations, and artifact scatters. The historic sites are linear transportation sites that include a wagon road (Payson to Heber) and two roads (State Route [SR] 87 and Forest Highway 11).

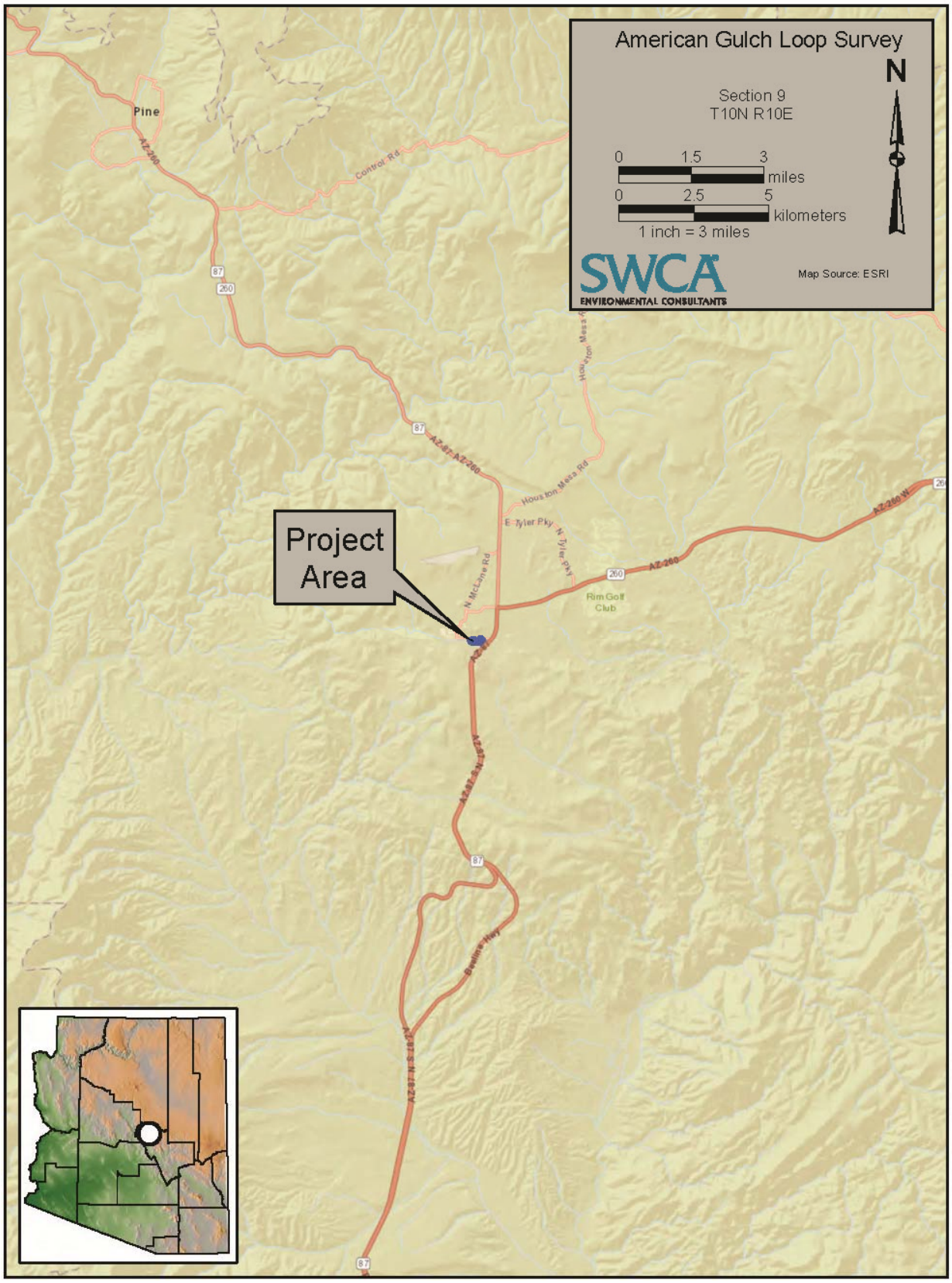


Figure 1. General location of the project area.

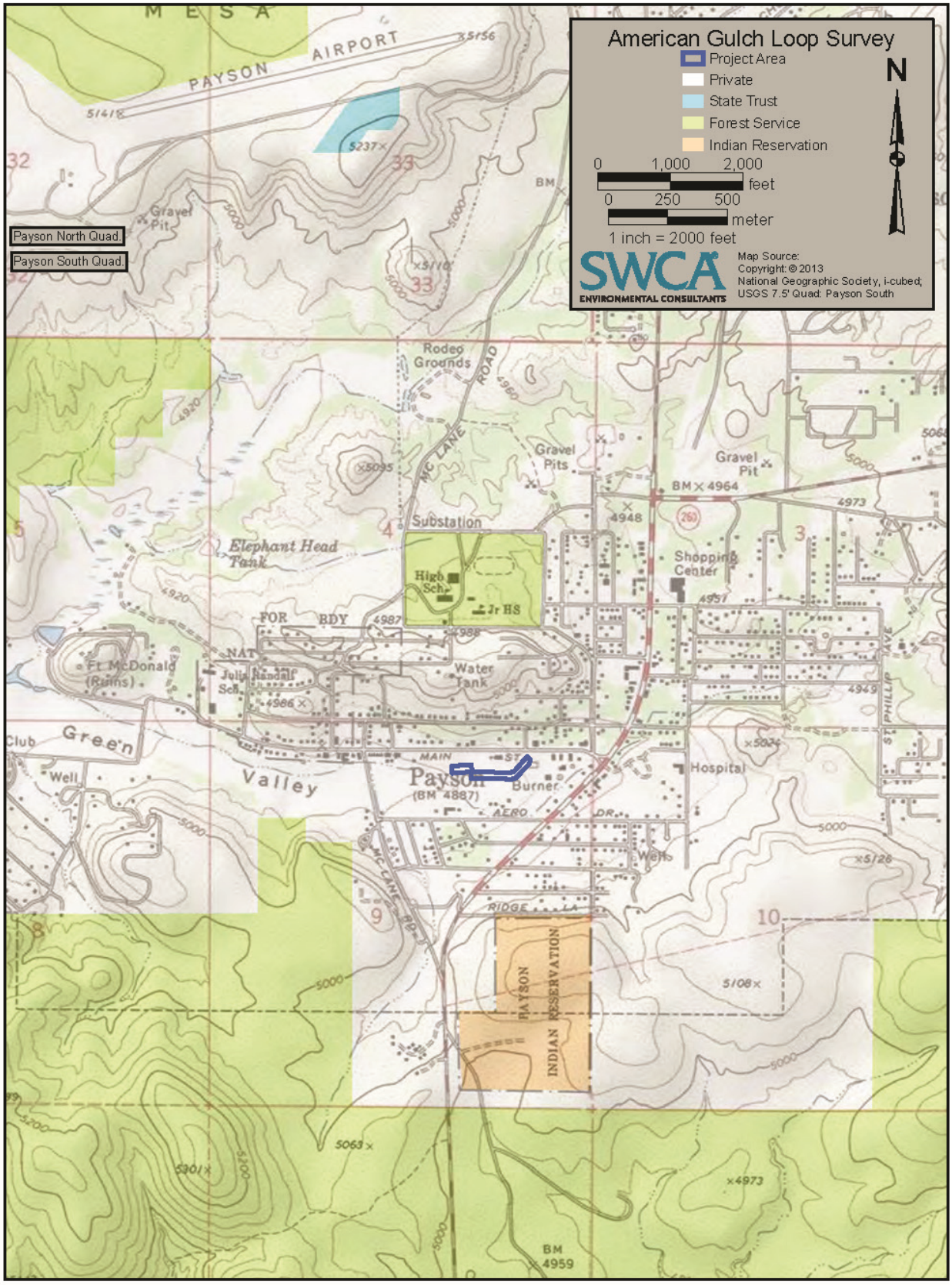


Figure 2. Project location.

Table 1. Previously Conducted Archaeological Surveys within a 0.5-Mile Radius of the Project Area

Agency Number	Project Name	Report Reference
1971-8.ASM	Oxbow Hill to Payson Survey	Huckell (1978)
1993-371.ASM	SR 87 in Payson; Mileposts 251.4–253.4	Weaver (1993)
1998-589.ASM	SR 87 Rye–Payson Survey	Bilsbarrow (1999)
2000-587.ASM	Vanderlink Cell Survey	Kober (2000)
2005-1268.ASM	Read Homes Payson	Christenson (2005)
80-021.ASU	Unknown	Unknown
85-002.ASU	Unknown	Unknown

Table 2. Previously Recorded Archaeological Sites within a 0.5-Mile Radius of the Project Area

Site Number	Site Type	Cultural/Temporal Affiliation	NRHP* Eligibility Status (source)
AZ AA:6:63(ASM)/ AR-03-12-03-680	State Route 87	Euro-American/Historic	Determined eligible (State Historic Preservation Office)
AZ O:15:17(ASM)	Field house with associated artifacts	Native Archaeological Culture/Ceramic	Not evaluated (recorder)
AZ O:15:18(ASM)	Field houses with associated artifacts	Native Archaeological Culture/Ceramic	Not evaluated (recorder)
AZ O:15:19(ASM)	Field house with associated artifacts	Native Archaeological Culture/Ceramic	Not evaluated (recorder)
AZ O:15:59(ASU)	Habitation with associated artifacts	Native Archaeological Culture/Ceramic	Not evaluated (recorder)
AR-03-12-04-119	Field house with associated artifacts	Prehistoric/Ceramic	Not evaluated (recorder)
AR-03-12-04-123	Field houses with associated artifacts	Prehistoric/Ceramic	Not evaluated (recorder)
AR-03-12-04-124	Habitation	Prehistoric/Ceramic	Not evaluated (recorder)
AR-03-12-04-128	Artifact scatter	Prehistoric/Ceramic	Not evaluated (recorder)
AR-03-12-04-144	Habitation with associated features and artifacts	Prehistoric/Ceramic	Not evaluated (recorder)
AR-03-12-04-652	Payson to Heber wagon road	Euro-American/Historic	Not evaluated (recorder)
AR-03-12-04-878	Forest Highway 11	Euro-American/Historic	Not evaluated (recorder)

* NRHP = National Register of Historic Places

National Register of Historic Places–Listed Properties

The National Park Service's National Register of Historic Places (NRHP) database was searched to identify properties listed in the NRHP that are located in or within 0.5 mile of the project area (or area of potential effects). Four NRHP-listed properties are within a 0.5-mile radius of the project area. These properties include the George Randall House, the Ox Bow Inn, and the Payson School. These properties are located approximately 0.25 mile east and west of the current project area (see Appendix A).

Historical Map Research

Historical maps were consulted to identify historic-era properties that were present, and may still be present, in the search area.

The General Land Office (GLO) map of Township 10 North, Range 10 East, filed in 1909, depicts two dirt roads that partially overlap with the current project area (Figure 3). One road is the PAYSON TO CAMP VERDE–PAYSON TO STAR VALLEY which bisects the N½ of Section 9 before heading northeast into Section 4. The second road is a spur off of the PAYSON TO STAR VALLEY road that leads to S. STUART house and what appears to be his fields located in Sections 3–4, 9, and 10. No evidence for these roads was observed during the current project and the project area is developed with commercial buildings and city roads that have destroyed any evidence of these roads.

In addition, the U.S. Geological Survey (USGS) Payson, Arizona, 15-minute quadrangles filed in 1936 and 1942 were examined. A few roads and the OLD FORT MCDONALD are depicted, but no historic-era features are depicted within the current project area. The USGS Holbrook West, Arizona 1 × 1–degree maps filed in 1887 and 1892 were examined. The town of Payson is depicted but no historic-era features are depicted within the current project area. Finally, the USGS Holbrook, Arizona 1 × 2–degree map filed in 1954 was examined. No historic-era features are depicted.

PHYSIOGRAPHIC CONTEXT

The project area is located in the town of Payson in the Green Valley, approximately 11 miles south of the Mogollon Rim, 3.7 miles east of Snowstorm Mountain, and 0.3 mile west of SR 87. Surface sediments are associated with the Early Proterozoic Granitic Rocks deposits which consist of various granitic rocks. The soils associated with this deposit in the project area are generally gravelly brown clay loam from floodplain deposits. The project elevation is 4,887 feet (1,489 meters [m]) above mean sea level.

The project area lies within the Great Basin Conifer Woodland biotic community, as described by Brown (1994). The project area is primarily devoid of overstory natural vegetation; however, some native vegetation remained. Observed vegetation includes cottonwood (*Populus* spp.), juniper (*Juniperus* spp.), forbs, and grasses (Figures 4 and 5).

The project area is bisected by a stabilized drainage that flows through the project area, installation of a sidewalk, and blading from construction of businesses and parking lots (see Figures 4 and 5).

CULTURE HISTORY

The following culture history is adapted primarily from North et al. (2005).

Prehistoric Period

Payson, and the surrounding area, is located in the transition zone for several well-documented prehistoric cultures (Sinagua, Hohokam, Anasazi, Mogollon, and Salado), but the cultural sequence in the region itself has not been as well documented. Most Paleoindian and Early Archaic artifacts in the Payson area are isolated projectile points, which suggests occasional use of the area for hunting and other short-term activities (Huckell 1978). During the Middle and Late Archaic periods, there is an increase in the frequency of sites, which consist of base camps, flaked stone scatters, or rockshelter sites, such as the Horton Rock Shelter (Hohmann 1988; Redman 1993).

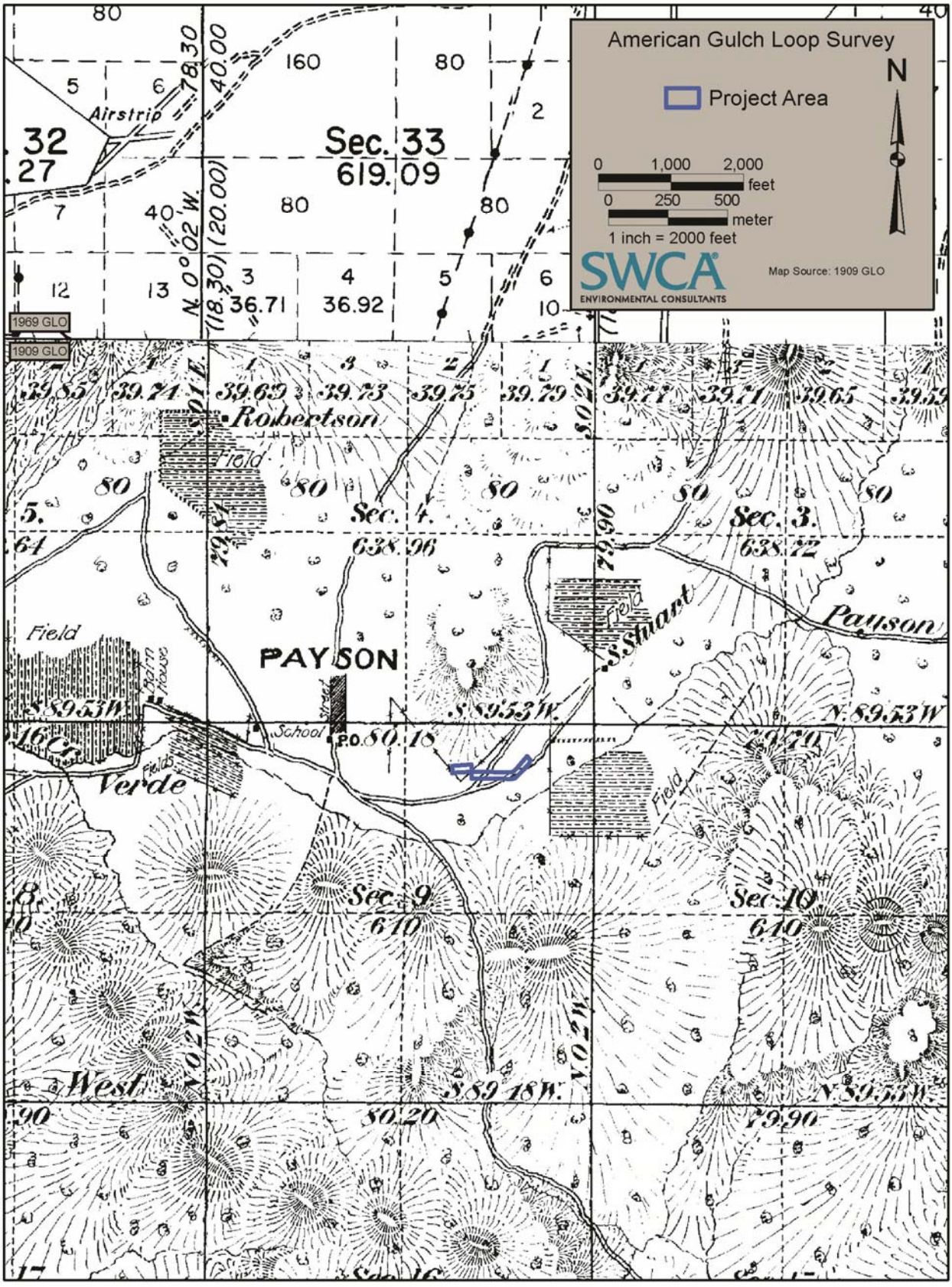


Figure 3. Project area shown on the 1909 GLO map.

Figure 4. Overview of project area; view facing west.

Figure 5. Overview of project area; view facing east.

The end of the Archaic period saw drastic changes in settlement patterns, subsistence base, and technology in the Payson area, as in the rest of Arizona. Dating for this transition is uncertain for the Payson area, since there are few chronometric dates. Traditionally, the end of the Archaic has been placed at A.D. 700, since by that time, ceramics and pit houses are found in the region. One such site has recently been excavated by Desert Archaeology, Inc., in Little Green Valley (Herr et al. 2000).

The appearance of these Hohokam-style ceramics and pit houses signaled the beginning of the Union Park phase (A.D. 700–1000) (Redman 1993; Wood 1985). It is not known whether the appearance of these new traits represents a large-scale immigration of Hohokam to the area, intensive contact between Hohokam and Late Archaic groups indigenous to the area, or a combination of the two.

From A.D. 1000–1150, known as the Star Valley phase, the Payson area experienced a growth in population and the establishment of settlements consisting of small masonry structures (Redman 1993). Although Hohokam red-on-buff ceramics were still used, black-on-white ceramics from the north begin to appear in Star Valley phase assemblages (North et al. 2005).

After the Star Valley phase, the Payson phase (A.D. 1150–1250) was characterized by the appearance of larger villages with smaller surrounding hamlets in Round Valley, Green Valley, and Star Valley and on Houston Mesa (Redman 1993). Ceramics commonly found at Payson phase villages mostly consist of locally manufactured plain wares and red wares. At the end of the Payson phase in A.D. 1250, the region was abandoned, and the few remaining people were widely dispersed across the landscape (Redman 1993).

Protohistoric and Historic Periods

Several radiocarbon dates imply Apache/Yavapai use of the area by the seventeenth or eighteenth centuries. Evidence of Apache/Yavapai occupation of the area is limited, and generally consists of ephemeral shelter, roasting, and resource procurement sites (Redman 1993:34). Apache occupation within the Mogollon Rim escarpment may have continued unabated until the U.S. military began tracking them down in the 1860s, eventually removing all Payson area Apaches to Fort Verde and then to San Carlos.

U.S. Territorial (1848–1912) occupation of the Payson area did not commence in earnest until the late 1870s, when ranchers, farmers, and to a lesser extent, miners colonized the area. The correlation between the arrival of Euro-American settlers and the removal of local Apache bands to San Carlos is no coincidence. While ranching and farming dominated the early decades of Euro-American occupation in the Payson area, logging became a significant economic pursuit after 1900. The construction of the Theodore Roosevelt Dam (located approximately 40 miles south of Payson) and establishment of the U.S. Department of Agriculture's Tonto National Forest also contributed to Euro-American population growth in the area during the early portion of the twentieth century (Redman 1993:35). Travel routes in and out of the Payson area were greatly improved in the 1950s and 1960s as a result of road construction projects such as SR 87 and SR 260. Payson and nearby settlements retained their rural character until the latter half of the 1900s, when recreation introduced significant money into local economies. This in turn prompted the substantial growth seen in recent decades.

SURVEY METHODS

Resource Definitions

Archaeological resources were evaluated according to criteria established by the Arizona State Museum (ASM). The criteria recognize two classes of archaeological remains: the site and the isolated occurrence

(IO). The archaeological site is defined under rules adopted for the administration of the Arizona Antiquities Act:

> "Archaeological site" means any area with material remains of past Indian or non-Indian life or activities that are of archaeological interest, including without limitation, historic or prehistoric ruins, burial grounds, and inscriptions made by human agency. (Arizona Antiquities Act, Arizona Revised Statutes 41-841, *et seq.*, Chapter 8-201, A.3)
>
> As interpreted by the ASM, "remains of archaeological interest" may include "purposeful constructions" or simply concentrations of materials more than 50 years old. Additionally, sites should consist of at least one of the following:
>
> 30+ artifacts of a single class (i.e., 30 sherds, 30 tin cans) within an area 15 meters (50 feet) in diameter, except when all pieces appear to originate from a single source (i.e., one ceramic pot, one core, one glass bottle);
>
> 20+ artifacts which include at least 2 classes of artifact types (i.e., sherds, groundstone, nails, glass) within an area 15 meters (50 feet) in diameter:
>
> One or more archaeological features in temporal association with any number of artifacts;
>
> Two or more temporally associated archaeological features without artifacts.
>
> Non-linear, isolated features without associated artifacts may be recorded at the discretion of the archaeologists. An "isolated feature" is defined as a feature that does not have any other features within a 100 meter (325 feet) diameter. This might include isolated rock piles. mine shafts, prospecting pits or unidentified depressions without associated artifact associations. (ASM 1995)

An archaeological occurrence meeting these minimum criteria is recorded as a site. An occurrence not meeting these criteria is generally classified as an IO, although under exceptional circumstances an occurrence may be judgmentally classified as a site.

Survey Coverage

SWCA archaeologist David M. R. Barr surveyed the project area on June 10, 2015, resulting in a total of one person–field day. General conditions for the survey were excellent, and ground visibility was generally 90 percent.

The survey was conducted using standard archaeological techniques following ASM guidelines for survey coverage and site recording methodologies. According to the standards for pedestrian survey established by ASM, a person conducting a pedestrian survey can achieve 100 percent coverage of a parcel by walking a series of systematic transects spaced no more than 20 m (66 feet) apart. The survey entailed systematically walking the 2.5-acre project area in parallel transects spaced no more than 10 m apart.

The archaeologist sought evidence for cultural resources in the form of artifacts (e.g., ceramics, lithics, historical metals, or glass) or features (concentrations of fire-affected rock, charcoal-stained soil, prehistoric or historical structures, or other cultural anomalies). In addition to searching for archaeological remains, the archaeologist included in his survey in-use properties (e.g., buildings, roads, corrals) greater than 50 years old.

Arizona Register Criteria for Evaluation

Four criteria are applied in the evaluation of cultural properties for inclusion in the NRHP (36 Code of Federal Regulations 60.4). The same criteria are used to evaluate properties for inclusion in the Arizona Register of Historic Places (ARHP) (Arizona Administrative Code Section R12-8-302). Normally, a significant property must be at least 50 years old and meet at least one of these four criteria to be considered eligible for listing in the NRHP/ARHP. According to the NRHP/ARHP criteria, the quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and

A. that are associated with events that have made a significant contribution to the broad patterns of our history; or

B. that are associated with the lives of persons significant in our past; or

C. that embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguished entity whose components may lack individual distinction; or

D. that have yielded, or may be likely to yield, information important in prehistory or history.

SURVEY FINDINGS AND MANAGEMENT RECOMMENDATIONS

The survey of the project area resulted in the identification of no new or previously documented archaeological sites. Although four NRHP-listed historic properties are found within the 0.5-mile records-search radius, the three properties are located over 0.25 mile from the proposed project area. Because of this distance, the proposed construction and use of the trail will not result in an adverse visual effect to any of the properties. Because no historic properties are located in the project area and no adverse visual effects are anticipated, SWCA recommends a finding of No Historic Properties Affected for the proposed project. No further work is recommended. However, if previously undocumented buried cultural resources are identified during ground-disturbing activities, all work in the immediate vicinity of the discovery should stop until the find can be evaluated by a professional archaeologist.

REFERENCES CITED

Arizona State Museum (ASM)
1995 *Revised Site Definition Policy*. Arizona State Museum, University of Arizona, Tucson.

Bilsbarrow, Matthew H.
1999 *A Cultural Resources Survey of the State Route 87 Highway Corridor from Rye to Payson (Mileposts Northbound/240.90 Southbound/251.40), Payson Ranger District, Tonto National Forest, Northwestern Gila County, Arizona*. Archaeological Research Services, Tempe.

Brown, David E. (editor)
1994 *Biotic Communities: Southwestern United States and Northwestern Mexico*. University of Utah Press, Salt Lake City.

Christenson, Andrew L.
2005 Letter Report (Read Homes Payson). A. L. Christenson, Prescott, Arizona.

Herr, Sarah, Pat H. Stein, and Patricia Cook
2000 *Preliminary Report of Archaeological Data Recovery in the Preacher Canyon Section and Sharp Creek Campground, State Route 260–Payson to Heber Archaeological Project, Gila County, Arizona*. Project Report No. 00-129 (Revised). Desert Archaeology, Inc., Tucson.

Hohmann, John W.
1988 Horton Rock Shelter, Site AR-03-12-04-532(TNF). In *Continuing Studies in Payson Prehistory*, edited by John W. Hohmann and Charles L. Redman, pp. 22–49. Anthropological Field Studies No. 21. Office of Cultural Resource Management, Department of Anthropology, Arizona State University, Tempe.

Huckell, Bruce B.
1978 *The Oxbow Hill Project: Part of the ASM Contributions to Highway Salvage Archaeology in Arizona*. Technical Series No. 48. Arizona State Museum, University of Arizona, Tucson.

Kober, Brent
2000 *A Cultural Resources Survey for a Wireless Communications Facility: Crown/Vanderlink AZ 19580, Gila County, Arizona*. Report No. 00-85. Northland Research, Inc., Flagstaff.

North, Chris, Dennis Gilpin, F. Michael O'Hara III, and Alan Ferg
2005 *An Ethnohistoric Survey of the Payson Ranger District*. Cultural Resources Report No. 04-374. SWCA Environmental Consultants, Phoenix.

Redman, Charles L.
1993 *People of the Tonto Rim: Archaeological Discovery in Prehistoric Arizona*. Smithsonian Institution Press, Washington, D.C.

Weaver, Jr., Donald E.
1993 *An Archaeological Survey of a Portion of the State Route 87 Right-of-Way in Payson, Mileposts 251.4 to 253.4, Gila County, Arizona*. Plateau Mountain Desert Research, Flagstaff.

Wood, J. Scott
1985 Second Foundation: Settlement Patterns and Agriculture in the Northeastern Hohokam Periphery, Central Arizona. Manuscript on file, Tonto National Forest, Phoenix.

APPENDIX A

Previous Research Maps

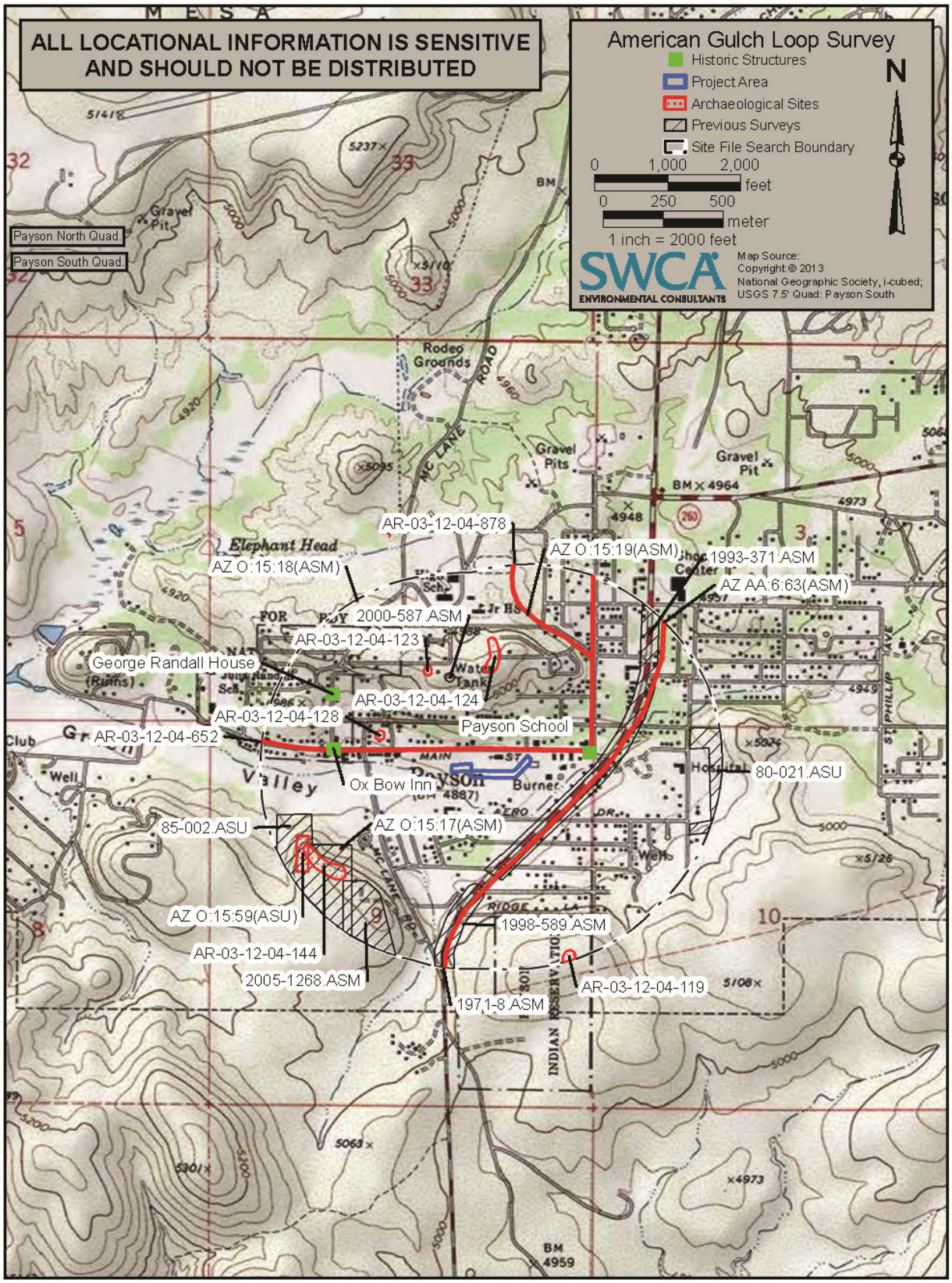


Figure A.1. Previously recorded sites, surveys, and historic buildings/districts within a 0.5-mile radius of the project area.

Fleetham, Trever

From: DeSchaaf, Sheila
Sent: Tuesday, August 28, 2018 4:24 PM
To: Fleetham, Trever
Subject: FW: American Gulch - Payson Survey; SHPO-2015-0540(126431)

Follow Up Flag: Follow up
Flag Status: Flagged

FYI

From: Mary-Ellen Walsh [mailto:mwalsh@azstateparks.gov]
Sent: Thursday, July 30, 2015 8:41 AM
To: DeSchaaf, Sheila
Cc: Robyn Beck
Subject: Re: American Gulch - Payson Survey; SHPO-2015-0540(126431)

Good morning,
I have reviewed the report for the above-referenced project.

SHPO concurs with a finding of "No Historic Properties Affected".

The only comment I have is the report incorrectly attributes the Heritage Grant to Arizona State Parks; it should be Arizona Game & Fish Department.
Please have this correction made and send me 1 unbound copy of the revised report.

Thank you!

Mary-Ellen Walsh, M.A., RPA
Archaeological Compliance Specialist
State Historic Preservation Office
1300 W. Washington Street
Phoenix, AZ 85007

Phone: (602) 542-7120
Email: mwalsh@azstateparks.gov
http://azstateparks.com/SHPO/

On Jul 21, 2015, at 3:00 PM, DeSchaaf, Sheila <sdeschaaf@paysonaz.gov> wrote:

<33603_CR_061715_sbreduced.pdf>

Key Personnel

Town of Payson

LaRon Garrett
Town Manager

Sheila DeSchaaf
Public Works Director
Planning & Development Director

Trever Fleetham
Planning & Sustainability Advisor

Consultant

Natural Channel Design, Inc.

See attached biographies/ resumes on page 148

Figure 5. Photo Pt 1 OHWM Looking downstream from culvert at beginning of project.

Figure 6. Photo Pt 2 OHWM Looking downstream from inside of culvert.

Figure 7. Photo Pt 3 OHWM Looking upstream at right bank towards box culvert.

Figure 8. Photo Pt 4 OHWM Looking across channel towards left bank.

Figure 9. Photo Pt 5 OHWM Looking downstream from center of channel.

Figure 10. Photo Pt 6 OHWM Looking upstream towards culvert.

Figure 11. Photo Pt 7 OHWM Looking upstream from left bank.

Figure 12. Photo Pt 8 OHWM Looking down at right bank from across channel.

Figure 13. Photo Pt 9 OHWM Looking downstream from left bank.

Figure 14. Photo Pt 10 OHWM Looking upstream from left bank.

Figure 15. Photo Pt 11 OHWM Looking across channel from left bank.

Figure 16. Photo Pt 12 OHWM Looking downstream from left bank.

Figure 17. Photo Pt 13 OHWM Looking upstream from left bank.

Figure 18. Photo Pt 14 OHWM Looking upstream from bridge near end of project.

Figure 19. Photo Pt 15 OHWM Looking downstream towards bridge.

Figure 20. Photo Pt 16 OHWM Looking upstream towards bridge from end of project.

Figure 21. Photo pt 17 OHWM Looking downstream from end of project.

Tommie C. Martin, District I
610 E. Hwy 260, Payson, 85547
(928) 402-8753
(800) 304-4452, ext.7100
tmartin@gilacountyaz.gov

Tim R. Humphrey, District II
(928) 425-3231
thumphrey@gilacountyaz.gov

Woody Cline, District III
(928) 402-4401
wcline@gilacountyaz.gov

W. James Menlove,
County Manager
(928) 402-4257
jmenlove@gilacountyaz.gov

Marian Sheppard,
Clerk of the Board of Supervisors
(928) 402-8757
msheppard@gilacountyaz.gov

GILA COUNTY

From the Office of:

Tim R. Humphrey, Chairman

Supervisor, District 2

August 30, 2018

Arizona Water Protection Fund Commission
1110 West Washington Street, Suite 310
Phoenix, AZ 85007

To Whom It May Concern:

I am writing to express my support of the American Gulch Channel and Riparian Enhancement Project. As a member of the Gila County Board of Supervisors, I am eager to see improvements made in within and around the American Gulch to help make Payson and Gila County better for all. The community's efforts to transform this long-neglected floodway into a widely beneficial asset are much needed, and have gained tremendous enthusiasm over recent years.

I strongly encourage the Arizona Water Protection Fund Commission to award the American Gulch Channel and Riparian Enhancement Project the necessary funds to complete the construction of this much needed and beneficial effort.

Best Regards,

Tim Humphrey
Chairman – District 2
Gila County Board of Supervisors
1400 E. Ash St. Globe, AZ 85501
(928) 425-3231
thumphrey@gilacountyaz.gov

April 16, 2018

Town of Payson
LaRon Garrett Town Manager
303 N. Beeline Highway
Payson, AZ 85541

LaRon, we the undersigned merchants, and interested community members, are writing to you and the council to request inclusion in the FY 2019 budget, money to finish landscaping phase 1 of the American Gulch Project.

We understand that there is a quote of approximately $275,000 to complete earthwork and landscaping consistent with the Master Plan for the American Gulch project passed by the council, running from Sawmill Crossing shopping center to Westerly street.

While it does not complete the American Gulch project by any stretch of the imagination, it is a step forward in the long range plan of having a American Gulch walkway from Sawmill Crossing to Green valley Park. Completing that section of the "American Gulch "riparian area" "phase one" "Green Valley Riverwalk" (whatever name is attached), would give the town a handle on what future costs and construction might be, as well as giving the community some sense of what it might look like.

We see this as a step forward in the long-term redevelopment of the Main Street area

Sincerely yours,

Payson Main Street Guild
Property and Business Owners

August 29, 2018

Arizona Water Protection Fund Commission
1110 West Washington Street, Suite 310
Phoenix, AZ 85007

To Whom It May Concern:

I am writing to express my support of the American Gulch Channel and Riparian Enhancement Project. As a member of the Tonto Apache Tribal Council, and a member of the greater Payson area community, I am eager to see improvements made in and around the American Gulch. The community's efforts to transform this long-neglected floodway into a widely beneficial asset are much needed, and have gained tremendous enthusiasm over recent years.

I strongly encourage the Arizona Water Protection Fund Commission to award the American Gulch Channel and Riparian Enhancement Project the necessary funds to complete the construction of this much needed and beneficial effort.

Best Regards,

Farrell Hoosava

Tribal Council Member
Tonto Apache Tribe
Payson, AZ
(928)474-5000 Ext. 8133
fhoosava@tontoapache.org

September 4, 2018

Town of Payson
303 N Beeline Hwy
Payson, AZ 85541

RE: American Gulch

To whom it may concern:

My name is Maia Crespin, Executive Director for the Rim Country Regional Chamber of Commerce. We are located on the corner of Main Street and the Beeline Highway (Highway 87). The Chamber and Visitors Center are housed in the same building, so we service both the business community as well as our visitors.

I was advised there is a grant that could assist in beautifying our Payson community via the American Gulch trail between the Sawmill Theater to Westerly Road. The area could really use a facelift especially from a tourism aspect. We had over 1,200 visitors come through the Visitors Center last month (August). The number one recreational activity people are flocking to Payson for is hiking. We have a variety of trails for all experience levels. However, we do not frequently recommend the American Gulch Trail since it is not visually appealing nor a good representation of how we want our visitors to remember Payson, Arizona. The trail is right around the corner from the Chamber/Visitors Center and is great for all skill levels since it is flat. We are primarily a retirement community and the trail would also be a great place for moms to walk with their strollers. Green Valley Park is the primary source for most of the locals but the American Gulch Trail would be a perfect alternative.

We have quite a few businesses on Main Street who service our visitors and locals. Beautifying the American Gulch would be another great way to boost their revenue and overall tourism for Rim Country. We currently have a Main Street Guild Committee who meet once a month with the Town of Payson's Economic Development Department to discuss ways we can revitalize Main Street and this would be perfect. People would be able to see the American Gulch as they drive down Main Street or sip a cup of tea outside the Mogollon Moose Bakery.

We would greatly appreciate your consideration in granting our community the funds to help boost tourism and bringing a smile to the faces of our visitors and locals.

