23rd Navajo Nation Council

MEMORANDUM

To : Manuel Rico, Senior Programs and Projects Specialist
OFFICE OF LEGISLATIVE SERVICES

From : _____
Tom Platero, Executive Director
OFFICE OF LEGISLATIVE SERVICES

Date : January 9, 2019

Subject : ***23rd Navajo Nation Council Expired Legislation***

Pursuant to 2 N.N.C. § 164 (A) (1), "The last day for consideration of resolutions shall be December 31st of the year immediately preceding the swearing in of the new Council", the following legislation need to be closed out and labeled as "expired":

NAVAJO NATION COUNCIL:

0399-17	0424-17	0098-18	0136-18
0183-18	0224-18	0328-18	0344-18
0356-18	0358-18	0367-18	0373-18
0385-18	0393-18	0404-18	0416-18
0422-18			

NAABIK'IYATI' COMMITTEE:

0224-15	0361-16	0341-18	0406-18
0418-18	0427-18		

Post Office Box 3390 • Window Rock, AZ 86515 • Telephone (928) 871-6380 / 6381 / 6382 / 6383 / 6887 • Fax (928) 871-7259

BUDGET AND FINANCE COMMITTEE:

0021-17	0392-17	0099-18	0261-18
0287-18	0398-18	0435-18	0436-18

HEALTH, EDUCATION AND HUMAN SERVICES COMMITTEE:

0414-18	0419-18	0451-18

LAW AND ORDER COMMITTEE:

0114-17	0031-18	0217-18	0307-18
0353-18	0360-18	0364-18	0437-18

RESOURCES AND DEVELOPMENT COMMITTEE:

0402-15	0104-16	0121-16	0183-16
0282-16	0296-16	0370-16	0384-16
0135-17	0176-17	0386-17	0400-17
0076-18	0395-18	0415-18	0443-18

Legislation need to be closed out as soon as possible. If you have any questions, please let me know.

CONCURRENCE:

Honorable LoRenzo C. Bates, Speaker
23rd Navajo Nation Council

COPIES: Pete K. Atcitty, Chief of Staff, Office of the Speaker
Ed McCool, Acting Chief Legislative Counsel, Office of Legislative Counsel
Files

LEGISLATIVE SUMMARY SHEET

Tracking No. 0136-18

DATE: April 11, 2018

TITLE OF RESOLUTION: AN ACTION RELATING TO RESOURCES AND DEVELOPMENT COMMITTEE, BUDGET AND FINANCE COMMITTEE; NAABIK'ÍYÁTI' COMMITTEE AND THE NAVAJO NATION COUNCIL; APPROVING SUPPLEMENTAL FUNDING FROM THE UNRESERVED, UNDESIGNATED FUND BALANCE IN THE AMOUNT OF TWO MILLION EIGHTY THOUSAND TWO HUNDRED AND NINETY-SEVEN DOLLARS ($2,080,297.00) FOR THE CONSTRUCTION OF THE GREASEWOOD SPRINGS BRIDGE, NAVAJO ROUTE NO. N9003; WAIVING 12 N.N.C. §§ 820(I) AND 860(C) RELATING TO THE CAPITAL IMPROVEMENT PROCESS

PURPOSE: If approved, this resolution will approve supplemental funding in the amount of $2,080,297,000.00 from the Unreserved Undesignated Fund Balance for construction of the Greasewood Springs bridge, Navajo Route No. N9003 and will waive the Capital Improvement Process.

This written summary does not address recommended amendments as may be provided by the standing committees. The Office of Legislative Counsel requests each Council Delegate to review each proposed resolution in detail.

5-DAY BILL HOLD PERIOD: Waived
Website Posting Time/Date: 12:55pm 4/19/18
Posting End Date: 4/24/2018
Eligible for Action: 4/25/2018

Resources & Development Committee
THENCE
Budget & Finance Committee
THENCE
Naa'bik'íyáti' Committee
THENCE
Navajo Nation Council

PROPOSED NAVAJO NATION COUNCIL RESOLUTION

23rd NAVAJO NATION COUNCIL – Fourth Year, 2018

INTRODUCED BY

(Lee Jackson)

(Prime Sponsor)

TRACKING NO. 0136-18

AN ACTION

RELATING TO RESOURCES AND DEVELOPMENT COMMITTEE, BUDGET AND FINANCE COMMITTEE; NAABIK'ÍYÁTI' COMMITTEE AND THE NAVAJO NATION COUNCIL; APPROVING SUPPLEMENTAL FUNDING FROM THE UNRESERVED, UNDESIGNATED FUND BALANCE IN THE AMOUNT OF TWO MILLION EIGHTY THOUSAND TWO HUNDRED AND NINETY-SEVEN DOLLARS ($2,080,297.00) FOR THE CONSTRUCTION OF THE GREASEWOOD SPRINGS BRIDGE, NAVAJO ROUTE NO. N9003; WAIVING 12 N.N.C. §§ 820(I) AND 860(C) RELATING TO THE CAPITAL IMPROVEMENT PROCESS

BE IT ENACTED:

SECTION ONE. AUTHORITIES

A. The Navajo Nation established the Resources and Development Committee as a Navajo Nation Council standing committee and as such gave the Committee oversight over the Division of Transportation. 2 N.N.C. §§ 500 (A), 501 (C)(1).

B. The Navajo Nation established the Budget and Finance Committee as a Navajo Nation Council standing committee and as such empowered the Committee the authority to review and recommend to the Navajo Nation Council the management of all funds. 2 N.N.C. §§ 164 (A)(9), 300 (A), 301 (B)(2).

C. The Navajo Nation Council established the Naabik'íyáti' Committee as a Navajo Nation standing committee and as such proposed legislation that requires final action by the Navajo Nation Council shall be assigned to the Naabik'íyáti' Committee. 2 N.N.C. §§ 164 (A)(9), 700 (A).

SECTION TWO. TITLE 12 FINANCE ACT SUPPLEMENTAL APPROPRIATION PROCESS AND THE TITLE 12 CAPITAL IMPROVEMENT PROCESS

A. The Title 12 Finance Act Supplemental Appropriation requirements include:

1. Pursuant to 12 N.N.C. § 820(L), when the Controller identifies additional sources of revenues above and beyond the initial or current revenue projections, supplemental appropriations may be allocated by the Navajo Nation Council.
2. Pursuant to 12 N.N.C. § 820 (L), "Supplemental appropriations made from non-recurring revenues shall only be made for non-recurring operations or purposes, as set forth at § 820 (F). The Controller of the Navajo Nation shall be responsible for designating recurring and non-recurring revenues and purposes."
3. Pursuant to 12 N.N.C. § 820(M), all requests for annual operating funds and supplemental funds shall be submitted to the Office of Management and Budget ("OMB") for budget impact analysis.

B. The Title 12 Capital Improvement Process includes:

1. Pursuant to 12 N.N.C. § 810(F), "Capital Improvement" means a major project undertaken by the Navajo Nation that is generally not recurring on an annual basis and which fits within one or more of the following categories:
   (1) All projects requiring debt obligation or borrowing;
   (2) Any acquisition or lease of land;
   (3) Purchase of major equipment or vehicles, with a life expectancy of five years or more, valued in excess of an amount to be established by the Controller;

(4) Major building improvements that are not routine maintenance expenses and that substantially enhance the value or extend the useful life of a structure;

(5) Construction of new buildings or facilities including engineering, design, and other pre-construction costs with an estimated cost in excess of an amount to be determined by the Controller; and/or

(6) Major equipment or furnishing required to furnish new buildings or other projects, the cost of which is above a certain amount to be established by the Controller.

2. Pursuant to 12 N.N.C. § 820 (I), the "[d]evelopment of the Capital Budget shall be coordinated with development of the Operating Budget. All budget requests for capital improvements shall be in compliance with an adopted Capital Improvement Plan and shall not be approved unless in compliance with the Plan."

3. Pursuant to 12 N.N.C. § 820 (M), the Office of Management and Budget shall coordinate the overall preparation, adoption and implementation of both the annual operating and capital budgets of the Navajo Nation. All requests for annual operating funds and supplemental funds shall be submitted to the Office of Management and Budget for budget impact analysis and other appropriate action.

4. Pursuant to 2 N.N.C. § 501 (B)(4)(c), the Resources and Development Committee is to review and recommend to the Navajo Nation Council through the appropriate process supplemental appropriations to the capital improvement projects annual budget to fund necessary additional capital improvement projects.

5. Pursuant to 12 N.N.C. § 860 (C)(2) "[t]he appropriation portion of the Capital Improvement Plan is subject to approval of the Navajo Nation Council upon recommendation of the Budget and Finance Committee. Any modification or amendment affecting the approved Capital Improvement Plan is subject to

review and concurrence by the Resources and Development Committee prior to consideration by the Navajo Nation Council."

SECTION THREE. FINDINGS

A. This is a funding request for a supplemental appropriation from the Unreserved, Undesignated Fund Balance in the amount of $2,080,297.00. *See* **Exhibit A.**

B. The construction of the Greasewood Springs bridge, Navajo Route No. N9003, is not included in the Title 12 Capital Improvement Plan because the Capital Improvement Plan was rescinded by Navajo Nation Council by CAP-23-17.

C. Pursuant to Section XIV. B. of the 2018 Budget Instructions Manual, the supplemental funding request budget forms are attached hereto as **Exhibit A.**

D. The Office of the Controller has provided a memorandum dated March 7, 2018, indicating the balance in the Unreserved, Undesignated Fund Balance as of March 6, 2018, is $15,075,206.00. This memorandum is provided to meet the requirements of 12 N.N.C, 820 (L). The Controller of the Navajo Nation has designated the funds as non-recurring. This memorandum is attached as **Exhibit B.**

E. The Office of Management and Budget has provided a Budget Impact Analysis of the construction of the Greasewood Springs bridge, Navajo Route No. N9003, pursuant to 12 N.N.C. § 820(M) and is attached as **Exhibit C.**

F. The Navajo Nation finds it in the best interest of the Navajo people to approve this supplemental appropriation request and to waive the Capital Budget and Capital Improvement Plan requirements as stated in 12 N.N.C. §§ 820(I) and 860 (C) regarding the construction of the Greasewood Springs bridge, Navajo Route No. N9003.

SECTION FOUR. APPROVING SUPPLEMENTAL FUNDING FROM THE UNRESERVED, UNDESIGNATED FUND BALANCE IN THE AMOUNT OF $2,080,297.00 FOR THE CONSTRUCTION OF THE GREASEWOOD SPRINGS BRIDGE, NAVAJO ROUTE NO. N9003

A. This supplemental appropriation of $2,080,297.00 shall be from that amount of funds that exceeds the minimum fund balance of the Unreserved, Undesignated Fund Balance as determined by the Office of the Controller and to Business Unit Number NEW.

B. The Navajo Nation hereby approves the supplemental appropriation from the Unreserved, Undesignated Fund Balance to the Navajo Nation Division of Transportation for Business Unit NEW as stated in **Exhibit A**.

SECTION FIVE. WAIVING 12 N.N.C. §§ 820(I) AND 860 (C) REGARDING THE CAPITAL IMPROVEMENT PROCESS

The Navajo Nation Council hereby waives 12 N.N.C. §§ 820(I) and 860(C) with regard to the Capital Improvement process and the construction of the Greasewood Springs bridge, Navajo Route No. N9003. The waiver of 12 N.N.C. §§ 820(I) and 860(C) includes submittal of the Capital Project to the Capital Project Management Department for review, guidance and advice or the requirements pursuant to TCDCJY-77-99 regarding the Capital Improvement Projects Guidelines Policies and Procedures.

SECTION SIX. EFFECTIVE DATE

The provisions of this Act shall become effective in accord with 2 N.N.C. § 221(B).

Document No. 009061 1.3.2018 Date Issued: 11/

EXHIBIT A

SECTION 164 REVIEW FORM

+2,080,297
Approve $2,381,140 UUFB-N9003

Title of Document: Greasewood Contact Name: BEGAY, ARDANIEL JOE

Program/Division: DIVISION OF TRANSPORTATION

Email: abegay@navajodot.org Phone Number: 505-371-8351

Division Director Approval for 164A: 11/6/2017

Check document category; only submit to category reviewers. Each reviewer has a maximum 7 working days, except Business Regulatory Department which has 2 days, to review and determine whether the document(s) are sufficient or insufficient. If deemed insufficient, a memorandum explaining the insufficiency of the document(s) is required.

Section 164(A) Final approval rests with Legislative Standing Committee(s) or Council

				Sufficient	Insufficient
☐	**Statement of Policy or Positive Law:**				
	1. OAG:		Date:	☐	☐
☑	**IGA, Budget Resolutions, Budget Reallocations or amendments: (OMB and Controller sign ONLY if document expends or receives funds)**				
	1. OMB:	D Begay - See Memo	Date: 2-23-18	☑	☐
	2. OOC:	Robert Curtis - See Memo	Date: 3-7-18	☑	☐
	3. OAG:	[signature]	Date: 3/13/18	☑	☐

Section 164(B) Final approval rests with the President of the Navajo Nation

☐	**Grant/Funding Agreement or amendment:**				
	1. Division:		Date:	☐	☐
	2. OMB:		Date:	☐	☐
	3. OOC:		Date:	☐	☐
	4. OAG:		Date:	☐	☐
☐	**Subcontract/Contract expending or receiving funds or amendment:**				
	1. Division:		Date:	☐	☐
	2. BRD:		Date:	☐	☐
	3. OMB:		Date:	☐	☐
	4. OOC:		Date:	☐	☐
	5. OAG:		Date:	☐	☐
☐	**Letter of Assurance/M.O.A./M.O.U./Other agreement not expending funds or amendment:**				
	1. Division:		Date:	☐	☐
	2. OAG:		Date:	☐	☐
☐	**M.O.A. or Letter of Assurance expending or receiving funds or amendment:**				
	1. Division:		Date:	☐	☐
	2. OMB:		Date:	☐	☐
	3. OOC:		Date:	☐	☐
	4. OAG:		Date:	☐	☐

NAVAJO NATION DEPARTMENT OF JUSTICE

☐ RESUBMITTAL

DOCUMENT REVIEW REQUEST FORM

RECEIVED
MAR 12 2018
DEPARTMENT OF JUSTICE
RECEPTIONIST DESK

DOJ
03-12-18 @ 306pm
DATE / TIME
☑ 7 Day Deadline
DOC # 009061
SAS #:
UNIT: NRU

*** FOR NNDOJ USE ONLY - DO NOT CHANGE OR REVISE FORM. VARIATIONS OF THIS FORM WILL NOT BE ACCEPTED. ***

CLIENT TO COMPLETE

DATE OF REQUEST:	11/2/2017	DIVISION:	Transportation
CONTACT NAME:	Arlando Teller	DEPARTMENT:	Executive
PHONE NUMBER:	505-371-8350	E-MAIL:	ateller@navajodot.org

TITLE OF DOCUMENT: 164(A) Review #9061 - Approve funding in the amount of ~~$2,381,140~~ +2,060,297- from the Unreserved, Undesignated Fund Balance for the Navajo Route N9003 Bridge project in the Lower Greasewood Chapter.