Sincerely,

Maia Crespin, Executive Director
Rim Country Regional Chamber of Commerce
maia@rimcountrychamber.com
928-474-4515

Gila County Property Report

Wednesday, September 05, 2018

Account # : R000046697 **Parcel # :** 304-16-223N - **Appraisal Year :** 2018

Acct Type : Municipal **Tax District :** 1053 **Map # :** 16 **Parcel Size :** 4.60 acres

Owner Name and Address :

TOWN OF PAYSON
303 N BEELINE HWY
PAYSON AZ 85541

Property Location :

No #
204 W AERO DR
AZ 00000-0000 MH Space

Business/Complex :

Property Sales History

No Records Returned

Legal Description :

COMM SE COR SUNSET STRIP ADDITION, PLAT 314; TH N89D44'34"E, 35.0' TO POB; TH N0D26'22"W, 469.66'; TH S89D19'45"W, 230.0'; TH N0D27'W, 170.0'; TH S83D59'20"E, 68.76'; TH N89D19'47"E, 448.58'; TH N76D19'18"E, 44.43'; TH S0D26'22"E, 358.48'; TH S89D28'36"W, 59.82'; TH S0D20'55"E, 124.79'; TH S89D48'42"W, 155.07'; TH S0D27'W, 150.33'; TH S89D41'W, 115.17' TO POB NE4 SEC 9 T10N R10E = 4.60 AC (OUT OF 304-16-223G & -223L)

Building Count :

Bldg ID	Occupancy	Built As	Quality	Sq Ft	Year
1.00	Storage - Material	Storage - Material	Average	544	1968
2.00	Light Commercial Utility	Light Commercial Utility	Average	3000	1998
3.00	Light Commercial Utility	Light Commercial Utility	Average	936	1998
4.00	Light Commercial Utility	Light Commercial Utility	Average	4000	2002
5.00	Commercial Yard Improvements	Commercial Yard Improvements	Average	1	1998

Valuation:

Value Method:	Cost	**Full Cash Value (FCV):**	$263,220.00	**Use Code:**	9720
		Limited Value (LPV):	$263,220.00	**Property Use:**	9720-MUNICIP COMMER PROP
Assessment Ratio:	15.00 %	**Assessed FCV:**	$39,483.00		
		Assessed LPV:	$0.00		

Disclaimer:

The Assessor’s Office has compiled information on this website that it uses to identify, classify, and value real and personal property. This website is not updated in ‘real time.’ The Assessor does not guarantee that any information provided on this website is accurate, complete, or current. The information provided on this site is not equivalent of a title report or a real estate survey. Users should independently research, investigate, and verify all information before relying on it or in the preparation of legal documents. Please contact (928) 402-8714 if you believe any information is incomplete, out of date, or incorrect so that the appropriate correction can be addressed. Please note that a statutory process is available to correct errors pursuant to Arizona Revised Statutes 42-16254

Gila County Property Report

Wednesday, September 05, 2018

Account # : R000046198 **Parcel # :** 304-16-222K - **Appraisal Year :** 2018

Acct Type : Municipal **Tax District :** 1053 **Map # :** 16 **Parcel Size :** 0.19 acres

Owner Name and Address :

TOWN OF PAYSON

303 N BEELINE HWY
PAYSON AZ 85541

Property Location :

No #

PAYSON AZ 85541 MH Space

Business/Complex :

Property Sales History

Sale Date	Doc Date	Book	Page	Type	Amount	Grantor	Grantee
7/30/2010	7/30/2010	-	-	WD	$390,000.00	EL CAMINO WESTERLY	MESSINGER PAYSON FURERAL HOME INC
12/29/2010	12/29/2010	-	-	QC	$0.00	EL CAMINO WSTERLY LLC	TOWN OF PAYSON

Legal Description :

PARCEL C OF ROS 3851 NE4 SEC 9 T10N R10E = 0.19 AC (OUT OF 304-16-222E)

Building Count :

No Records Returned

Valuation:

Value Method:	Market	**Full Cash Value (FCV):**	$28,927.00	**Use Code:**	9700
		Limited Value (LPV):	$28,927.00	**Property Use:**	9700-MUNICIPAL VACANT LAND DEFAULT
Assessment Ratio:	15.00 %	**Assessed FCV:**	$4,339.00		
		Assessed LPV:	$0.00		

Disclaimer:

The Assessor's Office has compiled information on this website that it uses to identify, classify, and value real and personal property. This website is not updated in 'real time.' The Assessor does not guarantee that any information provided on this website is accurate, complete, or current. The information provided on this site is not equivalent of a title report or a real estate survey. Users should independently research, investigate, and verify all information before relying on it or in the preparation of legal documents. Please contact (928) 402-8714 if you believe any information is incomplete, out of date, or incorrect so that the appropriate correction can be addressed. Please note that a statutory process is available to correct errors pursuant to Arizona Revised Statutes 42-16254

Community Development Department
303 North Beeline Highway
Payson, AZ 85541
Phone : 928-474-5242 • Fax : 928-472-7490 • TDD: 928-472-6449
www.paysonaz.gov

CWA Section 404 Permit Agent Authorization

I, KAIBAB INDUSTRIES, INC. (printed name), as the owner of the property at 201 W. MAIN ST., PAYSON, AZ 85541 (address), tax parcel # 304-16-301, hereby authorize the Town of Payson and/or its agents to act on my behalf for the jurisdictional delineation and CWA Section 404 permit for construction of enhancements to the American Gulch. I am aware of the project and its implications it may have on my property.

Owner Signature

06-25-18
Date

This instrument was acknowledged before me this 25 day of June, 2018 by Gordon Whiting

In witness whereof, I herewith set my hand and official seal.

Notary Public

ASHLY A. FIGUEROA
Notary Public - State of Arizona
GILA COUNTY
My Commission Expires
June 11, 2020

Community Development Department
303 North Beeline Highway
Payson, AZ 85541
Phone : 928-474-5242 • Fax : 928-472-7490 • TDD: 928-472-6449
www.paysonaz.gov

CWA Section 404 Permit Agent Authorization

I, PAUL R. MESSINGER CEO (printed name), as the owner of the property at 900 South Westerly Road, Payson, AZ 85541, tax parcel #304-16-222F, hereby authorize the Town of Payson and/or its agents to act on my behalf for the jurisdictional delineation and CWA Section 404 permit for construction of enhancements to the American Gulch. I am aware of the project and its implications it may have on my property.

Messinger Payson Funeral Home, Inc

Paul R Messinger CEO — 7-5-18

Owner Signature — Date

This instrument was acknowledged before me this 5th day of July, 2018 by Paul R Messinger.

In witness whereof, I herewith set my hand and official seal.

AUDREY WILCOX
NOTARY PUBLIC, ARIZONA
GILA COUNTY
My Commission Expires
July 19, 2021

Audrey L Wilcox

Notary Public

Evidence of Physical and Legal Availability of Water

Temporary irrigation may be utilized to aid vegetation establishment, but the vegetative palette of this project should be self-supporting under the ephemeral flow regime provided by the watershed. Water for construction and/or irrigation to establish vegetation installations will be provided by metered service delivery from the Town of Payson municipal water system.

Preliminary
Pre-Final Submittal

Design Report

American Gulch
Channel and Riparian Enhancement
City of Payson, Arizona

Natural Channel Design, Inc.
2900 N. West St., Suite 5
Flagstaff, AZ 86004

December 2017

Design Report

American Gulch
Channel and Riparian Enhancement
City of Payson, Arizona

Submitted to:
City of Payson, Arizona
Planning and Development

Point of Contact:
Sheila DeSchaaf
sdeschaaf@paysonaz.gov

December 2017

Preliminary
Pre-Final Submittal

Prepared by:
Natural Channel Design, Inc.
2900 N. West St., Suite 5
Flagstaff, AZ 86004

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

APPENDICES

PROJECT DESCRIPTION

American Gulch forms a major drainage through the town of Payson, AZ. The ephemeral channel through the project area has been highly modified to serve as a stormwater conveyance and currently is sized to contain the FEMA estimated 100-year flood event. The current channel configuration through the project area is a grass lined, trapezoidal channel bounded by development on one side and a recently built urban trail on the other. The current channel configuration appears to be a major departure from the original landform which was likely a wide swale with a large floodplain. The existing configuration reflects that of an incised and narrowed channel, configured to contain flood flows in a narrow corridor and allow for development. The current channel has evidence of some erosion and aggradation of sediment from storm flows and there are signs of encroachment from invasive tree and weed species.

The Town of Payson wishes to improve the aesthetics and habitat function of the channel while retaining flood control functions. The channel template provided with this design will utilize natural channel design principles with aims to improve sediment transport function and the ability of the channel to support appropriate native vegetation. However, it should be understood that the natural channel design employed requires features that accommodate the incised nature of the flood control channel and the relatively fine grained sediment that is found in the historical alluvial fill of the floodplain.

Figure 1. Project reach (blue) of American Gulch.

Temporary irrigation may be utilized to aid vegetation establishment, but the vegetative palette should be self-supporting under the ephemeral flow regime provided by the watershed. It is understood that perennial flows may be added at some future date by the introduction of a small amount of reclaimed water into the stream system.

DESIGN APPROACH

A natural channel requires a properly dimensioned active channel and a floodplain to spread flood flows and dissipate the energy of these relatively high flows. Natural channels are a product of the geology, vegetation components, sediment and runoff supplied by the watershed. By comparison, the American Gulch is a highly modified channel, originally designed primarily for flood control purposes. Additionally, it is located in a highly modified watershed which has been urbanized so that flood flows and sediment regime are greatly altered. Naturalizing the channel requires an understanding of how sediment supply, modified flow regime and changes in flood plain geometry can fit into a natural channel system which provides ecological and aesthetic benefits as well as flood control. This assessment and design has used a combination of empirical and analytical methods to understand the physical elements of the watershed upstream of the American Gulch and to develop the the proposed channel modifications. The final product is intended to emulate natural channel form and function as best as can be provided within the bottom of an otherwise entrenched, trapezoidal channel.

Hydraulic modeling has been conducted to ensure the recommended channel template does not adversely impact the regulatory floodplain along the channel reach. Post-project, the regulatory 'Approximate Zone A' flood will continue to be "contained in channel" as is the condition within the effective FEMA floodplain map (Map No.04007C0427D, Effective 12/4/2007). Generally, the channel modifications proposed herein result in an increase in the channel cross sectional area through the subject reach. Channel roughness may vary with the addition of feature rocks and modified vegetation. However, on balance, the channel capacity will still be capable of passing the design 100-year event.

EMPIRICAL METHODS

An alluvial stream channel is a product of watershed processes. A functional channel will successfully transport water and sediment originating in the watershed. A stream channel adjusts its size, sinuosity, and slope to accommodate a range of stream flows and to move sediment through the system. Generally speaking, a stream is also constantly dissipating energy as it moves downstream. In a low gradient channel, bars, meanders and a broad floodplain are important features for dissipating excess energy. If unable to expend this energy, the channel is inherently unstable and prone to lateral and/or vertical erosion, especially during large flow events.

A stream creates a set of physical features (central or bankfull channel, geomorphic floodplain, low & high terraces) to accomplish the transport of water and sediment. Each feature provides an essential purpose. The central or bankfull channel transports the majority of sediment load along the channel bottom. The geomorphic floodplain lies adjacent to the central channel and is overtopped by moderate, frequent flow events. Low and high terraces are abandoned floodplains or bars created by infrequent, large flood events. The floodplain and terraces spread high flows, dissipating energy and slowing velocities. The geomorphic floodplain should not be confused with the regulatory 100-year floodplain. The 100-year floodplain is not an alluvial feature but the lateral extents inundated during a 100-year flood event. Generally, channel, geomorphic floodplain, and terraces all lie within the 100–year floodplain. In the southwest, as in other regions, the channel and geomorphic floodplain are created and maintained by moderate, frequent flood events with return intervals in the range of one to two years (Moody et al. 2003). In many gravel bed streams, this flow has been shown to carry the greatest amount of sediment over time (Andrews, 1980) and is considered the stream forming flow, channel maintenance flow or bankfull flow. The channel that carries this amount of flow is called the bankfull channel.

These geomorphic features are vaguely identified within this reach of American Gulch and there is evidence that a bankfull channel is beginning to form in the bottom of what was a uniform trapezoidal channel section. The bankfull channel is poorly defined and eroding through (Figure 2) a turf reinforcement mat that was placed in the channel bottom, approximately fifteen years ago. The floodplain is constrained by development surrounding the project reach and the channel itself was originally designed to contain the FEMA 100-year flood.

The upstream watershed has a multitude of natural and artificial features as it collects water from a developing urbanized area and is routed through culverts and reaches of poorly defined channels. Combined, these natural and artificial features and the relatively recent age of the constructed channel promote a system that is in a state of adjustment and instability.

Figure 2. Typical cross-section of American Gulch within the project reach.

Using the geomorphic approach, it can be reasonably assumed that the cross sectional geometry and profile of a stable reference reach a similar nearby system can be used to model and determine appropriate channel dimensions. Because of the relatively narrow limitation of the existing trapezoidal flood control channel reference conditions may need to be altered somewhat to ensure that substrate and form can be relatively stable during high flow events.

It should be clear that the assessment and understanding of any natural or quasi-natural system has an inherent level of uncertainly. Large flood events result in erosion and deposition in any alluvial (river) system. The recommendations included in this design report should be taken with the understanding that the measures are intended to reduce, rather than eliminate future erosion and sediment issues within the reach of interest here. The design is intended to enhance natural channel functions within the confines of the effective FEMA 100-year flood limits.

Analytical Methods

With an understanding of the geomorphic principals at play in the river system, analytical engineering analysis is then applied to evaluate the existing channel with respect to capacity and shear stress. The upstream watershed is delineated through the use of topographic maps and aerial photographs. This watershed area, coupled with the reference reach channel cross-sectional area is compared with other sites within the region to determine bankfull channel characteristics. Other hydrologic data was obtained from the work performed by Stantech Consulting, Inc. in 1997 Inc.

With the hydrologic data determined, the hydraulic performance of the existing channel has been modeled and a recommended configuration has been developed to mitigate erosion and sedimentation issues. The recommended channel configuration has also been modeled and tested to determine its effectiveness.

WATERSHED

The American gulch watershed above the project site encompasses a total of 1,200 acres, a large portion of which is urban land (See Figure 3).

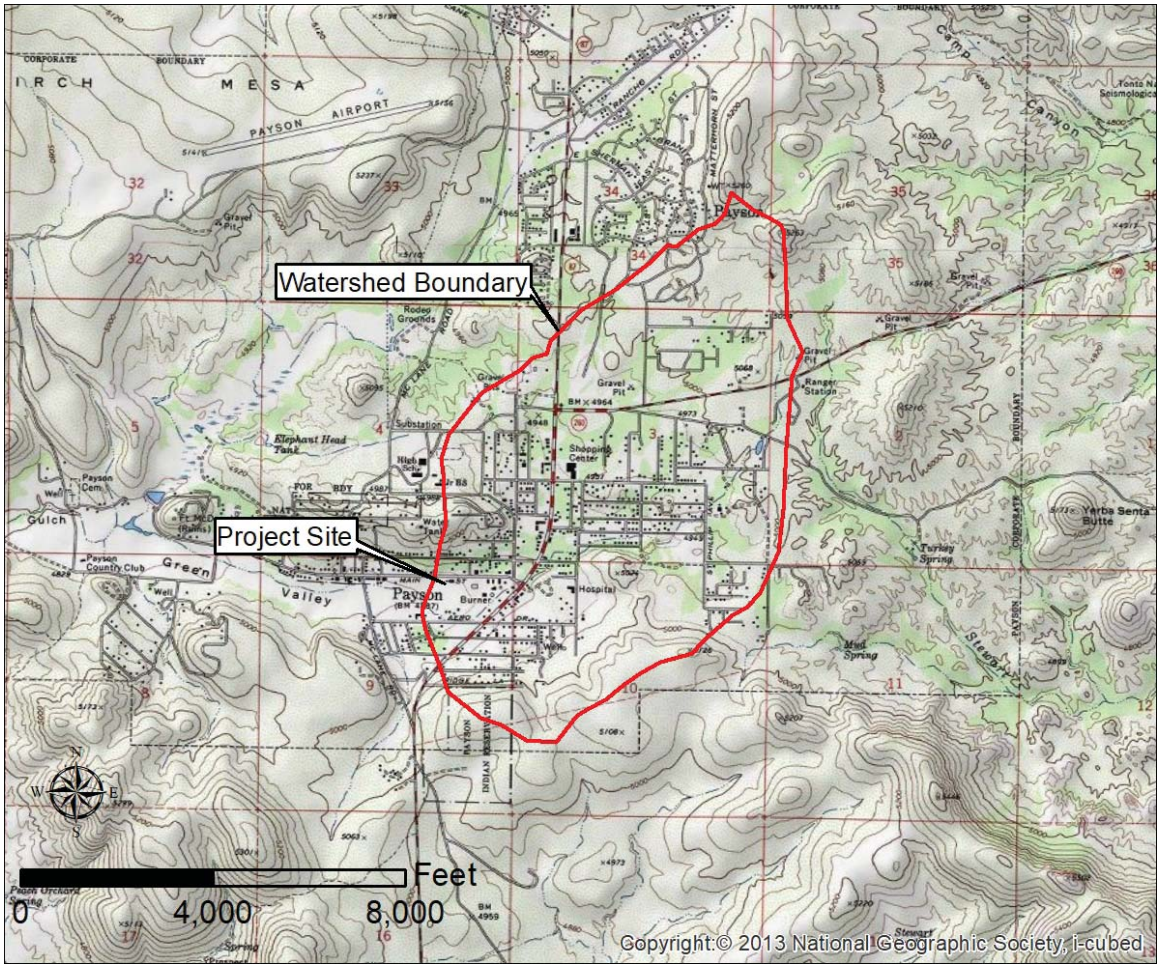


Figure 3. American Gulch watershed upstream of the project reach.

HYDRAULIC ANALYSIS - OVERVIEW

A hydraulic analysis of the subject reach of American Gulch was conducted to verify that the proposed enhancements will not impact the ability of channel to carry the 100-year flood event. That analysis included a comparison of a 1997 HEC-RAS model (upon which the FEMA regulatory flood for this reach is based) and an updated model that includes the existing reach condition, modified with the proposed enhancements.

The current FEMA Flood Insurance Rate Map (FIRM) shows that the subject reach of the channel is within Zone A (flood elevations not defined), but that the regulatory, 100-year flood is contained within the channel. Additionally, the effective Flood Insurance Study (FIS 04007CV001A, 12/4/2007) defines that flood event as 1,550 cfs at State Highway 87 (upstream of the reach) and 2,000 cfs at McLane Road (downstream of the reach).

The 1997 HEC-RAS model (performed by Stantech Consulting, Inc., and provided to NCD by the Town of Payson), modeled the 100-year flows through the reach as 2,230 cfs, which are higher than the effective FEMA flood. Per a request from Town officials, our analysis of the post-project flood event uses this higher, more conservative design flood flow.

HYDRAULIC ANALYSIS – METHODOLOGY

NCD recreated the 1997 HEC-RAS model from a PDF copy of the model input/output as received from the Town of Payson. The results of the recreated model were compared with the results of the original model output for validation. Generally, the recreated model duplicated the 1997 model results within 0.1 ft. The minor differences in the results are attributed to differences internal to the software from 1997 (HEC-RAS v2.0) and the 2017 (HEC-RAS v5.0.0).

Elevations within this duplicate model were then adjusted from the 1929 NGVD datum to match the 1988 NAVD datum (+2.47 ft) that is currently used by FEMA and upon which the current topographic survey is based.

A new HEC-RAS model (proposed condition) was then created, based upon the proposed channel enhancements, merged into the current topographic survey of the reach. The channel conditions upstream and downstream of the subject reach were entered into the new model, matching the cross sections of the 1997 model, but adjusted to the 1988 datum. Upstream and downstream water surface elevations were also entered into the model as 'known' boundary conditions, based upon the water surface elevations in the adjusted 1997, 100-year model run.

The 2,230 cfs, 100-year design flood was then routed through this proposed condition model to verify its containment within the banks of the American Gulch. Results of that model demonstrate that the design flood event continues to be contained within the channel. Water surface elevations fluctuate above and below that of the adjusted 1997 model run. However, the 100-year flood continues to be contained within the channel. Differences between the current design model run and the duplicated 1997 model can be attributed to differences between the then 'design' channel dimensions and those that exist in an as-built, aged channel condition that exists today. Additionally, with the proposed condition model, we have assigned higher Manning's 'n' roughness coefficients to account for the existing vegetation on the channel banks and additional vegetation/roughness that will be introduced with the riparian enhancements per the NCD plans.

Roughness Coefficients: Manning's n values used in the 1997 model for the American Gulch were generally 0.032 for the entire channel width within the reach associated with this project. For the proposed condition, with channel and riparian enhancements, we have assigned higher roughness coefficients to account for rock and riprap features and additional vegetation that will be included per the plans prepared by NCD. Generally, the bankfull channel bottom is assigned an 'n' value of 0.032, the bankfull bench is assigned an 'n' of 0.45 and the channel banks an 'n' of 0.40.

Higher roughness coefficients typically raise the water surface elevation, all other factors being the same. However, the proposed modifications with this project result in a lower channel bottom, resulting in a larger cross sectional area of the wash. The net effect being that the increased roughness and increased cross sectional area tend to cancel each other out in considering the ultimate channel capacity.

HYDRAULIC ANALYSIS – RESULTS

A comparison of the results of the different model runs are provided in Table 1 below.

Table 1. HEC-RAS Water Surface Elevations per Model Run

River Station (mi)	Reach Station (ft)	Water Surface Elevations (ft)						[c] Proposed Condition Freeboard (ft)
		1997 Model	Duplicate 1997 Model	△ WS Elev	1997 Model Adjust to NAVD 88	Proposed Condition Model	△ WS Elev	
2.409	4880.33	4880.33	4880.33	0.00	4882.80	4882.80	0.00	n/a
2.462	4883.65	4883.65	4883.66	-0.01	4886.12	4885.79	-0.33	n/a
2.500	4886.49	4886.49	4886.47	0.02	4888.96	4890.09	1.13	4.2
2.512	4887.87	4887.87	4887.86	0.01	4890.34	4890.40	0.06	4.1
2.523	4889.30	4889.30	4889.33	-0.03	4891.77	4891.66	-0.11	2.7
2.542	4889.37	4889.37	4889.27	0.10	4891.84	4892.18	0.34	0.7
2.580	4890.10	4890.10	4890.05	0.05	4892.57	4894.58	2.01 [b]	0.1
2.599	4892.28	4892.28	4892.22	0.06	4894.75	4895.09	0.34	0.4
2.615	4893.31	4893.31	4893.35	-0.04	4895.78	4896.24	0.46	1.3
2.623	4894.09	4894.09	4894.02	0.07	4896.56	4896.42	-0.14	1.0
2.633	4894.77	4894.77	4894.76	0.01	4897.24	4896.82	-0.42	2.1
2.648	4895.26	4895.26	4895.26	0.00	4897.73	4897.31	-0.42	3.0
2.676	4896.42	4896.42	4896.31	0.11	4898.89	4898.20	-0.69	3.2
2.683	4893.35	4893.35	4896.12	-2.77 [a]	4898.59	4898.06	-0.53	7.4
2.693	4900.30	4900.30	4900.30	0.00	4902.77	4902.77	0.00	n/a
2.703	4900.06	4900.06	4899.68	0.38	4902.53	4902.02	-0.52	n/a
2.712	4900.90	4900.90	4901.02	-0.12	4903.37	4903.31	-0.06	n/a
2.751	4901.93	4901.93	4902.02	-0.09	4904.40	4904.38	-0.02	n/a
2.778	4903.29	4903.29	4903.28	0.01	4905.76	4905.76	0.00	n/a

[a] Discrepancy in model run between original and duplicate, immediately downstream of box culverts. Differences attributed to calculation differences within HEC-RAS between v3.0 in 1997 and v5.0 used for this project.

[b] Large change in water surface shown attributed to differences in as-built channel bank conditions and higher roughness coefficients. Flood flows remain within the channel and will not impact conditions shown in the effective FEMA FIRM panel.

[c] Freeboard provided based upon 2330 cfs flow used to match that of the 1997 model. The effective FEMA flood through this reach is 2,000 cfs and consequently will have greater freeboard values, further ensuring continuation of the condition that the 100-yr design flood is "contained within the channel" per the effective FEMA flood map. Values marked 'n/a' refers to values that are either below the pre-project water surface elevation and outside the limits of the channel modifications.

GEOMORPHIC DESIGN

CHANNEL

The dimensions for the design of the bankfull channel was obtained from surveying a functioning reference reach downstream from the project area. The reference site was the same Rosgen Classification channel type (B4c, which is a moderately entrenched, gravel bed channel in a relatively narrow valley), had a similar valley slope and had conditions indicative of a stable channel including well vegetated banks and lack of scour or eroding banks. The bankfull channel was surveyed, including a longitudinal profile and four channel cross sections located within riffles and pools. Since the watershed area of the reference reach was larger than that of the project reach, the channel dimensions were then scaled down to match the project site and used as a template for design of the project reach (Figure 4).

Table 2. Design Riffle Dimensions.

Bankfull Width (ft)	*Mean Channel Depth (ft)*	*Max Channel Depth (ft)*	*Channel Cross Sectional Area (sq ft)*	*Inner Berm Top Width (ft)*	*Inner Berm Mean Depth (ft)*	*Inner Berm Area (sq ft)*
19.0	*0.92*	*1.7*	*17.5*	*6.0*	*0.42*	*2.5*

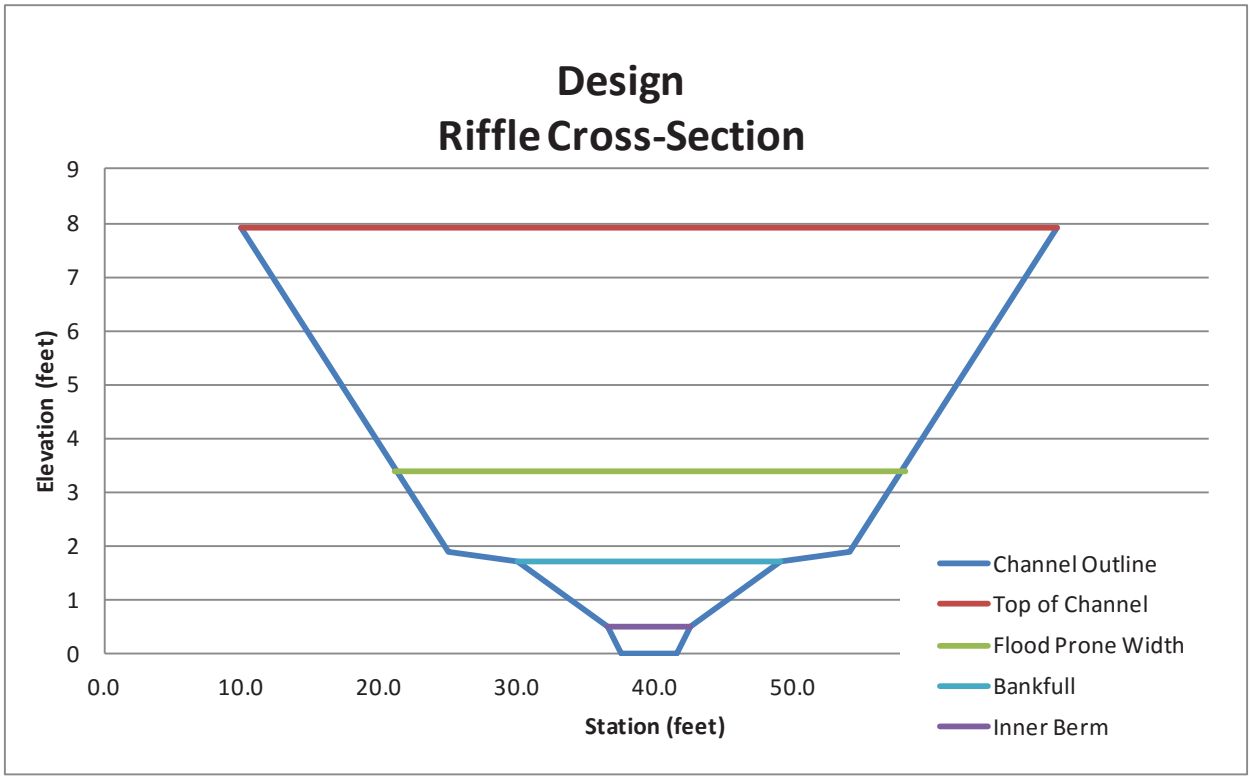


Figure 4. Design channel cross-section.

Streams naturally meander across their valley as a function of slope, bed and bank material and vegetation influences. The need for the channel to remain in the existing straight, narrow channel limits the extent to which a more natural channel pattern can be incorporated into the design. The design meander belt width would ideally be 40 to 50 feet wide but was truncated to 30 feet to fit into the existing narrower channel.

STABILIZATION STRUCTURES

CROSS-VANE WEIR

Cross vane weirs are utilized for grade control while centering flows and maintaining sediment transport (Rosgen, 2006). They consist of natural rock arranged in a v-shape across the channel, with the apex of the 'V' pointing upstream. The arms of the v extend from bankfull elevation upstream into the bed of the channel at a 2%-7% slope relative to bankfull slope. The arms extend out from the bank at an angle of less than 30º and extend approximately 1/3 the bankfull distance into the stream before arcing to join the adjacent arm. Rock size is determined by empirically based equations and design shear methods developed by Wildland Hydrology. Top rocks or feature rocks are placed with footer rocks on the downstream side to resist movement. The instream portion of the weir is tied to wings of rock buried in

each bank. Cross vanes can be placed in series to protect grade breaks and can be utilized to help recent flows downstream of over widened reaches.

Cross vanes are constructed with a "U" shape with the apex of the structure pointing upstream. The angle the wings make with the upstream bank should be approximately 20 to 30 degrees so that flows are directed away from the banks and deeper pool areas are created directly downstream of center weir section. See the construction drawings for specification, location and details of this practice.

ROCK VANE

Rock Vanes provide bank protection along the outside of meanders. These structures break up high velocities along the bank, and direct flow toward the center of the channel. Rock Vanes consist of ~30 inch diameter rocks dug into the bed of the stream and extending to the bankfull elevation. The vane is keyed three to five feet into the bank and extends less than one third the bankfull distance across the channel. See the construction drawings for specification, location and details of this practice.

TOE ROCK

Toe rock provides bank protection along the outside edge of the deeper pool sections of the stream where the outside bank slope would otherwise exceed 2h:1v in tying back into the existing channel banks. The toe rock will provide stability along that edge and prevent raveling of the slope above.

TRM –TURF REINFORCEMENT MATT

TRM is not a normal practice utilized for natural channel design projects. However, the base material for this project is decomposed granite material with very low cohesion and particle size. The current channel is lined with TRM and is showing signs of degradation wherever the mat is compromised. Because the design constraints do not allow the widening of the flood plain channel to alleviate shear stress during high flows, TRM will be utilized within the in-channel flood plain areas to help ensure that the relatively small substrate material remains in place during a large flood flow. The TRM will allow native, floodplain-targeted vegetation to grow in the areas immediately outside the active channel. In order to promote rapid growth, a layer of soil will be spread over the TRM to act as a bedding substrate for the vegetation.

CHANNEL SUBSTRATE MATERIAL

The unconsolidated soil, consisting primarily of decomposed granite, will require replacement by larger substrate material within the active channel. This material mix will be of native rock material, sized in a gradation to mimic naturally armored washes of this size and be placed within the channel bottom. Materials have been sized to resist movement under normal flood conditions and larger materials will serve as grade control to resist movement under the largest flow conditions to help stabilize the channel. Movement of materials in natural channels is normal during higher flows. Materials moved downstream are replaced by materials from upstream to maintain channel shape and size. Finer sediments will be placed on the channel substrate material and 'washed' in to fill voids and help stabilized the bed.

REVEGETATION

Riparian vegetation provides critical benefits to the physical stream system. Vegetation rooting provides additional strength to erodible banks. Equally important, the vegetation increases roughness or resistance to flow along the channel and banks slowing flow velocities and dissipating energy. The species and distribution of vegetation is largely dependent on two critical variables; soil moisture and disturbance. Flooding is the driver for both of these variables. As a result both soil moisture and disturbance are

highest closest to the stream channel and decrease laterally moving away and up. Plants adapted to varying degrees of soil moisture and disturbances thrive along zones running parallel to the stream channel.

Researchers at the NRCS Plant Materials Center in Idaho have divided the riparian corridor into discreet planting zones: Toe, Bank, Overbank, Transition, and Upland (Hoag, et al, 2001). Each zone supports a different community complimenting stream processes and creating habitats (Figure 5). For example, the toe zone adjacent to the perennial flow supports wetland species, the bank and overbank zone is dominated by grasses and shrubby willows, and the transition zone supports more arid grasses, shrubs and trees. The stiffness of vegetation (and associated roughness) generally increases as it moves away from the central stream channel.

The presence of low, flexible shrubby vegetation near the edge of the stream provides an important hydrologic function. The flexible stems provide resistance to high flows but bend out of the way allowing flows to pass. Velocities are slowed but high volumes of water are allowed to pass through the flexible stems. When stiff, large diameter vegetation is allowed to encroach upon the lower portions of the floodplain the capacity of the site to pass large flows is diminished. Large volumes of water are prevented from spreading across the floodplain, increasing velocities near the center of the stream. Such situations can lead to deepening and narrowing of the stream channel over time.

A native riparian vegetative community has been prescribed for revegetation. Figure 5 illustrates typical planting zone which a stable habitat that consists of a patchwork of plant communities for a functioning riparian corridor.

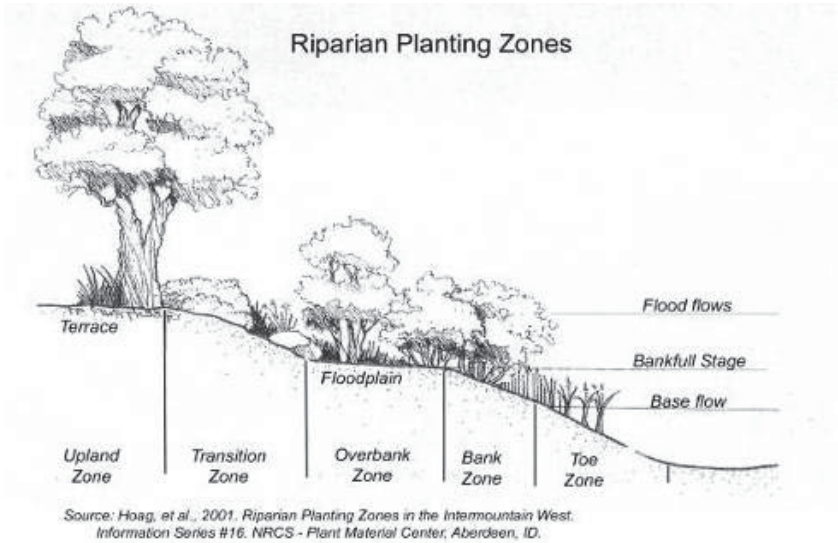


Figure 5. Typical cross-section of riparian planting zones.

Existing native trees will remain intact on the side slopes with additional riparian tree species (Ash and Juniper) planted on the higher slopes throughout the project reach. Grasses and wetland plants are intended to dominate the channel flood plain. Native willow shrubs are specified for the outside of meander bends along the toe of the slope where they will help strengthen the bank and not create large changes in overall channel roughness. See the design sheets for a summary of revegetation activities and quantities. See the construction drawings for specification, location and details.

REFERENCES

Andrews, E.D., 1980. *Effective and bankfull discharges of streams in the Yampa River Basin, Colorado and Wyoming*. J. Hydrology., 46:311-330.

Hoag, J.C., Berg, F..E., Wyman, S.K., and Sampson, R.W., 2001. *Riparian Planting Zones in the Intermountain West*. Riparian/Wetland Project Information Series No. 16. NRCS Plant Materials Center, Aberdeen, ID.

Moody, T., Wirtanen, M., and Yard, S., 2003. *Regional Relationships of Natural Channels of the Arid Southwest*. Natural Channel Design, Inc. Flagstaff, AZ.

Ogden, W. S., 1997. *Drainage Design Report For American Gulch Channelization Plan For Kaibab Mill Site Property*. Stantech Consulting, Inc. Phoenix, AZ.

Rosgen, D.L., 2006. *Cross-Vane, W-Weir, and J-Hook Vane Structures- Description, Design, and Application for Stream Stabilization and River*. Wildland Hydrology, Fort Collins, CO.