1-3-and

DOJ SECRETARY TO COMPLETE

DATE/TIME IN UNIT: 3.12.18 3:31p

REVIEWING ATTORNEY/ADVOCATE: Veronica Blackhat 3-21-18

DATE TIME OUT OF UNIT: 3·13·18 4:31p

DOJ ATTORNEY / ADVOCATE COMMENTS

Sufficient

REVIEWED BY: (*Print*)	Date / Time	SURNAMED BY: (*Print*)	Date / Time
		VBlackhat	3/13/18 3:53pm

DOJ Secretary ~~Called~~ Emailed: Arlando Teller for Document Pick Up on 3·13·18 at 4:15p By: RJ

PICKED UP BY: (*Print*) DATE / TIME:

NNDOJ/DRRF-July 2013

No Answer)

RECEIVED
MAR 2018
NR... T
C... ...LECTION

COMPLETED

THE NAVAJO NATION
SUPPLEMENTAL FUNDING PROPOSAL SUMMARY

PART I. **Business Unit No.:** New BU# **Program Title:** N9003 Greasewood

Division/Branch: of Transportation **Amount Requested:** $2,080,297 **Phone No.:** 505-371-8300

Prepared By: Edith Morgan, Sr. Accountant **Email Address:** emorgan@navajodot.org

PART II. REASON FOR REQUEST AND STATEMENT OF NEED:

20"wide dirt roadway provides connection across Pueblo colorado Wash in the Lower Greasewood Chapter. The route is designated as a school bus route and serves Greasewood Springs Schools. During rain run off events the route become impassable due to deep, swift flows in the wash. School buses and emergency vehicles must wait until flows have subsides or they must reroute to the north and cross the wash at Cornfields. It is proposed that a bridge be built across the wash to provide an all weather crossing. Slope protection will be required to protect against scour and erosion at the upstream and downstream sides of the crossing.

PART III. CONTINGENCY PLAN IF REQUEST IS NOT FUNDED:

The chapter will continue to seek funds from all viable sources to meet the needs of its community.

PART IV. ALTERNATIVE FUNDING SOURCES BEING PURSUED:

FET funds will be used for Design & Planning @ $208,000

PART V. AFFIRMATION IS PROVIDED THAT THE PROPOSAL INFORMATION IS COMPLETE AND ACCURATE AND THE APPROPRIATE BRANCH CHIEF RECOMMENDS APPROVAL.

12/15/17

Garret Silversmith, Division Director

REVIEWED BY: Division Director's Signature / Date

12/20/17

Clara Pratte, Chief of Staff

RECOMMEND APPROVAL: Branch Chief's Signature / Date

3

THE NAVAJO NATION
PROJECT BUDGET SUMMARY

PROJECT FORM 1

PART I. Business Unit No.: **NE BU#** Project Title: **N9003 Greasewood Springs Bridge**

Division/Branch: Navajo DOT Chapter: Greasewood Springs Agency: Ft. Defiance

Prepared By: Melissa Peshlakai, Office Specialist Phone No.: 505-371-8318

PART II. Check one: XX Original ____ Revision ____ Reallocation ____ Modification

Project Funds/Source(s)	Appropriation End Date	Amount	% of Total
Undesignated, Unreserved Fund Balance	FY 2018	2,080,297.00	100%
	TOTAL:	2,080,297.00	100%

PART III. Budget at LOD 4	Amount
9000 - Capital Outlay	2,080,297.00
TOTAL	2,080,297.00

PART IV. Project Information

Project Type: **Bridge**

Planned Start Date: 1/1/2018

Planned End Date: 9/30/2020

Project Manager: Joseph Peterman, Department Manager 1

FOR OMB USE ONLY

Resolution No.:

FMIS Set Up Date:

Company No.:

OMB Analyst:

PART V. ACKNOWLEDGEMENT:

I HEREBY ACKNOWLEDGE THAT THE INFORMATION CONTAINED ON THIS FORM IS COMPLETE AND ACCURATE.

Arlando Teller, Deputy Director 2/15/18
SUBMITTED BY: Dept. Director Signature / Date

Garret Silversmith, Division Director 2/15/18
VERIFIED BY: Div. Director Signature / Date

THE NAVAJO NATION
PROJECT PROCESS SCHEDULE

PART I. Business Unit No.: **New BU#** Project Title: **N9003 Greasewood Springs Bridge**

Project Description: Plan, Design & Construct Bridge on N9003 Greasewood Springs Bridge

PART II. Project Task List: such as Plan, Design, Construct, Equip or Furnish.

PART III. Use Fiscal Year (FY) Quarters to complete the information below. O = Oct.; N = Nov.; D = Dec., etc.

Project Task List	FY 2018												FY 2019												Expected Completion Date if exceeds 8 FY Qtrs.
	1st Qtr.			2nd Qtr.			3rd Qtr.			4th Qtr.			1st Qtr.			2nd Qtr.			3rd Qtr.			4th Qtr.			Date 9/30/2020
	O	N	D	J	F	M	A	M	J	Jul	A	S	O	N	D	J	F	M	A	M	J	Jul	A	S	
Project consultant selection							X																		
Plan & Design of Bridge complete														X											
Selection of project contractor process, advertise, selection, 164 review process															X →										
Bridge Construction State																			X						
Bridge Construction Complete																									X

PART IV.	$	$	$	$	$	$	$	$	PROJECT TOTAL
Expected Quarterly Expenditures			0.00	0.00	0.00	0.00	1,040,148.00	1,040,149.00	$2,080,297.00

PART I. Business Unit No. **New BU#**

Project Title: **N9003 GREASEWOOD SPRINGS BRIDGE**

PART II.

(A) Fund Source Code	(B) Object Code (LOD 4)	(C) Object Code (LOD 6)	(D) Object Code Description (LOD 7) & Justification		(E) Budget TOTAL
1	**0004**	**9020**	**INFRASTRUCTURE**		
			9028 - BRIDGE		**2,080,297.00**
			Remore Concrete Barrier - QTY: 110 LF @10.00	1,100.00	
			Aggregate Base - QTY: 402 CY @ $50.00	20,000.00	
			AC Payment - QTY: 600 TON @ $100.00	60,000.00	
			Bridge - QTY: 13160 SY @ $110.00	1,447,600.00	
			Riprap (Gabions) - QTY: 530 CY @ $175.00	92,750.00	
			Guardrail - QTY: 540 LF @ $25.00	13,500.00	
			Guardrail end term - QTY: 4 ea @ $4,000.00	16,000.00	
			Contingency @ 20%	330,190.00	
			Navajo Tax @ 5%	99,057.00	
				2,080,297.00	
				PAGE TOTAL:	**$2,080,297.00**

NAVAJO D.O.T.

Navajo Division of Transportation
Project Description

Route: N9003

Location: Greasewood

Chapter: Lower Greasewood

County: Navajo

Business Unit Number:

Programmed Amount: Design - FET (FY17) $208,000 (proposed)

Length: 0.3 miles

Roadway Width: 20'

Average Daily Traffic: 194

ADT Year: 2014

Functional Classification: 4

Surface Type: 2

School Bus Route: Yes

Maintained By: NDOT

Ownership: BIA

Type of Project: PCCP Low Water Crossing, Gabions

Expected Construction Date: Spring 2017

Estimated Construction Duration: 3 mos.

Purpose and Need:

The 20' wide dirt roadway provides connection across Pueblo Colorado Wash in the Lower Greasewood Chapter. The route is designated as a school bus route and serves Greasewood Springs Schools. During rain runoff events the route becomes impassable due to deep, swift flows in the wash. School buses and emergency vehicles must wait until flows have subsided or they must reroute to the north and cross the wash at Cornfields.

Scope of Work:

It is proposed that a bridge be built across the wash to provide an all weather crossing. Slope protection will be required to protect against scour and erosion at the upstream and downstream sides of the crossing.

Estimated Cost:

ITEM	DESCRIPTION	QUAN	UNIT	UNIT PRICE	AMOUNT
1	Remove Conc Barrier	110	LF	$10	$1,100
2	Aggregate base	400	CY	$50	$20,000
3	AC Pavement	600	TON	$100	$60,000
4	Bridge	13,160	SY	$110	$1,447,600
5	Riprap (Gabions)	530	CY	$175	$92,750
6	Guardrail	540	LF	$25	$13,500
7	Guardrail end term	4	EA	$4,000	$16,000
				Subtotal	*$1,650,950*
				Contingency (20%)	$330,190
				Subtotal	*$1,981,140*
				Navajo Tax (5%)	$99,057
				Total Estimated Project Cost	**$2,080,297**

It is estimated that the design will be 10% of the construction cost. The design is estimated to be $208,000.

December 13, 2017

THE NAVAJO NATION

RUSSELL BEGAYE
JONATHAN NEZ VICE-PRESIDENT

EXHIBIT B tabbies

Memorandum:

To: 2 NNC § 164 Reviewers

Delegates & 2 NNC '164 Reviewers
Navajo Nation Government

From: Robert Willie, Accounting Manager
Office of the Controller

Date: March 7, 2018

Subject: 164 Review-009061-Approve $2,080,297 UUFB-N9003 Greasewood

The Office of the Controller has reviewed the above referenced document.

1. The balance of the UUFB is $15,075,206 as of March 6, 2018; there are a number of other supplemental requests that will be considered by the Navajo Nation Council in the near future. This supplemental request is for $2,080,297 for the Greasewood Springs Bridge Constuction, Navajo Route No. N9003.
2. The costs for this project we determined are NON-RECURRING costs.
3. Important Note: Our office is currently monitoring the Nation's actual minerals revenue to-date versus the projected revenues for FY 2018. Additionally, our office has started the revenue projection task for the upcoming 2019 operating budgets. Being that minerals revenue levels are decreasing, we recommend the Nation spend the UUFB in a prudent and conservative manner for these reasons The Navajo Nation actual minerals revenue to date vs. the projection for FY 2018 is a real concern going forward as well as for the upcoming Fiscal 2019 therefore is this type of spending prudent as there may be possible shortfall in revenue in the near future which would affect the UUFB.

If you should have any questions you can contact me at tribal extension X6125.

THE NAVAJO NATION

RUSSELL BEGAYE
JONATHAN NEZ VICE PRESIDENT

EXHIBIT tabbies C

MEMORANDUM

TO : Executive Order/164 Reviewers

FROM :
Dominic Beyal, Executive Director
Office of Management and Budget

DATE : February 23, 2018

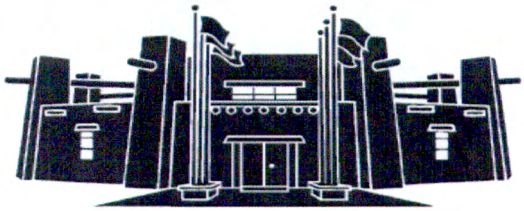
SUBJECT : **164 Review Document No. 009061**: UUFB Funding Request in the amount of $2,080,297 for the Navajo Division of Transportation to fund the Greasewood Springs Bridge Construction, Navajo Route no. N9003.

Pursuant to Executive Order No. 07-2013, the Office of Management and Budget (OMB) reviewed the proposed document and provides the following:

1. The 164 review document was initially submitted to OMB on November 9, 2017. The document was retrieved by NDOT on November 16, 2017 and resubmitted to OMB on January 4, 2018. There is no information provided by NDOT explaining why it was retrieved and resubmitted using the same 164 review number. OMB noted the amount changed from $2,381,140 (Nov) to $2,080,297 (Jan) on the 164 review sheet. The budget has remained at $2,080,297.
2. OMB worked with NDOT to correct the project budget forms. The corrected budget is dated 2/15/18.
3. The source of funds is the Undesignated, Unreserved Fund Balance (UUFB). According to the Controller, the UUFB is approximately $27.7 million as of February 14, 2018. During the recent NNC special session on February 15-16, 2018, the NNC appropriated $17.9 million from the UUFB resulting in a new UUFB balance of $9.7 million, contingent upon the President's action. The requests from the UUFB has grown over $60 million.
4. The Navajo Nation approved the Fiscal Year 2018 budget legislation, CS-53-17, and directed the Branch Chiefs of the Executive, Legislative and Judicial Branches to prioritize the unmet needs of their respective branches and to prepare appropriate budgets for such prioritized needs for potential consideration of supplemental appropriations in Fiscal Year 2018 in accordance with 12 NNC Section 820 (L). Only the Judicial Branch has done so with the prioritized list attached as Exhibit L to the budget legislation. Therefore, the question is: is this a top priority? Should it be considered ahead of the other needs?
5. By resolution CJA-03-18, the Sihasin Fund was amended to expand the purpose of the Sihasin Fund to include other infrastructure development such as transportation, etc. Hence, this project is eligible for funding from the Sihasin Fund.
6. The budget document is sufficient.

Contact D.Sam, Senior Budget Analyst, at (928) 871-6470 if there are any questions and/or concerns regarding this memorandum.

Office of Legislative Counsel
Telephone: (928) 871-7166
Fax # (928) 871-7576



Honorable LoRenzo Bates
Speaker
23rd Navajo Nation Council

M E M O R A N D U M

TO: Honorable Lee Jack, Sr.
23rd Navajo Nation Council Delegate

FROM: _____
Candace French, Attorney
Office of Legislative Counsel

THRU: _____
Levon B. Henry, Chief Legislative Council
Office of Legislative Counsel

DATE: April 11, 2018

RE: AN ACTION RELATING TO RESOURCES AND DEVELOPMENT COMMITTEE, BUDGET AND FINANCE COMMITTEE; NAABIK'ÍYÁTI' COMMITTEE AND THE NAVAJO NATION COUNCIL; APPROVING SUPPLEMENTAL FUNDING FROM THE UNRESERVED, UNDESIGNATED FUND BALANCE IN THE AMOUNT OF TWO MILLION EIGHTY THOUSAND TWO HUNDRED AND NINETY-SEVEN DOLLARS ($2,080,297.00) FOR THE CONSTRUCTION OF THE GREASEWOOD SPRINGS BRIDGE, NAVAJO ROUTE NO. N9003; WAIVING 12 N.N.C. §§ 820(I) AND 860(C) RELATING TO THE CAPITAL IMPROVEMENT PROCESS

Per your request, attached is the above-reference proposed resolution and associated legislative summary sheet. Based on existing law and the documents submitted to our office, the resolution as drafted is legally sufficient. However, as with all legislation, the proposed resolution is subject to review by the courts in the event of a challenge.

The Office of Legislative Counsel recommends the appropriate standing committee(s) reviews based on the standing committees powers outlined in 2 N.N.C. §§ 301, 401, 501, 601, and 701. Nevertheless, "the Speaker of the Navajo Nation Council shall introduce [the proposed resolution] into the legislative process by assigning it to the respective oversight committee(s) of the Navajo Nation Council having authority over the matters for proper consideration. 2 N.N.C. § 164(A)(5).