U.S. Army Corps of Engineers, 2016. *HEC-RAS River Analysis System Hydraulic Reference Manual*, Version 5.0. US Army Corps of Engineers, Institute for Water Resources, Hydrologic Engineering Center, Davis, CA

FEMA Studies:
FEMA FIS04007CV001A Gila County, AZ Dec 4 2007
FEMA Firm Panel #04007C0427D Dec 4, 2007

APPENDIX A

HEC-RAS INPUT/OUTPUT REPORTS

1997 DUPLICATE EFFECTIVE MODEL

2017 DESIGN CONDITION MODEL

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X     X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X      X    X        X
X     X  X        X    X       X   X     X    X        X
X     X  XXXXXX    XXXX        X    X    X    X   XXXXX
```

PROJECT DATA
Project Title: AMERICN GULCH 1997 Duplicate
Project File : AMERICNGULCH1997.prj
Run Date and Time: 12/26/2017 3:11:21 PM

Project in English units

PLAN DATA

Plan Title: Plan 02
Plan File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\1997 Model Condition\Duplicate 1997 Model\AMERICNGULCH1997.p02

Geometry Title: AMERICAN GULCH 1997 Duplicate
Geometry File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\1997 Model Condition\Duplicate 1997 Model\AMERICNGULCH1997.g01

Flow Title : Flow 02
Flow File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\1997 Model Condition\Duplicate 1997 Model\AMERICNGULCH1997.f02

Plan Summary Information:
Number of: Cross Sections = 20 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 1 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 40
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Flow 02
Flow File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\1997 Model Condition\Duplicate 1997 Model\AMERICNGULCH1997.f02

Flow Data (cfs)

River	Reach	RS	PF 1
American Gulch	FEMA	2778	2293
American Gulch	FEMA	2409	3211

Boundary Conditions

River	Reach	Profile	Upstream	Downstream

American Gulch FEMA PF 1 Known WS = 4903.29 Known WS = 4880.33

GEOMETRY DATA

Geometry Title: AMERICAN GULCH 1997 Duplicate
Geometry File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\1997 Model Condition\Duplicate 1997 Model\AMERICNGULCH1997.g01

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2778

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9976.6	4904.99	9980	4903.27	9994	4896.27	10000	4894.77	10006	4895.77
10012	4895.77	10012	4896.52	10013.5	4896.52	10013.5	4897.27	10015	4897.27
10015	4898.02	10016.5	4898.02	10016.5	4898.77	10018	4898.77	10018	4899.52
10019.5	4899.52	10019.5	4900.27	10021	4900.27	10021	4901.02	10022.5	4901.02
10022.5	4901.77	10024	4901.77	10024	4902.52	10025.5	4902.52	10025.51	4903.27
10027.5	4904.27	10037	4905.89						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9976.6	.032	9980	.045	10006	.025	10025.5	.032

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9980 10025.51 145 145 145 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4904.70	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.42	Wt. n-Val.	0.000	0.036	0.000	
W.S. Elev (ft)	4903.28	Reach Len. (ft)	145.00	145.00	145.00	
Crit W.S. (ft)	4902.11	Flow Area (sq ft)	0.00	239.60	0.00	
E.G. Slope (ft/ft)	0.007527	Area (sq ft)	0.00	239.60	0.00	
Q Total (cfs)	2293.00	Flow (cfs)	0.00	2293.00	0.00	
Top Width (ft)	45.55	Top Width (ft)	0.02	45.51	0.02	
Vel Total (ft/s)	9.57	Avg. Vel. (ft/s)	0.11	9.57	0.11	
Max Chl Dpth (ft)	8.51	Hydr. Depth (ft)	0.01	5.26	0.01	
Conv. Total (cfs)	26430.1	Conv. (cfs)	0.0	26430.1	0.0	
Length Wtd. (ft)	145.00	Wetted Per. (ft)	0.02	54.92	0.02	
Min Ch El (ft)	4894.77	Shear (lb/sq ft)		2.05		
Alpha	1.00	Stream Power (lb/ft s)		19.62		
Frctn Loss (ft)	0.97	Cum Volume (acre-ft)	1.85	8.71	1.48	
C & E Loss (ft)	0.03	Cum SA (acres)	2.16	2.26	1.49	

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2751

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9977	4904.1	9980.5	4902.4	9994	4895.4	10000	4893.9	10006	4894.9
10012	4894.9	10012	4895.65	10013.5	4895.65	10013.5	4896.4	10015	4896.4
10015	4897.15	10016.5	4897.15	10016.5	4897.9	10018	4897.9	10018	4898.65
10019.5	4898.65	10019.5	4899.4	10021	4899.4	10021	4900.15	10022.5	4900.15
10022.5	4900.9	10024	4900.9	10024	4901.65	10025.5	4901.65	10025.51	4902.4
10027.5	4903.4	10037	4904.5						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9977	.032	10006	.025	10025.5	.032

```
Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9980.510025.51           203.12  203.12  203.12             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4903.70    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               1.68    Wt. n-Val.                           0.029
  W.S. Elev (ft)           4902.03    Reach Len. (ft)          203.12     203.12     203.12
  Crit W.S. (ft)                      Flow Area (sq ft)                   220.70
  E.G. Slope (ft/ft)      0.006037    Area (sq ft)                        220.70
  Q Total (cfs)            2293.00    Flow (cfs)                         2293.00
  Top Width (ft)             44.28    Top Width (ft)                       44.28
  Vel Total (ft/s)           10.39    Avg. Vel. (ft/s)                     10.39
  Max Chl Dpth (ft)           8.13    Hydr. Depth (ft)                      4.98
  Conv. Total (cfs)        29511.3    Conv. (cfs)                        29511.3
  Length Wtd. (ft)           203.12    Wetted Per. (ft)                     53.29
  Min Ch El (ft)           4893.90    Shear (lb/sq ft)                      1.56
  Alpha                       1.00    Stream Power (lb/ft s)               16.22
  Frctn Loss (ft)             1.05    Cum Volume (acre-ft)        1.85       7.95       1.48
  C & E Loss (ft)             0.10    Cum SA (acres)              2.16       2.11       1.49


Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: American Gulch
REACH: FEMA               RS: 2712

INPUT
Description:
Station Elevation Data    num=      26
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9977  4901.6    9978 4901.18    9994 4894.18   10000 4892.68   10006 4893.68
   10012 4893.68   10012 4894.43 10013.5 4894.43 10013.5 4895.18   10015 4895.18
   10015 4895.93 10016.5 4895.93 10016.5 4896.68   10018 4896.68   10018 4897.43
 10019.5 4897.43 10019.5 4898.18   10021 4898.18   10021 4898.93 10022.5 4898.93
 10022.5 4899.68   10024 4899.68   10024 4900.43 10025.5 4900.4310025.51 4901.18
 10027.1    4902

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9977    .032   10006    .02510025.51    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          997810025.51              36   46.88      62             .3       .5

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4902.55    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               1.33    Wt. n-Val.                0.000      0.029      0.000
  W.S. Elev (ft)           4901.21    Reach Len. (ft)           36.00      46.88      62.00
  Crit W.S. (ft)           4899.95    Flow Area (sq ft)          0.00     247.75       0.00
  E.G. Slope (ft/ft)      0.004500    Area (sq ft)               0.00     247.75       0.00
  Q Total (cfs)            2293.00    Flow (cfs)                 0.00    2293.00       0.00
  Top Width (ft)             47.66    Top Width (ft)             0.08      47.51       0.07
  Vel Total (ft/s)            9.26    Avg. Vel. (ft/s)           0.20       9.26       0.19
  Max Chl Dpth (ft)           8.53    Hydr. Depth (ft)           0.02       5.21       0.02
  Conv. Total (cfs)        34181.3    Conv. (cfs)                 0.0    34181.3        0.0
  Length Wtd. (ft)           46.88    Wetted Per. (ft)           0.09      56.73       0.07
  Min Ch El (ft)           4892.68    Shear (lb/sq ft)                      1.23
  Alpha                       1.00    Stream Power (lb/ft s)               11.36
  Frctn Loss (ft)             0.35    Cum Volume (acre-ft)        1.85       6.86       1.48
  C & E Loss (ft)             0.28    Cum SA (acres)              2.16       1.89       1.49


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION
```

```
RIVER: American Gulch
REACH: FEMA               RS: 2703

INPUT
Description: Section 4 of bridge routine
Station Elevation Data    num=      27
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9977  4901.2  9977.7  4900.9    9994  4893.9   10000  4892.4   10006  4893.4
   10012  4893.4   10012 4894.15 10013.5 4894.15 10013.5  4894.9   10015  4894.9
   10015 4895.65 10016.5 4895.65 10016.5  4896.4   10018  4896.4   10018 4897.15
 10019.5 4897.15 10019.5  4897.9   10021  4897.9   10021 4898.65 10022.5 4898.65
 10022.5  4899.4   10024  4899.4   10024 4900.15 10025.5 4900.1510025.51  4900.9
 10027.5  4901.9   10037  4902.1

Manning's n Values        num=       4
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
    9977    .032  9977.7    .045   10006    .025 10027.5    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        9977.710025.51               42      50      61             .3       .5

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4901.91    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               2.25    Wt. n-Val.                           0.036
  W.S. Elev (ft)           4899.66    Reach Len. (ft)           42.00      50.00      61.00
  Crit W.S. (ft)           4899.66    Flow Area (sq ft)                   190.44
  E.G. Slope (ft/ft)      0.014914    Area (sq ft)                        190.44
  Q Total (cfs)            2293.00    Flow (cfs)                         2293.00
  Top Width (ft)             43.41    Top Width (ft)                       43.41
  Vel Total (ft/s)           12.04    Avg. Vel. (ft/s)                     12.04
  Max Chl Dpth (ft)           7.26    Hydr. Depth (ft)                      4.39
  Conv. Total (cfs)        18776.1    Conv. (cfs)                        18776.1
  Length Wtd. (ft)           50.00    Wetted Per. (ft)                     51.13
  Min Ch El (ft)           4892.40    Shear (lb/sq ft)                      3.47
  Alpha                       1.00    Stream Power (lb/ft s)               41.76
  Frctn Loss (ft)             0.58    Cum Volume (acre-ft)        1.85       6.62       1.48
  C & E Loss (ft)             1.18    Cum SA (acres)              2.16       1.85       1.49


Warning: The energy equation could not be balanced within the specified number of iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than
         1.4.  This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
         water surface came back below critical depth.  This indicates that there is not a valid subcritical answer.  The
         program defaulted to critical depth.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: American Gulch
REACH: FEMA               RS: 2693

INPUT
Description: Section 3 of bridge routine
Station Elevation Data    num=       6
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970  4900.9 9983.99  4898.4    9984  4890.4   10016  4890.410016.01  4898.4
   10030  4900.9

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9970    .032 9983.99    .01510016.01    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9983.9910016.01               50      50      50             .6       .8
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    9970 9983.99    4901       T
10016.01   10030    4901       T
```

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4900.16	Element	Left OB	Channel	Right OB
Vel Head (ft)	6.16	Wt. n-Val.		0.015	
W.S. Elev (ft)	4894.00	Reach Len. (ft)	0.10	0.10	0.10
Crit W.S. (ft)	4895.81	Flow Area (sq ft)		115.19	
E.G. Slope (ft/ft)	0.009335	Area (sq ft)		115.19	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	32.01	Top Width (ft)		32.01	
Vel Total (ft/s)	19.91	Avg. Vel. (ft/s)		19.91	
Max Chl Dpth (ft)	3.60	Hydr. Depth (ft)		3.60	
Conv. Total (cfs)	23733.2	Conv. (cfs)		23733.2	
Length Wtd. (ft)		Wetted Per. (ft)		38.40	
Min Ch El (ft)	4890.40	Shear (lb/sq ft)		1.75	
Alpha	1.00	Stream Power (lb/ft s)		34.80	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.85	6.44	1.48
C & E Loss (ft)		Cum SA (acres)	2.16	1.80	1.49

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Program found supercritical flow starting at this cross section.

BRIDGE

RIVER: American Gulch
REACH: FEMA   RS: 2688

INPUT
Description: 3-10'x8'x50' cbc
Distance from Upstream XS =   .1
Deck/Roadway Width   =   49.8
Weir Coefficient   =   2.6
Upstream Deck/Roadway Coordinates
    num=   4
     Sta Hi Cord Lo Cord   Sta Hi Cord Lo Cord   Sta Hi Cord Lo Cord
    9970 4900.9   9984 4900.9 4898.4   10016 4900.9 4898.4
   10030 4900.9

Upstream Bridge Cross Section Data
Station Elevation Data   num=   6
     Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
    9970 4900.9 9983.99 4898.4   9984 4890.4   10016 4890.410016.01 4898.4
   10030 4900.9

Manning's n Values   num=   3
     Sta   n Val   Sta   n Val   Sta   n Val
    9970   .032 9983.99   .01510016.01   .032

Bank Sta: Left   Right   Coeff Contr.   Expan.
       9983.9910016.01   .6   .8
Ineffective Flow   num=   2
   Sta L   Sta R   Elev Permanent
    9970 9983.99   4901   T
10016.01   10030   4901   T

Downstream Deck/Roadway Coordinates
    num=   4
     Sta Hi Cord Lo Cord   Sta Hi Cord Lo Cord   Sta Hi Cord Lo Cord
    9970 4900.1   9984 4900.1 4898.05 10016.1 4900.1 4898.05
   10030 4900.1

Downstream Bridge Cross Section Data
Station Elevation Data   num=   6
     Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev   Sta   Elev
    9970 4900.2 9983.99 4898.05   9984 4890.05   10016 4890.0510016.01 4898.05
   10030 4900.1

Manning's n Values   num=   3
     Sta   n Val   Sta   n Val   Sta   n Val
    9970   .032 9983.99   .01510016.01   .032

Bank Sta: Left   Right   Coeff Contr.   Expan.

```
      9983.9910016.01             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
    9970 9983.99    4900       T
10016.01   10030    4900       T

Upstream Embankment side slope              =         horiz. to 1.0 vertical
Downstream Embankment side slope            =         horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =  4900.9
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=  9994.5    Downstream=  9994.5
Upstream     num=       2
    Width   Elev    Width   Elev
       1  4890.4       1  4898.4
Downstream     num=       2
    Width   Elev    Width   Elev
       1 4890.05       1 4898.05

Pier Data
Pier Station     Upstream= 10005.5    Downstream= 10005.5
Upstream     num=       2
    Width   Elev    Width   Elev
       1  4890.4       1  4898.4
Downstream     num=       2
    Width   Elev    Width   Elev
       1 4890.05       1 4898.05

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum              Cd   =       2
       Yarnell               KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

Additional Bridge Parameters
       Add Friction component to Momentum
       Add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the downstream end
       Criteria to check for pressure flow = Upstream water surface

BRIDGE OUTPUT  Profile #PF 1

  E.G. US. (ft)              4900.16    Element                Inside BR US  Inside BR DS
  W.S. US. (ft)              4894.00    E.G. Elev (ft)             4899.09       4898.54
  Q Total (cfs)              2293.00    W.S. Elev (ft)             4897.02       4895.74
  Q Bridge (cfs)             2293.00    Crit W.S. (ft)             4896.08       4895.74
  Q Weir (cfs)                          Max Chl Dpth (ft)             6.62          5.69
  Weir Sta Lft (ft)                     Vel Total (ft/s)             11.54         13.43
  Weir Sta Rgt (ft)                     Flow Area (sq ft)           198.62        170.75
  Weir Submerg                          Froude # Chl                  0.79          0.99
  Weir Max Depth (ft)                   Specif Force (cu ft)       1480.02       1442.84
  Min El Weir Flow (ft)      4900.91    Hydr Depth (ft)               6.62          5.69
  Min El Prs (ft)            4898.40    W.P. Total (ft)              69.54         64.03
  Delta EG (ft)                 1.87    Conv. Total (cfs)          39607.9       32527.4
  Delta WS (ft)                -0.82    Top Width (ft)               30.01         30.01
  BR Open Area (sq ft)        240.07    Frctn Loss (ft)               0.26          0.00
  BR Open Vel (ft/s)           13.43    C & E Loss (ft)               0.09          0.26
  BR Sluice Coef                        Shear Total (lb/sq ft)        0.60          0.83
  BR Sel Method          Energy only    Power Total (lb/ft s)         6.90         11.11


Warning: The energy equation could not be balanced within the specified number of iterations.  The program used critical
```

depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2683

INPUT
Description: Section 2 of the bridge routine
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4900.2	9983.99	4898.05	9984	4890.05	10016	4890.05	10016.01	4898.05
10030	4900.1								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9983.99	.015	10016.01	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9983.99	10016.01	40	40	40	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9970	9983.99	4900	T
10016.01	10030	4900	T

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4898.33	Element			
Vel Head (ft)	3.51	Wt. n-Val.		0.015	
W.S. Elev (ft)	4894.82	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	4895.46	Flow Area (sq ft)		152.53	
E.G. Slope (ft/ft)	0.004069	Area (sq ft)		152.53	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	32.01	Top Width (ft)		32.01	
Vel Total (ft/s)	15.03	Avg. Vel. (ft/s)		15.03	
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)		4.76	
Conv. Total (cfs)	35947.1	Conv. (cfs)		35947.1	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		41.57	
Min Ch El (ft)	4890.05	Shear (lb/sq ft)		0.93	
Alpha	1.00	Stream Power (lb/ft s)		14.01	
Frctn Loss (ft)	0.16	Cum Volume (acre-ft)	1.85	6.44	1.48
C & E Loss (ft)	0.36	Cum SA (acres)	2.16	1.80	1.49

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2676

INPUT
Description:
Station Elevation Data num= 7

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4899.8	9973.8	4897.77	9989	4889.77	10000	4888.77	10011	4889.77
10026.5	4897.77	10030	4899.6						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9973.8	.045	10026.5	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9973.8	10026.5	150.68	150.68	150.68	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4897.77	Element			
Vel Head (ft)	1.45	Wt. n-Val.		0.045	
W.S. Elev (ft)	4896.31	Reach Len. (ft)	150.68	150.68	150.68
Crit W.S. (ft)	4895.31	Flow Area (sq ft)		237.13	
E.G. Slope (ft/ft)	0.010880	Area (sq ft)		237.13	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	

Top Width (ft)	47.11	Top Width (ft)	47.11		
Vel Total (ft/s)	9.67	Avg. Vel. (ft/s)	9.67		
Max Chl Dpth (ft)	7.54	Hydr. Depth (ft)	5.03		
Conv. Total (cfs)	21983.6	Conv. (cfs)	21983.6		
Length Wtd. (ft)	150.68	Wetted Per. (ft)	50.41		
Min Ch El (ft)	4888.77	Shear (lb/sq ft)	3.20		
Alpha	1.00	Stream Power (lb/ft s)	30.90		
Frctn Loss (ft)	1.10	Cum Volume (acre-ft)	1.85	6.26	1.48
C & E Loss (ft)	0.02	Cum SA (acres)	2.16	1.77	1.49

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2648

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4898.1	9989	4888.72	10000	4887.72	10011	4888.72	10030	4897.7

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9970	.032	10030	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9970	10030	90	79.32	70	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4896.64	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.38	Wt. n-Val.		0.032	
W.S. Elev (ft)	4895.26	Reach Len. (ft)	90.00	79.32	70.00
Crit W.S. (ft)		Flow Area (sq ft)		243.64	
E.G. Slope (ft/ft)	0.005265	Area (sq ft)		243.64	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	49.10	Top Width (ft)		49.10	
Vel Total (ft/s)	9.41	Avg. Vel. (ft/s)		9.41	
Max Chl Dpth (ft)	7.54	Hydr. Depth (ft)		4.96	
Conv. Total (cfs)	31602.3	Conv. (cfs)		31602.3	
Length Wtd. (ft)	79.32	Wetted Per. (ft)		52.19	
Min Ch El (ft)	4887.72	Shear (lb/sq ft)		1.53	
Alpha	1.00	Stream Power (lb/ft s)		14.44	
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.85	5.43	1.48
C & E Loss (ft)	0.03	Cum SA (acres)	2.16	1.60	1.49

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2633

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4896.9	9984	4890.66	9989	4888.16	10000	4887.16	10011	4888.16
10030	4896.8								

Manning's n Values num= 2

Sta	n Val	Sta	n Val
9970	.032	9984	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9970	10030	58	50	44	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4896.07	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.31	Wt. n-Val.		0.043	
W.S. Elev (ft)	4894.76	Reach Len. (ft)	58.00	50.00	44.00
Crit W.S. (ft)		Flow Area (sq ft)		249.76	
E.G. Slope (ft/ft)	0.008973	Area (sq ft)		249.76	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	50.72	Top Width (ft)		50.72	
Vel Total (ft/s)	9.18	Avg. Vel. (ft/s)		9.18	
Max Chl Dpth (ft)	7.60	Hydr. Depth (ft)		4.92	
Conv. Total (cfs)	24206.4	Conv. (cfs)		24206.4	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		53.70	
Min Ch El (ft)	4887.16	Shear (lb/sq ft)		2.61	
Alpha	1.00	Stream Power (lb/ft s)		23.92	
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	1.85	4.98	1.48
C & E Loss (ft)	0.06	Cum SA (acres)	2.16	1.51	1.49

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2623

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4896	9989	4887.81	10000	4886.81	10011	4887.81	10016	4890.31
10030	4896.2								

Manning's n Values num= 2

Sta	n Val	Sta	n Val
9970	.045	10016	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9970	10030	50	44.65	36	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4895.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.50	Wt. n-Val.		0.043	
W.S. Elev (ft)	4894.02	Reach Len. (ft)	50.00	44.65	36.00
Crit W.S. (ft)		Flow Area (sq ft)		233.53	
E.G. Slope (ft/ft)	0.011056	Area (sq ft)		233.53	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	50.23	Top Width (ft)		50.23	
Vel Total (ft/s)	9.82	Avg. Vel. (ft/s)		9.82	
Max Chl Dpth (ft)	7.21	Hydr. Depth (ft)		4.65	
Conv. Total (cfs)	21807.2	Conv. (cfs)		21807.2	
Length Wtd. (ft)	44.65	Wetted Per. (ft)		52.94	
Min Ch El (ft)	4886.81	Shear (lb/sq ft)		3.04	
Alpha	1.00	Stream Power (lb/ft s)		29.90	
Frctn Loss (ft)	0.40	Cum Volume (acre-ft)	1.85	4.71	1.48
C & E Loss (ft)	0.06	Cum SA (acres)	2.16	1.45	1.49

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2615

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4895.9	9989	4887.5	10000	4886.5	10011	4887.5	10030	4895.6

Manning's n Values num= 2

Sta	n Val	Sta	n Val
9970	.032	10030	.032

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

	9970	10030	85.35	85.35	85.35	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4895.06	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.71	Wt. n-Val.		0.032		
W.S. Elev (ft)	4893.35	Reach Len. (ft)	85.35	85.35	85.35	
Crit W.S. (ft)	4892.88	Flow Area (sq ft)		218.76		
E.G. Slope (ft/ft)	0.007406	Area (sq ft)		218.76		
Q Total (cfs)	2293.00	Flow (cfs)		2293.00		
Top Width (ft)	48.97	Top Width (ft)		48.97		
Vel Total (ft/s)	10.48	Avg. Vel. (ft/s)		10.48		
Max Chl Dpth (ft)	6.85	Hydr. Depth (ft)		4.47		
Conv. Total (cfs)	26644.1	Conv. (cfs)		26644.1		
Length Wtd. (ft)	85.35	Wetted Per. (ft)		51.50		
Min Ch El (ft)	4886.50	Shear (lb/sq ft)		1.96		
Alpha	1.00	Stream Power (lb/ft s)		20.59		
Frctn Loss (ft)	0.73	Cum Volume (acre-ft)	1.85	4.48	1.48	
C & E Loss (ft)	0.04	Cum SA (acres)	2.16	1.40	1.49	

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2599

INPUT
Description:
Station Elevation Data num= 5

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4894.5	9989	4886.9	10000	4885.9	10011	4886.9	10030	4894.6

Manning's n Values num= 2

Sta	n Val	Sta	n Val
9970	.032	10030	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.		
9970	10030	100	100	100	.1	.3	

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4894.30	Element	Left OB	Channel	Right OB	
Vel Head (ft)	2.08	Wt. n-Val.		0.032		
W.S. Elev (ft)	4892.22	Reach Len. (ft)	100.00	100.00	100.00	
Crit W.S. (ft)	4892.22	Flow Area (sq ft)		198.16		
E.G. Slope (ft/ft)	0.010049	Area (sq ft)		198.16		
Q Total (cfs)	2293.00	Flow (cfs)		2293.00		
Top Width (ft)	48.41	Top Width (ft)		48.41		
Vel Total (ft/s)	11.57	Avg. Vel. (ft/s)		11.57		
Max Chl Dpth (ft)	6.32	Hydr. Depth (ft)		4.09		
Conv. Total (cfs)	22873.9	Conv. (cfs)		22873.9		
Length Wtd. (ft)	100.00	Wetted Per. (ft)		50.56		
Min Ch El (ft)	4885.90	Shear (lb/sq ft)		2.46		
Alpha	1.00	Stream Power (lb/ft s)		28.45		
Frctn Loss (ft)	1.26	Cum Volume (acre-ft)	1.85	4.07	1.48	
C & E Loss (ft)	0.08	Cum SA (acres)	2.16	1.30	1.49	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2580

INPUT
Description:

```
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970  4893.2    9984  4886.2   10000  4885.2   10016  4886.2   10030  4893.7

Manning's n Values        num=       2
     Sta   n Val     Sta   n Val
    9970    .032   10030    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9970   10030              200     200     200             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4892.95    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               2.89    Wt. n-Val.                           0.032
  W.S. Elev (ft)           4890.06    Reach Len. (ft)          200.00     200.00     200.00
  Crit W.S. (ft)           4890.72    Flow Area (sq ft)                   168.09
  E.G. Slope (ft/ft)      0.016612    Area (sq ft)                        168.09
  Q Total (cfs)            2293.00    Flow (cfs)                         2293.00
  Top Width (ft)             46.91    Top Width (ft)                       46.91
  Vel Total (ft/s)           13.64    Avg. Vel. (ft/s)                     13.64
  Max Chl Dpth (ft)           4.85    Hydr. Depth (ft)                      3.58
  Conv. Total (cfs)        17790.9    Conv. (cfs)                        17790.9
  Length Wtd. (ft)          200.00    Wetted Per. (ft)                     48.85
  Min Ch El (ft)           4885.20    Shear (lb/sq ft)                      3.57
  Alpha                       1.00    Stream Power (lb/ft s)               48.68
  Frctn Loss (ft)             1.58    Cum Volume (acre-ft)        1.85       3.65       1.48
  C & E Loss (ft)             0.05    Cum SA (acres)              2.16       1.19       1.49


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.

CROSS SECTION


RIVER: American Gulch
REACH: FEMA               RS: 2542

INPUT
Description:
Station Elevation Data    num=       5
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
    9970    4891    9984  4884.8   10000  4883.8   10016  4884.8   10030  4891.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
    9970    .032    9970    .032   10030    .032

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9970   10030              100     100     100             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4891.26    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               1.99    Wt. n-Val.                           0.032
  W.S. Elev (ft)           4889.27    Reach Len. (ft)          100.00     100.00     100.00
  Crit W.S. (ft)           4889.27    Flow Area (sq ft)                   202.78
  E.G. Slope (ft/ft)      0.010056    Area (sq ft)                        202.78
  Q Total (cfs)            2293.00    Flow (cfs)                         2293.00
  Top Width (ft)             51.57    Top Width (ft)                       51.57
  Vel Total (ft/s)           11.31    Avg. Vel. (ft/s)                     11.31
  Max Chl Dpth (ft)           5.47    Hydr. Depth (ft)                      3.93
  Conv. Total (cfs)        22866.1    Conv. (cfs)                        22866.1
  Length Wtd. (ft)          100.00    Wetted Per. (ft)                     53.58
  Min Ch El (ft)           4883.80    Shear (lb/sq ft)                      2.38
  Alpha                       1.00    Stream Power (lb/ft s)               26.87
  Frctn Loss (ft)             0.61    Cum Volume (acre-ft)        1.85       2.79       1.48
  C & E Loss (ft)             0.29    Cum SA (acres)              2.16       0.97       1.49


Warning: The energy equation could not be balanced within the specified number of iterations.  The program used critical
         depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
```

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2523

INPUT
Description:
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4889	9980	4884.1	10000	4883.1	10020	4884.1	10030	4889.1
10030.4	4889.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9970	.032	10030.4	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9970	10030.4	30	30	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4890.34	Element			
Vel Head (ft)	1.01	Wt. n-Val.		0.032	
W.S. Elev (ft)	4889.33	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)	4888.04	Flow Area (sq ft)		284.23	
E.G. Slope (ft/ft)	0.004063	Area (sq ft)		284.23	
Q Total (cfs)	2293.00	Flow (cfs)		2293.00	
Top Width (ft)	60.40	Top Width (ft)		60.40	
Vel Total (ft/s)	8.07	Avg. Vel. (ft/s)		8.07	
Max Chl Dpth (ft)	6.23	Hydr. Depth (ft)		4.71	
Conv. Total (cfs)	35971.9	Conv. (cfs)		35971.9	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		63.17	
Min Ch El (ft)	4883.10	Shear (lb/sq ft)		1.14	
Alpha	1.00	Stream Power (lb/ft s)		9.21	
Frctn Loss (ft)	0.11	Cum Volume (acre-ft)	1.85	2.24	1.48
C & E Loss (ft)	0.04	Cum SA (acres)	2.16	0.84	1.49

Warning: The cross-section end points had to be extended vertically for the computed water surface.

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2513

INPUT
Description:
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9413.5	4892.6	9426.5	4892	9452.5	4891	9578.5	4890	9618.5	4889
9684	4888.1	9692	4888	9707	4887.8	9774	4887.9	9828	4887.5
9876	4887.5	9888	4887.9	9896	4888	9908	4889	9913	4889.4
9919	4890	9924	4891	9962.5	4892.5	9970	4888.72	9980	4883.72
10000	4882.72	10020	4883.72	10030	4888.72	10040.9	4894.2	10063	4895.3
10102	4895.4	10125	4896	10199	4897	10211	4897.9	10226	4897
10256	4896.9	10351	4897.6	10359	4897.6	10363	4897.7	10363.1	4897.2
10384	4897.3	10405.5	4897.3	10405.6	4897.8	10409.5	4897.9		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9413.5	.025	9578.5	.04	9962.5	.032	10040.9	.045	10359	.025

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9962.5	10040.9	69	69	.1	.3

Left Levee Station= 9962.5 Elevation= 4892.5

Blocked Obstructions num= 1

Sta L	Sta R	Elev
9452.5	9578.5	4895

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4890.19	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.87	Wt. n-Val.		0.032		
W.S. Elev (ft)	4889.32	Reach Len. (ft)	69.00	69.00	69.00	
Crit W.S. (ft)	4887.69	Flow Area (sq ft)		306.48		
E.G. Slope (ft/ft)	0.003288	Area (sq ft)		306.48		
Q Total (cfs)	2293.00	Flow (cfs)		2293.00		
Top Width (ft)	62.37	Top Width (ft)		62.37		
Vel Total (ft/s)	7.48	Avg. Vel. (ft/s)		7.48		
Max Chl Dpth (ft)	6.60	Hydr. Depth (ft)		4.91		
Conv. Total (cfs)	39990.6	Conv. (cfs)		39990.6		
Length Wtd. (ft)	69.00	Wetted Per. (ft)		65.06		
Min Ch El (ft)	4882.72	Shear (lb/sq ft)		0.97		
Alpha	1.00	Stream Power (lb/ft s)		7.23		
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	1.85	2.03	1.48	
C & E Loss (ft)	0.10	Cum SA (acres)	2.16	0.80	1.49	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2512

INPUT
Description:
Station Elevation Data num= 59

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9432.8	4893.1	9435.8	4893	9456.8	4892	9465.8	4891.5	9537.8	4891
9567.8	4890.9	9583.8	4890.8	9592.8	4890.9	9609.8	4890	9617.8	4889.5
9658.6	4889.6	9700.4	4889.2	9742.8	4889.5	9756.4	4889.7	9799.5	4889.2
9826.6	4889	9850.3	4888.5	9855.5	4889.3	9861.5	4888.8	9899.7	4888.2
9911.6	4887.7	9924.4	4887.7	9929.8	4888.2	9937	4889	9970	4889
9980	4883.9	10000	4882.9	10020	4883.9	10030	4888.9	10034.5	4889
10057.6	4890.3	10072.2	4890.9	10083	4891.3	10099.8	4890.7	10118.3	4890.9
10125	4893	10138.6	4893.5	10141.6	4894.1	10145.7	4893.4	10160.8	4892.5
10177.8	4892.8	10190.1	4894	10210.9	4894.3	10214.1	4893.7	10228.8	4899.1
10235.2	4897.9	10251.3	4897.5	10292.2	4897.6	10339.1	4897.8	10366.2	4898.3
10373.1	4898.6	10377.4	4898.6	10377.6	4898.1	10398.5	4898.6	10418.9	4898.2
10419.8	4898.5	10424.2	4898.5	10432.2	4899	10443.7	4899.4		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9432.8	.025	9465.8	.04	9970	.032	10030	.05

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9970	10030	23	23	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10030	10437	4899.4	F

Left Levee Station= 9970 Elevation= 4889
Blocked Obstructions num= 1

Sta L	Sta R	Elev
9494.5	9605.5	4895

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4889.72	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.86	Wt. n-Val.		0.032		
W.S. Elev (ft)	4887.86	Reach Len. (ft)	23.00	23.00	23.00	
Crit W.S. (ft)	4887.86	Flow Area (sq ft)		209.56		
E.G. Slope (ft/ft)	0.009930	Area (sq ft)		209.56		
Q Total (cfs)	2293.00	Flow (cfs)		2293.00		
Top Width (ft)	55.69	Top Width (ft)		55.69		
Vel Total (ft/s)	10.94	Avg. Vel. (ft/s)		10.94		
Max Chl Dpth (ft)	4.96	Hydr. Depth (ft)		3.76		
Conv. Total (cfs)	23011.1	Conv. (cfs)		23011.1		
Length Wtd. (ft)	23.00	Wetted Per. (ft)		57.63		
Min Ch El (ft)	4882.90	Shear (lb/sq ft)		2.25		

Alpha	1.00	Stream Power (lb/ft s)		24.67	
Frctn Loss (ft)	0.31	Cum Volume (acre-ft)	1.85	1.62	1.48
C & E Loss (ft)	0.10	Cum SA (acres)	2.16	0.70	1.49

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2500

INPUT
Description:
Station Elevation Data num= 28

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9401	4891.7	9420	4891	9435	4890	9548	4889.8	9607	4889
9635	4889	9663	4888	9701	4887	9835	4886.2	9872	4887
9885	4894	9899	4895	9912	4895	9926	4894	9949	4893
9962	4892.3	9970	4888.25	9980	4883.25	10000	4882.25	10020	4883.25
10030	4888.25	10046	4896.1	10132	4897	10142	4897	10181	4897
10185	4898	10190	4899	10195	4900				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9401	.025	9420	.04	9962	.032	10046	.055

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9962	10046	210	198	186	.1	.3

Left Levee Station= 9912 Elevation= 4895
Blocked Obstructions num= 1

Sta L	Sta R	Elev
9435	9548	4895

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4889.32	Element	Left OB	Channel	Right OB	
Vel Head (ft)	2.85	Wt. n-Val.		0.032		
W.S. Elev (ft)	4886.47	Reach Len. (ft)	210.00	198.00	186.00	
Crit W.S. (ft)	4887.22	Flow Area (sq ft)		169.37		
E.G. Slope (ft/ft)	0.018715	Area (sq ft)		169.37		
Q Total (cfs)	2293.00	Flow (cfs)		2293.00		
Top Width (ft)	52.87	Top Width (ft)		52.87		
Vel Total (ft/s)	13.54	Avg. Vel. (ft/s)		13.54		
Max Chl Dpth (ft)	4.22	Hydr. Depth (ft)		3.20		
Conv. Total (cfs)	16761.2	Conv. (cfs)		16761.2		
Length Wtd. (ft)	200.43	Wetted Per. (ft)		54.44		
Min Ch El (ft)	4882.25	Shear (lb/sq ft)		3.64		
Alpha	1.00	Stream Power (lb/ft s)		49.22		
Frctn Loss (ft)	4.01	Cum Volume (acre-ft)	1.85	1.52	1.48	
C & E Loss (ft)	0.52	Cum SA (acres)	2.16	0.68	1.49	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Note: Program found supercritical flow starting at this cross section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2462

INPUT
Description:
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9427	4888.3	9441	4888	9459	4887	9573	4887	9590	4887
9598	4886	9607	4885	9616	4884	9793	4883	9899	4882.3
9969	4883	9979	4881.79	10000	4880.86	10021	4881.91	10031.5	4882.95

10047	4883	10108	4883	10122	4884	10130	4885	10137	4886
10156	4886	10163	4885	10175	4884	10189	4883.1	10208	4884
10210	4885	10230	4894	10277	4894.2	10341	4894	10367	4893

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9427	.025	9441	.04	9969	.032	10031.5	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9969 10031.5 270 280 285 .6 .8

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10047	10367	4895	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
9459	9573	4890

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4884.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.13	Wt. n-Val.	0.040	0.032	0.055
W.S. Elev (ft)	4883.66	Reach Len. (ft)	270.00	280.00	285.00
Crit W.S. (ft)	4884.08	Flow Area (sq ft)	216.09	122.32	10.60
E.G. Slope (ft/ft)	0.021465	Area (sq ft)	216.09	122.32	59.59
Q Total (cfs)	2293.00	Flow (cfs)	960.70	1299.71	32.58
Top Width (ft)	461.41	Top Width (ft)	292.67	62.50	106.23
Vel Total (ft/s)	6.57	Avg. Vel. (ft/s)	4.45	10.63	3.07
Max Chl Dpth (ft)	2.80	Hydr. Depth (ft)	0.74	1.96	0.68
Conv. Total (cfs)	15650.7	Conv. (cfs)	6557.2	8871.1	222.4
Length Wtd. (ft)	277.37	Wetted Per. (ft)	292.68	62.67	15.50
Min Ch El (ft)	4880.86	Shear (lb/sq ft)	0.99	2.62	0.92
Alpha	1.68	Stream Power (lb/ft s)	4.40	27.79	2.82
Frctn Loss (ft)	2.65	Cum Volume (acre-ft)	1.33	0.86	1.35
C & E Loss (ft)	0.02	Cum SA (acres)	1.46	0.41	1.27

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: American Gulch
REACH: FEMA RS: 2409

INPUT
Description: Z
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9667	4883.8	9696.4	4883.8	9715.9	4883.4	9723.4	4881.5	9729.4	4882.8
9731	4882.4	9732.2	4881.5	9743	4881.9	9752.9	4881.9	9786.2	4881.3
9830.3	4880.3	9868.1	4879.8	9901.3	4879.5	9944.7	4879	9969.5	4878.7
9983.1	4878	10000	4876.9	10006	4877	10024.3	4878.5	10036.4	4879
10046.5	4878.2	10060.5	4877.5	10069.3	4878.2	10072.1	4878.8	10077.6	4879.3
10105.3	4878.6	10138.3	4878.6	10166.8	4878.7	10198.6	4878.9	10230.5	4879.3
10254.5	4879.6	10295.5	4879.1	10325.2	4879.3	10341.2	4879.5	10351.2	4880
10353.9	4880.6	10354.6	4886.8	10361	4886.9	10368.2	4886.9		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9667	.04	10006	.04	10072.1	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
10006 10072.1 39 39 39 .3 .5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10254.5	10368.2	4890	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4880.79	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.040	0.040	0.040
W.S. Elev (ft)	4880.33	Reach Len. (ft)			

Crit W.S. (ft)	4880.13	Flow Area (sq ft)	212.66	145.47	259.26
E.G. Slope (ft/ft)	0.011288	Area (sq ft)	212.66	145.47	353.93
Q Total (cfs)	3211.00	Flow (cfs)	948.21	969.38	1293.40
Top Width (ft)	523.72	Top Width (ft)	177.04	66.10	280.59
Vel Total (ft/s)	5.20	Avg. Vel. (ft/s)	4.46	6.66	4.99
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)	1.20	2.20	1.42
Conv. Total (cfs)	30222.4	Conv. (cfs)	8924.7	9124.0	12173.7
Length Wtd. (ft)		Wetted Per. (ft)	177.10	66.31	182.44
Min Ch El (ft)	4877.00	Shear (lb/sq ft)	0.85	1.55	1.00
Alpha	1.08	Stream Power (lb/ft s)	3.77	10.30	5.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

HEC-RAS HEC-RAS 5.0.0 February 2016
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X       X   X     X  X    X
X     X  X        X            X   X     X    X   X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X            X  X      X    X        X
X     X  X        X    X       X   X     X    X        X
X     X  XXXXXX    XXXX        X    X    X    X   XXXXX
```

PROJECT DATA
Project Title: AmericanGulch
Project File : AmericanGulch.prj
Run Date and Time: 12/26/2017 3:18:56 PM

Project in English units

PLAN DATA

Plan Title: Plan 01
Plan File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\Design Condition\AmericanGulchMK\AmericanGulch.p01

Geometry Title: ncd_design_geometry
Geometry File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\Design Condition\AmericanGulchMK\AmericanGulch.g01

Flow Title : Flow 03
Flow File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\Design Condition\AmericanGulchMK\AmericanGulch.f03

Plan Summary Information:
Number of: Cross Sections = 21 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 2 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Mixed Flow

FLOW DATA

Flow Title: Flow 03
Flow File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\Design Condition\AmericanGulchMK\AmericanGulch.f03

Flow Data (cfs)

River	Reach	RS	PF 1
reach1	American Gulch	2.778	2230

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
reach1	American Gulch	PF 1	Known WS = 4905.76	Known WS = 4882.8

GEOMETRY DATA

Geometry Title: ncd_design_geometry
Geometry File : d:\NCD Data\NCD\American Gulch\Hydraulics\HEC-RAS\Design Condition\AmericanGulchMK\AmericanGulch.g01

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.778

INPUT
Description: Upstream XS per Original Stan-Tech HEC-RAS model
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9976.6	4907.46	9980	4905.74	9994	4898.74	10000	4897.24	10006	4898.24
10012	4898.24	10012	4898.99	10013.5	4898.99	10013.5	4899.74	10015	4899.74
10015	4900.49	10016.5	4900.49	10016.5	4901.24	10018	4901.24	10018	4901.99
10019.5	4901.99	10019.5	4902.74	10021	4902.74	10021	4903.49	10022.5	4903.49
10022.5	4904.24	10024	4904.24	10024	4904.99	10025.5	4904.99	10025.51	4905.74
10027.5	4906.74	10037	4908.36						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9976.6	.032	9980	.045	10006	.025	10025.5	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
998	10025.51	145	145	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4907.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.39	Wt. n-Val.		0.036	
W.S. Elev (ft)	4905.66	Reach Len. (ft)	145.00	145.00	145.00
Crit W.S. (ft)	4904.48	Flow Area (sq ft)		235.54	
E.G. Slope (ft/ft)	0.007479	Area (sq ft)		235.54	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	45.35	Top Width (ft)		45.35	
Vel Total (ft/s)	9.47	Avg. Vel. (ft/s)		9.47	
Max Chl Dpth (ft)	8.42	Hydr. Depth (ft)		5.19	
Conv. Total (cfs)	25785.1	Conv. (cfs)		25785.1	
Length Wtd. (ft)	145.00	Wetted Per. (ft)		54.67	
Min Ch El (ft)	4897.24	Shear (lb/sq ft)		2.01	
Alpha	1.00	Stream Power (lb/ft s)		19.05	
Frctn Loss (ft)	1.01	Cum Volume (acre-ft)	0.89	9.67	1.28
C & E Loss (ft)	0.03	Cum SA (acres)	1.42	2.36	1.32

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.751

INPUT
Description:
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9977	4906.57	9980.5	4904.87	9994	4897.87	10000	4896.37	10006	4897.37
10012	4897.37	10012	4898.12	10013.5	4898.12	10013.5	4898.87	10015	4898.87
10015	4899.62	10016.5	4899.62	10016.5	4900.37	10018	4900.37	10018	4901.12
10019.5	4901.12	10019.5	4901.87	10021	4901.87	10021	4902.62	10022.5	4902.62
10022.5	4903.37	10024	4903.37	10024	4904.12	10025.5	4904.12	10025.51	4904.87
10027.5	4905.87	10037	4906.97						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9977	.032	10006	.025	10025.5	.032

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9980.510025.51 203.12 203.12 203.12 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4906.01	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.73	Wt. n-Val.		0.029		
W.S. Elev (ft)	4904.28	Reach Len. (ft)	203.12	203.12	203.12	
Crit W.S. (ft)		Flow Area (sq ft)		211.32		
E.G. Slope (ft/ft)	0.006466	Area (sq ft)		211.32		
Q Total (cfs)	2230.00	Flow (cfs)		2230.00		
Top Width (ft)	43.87	Top Width (ft)		43.87		
Vel Total (ft/s)	10.55	Avg. Vel. (ft/s)		10.55		
Max Chl Dpth (ft)	7.91	Hydr. Depth (ft)		4.82		
Conv. Total (cfs)	27732.1	Conv. (cfs)		27732.1		
Length Wtd. (ft)	203.12	Wetted Per. (ft)		52.60		
Min Ch El (ft)	4896.37	Shear (lb/sq ft)		1.62		
Alpha	1.00	Stream Power (lb/ft s)		17.11		
Frctn Loss (ft)	1.22	Cum Volume (acre-ft)	0.89	8.92	1.28	
C & E Loss (ft)	0.06	Cum SA (acres)	1.42	2.21	1.32	

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.712

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9977	4904.07	9978	4903.65	9994	4896.65	10000	4895.15	10006	4896.15
10012	4896.15	10012	4896.9	10013.5	4896.9	10013.5	4897.65	10015	4897.65
10015	4898.4	10016.5	4898.4	10016.5	4899.15	10018	4899.15	10018	4899.9
10019.5	4899.9	10019.5	4900.65	10021	4900.65	10021	4901.4	10022.5	4901.4
10022.5	4902.15	10024	4902.15	10024	4902.9	10025.5	4902.91	10025.51	4903.65
10027.1	4904.47								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9977	.032	10006	.025	10025.51	.032

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
997810025.51 36 46.88 62 .1 .3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4904.73	Element	Left OB	Channel	Right OB	
Vel Head (ft)	1.52	Wt. n-Val.		0.029		
W.S. Elev (ft)	4903.21	Reach Len. (ft)	36.00	46.88	62.00	
Crit W.S. (ft)	4902.35	Flow Area (sq ft)		225.38		
E.G. Slope (ft/ft)	0.005609	Area (sq ft)		225.38		
Q Total (cfs)	2230.00	Flow (cfs)		2230.00		
Top Width (ft)	46.50	Top Width (ft)		46.50		
Vel Total (ft/s)	9.89	Avg. Vel. (ft/s)		9.89		
Max Chl Dpth (ft)	8.06	Hydr. Depth (ft)		4.85		
Conv. Total (cfs)	29776.0	Conv. (cfs)		29776.0		
Length Wtd. (ft)	46.88	Wetted Per. (ft)		55.18		
Min Ch El (ft)	4895.15	Shear (lb/sq ft)		1.43		
Alpha	1.00	Stream Power (lb/ft s)		14.15		
Frctn Loss (ft)	0.40	Cum Volume (acre-ft)	0.89	7.91	1.28	
C & E Loss (ft)	0.07	Cum SA (acres)	1.42	2.00	1.32	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.703

INPUT
Description: Section 4 of bridge routine - from Stan-tech RAS Model
Station Elevation Data num= 27

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9977	4903.67	9977.7	4903.37	9994	4896.37	10000	4894.87	10006	4895.87
10012	4895.87	10012	4896.62	10013.5	4896.62	10013.5	4897.37	10015	4897.37
10015	4898.12	10016.5	4898.12	10016.5	4898.87	10018	4898.87	10018	4899.62
10019.5	4899.62	10019.5	4900.37	10021	4900.37	10021	4901.12	10022.5	4901.12
10022.5	4901.87	10024	4901.87	10024	4902.62	10025.5	4902.6210025.51		4903.37
10027.5	4904.37	10037	4904.57						

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9977	.032	9977.7	.045	10006	.025	10027.5	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9977.710025.51		42	50	61	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4904.26	Element			
Vel Head (ft)	2.19	Wt. n-Val.		0.036	
W.S. Elev (ft)	4902.07	Reach Len. (ft)	42.00	50.00	61.00
Crit W.S. (ft)	4902.07	Flow Area (sq ft)		187.88	
E.G. Slope (ft/ft)	0.014664	Area (sq ft)		187.88	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	43.28	Top Width (ft)		43.28	
Vel Total (ft/s)	11.87	Avg. Vel. (ft/s)		11.87	
Max Chl Dpth (ft)	7.20	Hydr. Depth (ft)		4.34	
Conv. Total (cfs)	18415.2	Conv. (cfs)		18415.2	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		50.92	
Min Ch El (ft)	4894.87	Shear (lb/sq ft)		3.38	
Alpha	1.00	Stream Power (lb/ft s)		40.10	
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.89	7.68	1.28
C & E Loss (ft)	0.70	Cum SA (acres)	1.42	1.95	1.32

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.693

INPUT
Description: Section 3 of bridge routine - per Stantech RAS Model
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4903.37	9983.99	4900.87	9984	4892.87	10016	4892.8710016.01		4900.87
10030	4903.37								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9983.99	.01510016.01		.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9983.9910016.01		50	50	50	.6	.8

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9970	9983.99	4903.47	T
10016.01	10030	4903.47	T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4903.44	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.79	Wt. n-Val.		0.015	
W.S. Elev (ft)	4902.65	Reach Len. (ft)	0.10	0.10	0.10
Crit W.S. (ft)	4898.18	Flow Area (sq ft)		312.99	
E.G. Slope (ft/ft)	0.000425	Area (sq ft)	8.84	312.99	8.84
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	51.91	Top Width (ft)	9.95	32.02	9.95
Vel Total (ft/s)	7.12	Avg. Vel. (ft/s)		7.12	
Max Chl Dpth (ft)	9.78	Hydr. Depth (ft)		9.77	
Conv. Total (cfs)	108215.4	Conv. (cfs)		108215.4	
Length Wtd. (ft)	0.10	Wetted Per. (ft)		48.00	
Min Ch El (ft)	4892.87	Shear (lb/sq ft)		0.17	
Alpha	1.00	Stream Power (lb/ft s)		1.23	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.88	7.40	1.27
C & E Loss (ft)		Cum SA (acres)	1.42	1.91	1.31

BRIDGE

RIVER: reach1
REACH: American Gulch RS: 2.688

INPUT
Description: 3-10'x8'x50' cbc
Distance from Upstream XS = .1
Deck/Roadway Width = 49.8
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 4

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
9970	4903.37	9984	4903.37	4900.87	10016 4903.37 4900.87
10030	4903.37				

Upstream Bridge Cross Section Data
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4903.37	9983.99	4900.87	9984	4892.87	10016	4892.87	10016.01	4900.87
10030	4903.37								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9983.99	.01	5	10016.01 .032

Bank Sta: Left Right Coeff Contr. Expan.
9983.99 10016.01 .6 .8
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9970	9983.99	4903.47	T
10016.01	10030	4903.47	T

Downstream Deck/Roadway Coordinates
num= 4

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
9970	4902.57	9984	4902.57	4900.57	10016.1 4902.57 4900.57
10030	4902.57				

Downstream Bridge Cross Section Data
Station Elevation Data num= 6

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4902.67	9983.99	4900.52	9984	4892.52	10016	4892.52	10016.01	4900.52
10030	4902.57								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9983.99	.01	5	10016.01 .032

Bank Sta: Left Right Coeff Contr. Expan.
9983.99 10016.01 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9970	9983.99	4902.67	T
10016.01	10030	4902.67	T

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .95

```
Elevation at which weir flow begins         = 4902.47
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Piers =  2

Pier Data
Pier Station     Upstream=  9994.5    Downstream=  9994.5
Upstream     num=       2
    Width   Elev    Width   Elev
       1 4892.87       1 4900.87
Downstream     num=       2
    Width   Elev    Width   Elev
       1 4892.52       1 4900.52

Pier Data
Pier Station     Upstream= 10005.5    Downstream= 10005.5
Upstream     num=       2
    Width   Elev    Width   Elev
       1 4892.87       1 4900.87
Downstream     num=       2
    Width   Elev    Width   Elev
       1 4892.52       1 4900.52

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
       Momentum              Cd   =       2
       Yarnell               KVal =    1.25
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Pressure and Weir flow
           Submerged Inlet Cd          =
           Submerged Inlet + Outlet Cd =      .8
           Max Low Cord                =

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
           inside the bridge at the upstream end
       Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT  Profile #PF 1

  E.G. US. (ft)               4903.44    Element                Inside BR US  Inside BR DS
  W.S. US. (ft)               4902.65    E.G. Elev (ft)             4903.44       4902.63
  Q Total (cfs)               2230.00    W.S. Elev (ft)             4902.65       4902.61
  Q Bridge (cfs)              2228.73    Crit W.S. (ft)             4898.45       4898.05
  Q Weir (cfs)                   1.35    Max Chl Dpth (ft)             9.78         10.09
  Weir Sta Lft (ft)           9983.99    Vel Total (ft/s)              0.00          7.67
  Weir Sta Rgt (ft)          10016.01    Flow Area (sq ft)                          290.86
  Weir Submerg                   0.00    Froude # Chl                  0.52          0.51
  Weir Max Depth (ft)            0.07    Specif Force (cu ft)       2030.75       2101.51
  Min El Weir Flow (ft)       4903.38    Hydr Depth (ft)                             9.08
  Min El Prs (ft)             4900.87    W.P. Total (ft)             108.00        144.08
  Delta EG (ft)                  2.77    Conv. Total (cfs)
  Delta WS (ft)                  4.81    Top Width (ft)                             59.61
  BR Open Area (sq ft)         240.07    Frctn Loss (ft)
  BR Open Vel (ft/s)             9.28    C & E Loss (ft)
  BR Sluice Coef                 0.45    Shear Total (lb/sq ft)
  BR Sel Method            Press/Weir    Power Total (lb/ft s)


Warning: The momentum, Class B, supercritical, water surface downstream of the bridge had a higher energy than the
         upstream cross section.  This is not physically possible.  The downstream water surface has been computed by
         taking the momentum result inside of the bridge and performing an energy balance.
Note:    Yarnell answer is not valid if the water surface is above the low chord or if there is weir flow.  The Yarnell answer
         has been disregarded.
Note:    The momentum method has computed a class B profile.
Note:    The downstream water surface is below the minimum elevation for pressure flow.  The sluice gate equations were
         used for pressure flow.
Note:    For the cross section inside the bridge at the upstream end, the water surface and energy have been projected
         from the upstream cross section.  The selected bridge modeling method does not compute answers inside the bridge.
```

Note: For the cross section inside the bridge at the downstream end, the water surface and energy are based on critical depth over the weir.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.683

INPUT
Description: Section 2 of bridge routine - per Stantech RAS model

Station Elevation Data	num=	6							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9970	4902.67	9983.99	4900.52	9984	4892.52	10016	4892.52	10016.01	4900.52
10030	4902.57								

Manning's n Values	num=	3		
Sta	n Val	Sta	n Val	Sta	n Val
9970	.032	9983.99	.01	10016.01	.032

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9983.99	10016.01	40	40	40	.3	.5

Ineffective Flow	num=	2	
Sta L	Sta R	Elev	Permanent
9970	9983.99	4902.67	T
10016.01	10030	4902.67	T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4900.51	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.67	Wt. n-Val.		0.015	
W.S. Elev (ft)	4897.84	Reach Len. (ft)	40.00	40.00	40.00
Crit W.S. (ft)	4897.84	Flow Area (sq ft)		170.27	
E.G. Slope (ft/ft)	0.002783	Area (sq ft)		170.27	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	32.01	Top Width (ft)		32.01	
Vel Total (ft/s)	13.10	Avg. Vel. (ft/s)		13.10	
Max Chl Dpth (ft)	5.32	Hydr. Depth (ft)		5.32	
Conv. Total (cfs)	42269.5	Conv. (cfs)		42269.5	
Length Wtd. (ft)	40.00	Wetted Per. (ft)		42.92	
Min Ch El (ft)	4892.52	Shear (lb/sq ft)		0.69	
Alpha	1.00	Stream Power (lb/ft s)		9.03	
Frctn Loss (ft)	0.30	Cum Volume (acre-ft)	0.88	7.12	1.27
C & E Loss (ft)	0.49	Cum SA (acres)	1.41	1.89	1.30

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.676

INPUT
Description: Section 1 of bridge routine

Station Elevation Data	num=	20							
Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4903.25	2.99	4903.31	8.97	4902.58	11.26	4901.05	12.13	4900.83
15.37	4898.05	22.9	4892.88	33.28	4892.46	39.78	4891.25	40.79	4890.75
44.79	4890.75	45.79	4891.25	52.29	4892.45	60.25	4892.77	62.41	4894.27
65.39	4896.33	74.62	4902.57	75.53	4902.77	77.72	4902.69	82	4902.73

Manning's n Values	num=	5							
Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	22.9	.045	40.79	.032	45.79	.045	60.25	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.97	74.62	150.68	150.68	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4899.71	Element	Left OB	Channel	Right OB	
Vel Head (ft)	4.31	Wt. n-Val.		0.043		
W.S. Elev (ft)	4895.41	Reach Len. (ft)	150.68	150.68	150.68	
Crit W.S. (ft)	4896.71	Flow Area (sq ft)		133.97		
E.G. Slope (ft/ft)	0.056514	Area (sq ft)		133.97		
Q Total (cfs)	2230.00	Flow (cfs)		2230.00		
Top Width (ft)	44.83	Top Width (ft)		44.83		
Vel Total (ft/s)	16.64	Avg. Vel. (ft/s)		16.64		
Max Chl Dpth (ft)	4.66	Hydr. Depth (ft)		2.99		
Conv. Total (cfs)	9380.5	Conv. (cfs)		9380.5		
Length Wtd. (ft)	150.68	Wetted Per. (ft)		46.91		
Min Ch El (ft)	4890.75	Shear (lb/sq ft)		10.08		
Alpha	1.00	Stream Power (lb/ft s)		167.72		
Frctn Loss (ft)	0.99	Cum Volume (acre-ft)	0.88	6.98	1.27	
C & E Loss (ft)	0.04	Cum SA (acres)	1.41	1.85	1.30	

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.648

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4901.26	1.54	4901.19	8.09	4901.08	11.35	4901.09	19.49	4900.83
29.24	4892.81	30.43	4891.87	42.91	4891.38	50.74	4890.18	52.74	4889.68
55.75	4889.68	58.77	4889.69	60.77	4890.19	61.98	4891.39	69.62	4891.7
75.74	4896.06	78.2	4897.79	81.96	4900.51	85.68	4900.6	88.91	4900.58

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	30.43	.045	52.74	.032	58.77	.045	69.62	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
19.49	81.96	90	79.32	70	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4898.16	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.96	Wt. n-Val.		0.042		
W.S. Elev (ft)	4897.21	Reach Len. (ft)	90.00	79.32	70.00	
Crit W.S. (ft)	4895.47	Flow Area (sq ft)		284.39		
E.G. Slope (ft/ft)	0.005934	Area (sq ft)		284.39		
Q Total (cfs)	2230.00	Flow (cfs)		2230.00		
Top Width (ft)	53.48	Top Width (ft)		53.48		
Vel Total (ft/s)	7.84	Avg. Vel. (ft/s)		7.84		
Max Chl Dpth (ft)	7.53	Hydr. Depth (ft)		5.32		
Conv. Total (cfs)	28947.6	Conv. (cfs)		28947.6		
Length Wtd. (ft)	79.32	Wetted Per. (ft)		57.87		
Min Ch El (ft)	4889.68	Shear (lb/sq ft)		1.82		
Alpha	1.00	Stream Power (lb/ft s)		14.28		
Frctn Loss (ft)	0.50	Cum Volume (acre-ft)	0.88	6.26	1.27	
C & E Loss (ft)	0.00	Cum SA (acres)	1.41	1.68	1.30	

Note: Manning's n values were composited to a single value in the main channel.
Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.633

INPUT
Description:
Station Elevation Data num= 23

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4900.9	.96	4900.9	3.33	4900.87	7.97	4897.97	10	4897.51
17.6	4892.31	26.01	4891.97	26.68	4891.71	30.74	4889.89	31.87	4889.23
32.08	4889.12	36.75	4889.12	36.99	4889.25	38.08	4889.89	39.49	4890.12
45.01	4890.98	60.01	4891.59	73.27	4898.7	74.34	4899.26	75.02	4899.69
75.17	4899.7	80.36	4899.9	90	4900				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	17.6	.045	32.08	.032	36.99	.045	60.01	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
3.33	75.17	58	50	44	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4897.66	Element			
Vel Head (ft)	0.96	Wt. n-Val.		0.043	
W.S. Elev (ft)	4896.70	Reach Len. (ft)	58.00	50.00	44.00
Crit W.S. (ft)		Flow Area (sq ft)		283.27	
E.G. Slope (ft/ft)	0.006697	Area (sq ft)		283.27	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	58.36	Top Width (ft)		58.36	
Vel Total (ft/s)	7.87	Avg. Vel. (ft/s)		7.87	
Max Chl Dpth (ft)	7.58	Hydr. Depth (ft)		4.85	
Conv. Total (cfs)	27249.9	Conv. (cfs)		27249.9	
Length Wtd. (ft)	50.00	Wetted Per. (ft)		61.96	
Min Ch El (ft)	4889.12	Shear (lb/sq ft)		1.91	
Alpha	1.00	Stream Power (lb/ft s)		15.05	
Frctn Loss (ft)	0.35	Cum Volume (acre-ft)	0.88	5.74	1.27
C & E Loss (ft)	0.01	Cum SA (acres)	1.41	1.58	1.30

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.623

INPUT
Description:
Station Elevation Data num= 25

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4898.97	13.19	4898.97	16.39	4899	17.61	4899.03	23.88	4897.06
27.06	4894.58	29.76	4892.14	36.81	4891.87	38.64	4890.46	39.26	4889.94
39.78	4889.58	41.03	4888.72	43.79	4888.72	46.55	4888.73	47.84	4889.61
48.31	4889.94	53.99	4890.74	55.8	4890.99	76.14	4891.81	81.01	4895.3
82.83	4896.58	85.48	4898.35	85.96	4898.34	90.24	4898.59	93.2	4898.7

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	29.76	.045	41.03	.032	46.55	.045	76.14	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
17.61	85.48	50	44.65	36	.3	.5

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4897.30	Element			
Vel Head (ft)	1.01	Wt. n-Val.		0.043	
W.S. Elev (ft)	4896.29	Reach Len. (ft)	50.00	44.65	36.00
Crit W.S. (ft)		Flow Area (sq ft)		276.83	
E.G. Slope (ft/ft)	0.007328	Area (sq ft)		276.83	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	57.56	Top Width (ft)		57.56	
Vel Total (ft/s)	8.06	Avg. Vel. (ft/s)		8.06	
Max Chl Dpth (ft)	7.57	Hydr. Depth (ft)		4.81	
Conv. Total (cfs)	26049.8	Conv. (cfs)		26049.8	
Length Wtd. (ft)	44.65	Wetted Per. (ft)		62.05	
Min Ch El (ft)	4888.72	Shear (lb/sq ft)		2.04	
Alpha	1.00	Stream Power (lb/ft s)		16.44	

Frctn Loss (ft)	0.26	Cum Volume (acre-ft)	0.88	5.42	1.27
C & E Loss (ft)	0.08	Cum SA (acres)	1.41	1.51	1.30

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.615

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4897.49	.77	4897.45	5.03	4897.3	8.6	4897.52	20.44	4897.44
26.41	4892.17	29.64	4890.37	35.76	4890.12	36.96	4888.92	38.97	4888.42
41.98	4888.41	44.99	4888.41	47	4888.91	54.82	4890.11	69.66	4890.69
72.47	4892.59	79.34	4897.15	82.15	4897.25	100	4897.4		

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	38.97	.032	44.99	.045	69.66	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
20.44	79.34	85.35	85.35	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4896.96	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.84	Wt. n-Val.		0.041	
W.S. Elev (ft)	4896.11	Reach Len. (ft)	85.35	85.35	85.35
Crit W.S. (ft)		Flow Area (sq ft)		302.92	
E.G. Slope (ft/ft)	0.004865	Area (sq ft)		302.92	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	55.84	Top Width (ft)		55.84	
Vel Total (ft/s)	7.36	Avg. Vel. (ft/s)		7.36	
Max Chl Dpth (ft)	7.70	Hydr. Depth (ft)		5.43	
Conv. Total (cfs)	31971.6	Conv. (cfs)		31971.6	
Length Wtd. (ft)	85.35	Wetted Per. (ft)		60.17	
Min Ch El (ft)	4888.41	Shear (lb/sq ft)		1.53	
Alpha	1.00	Stream Power (lb/ft s)		11.26	
Frctn Loss (ft)	0.59	Cum Volume (acre-ft)	0.88	5.12	1.27
C & E Loss (ft)	0.06	Cum SA (acres)	1.41	1.46	1.30

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.599

INPUT
Description:
Station Elevation Data num= 26

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4896.54	1.39	4896.55	3.56	4896.81	14.6	4896.24	16.94	4896.24
19.63	4896.08	22.97	4894.54	24.48	4893.85	28.53	4890.37	28.7	4890.08
42.67	4889.51	49.18	4888.31	50.18	4887.81	52.18	4887.81	54.18	4887.8
55.18	4888.3	61.69	4889.5	63.48	4889.58	63.82	4889.89	68.08	4893.24
72	4894.76	74.59	4895.6	76.55	4896.36	78.87	4896.67	80.18	4896.77
81.3	4896.8								

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	28.7	.045	50.18	.032	54.18	.045	63.48	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
19.63	76.55	100	100	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4896.31	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.42	Wt. n-Val.		0.042	
W.S. Elev (ft)	4894.89	Reach Len. (ft)	100.00	100.00	100.00
Crit W.S. (ft)		Flow Area (sq ft)		233.21	
E.G. Slope (ft/ft)	0.010557	Area (sq ft)		233.21	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	50.18	Top Width (ft)		50.18	
Vel Total (ft/s)	9.56	Avg. Vel. (ft/s)		9.56	
Max Chl Dpth (ft)	7.09	Hydr. Depth (ft)		4.65	
Conv. Total (cfs)	21703.3	Conv. (cfs)		21703.3	
Length Wtd. (ft)	100.00	Wetted Per. (ft)		53.91	
Min Ch El (ft)	4887.80	Shear (lb/sq ft)		2.85	
Alpha	1.00	Stream Power (lb/ft s)		27.26	
Frctn Loss (ft)	0.77	Cum Volume (acre-ft)	0.88	4.59	1.27
C & E Loss (ft)	0.16	Cum SA (acres)	1.41	1.35	1.30

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.580

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4895.2	9.7	4894.96	19.08	4894.14	26.34	4889.06	34.13	4888.76
40.72	4887.57	41.73	4887.07	43.76	4887.07	45.79	4887.08	46.8	4887.58
53.39	4888.79	57.72	4888.96	69.32	4889.46	69.59	4889.94	70.32	4890.06
76.76	4895.58	77.65	4895.79	78.29	4895.8	80.84	4896.07		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	26.34	.045	41.73	.032	45.79	.045	69.32	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
19.08	76.76	200	200	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4895.38	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.89	Wt. n-Val.	0.040	0.043	
W.S. Elev (ft)	4894.49	Reach Len. (ft)	200.00	200.00	200.00
Crit W.S. (ft)		Flow Area (sq ft)	0.70	293.78	
E.G. Slope (ft/ft)	0.005799	Area (sq ft)	0.70	293.78	
Q Total (cfs)	2230.00	Flow (cfs)	0.61	2229.39	
Top Width (ft)	60.40	Top Width (ft)	3.99	56.41	
Vel Total (ft/s)	7.57	Avg. Vel. (ft/s)	0.88	7.59	
Max Chl Dpth (ft)	7.42	Hydr. Depth (ft)	0.17	5.21	
Conv. Total (cfs)	29284.2	Conv. (cfs)	8.0	29276.2	
Length Wtd. (ft)	200.00	Wetted Per. (ft)	4.00	60.41	
Min Ch El (ft)	4887.07	Shear (lb/sq ft)	0.06	1.76	
Alpha	1.00	Stream Power (lb/ft s)	0.06	13.36	
Frctn Loss (ft)	1.67	Cum Volume (acre-ft)	0.88	3.99	1.27
C & E Loss (ft)	0.07	Cum SA (acres)	1.41	1.23	1.30

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.542

```
INPUT
Description:
Station Elevation Data    num=      31
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 4892.92    8.97 4892.79   12.93 4892.69   13.03 4892.48   19.33  4892.2
   19.46 4892.19   19.48 4892.18   20.29 4892.17   20.72 4891.96   21.87 4891.42
   24.53 4889.89   24.63  4889.8   25.21  4889.3   26.97 4887.77   37.46 4887.34
   44.16 4886.13    45.2 4885.63   47.26 4885.62   49.32 4885.62   50.35 4886.12
   57.06 4887.31   65.49 4887.62   66.25 4888.53   68.29 4890.69   69.31 4890.53
   75.37 4893.26   77.56  4893.9   77.71 4894.21   77.79 4894.19   79.94 4894.65
    82.5  4894.7

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   26.97    .045    45.2    .032   49.32    .045   65.49     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         20.29   75.37              100     100     100             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4893.65    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               1.55    Wt. n-Val.                          0.043
  W.S. Elev (ft)           4892.10    Reach Len. (ft)          100.00     100.00     100.00
  Crit W.S. (ft)           4891.59    Flow Area (sq ft)                   223.22
  E.G. Slope (ft/ft)      0.012952    Area (sq ft)                        223.22
  Q Total (cfs)            2230.00    Flow (cfs)                         2230.00
  Top Width (ft)             52.37    Top Width (ft)                       52.37
  Vel Total (ft/s)            9.99    Avg. Vel. (ft/s)                     9.99
  Max Chl Dpth (ft)           6.48    Hydr. Depth (ft)                     4.26
  Conv. Total (cfs)        19594.2    Conv. (cfs)                        19594.2
  Length Wtd. (ft)          100.00    Wetted Per. (ft)                     55.89
  Min Ch El (ft)           4885.62    Shear (lb/sq ft)                     3.23
  Alpha                       1.00    Stream Power (lb/ft s)               32.26
  Frctn Loss (ft)             0.98    Cum Volume (acre-ft)        0.88      2.80       1.27
  C & E Loss (ft)             0.19    Cum SA (acres)              1.40      0.98       1.30


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional cross
         sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This may indicate
         the need for additional cross sections.
Note:    Manning's n values were composited to a single value in the main channel.

CROSS SECTION


RIVER: reach1
REACH: American Gulch     RS: 2.523

INPUT
Description:
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0 4892.04    7.89 4891.97    9.22 4891.87   21.16 4890.62   23.23 4888.35
   24.37 4887.17   33.16 4886.84   40.33 4886.57   48.25 4885.38   50.28 4884.88
   53.32 4884.88   56.37 4884.89    58.4 4885.39   59.62 4886.59   74.35 4887.19
   77.64 4889.19   80.92 4891.36   83.68 4893.29    83.8 4893.28   86.49  4893.4

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   24.37    .045   50.28    .032   56.37    .045   74.35     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          9.22   83.68               30      30      30             .1       .3

CROSS SECTION OUTPUT  Profile #PF 1

  E.G. Elev (ft)           4892.49    Element                  Left OB    Channel   Right OB
  Vel Head (ft)               0.92    Wt. n-Val.                          0.042
  W.S. Elev (ft)           4891.57    Reach Len. (ft)           30.00      30.00      30.00
  Crit W.S. (ft)                      Flow Area (sq ft)                   290.11
  E.G. Slope (ft/ft)      0.007627    Area (sq ft)                        290.11
  Q Total (cfs)            2230.00    Flow (cfs)                         2230.00
  Top Width (ft)             69.11    Top Width (ft)                       69.11
  Vel Total (ft/s)            7.69    Avg. Vel. (ft/s)                     7.69
```

Max Chl Dpth (ft)	6.69	Hydr. Depth (ft)		4.20	
Conv. Total (cfs)	25533.8	Conv. (cfs)		25533.8	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		72.66	
Min Ch El (ft)	4884.88	Shear (lb/sq ft)		1.90	
Alpha	1.00	Stream Power (lb/ft s)		14.61	
Frctn Loss (ft)	0.23	Cum Volume (acre-ft)	0.88	2.21	1.27
C & E Loss (ft)	0.01	Cum SA (acres)	1.40	0.84	1.30

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.513

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4893.88	2.07	4893.89	4.44	4893.88	5.03	4893.83	14.7	4892.31
18.99	4889.91	23.58	4886.42	29.83	4886.18	36.48	4884.99	37.51	4884.49
39.55	4884.5	41.61	4884.5	42.65	4885	49.42	4886.22	71.35	4887.11
75.86	4890.34	81.8	4894.77	82.07	4894.88	84.37	4894.91	100	4895.11

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	23.58	.045	37.51	.032	41.61	.045	71.35	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
5.03	81.8	30	30	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4892.24	Element			
Vel Head (ft)	1.04	Wt. n-Val.		0.043	
W.S. Elev (ft)	4891.20	Reach Len. (ft)	30.00	30.00	30.00
Crit W.S. (ft)		Flow Area (sq ft)		273.13	
E.G. Slope (ft/ft)	0.008013	Area (sq ft)		273.13	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	60.33	Top Width (ft)		60.33	
Vel Total (ft/s)	8.16	Avg. Vel. (ft/s)		8.16	
Max Chl Dpth (ft)	6.71	Hydr. Depth (ft)		4.53	
Conv. Total (cfs)	24912.4	Conv. (cfs)		24912.4	
Length Wtd. (ft)	30.00	Wetted Per. (ft)		63.63	
Min Ch El (ft)	4884.49	Shear (lb/sq ft)		2.15	
Alpha	1.00	Stream Power (lb/ft s)		17.53	
Frctn Loss (ft)	0.32	Cum Volume (acre-ft)	0.88	2.02	1.27
C & E Loss (ft)	0.05	Cum SA (acres)	1.40	0.80	1.30

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.507

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4893.98	3.87	4893.96	6.15	4893.77	10.49	4893.08	21.68	4886.83
22.28	4886.38	28.49	4886.14	35.14	4884.95	36.16	4884.45	38.21	4884.45
40.25	4884.46	41.28	4884.96	44.7	4885.58	47.93	4886.17	61.63	4886.74
69.14	4887.04	72.78	4889.65	78.33	4892.06	81.76	4894.75	81.9	4894.79
81.91	4894.85	82.81	4894.97	99.68	4895.52	100	4895.52		

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.04	22.28	.045	36.16	.032	40.25	.045	69.14	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
10.49	81.76	68	38	.1	.3

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4891.87	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.53	Wt. n-Val.		0.043	
W.S. Elev (ft)	4890.34	Reach Len. (ft)	68.00	38.00	38.00
Crit W.S. (ft)	4890.04	Flow Area (sq ft)		224.56	
E.G. Slope (ft/ft)	0.014720	Area (sq ft)		224.56	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	58.95	Top Width (ft)		58.95	
Vel Total (ft/s)	9.93	Avg. Vel. (ft/s)		9.93	
Max Chl Dpth (ft)	5.89	Hydr. Depth (ft)		3.81	
Conv. Total (cfs)	18380.2	Conv. (cfs)		18380.2	
Length Wtd. (ft)	38.00	Wetted Per. (ft)		61.47	
Min Ch El (ft)	4884.45	Shear (lb/sq ft)		3.36	
Alpha	1.00	Stream Power (lb/ft s)		33.34	
Frctn Loss (ft)	0.47	Cum Volume (acre-ft)	0.88	1.85	1.27
C & E Loss (ft)	0.07	Cum SA (acres)	1.40	0.76	1.30

Note: Manning's n values were composited to a single value in the main channel.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.500

INPUT
Description:
Station Elevation Data num= 24

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4895.8	6.667	4895.8	8.384	4895.8	8.649	4887.36	11.7614887.273	
14.3664886.835		15.8914886.333		17.2344886.029		21.2	4885.9	25.199	4885.7
33.2	4884.5	34.1	4883.9	36.6	4883.9	39.1	4883.9	40	4884.5
48	4885.7	52	4885.9	61.3114886.105		63.1324886.328		65.1814886.311	
66.3994886.505		66.72	4894.63	69.288	4894.63	78.096	4894.63		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	8.649	.045	66.399	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.384	66.72	62	50	52	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	10	4896	F
65	78.096	4896	F

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4891.32	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.30	Wt. n-Val.		0.045	
W.S. Elev (ft)	4890.02	Reach Len. (ft)	1.00	1.00	1.00
Crit W.S. (ft)	4889.32	Flow Area (sq ft)		244.04	
E.G. Slope (ft/ft)	0.010687	Area (sq ft)		253.10	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	57.97	Top Width (ft)		57.97	
Vel Total (ft/s)	9.14	Avg. Vel. (ft/s)		9.14	
Max Chl Dpth (ft)	6.12	Hydr. Depth (ft)		4.44	
Conv. Total (cfs)	21571.3	Conv. (cfs)		21571.3	
Length Wtd. (ft)	1.00	Wetted Per. (ft)		55.72	
Min Ch El (ft)	4883.90	Shear (lb/sq ft)		2.92	
Alpha	1.00	Stream Power (lb/ft s)		26.70	
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.88	1.64	1.27
C & E Loss (ft)	0.00	Cum SA (acres)	1.40	0.70	1.30

Warning: When the Manning's n value for the channel was composited, the computed n value was larger [smaller] than the largest [smallest] user entered n value. The n value has been set to the largest [smallest] entered value. The user may wish to examine this cross section and enter a single n value for the entire channel.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

BRIDGE

RIVER: reach1

```
REACH: American Gulch     RS: 2.495

INPUT
Description:
Distance from Upstream XS =       1
Deck/Roadway Width        =      48
Weir Coefficient          =     2.6
Upstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
   6.709  4895.8 4891.65      67 4894.63 4890.67

Upstream Bridge Cross Section Data
Station Elevation Data    num=      24
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  4895.8   6.667  4895.8   8.384  4895.8   8.649 4887.36  11.7614887.273
  14.3664886.835  15.8914886.333  17.2344886.029    21.2  4885.9  25.199  4885.7
    33.2  4884.5    34.1  4883.9    36.6  4883.9    39.1  4883.9      40  4884.5
      48  4885.7      52  4885.9  61.3114886.105  63.1324886.328  65.1814886.311
  66.3994886.505   66.72 4894.63  69.288 4894.63  78.096 4894.63

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04   8.649    .045  66.399     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
         8.384   66.72             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      10    4896       F
      65  78.096    4896       F

Downstream  Deck/Roadway Coordinates
    num=       2
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
  15.096  4895.8 4891.34      84 4894.63  4889.8

Downstream Bridge Cross Section Data
Station Elevation Data    num=      20
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
       0  4895.8  11.014  4895.8  18.181  4895.8  18.9344886.414  23.5594885.726
    29.2  4884.8    41.2  4884.2    42.1  4883.6    44.6  4883.6    47.1  4883.6
      48  4884.2  56.001  4885.4      60  4885.6  69.7034886.383  75.1394887.375
  78.3264887.813  81.1514889.012  82.6074889.532  83.112 4894.63  90.499 4894.63

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0     .04  18.934    .045  82.607     .04

Bank Sta: Left   Right    Coeff Contr.   Expan.
        18.181  83.112             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0      20    4896       F
      80  90.499    4896       F

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Bridge Coefficient Sets =  1

Low Flow Methods and Data
       Energy
Selected Low Flow Methods = Highest Energy Answer

High Flow Method
       Energy Only

Additional Bridge Parameters
       Add Friction component to Momentum
       Do not add Weight component to Momentum
       Class B flow critical depth computations use critical depth
```

inside the bridge at the upstream end
Criteria to check for pressure flow = Upstream energy grade line