Please review the proposed resolution to ensure it is drafted to your satisfaction. If you approve, please sign as "Primary Sponsor" and submit it to the Office of Legislative Services where the proposed resolution will be given a tracking number and referred to the Office of the Speaker. If the proposed legislation is unacceptable to you, please contact me at the Office of Legislative Counsel and advise me of the changes you would like to make to the proposed resolution.

THE NAVAJO NATION
LEGISLATIVE BRANCH
INTERNET PUBLIC REVIEW PUBLICATION

LEGISLATION NO: _0136-18_____ **SPONSOR:** Lee Jack, Sr.

TITLE: An Action Relating to Resources and Development Committee, Budget and Finance Committee; Naabik'iyati' Committee and the Navajo Nation Council; Approving Supplemental Funding from the Unreserved, Undesignated Fund Balance in the amount of two million eighty thousand two hundred and ninety-seven dollars ($2,080,297.00) for the construction of the Greasewood Springs Bridge, Navajo Route No. N9003; waiving 2 N.N.C. §§ 820(I) and 860(C) relating to the capital improvement process

***Date posted*: April 19, 2018 at 12:55pm**

Digital comments may be e-mailed to comments@navajo-nsn.gov

Written comments may be mailed to:

Executive Director
Office of Legislative Services
P.O. Box 3390
Window Rock, AZ 86515
(928) 871-7590

Comments may be made in the form of chapter resolutions, letters, position papers, etc. Please include your name, position title, address for written comments; a valid e-mail address is required. Anonymous comments will not be included in the Legislation packet.

THE NAVAJO NATION
LEGISLATIVE BRANCH
INTERNET PUBLIC REVIEW SUMMARY

LEGISLATION NO.: 0136-18

SPONSOR: Honorable Lee Jack Sr.

TITLE: An Action Relating To Resources and Development Committee, Budget and Finance Committee; Naabik'iyati' Committee and the Navajo Nation Council; Approving Supplemental Funding from the Unreserved, Undesignated Fund Balance in the amount of two million eighty thousand two hundred and ninety-seven dollars ($2,080,297.00) for the construction of the Greasewood Springs Bridge, Navajo Route No. N9003; waiving 2 N.N.C. §§ 820(I) and 860(C) relating to the capital improvement process

Posted: April 19, 2018 at 12:55pm

5 DAY Comment Period Ended: April 24, 2018

Digital Comments received:

Comments Supporting	***None***
Comments Opposing	***None***
Inconclusive Comments	***None***

Legislative Secretary II
Office of Legislative Services

4/25/2018 8:32am
Date/Time

RESOURCES AND DEVELOPMENT COMMITTEE
23rd NAVAJO NATION COUNCIL

FOURTH YEAR 2018

COMMITTEE REPORT

Mr. Speaker,

The **RESOURCES AND DEVELOPMENT COMMITTEE** to whom has been assigned:

Legislation # 0136-18:: An Action Relating to Resources and Development, Budget and Finance Committee; Naabik'Iyati Committee and the Navajo Nation Council; Approving Supplemental Fund from the Unreserved, Undesignated Fund Balance in the Amount of Two Million Eight Thousand Two Hundred and Ninety-Seven Dollars ($2,080,297.00) for the Construction of the Greasewood Springs Bridge, Navajo Route No. N9003; Waiving 2 N.N.C. §§ 820 (I) and 860 (C) Relating to the Capital Improvement Process. *Sponsor: Honorable Lee Jack, Sr.*

Has had it under consideration and reports TABLED with the following amendments

f. Paragraph 4 of 5, New Paragraph F.

F. Petition to Legislation 136-18 for the construction of the Greasewood Springs Bridge, Navajo Route No. N9003, Greasewood Springs, Arizona attached as **Exhibit D**, supports the funding and construction of the bridge.

Re-letter the remaining paragraphs of SECTION THREE. FINDINGS.

And thereafter referred the matter to Budget and Finance Committee.

Respectfully submitted,

Alton Joe Shepherd, Chairperson
Resource and Development Committee of
the 23rd Navajo Nation Council

Date: May 2, 2018
Meeting Location: Navajo Nation Council Chamber
Window Rock, Arizona

MAIN MOTION: Davis Filfred S: Leonard Pete V:
ROLL CALL VOTE TALLY:
YEAS:
NAYS:
EXCUSED: Walter Phelps

AMENDMENT # 1:
MOTION: Davis Filfred S: Leonard Pete V: 4-0-1 (CNV)
ROLL CALL VOTE TALLY:
YEAS: Benjamin Bennett, Davis Filfred, Leonard Pete and Jonathan Perry
NAYS:
EXCUSED: Walter Phelps

MOTION TO TABLE:
MOTION: Leonard Pete S: Benjamin Bennett V: 4-0-1 (CNV)
ROLL CALL VOTE TALLY:
YEAS: Benjamin Bennett, Davis Filfred, Leonard Pete and Jonathan Perry
NAYS: NONE
EXCUSED: Walter Phelps

EXHIBIT "D"

Petition to support Legislation 136-18 for the construction of the Greasewood Springs Bridge, Navajo Route No. N9003, Greasewood Springs, AZ

Petition summary and background	The Greasewood Springs, Navajo Route No. N9003 is a designated bus route and serves the Greasewood Springs School. During rain run off events, the route becomes impassable due to deep, swift flow in the wash. School bus and emergency vehicles must wait until flow subsides or they must reroute to the North and cross the wash at Cornfields. It is proposed to build a bridge to provide an all-weather crossing. Legislation 136-18 is a resolution to request funding for construction from the Undesignated Unreserved Fund Balance in the amount of $2,080,297.00.
Action petitioned for	We, the undersigned, are citizens who support Legislation No. 136-18 and support the construction of a bridge on Navajo Route No. N9003, Greasewood Springs, AZ.

Printed Name	Signature	Address	Comment	Date
Sophia Hill	Sophia Hill	HC58Box 70 unit 179, Ganado AZ 86505		4/27/18
Dianna Hill	Dianna Hill	HC58 Box 70 unit 179, Ganado AZ 86505		4/27/18
Ethel C. Hill	Ethel C. Hill	HC58 Box 70 unit 179, Ganado AZ 86505		4/27/18
Maggie R Sangster	Maggie R Sangster	P.O. Box 3616 Indian Wells AZ. 86031		4/27/18
David C. Sangster Sr.	David C. Sangster Sr.	P.O. Box 3616 Indian Wells, AZ. 86031		4.27.18
Scendra Sangster	Scendra Sangster	Box 3540, Chinle, AZ 86503		4/27/18
Tommy Clark	Tommy Clark	Hc58 Box-137 Ganado Az 86505		4/27/18
Dennis Hill Jr	Dennis Hill Jr	Hc 58 Box 70 Unit 179		4/27/18
Dorton Hill	Dorton Hill	Hc 58 Box 70 unit 179		4/27/18
Emerson Joe	Emerson Joe	HC58 Box 20 Ganado AZ		4/27/18

Printed Name	Signature	Address	Comment	Date
Kee John Joe	Kee John Joe	HC58 Box 70 Ganado Az 86505		4-27-18
Geraldine M. Yazzie	Geraldine M. Yazzie	28 N. Highway 77 PMB 5123		4-27-18
Samuel Begay	Samuel Begay	28 N. Highway 77 PMB 5123		4-27-18
Clarissa Yazzie	Clarissa Yazzie	HC58 Box 70 Unit 238 Ganado Az 86505		4-27-18
Sequoia Begay	Sequoia Begay	HC58 Box 70 Unit 238 Ganado Az 86505		4-27-18
Lula M. Joe	Lula M. Joe	HC 58 Box 70 unit 173 Ganado. AZ 86505		4-27-18
Leonard Joe	Leonard Joe	HC 58 Box 70 unit 173 Ganado, AZ. 86505		4-27-18
Kevin Gore		P.O. Box 1 Ganado AZ 86505		4/27/18
William Claw	William Claw	HC 117 Box 90 Ganado AZ 86505		4/27/18
Mary Jane Begay	Mary Jane Begay	HC 58 Box 70 Ganado, AZ 86505		4/27/18
Betty Thomas	Betty Thomas	HC58 Box 70 unit 280 Ganado, Az 86505		4/27/18
Leroy Thomas	Leroy Thomas	HC 58 Box 70 Unit 280 Ganado Az 86505		4/27/18
Iris Mike	Iris Mike	HC 58 Box 70 #164 Ganado, AZ 86505		4/27/18
Vincent Mike	Vincent Mike	HC 58 Box 70 #164 Ganado, Az 86505		4/27/18
Daisy Thompson	Daisy Thompson	HC 58 Box 70 #164 Ganado, AZ 86505		4/27/18
Tyron Thompson	Tyron Thompson	HC 58 Box 70 #164 Ganado, Az 86505		4/27/18

Printed Name	Signature	Address	Comment	Date
Evelyn R Begay	Evelyn R Begay	HC58 Box 70 Ganado, AZ 86505		4-27-18
BEN Begay	Ben Begay	HC58 Box 70 Ganado AZ 86505		4-27-18
HELEN BEGAY	Helen Begay	HC58 Box 70 # 119 Ganado, Ariz		4-27-18
LEA J. BEGAY	Lea J. Begay	" "		4-27-18
Christine Shorty	Christine Shorty	HC58 Box 127. Ganado, Ariz		4-27-18
Larry Brown	Larry Brown	P.O. Box 1322 Ganado, Az 86505		4-27-18
Phyllisicita Brown	Phyllisicita Brown	P. Box 1322 Ganado, Az 86505		4-27-18
Ben Begay	Ben Begay	HC58 Box 70 # 222 Ganado. Az 86505		4-27-18
GILBERT YAZZIE		HC58 Box 70 Unit 138 GANADO, Az. 86505		4-27-18
Nathan Yazzie	Nathan	HC58 Box 70 Unit 138 Ganado Az. 86505		4-27-18
Cynthia A. Yazzie	Cynthia A. Yazzie	HC58 Box 70 UNIT 138 GANADO, Az. 86505		4-27-18
Sean Begaye	Sean Begaye	HC 58 Box 70 Unit #123 Ganado, AZ 86505		4-30-18
Minnie K. Mike	Minnie K. Mike	HC58 Box 70 unit-174 Ganado, Az		4-30-18
ALTHEA MIKE		HC58 Box 70 Ganado Az		4-30-18
Mary L Day	MARY L. Day	HC58 Box 70 Ganado Az		4-30-18
Ethel Leman	Ethel Leman	" " "		4-30-18

Printed Name	Signature	Address	Comment	Date
Shirley Adakai	Shirley Adakai	HC 58 Box 70 Unit 277 Ganado Az 86505	We really need this.	4/30/18
Stanley Clark	Stanley Clark	HC 58 Box 70 Unit 277 Ganado, Az 86505	" " "	4-30-18
Joe K. Begay	Joe K. Begay	Box # 1281 Ganado	" " "	4-30-18
Rose M. Begay	Rose M. Begay	P.O. Box 1281 Ganado, Az 86505	We really need it support you also.	4-30-18
Alberta Lee	Alberta Lee	HC58 Box 70 #254 Ganado Az 86505	" " "	4-30-18
Stella B Yazzie	Stella B Yazzie	HC58 Box 70 #163 Ganado Az 86505	" " "	4-30-18
Grace Yazzie	Grace Yazzie	HC58 Box 70 #163 Ganado, Az 86505	Support of Bridge	4-30-18
Marie Humeyumptewa	Marie Humeyumptewa	P.O Box 4053 Tuba City 86045	We really need that	4-30-18
Leandra Woodty	Leandra Woodty	HC 58 Box 70 #235 Ganado, Az 86505	Need a bridge somewhere.	4/30/18
Barbara Begay yazzie	Barbara Begayazzie	#225 HC58 Box 70 Ganado Az		4-30-18
Billy J. Yazzie	Billy J. Yazzie	HC 58 Box 70 Ganado, AZ 86505	Support of Bridge	5-1-18
Rhiannon Gishey		PO Box 375 Holbrook AZ 86025		5/01/18
Leland Duffy	Leland Duffy	HC58 Box 70 Unit 159 Ganado Az 86505	Support of Bridge	5/1/18
Bill Spencer	Bill Spencer	Box 1260 Ganado Az 86505	Approve Please No Delays.	5/01/18
Julius Yazzie	Julius Yazzie	HC 58 Box 70 unit 143	Support of Bridge	5/01/18
Cassius Tsosie	Cassius Tsosie	PO Box 414 Window Rock 86515	BUILD IT.	5/1/2018

Printed Name	Signature	Address	Comment	Date
Grayson Greymountain	Grayson Greymountain	P.O. Box 3565 Fountain Hills, AZ 85037	Build a good bridge	5-1-18

RESOURCES AND DEVELOPMENT COMIMTTEE
Regular Meeting
May 2, 2018

ROLL CALL
VOTE TALLY SHEET:

Legislation # 0136-18: An Action Relating to Resources and Development, Budget and Finance Committee; Naabik'Iyati Committee and the Navajo Nation Council; Approving Supplemental Fund from the Unreserved, Undesignated Fund Balance in the Amount of Two Million Eight Thousand Two Hundred and Ninety-Seven Dollars ($2,080,297.00) for the Construction of the Greasewood Springs Bridge, Navajo Route No. N9003; Waiving 2 N.N.C. §§ 820 (I) and 860 (C) Relating to the Capital Improvement Process. *Sponsor: Honorable Lee Jack, Sr.*

MAIN MOTION: Davis Filfred S: Leonard Pete V:
ROLL CALL VOTE TALLY:
YEAS:
NAYS:
EXCUSED: Walter Phelps

AMENDMENT # 1:
MOTION: Davis Filfred S: Leonard Pete V: 4-0-1 (CNV)
ROLL CALL VOTE TALLY:
YEAS: Benjamin Bennett, Davis Filfred, Leonard Pete and Jonathan Perry
NAYS:
EXCUSED: Walter Phelps

MOTION TO TABLE:
MOTION: Leonard Pete S: Benjamin Bennett V: 4-0-1 (CNV)
ROLL CALL VOTE TALLY:
YEAS: Benjamin Bennett, Davis Filfred, Leonard Pete and Jonathan Perry
NAYS: NONE
EXCUSED: Walter Phelps

Alton Joe Shepherd, Chairperson
Resources and Development Committee

Shammie Begay, Legislative Advisor
Resources and Development Committee

23rd NAVAJO NATION COUNCIL

Fourth Year 2018

Mr. Speaker:

The **BUDGET & FINANCE COMMITTEE** to whom has been assigned

NAVAJO LEGISLATIVE BILL # 0136-18:

An Action Relating to Resources and Development Committee, Budget and Finance Committee; Naabikiyati Committee and the Navajo Nation Council; Approving Supplemental Funding from the Unreserved, Undesignated Fund Balance in the Amount of Two Million Eighty Thousand Two Hundred and Ninety-Seven Dollars ($2,080,297.00) for the Construction of the Greasewood Springs Bridge, Navajo Route No. N9003; Waiving 12 N.N.C. §§ 820(I) and 860 (C) Relating to the Capital Improvement Process
Sponsored by Lee Jack, Sr., Council Delegate

has had it under consideration and reports the same with the recommendation that It **Do Not Pass** with 1 amendment.

1. On page 4, lines 20, insert a new paragraph "G" "G. The Greasewood Springs Chapter supports the low water crossing for N9003, Resolution No. GSCO7-15-0566, Resolution No. GSC09-17-0758 and Resolution No. GSC09-17-0759 with Wash Crossing Improvements Drainage Study, attached as Exhibit E."

Re-letter the remaining paragraphs of SECTION THREE. FINDINGS
Amendment 1 Motion: Dwight Witherspoon Second: Tom T. Chee Vote: 5-0 Yeas: Leonard Tsosie, Lee Jack, Sr., Tom T. Chee, Dwight Witherspoon, Tuchoney Slim, Jr. Nays:

And therefore, referred to the **NAABIKIYATI** Committee

Respectfully submitted,

Seth Damon, Chairman

Adopted: _____ Not Adopted: _____
Legislative Advisor Legislative Advisor

15 May 2018

The vote was **2** in favor **3** opposed *Failed Vote Yeas: Tom T. Chee, Lee Jack, Sr. Nays: Leonard Tsosie, Dwight Witherspoon, Tuchoney Slim Jr.*
Motion: Dwight Witherspoon
Second: Tom T. Chee

Greasewood Springs Chapter

Diwozhii Bii' To doo' Bi'Naha'ta'

EXHIBIT "E"

Ronald Gishey, Sr., President
Immanuel Harlan Charley, Vice-President
Emery Lester, Secretary/Treasurer
Bill Spencer., Grazing Committee Member
Lee Jack, Sr., Council Delegate

GSC07-15-0566

RESOLUTION OF THE GREASEWOOD SPRINGS CHAPTER

Resolution to approve the Greasewood Springs Low Water Crossing and deciding to go with Option # 3 and to Request for Funding to Fund this Project.

WHEREAS:

1. The Greasewood Springs Chapter exists as a local unit of government recognized as a political sub-division of the Navajo Nation, pursuant of the Navajo Nation Code No. 26, Section (a) and is authorized to review all matter effecting the community in order to address the needs of the local residents with the authority to act in the best interest of the general welfare of its community membership; and

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation council approved the Historic Local Governance Act, which authorized the local Navajo Communities to plan develop and implement a restructuring process to improve community decision making allowing communities to excel and flourish enabling Navajo leaders to lead toward a prosperous future and improve the strength of the Navajo Nation Sovereignty; and

3. The Greasewood Springs Chapter respectfully request for the approval to request to approve the Greasewood Springs Low Water Crossing and deciding to go with option # ___ and to request for funding to fund this project.

4. Furthermore,

NOW THEREFORE IT BE RESOLVED THAT:

1. The Greasewood Springs Chapter hereby approves to request to request to approve the Greasewood Springs Low Water Crossing and deciding to go with option # ___ and to request for funding to fund this project.

1. The Greasewood Springs Chapter approves to approve the Greasewood Springs Low Water Crossing and deciding to go with option # ___ and to request for funding to fund this project.

CERTIFICATION

We, hereby certify that the foregoing was duly considered by the Greasewood Springs Chapter at a duly called regular chapter meeting in Greasewood Springs (Navajo Nation) Arizona, at which a quorum of community membership was present and the same had passed with a vote of; **31** in favor, **0** in opposed and **02** in abstained on this 13th day of July, in the year 2015.

Motioned By: Iris Begaye Seconded By: Cecelia Nez

Ronald Gishey, Sr., President

Greasewood Springs Chapter
Diwozhii Bii' To doo' Bi'Naha'ta'

Calvin F. Lee, President
Emery Lester, Vice-President
Omercita Begay, Secretary/Treasurer

Bill Spencer., Grazing Committee Member
Lee Jack, Sr., Council Delegate

GSC09-17-0758

RESOLUTION OF THE GREASEWOOD SPRINGS CHAPTER

Resolution requesting the Navajo Department of Transportation to allocate and contribute funding for the Design and Engineering of the Greasewood Springs N9003-Bridge project.

WHEREAS:

1. The Greasewood Springs Chapter exists as a local unit of government recognized as a political sub-division of the Navajo Nation, pursuant of the Navajo Nation Code No. 26, Section (a) and is authorized to review all matter effecting the community in order to address the needs of the local residents with the authority to act in the best interest of the general welfare of its community membership; and

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation council approved the Historic Local Governance Act, which authorized the local Navajo Communities to plan develop and implement a restructuring process to improve community decision making allowing communities to excel and flourish enabling Navajo leaders to lead toward a prosperous future and improve the strength of the Navajo Nation Sovereignty; and

3. The Greasewood Springs Chapter respectfully request the Navajo Department of Transportation to allocate and contribute funding for the Design and Engineering of the Greasewood Springs N9003-Bridge project.

4. Preliminary Feasibility Studies have been conducted by the Dibble Engineering: Wash Crossing Improvement Drainage Study, Greasewood Crossing N9003, DE Project 101411.02, June 15, 2015.

NOW THEREFORE IT BE RESOLVED THAT:

1. The Greasewood Springs Chapter hereby approves the request to the Navajo Department of Transportation to allocate and contribute funding for the Design and Engineering of the Greasewood Springs N9003-Bridge Project.

2. Preliminary Feasibility Studies have been conducted by the Dibble Engineering: Wash Crossing Improvement Drainage Study, Greasewood Crossing N9003, DE Project 101411.02, June 15, 2015.

CERTIFICATION

We, hereby certify that the foregoing was duly considered by the Greasewood Springs Chapter at a duly called regular chapter meeting in Greasewood Springs (Navajo Nation) Arizona, at which a quorum of community membership was present and the same had passed with a vote of; **29** in favor, **00** in opposed and **00** in abstained on this 19th day of September, in the year 2017.
Motioned By: Clarissa Yazzie Seconded By: Billy J. Yazzie

Calvin F. Lee, President

Greasewood Springs Chapter
Diwozhii Bii' To doo' Bi'Naha'ta'

Calvin F. Lee, President
Emery Lester, Vice-President
Omercita Begay, Secretary/Treasurer

Bill Spencer., Grazing Committee Member
Lee Jack, Sr., Council Delegate

GSC09-17-0759

RESOLUTION OF THE GREASEWOOD SPRINGS CHAPTER

Resolution requesting the Navajo Department of Transportation Tribal Transportation Program to accept the Greasewood Springs N9003-Bridge project as a Priority and to be put on the TTP Priority List.

WHEREAS:

1. The Greasewood Springs Chapter exists as a local unit of government recognized as a political sub-division of the Navajo Nation, pursuant of the Navajo Nation Code No. 26, Section (a) and is authorized to review all matter effecting the community in order to address the needs of the local residents with the authority to act in the best interest of the general welfare of its community membership; and

2. Pursuant to Resolution No. CAP-34-98, the Navajo Nation council approved the Historic Local Governance Act, which authorized the local Navajo Communities to plan develop and implement a restructuring process to improve community decision making allowing communities to excel and flourish enabling Navajo leaders to lead toward a prosperous future and improve the strength of the Navajo Nation Sovereignty; and

3. The Greasewood Springs Chapter respectfully request the Navajo Department of Transportation Tribal Transportation Program to accept the Greasewood Springs N9003-Bridge project as a Priority and to be put on the TTP Priority List.

4. Preliminary Feasibility Studies have been conducted by the Dibble Engineering: Wash Crossing Improvement Drainage Study, Greasewood Crossing N9003, DE Project 101411.02, June 15, 2015.

NOW THEREFORE IT BE RESOLVED THAT:

1. The Greasewood Springs Chapter hereby approves the request to the Navajo Department of Transportation Tribal Transportation Program to accept the Greasewood Springs N9003-Bridge project as a Priority and to be put on the TTP Priority List.

2. Preliminary Feasibility Studies have been conducted by the Dibble Engineering: Wash Crossing Improvement Drainage Study, Greasewood Crossing N9003, DE Project 101411.02, June 15, 2015.

CERTIFICATION

We, hereby certify that the foregoing was duly considered by the Greasewood Springs Chapter at a duly called regular chapter meeting in Greasewood Springs (Navajo Nation) Arizona, at which a quorum of community membership was present and the same had passed with a vote of; **24** in favor, **01** in opposed and **02** in abstained on this 19th day of September, in the year 2017.

Motioned By: Iris S. Begaye Seconded By: Leon Lee

Calvin F. Lee, President

THE NAVAJO NATION
GREASEWOOD SPRING CHAPTER
P.O. Box 1260 * Ganado, Arizona * 86505
Telephone: (928) 654-3239 * Fax: (928) 654-3232
Email: greasewoodsprings@navajochapters.org

President: Calvin F. Lee * Vice-President: Emery Lester * Secretary/Treasurer: Omercita Begay
Council Delegate: Lee Jack Sr. * Grazing Official: Bill Spencer

TO: KAREN BENALLY, PLANNING DEPARTMENT MANAGER
NAVAJO DEPARTMENT OF TRANSPORTATION

FROM: CALVIN F. LEE, PRESIDENT
GREASEWOOD SPRINGS CHAPTER

CONCURRED BY: OMERCITA BEGAY, SECRETARY/TREASURER
GREASEWOOD SPRINGS CHAPTER

DATE: AUGUST 24, 2017

RE: REQUEST TO ADD BIDGE PROJECT (N9003) TO T.T.P. PRIORITY PROJECT LIST

This letter serves as a formal request to the Tribal Transportation Program (TTP) for the Project ready Greasewood Crossing Pueblo Colorado Wash, Route N9003, located in Greasewood Springs, Arizona, to be included in into the T.T.P. Priority Project List.

Currently, the Greasewood Springs Crossing N9003 is project ready and we are looking for funding to help with the construction of the Bridge. Route N9003 is a direct route to N9006. Dibble Engineering has completed the Hydrology report and is attached to this letter.

If you have any questions or concerns regarding this letter please, feel free to contact me via email at greasewoodsprings@navajochapters.org or the listed phone number (928) 654-3239.

XC: FILE
EMERY LESTER, VICE-PRESIDENT

Greasewood Crossing N9003

WASH CROSSING IMPROVEMENTS DRAINAGE STUDY

NAVAJO D.O.

Table of Contents

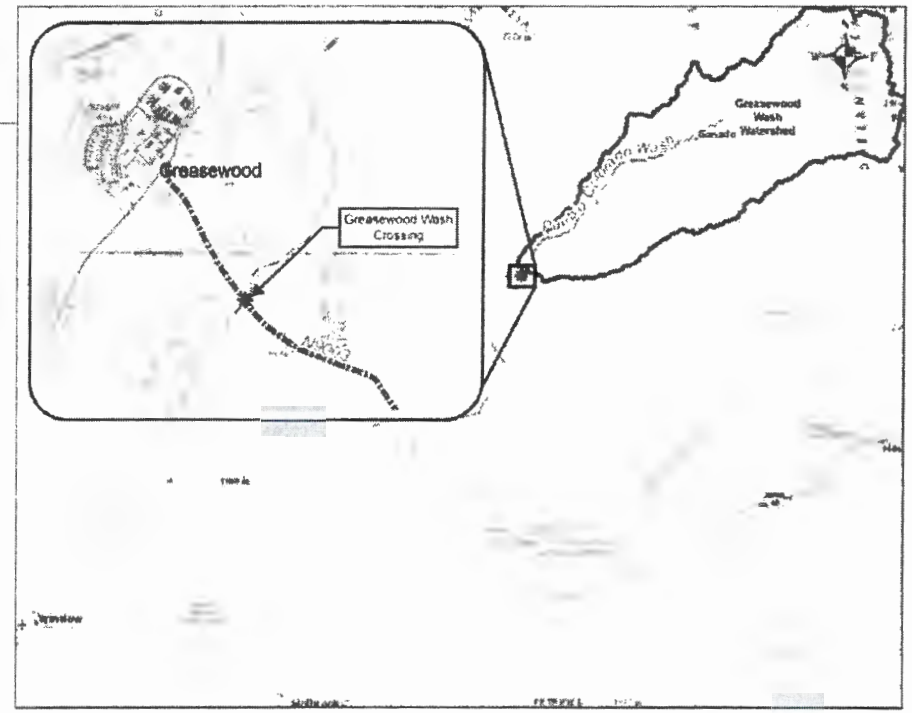
Introduction

- NAVAJO DOT identified 6 locations where washes flow over roadways during storm events.
- Dibble Engineering performed hydrologic analysis to understand flow rates.
- Three design alternatives analyzed to select preferred method.

Dibble Engineering

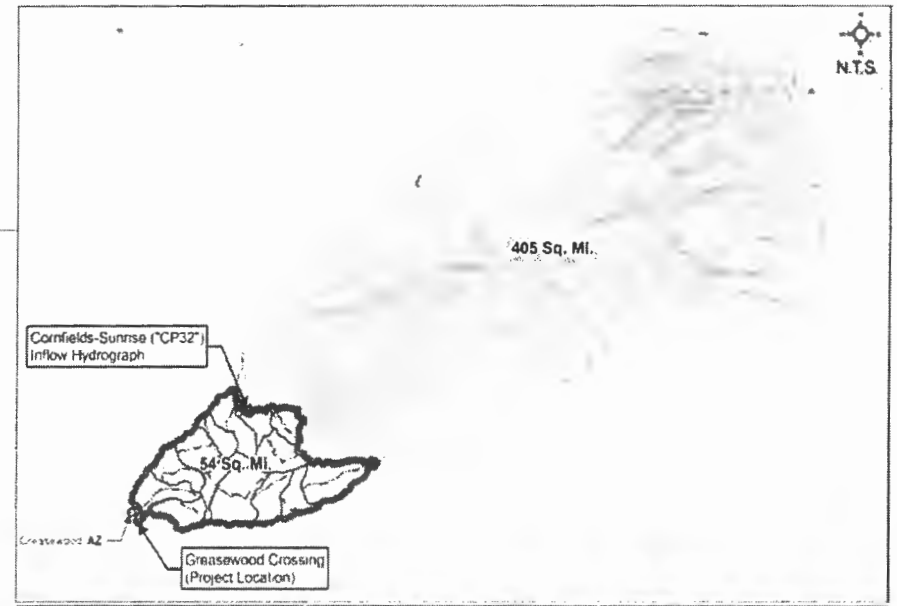
Location

- Pueblo Colorado Wash
- Crosses N9003 approximately 1.5 mile southeast of Greasewood, AZ
- "Greasewood Crossing"
- Low-flow sandy bottom
- Average width of 50 feet
- Flat overbanks with fine sands and grasses, shrubs and trees.