BRIDGE OUTPUT Profile #PF 1

			Inside BR US	Inside BR DS
E.G. US. (ft)	4891.32	Element		
W.S. US. (ft)	4890.02	E.G. Elev (ft)	4891.31	4890.68
Q Total (cfs)	2230.00	W.S. Elev (ft)	4890.01	4889.20
Q Bridge (cfs)	2230.00	Crit W.S. (ft)	4889.32	4888.90
Q Weir (cfs)		Max Chl Dpth (ft)	6.11	5.60
Weir Sta Lft (ft)		Vel Total (ft/s)	9.18	9.78
Weir Sta Rgt (ft)		Flow Area (sq ft)	243.00	228.12
Weir Submerg		Froude # Chl	0.77	0.88
Weir Max Depth (ft)		Specif Force (cu ft)	1193.18	1151.52
Min El Weir Flow (ft)	4895.75	Hydr Depth (ft)	4.42	3.80
Min El Prs (ft)	4891.62	W.P. Total (ft)	55.72	60.88
Delta EG (ft)	0.67	Conv. Total (cfs)	21417.3	18171.3
Delta WS (ft)	1.12	Top Width (ft)	57.97	62.96
BR Open Area (sq ft)	305.93	Frctn Loss (ft)	0.61	0.02
BR Open Vel (ft/s)	9.78	C & E Loss (ft)	0.02	0.03
BR Sluice Coef		Shear Total (lb/sq ft)	2.95	3.52
BR Sel Method	Energy only	Power Total (lb/ft s)	27.09	34.44

Warning: When the Manning's n value for the channel was composited, the computed n value was larger [smaller] than the largest [smallest] user entered n value. The n value has been set to the largest [smallest] entered value. The user may wish to examine this cross section and enter a single n value for the entire channel.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.
Warning: When the Manning's n value for the channel was composited, the computed n value was larger [smaller] than the largest [smallest] user entered n value. The n value has been set to the largest [smallest] entered value. The user may wish to examine this cross section and enter a single n value for the entire channel.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.4903

INPUT
Description:
Station Elevation Data num= 20

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	4895.8	11.014	4895.8	18.181	4895.8	18.9344886.414		23.5594885.726	
29.2	4884.8	41.2	4884.2	42.1	4883.6	44.6	4883.6	47.1	4883.6
48	4884.2	56.001	4885.4	60	4885.6	69.7034886.383		75.1394887.375	
78.3264887.813		81.1514889.012		82.6074889.532		83.112 4894.63		90.499 4894.63	

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.04	18.934	.045	82.607	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
18.181	83.112	92	73	93	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	20	4896	F
80	90.499	4896	F

CROSS SECTION OUTPUT Profile #PF 1

			Left OB	Channel	Right OB
E.G. Elev (ft)	4890.65	Element			
Vel Head (ft)	1.75	Wt. n-Val.		0.045	
W.S. Elev (ft)	4888.90	Reach Len. (ft)	92.00	73.00	93.00
Crit W.S. (ft)	4888.90	Flow Area (sq ft)		210.37	
E.G. Slope (ft/ft)	0.019730	Area (sq ft)		213.52	
Q Total (cfs)	2230.00	Flow (cfs)		2230.00	
Top Width (ft)	62.16	Top Width (ft)		62.16	
Vel Total (ft/s)	10.60	Avg. Vel. (ft/s)		10.60	
Max Chl Dpth (ft)	5.30	Hydr. Depth (ft)		3.51	
Conv. Total (cfs)	15876.0	Conv. (cfs)		15876.0	
Length Wtd. (ft)	76.14	Wetted Per. (ft)		60.88	
Min Ch El (ft)	4883.60	Shear (lb/sq ft)		4.26	
Alpha	1.00	Stream Power (lb/ft s)		45.12	
Frctn Loss (ft)	2.34	Cum Volume (acre-ft)	0.88	1.36	1.27

C & E Loss (ft)	0.07	Cum SA (acres)	1.40	0.64	1.30

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.
Warning: When the Manning's n value for the channel was composited, the computed n value was larger [smaller] than the largest [smallest] user entered n value. The n value has been set to the largest [smallest] entered value. The user may wish to examine this cross section and enter a single n value for the entire channel.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.462

INPUT
Description: Matching D/S XS per Stantech Ras Model
Station Elevation Data num= 30

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9427	4890.77	9441	4890.47	9459	4889.47	9573	4889.47	9590	4889.47
9598	4888.47	9607	4887.47	9616	4886.47	9793	4885.47	9899	4884.77
9969	4885.47	9979	4884.26	10000	4883.33	10021	4884.38	10031.5	4885.42
10047	4885.47	10108	4885.47	10122	4886.47	10130	4887.47	10137	4888.47
10156	4888.47	10163	4887.47	10175	4886.47	10189	4885.57	10208	4886.47
10210	4887.47	10230	4896.47	10277	4896.67	10341	4896.47	10367	4895.47

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9427	.025	9441	.04	9969	.032	10031.5	.055

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9969 10031.5 270 280 285 .6 .8
Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10047	10367	4897.47	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
9459	9573	4892.47

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4888.24	Element	Left OB	Channel	Right OB
Vel Head (ft)	2.46	Wt. n-Val.	0.040	0.032	0.055
W.S. Elev (ft)	4885.78	Reach Len. (ft)	270.00	280.00	285.00
Crit W.S. (ft)	4886.53	Flow Area (sq ft)	125.26	100.67	5.23
E.G. Slope (ft/ft)	0.054278	Area (sq ft)	125.26	100.67	25.81
Q Total (cfs)	2230.00	Flow (cfs)	720.21	1493.82	15.97
Top Width (ft)	382.49	Top Width (ft)	231.31	62.50	88.68
Vel Total (ft/s)	9.65	Avg. Vel. (ft/s)	5.75	14.84	3.05
Max Chl Dpth (ft)	2.45	Hydr. Depth (ft)	0.54	1.61	0.34
Conv. Total (cfs)	9571.8	Conv. (cfs)	3091.3	6411.9	68.6
Length Wtd. (ft)	277.89	Wetted Per. (ft)	231.32	62.67	15.50
Min Ch El (ft)	4883.33	Shear (lb/sq ft)	1.83	5.44	1.14
Alpha	1.70	Stream Power (lb/ft s)	10.55	80.77	3.49
Frctn Loss (ft)	1.69	Cum Volume (acre-ft)	0.75	1.10	1.24
C & E Loss (ft)	0.19	Cum SA (acres)	1.15	0.53	1.21

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: reach1
REACH: American Gulch RS: 2.409

INPUT
Description: Matching D/S XS per Stantech Model
Station Elevation Data num= 39

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9667	4886.27	9696.4	4886.27	9715.9	4885.87	9723.4	4883.97	9729.4	4885.27
9731	4884.87	9732.2	4883.97	9743	4884.37	9752.9	4884.37	9786.2	4883.77
9830.3	4882.77	9868.1	4882.27	9901.3	4881.97	9944.7	4881.47	9969.5	4881.17
9983.1	4880.47	10000	4879.37	10006	4879.47	10024.3	4880.97	10036.4	4881.47
10046.5	4880.67	10060.5	4879.97	10069.3	4880.67	10072.1	4881.27	10077.6	4881.77
10105.3	4881.07	10138.3	4881.07	10166.8	4881.17	10198.6	4881.37	10230.5	4881.77
10254.5	4882.07	10295.5	4881.57	10325.2	4881.77	10341.2	4881.97	10351.2	4882.47
10353.9	4883.07	10354.6	4889.27	10361	4889.37	10368.2	4889.37		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
9667	.04	10006	.04	10072.1	.04

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9969.5 10072.1 39 39 39 .3 .5
Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
10254.5	10368.2	4892.47	T

CROSS SECTION OUTPUT Profile #PF 1

E.G. Elev (ft)	4883.04	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.24	Wt. n-Val.	0.040	0.040	0.040	
W.S. Elev (ft)	4882.80	Reach Len. (ft)				
Crit W.S. (ft)	4882.34	Flow Area (sq ft)	116.71	241.32	259.22	
E.G. Slope (ft/ft)	0.004888	Area (sq ft)	116.71	241.32	353.87	
Q Total (cfs)	2230.00	Flow (cfs)	267.84	1111.25	850.91	
Top Width (ft)	523.70	Top Width (ft)	140.51	102.60	280.59	
Vel Total (ft/s)	3.61	Avg. Vel. (ft/s)	2.29	4.60	3.28	
Max Chl Dpth (ft)	3.43	Hydr. Depth (ft)	0.83	2.35	1.42	
Conv. Total (cfs)	31895.8	Conv. (cfs)	3830.9	15894.3	12170.7	
Length Wtd. (ft)		Wetted Per. (ft)	140.52	102.87	182.44	
Min Ch El (ft)	4879.37	Shear (lb/sq ft)	0.25	0.72	0.43	
Alpha	1.17	Stream Power (lb/ft s)	0.58	3.30	1.42	
Frctn Loss (ft)		Cum Volume (acre-ft)				
C & E Loss (ft)		Cum SA (acres)				

Note: Hydraulic jump has occurred between this cross section and the previous upstream section.

AMERICAN GULCH
CHANNEL AND RIPARIAN ENHANCEMENT

BIOLOGICAL ASSESSMENT

Natural Channel Design, Inc.

February 2018

AMERICAN GULCH
CHANNEL AND RIPARIAN ENHANCEMENT

BIOLOGICAL ASSESSMENT

Submitted to:

Town of Payson
Attn: Sheila DeSchaaf
303 Beeline Highway
Payson, AZ 85541

Prepared By:
Natural Channel Design, Inc.
2900 N. West St., Suite 5
Flagstaff AZ 86004

Natural Channel Design, Inc.

February 2018

INTRODUCTION

This biological assessment evaluates the potential effects of the American Gulch Channel Enhancement project on federally listed threatened and endangered species and their habitats. The Town of Payson intends to construct a natural channel within the existing grass-lined trapezoidal channel. Although heavily influenced by anthropomorphic pressures, the channel is a well-defined drainage that appears to have ordinary high water mark indicators upstream of, below and through the reach that will be affected by this project. The presence of such features typically indicates that a construction project in such a drainage may be subject to regulation by the EPA and US Army Corps of Engineers under Section 404 of the Clean Water Act. This biological assessment is being completed as part of the 404 permitting process.

PROJECT DESCRIPTION

American Gulch forms a major drainage through the town of Payson, AZ. The ephemeral channel through the project area has been highly modified to serve as a stormwater conveyance and currently is sized to contain the FEMA estimated 100-year floodplain. The current channel configuration through the project area is a grass lined, trapezoidal channel bounded by development on one side and a recently built urban trail on the other. The current channel configuration appears to be a major departure from the original landform which was likely a wide swale with a large floodplain. The existing configuration reflects that of an incised and narrowed channel, configured to contain flood flows in a narrow corridor and allow for development. The current channel has evidence of some erosion and aggradation from storm flows and there are signs of encroachment from invasive tree and weed species.

The Town of Payson wishes to improve the aesthetics, and habitat function of the channel while retaining the flood control functions. The new channel shall conform to natural channel design principles as much as practical to improve sediment transport function and the ability of the channel to support appropriate native vegetation.

The project will construct a more natural, stable bankfull (low flow) channel in the bottom of the existing channel and will include stabilization structures including rock cross-vane weirs, rock vanes, toe rock, TRM (turf reinforced matt) and larger natural substrate material. The project is approximately 1000 ft long and construction will take place entirely within the existing channel with the exception of additional native plantings along the edge of the channel and around the urban trail. The entire site including all disturbed areas will be revegetated with both riparian and upland native vegetation (grasses, forbs, shrubs including willows, and trees).

PROJECT LOCATION

The project is located in Payson, Arizona within the town limits in Township 10N, Range 10E, Section 9 (Figure 1) at an elevation of 4,900 feet. The project extends through a portion of American Gulch, just south of Main Street, from its intersection with Meadows Street downstream 1000 feet to its intersection with Westerly Road.

Figure 1. Map of project location (red outline).

HABITAT DESCRIPTION

The proposed project will be constructed within the existing channel, a highly urbanized, grass-lined trapezoidal channel. This portion of American Gulch is an ephemeral channel that only runs after rainfall and snowmelt events. In the project area, the channel has a top width of approximately 60 feet and is lined with a mix of native and invasive grasses and forbs. There are few trees and shrubs, particularly native ones, in and around the channel (Figures 2 and 3). Land use adjacent to the channel is generally multifamily housing, commercial and retail properties with some vacant lands. The channel drains to the popular Green Valley Lakes open space.

Figure 2. Google Earth image of project area, image dated April 2017.

Figure 3. Typical habitat along American Gulch in the project area (photo taken May 2017).

SPECIES CONSIDERED

The species considered for this Biological Assessment include species on the U.S. Fish and Wildlife Service (USFWS) Threatened and Endangered Species List that may occur in the proposed project location or may be affected by the proposed project (Table 1; USFWS 2018) and species on the Arizona Game and Fish Department (AGFD) list for species with special status within five miles of the project vicinity (Table 2; AGFD 2018). The USFWS and AGFD lists were obtained using each agency's online evaluation system. There is no critical habitat within the project area.

All Threatened, Endangered and Sensitive (TES) species from these lists were evaluated to determine potential presence of the species or suitable habitat within the project area. A total of 13 individual species were on the obtained lists and all were eliminated from further consideration because there is no suitable habitat in or adjacent to the project area. The majority of the species require habitat with permanent or semi-permanent water which is lacking at the site.

Table 1. USFWS list of Threatened and Endangered Species.

Name	USFWS Status	Considered for Assessment	Notes
Mammals			
Gray Wolf (*Canis lupus*)	Proposed Experimental Population, Non-Essential	No	Urban setting, no suitable habitat in project site; site outside species current distribution range.
Birds			
Mexican Spotted Owl *(Strix occidentalis lucida)*	Threatened	No	Urban setting, no suitable roosting, nesting or foraging habitat in project site.
Yellow-billed Cuckoo *(Coccyzus americanus)*	Threatened	No	No suitable riparian habitat in project site.
Reptiles			
Northern Mexican Gartersnake *(Thamnophis eques megalops)*	Threatened	No	No suitable riparian or wetland habitat in project site.
Amphibians			
Chiricahua Leopard Frog *(Rana chiricahuensis)*	Threatened	No	Ephemeral channel. No persistent aquatic habitat in project site.
Fish			
Spikedace *(Meda fulgida)*	Endangered	No	Ephemeral channel. No persistent aquatic habitat in project site.

Table 2. AZGFD list of Sensitive Species.

Name	Listing Status	Considered for Assessment	Notes
Birds			
Golden Eagle *(Aquila chrysaetos)*	BGA	No	Urban setting. No suitable habitat in project site. Prefer open and open wooded country and barren areas. They nest on rock ledges, cliffs or in large trees.
Reptiles			
Narrow-headed Gartersnake *(Thamnophis rufipunctatus)*	LT	No	Ephemeral channel. No suitable habitat in project site. Requires permanent water.
PCH for Narrow-headed Gartersnake *(Thamnophis rufipunctatus)*	Proposed critical habitat	No	Site would not be located within the proposed critical habitat.
Amphibians			
Arizona Toad (*Anaxyrus microscaphus*)	SC	No	Ephemeral channel. No suitable aquatic or riparian habitat in project site.
Lowland Leopard Frog (*Lithobates yavapaiensis*)	SC	No	Ephemeral channel. No persistent aquatic habitat in project site.
Fish			
Desert Sucker (*Catostomus clarkii*)	SC	No	Ephemeral channel. No persistent aquatic habitat in project site.
Roundtail Chub (*Gila robusta*)	CCA	No	Ephemeral channel. No persistent aquatic habitat in project site.
Invertebrates			
Maricopa Tiger Beetle (*Cicindela oregona maricopa*)	SC	No	Ephemeral channel. No suitable habitat in project site. Found along banks of permanent and semi-permanent streams.

Listing status: SC=Species of Concern; BGA=Bald and Golden Eagle Act; LT=Listed Threatened; CCA=Candidate Conservation Agreement;

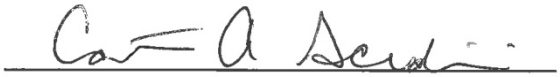
Other Effects

There is no suitable habitat in the project area for any of the TES species considered; therefore, there will be no direct effects to any TES species from the noise or disruption of habitat due the construction activities.

There will be no indirect effects from the project. Once the project is complete there will be essentially no change in the habitat for TES species. There should be an improvement in the general habitat through the revegetation of native species in this section of American Gulch. We are not aware of other projects in the area at this time, therefore, it is anticipated that there will be no cumulative effects to any TES species from this project. There are no critical habitats within the project area.

EFFECT DETERMINATION

The proposed American Gulch Channel Enhancement Project will have no effect on any threatened, endangered or sensitive species because there is no suitable habitat in the project area or vicinity.

Prepared  by: February 19, 2018

Cathy Scudieri
Restoration Ecologist
Natural Channel Design, Inc

Date

REFERENCES

Arizona Game and Fish Department (AGFD). 2001. *Cicindela oregona maricopa*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp.

Arizona Game and Fish Department (AGFD). 2002. *Aquila chrysaetos*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp.

Arizona Game and Fish Department (AGFD). 2002. *Catostomus clarki*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp.

Arizona Game and Fish Department (AGFD). 2005. *Strix occidentalis lucida*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 12 pp.

Arizona Game and Fish Department (AGFD). 2006. *Lithobates yavapaiensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 10 pp.

Arizona Game and Fish Department (AGFD). 2006. *Rana chiricahuensis*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 11 pp.

Arizona Game and Fish Department (AGFD). 2011. *Coccyzus americanus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp.

Arizona Game and Fish Department (AGFD). 2012. *Thamnophis eques megalops*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 8 pp.

Arizona Game and Fish Department (AGFD). 2012. *Thamnophis rufipunctatus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp.

Arizona Game and Fish Department (AGFD). 2013. *Anaxyrus microscaphus*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 5 pp.

Arizona Game and Fish Department (AGFD). 2013. *Mega fulgida*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 6 pp.

Arizona Game and Fish Department (AGFD). 2015. *Gila robusta*. Unpublished abstract compiled and edited by the Heritage Data Management System, Arizona Game and Fish Department, Phoenix, AZ. 7 pp.

Arizona Game and Fish Department (AGFD). 2018. Arizona's Online Environmental Review Tool. http://azhgis2.esri.com.

U.S. Fish and Wildlife Service (USFWS). 2012. Mexican spotted owl recovery plan, First Revision, (*Strix occidentalis lucida*). Southwest Region, U.S. Fish and Wildlife Service, Albuquerque, New Mexico.

U. S. Fish and Wildlife Service (USFWS). 2018. Environmental Conservation Online System, Information for Planning and Conservation. https://ecos.fws.gov/ipac/.

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

District Office: Los Angeles District | File/ORM #: | PJD Date: 3/8/2018

State: AZ | City/County: Payson / Gila

Nearest Waterbody: American Gulch

Location: TRS, LatLong or UTM: N34.23008 deg, W111.33007 deg

Name/ Address of Person Requesting PJD:
Town of Payson
Planning and Development
Attn:Sheila DeSchaaf
303 N. Beeline Highway
Payson, Az 85541

Identify (Estimate) Amount of Waters in the Review Area:

Non-Wetland Waters: 1,100 linear ft | 33 width | 0.85 acres | Stream Flow: Ephemeral

Wetlands: 0 acre(s) | Cowardin Class: N/A

Name of Any Water Bodies on the Site Identified as Section 10 Waters: Tidal: | Non-Tidal:

☐ Office (Desk) Determination
☑ Field Determination: Date of Field Trip: May 1, 2017

SUPPORTING DATA: Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

- ☑ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: ArcGis aerial with OHWM overlay and Photo Poin
- ☐ Data sheets prepared/submitted by or on behalf of the applicant/consultant.
  - ☐ Office concurs with data sheets/delineation report.
  - ☐ Office does not concur with data sheets/delineation report.
- ☐ Data sheets prepared by the Corps
- ☐ Corps navigable waters' study:
- ☐ U.S. Geological Survey Hydrologic Atlas:
  - ☐ USGS NHD data.
  - ☐ USGS 8 and 12 digit HUC maps.
- ☑ U.S. Geological Survey map(s). Cite quad name: Payson South
- ☐ USDA Natural Resources Conservation Service Soil Survey. Citation:
- ☑ National wetlands inventory map(s). Cite name: www.fws.gov/wetlands/Data/Mapper.html
- ☐ State/Local wetland inventory map(s):
- ☑ FEMA/FIRM maps: FIRM D40107-0003 & 4A
- ☑ 100-year Floodplain Elevation is: contained within constructed channel
- ☑ Photographs: ☑ Aerial (Name & Date): Google Maps Aerial - 4-21-17
  ☑ Other (Name & Date): Ground based photos from Field Assessment
- ☐ Previous determination(s). File no. and date of response letter:
- ☐ Other information (please specify):

IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and Date of Regulatory Project Manager (REQUIRED)

Signature and Date of Person Requesting Preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

EXPLANATION OF PRELIMINARY AND APPROVED JURISDICTIONAL DETERMINATIONS:

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "preconstruction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable.

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

Appendix A - Sites

District Office	Los Angeles District	File/ORM #		PJD Date:	
State	AZ	City/County	Payson / Gila County	Person Requestinq PJD	Sheila DeSchaaf, City of Payson

Site Number	Latitude	Longitude	Cowardin Class	Est. Amount of Aquatic Resource in Review Area	Class of Aquatic Resource
1	N34.23008	W111.33007	n/a	0.85 ac	Non-Section 10 non-wetlanc

Notes:

This PJD covers approximately 1,100 l.f. of American Gulch in Payson, Gila County, Az. The reach is located south of W. Main St. between the west entrance to Sawmill Crossing shopping center across from S. Meadow St. to approximately 90 ft. west of the S. Westerly Rd. bridge. This is an ephemeral, trapezoidal channel constructed in the late 1990's. Upstream from the project, the channel is concrete lined. Through the project, the bed is composed of clay loam with a covering of decomposed granite which is covered by failing turf reinforcing matt. Vegetation in the channel bed is primarily perennial, non-native grass with a few encroaching trees. Banks are native grasses and forbs. The channel flows into an open pasture which is identified as a freshwater emergent wetland in the National Wetlands Inventory map, but this designation is based on 1980's imagery and is not accurate. From S. Westerly Rd heading west, there is an active channel for approximately 300 ft downstream from the project area before it spreads into the dry pasture. A gully with an active headcut drains the upper end of the pasture.

The site was surveyed in May 2017 and again in August 2017 by NCD personnel - Allen Haden, Mark Wirtanen, and Jake Fleishman. Field survey equipment used included gps survey grade Trimble RTK units used to create a topographic map of the project area. Due to the channel being TRM lined, scour lines were not evident, but OHWM was delineated based on recent flow debris lines, transition from mesic vegetation in the bed to more xeric vegetation on the banks and the presence of water staining in the upstream box culvert.

Watershed at the project area is approximately 1,200 acres, the majority of which is in urban development. OHW discharge is estimated to be around 65 cfs or approximately a 2-year recurrence interval.

SEE ATTACHED REPORT FOR PHOTOS

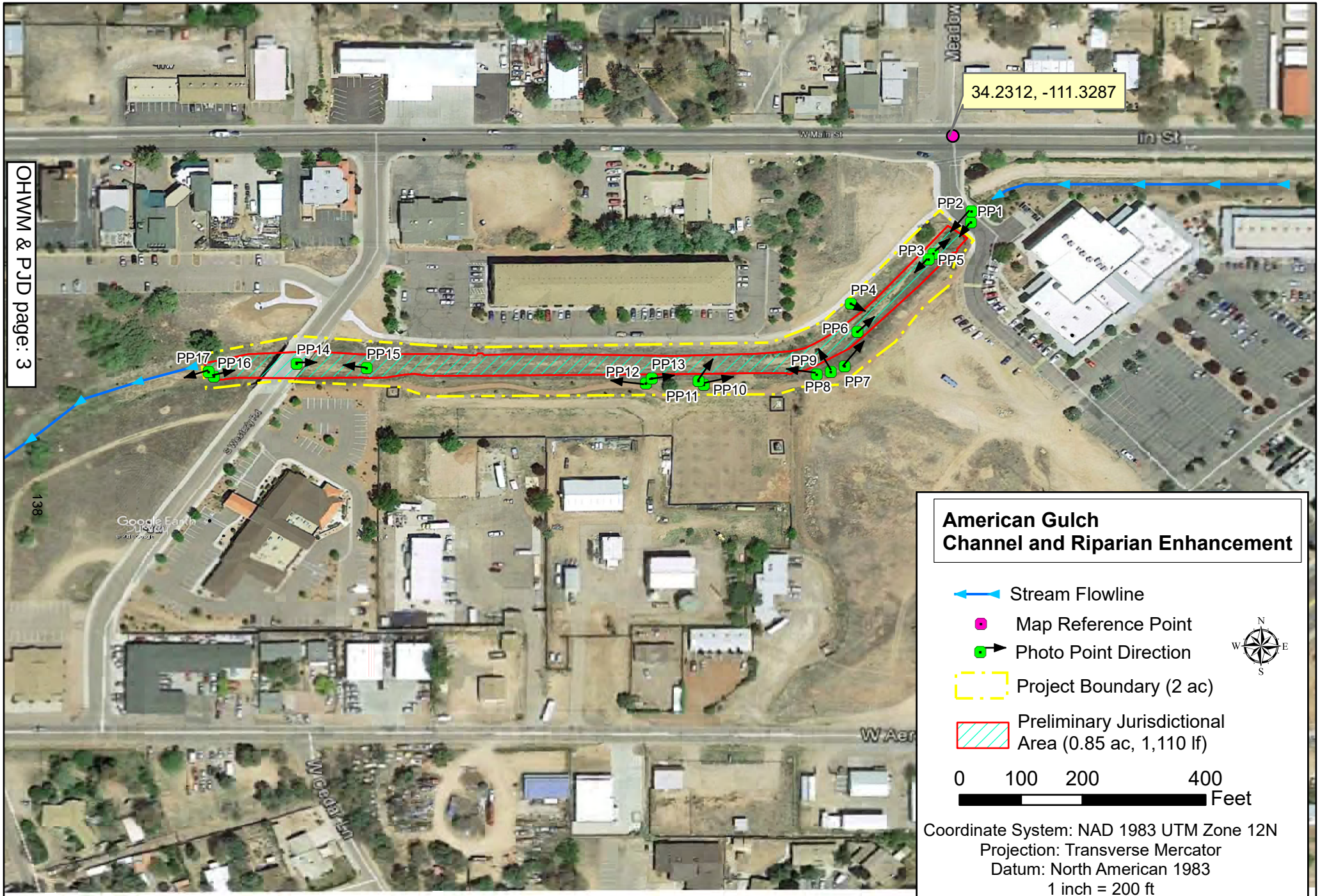


Figure 2. Overview map of project area.

Google Earth Imagery
Date 4/21/2017

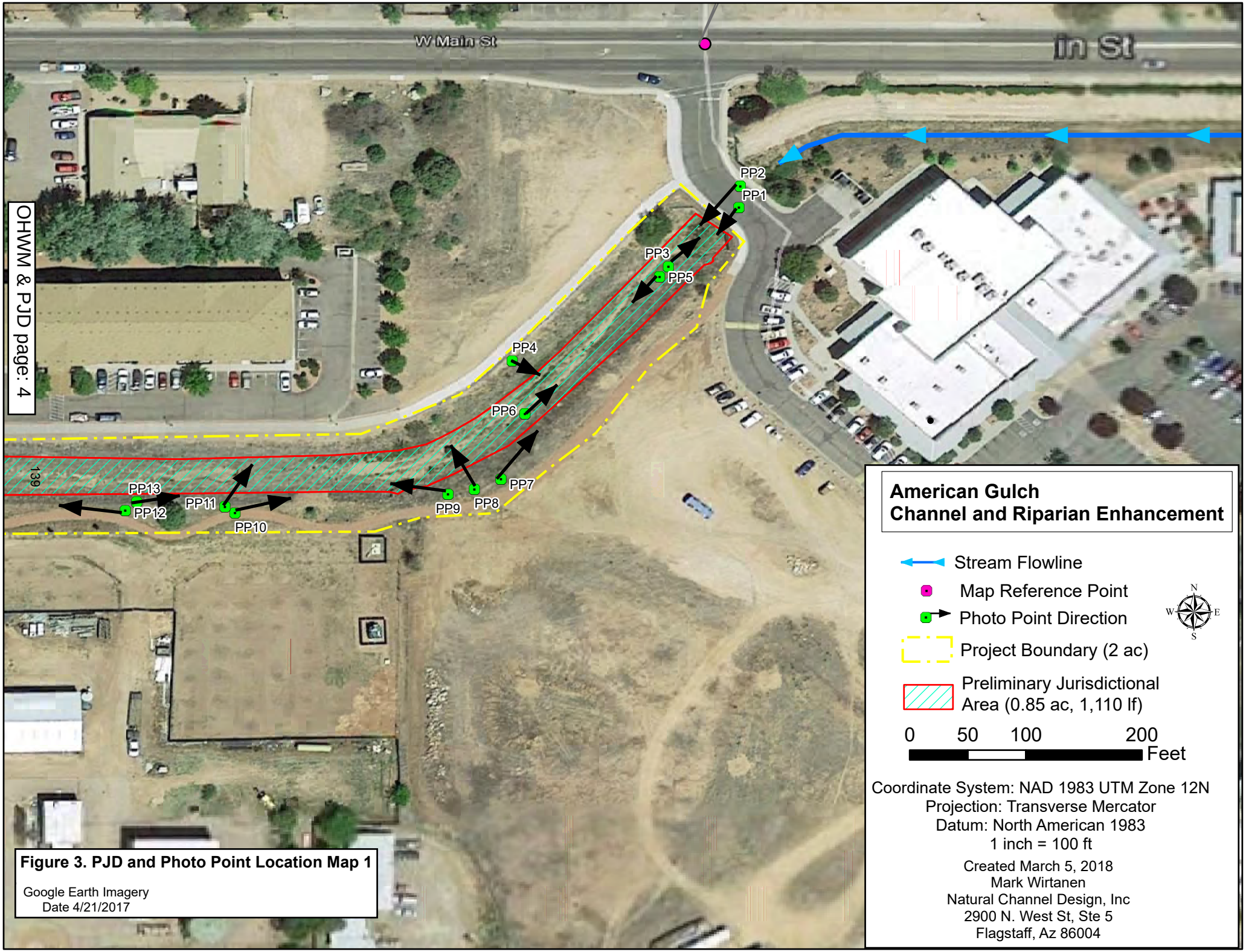


Figure 3. PJD and Photo Point Location Map 1

Google Earth Imagery
Date 4/21/2017

Figure 4. PJD and Photo Point Location Map 2

Google Earth Imagery
Date 4/21/2017

Arizona State Museum
THE UNIVERSITY OF ARIZONA

PROJECT REGISTRATION FORM

ASM Accession # 2015-0335_____

This form must be submitted with **EVERY** submission of project materials to the Museum.

FOR ASM USE ONLY:

AZSITE REF ID # 22103 **AZPROJ #** _____

Bib # 72231 **Electronic Copy Bib #** 72232

Arizona State Museum
This project is complete and paid in full.

Received by: **Christina Jenkins** **Date:** **10/8/2015**

Institution: SWCA Environmental Consultants Project #: 33603

Project Name: American Gulch Loop Trail Director: S. Jerome Hesse

Project Sponsor: Town of Payson PRF completed by: India S. Hesse

Purpose of project: Archaeological survey for proposed American Gulch Loop Trail. Date PRF completed: August 16, 2015

Project type: X non-collection survey _____ collection survey _____ testing _____ excavation _____ monitoring _____ site monitoring

Dates of fieldwork: June 10, 2015 Person-field days: 1

Additional Project Information

Project location: State Arizona Municipality Payson County Gila

Legal description of project location; *Baseline*, *Township*, *Range*, *Section* ***ONLY*** (not quarter-quarter)

Provide a written description ***ONLY*** if legal description cannot be given.

Section 9, Township 10 North, Range 10 East in Payson, Gila County, Gila and Salt River Baseline and Meridian, on the U.S. Geological Survey (USGS) Payson South, Arizona, 7.5-minute quadrangle

ASM Quadrangle(s) (e.g. AZ E:12:SW; add additional page if necessary)

AZ O:15:NE

Land Jurisdiction: (check all that apply)

X private _____ state _____ ACE X city _____ county _____ tribal

_____ BLM _____ BOR _____ USFS _____ WAPA _____ DOD _____ NPS

Permits and Agreements

State of Arizona Blanket Antiquities Permit: 2015-017bl Other Permits: None

Survey Details (Complete ***ONLY*** for Survey projects)

For Block Surveys: 2.5 acres (divide m^2 by 4,047 for acres)

For Linear Surveys: _____ km of _____ meter wide right-of-way (__ acres total)

Transects spaced 20 meters apart or less are considered 100%

If survey was not completed in this manner, explain why: _____

Site Information

List of **NEWLY** recorded sites (ASM numbers only; attach additional page if necessary):

None

List of **PREVIOUSLY** known sites in project area (ASM numbers only):

NOTE: Only existing ASM site numbers are considered updates. Site numbers from other organizations receiving an ASM site number for the first time are considered "New"

None

Arizona State Museum
THE UNIVERSITY OF ARIZONA

PROJECT REGISTRATION FORM

ASM Accession # 2015-0335_____

Project Materials Submitted

A. **Basic Project Records. Indicate "X" for submitted; "NA" for records not created (attach additional page if necessary). All documents must be submitted at the same time**
If we need to contact you regarding incomplete/incorrect submissions, additional fees may incur.
For information regarding the ASM Fee Structure, visit http://www.statemuseum.arizona.edu/crservices/fee_schedule

X Project Registration Fee Amount: **$100.00** **Paid online 6/16/2015**

X **USGS 7.5-minute map at 1:24,000 scale**. Survey boundary and sites (if present) must be clearly defined. Aerial photographs are **not** acceptable

X Digital copy of PRF (PDF or MS Word format only)

X Shapefiles of project area and site boundaries

N/A NO shapefiles submitted Shapefile creation fee Amount: **$**
Example: A negative survey requires 1 shape. A survey that identified two new sites requires 3 shapes. Shapes need to be submitted for previously-recorded sites ONLY if the boundary is being updated.

X Final report. Do **NOT** send drafts or reports that are not yet accepted by jurisdictional agencies
Non-collection surveys - TWO hard copies and ONE electronic copy (PDF or MS Word) required
All other projects - THREE hard copies and one electronic copy required
Provide report citation below (required):

Barr, David M. (2015) *Archaeological Survey of 2.5 Acres for the Proposed American Gulch Loop Trail Project in Payson, Gila County, Arizona.* SWCA Cultural Resources Report No. 15-313. SWCA Environmental Consultants, Tucson.

N/A Electronic photographs with photo log (.tiff format @ 300 ppi ONLY). ALL photos taken during project are required to be submitted. See "ASM Policy Regarding Cultural Resources Photographic Documentation and
N/A Submissions" and for additional information details.

N/A Digital Curation fee Amount **$**

_____ AZSITE Entry Module (required if new sites were recorded). If not submitted, fee required (see below)

_____ **No entry module** Amount: **$**

B. **REPOSITORY ONLY: Other Project Materials. For each category below indicate "X for submitted at this time or "NA" for records not created. Everything must be submitted at the same time.**

_____ Electronic database inventory
_____ Laboratory or analysis records
_____ Field maps or analysis maps
_____ Traditional photographic format (with log). Negatives and Contact prints are both required with this material.
_____ Artifacts and bags labeled with ASM site numbers.
_____ ASM Summary Inventory Form
_____ ASM Collection Inventory Forms
_____ Collections Released for Analysis Forms
_____ Deed of Gift (mandatory for object collected from private land)
_____ Faunal Sign-Off sheet (original MUST be submitted to Todd Pitezel, ASM Repatriation Coordinator)
_____ Human remains certification form

C. What project materials have been submitted to others? List materials and agencies.
None.

D. What original project materials do you still retain? Describe material, reason for retaining, and date to be submitted.
None.