Results

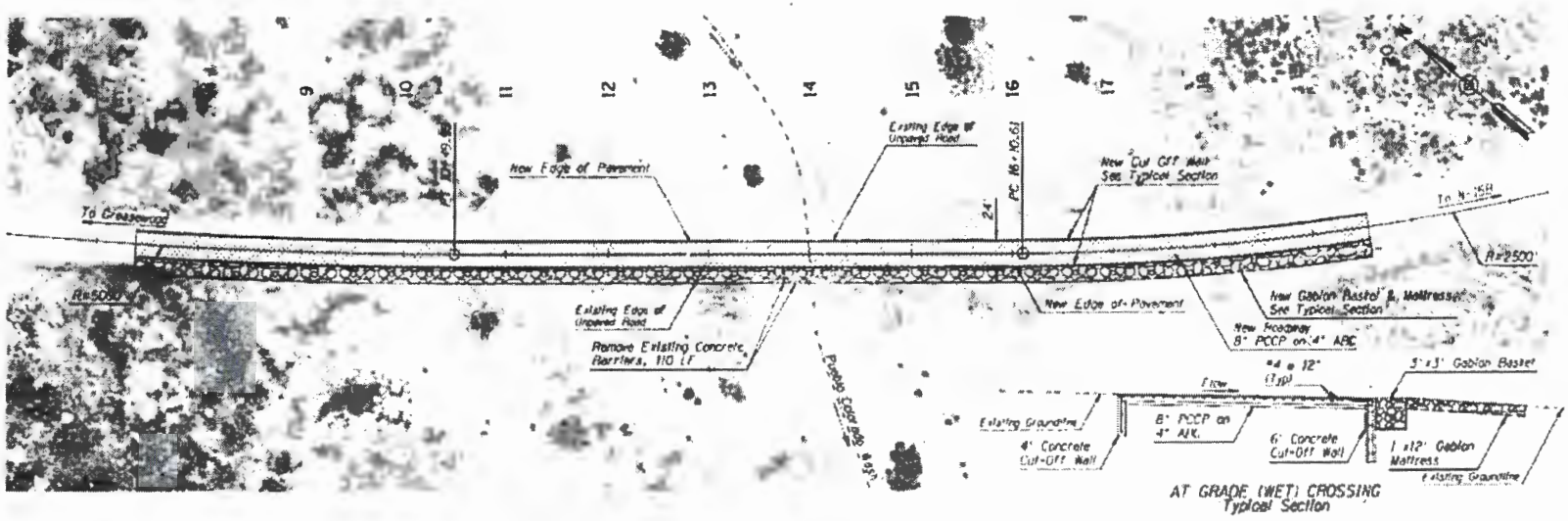
- 460 mi^2 watershed
- 10 year design storm for Design 1 & 2
- 100 year design storm for Design 3
- 10 year scour depth of 5 feet
- 100 year scour depth of 11.4 feet



24 Hr Design Storm	Peak Flow (cfs)	Time to Peak (hr)
10 Year	1713	13.1
25 Year	3602	24.3
50 Year	6303	22.4
100 Year	10240	20.9

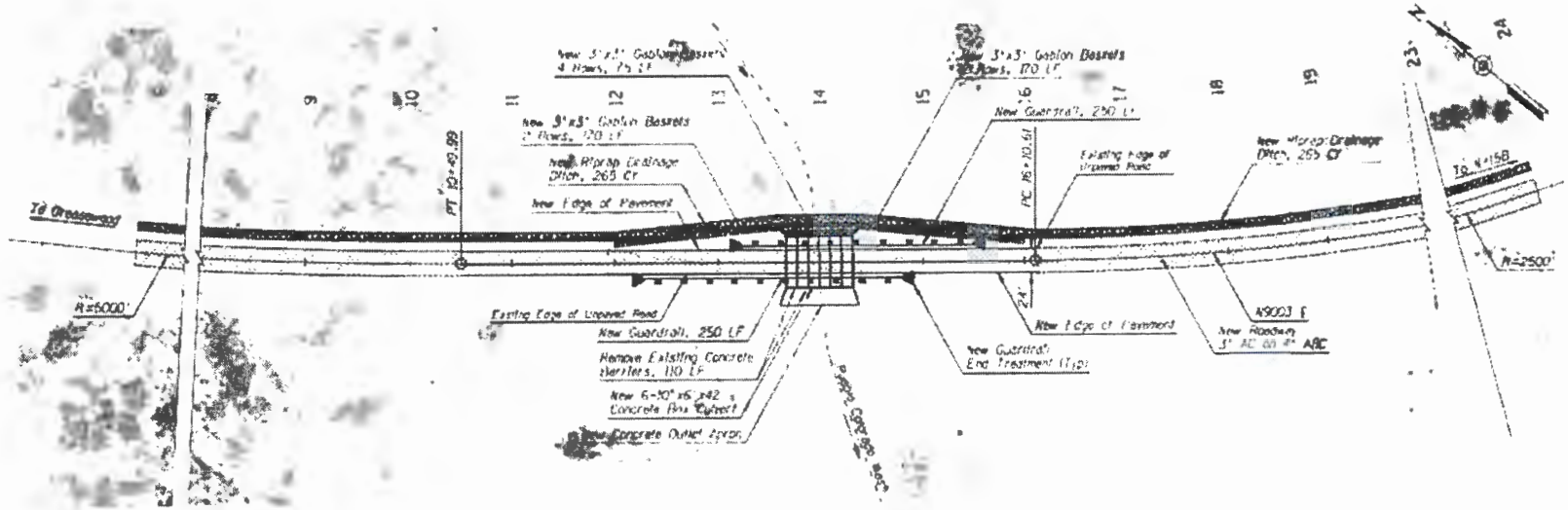
Alternatives

Design 1: Wet Crossing = $854,070.00



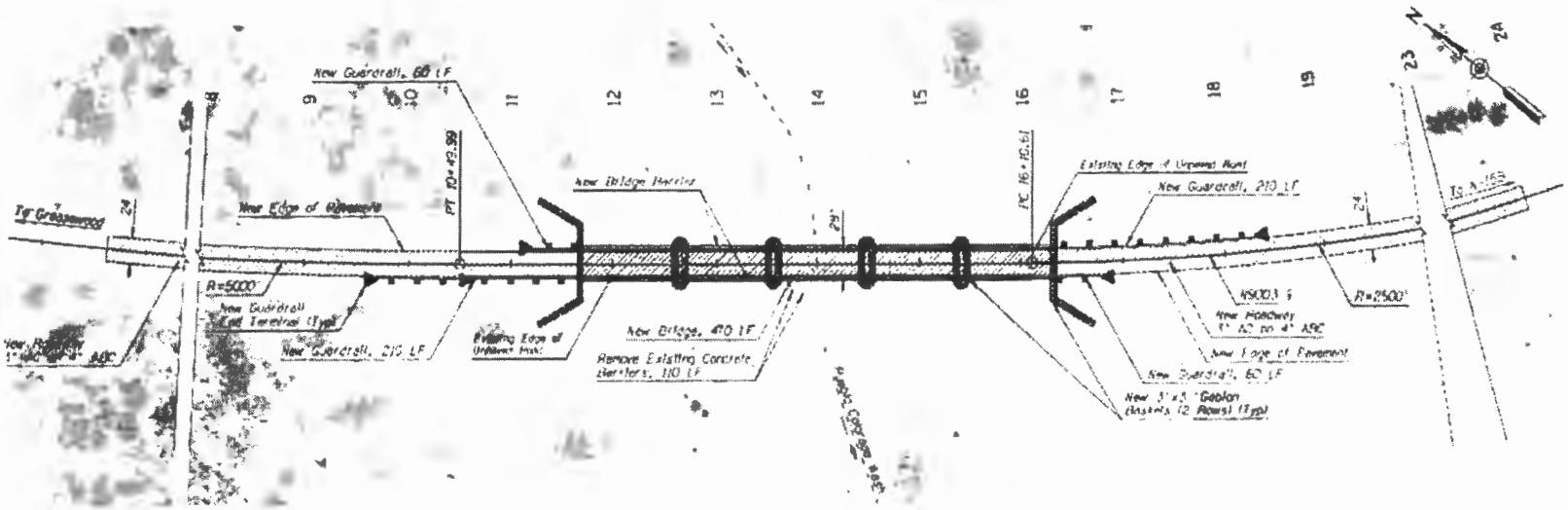
Alternatives

Design 2: Vented Low Ford Crossing = $532,614.00



Alternatives

Design 3: Bridge Crossing = $1,981,140.00

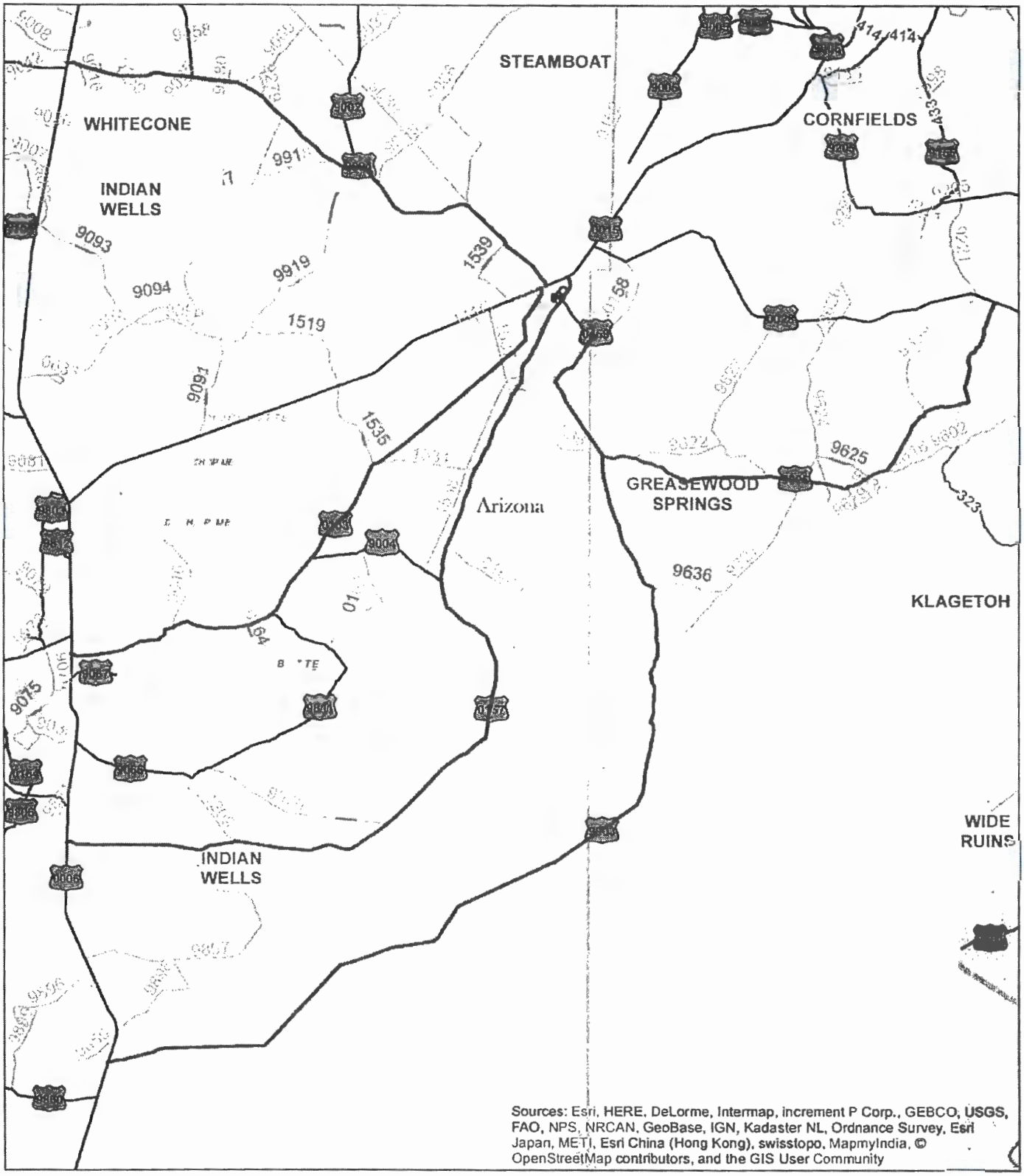


Funding Sources

- NN Council Delegates
- NN Fuel Excise Tax
- Federal Funding
- Partnerships
- State
- County
- Chapter

Conclusion

- Questions



Legend

- Chapter house
- FY13_Inventory_Roads
- BIA Roads
- County Roads
- US_Highways
- State Hwys
- State
- County Boundaries
- Chapter Boundaries

NORTH

0 1.75 3.5 7

Miles

GREASEWOOD CROSSING (N9003)

Wash Crossing Improvements Drainage Study

DE Project 101411.02

June 25, 2015

Prepared For:

NAVAJO D.O.T.

NDOT
PO Box 4620
Window Rock, AZ 86515

Dibble Engineering

7500 North Dreamy Draw Drive
Suite 200
Phoenix, Arizona 85020
P. 602.957.1155
F. 602.957.2838
www.dibblecorp.com

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EXECUTIVE SUMMARY

The Navajo Division of Transportation (NDOT) has identified six locations where washes currently flow over roadways during storm events. Due to the rural nature of the roadway system on the Nation, washes that flow over these roadways can cause inconvenience to travelers and even dangerous conditions during larger rainfalls, as well as continuous maintenance requirements to regrade the roadway.

In order to make improvements to these wash crossings, Dibble Engineering (Dibble) has performed a drainage alternatives analysis for the purpose of selecting a preferred method of conveying stormwater beneath or over the roadways in lieu of allowing them to overtop the unprotected roadways. This will include recommendations for three drainage solutions at each wash crossing. This study is for the **Greasewood crossing** of the Pueblo Colorado Wash on N9003.

A detailed hydrologic analysis was performed to understand the peak flow rates expected at each crossing location during various recurrence intervals (10-year through 100-year storms). The flow rates were used in a hydraulic model to analyze both the existing conditions and the three proposed alternatives. Using this information, a plan and profile exhibit showing the three alternatives has been prepared and included with this report in **Appendix D**. An estimate of the probable cost has also been included for each alternative.

Alternative 1 will provide a redesigned wet crossing which includes a protected roadway surface which allows stream flows to cross over the improved roadway with scour protection for the intended design storm event, which is the 10-year storm event for this alternative. The wet crossing will provide a concrete surface for the roadway to allow for sedimentation removal and to protect the roadway surface from erosion after storm events. Gabion mattresses and/or concrete cutoff walls will be used to further protect the wet crossing from the effects of scour and erosion at the upstream and downstream edges of the crossing. Although the simplest in nature, due to the extended concrete pavement section, Alternative 1 will have the second highest cost estimated at **$854,070**.

Alternative 2 will provide a vented low flow crossing which allows flow from the more frequent storms to be conveyed under the roadway allowing for a safer crossing solution. The vented crossing will allow design flows up to the 10-year storm event to be conveyed under the roadway via culverts without overtopping while flows larger than the 10-year will overtop the roadway in a manner protected from erosion similar to a wet crossing. Alternative 2 will have an estimated cost of **$532,614**.

Alternative 3 is a roadway profile that will provide an opening under the roadway to provide a dry roadway crossing for flows up to the 100-year storm event. Since the 100-year storm event discharge is significantly larger than the 10-year flow, the hydraulic opening area must be approximately 6 times larger than the culvert area sized for Alternative 2. The resulting width at the roadway crossing will require a bridge to span a length of approximately 450-ft wide and require multiple piers. Alternative 3 has the highest estimated cost of **$1,981,140**.

I. Introduction

A. General

This drainage report has been prepared to document the drainage design for the Pueblo Colorado Wash crossing of N9003. The wash crossing project is located approximately one half mile southeast of Greasewood, AZ in Navajo County along N9003 and will be referred to in this report as the "Greasewood crossing". The project location is shown below on **Figure 1 - Project Location Map**.

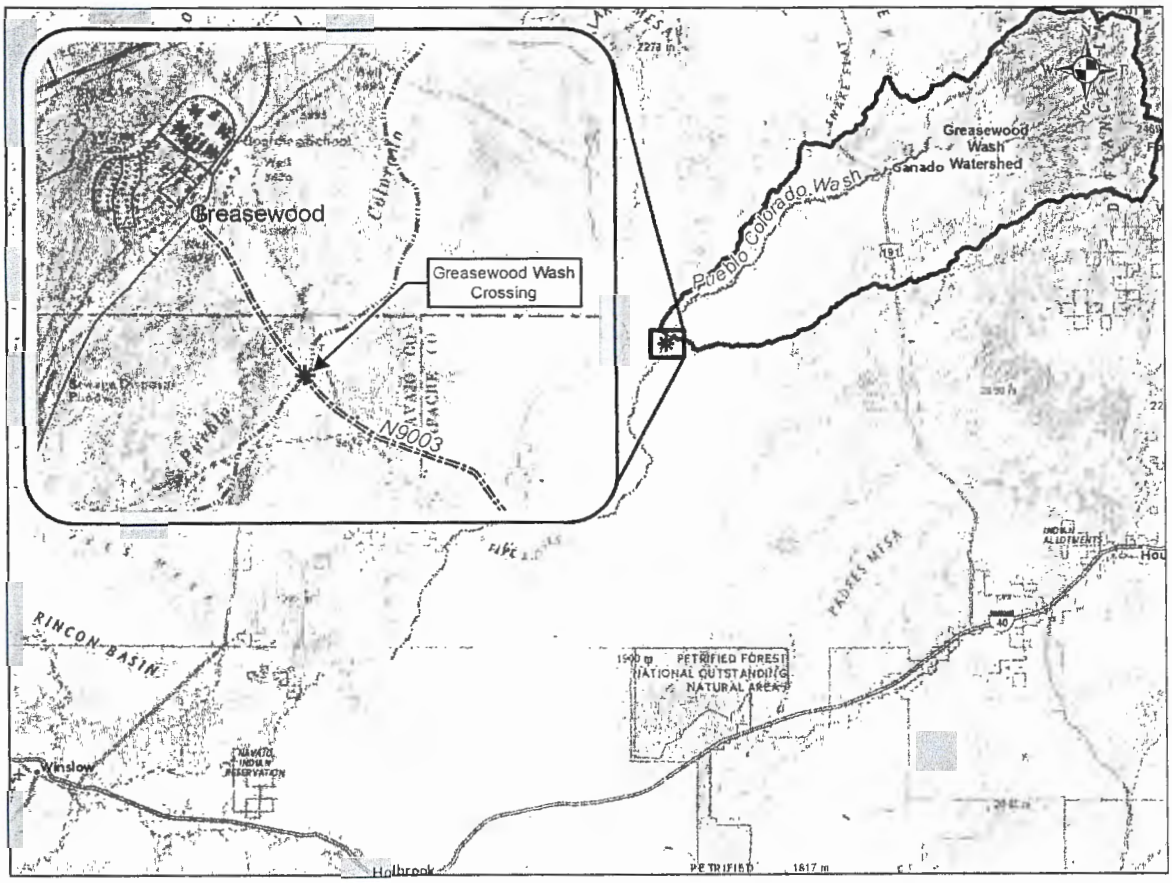

Figure 1 - Project Location Map

B. Objective of the Study

This drainage study for the Greasewood crossing was prepared to document data collection efforts, methodologies and calculations, alternatives analysis and recommendations for the proposed drainage crossing.

C. *Study Area*

At the N9003 crossing, the Pueblo Colorado Wash has a floodplain width of approximately 2,300 feet. The wash has an incised low-flow sandy bottom with an average width of approximately fifty (50) feet. The floodplain overbanks are flat with fine sands and grasses, shrubs and trees. **Figure 2** is a photo taken upstream of the crossing looking downstream at the low-flow channel and left overbank. Additional site photographs are included in **Appendix A**.

Figure 2 – Greasewood Wash Photo (Oct. 22, 2014)

D. *FEMA Floodplain*

There is no flood map printed for this location on the Navajo Nation and the Pueblo Colorado Wash is not listed in the Navajo County Flood Insurance Study (FIS). The project is located on the unprinted FIRM Panel 04017C2300E.

II. Data Collection

As part of the data collection efforts for this project, Dibble met with NDOT representatives at the project site on October 22, 2014 and took photographs to help support our hydraulics analysis assumptions. Field photographs are included in **Appendix A**. A site survey was performed by NDOT and provided to Dibble Engineering on January 14, 2015. The survey provided detailed topographic information for the low flow wash and overbanks for an area ranging from 200 to 400 feet wide for a distance of approximately 500 feet upstream and downstream of the roadway crossing. U.S. Geologic Survey (USGS) Digital Elevation Model (DEM) information was collected to supplement the existing terrain information beyond the area surveyed.

NDOT also provided a drainage study titled, Site No. 15 N9205 – Pueblo Colorado Wash Crossing, October 25, 2009. This study was prepared for a site located along the Pueblo Colorado Wash, approximately 9.5 miles upstream of the Greasewood crossing and referred to as the "Cornfields Sunrise". The electronic

hydrology models (HEC-1) prepared for the Cornfields Sunrise watershed were also obtained and updated for use in this study.

III. Design Criteria

A design memorandum was provided to NDOT on November 24, 2014 which outlined the design criteria proposed for the analysis of the six identified crossing locations, of which the Greasewood crossing is included. Information from this memo has also been provided below.

Design methodology will follow guidance provided in the following publications:

- *Low Volume Roads Best Management Practices Field Guide*, USDA Forest Service, 2003.
- *Low Water Crossings: Geomorphic, Biological, and Engineering Design Considerations*, USDA Forest Service, 2006.
- *Hydraulic Design of Highway Culverts HDS 05*, FHWA, 2005.
- *Highway Hydrology HDS 02*, FHWA, 2002.
- *Evaluating Scour at Bridges HEC 18*, FHWA, 2001.
- *State Standard for Watercourse System Sediment Balance 5-96*, ADWR, 1996.
- *State Standard for Watercourse Bank Stabilization 7-98*, ADWR, 1998.

The Bureau of Indian Affairs (BIA) criteria specifies that each crossing be designed to convey the 100-year flow with a "dry" crossing which would convey the 100-year design flow under the roadway without overtopping. For these six crossing improvements, NDOT has the option not to follow BIA criteria, because federal funding is not involved.

1. **Wet Crossing/"Dip" Crossing**
    a. The 10-year design flow depth (+1 ft freeboard) will be protected by a paved, at-grade crossing.
    b. The roadway will not include protection from larger storm events, such as the 25-, 50-, and 100-year storms.

2. **Vented Low Flow Crossing**
    a. Culverts will convey the 10-year design flow under the roadway without overtopping
    b. Flows from storm events that overtop the roadway (in excess of the 10-year event and up to the 100-year event) will be used to design protection of the roadway and immediate adjacent areas

3. **100-Year Dry Crossing**
    a. The roadway will convey the 100-year storm event with no overtopping. We anticipate accomplishing this by means of a bridge, multiple large culverts or other structures. If a bridge is used, an appropriate freeboard beneath the bridge low chord shall be provided.

IV. Study Approach & Methodology

A. Existing Models & Revisions

In 2009, NDOT contracted a consultant to prepare a number of drainage studies at various wash crossing locations. One of these studies titled, *Site No. 15 N9205 – Pueblo Colorado Wash Crossing*, dated October 25, 2009, was prepared for a site located along the Pueblo Colorado Wash, approximately 9.5 miles upstream of the Greasewood crossing. This 2009 study was prepared for a wash crossing that will also be studied by Dibble Engineering under a separate cover and will be referred to as the "Cornfields Sunrise Crossing". This hydrology model has a combined area of 405.96 square miles and contributes to the Greasewood crossing being reviewed by this study. The electronic hydrology (HEC-1) models prepared for this upstream study were obtained and updated for use in this study. Some of the revisions made to the 2009 hydrology models are listed below.

- The IT record was modified to use a 10 minute time step instead of 5 minutes previously used. The larger time step is more appropriate for the large subbasins areas (10-20 sq. miles).
- Current NOAA atlas 14 rainfall values were referenced from the National Oceanic and Atmospheric Administration (NOAA) website and utilized.
- Areal reduction factors for the 405.96 sq. mi. watershed were applied to the HEC-1 rainfall record. In the case of the 100-year model, the 3.11 inch rainfall was reduced by a factor established for Northeast Arizona of 0.639 to a total depth of 1.99 inches used in the model.
- A ZW record was used to create a DSS output file which was used to prepare an outflow hydrograph which was imported into the Greasewood crossing hydrology model.

B. HEC-1 Hydrology Methodology

A new hydrology model had to be prepared for the additional 54 square mile area downstream of the Cornfields Sunrise watershed that contributes to the Greasewood crossing. The hydrology is analyzed using the U.S Army Corps of Engineer's *HEC-1* hydrology software. The Flood Control District of Maricopa County's (FCDMC) *Drainage Design Management System for Windows (DDMSW) version 4.8.2* was used to pre-process the HEC-1 modeling parameters. The 100-year, 50-year, 25-year and 10-year 24-hour storms have been modeled.

1. Subbasin Boundaries

Watershed boundaries, sub-basin limits, and flow paths have been determined using USGS mapping and aerial photography.

2. Rainfall

NOAA atlas 14 rainfall information for the watershed area was collected from the NOAA website to establish site specific rainfall parameters for the hydrology model. Depth-Area reduction factors were applied based on values for "Eastern" areas as shown on Table 3.0 Depth-Area Reduction Factors from the *State Standard for Hydrologic Modeling Guidelines* (SS10-07), August, 2007.

3. *Land Use*

The existing conditions land use data was prepared based on aerial photography. The existing land uses were digitized to a shapefile layer and prepared for use with DDMSW to calculate composite land use parameters for each watershed sub-basin.

4. *Soils*

Soils data for use in hydrologic modeling was obtained from current Natural Resource Conservation Service (NRCS) Soil Survey 715: Fort Defiance Area, Parts of Apache and Navajo Counties, Arizona. A soils shapefile layer was prepared for use with DDMSW to calculate composite soils parameters for each sub-basin in order to calculate runoff and loss parameters.

5. *Routing Method*

The Normal-Depth routing method was used with an 8-point representative route section for the HEC-1 model to account for travel time and attenuation within the model. The number of steps to be used in the storage routing or "NSTPS" values were calculated within the DDMSW program.

6. *Inflow Hydrographs*

The DDMSW program allows for inflow hydrographs to be developed within the HEC-1 model using QI records. A hydrograph was developed from the upstream Cornfields Sunrise hydrology model and formatted in order to import that data into DDMSW for use in the Greasewood crossing HEC-1 model.

C. *Regional Regression Hydrology Methodology*

In addition to the detailed HEC-1 analysis performed, an approximate hydrologic analysis of the watershed using regional regression calculations was conducted. Two different publications were referenced to produce two different regression equations applicable to the northeast part of Arizona, one from the USGS and one from the Arizona Department of Transportation (ADOT). These regression equations were developed for estimating the magnitude of peak discharges for various recurrence intervals using data collected from gaging stations and peak discharge data collected from various regions of the state. The equations use variables including the watershed area, slopes and average elevations to estimate a peak discharge and typically have an average standard error of estimate in the range of 70% to 95%. The guidelines and calculations used for the USGS and ADOT regression equations to obtain indirect estimates of peak discharges are included in **Appendix B**. The regional regression equations tend to be conservative for planning level analysis and in this case, the peak flows from the regression equation analysis resulted in values that are 3 to 6 times larger than the results from the HEC-1 analysis. For this drainage study, the flow rates derived from the HEC-1 analysis will be utilized.

D. *Hydraulic Wash Analysis Methodology*

A steady state backwater analysis was prepared to analyze the flow characteristics at the Greasewood crossing location. The cross section geometry, reach lengths and n-values were

produced using the Army Corps of Engineers' hydraulic model pre-processor called, HEC-GeoRAS (version 10.1). The information from HEC-GeoRAS is then imported to the Corps' River Analysis System software called, HEC-RAS (version 4.1.0). The results of the HEC-RAS analysis were used to understand the existing conditions flow depths and velocities and to model the proposed alternatives.

Cross sections were cut using a combination of survey data provided by NDOT, USGS DEM information and aerial imagery observations with an approximate spacing of 100 feet. Manning's n-values were updated based on aerial imagery and field observations. Contraction and expansion values were set at 0.1 and 0.3 for most sections and updated to 0.3 and 0.5 upstream and downstream of the roadway crossings with alternatives that propose a constriction of flow. Design flow rates used in the HEC-RAS model were taken from the updated HEC-1 model prepared for the wash crossing. Results of the hydraulic analysis are included in **Appendix C.**

E. Scour Analysis

The design of any stream crossing of a roadway should take into consideration the potential for general and long term degradation or scour. A scour analysis can be very detailed for final design purposes or more approximate methods may be used to estimate a probable scour depth based on the design flow rate. For this conceptual alternatives analysis study, the Arizona State Standard (SS5-96) Level 1 scour methodology was used. This method involves an empirical equation developed based on various soil types within Arizona and is based exclusively on the design flow rate without regard for specific soils at the site. Since Alternative 1 will be designed specifically for the 10-year flow rate, the equation was modified to use the 10-year flow rate in order to estimate a maximum 10-year scour depth. The 100-year flow rate was used to estimate the scour depth for Alternatives 2 and 3. Calculations for the scour analysis are included in **Appendix C.**

V. Alternatives Analysis

A. Alternative 1 - Wet Crossing

1. Proposed Design

The existing N9003 crossing of the Pueblo Colorado wash is an uprotected, at-grade crossing. Alternative 1 will provide a redesigned wet crossing which includes a protected roadway surface which allows stream flows to cross over the improved roadway for the intended design storm event, which is the 10-year storm event for this alternative. The proposed wet crossing design is based upon existing details similar to the Maricopa Association of Governments (MAG) standard detail 552, "Ford Crossing and Cut-off Walls". The road surface itself at the wet crossing is proposed to be Portland cement concrete pavement (PCCP) to allow for large equipment to remove sediment from the surface without causing damage to an asphalt surface. Gabion baskets and mattresses or concrete cutoff walls can be used to further protect the wet crossing from the effects of scour and erosion at the upstream and downstream edges of the crossing. A plan and profile view of the wet crossing at the Greasewood crossing project location is included in **Appendix D.**

A benefit of wet crossings over the existing condition is that the wet crossing will act as a grade-control structure which will help control long term erosion or aggradation at this location. Although some maintenance will still be necessary to remove sediment from the roadway after storm events, significant regrading of the roadway will likely be reduced from what is currently necessary due to the hardened roadway surface. However a wet crossing option will only be protected up to the 10-year storm event and larger recurrence intervals may impact the roadway at higher elevations beyond the concrete crossing limit.