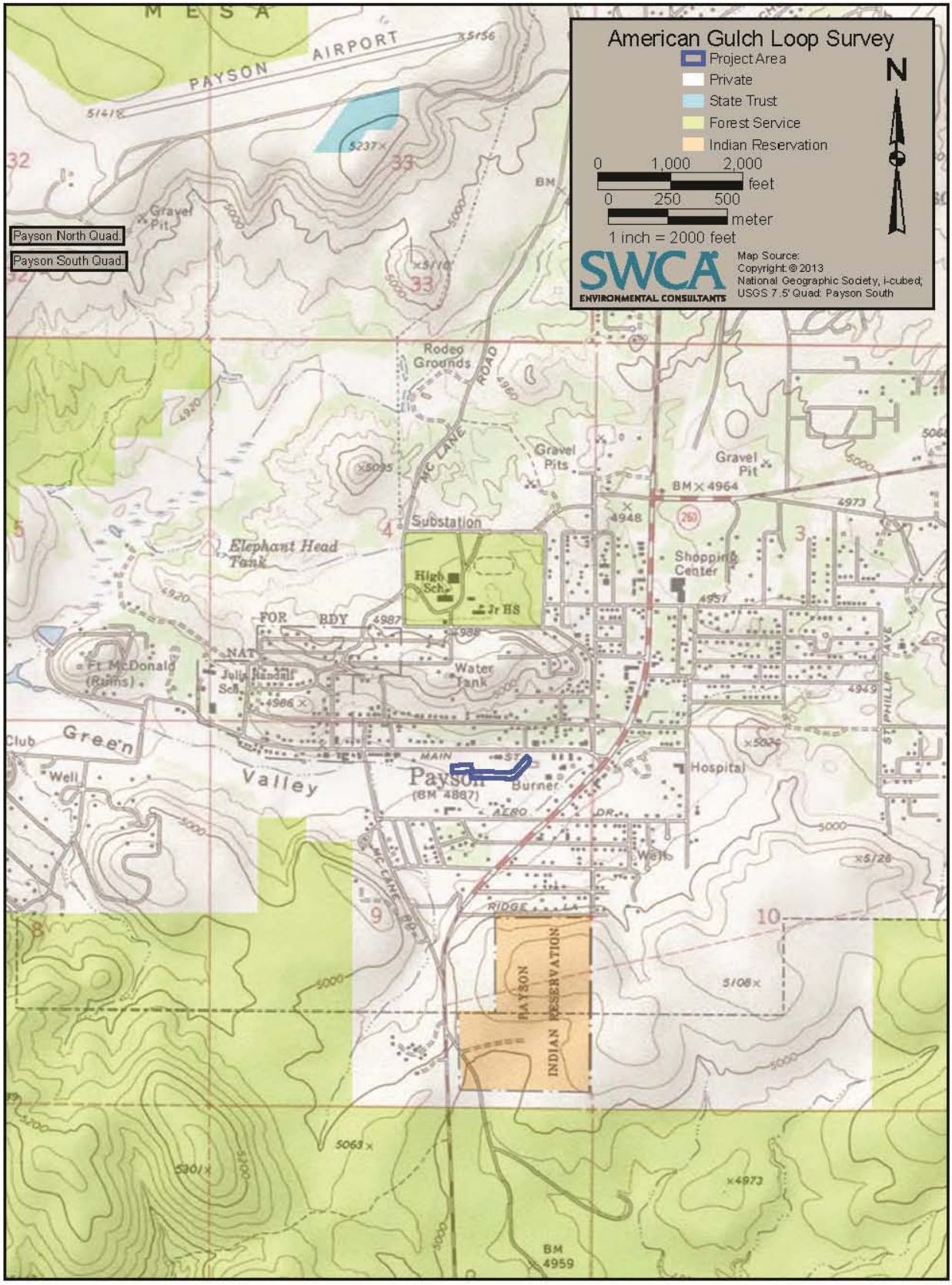
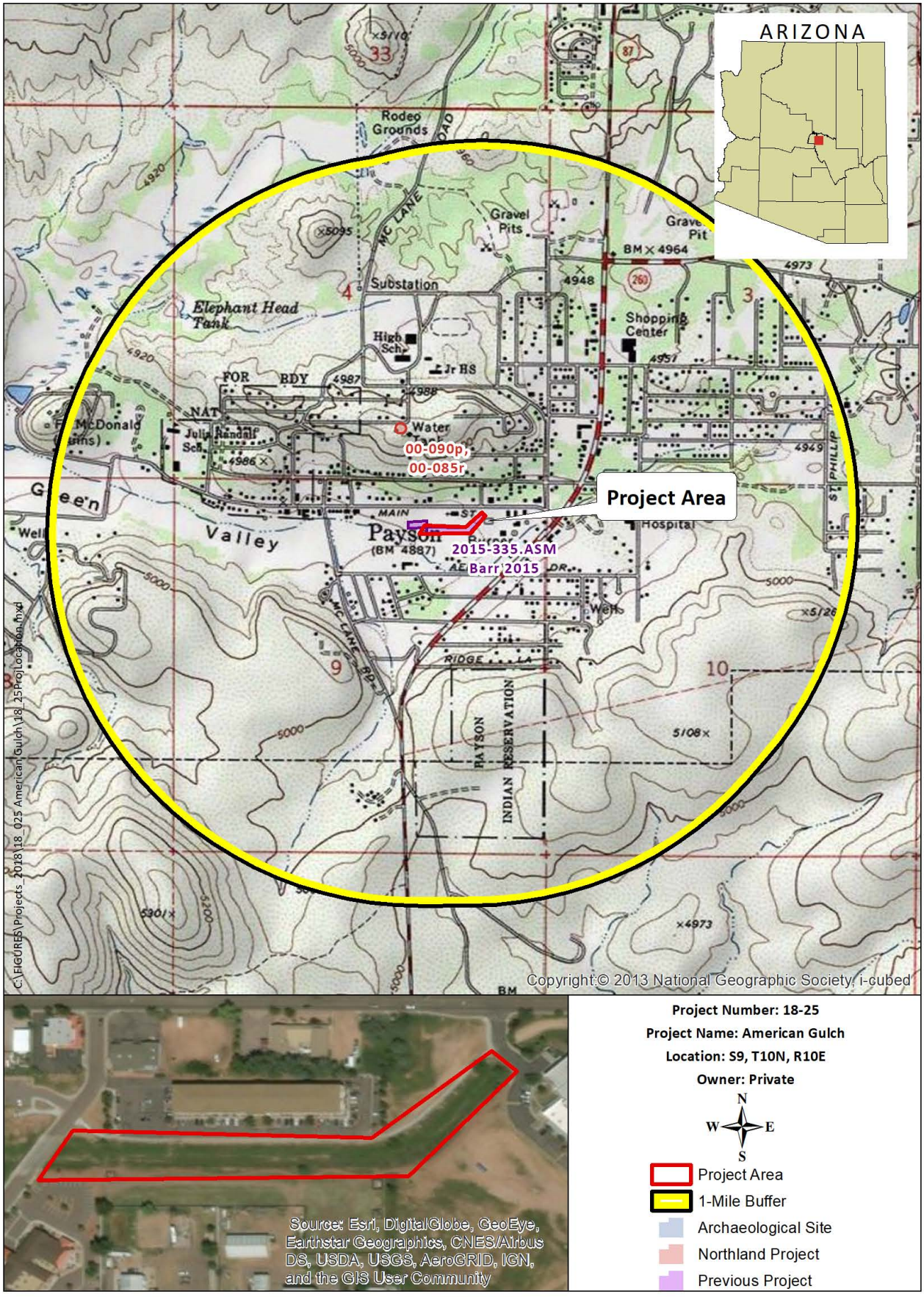


Figure 2. Project location.


ARIZONA
Project Area
00-090p,
00-085r
2015-335.ASM
Barr 2015
Payson
Rodeo Grounds
Gravel Pits
Substation
Elephant Head Tank
Shopping Center
Water
Valley
MAIN ST
RIDGE LA
MC LANE RD
PAYSON INDIAN RESERVATION
Copyright © 2013 National Geographic Society, i-cubed
C:\FIGURES\Projects_2018\18_025 American Gulch\18_25ProjLocation.mxd
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Project Number: 18-25
Project Name: American Gulch
Location: S9, T10N, R10E
Owner: Private
N
W
E
S
Project Area
1-Mile Buffer
Archaeological Site
Northland Project
Previous Project

APPLICATION

For Coverage Under The Clean Water Act

Section 401 Certification

COMPLETE AND SIGN THE FOLLOWING FORM AND SUBMIT IT TO:

Arizona Department Of Environmental Quality, Surface Water Section — 401 Certification

1110 West Washington, 5415A-1; Phoenix, Arizona 85007

For ADEQ Use Only

LTF No. _____ ADEQ WQDB No. _____ Date Rec'd: _____

404 PERMIT TYPE (Check one):

X NATIONWIDE PERMIT or Regional General Permit (No. 27)

_____ INDIVIDUAL PERMIT

- Project Name: American Gulch Channel & Riparian Enhancement
- U.S. Army Corps of Engineers Project Number (if available): _____
- Location of Project (include City/Town (indicate if near rather than in), County, Township, Range, Section (if applicable), Also include street address of site, site office, etc. (if applicable):

Downstream from 201 W. Main St, Payson, Gila County, Arizona. T10N, R10E, Sec 9

Starting at downstream end of box culvert at the west entrance to Sawmill Crossing shopping center across from S. Meadow St. going downstream 1,100 feet, ending 90 ft downstream from S. Westerly road bridge. Payson, Az 85541

- Approximate Center of Project:

Latitude: 34° 13' 48.67" (Degrees, minutes, seconds)

Longitude: 111° 19' 47.44" (Degrees, minutes, seconds)

- Directions to project location (from nearest intersection of major streets/highways). Include map(s) or drawings displaying location in the state and relative to nearby cities, highways, waterbodies, etc.)

From Az-87 in Payson, Az, turn west onto W. Main St. and proceed 0.2 mile to north west entrance to Sawmill Center Shopping Center. Project starts at the box culvert crossing American Gulch and extends 1,100 feet downstream, ending appx. 90 ft downstream from the S. Westerly road bridge.

- Waterbody(ies) (if known, otherwise "unnamed" or "unnamed tributary to"). Include flow regime (ephemeral, intermittent or perennial), name of downstream waterbody(ies) and name of basin (from Water Quality Standards for Surface Waters):

American Gulch, an ephemeral tributary which flows appx 6 miles then joins the East Verde River, in the East Verde River Watershed

APPLICANT INFORMATION (Complete all that apply. Use "N/A" for not applicable)

- Applicant Name: Sheila DeSchaaf Title: _____
- Applicant's Company, Agency, etc: Town of Payson (parcel owner and easement holder)
- Phone Number: 928-213-2410 email address: sdeschaaf@paysonaz.gov
- Applicant's Mailing Address: 303 N. Beeline Highway

City: Payson State: | A | Z | Zip Code: 85541

- Property Owner Name (If Different From Applicant): _____ Title: _____
- Property Owner Company, Agency, etc: _____
- Phone Number: _____ email address: _____
- Property Owner's Mailing Address: _____

City: _____ State: |___|___| Zip Code: _____

- Agent Name: _____ Title: _____
- Agent Company, Agency, etc: _____
- Phone Number: _____ email address: _____
- Agent Mailing Address: _____

City: _____ State: |___|___| Zip Code: _____

CERTIFICATIONS

- I hereby authorize (agent) _____ to act in my behalf in the processing of this application and to furnish any supplemental information in support of this application. I understand that I am bound by the actions of my agent.

  Applicant's Signature: : _____ Date: _____

- I have reviewed the following items (available at www.azdeq.gov):
  1. Arizona Water Quality Standards for Surface Waters (18 A.A.C. 11, Article 1)
  2. Executive Order No. 91-6, Protection of Riparian Areas, Dated February 14, 1991.

- Application is hereby made for Arizona certification under CWA section 401 for the above-named project. I certify that I am familiar with the information contained or referenced in this application and that the information is true, accurate and complete.

  Applicant's Signature: : _____ Date: _____

  Property Owner's Signature (if applicable): _____Date: _____

  Agent's Signature (if applicable): _____Date: _____

A. PROJECT DESCRIPTION (Complete all items. Attach additional pages as necessary.)

Project Name: American Gulch Channel & Riparian Enhancement

Describe purpose and work to be performed, including fill material and revegetation / reclamation plan (attach design drawings for project):

Project includes the elements described below:

1. Creating a bankfull channel form in an existing flat bottom trapezoidal channel to improve sediment transport and increase native riparian vegetation to improve aesthetics and create habitat. A bankfull channel will be constructed and utilize three rock cross-vane weirs to provide grade control , five rock vanes with toe rock to provide bank protection and riprap for culvert outlet protection. Site will be revegetated with native grasses, forbs and will have native trees and shrubs installed along the banks. See attached Construction Sheets for details.

B. AREA OF DISTURBANCE (**Label units; e.g., acres, square feet, square miles, etc.**)

1. Provide the total jurisdictional area within the project boundaries 0.85 acres .
2. Provide the impacted jurisdictional area 0.85 acres .
3. Provide the project area 2.0 acres .
4. List the reason(s) for the impacts (e.g., pad fill, road crossing, etc.):

Create a bankfull channel and improve riparian habitat and aesthetics.

C. ADDITIONAL INFORMATION (Include the following items per A.R.S. § 49-202(g):

1. U.S.G.S. 7.5 min. Topographic map or other contour map of project area.
2. Map delineating the ordinary high water mark of jurisdictional waters affected by activity to be certified.
3. Copy of application for federal permit or license subject to the requested certification.
4. Describe the measures to be applied to the activities in order to control the discharge of pollutants into waters of the U.S. (WUS). Describe the procedures, practices and/or facilities that will: (a) minimize potential pollution of surface waters, and (b) demonstrate compliance with state water quality standards (see 18 A.A.C. 11, article 1). Describe any erosion and sedimentation pollution control measures to be employed. These measures may be procedural or physical in nature, temporary or permanent; regardless, their purpose is to prevent the entry of sediment or other pollutant into any WUS and must be functional prior to beginning any construction activity other than the creation of the measures themselves. Use additional sheets if needed. Note that waters of the state include all watercourses and perennial, intermittent and ephemeral streams (see A.R.S. § 49-201(40)). If the response below refers to another document; e.g., stormwater pollution prevention plan, the applicable portions of the referenced document must be included with this application. These responses may be incorporated into the 401 certification as conditions.

BMP measures will be included with SWPPP plan.

Final BMP's may include the use of sediment wattles and/or silt fences as well as standard BMP's related to equipment refueling, concrete wash-out, track pads, etc. Work in this ephemeral channel will be conducted during no flow periods.

The party responsible for the activity may be required (as a condition of the 401 certification) to monitor for turbidity (as an indicator), suspended sediment concentration (SSC) and other parameters every day or at an interval to be specified in conditions of the 401 Certification. ADEQ may require results of any monitored parameters to be reported to ADEQ and made available upon request to any person.

March 08

SD

SHEILA DESCHAAF

928-472-5037 | 303 N BEELINE HWY, PAYSON, AZ 85541
SDESCHAAF@PAYSONAZ.GOV

OBJECTIVE

Challenging management position within a small to mid size community.

SKILLS

-Certified Planner through the American Institute of Certified Planners (023831)
-Certified Economic Development Professional (AZ EDPro) through the Arizona Association of Economic Development.

EXPERIENCE

PUBLIC WORKS DIRECTOR • TOWN OF PAYSON • JANUARY 2018-PRESENT
Organize, direct, and coordinate the activities of the Engineering, Streets, Water, and Airport Divisions within the Public Works Department. Oversee procurement, management, and maintenance of the Town's fleet of equipment, construction, maintenance, and operation of Town-owned facilities and related electrical and mechanical systems. Administer departmental service contracts including solid waste collection and Town wide custodial service contracts. Manages all residential waste disposal activities including recycling and household hazardous waste programs. Determine major departmental policies, responsible for planning long-term programs, resolving difficult administrative problems, and managing the departmental budget. Responsible for the administration and coordination of programs and technical staff.

PLANNING & DEVELOPMENT DIRECTOR • TOWN OF PAYSON • 2014-2017
Responsible for numerous zoning text and map amendments, meeting public noticing requirements, departmental budgeting, staff training and development, Guided the development of the Town's 5-year Economic Development Strategic Plan, formulation of the Economic Development Advisory Consortium, and implementation of numerous initiatives recommended by that plan. Presented Town planning projects to various community groups. Chair of the Development Services Committee.

ZONING ADMINISTRATOR • TOWN OF PAYSON • 2011-2014
Coordinated and oversaw the Town's first Impact Fee Assessment, Infrastructure Improvement Plan and fee schedule mandated by SB1525. Managed the consultant and outreach process for Payson's 2014-2024 General Plan Update, ratified by the voters by 74% margin. Responsible for administration and interpretation of the Town's zoning code, state statutes and federal laws governing land use.

PLANNING SPECIALIST I/II • TOWN OF PAYSON • 2005-2011
Assisted with technical review of zoning applications and planning studies or project analysis. Provided exemplary customer service for internal and external customers needing assistance with planning-related questions. Resolved all zoning code enforcement complaints

SD

SHEILA DESCHAAF

928-472-5037 | 303 N BEELINE HWY, PAYSON, AZ 85541
SDESCHAAF@PAYSONAZ.GOV

through civil court. Regularly conferred with engineers, architects, developers, and attorneys on a variety of development projects.

911 DISPATCHER • TOWN OF PAYSON • 2002-2008
Received and dispatched emergency and non-emergency calls for service for police and fire. Determined priority of calls, assigned appropriate first responders. Assisted residents in crisis situations until aid arrived. Updated and queried state and national criminal justice information systems databases. Maintained integrity of criminal history reporting information reported by our agency.

EDUCATION

MASTER OF ADMINISTRATION IN PUBLIC MANAGEMENT • 2013 • NORTHERN ARIZONA UNIVERSITY
Graduated "with distinction" for superior academic achievement.

BACHELOR OF ARTS IN SOCIAL SCIENCE • 2011 • COLORADO STATE UNIVERSITY, PUEBLO

ASSOCIATE OF ARTS – FOREIGN LANGUAGE; CHINESE/MANDARIN • 1996 • MONTEREY PENINSULA COLLEGE

VOLUNTEER EXPERIENCE OR LEADERSHIP

Payson Unified School District Governing Board
Northern Gila County Sanitary District Governing Board
MHA Foundation Board of Directors (nonprofit organization supporting health in education)
Squadron Commander - U.S. Air Force, Defense Language Institute, Below the Zone (meritorious) promotion for outstanding service
Coach – Youth Cheerleading, Parks & Recreation Soccer, Basketball
Troop Leader – Arizona Cactus Pine Girl Scouts

Trever Fleetham

4697 Old Trails End Dr. Pine, AZ 85544 (480) 329-2624 tafleetham@gmail.com

Professional Profile

Professional planner for over three years, with degrees in Urban Planning and Sustainability, experience applying local, state, and federal laws, regulations, and policies related to building, land use, and economic development.

Education

Arizona State University, Tempe, AZ – 2013 (3.45 GPA – Cum Laude)

- Bachelor of Science in Urban Planning
- Bachelor of Science in Sustainability

Awards and Honors

- Regent High Honors Endorsement (Scholarship) – 2009-2013
- Avnet TechGames Scholarship Recipient – 2011
- Dean's List – Spring 2012, Fall 2012, Spring 2013

Work Experience

Town of Payson, Planning and Development Department, Payson, AZ

Planner I (Planning and Sustainability Advisor) July 1, 2017 – Present
Planning Technician (Planning and Sustainability Advisor) August 18, 2014 – June 30, 2017

- Provide front counter services related to building, land use, and site development
- Process and issue building and land use permits, including all residential zoning reviews for the towns of Payson and neighboring Star Valley
- Review departmental codes, plans, and processes for opportunities of improvement, and write revisions to present in public meetings to the Planning & Zoning Commission and Town Council
- Research and write grant applications to fund various departmental projects, including those which help implement the town's comprehensive plan
- Manage several short and long term concurrent projects and duties
- Engage citizens and organizations such as Sustainable Rim Country, High Country Garden Club, and Payson Art League in order to collaborate on efforts that make the community more livable, sustainable, and safe

The Home Depot, Scottsdale, AZ

Head Cashier November 21, 2013 – August 15, 2014

- Supervised all front end operations and associates, ensuring efficiency and accuracy
- Motivated and drove cashiers to perform well in order to improve customer service and store operations
- Provided customers with fast, friendly, accurate and safe service

City of Phoenix, Planning and Development Department, Phoenix, AZ

Long Range Planning Intern February 8, 2013 – August 31, 2013

- Member of the team tasked with developing the Phoenix General Plan update
- Facilitated community outreach efforts that created a dialog in order to gather general plan ideas
- Organized community feedback from outreach and online collaborative website; analyzed responses to look for commonalities to apply to general plan update

Flexible Display Center, Arizona State University, Tempe, AZ

Undergraduate Research Assistant -Device Engineer January 1, 2010 – May 31, 2012

- Conducted independent and team-oriented research on the fabrication, characterization and testing of electronic devices
- Conducted the detailed maintenance of highly sensitive vacuum equipment
- Presented findings to the ASU campus at an annual colloquium and published results in a peer reviewed journal

Publications: C. Park, T. Fleetham, J. Li, B. Vogt, "High Performance Bulk-Heterojunction Organic Solar Cells Fabricated with non-Halogenated Solvent Processing" Org. Electron., 12 (2011), pp. 1465–1470

Additional Experience, Skills & Certifications

- Certified Planner through the American Institute of Certified Planners (30733)
- Proficient with Microsoft Suite
- Familiar with GIS, Google SketchUp
- Received certificate of completions for several conferences and continuing education classes related to planning, building, and economic development

LARON G. GARRETT, P.E.
TOWN MANAGER

EDUCATION: Graduated - Ricks College - 1978
Associate in Engineering

Graduated - Utah State University - 1981
Bachelor of Science in Civil and Environmental Engineering

Additional College Courses:
AutoCADD - Arizona State University - 1988
Business Management - Glendale Community College - 1988
Business Economics - Keller Graduate School - 1989
Business Accounting - Keller Graduate School - 1989

Seminars:
Project Management (Employer In-House)
Oral Presentations (Employer In-House)
Counselor Selling (Wilson Learning Center)
Neighborhood Design and Traffic Control (Univ. Of Wisconsin)

PROFESSIONAL REGISTRATION: Professional Engineer (Civil) Arizona #19225 (1986)
Professional Engineer (Civil) Wyoming #5686 (1986)

PROFESSIONAL AFFILIATIONS: Member - American Society of Civil Engineers
Member - American Public Works Association
Member - Arizona Airports Association

PROFESSIONAL EMPLOYMENT: Town of Payson, Arizona October 1, 2015 to Present
Town Manager and Public Works Director

Town of Payson, Arizona May 26, 2015 to Present
Acting Town Manager and Public Works Director

Town of Payson, Arizona July 2011 to May 2015
Assistant Town Manager over Public Works, Community Development, and Recreation and Tourism Divisions

Town of Payson, Arizona November 2008 to June 2011
Public Works Director and Town Engineer

Town of Payson, Arizona November 1994 to November 2008
Town Engineer and Assistant Public Works Director

Burgess & Niple, Inc. September 1991 to November 1994
Payson, AZ Branch Office
Project Engineer
Vice President in charge of Payson, AZ office

American Engineering Company June 1981 to September 1991
Phoenix, AZ
Project Engineer/Manager
Vice President

SUMMARY OF EXPERIENCE

Current Employment: (October 1, 2015 – Present)
Town Manager responsible for all Town of Payson operations.

Town of Payson Employment: (July 2011 – September 2015)
Acting Town Manager responsible for all Town of Payson operations.
Assistant Town Manager responsible for all operations in the Town of Payson Public Works Department including the Engineering Division, Street Division, Parks Operation Division, Municipal Airport, and Water Division. Also responsible for all operations of the Community Development Division and Recreation and Tourism Division.

Town of Payson Employment: (November 1994 – June 2011)
Responsible for all operations in the Town of Payson Public Works Department including the Engineering Division, Street Division, Parks Operation Division, and Municipal Airport, and supervision of the Water Division.

Engineering Division: Responsible for reviewing improvement plans for new commercial and residential subdivision development for code compliance. Review of all storm water drainage systems for compliance with applicable codes. Construction management and inspection for all street construction projects (new and reconstruction), assist the water department in preparing and reviewing plans for new water well and water line construction. Provide engineering support for all Town departments on an as needed basis. Responsible for preparing and maintaining a budget of $100,000 for the Engineering Division and $2- $4 million in capital improvements annually. Responsible for implementing the public works department capital improvement project plan.

Street Division: Responsible for directing the Street Division field crews in maintaining approximately 105 miles of paved streets and approximately 9 miles of unpaved streets. This also includes maintenance of about 12 miles of storm drain and 70 miles of open drainage ditches and channels. Responsible for preparing and maintaining an annual budget of $2.3 million for the Street Division. Responsible for the maintenance, upkeep and replacement of all Street Division equipment.

Park Division: Responsible for directing the Parks Operations Division field crews in maintaining approximately 80 acres of improved park lands. Responsible for preparing and maintaining an annual budget of $.8 million for the Parks Operations Division. Responsible for the maintenance, upkeep and replacement of all Parks Division equipment.

Municipal Airport: Responsible for operations and maintenance at the Payson Municipal Airport. This includes overseeing all Airport Improvement Project (AIP) federal and state grant funded capital improvements.

General: Over the past twenty plus years I have been responsible for presenting requests for the above departments to the Town Council for approval, coordinating public works issues with the general public and providing basic engineering services for the Town.

SUMMARY OF EXPERIENCE

Previous Employment (1981 - 1994):

Development:
Project Engineer responsible for design and improvement plan preparation for master planned communities, single family developments, multi-family developments, commercial and industrial projects. This includes boundary and topographic surveying, plans and specifications for grading , paving, water and sewer improvements, hydrology studies and reports and utility coordination

Municipal: Responsible for preparation of contract documents, specifications, and improvement plans for municipal street paving projects, public water system improvements and extensions and public sanitary sewer system improvements and extensions.

Improvement Districts:
Project Engineer responsible for all aspects of municipal Improvement Districts. This includes preliminary engineering, cost estimates and assessments, final improvement plans, specifications, construction cost estimates and assessments, construction inspection and final assessment recapitulation.

Computer:
Experienced in the following computer software applications:

AutoCADD (Including Autodesk Civil Applications)
Microsoft Project
Microsoft Office (Word, Excel, Powerpoint, etc.)
Corel Professional Package 8.0 (Word Perfect, Quattro Pro, Presentations, etc.)

REFERENCES: Available Upon Request

PERSONAL INFORMATION:

Current Address
501 W. Four Pines Road
Payson, Arizona 85541

Telephone Numbers
Work: (928) 472-5041
Cell: (928) 978-3590

Natural Channel Design, Inc

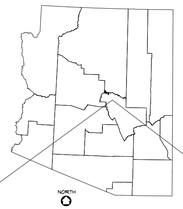
Natural Channel Design, Inc. (NCD) is a civil engineering / environmental engineering consulting firm with an interdisciplinary team of civil engineers and natural resource specialists. They provide services in conservation engineering, restoration ecology, natural resource planning and river engineering and weed management. NCD specializes in research, assessment, design and planning of natural resources. NCD has been operating for over 18 years and has designed, managed, obtained permits, and supervised construction of numerous riparian and aquatic restoration projects throughout the southwest. NCD has extensive experience in watershed assessment, geomorphology, hydrology, hydraulics, wetland and riparian ecology, wildlife biology, vegetation, bioengineering, drainage, erosion control, irrigation, wetland delineation, stream bank stabilization, GIS and spatial modeling. NCD has applied that expertise to community planning, design and permitting of projects for federal, state and county agencies, tribal entities, municipalities, and private owners. The goal of their research, education and design services is to improve the health, resilience and ecosystem function of our aquatic and riparian resources.

Item	Quantity	Unit	Unit Cost	Total
Rip Rap Related Items				
Install Riprap Outlet Protection (D50=8 in) @ Sta 33+76 left	8	CY	$80.00	$640.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 38+03 right	11	CY	$80.00	$880.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 39+03 left	6	CY	$80.00	$480.00
Install Riprap Outlet Protection (D50=8 in) @ Sta 39+37 left	6	CY	$80.00	$480.00
Install Riprap Outlet Protection (D50=14 in) @ Sta 39+37 left	38	CY	$100.00	$3,800.00
Rock Vane Channel/Bank Protection Items				
Install Rock Vane Channel/Bank Protection	6	EA	$2,000.00	$12,000.00
Install Cross Vane Weir Sta 39+45 (small)	1	LS	$6,000.00	$6,000.00
Install Cross Vane Weir Sta 30+83 (large)	1	LS	$12,000.00	$12,000.00
Install Toe Rock	150	LF	$110.00	$16,500.00
Erosion Control Fabric				
Install Pyramat 75 (downstream of box culvert to first weir)	202	SY	$12.00	$2,424.00
Install Pyramat 25 (across bankfull bench, full length of reach)	2,072	SY	$11.50	$23,828.00
Earthwork				
Cut (excavation and haul-off of excess)	1839	CY	$10.00	$18,390.00
Fill (move material within channel, shape and compact)	182	CY	$8.00	$1,456.00
Place 8-inch minus substrate in Riffle/Run (see plans for gradation)	722	CY	$50.00	$36,100.00
Vegetation				
Install Trees	20	EA	$600.00	$12,000.00
Install Large Shrubs	45	EA	$60.00	$2,700.00
Install Small Shrubs & Forbes	72	EA	$20.00	$1,440.00
Install Shrub Willows	18	EA	$60.00	$1,080.00
Install Grass & Sedge Plugs	110	EA	$5.00	$550.00
Reseeding	2	AC	$4,000.00	$8,000.00
Miscellaneous				
Mobilization/Demobilization	1	LS	$5,000.00	$5,000.00
SWPPP	1	LS	$2,000.00	$2,000.00
(Costs shown are installed costs)			Subtotal:	$167,748.00
			Contingency (15% of subtotal):	$25,162.20
			Estimated Construction Total:	$192,910.20

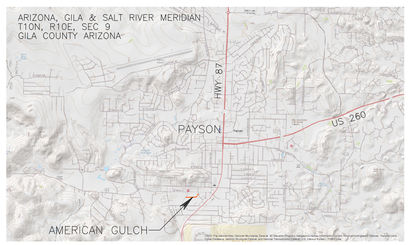
Natural Channel Design, Inc. Services Rendered

Task #	Description	Project Lumpsum
1	Field Assessment	$12,452.00
2	Concept Design	$10,632.00
3	60% design	$12,872.00
4	Final Design	$12,872.00
5	Permit Application	$9,640.00
	Total:	**$58,468.00**

AMERICAN GULCH
CHANNEL AND RIPARIAN ENHANCEMENT
SAWMILL CROSSING TO WESTERLY ROAD
GILA COUNTY, ARIZONA



VICINITY MAP:



CALL ARIZONA BLUE STAKE
TWO WORKING DAYS
BEFORE YOU DIG
DIAL
8-1-1

ANY UNDERGROUND UTILITIES LOCATIONS DEPICTED ON THE PLANS ARE TO BE CONSIDERED APPROXIMATE ONLY. THE UTILITY LOCATIONS (IF SHOWN) WERE PLOTTED FROM A COMBINATION OF FIELD DATA, RECORD DATA, LANDOWNER INFORMATION, AND UTILITY MAPS PROVIDED BY OTHERS, AND MAY NOT REFLECT ALL EXISTING UTILITIES OR THE EXACT LOCATION. LOCATION OF ALL EXISTING UTILITIES SHALL BE CONFIRMED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. THE CONTRACTOR IS RESPONSIBLE FOR THE PROTECTION OF AND ANY DAMAGE TO EXISTING UTILITIES. CALL BEFORE YOU DIG (DIAL "811" OR "1-800-STAKE-IT").

PLAN LEGEND:

EXISTING FEATURES

- PARCEL BOUNDARY (APPROX)
- EXISTING MAJOR CONTOUR (5 FT)
- EXISTING MINOR CONTOUR (1 FT)
- PROPOSED MAJOR CONTOUR (5 FT)
- PROPOSED MINOR CONTOUR (1 FT)
- ROAD EDGES (APPROX)
- EXISTING GROUND
- RIP RAP
- ROCK VANE
- CROSS VANE WEIR
- EXISTING CULVERT
- PYRAMAT 25
- PYRAMAT 75

ABBREVIATIONS:

~	APPROXIMATELY	LF	LINEAR FEET
@	AT	LS	LUMP SUM
AB	AGGREGATE BASE	LWC	LOW WATER CROSSING
AC	ACRE	MAX	MAXIMUM
ACP	ASPHALT CONCRETE PAVEMENT	M.E.	MATCH EXISTING
APPROX	APPROXIMATELY	MIN	MINIMUM
BNK	BANKFULL	MISC	MISCELLANEOUS
BOP	BOTTOM OF POOL	MPT	MALE PIPE THREAD
BOR	BOTTOM OF RIFFLE	N/A	NOT APPLICABLE
BOT	BOTTOM OF TRENCH	NCD	NATURAL CHANNEL DESIGN, INC.
CC	CENTER TO CENTER	NO.	NUMBER
CFS	CUBIC FEET PER SECOND	NTS	NOT TO SCALE
CL	CENTER LINE	OC	ON CENTER
CLSM	CONTROLLED LOW STRENGTH MATERIAL	PE	LOW DENSITY POLYETHYLENE
CMP	CORRUGATED METAL PIPE	PROP.	PROPOSED
CONC	CONCRETE	PSI	POUNDS PER SQUARE INCH
CP	CONTROL POINT	PVC	POLYVINYL CHLORIDE
CY	CUBIC YARD	R	RADIUS
DIA	DIAMETER	REQD	REQUIRED
DIPS	DUCTILE IRON PIPE SIZE	RC	ROCK CLUSTER
DR	DIMENSION RATIO	SCH	SCHEDULE
DTL	DETAIL	SF	SQUARE FEET
DWG	DRAWING	SHT	SHEET
EA	EACH	SS	STAINLESS STEEL
ELEV	ELEVATION	STA	STATION
EX	EXISTING	STD	STANDARD
FG	FINISHED GRADE ELEVATION	SY	SQUARE YARD
FL	FLOWLINE ELEVATION	SYMM	SYMMETRICAL
FPT	FEMALE PIPE THREAD	TBD	TO BE DETERMINED
FT	FEET	TOCV	TOP OF CROSS VANE
FTG	FITTING	TOG	TOP OF GLIDE
GA	GAUGE	TOP	TOP OF POOL
GALV	GALVANIZED	TOR	TOP OF RIFFLE
GB	GRADE BREAK	TOT	TOP OF TRENCH
GPM	GALLONS PER MINUTE	TN	TONS
H	HEIGHT	TRIB	TRIBUTARY
HDPE	HIGH DENSITY POLYETHYLENE	TYP	TYPICAL
IE	INVERT ELEVATION	VLV	VALVE
IN.	INCH	W	WIDTH
IPS	IRON PIPE SIZE	W/	WITH
L	LENGTH	WCS	WATER CONTROL STRUCTURE
LB	POUNDS	WSE	WATER SURFACE ELEVATION

PREPARED FOR:

TOWN OF PAYSON
ENGINEERING DEPARTMENT
303 N. BEELINE HIGHWAY
PAYSON, AZ 85541

PREPARED BY:

NATURAL CHANNEL DESIGN, INC.
2900 N. WEST STREET #5
FLAGSTAFF, AZ 86004
PHONE: (928) 774-2336

SHEET INDEX:

MATERIALS QUANTITY ESTIMATE

MATERIAL	QUANTITY	UNIT
30 IN. FEATURE ROCKS	128	EA
24 IN. FEATURE ROCKS	75	EA
18 IN. FOOTER ROCKS	301	EA
D50 14 IN. RIP RAP	68.1	CY
D50 8 IN. RIP RAP	20.3	CY
CHANNEL SUBSTRATE	722	CY
GEOTEXTILE FABRIC	325	SY
PYRAMAT75	202	SY
PYRAMAT25	2072	SY
TREES	17	EA
LARGE SHRUB	43	EA
SMALL SHRUBS & FORBS	72	EA
SHRUB WILLOW	22	EA
GRASS & SEDGE PLUGS	100	EA
RESEEDING	2	ACRE
EARTHWORK CUT	1839	CY
EARTHWORK FILL	182	CY

PROJECT GENERAL NOTES

1. Site survey data was collected by NCD in August, 2017. Topographic survey was limited to the channel bottom, side slopes and along the top of bank from approximately Meadows St. to Westerly Road.
2. All stationing shown refers to baseline of construction along the new thalweg of the channel bottom and is measured horizontal distance.
3. 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 utilities are not present. The existence, location and depth of any utility must be determined by the contractor prior to any excavation. CALL BEFORE YOU DIG, Arizona Blue Stake at 811 or 1-800-STAKE-IT.
4. Construction activities will be conducted in a manner consistent with all safety regulations, and other permitting required by the Town of Payson, Gila County, the USACOE and others.
5. Installation shall be constructed to the lines and grades as shown on the drawings.
6. The project is located within a dynamic river system and changes may have occured between the time of design and the beginning of construction. As such, the contractor shall familiarize himself with the plans and immediately report variances between these plans and conditions at the project site to the engineer for resolution prior to construction and be responsible for discrepancies not so reported and resolved.
7. Unless otherwise specifically noted within the plans or details herein, all materials and workmanship shall comply with the current "M.A.G. Uniform Standard Specifications and Details for Public Works Construction". All work and materials which do not conform to the standards and specifcation are subject to removal and replacement at the contractor's expense. Where conflict exists between MAG specifications and notes or specification, contractor shall contact the engineer for clarification.
8. Contractor shall coordinate with the project owner (Town of Payson) for location of temporary construction yards and use of the property outside the limits of construction depicted within these plans.
9. Construction contractor shall, in accordance with generally accepted construction practices, assume sole and complete responsibility for the job site conditions during the course of construction of the project, including safety of all persons and property. This requirement shall be made to apply continuously and not be limited to only the normal working hours.

EARTHWORK

> The earthwork activities shall consist of excavation for channel shaping, bank sloping, over-excavation related to the installation of new rock vane/weir structures, for toe rock bank protection and for riprap outlet protection at existing CMP pipes.

Excavation

> Excavation shall include earth removal for shaping bankfull channel, and trenching in preparation for rock structures and for riprap areas. Disturbance of existing native vegetation shall be minimized to the greatest extent possible. All finished surfaces shall be generally smooth and pleasing in appearance.

Earthfill

> Materails: All fill materials shall be obtained from the required excavations and/or approved borrow sources and comply with MAG Specifcations and the requirements provided in the geotechnical report for this project.

Excess Excavation (Export Materails)

> The contractor shall be responsible for locating a suitable site for disposal of excess excavation materials. consult with Town of Payson for appropriate disposal and dispose of said materials in full compliance with provisions with any applicable permits for this project. Any costs associated with hauling and disposing of excess materials shall be included in the unit costs of cut/fill.

Topsoil

> Topsoil is called for within these plans for seedbed preparation over Pyramat turf reinforcement mat. Topsoil shall be imported to the site and meet the requirements as specificed within MAG Section 795. The purpose of the topsoil layer is to provide a suitable seedbed on top of the TRM prior to placement of final hydroseed treatment.

Topsoil shall be spread with hand tools across the TRM and provide approximately 1 inch of cover over the artificial TRM surface. Care shall be taken when spreading topsoil not to damage TRM or loosen stakes or securing pins.

Volume Estimates

> Estimated earthwork volumes provided within the quantity summary do not account for over-excavation as may be required for below grade rock structures or rip rap excavations. Excavation costs related to the construction of those items shall be considered incidental to the specific item and accounted for in the unit costs thereof.

> Overall earthwork quantities provided account for: channel excavation and shaping to finished grades.

> No accounting is made in volume estimates for the shrink or swell of earthwork between excavation and filling or stockpiling. Contractor shall be aware of this and make adjustments as necessary for hauling estimates or other related costs.

Material Quantities Estimate

An estimate of material quantities is included on this sheet for the convenience of the contractor. As this project is within a dynamic stream channel, subject to change in a natural environment and that naturally sourced, inexact materials (rocks, boulders, etc.) are to be used in the construction of in-stream features, the quantities provided are to be regarded as approximate only.

TURF REINFORCEMENT MAT

> Turf Reinforcement Mat (TRM) has been specified to be placed in portions of the project to provide stability to the bankfull bench area and prevent scour during larger flow events. TRM shall be 'Pyramat 75' and 'Pyramat 25' as shown within the included plans and details.

> Details are included herein relative to the installation of the TRM. All other aspects of installation no specifically shown or detailed witin these plans shalll be per the manufacturer's recommendations and installation details.

> Quantity of TRM fabric does not include anchor trenching and overlapping. Check with manufacturer before ordering to obtain the correct amount of fabric.

RIPRAP AND FEATURE ROCK AT IN-STREAM STRUCTURES

The work associated with the construction of the riprap scour pads at storm pipe outlets, rock vane weirs, rock vanes and and toe rock shall consist of furnishing all materials and installing loose rock and filter fabric where specified.

> Non-woven geotextile shall be placed behind the rock. Fabric shall have the properties as specified in Table 796-3 in MAG Section 796. The geotextile shall be placed per MAG Section 220.4. Securing pins shall be installed as necessary to prevent undue slippage or movement of the geotextile. Pins shall be 3/16-inch steel bars, pointed on one end and fabricated with a head to retain a steel washer. (1.5-inch diameter). Pin length shall be not less than 18 inches. U-shaped pins of said length are also acceptable.

> Rock shall be angular, dense, sound and free from cracks, seams, or other defects conducive to accelerated weathering and meet the requirements of MAG Section 703. The least dimension of an individual rock shall not be less than one-third the greatest dimension. Rock source shall be approved by the ENGINEER or authorized Town of Payson representative and have a bulk specific gravity of not less that 2.5 per ASTM C127. Rock shall be well graded with a D50 dimension as specified within the constrcution call-out note for each location.

> Rock placement shall begin at the bottom of slopes. Rock shall not be dropped more than 3 feet onto geotextile.

> Rock rip-rap used in the construction shall be placed by equipment on the surface and to the depth specified. It shall be installed to the full course thickness in one operation and in such a manner as to avoid serious displacement of the underlying material. The rock for riprap shall be delivered and placed in a manner that ensures the riprap in place is reasonably homogeneous with the larger rocks uniformly distributed and firmly in contact one to another with the smaller rocks and spalls filling the voids between the larger rocks. Some hand placing may be required to provide a neat and uniform surface.

> All erosion control rock shall be keyed-in such that finish rock surfaces conform to the plan sections and details included herein. Local surface irregularities of the erosion protection on the scour pad and bank slopes from the planned elevations shall not vary by more than 3 inches. The depth of erosion control material shall be no less than 24" as measured at right angles from the subgrade surface slope.

POLLUTION CONTROL/BMPs

> Total disturbance area related to the improvements shown herein is estimated to be less than 1.0 acre. As such, a SWPPP plan is not included herein nor is it anticipated to be required through ADEQ. Regardless, the contractor will still be required to adhere to industry standards of practice and employ Best Management Practices (BMPs) as necessary to minimize erosion and ensure that air and water pollution are minimized and held within legal limits. Any cost associated with the use of BMP's shall be considered incidental to the project as a whole.

> Transportation routes for materials, personnel, and equipment to, from, and within the project shall be limited to existing roads, the work areas identified with these plans and as otherwise approved by the Town of Payson at the time of construction. The contractor will coordinate with the Town of Payson to ensure that access across any adjacent properties is approved by a cooperating property owner, prior to utilizing that access.

> Contractor shall be responsible for all costs associated with the implementation of BMPs associated with storage and/or disposal of excess excavation materials if necessary. Such costs shall be considered incidental to the project as a whole.

> Contractor shall ensure that vehicles and equipment leaving the site and entering Town, County or State governed roads are clean and free of excess mud and debris and that loads are properly covered. Contractor will be responsible for installing track-out pads, if necessary and depending upon the soil moisture condition at the time of construction, to prevent tracking of mud onto those public roads.

WORK AREA & LEGAL ACCESS

> The work presented within these plans extends across Town of Payson property and into adjacent, privately held parcels. It will be the responsibility of the Town of Payson to secure the necessary agreements and/or temporary construction easements, and/or permanent easements, as necessary to perform the work outside of town-held properties. Contractor shall coodinate with the Town of Payson to verify legal access to any areas not identified as Town of Payson property. Approximate parcel lines are shown within the included plans.

CALL ARIZONA BLUE STAKE
TWO WORKING DAYS
BEFORE YOU DIG
DIAL
8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS AND SPECIFICATIONS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED BY THE PREPARER OF THESE PLANS.

DRAWING NUMBER: CVR01

DATE: 15 DECEMBER 2017

SHEET NUMBER: 1 OF 10

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

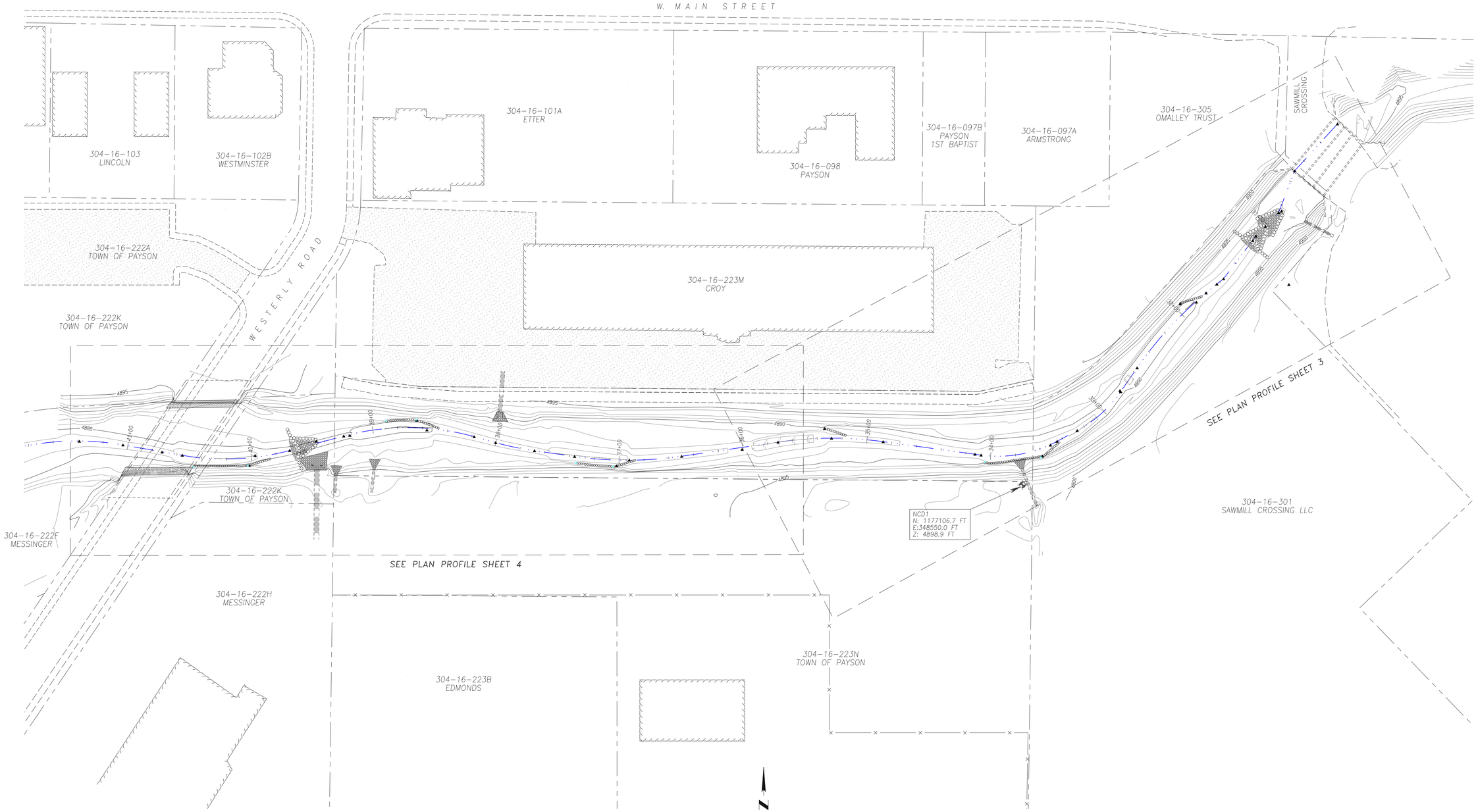
DRAWN BY: CS, JF, MW, AH
DESIGNED BY: MK, AH
CHECKED BY: MK, AH

NO.	DATE	BY	REVISION

COVER, LOCATION MAP, SPECIFICATIONS AND LEGEND

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



PROJECT OVERVIEW AND SURVEY CONTROL

1. Site survey data was collected by NCD in August, 2017. Topographic survey was limited to the channel bottom, side slopes and along the top of bank from approximately Meadows St. to Westerly Road.
2. All stationing shown refers to baseline of construction along the new thalweg of the channel bottom and is measured horizontal distance.

SURVEY INFORMATION

DATUM & COORDINATE GRID INFORMATION

COORDINATE PROJECTION:	NORTH AMERICAN DATUM 1983 (NAD83)
HORIZONTAL DATUM:	ARIZONA STATE PLANE, ARIZONA EAST, SURVEY FEET
VERTICAL DATUM:	NORTH AMERICAN VERTICAL DATUM 1988 (NAVD88)
GEOID MODEL:	GEOID09 (CONUS)

CONTROL POINT LIST

NAME	NORTHING	EASTING	ELEVATION	DESCRIPTION
ES0281	1177259.1	350049.0	4919.7	DISC SET IN BOULDER [1,3]
ES0743	1172983.4	347609.5	5008.20	GS DISC IN BEDROCK [1,3]
NCD1	1177106.7	348550.0	4898.9	3/8" REBAR W/ YELLOW CAP [2]

[1] NGS BENCHMARK
[2] YELLOW CAP MARKED "NATURAL CHANNEL"
[3] NOT SHOWN / OUTSIDE LIMITS OF PLAN VIEW SHOWN.

NOTE: LAYOUT CONTROL FOR CHANNEL IMPROVEMENTS AND STRUCTURE ARE PROVIDED ON SHEET 6. GENERAL SURVEY INFORMATION IS PROVIDED ABOVE.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

SHEET NAME: OVR01

SHEET NUMBER: 2 OF 10

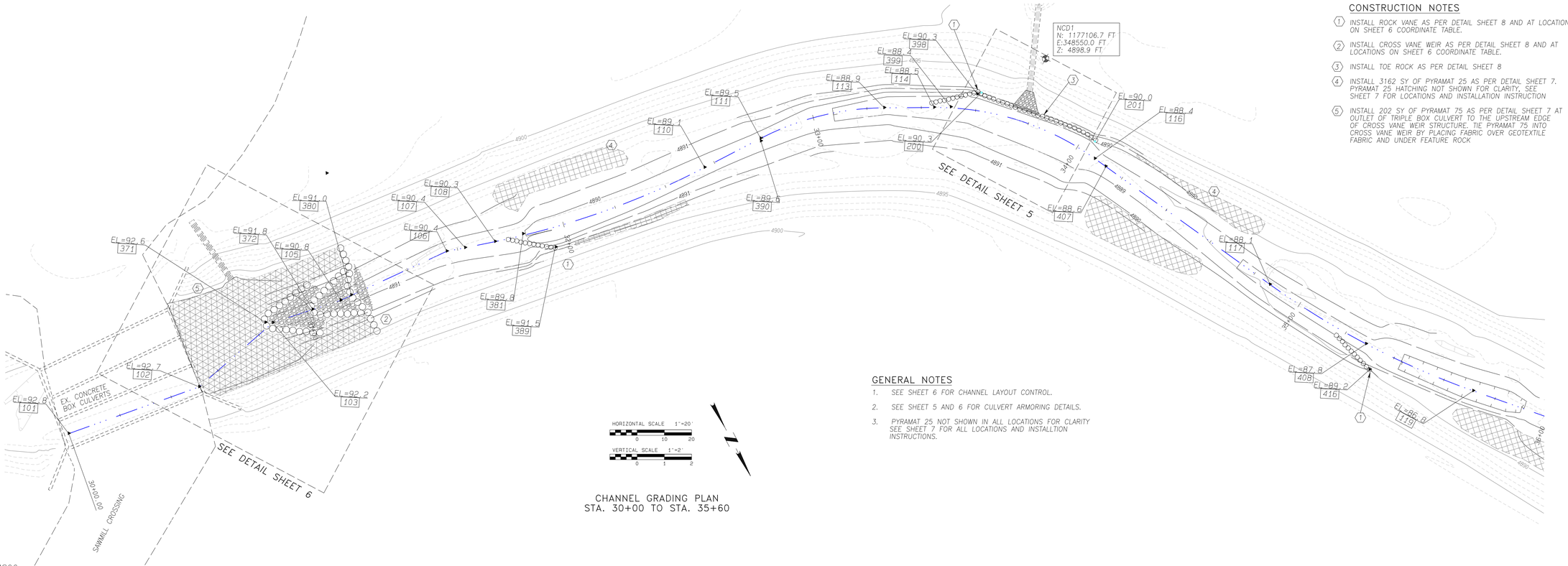
PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

PROJECT OVERVIEW

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: CS, JF, MW			
DESIGNED BY: MK			
CHECKED BY:			
NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



CHANNEL GRADING PLAN
STA. 30+00 TO STA. 35+60

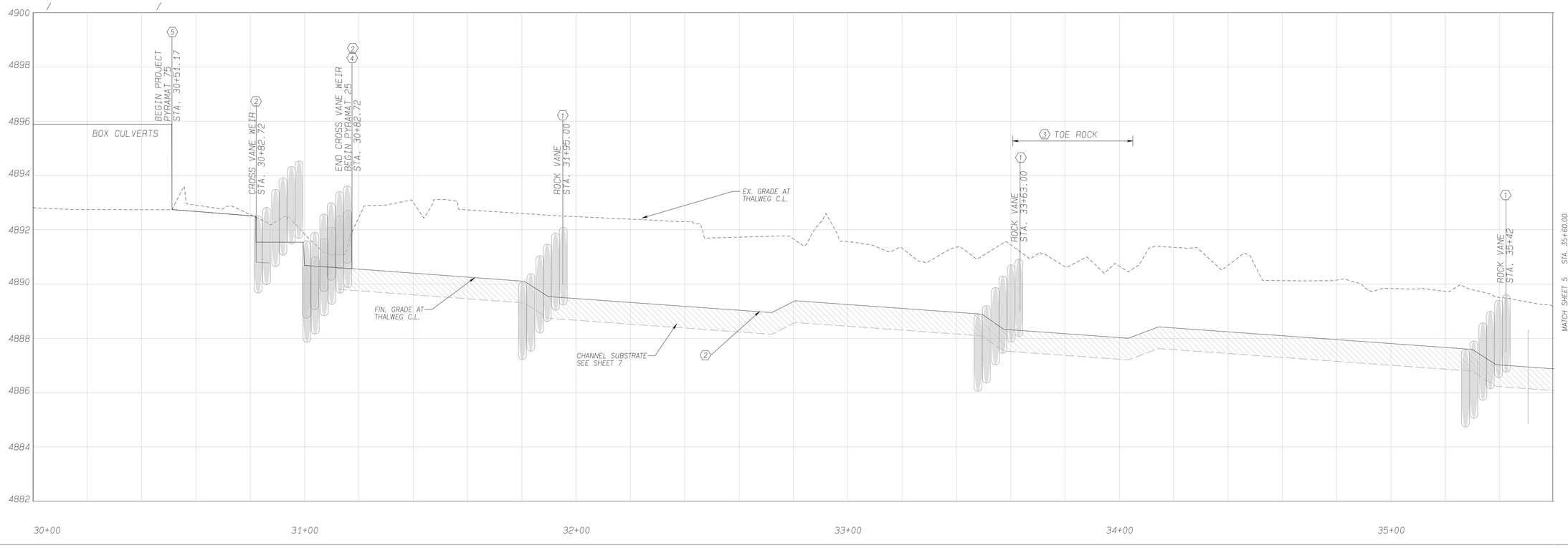
HORIZONTAL SCALE 1"=20'
0 10 20
VERTICAL SCALE 1"=2'
0 1 2

CONSTRUCTION NOTES

1. INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.
2. INSTALL CROSS VANE WEIR AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.
3. INSTALL TOE ROCK AS PER DETAIL SHEET 8
4. INSTALL 3162 SY OF PYRAMAT 25 AS PER DETAIL SHEET 7. PYRAMAT 25 HATCHING NOT SHOWN FOR CLARITY, SEE SHEET 7 FOR LOCATIONS AND INSTALLATION INSTRUCTION
5. INSTALL 202 SY OF PYRAMAT 75 AS PER DETAIL SHEET 7 AT OUTLET OF TRIPLE BOX CULVERT TO THE UPSTREAM EDGE OF CROSS VANE WEIR STRUCTURE. TIE PYRAMAT 75 INTO CROSS VANE WEIR BY PLACING FABRIC OVER GEOTEXTILE FABRIC AND UNDER FEATURE ROCK

GENERAL NOTES

1. SEE SHEET 6 FOR CHANNEL LAYOUT CONTROL.
2. SEE SHEET 5 AND 6 FOR CULVERT ARMORING DETAILS.
3. PYRAMAT 25 NOT SHOWN IN ALL LOCATIONS FOR CLARITY SEE SHEET 7 FOR ALL LOCATIONS AND INSTALLTION INSTRUCTIONS.



CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PLANS.

DATE: **15 DECEMBER 2017**

NCD PROJECT NUMBER: **17-283AZ**

SHEET NAME: **PLN01**

SHEET NUMBER: **3** OF **10**

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

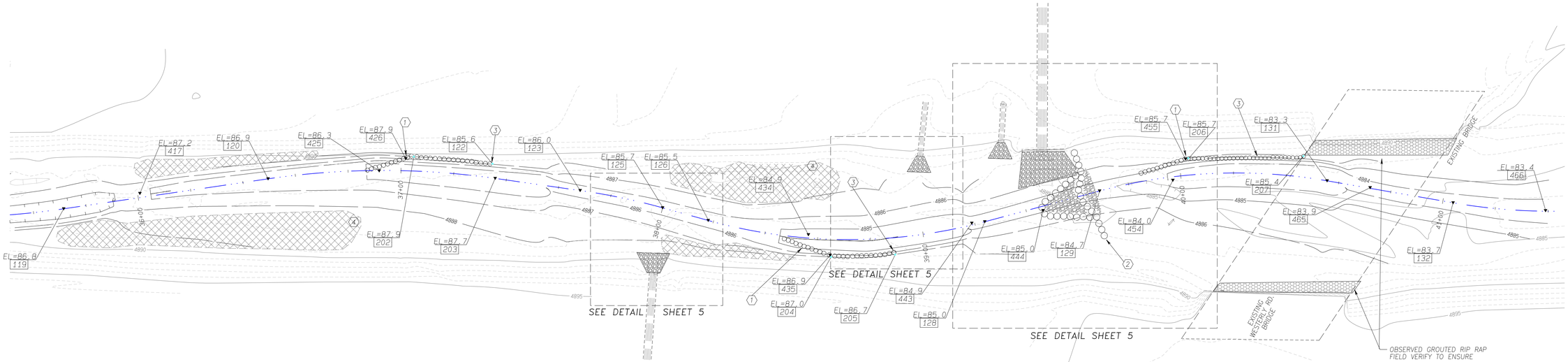
CHANNEL PLAN & PROFILE STA.30+00 TO 35+60

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

NO.	DATE	BY	REVISION

DRAWN BY: CS, JF, MW, AH
DESIGNED BY: **MK**
CHECKED BY: MK, AH

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



CHANNEL GRADING PLAN
STA. 35+60 TO STA. 41+63.74

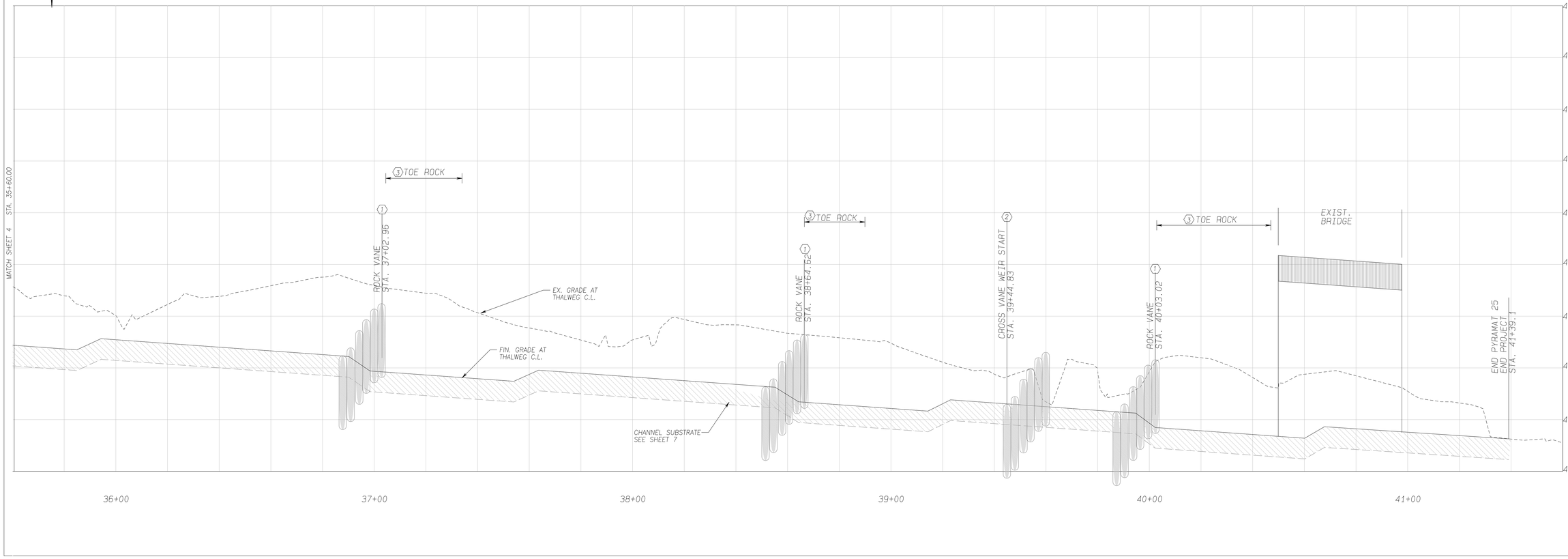
HORIZONTAL SCALE 1"=20'
0 10 20
VERTICAL SCALE 1"=2'
0 1 2

CONSTRUCTION NOTES

1. INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE
2. INSTALL CROSS VANE WEIR AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE
3. INSTALL TOE ROCK AS PER DETAIL SHEET 8
4. INSTALL 3162 SY OF PYRAMAT 25 AS PER DETAIL SHEET 7. PYRAMAT 25 HATCHING NOT SHOWN FOR CLARITY, SEE SHEET 7 FOR LOCATIONS AND INSTALLATION INSTRUCTION

GENERAL NOTES

1. SEE SHEET 6 FOR CHANNEL LAYOUT CONTROL.
2. SEE SHEET 5 AND 6 FOR CULVERT ARMORING DETAILS.
3. PYRAMAT 25 NOT SHOWN IN ALL LOCATIONS FOR CLARITY SEE SHEET 7 FOR ALL LOCATIONS AND INSTALLTION INSTRUCTIONS.



CHANNEL PLAN & PROFILE STA.35+60 TO 41+63.74

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND APPROVED BY THE ENGINEER PREPARING THESE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

SHEET NAME: PLN02

SHEET NUMBER: 4 OF 10

CALL ARIZONA BLUE STAKE INC. 811 OR 1-800-782-5348 BEFORE YOU DIG
8-1-1

DRAWN BY: CS, JF, MW, AH
DESIGNED BY: MK, AH
CHECKED BY: MK, AH

NO.	DATE	BY	REVISION

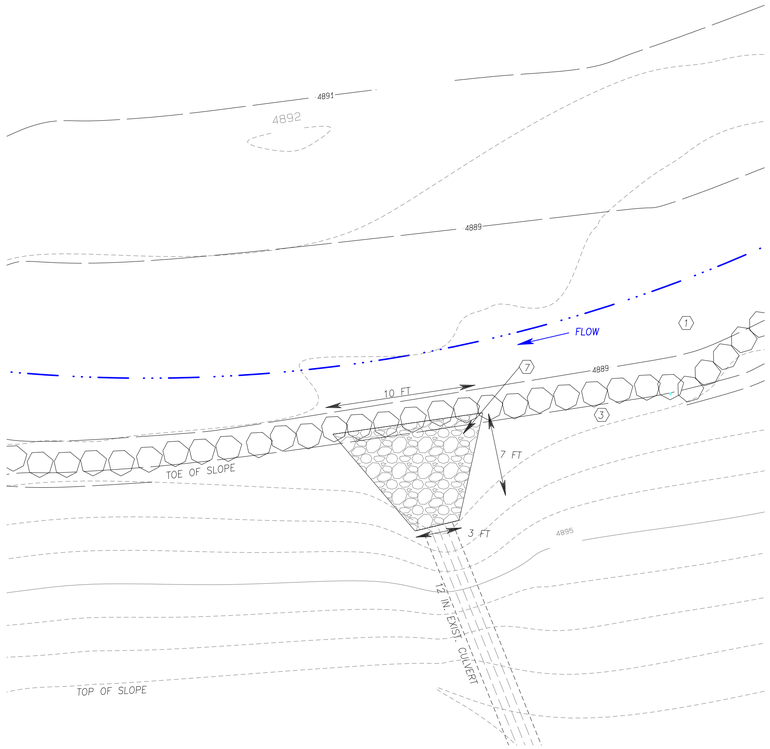
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

RIP RAP CULVERT OUTLET PROTECTION STA 33+76 LEFT

(1) INSTALL ROCK VANE AS PER DETAIL SHEET 9 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE

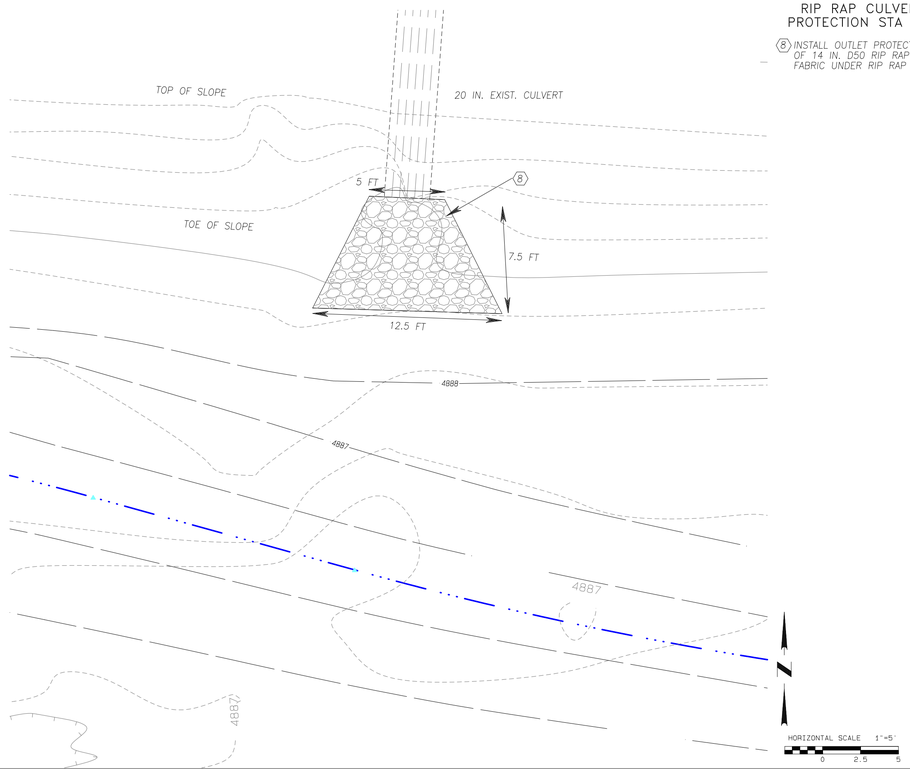
(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(7) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 8 CY OF 14 IN. D50 RIP RAP AND PLACE 5 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 38+03 RIGHT

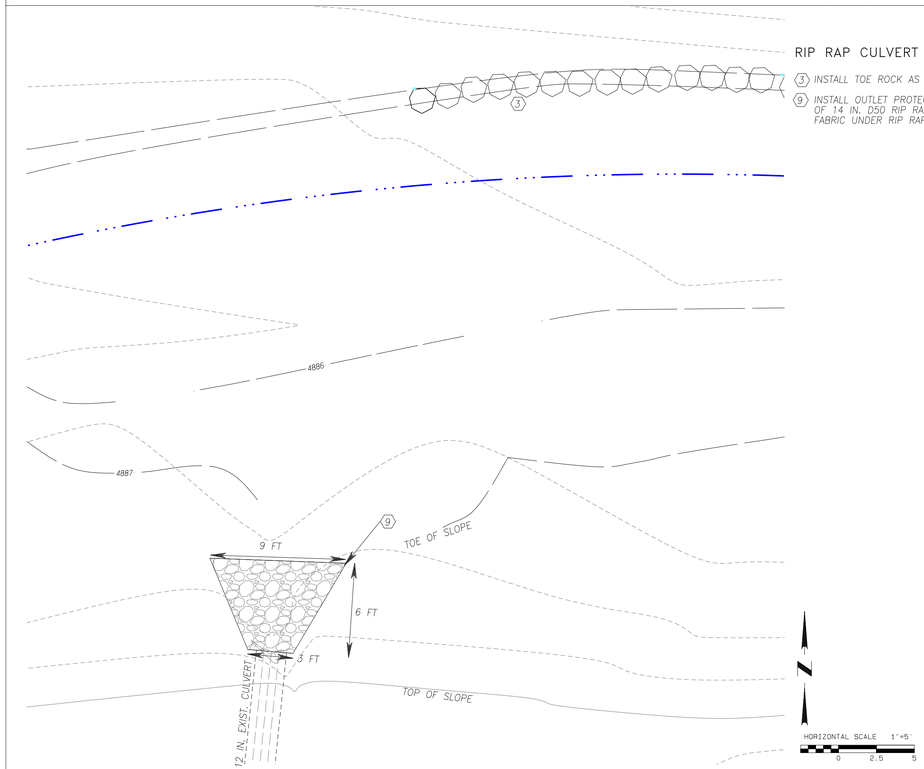
(8) INSTALL OUTLET PROTECTION FOR 18 IN. PIPE USING 11 CY OF 14 IN. D50 RIP RAP AND PLACE 7 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 39+03 LEFT

(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(9) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 6 CY OF 14 IN. D50 RIP RAP AND PLACE 4 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.



RIP RAP CULVERT OUTLET PROTECTION STA 39+37 LEFT

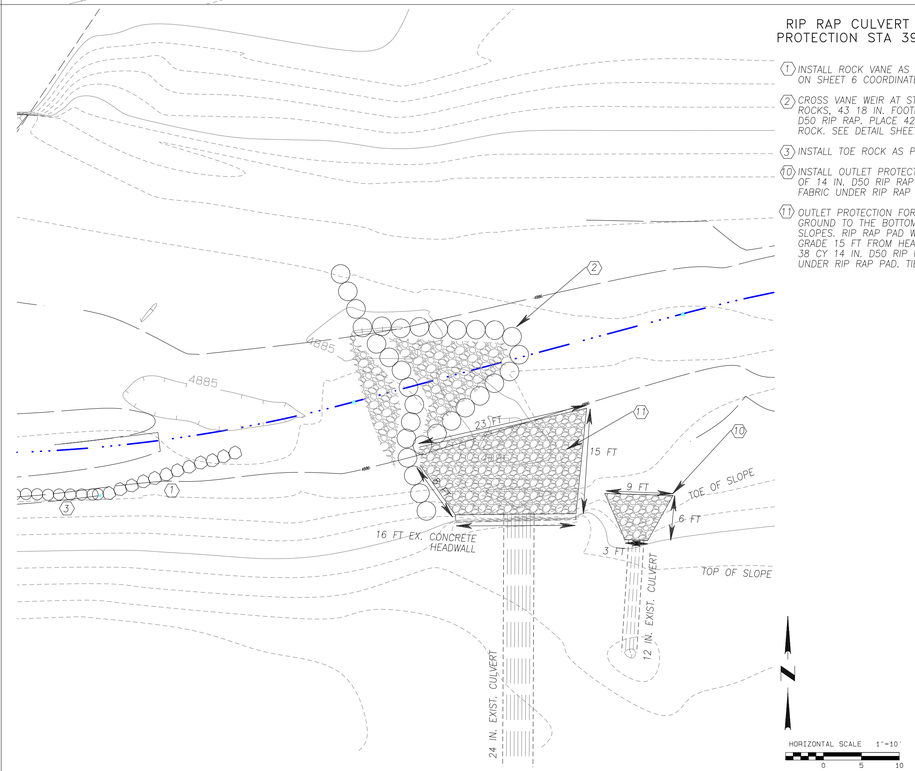
(1) INSTALL ROCK VANE AS PER DETAIL SHEET 8 AND AT LOCATIONS ON SHEET 6 COORDINATE TABLE.

(2) CROSS VANE WEIR AT STA. 39+45, 26 30 IN. FEATURE ROCKS, 43 18 IN. FOOTER ROCK AND 12 CY OF 8 IN. D50 RIP RAP. PLACE 42 SY OF GEOTEXTILE FABRIC UNDER ROCK. SEE DETAIL SHEET 8.

(3) INSTALL TOE ROCK AS PER DETAIL SHEET 8

(10) INSTALL OUTLET PROTECTION FOR 12 IN. PIPE USING 6 CY OF 14 IN. D50 RIP RAP AND PLACE 4 SY OF GEOTEXTILE FABRIC UNDER RIP RAP PAD.

(11) OUTLET PROTECTION FOR ARCH CULVERT. FILL FROM EXISTING GROUND TO THE BOTTOM OF THE HEADWALL AND TIE TO SIDE SLOPES. RIP RAP PAD WILL EXTEND INTO CHANNEL AND TIE TO GRADE 15 FT FROM HEADWALL INTO THE CHANNEL. FILL USING 38 CY 14 IN. D50 RIP RAP. PLACE 25 SY GEOTEXTILE FABRIC UNDER RIP RAP PAD. TIE TO WEIR WHERE THERE IS OVERLAP.



CALL ARIZONA BLUE STAKE BEFORE YOU DIG 811 8-1-1

SHEET NAME: CLVT01

SHEET NUMBER: 5 OF 10

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

DATE: 15 DECEMBER 2017

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

CULVERT PROTECTION

AMERICAN GULCH
RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

CHANNEL RESTORATION

DRAWN BY: CS, JF, MW			
DESIGNED BY: MK			
CHECKED BY:			
NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

CONSTRUCTION NOTES

(2) CROSS VANE WEIR AT STA. 30+83. 45 30 IN. FEATURE ROCKS, 74 18 IN. FOOTER ROCK AND 9 CY OF 8 IN. D50 RIP RAP. PLACE 73 SY OF GEOTEXTILE FABRIC UNDER ROCK. SEE DETAIL SHEET 8

(5) OUTLET PROTECTION FOR BOX CULVERT INSTALL 1815 SY OF PYRAMAT 75 AS PER DETAIL SHEET 8 AT OUTLET OF TRIPLE BOX CULVERT TO THE UPSTREAM EDGE OF CROSS VANE WEIR STRUCTURE. TIE PYRAMAT 75 INTO CROSS VANE WEIR BY PLACING FABRIC OVER GEOTEXTILE FABRIC AND UNDER FEATURE ROCK IF RIP RAP IS ALREADY PRESENT IN CHANNEL, TIE CROSS VANE WEIR INTO EXISTING RIP RAP IN CHANNEL BOTTOM.

NOTE:
IT IS UNKNOW IF AN EXISTING RIPRAP SCOUR PAD IS IN PLACE AT THE OUTLET OF THE BOX CULVERT. IF ONE IS ENCOUNTERED, DURING CONSTRUCTION, THEN THE PYRAMAT 75 PRODUCT LISTED IN CONSTRUCTION NOTE #5 MAY NOT BE NECESSARY. CONTRACTOR SHALL VERIFY THE PRESENCE OR ABSENCE OF RIPRAP BELOW THE SEDIMENT PRIOR TO ORDERING PYRAMAT 75 AND CONTACT THE ENGINEER IF A RIPRAP SCOUR PAD IS FOUND.

CHANNEL LAYOUT CONTROL

NOTE: CONTROL PROVIDED THIS TABLE IS FOR THE HORIZONTAL/VERTICAL LAYOUT OF THE CHANNEL CENTERLINE. SEE STRUCTURE/GEOMORPHIC GRADING TABLE (BELOW) FOR COORDINATES OF ROCK VANES, WIERS, POOLS, ETC.

PT# / STATION / BEARING	NORTH / DISTANCE	EAST	ELEV
101			
30+00.00	1177396.4	348802.6	4892.8
S42 23'21"W	50.92ft		
102			
30+50.92	1177358.8	348768.3	4892.7
S20 59'26"W	35.91ft		
158 36'05" AR			
103			
30+86.83	1177325.3	348755.4	4891.5
S43 56'35"W	26.23ft		
105			
31+13.06	1177306.4	348737.2	4890.6
S37 15'37"W	42.94ft		
106			
31+56.00	1177272.2	348711.2	4890.4
S51 11'40"W	6.86ft		
107			
31+62.86	1177267.9	348705.9	4890.2
S50 33'05"W	11.24ft		
108			
31+74.10	1177260.8	348697.2	4890.1
RADIUS POINT:	109	1177032.6	348884.9
RADIUS:	295.49ft		
DELTA:	15 52'45" LEFT		
110			
32+56.00	1177200.7	348641.9	4889.0
S34 40'20"W	23.19ft		
111			
32+79.19	1177181.6	348628.7	4889.3
RADIUS POINT:	112	1177238.5	348546.5
RADIUS:	100.00ft		
DELTA:	27 02'49" RIGHT		
113			
33+26.39	1177150.5	348593.9	4889.0
S61 43'10"W	18.34ft		
114			
33+44.73	1177141.8	348577.7	4888.9
RADIUS POINT:	115	1177229.8	348530.3
RADIUS:	100.00ft		
DELTA:	36 05'27" RIGHT		
116			
34+07.72	1177130.8	348516.7	4888.1
N82 11'24"W	79.23ft		
117			
34+86.95	1177141.5	348438.3	4887.9
RADIUS POINT:	118	1176844.3	348397.5
RADIUS:	300.00ft		
DELTA:	16 08'46" LEFT		
119			
35+71.49	1177141.1	348354.0	4886.8
S81 39'50"W	78.11ft		

PT# / STATION / BEARING	NORTH / DISTANCE	EAST	ELEV
120			
36+49.61	1177129.8	348276.7	4886.9
RADIUS POINT:	121	1177426.6	348233.2
RADIUS:	300.00ft		
DELTA:	16 27'27" RIGHT		
122			
37+35.78	1177129.7	348190.8	4885.6
N81 52'43"W	32.46ft		
123			
37+68.24	1177134.2	348158.7	4886.0
RADIUS POINT:	124	1177379.0	348193.6
RADIUS:	247.28ft		
DELTA:	7 22'52" RIGHT		
125			
38+00.09	1177140.8	348127.5	4885.7
N74 29'51"W	17.90ft		
126			
38+17.99	1177145.5	348110.3	4885.5
RADIUS POINT:	127	1176953.9	348057.1
RADIUS:	198.91ft		
DELTA:	30 28'56" LEFT		
128			
39+23.82	1177146.0	348005.7	4885.0
S75 01'13"W	44.96ft		
129			
39+68.78	1177134.4	347962.3	
RADIUS POINT:	130	1177327.6	347910.6
RADIUS:	200.00ft		
DELTA:	24 51'40" RIGHT		
131			
40+55.56	1177130.6	347876.3	4883.3
N80 07'08"W	48.34ft		
132			
41+03.90	1177138.9	347828.6	4883.7

STRUCTURE / GEOMORPHIC GRADING POINT COORDINATES

Coordinate Table

Pt #	North	East	Elev	Sta	Descriptor
200	1177128.8	348564.9	4890.3	33+61.13	START TOE ROCK
201	1177125.2	348519.7	4890.0	34+04.24	end toe rock
202	1177121.5	348221.6	4887.9	37+04.66	start toe rock
203	1177124.1	348191.9	4887.7	37+33.99	end toe rock
204	1177159.3	348063.8	4887.0	38+65.32	start toe rock
205	1177158.4	348039.6	4886.7	38+88.83	end toe rock
206	1177122.0	347928.8	4885.7	40+03.41	start toe rock
207	1177121.2	347885.2	4885.4	40+45.53	end toe rock
371	1177326.5	348757.8	4892.6	30+84.84	weir start
372	1177314.2	348744.8	4891.8	31+02.20	weir start 2
380	1177302.9	348734.7	4891.0	31+17.38	weir step
381	1177253.5	348689.4	4889.8	31+84.75	top pool
389	1177252.2	348676.5	4891.5	31+85.05	vane tie
390	1177182.5	348628.2	4889.6	32+78.80	pool end
398	1177130.0	348566.0	4890.3	33+59.81	vane tie
399	1177138.8	348572.4	4888.4	33+50.83	pool start
407	1177131.4	348511.9	4888.6	34+12.62	pool end
408	1177144.3	348396.9	4887.8	35+28.48	pool start
416	1177152.1	348391.3	4889.2	35+33.89	vane tie
417	1177135.3	348325.2	4887.2	36+00.86	pool end
425	1177126.8	348234.7	4886.3	36+91.78	pool start
426	1177122.2	348224.6	4887.9	37+01.70	vane yie
434	1177150.9	348072.4	4884.9	38+56.42	pool start
435	1177159.7	348064.2	4886.9	38+64.95	vane tie
443	1177146.6	348010.6	4884.9	39+18.91	pool end
444	1177141.8	347983.7	4885.0	39+46.20	weir start
454	1177130.4	347934.6	4884.0	39+96.84	pool start
455	1177122.4	347929.8	4885.7	40+02.37	vane tie
465	1177133.2	347860.0	4883.9	40+72.02	pool end
466	1177141.8	347793.7	4883.4	41+39.05	tie to ex. channel
476	1177267.6	348763.6	4902.6	31+27.97	hydrant

NOTE:
> SEE SHEETS 3 AND 4 FOR GRAPHICAL REPRESENTATION OF LOCATIONS OF CONTROL COORDINATES ALONG CHANNEL ALIGNMENT
> ELEVATIONS PROVIDED REFERENCE FINISHED TOP OF ROCK IF A ROCK STRUCTURE OR THALWEG IF REFERENCING A POOL.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR TO CONSTRUCTION.