The benefit of a wet crossing over other crossing alternatives is primarily related to the difference in cost. Due to the simplified nature of the wet crossing and the lack of a new raised roadway profile or hydraulic structure, this alternative typically has the lowest cost.

The length for the wet crossing will be based upon the width associated with the 10-year design flow in the wash. The wash flow depths, velocities and other hydraulic parameters have been evaluated for the wash using HEC-RAS with updated geometry to reflect the proposed wet-crossing design and roadway profile. The profile for the wet crossing has been designed primarily to match the current natural slope of the wash channel invert while meeting AASHTO Guidelines for "Very Low Volume Local Roads". A design speed of 25 miles per hour was used for the wet crossing profile design.

2. *Probable Cost*

An estimate of the probable cost for the concrete surface wet crossing at the Greasewood crossing location was determined based upon an estimate of the quantities and unit costs for materials. The significant cost components of a wet crossing include the 8-in thick concrete surface, the aggregate subgrade material, the upstream and downstream toe-down wall or gabions, and the earthwork. A detailed probable cost has been prepared for this alternative and is included in **Appendix D**. The estimated cost for Alternative 1 is **$854,070**.

B. *Alternative 2 - Vented Low Flow Crossing*

1. *Proposed Design*

A vented low flow crossing is similar to a wet crossing in that larger storm events will cross over the roadway. But it differs from the wet crossing in that the smaller more frequent storms will be conveyed under the roadway allowing for a safer crossing solution during the more frequent storm events. Alternative 2 will allow design flows up to the 10-year storm event to be conveyed under the roadway without overtopping while flows larger than the 10-year will overtop the roadway in a manner protected from erosion similar to a wet crossing. To estimate the hydraulic opening area required, the 10-year design flow of 1,849 cfs was used along with a nomograph for inlet controlled box culverts from the Federal Highway Administration's *Hydraulic Design of Highway Culverts* (HDS 5) manual (see **Appendix D**).

A (6 barrel) 10 ft. x 6 ft. box culvert was required for use at the roadway crossing. A minimum roadway elevation of approximately 5,876.2 ft. will be required to contain the headwater for the 10-year design discharge which will require an increase to the roadway profile of about 2-3 feet adjacent to the crossing location. The actual point where elevation 5,876.2 will daylight into the

existing grade is uncertain due to the limited mapping available. For this project, an assumption was made that the existing departure roadway grades adjacent to the crossing were held constant in order to estimate a cost for the alternative.

A plan and profile view of the vented low flow crossing is included in **Appendix D**. The profile for the vented crossing has been designed to accommodate the anticipated 10-year water surface elevation without overtopping while meeting AASHTO Guidelines. A design speed of 35 miles per hour was used for the vented low flow profile design.

2. Probable Cost

An estimate of the probable cost for the vented low flow crossing alternative was determined based upon an estimate of the quantities and unit costs for materials. The significant cost components of the vented low flow crossing include the (6 barrel) 10 ft. x 6 ft. box culvert, the asphalt roadway surface material and subgrade, the upstream and downstream scour protection toe-down wall or gabions, guardrail and the roadway fill material. A detailed probable cost has been prepared for this alternative and is included in **Appendix D**. The estimated cost for Alternative 2 is **$532,614**.

C. Alternative 3 - 100-Year Dry Crossing

1. Proposed Design

The final alternative analyzed in this study is a roadway profile that will remain dry during the 100-year storm event. Since the 100-year storm event discharge is significantly larger than the 10-year flow (10,236 cfs vs. 1,849 cfs, respectively), the hydraulic opening area must be approximately 6 times larger than the 10-year design flow for Alternative 2.

To estimate the hydraulic opening area required to convey the 100-year design flow under the roadway, an encroachment analysis was initially prepared. An encroachment analysis is used to determine the estimated "floodway" limits for a given floodplain. The floodway is that portion of the available flow cross section that cannot be obstructed without causing an increase in the water-surface elevations resulting from a flood with a 100-year average return period. In other words, the floodway identifies the maximum encroachment limits of the left and right banks without causing an increase the existing 100-year water surface elevation greater than the state specified amount. FEMA has established this amount to be 1 ft., but some states have required a smaller amount of increase. By adding equal encroachments to both sides of the low flow channel, a rise in the water surface of approximately 1 ft. was reached. The resulting width at the roadway crossing was 450 feet. In order to further reduce the resulting water surface elevation at the roadway, the cross section geometry was reasonably modified upstream and downstream of the roadway to widen out the low flow section. The model geometry was updated to represent the raised roadway profile and 450 ft. opening at the low flow channel. The resulting 100-year water surface elevation is 5,877.4 ft. Given a freeboard of approximately 1.4 ft. and a bridge deck thickness of 3 ft., the bridge surface elevation would be approximately 5,882 ft.

2. *Probable Cost*

An estimate of the probable cost for the 100-year dry crossing (bridge) alternative has been determined based upon an estimate of the quantities and unit costs for materials. The significant cost components of the 100-year dry crossing include the bridge structure, the asphalt roadway surface material and subgrade, the upstream and downstream scour protection toe-down wall or gabions, guardrail and the roadway fill material. A detailed probable cost has been prepared for this alternative and is included in **Appendix D**. The estimated cost for Alternative 3 is **$1,981,140**.

VI. Results & Recommendations

A. Hydrology

A HEC-1 hydrology model was prepared for the 54 square mile watershed that contributes to the Greasewood crossing. This model includes 14 subbasins which have an average area of 8 square miles. An upstream watershed was also imported into the developed HEC-1 model to account for the 405 square mile watershed model developed for the Cornfields Sunrise crossing. **Figure 3** displays the watershed area.

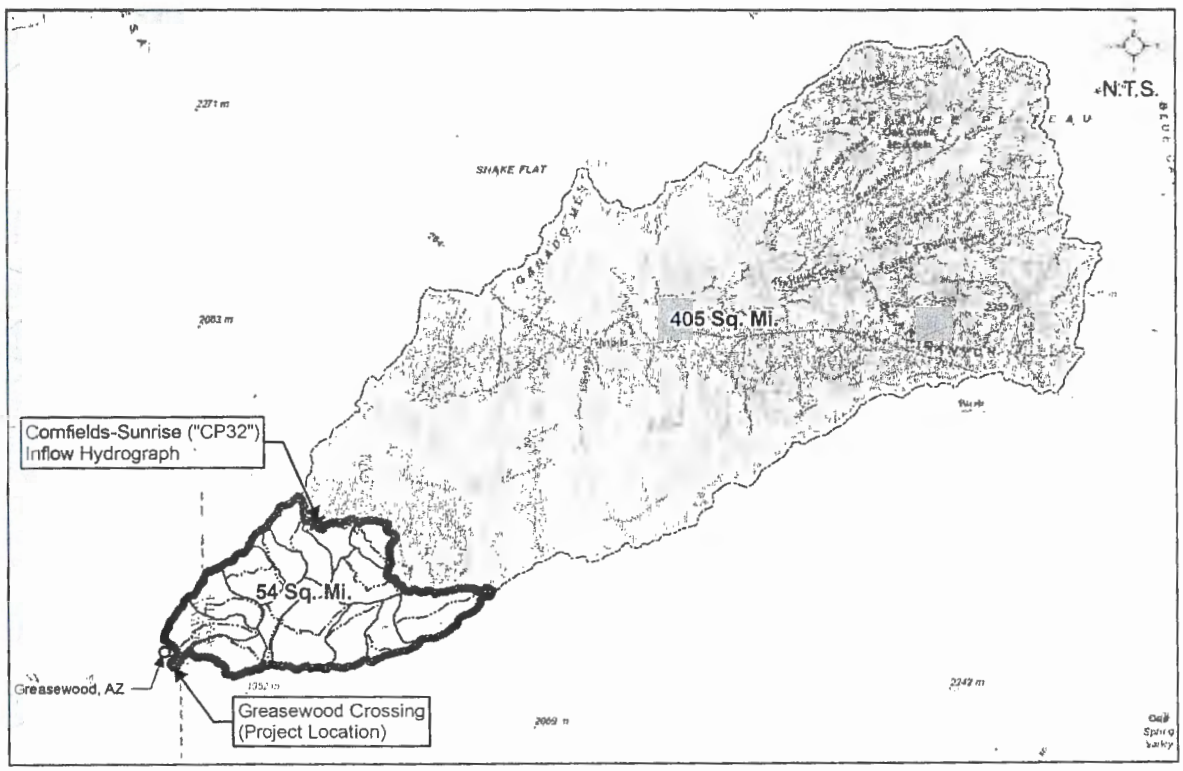

Figure 3 – Watershed Map

The combined watershed for the Greasewood crossing is 459 square miles. A separate inflow hydrograph was prepared for the 10, 25, 50 and 100-year models in order to establish peak flow rates for each return period. **Table 1** shows the inflow hydrograph peak flow rates and time to peak used in each hydrology model.

Table 1 – Cornfields Sunrise Inflow Hydrograph Results

HEC-1 Return Period (24-Hr Duration)	Peak Flow (cfs)	Time to Peak (hr)
10 Year	1,347	26.67
25 Year	3,993	22.00
50 Year	6,918	20.17
100 Year	11,202	18.17

A peak flow rate for the Greasewood crossing was determined for use in developing the HEC-RAS existing conditions hydraulic model. A summary of the flow rates determined for the Greasewood crossing project is included in **Table 2**.

Table 2 – Greasewood HEC-1 Model Results

HEC-1 Return Period (24-Hr Duration)	Peak Flow (cfs)	Time to Peak (hr)
10 Year	1,713	13.08
25 Year	3,602	24.25
50 Year	6,303	22.42
100 Year	10,240	20.92

The runoff from the 54 square mile Greasewood watershed will reach the N9003 roadway crossing quicker than the peak flow from the Cornfields Sunrise watershed and the two hydrographs will therefore not overlap and result in an increase to the peak flow rate at the Greasewood crossing. In order to visualize the difference in timing between the Cornfields Sunrise hydrograph ("CP32") and the Greasewood crossing hydrograph ("CPPC25"), they have been plotted and included with this report. Based on these hydrographs it can be observed that the Greasewood watershed area will have a peak flow rate of about 5,100 cfs and peak at around 13.3 hours. A second peak in the hydrograph occurs when the Cornfields Sunrise watershed runoff reaches the roadway crossing about 7.5 hours later with a combined flow rate of 10,240 cfs.

The Greasewood crossing is approximately 9 miles downstream of the Cornfields Sunrise inflow point. Due to attenuation or storage within the Pueblo Colorado wash overbank areas, there is a flow reduction that occurs resulting in a decrease in peak flow from the hydrograph inflow value of 11,202 cfs, to the road crossing flow value of 10,240 cfs.

In order to visualize the difference in timing between the Cornfields Sunrise hydrograph ("CP32") and the Greasewood crossing hydrograph ("CPPC25"), they have been plotted and included with this

report. Envelope curves showing how the Peak and Unit flow rates for this study compare with the USGS generated envelope curves for the Regional 11, Northeast Arizona have also been included with this report. The hydrographs and envelope curve plots along with additional drainage exhibits and model results including parameters for subbasins and routes, rainfall, land use and soils along with peak flow summary tables and HEC-1 model output have been included in **Appendix B**.

B. Hydraulics

There were three different scenarios or alternatives modeled with HEC-RAS as well as the existing conditions model. An existing conditions terrain was prepared using the topographic survey provided by NDOT along with more approximate elevation grid data available from the USGS and used to extract cross section geometry data for the hydraulic model using HEC-GeoRAS. The model geometry was updated manually within HEC-RAS to represent the existing condition as well as the three alternatives considered.

The first alternative is for a wet crossing solution which allows all storm event flows to be conveyed over the roadway and would protect the roadway up to the 10-year design storm using a concrete surface. The estimated length of protected roadway surface required to protect against the 10-year storm event is 1,420 ft.

The second alternative proposed is for a vented low-flow crossing solutions which provides an opening under the roadway to allow the 10-year design flow to pass under the roadway and larger storm events would pass over the roadway. The opening sized to convey the 10-year flow rate is a (6 barrel) 10 ft. x 6 ft. concrete box culvert. The roadway surface will also need to be elevated to provide an adequate headwater condition for this alternative.

The third alternative proposed is for a bridge solution that will protect the roadway from being overtopped by up to the 100-year design storm. The design solution includes a 450 ft. wide span bridge with piers. The model results from HEC-RAS have been printed and included in **Appendix C**.

C. Scour Analysis

A scour analysis was performed to estimate the total scour potential for a 10-year and 100-year design storm. The scour calculation uses simplified assumptions about the soil conditions and uses an equation provided in *State Standard for Watercourse System Sediment Balance 5-96*. The estimated 10-year scour depth is 5 ft. and the 100-year scour depth is 11.4 ft. These depths were used to estimate a cost associated with providing scour protection for each alternative. Scour calculations have been provided in **Appendix C**. The scour protection proposed for the Greasewood crossing alternatives is shown on the plan and profiles sheets in **Appendix D**.

D. Alternatives

A plan and profile exhibit along with an associated estimate of the probable cost have been prepared for the three alternatives and included with this report in **Appendix D**. It is not the goal of this report to provide a recommended option at this location, but rather to provide three alternatives for future design consideration purposes.