DATE: 15 DECEMBER 2017

SHEET NAME: C1VT02

SHEET NUMBER: 6 OF 10

NCD PROJECT NUMBER: 17-283AZ

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

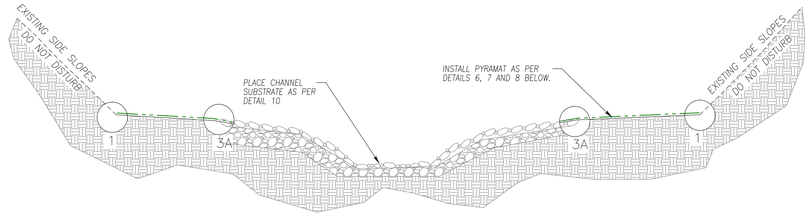
SAWMILL CROSSING BOX CULVERT PROTECTION AND PROJECT LAYOUT CONTROL

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

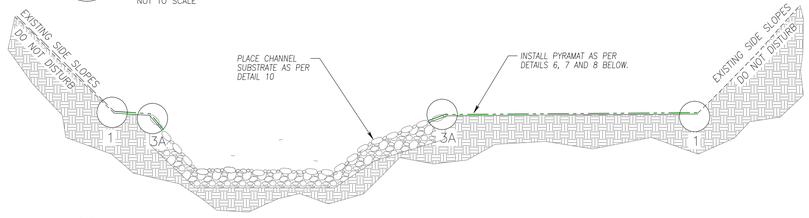
DRAWN BY: CS, JF, MW
DESIGNED BY: MK
CHECKED BY:

NO.	DATE	BY	REVISION

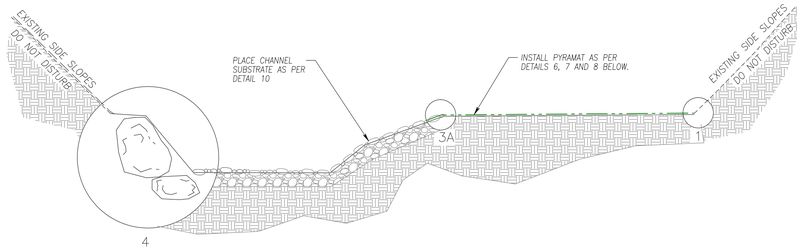
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



A/8 STA 30+87 TO 31+81, 32+80 TO 33+60, 34+14 TO 35+30, 35+97 TO 36+89, 37+64 TO 38+58, 39+23 TO 39+95, 40+68 TO 41+46
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE

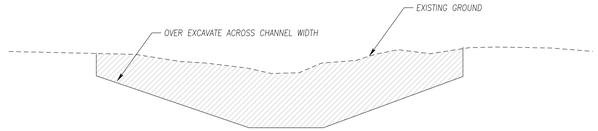


B/8 STA 33+61 TO 34+05, 36+89 TO 37+55, 39+37 TO 40+60
TYPICAL POOL CROSS SECTION
NOT TO SCALE

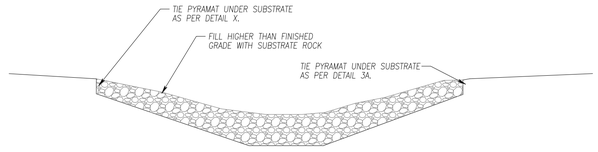


B/8 STA 33+61 TO 34+05, 37+04 TO 37+52, 38+64 TO 38+96, 40+06 to 40+46
TYPICAL TOE ROCK POOL CROSS SECTION
NOT TO SCALE

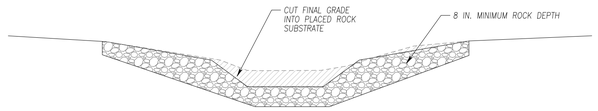
SUGGESTED CONSTRUCTION SEQUENCE



STEP 1: OVEREXCAVTE TO PREPARE FOR SUBSTRATE

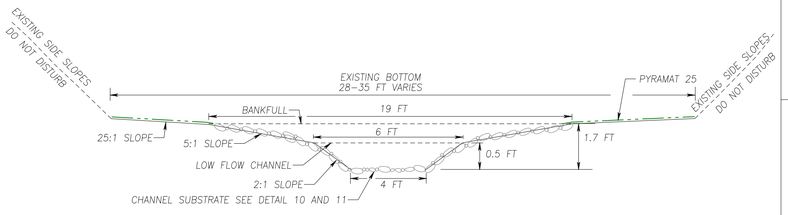


STEP 2: PLACE SUBSTRATE IN CUT CHANNEL BOTTOM

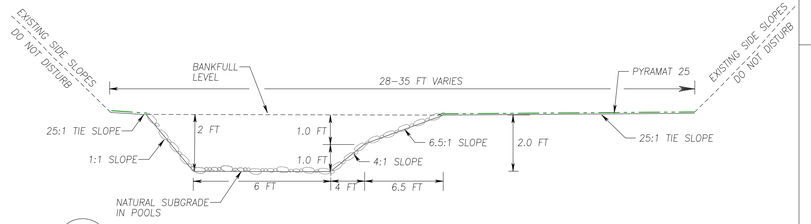


STEP 3: CUT FINAL CHANNEL INTO PLACED SUBSTRATE

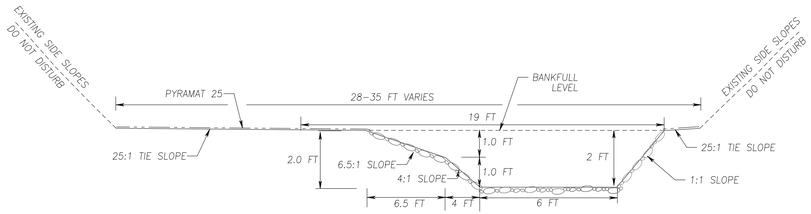
NOTE: FOR ADDITIONAL PYRAMAT INSTALLATION INSTRUCTION SEE MANUFACTURERS RECCOMENDATION



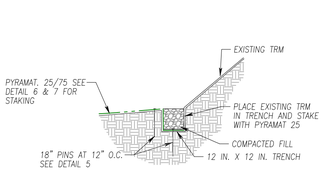
A/8 STA 30+87 TO 31+81, 32+80 TO 33+49, 34+14 TO 35+30, 35+94 TO 36+89, 37+64 TO 38+58, 39+23 TO 39+95, 40+68 TO 41+46
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE



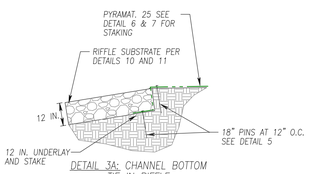
B/8 STA 33+57 TO 34+03, 36+97 TO 37+55, 40+01 TO 40+60
TYPICAL POOL CROSS SECTION
NOT TO SCALE



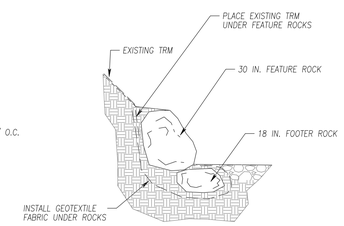
C/8 STA 31+89 TO 32+72, 35+38 TO 35+85, 38+64 TO 39+15
TYPICAL RIFFLE CROSS SECTION
NOT TO SCALE



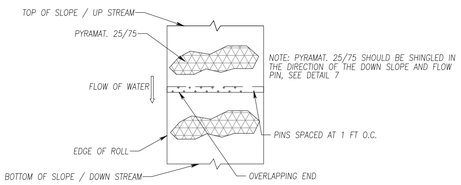
DETAIL 1: CHANNEL BOTTOM TIE IN RIFFLE



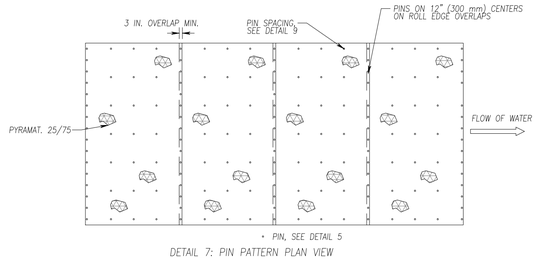
DETAIL 3A: CHANNEL BOTTOM TIE IN RIFFLE



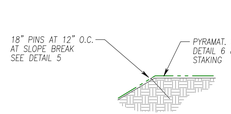
DETAIL 4: TOE ROCK FABRIC



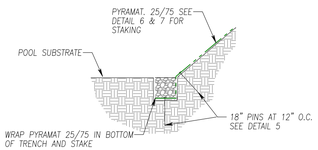
DETAIL 6: OVERLAP AT ROLL END DETAIL PLAN VIEW



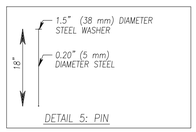
DETAIL 7: PIN PATTERN PLAN VIEW



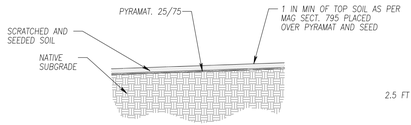
DETAIL 2: BREAK IN SLOPE INTERFACE PROFILE VIEW



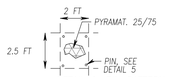
DETAIL 3B: CHANNEL BOTTOM TIE IN POOL



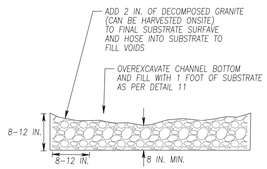
DETAIL 5: PIN



DETAIL 8: VEGETATION ESTABLISHMENT PROFILE VIEW



DETAIL 9: PIN PATTERN PLAN VIEW



DETAIL 10: RIFFLE SUBSTATE INSTALLATION SECTION VIEW

d	Lower Limit (in)	Upper Limit (in)
100	4.8	8
85	4.7	6.8
75	4.4	6.4
50	3.8	5.4
30	3.0	4.5
15	1	3.6

DETAIL 11: SUBSTRATE GRADATION

CALL ARIZONA BLUE STAKE 811 OR 1-800-782-5348 BEFORE YOU DIG
8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE ENGINEER OF RECORD PRIOR TO IMPLEMENTATION.

DATE: 15 DECEMBER 2017
NCD PROJECT NUMBER: 17-283AZ
SHEET NAME: DTL01
SHEET NUMBER: 7 OF 10

PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

DRAWN BY: CS, JF, MW, AH
CHECKED BY: MK, AH

NO.	DATE	BY	REVISION

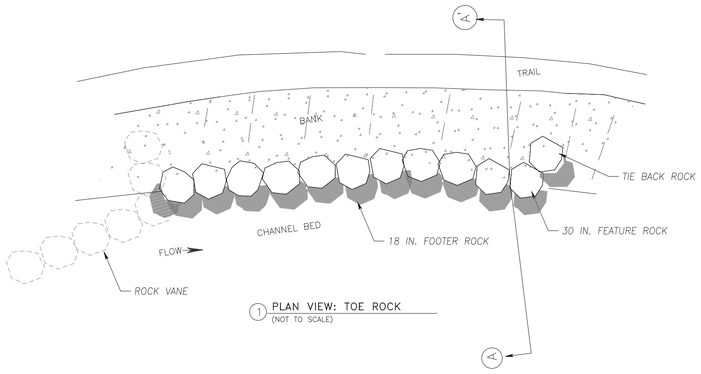
DETAIL SHEET

AMERICAN GULCH CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT

TOWN OF PAYSON

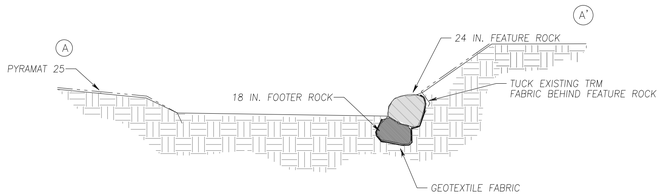
Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

TOE ROCK



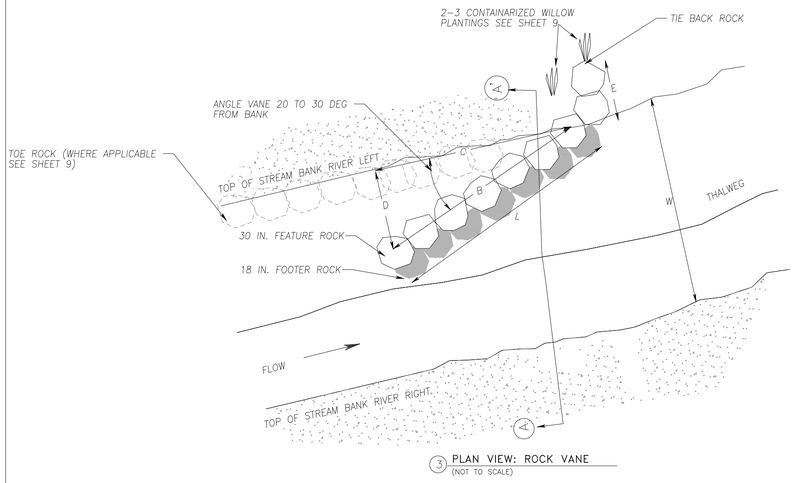
1 PLAN VIEW: TOE ROCK
(NOT TO SCALE)

TOE ROCK NOTES
1. TOE ROCK TO BE INSTALLED AT BASE OF EXISTING BANK OR SHAPED BANK AS SPECIFIED BY ENGINEER OR REPRESENTATIVE.
2. FEATURE ROCKS TO BE INSTALLED SO TOP OF ROCK IS AT BANKFULL ELEVATION.
3. PLACE GEOTEXTILE FABRIC UNDERNEATH FOOTER AND FEATURE ROCKS.
4. FEATURE ROCKS PLACED ON TOP OF FOOTER ROCK SO ROCK LOCKS TOGETHER.
5. FEATURE ROCKS TO BE PLACED TO MINIMIZE GAPS AND HAVE A GENERALLY SMOOTH FACE.

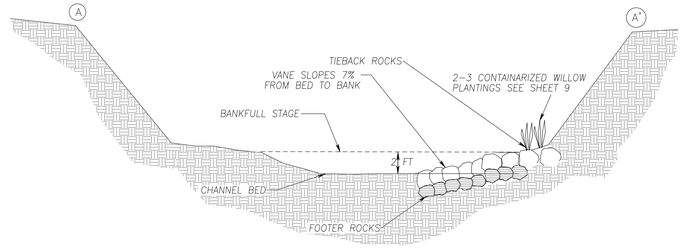


2 SECION VIEW: TOE ROCK
(NOT TO SCALE)

ROCK VANE WITH WILLOW TRANSPLANTS



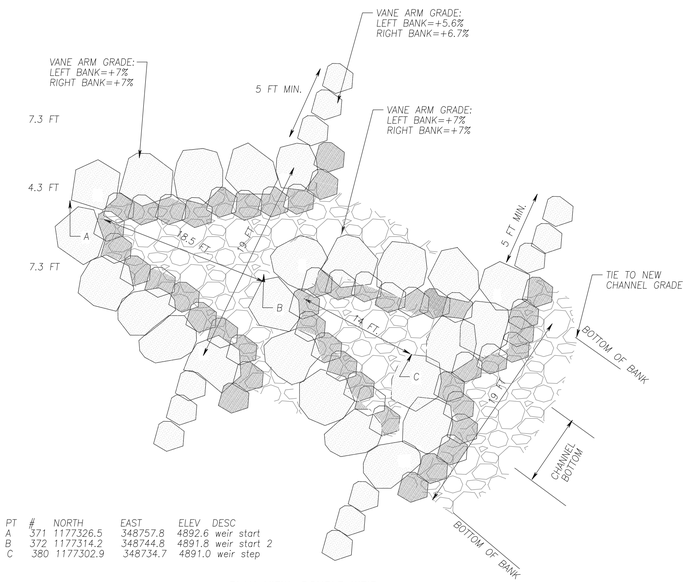
3 PLAN VIEW: ROCK VANE
(NOT TO SCALE)



3 SECTION VIEW: ROCK VANE
(NOT TO SCALE)

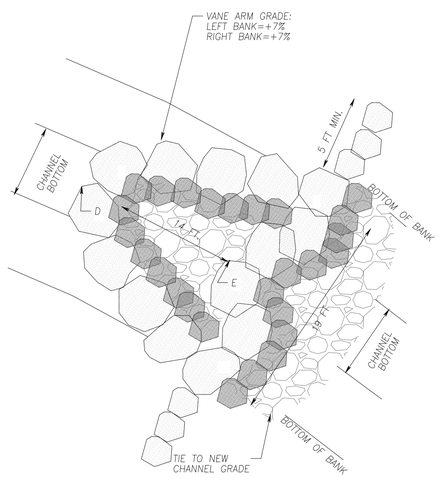
DIMENSIONS	
W =	19 ft
B =	18.4 ft
C =	17.3 ft
D =	6.3 ft
E =	5 ft

ROCK VANE NOTES
1. VANE MEASUREMENTS ARE BASED ON CENTERLINE OF ROCK
2. THE ROCK VANE IS UTILIZED TO SLOW VELOCITIES ALONG THE OUTSIDE OF A BEND AND RE-CENTER THE HIGHEST VELOCITIES TOWARDS THE CENTER OF THE STREAM.
3. ROCKS ARE SIZED ACCORDING TO THE SHEAR FORCES EXERTED ON THEM AT EACH FLOW. ROCK SHALL BE ANGULAR WITH A SPECIFIC GRAVITY GREATER THAN 2.5.



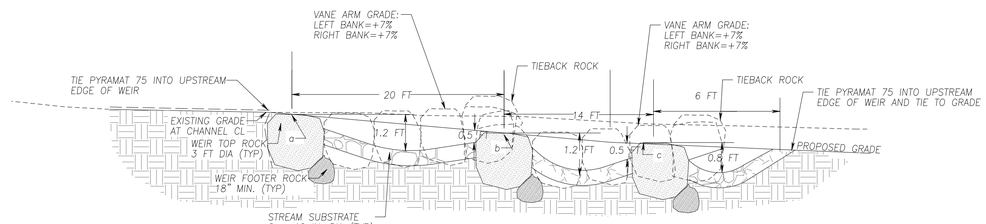
PT	#	NORTH	EAST	ELEV	DESC
A	371	1177326.5	348757.8	4892.6	weir start
B	372	1177314.2	348744.8	4891.8	weir start 2
C	380	1177302.9	348734.7	4891.0	weir step

1 PLAN VIEW: DOUBLE WEIR
(NOT TO SCALE)

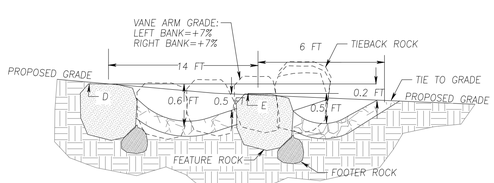


D 444 1177141.8 347983.7 4885.0 weir start

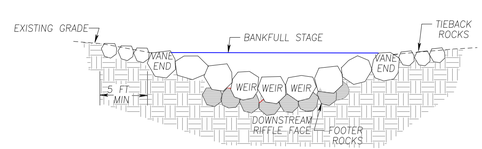
2 PLAN VIEW: SINGLE WEIR
(NOT TO SCALE)



3 PROFILE VIEW: DOUBLE WEIR
(NOT TO SCALE)



4 PROFILE VIEW: SINGLE WEIR
(NOT TO SCALE)



5 SECTION VIEW: WEIR FACE
(NOT TO SCALE)

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 811 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS IS NOT RESPONSIBLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

DATE: 15 DECEMBER 2017

SHEET NAME: DTL02

SHEET NUMBER: 8 OF 10

NCD PROJECT NUMBER: 17-283AZ

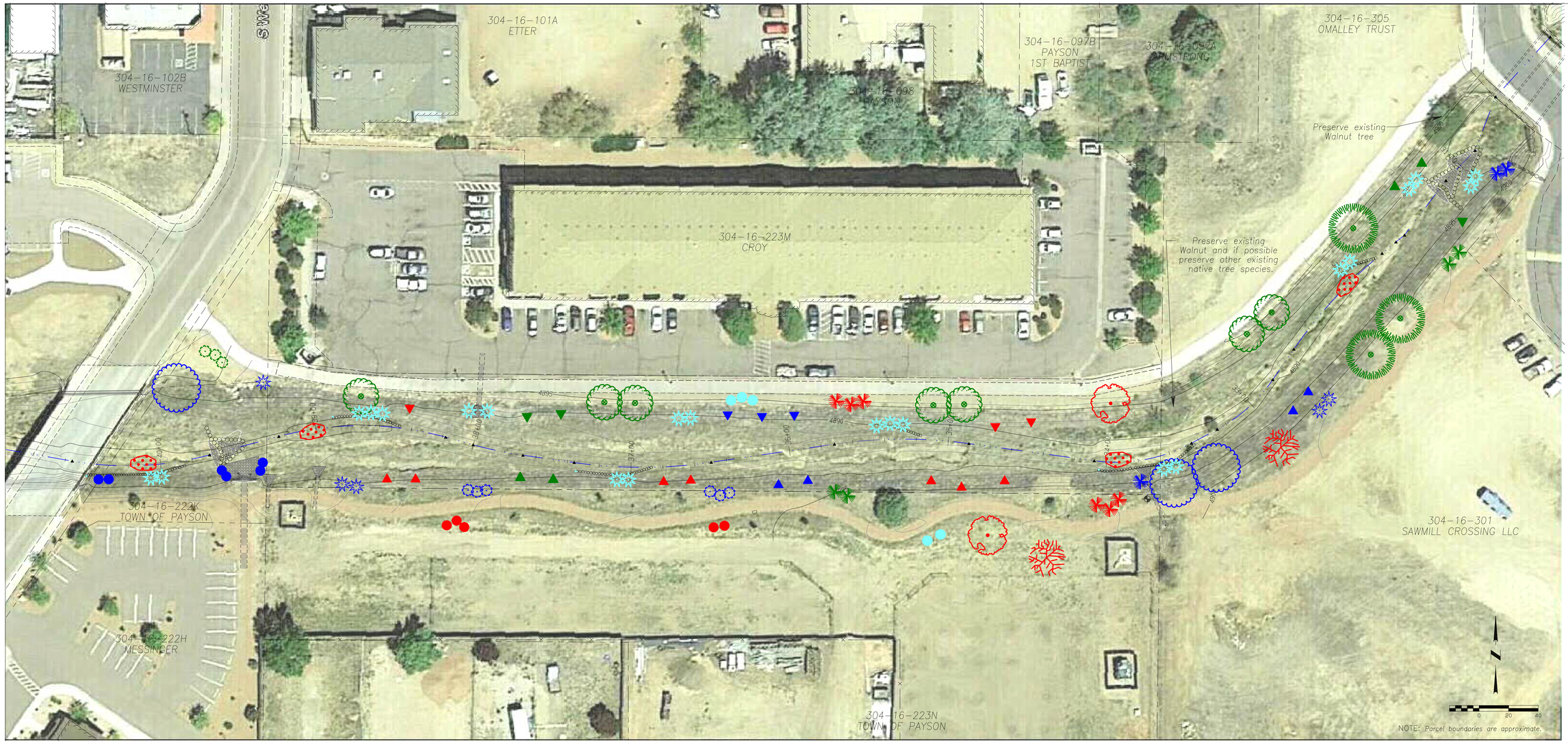
PRELIMINARY NOT FOR CONSTRUCTION 90% SUBMITTAL

DETAIL SHEET

CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
AMERICAN GULCH
TOWN OF PAYSON

DRAWN BY: CS, JF, MW			
DESIGNED BY: MK			
CHECKED BY:			
NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336



TREES

MINIMUM SIZE:
10 GAL. CONTAINER

- *Fremont Cottonwood*
- *Arizona Cypress*
- *Velvet Ash*
- *Emory Oak*
- *Alligator Juniper*

SHRUBS

MINIMUM SIZE:
3 GAL. CONTAINER

- *Fremont Mahonia*
- *Arroyo Willow*
- *False Indigobush*
- *Wright's Silktassel*
- *Stansbury Cliffrose*
- *Pointleaf Manzanita*
- *Alder-leaf Mountain Mahogany*
- *Redosier Dogwood*
- *Fernbush*
- *Rubber Rabbitbrush*

SMALL SHRUBS AND FORBS

MINIMUM SIZE: 1 GAL. CONTAINER

- *Fendler's Ceanothus (group of 3)*
- *Colorado Four O'Clock (group fo 3)*
- *Beargrass (group of 3)*

SEDGE/RUSH PLUGS

- *Sedge Plugs (group of 25)*

VEGETATION REMOVAL NOTE:

Native and non-native trees to be removed from existing channel bottom except as noted. Non-native trees and shrubs to be removed from existing channel sides and top terrace except as noted.

LOCATION NOTE:

Locations shown are approximate. Exact locations for planting shall be determined in the field with approval of NCD.

RIPARIAN AREA PLANTING LIST*

	TREES	
3	*Fremont Cottonwood (Populus fremontii)*	
7	*Velvet Ash (Fraxinus velutina)*	
2	*Emory Oak (Quercus emoryi)*	
2	*Alligator Juniper (Juniperus deppeana)*	
3	*Arizona Cypress (Cupressus arizonica)*	
		17 Total
	LARGE SHRUBS	
3	*False Indigobush (Amorpha fruticosa)*	
6	*Redosier Dogwood (Cornus sericea)*	
6	*Rubber Rabbitbrush (Ericameria nauseosa)*	
3	*Fernbush (Chamaebatiaria millefolium)*	
5	*Pointleaf Manzanita (Arctostaphylos pungens)*	
5	*Alder-leaf Mountain Mahogany (Cercocarpus montanus)*	
6	*Wright's Silktassel (Garrya wrightii)*	
4	*Stansbury Cliffrose (Fallugia paradoxa)*	
5	*Fremont's Mahonia (Berberis fremontii)*	
		43 Total
	SMALL SHRUBS & FORBS	
21	*Fendler's Ceanothus (Ceanothus fendleri)*	
30	*Colorado Four O'Clock (Mirabilis multiflora)*	
21	*Beargrass (Nolina microcarpa)*	
		72 Total
	SHRUB WILLOWS	
22	*Arroyo Willow (Salix lasiolepis)*	
		22 Total
	SEDGE/RUSH PLUGS	
100	*Mountain Rush (Juncus arcticus ssp. littoralis) preferred*	
	-or- Common Spikerush (Eleocharis palustris)	
		100 Total

* SPECIES NOTE:

If any plant species are unavailable, consult NCD for acceptable replacement prior to substitution.

Coyote Willow may NOT be substituted for Arroyo Willow.

GRASS AND FORB SEED

The entire site (including undisturbed slopes) is approximately 2 acres. The disturbed area along the channel bottom is approximately 1 acre. All disturbed areas shall be seeded with the specified native grasses and forbs (see below for details).

The undisturbed areas that are lacking in native vegetation shall be seeded with the specified native grass and forb seed mixes (see below), approximately 0.5 acres.

Seed must be spread evenly and if broadcast, the seed must be incorporated into the soil but not more than 0.5 inches.

There are three phases of seeding:

Phase 1: Following finish subgrade, but prior to placement of Pyramat, the disturbed area shall be seeded with Grass Mix 1 and Grass Mix 2 (approximately 1 acre). We recommend broadcast seeding by hand but seed does not need to be incorporated.

Phase 2: Following finish grade, after placement of Pyramat and layer of topsoil, the disturbed area shall be shall be seeded with Grass Mix 1, Grass Mix 2, and the Forb Mix (approximately 1 acre). Seed may be broadcast or hydroseeded. If broadcast, seed must be incorporated into the soil without disturbing the Pyramat or the overall depth of the added topsoil layer.

Phase 3: At the same time as Phase 2 or following completion of construction, the undisturbed areas shall be seeded with Grass Mix 1 and the Forb Mix (approx. 0.5 acre). Only the areas lacking in native vegetation, either bare, lightly vegetated or areas dominated by weedy annual species should be seeded. Seed should be broadcast by hand and incorporated into the soil.

Seed should be purchased from a reliable supplier to ensure that it is weed-free. Native grass and forb seed is sold as Pure Live Seed (PLS). If any of the grass or forb species are unavailable, consult NCD for suitable replacements.The recommended grass seed and forb mixes consists of the following species and rates:

Grass Mix 1

Native Grass Species (2.5 acres total):		*Seed Mix (lbs PLS/ac)*
Blue Grama	*(Bouteloua gracilis)*	*1.0*
Sideoats Grama	*(Bouteloua curtipendula)*	*2.0*
Purple Three-Awn	*(Aristida purpurea)*	*2.0*
Muttongrass	*(Poa fendleriana)*	*1.0*
Western Wheatgrass	*(Pascopyrum smithii)*	*3.0*
Prairie Junegrass	*(Koeleria macrantha)*	*0.5*
Squirreltail	*(Elymus elymoides)*	*1.5*
		11 lbs/ac

Grass Mix 2

Native Grass Species (2 acres total):		*Seed Mix (lbs PLS/ac)*
Deergrass	*(Muhlenbergia rigens)*	*2.0*
*Vine Mesquite ***	*(Panicum obtusum)*	*1.5*
		3.5 lbs/ac

Forb Mix

Native Forb Species (1.5 acres total):		*Seed Mix (lbs PLS/ac)*
Rocky Mountain Penstemon	*(Penstemon strictus)*	*0.25*
Blanketflower	*(Gaillardia sp.)*	*0.25*
Horsetail Milkweed	*(Asclepias subverticillata)*	*0.25*
Tufted Evening Primrose	*(Oenothera caespitosa)*	*0.25*
Globemallow	*(Sphaeralcea sp.)*	*0.25*
California Poppy	*(Eschscholzia californica ssp. mexicana)*	*0.25*
		3.0 lbs/ac

*** Vine Mesquite can be difficult to find. A possible source is Curtis & Curtis Seed out of Clovis, NM.*

PRELIMINARY
NOT FOR
CONSTRUCTION
90% SUBMITTAL

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS AND SPECIFICATIONS IS NOT RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS AND SPECIFICATIONS. ANY SUCH CHANGES MUST BE APPROVED IN WRITING BY THE PREPARER OF THESE PLANS.

DATE: **15 DECEMBER 2017**

NCD PROJECT NUMBER: **17-283AZ**

SHEET NAME: **VEG01**

SHEET NUMBER: **9** OF **10**

CALL ARIZONA BLUE STAKE
FOR LOCATION OF
BURIED UTILITIES
811

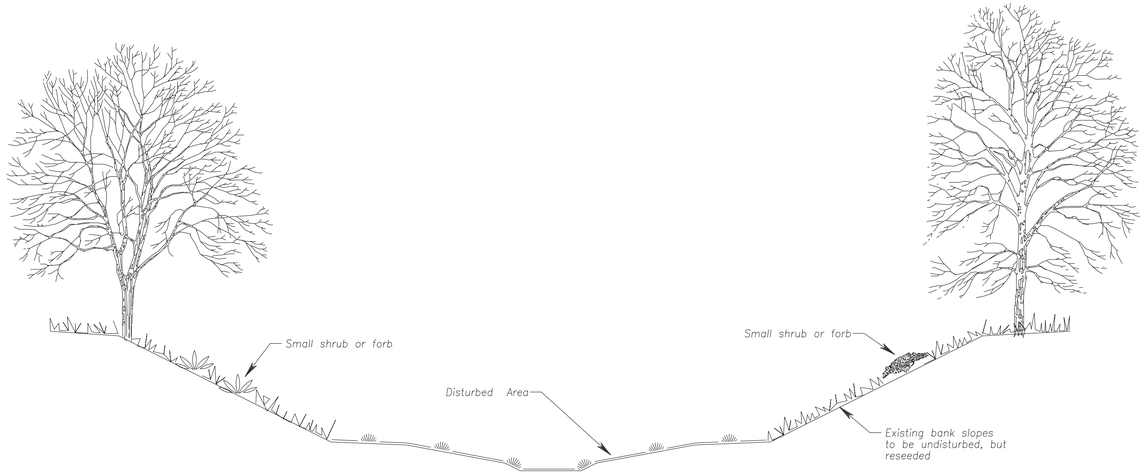
PLANTING PLAN VIEW

CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
AMERICAN GULCH
TOWN OF PAYSON

DRAWN BY: CS
DESIGNED BY: CS AH
CHECKED BY:

NO.	DATE:	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774-2336

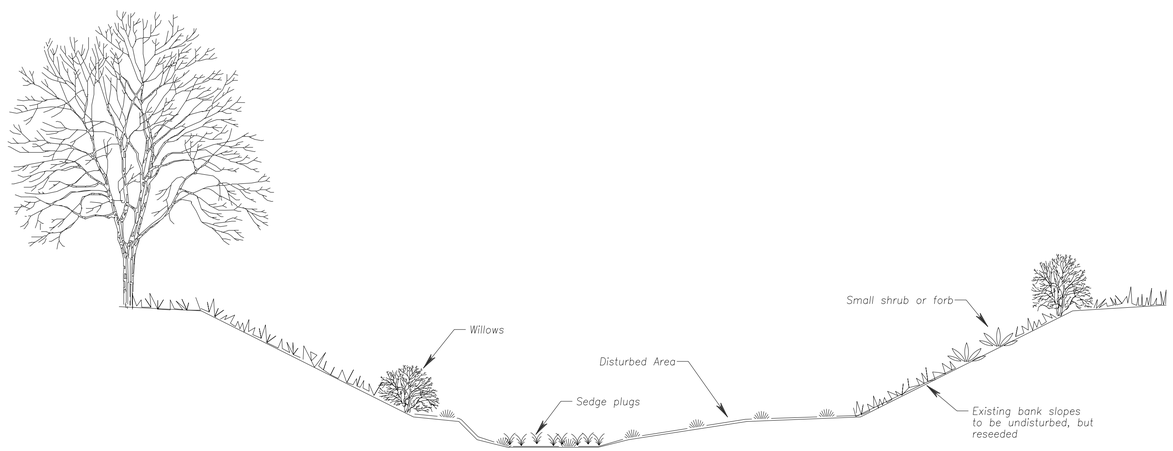


TYPICAL RIFFLE CROSS SECTION

NOT TO SCALE

NOTES:

- *In order to maintain channel capacity, there should be very little woody vegetation in the channel.*
- *No large woody vegetation, except willows, may be planted more than ~ 2 feet below top of bank.*
- *Small shrubs may be planted up to halfway down the bank.*
- *Disturbed areas shall be seeded with a mixture of native grasses and forbs.*



TYPICAL POOL CROSS SECTION

NOT TO SCALE

NOTES:

- *The majority of willows will be planted on the outside of the bend to protect bank from ersosion, near the end of the rock vanes. The willows should be planted near the bottom of the steep slope, just high enough to avoid interfering with the Pyramat.*
- *Sedge plugs shall be planted in bottom of some pools where water collects and is likely to persist for longer periods of time, per Planting Plan, Sheet 9.*
- *No other large woody vegetation should be planted more than ~2 feet below the top of bank.*
- *Small shrubs may be planted up to halfway down the bank.*
- *Disturbed areas shall be seeded with a mixture of native grasses and forbs.*

PLANTING NOTES:

IRRIGATION:

All containerized plants shall require temporary irrigation including willows and plugs for 3 years or until established. Irrigation installation is understood to be per Town of Payson.

SEDGE PLUGS:

With 2–3 advanced notice, sedge plugs can be grown out in a nursery. They can also be harvested in the wild from local sources. See below for details on harvesting sedge plugs. Plugs should be planted at 2 ft on center.

WILLOW PLANTS:

With 3–4 months advanced notice, willow poles can be collected from a local source and grown out at a nursery.

EXISTING SPECIES:

All Arizona Walnut trees shall be marked prior to construction and shall be preserved in place. Other native tree species shall be preserved if possible. Remove all non–native tree species, especially Tree of Heaven, from around the preserved trees.

INVASIVE SPECIES:

We recommend treating noxious and highly invasive species prior to start of construction. At a minimum we recommend treating Tree of Heaven (Ailanthus altissima) and Johnsongrass (Sorghum halepense) and any other species on the Arizona Noxious Species List. Much of the Johnsongrass will be removed during construction since it primarily grows in the channel bottom but some will remain on the undisturbed slopes.

HARVESTED WETLAND PLUGS: COLLECTION, HANDLING AND PLACEMENT

Wetland plugscollected from the wild, plugs should be harvested locally. Harvested plugs are readily transplanted because of their well developed root systems. Remaining plants at the harvest site will rapidly fill in the hole. Dig no more than 1 sq ft of plant material from a 4 sq ft area. It is not necessary to go deeper than 5 to 6 inches. This will provide enough root mass to ensure good establishment at the project site. It will also retain enough of the root system below the harvest point to allow the plants to grow back into the harvest hole.

Transplants can be harvested at almost any time of the year. The top growth may be cut to about 5 to 6 inches. If one sq ft of plant material is harvested, it is possible to cut the larger plug into 6 to 9 individual plant plugs. Cover the roots with water while in transit, do not allow plugs to dry out.

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 plant suppliers.

The plugs can be chopped quickly with a shovel or they can be cut with a small saw so they will fit easily into a predrilled, set diameter hole. Plugs should be planted at 2 ft on center. Tamp plugs into ground carefully.

CALL ARIZONA BLUE STAKE BEFORE YOU DIG 8-1-1

UNAUTHORIZED CHANGES & USES
THE ENGINEER PREPARING THESE PLANS WILL NOT BE RESPONSIBLE OR LIABLE FOR UNAUTHORIZED CHANGES TO OR USES OF THESE PLANS. ALL CHANGES MUST BE IN WRITING AND APPROVED BY THE ENGINEER OF RECORD PLANS.

DATE: **15 DECEMBER 2017**

SHEET NAME: **VEG02**

NCD PROJECT NUMBER: **17-283AZ**

SHEET NUMBER: **10** OF **10**

PRELIMINARY
NOT FOR
CONSTRUCTION
60% SUBMITTAL

PLANTING CROSS SECTIONS

AMERICAN GULCH
CHANNEL RESTORATION AND RIPARIAN ENHANCEMENT
TOWN OF PAYSON

DRAWN BY: CS
DESIGNED BY: CS AH
CHECKED BY:

NO.	DATE	BY	REVISION

Natural Channel Design, Inc.
2900 N West St. #5
Flagstaff, Arizona 86004
(928) 774–2336