VII. References

1. AASHTO, *A Policy on Geometric Design of Highways and Streets*, 6th Edition, 2011.
2. ADOT, *Highway Drainage Design Manual*, Vol. 2, Hydrology. 2nd Edition, 2014.
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4. ADWR, *State Standard for Watercourse Bank Stabilization 7-98*, 1998.
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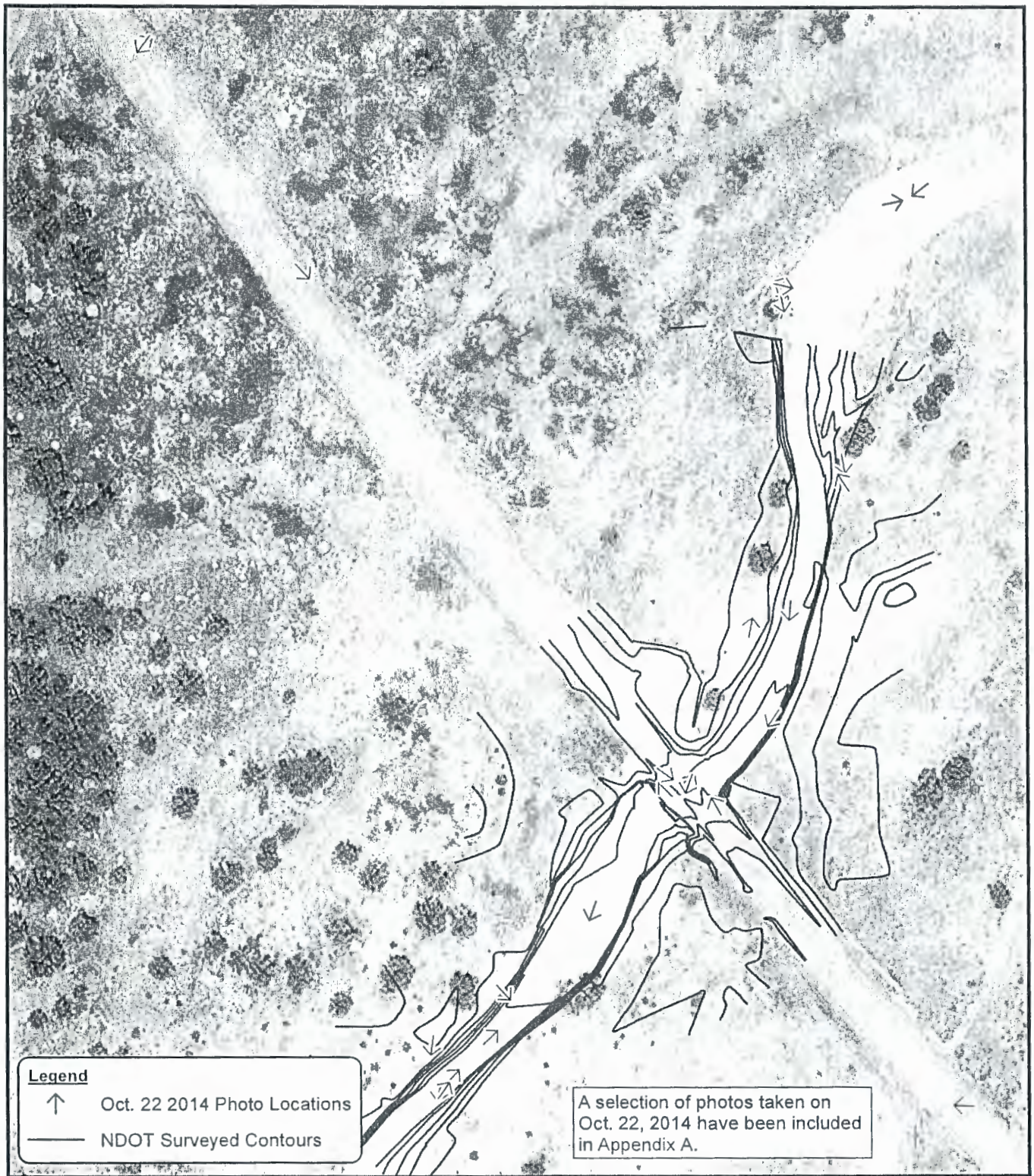
8. FHWA, HY-8 Culvert Hydraulic Analysis Program (Ver. 7.30), January 16, 2013.
9. Flood Control District of Maricopa County. *Drainage Design Management System for Windows (DDMSW), version 4.8.2.*
10. U.S. Army Corps of Engineers Hydrologic Engineering Center, *HEC-1 Flood Hydrograph Package*, Ver. 4.1 June 1998.
11. USDA Forest Service, *Low Volume Roads Best Management Practices Field Guide*, 2003.
12. USDA Forest Service, *Low Water Crossings: Geomorphic, Biological, and Engineering Design Considerations*, 2006.
13. USGS, Scott D. Waltemeyer, *Analysis of the Magnitude and Frequencey of Peak Discharges for the Navajo Nation in Arizona, Utah, Colorado, and New Mexico*, Scientific Investigations Report 2006-5306, 2006.

Appendix A
Field Photographs



Dibble Engineering

NAVAJO D.O.T.

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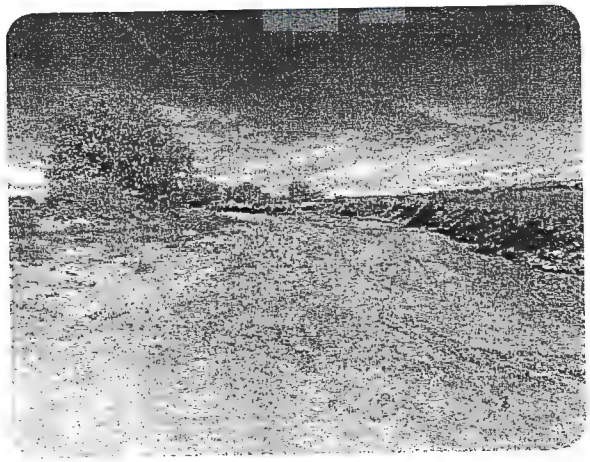
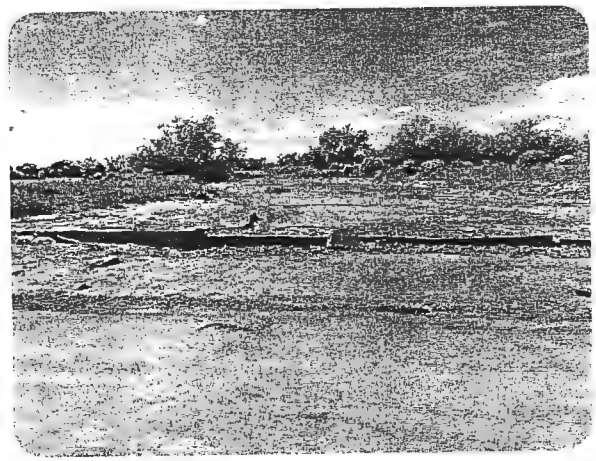
Figure A-1
Photo Map



Upstream (North) at crossing



Downstream (South) at crossing

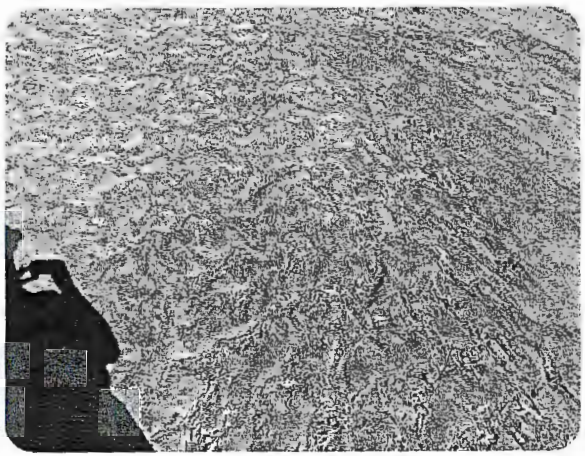
West at crossing

East at crossing

Site photos taken 10/22/14

Upstream, north of crossing

Downstream, north of crossing



Wash surface

Wash bottom, north of crossing

Grade control barriers, south of crossing

Wash and east bank, north of crossing

Looking east across channel

Looking south at crossing

Looking west at crossing in distance

Looking east at crossing in distance

West overbank protection

Wash bottom, south of crossing

Appendix B
Hydrology Analysis

Dibble Engineering

USGS Regional Regression Equation Hydrologic Analysis - Region 11

USGS eqn from: Analysis of the Magnitude and Frequency of Peak Discharges for the Navajo Nation in Arizona, Utah, Colorado, and New Mexico

Table 2. Regional flood-frequency equations using generalized least-squares regression.

[Q, peak discharge, in cubic feet per second for indicated recurrence interval in years; A, drainage area, in square miles; S, average basin slope, in percent; E, average basin elevation, in feet; flood regions are listed in appendix 1]

Flood-frequency equations	Recurrence interval (years)	Average standard error of estimates			
		Regression		Prediction	
		Log units	Percent	Log units	Percent
Region 11					
$Q2 = 3.05 \times 10^{2} A^{0.476} S^{0.608}$	2	0.348	95	0.367	102
$Q5 = 8.44 \times 10^{2} A^{0.471} S^{0.653}$	5	0.278	71	0.296	77
$Q10 = 1.49 \times 10^{3} A^{0.466} S^{0.688}$	10	0.262	66	0.280	72
$Q25 = 2.79 \times 10^{3} A^{0.460} S^{0.730}$	25	0.263	67	0.282	72
$Q50 = 4.19 \times 10^{3} A^{0.455} S^{0.759}$	50	0.274	70	0.295	77
$Q100 = 6.03 \times 10^{3} A^{0.450} S^{0.784}$	100	0.290	75	0.313	83
$Q500 = 1.25 \times 10^{4} A^{0.439} S^{0.836}$	500	0.336	91	0.363	101

Input Parameters

Area (A)	459.0	Sq. Mi.
Slope (S)	0.3	%

Recurrence Interval

Q2=	2,712.9	cfs
Q5=	6,896.5	cfs
Q10=	11,320.4	cfs
Q25=	19,424.5	cfs
Q50=	27,320.4	cfs
Q100=	37,000.6	cfs

Equation Constants			
Pre	*exp*	*A*	*S*
3.05	*2*	*0.476*	*0.608*
8.44	*2*	*0.471*	*0.653*
1.49	*3*	*0.466*	*0.688*
2.79	*3*	*0.460*	*0.730*
4.19	*3*	*0.455*	*0.759*
6.03	*3*	*0.450*	*0.784*

Calculated By: JTB Date: 3/10/2015

Dibble Engineering

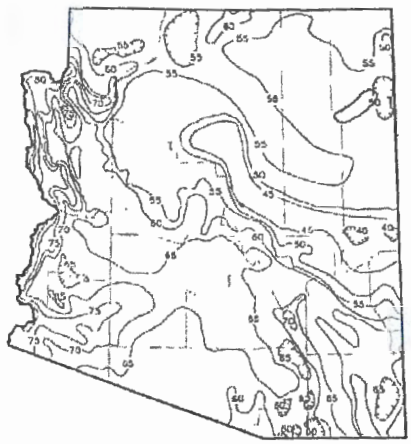
ADOT Regional Regression Equation Hydrologic Analysis - Region 11

Regression Equation from: ADOT Hydrology Manual, Chapter 11, Table 11-4
Flood Magnitude-Frequency Relations for the Northeastern Arizona Region (R11)

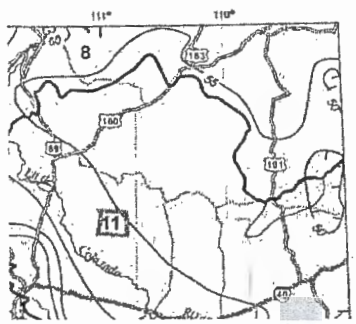
Table 11-4 Flood Magnitude-Frequency Relations for the Northeastern Arizona Region (R11)

Recurrence interval, in years	Equation	Estimated average standard error of regression, in log units
2	$Q = 26\ AREA^{0.62}$	0.609
5	$Q = 130\ AREA^{0.56}$	0.309
10	$Q = 0.10\ AREA^{0.52} EVAP^{2.0}$	0.296
25	$Q = 0.17\ AREA^{0.52} EVAP^{2.0}$	0.191
50	$Q = 0.24\ AREA^{0.54} EVAP^{2.0}$	0.294
100	$Q = 0.27\ AREA^{0.58} EVAP^{2.0}$	0.863

Equation: Q, peak discharge, in cubic feet per second; AREA, drainage area, in square miles; and EVAP, mean annual evaporation, in inches.



— 55 — Mean Annual Evaporation, in inches



Input Parameters

Area (A)	459.0	Sq. Mi.
EVAP	52	inches

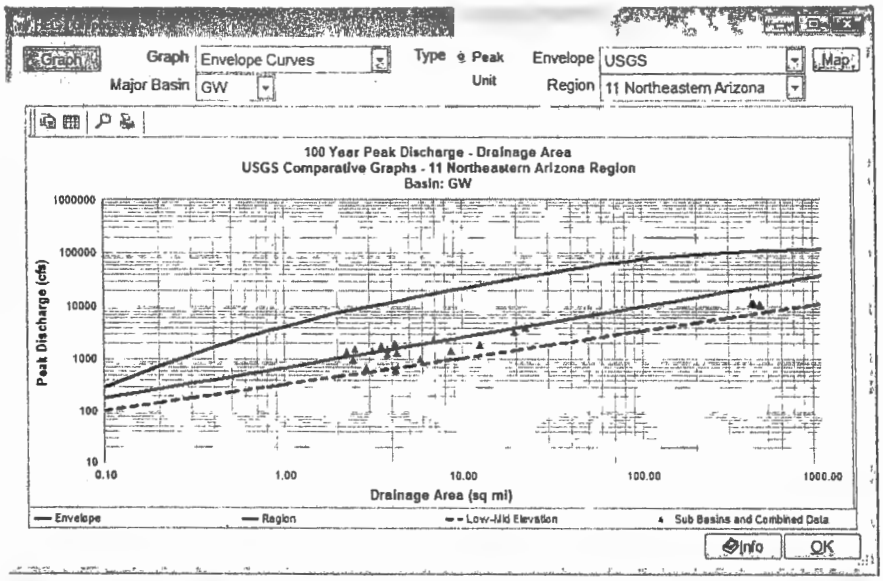
Recurrence Interval

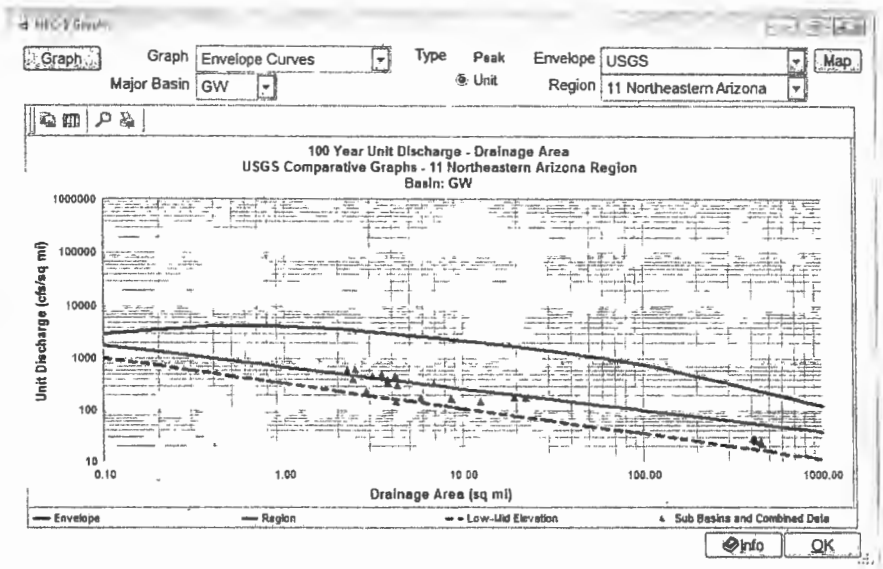
Q2=	1,162.3	cfs
Q5=	4,023.2	cfs
Q10=	6,548.8	cfs
Q25=	11,133.0	cfs
Q50=	17,766.9	cfs
Q100=	25,541.0	cfs

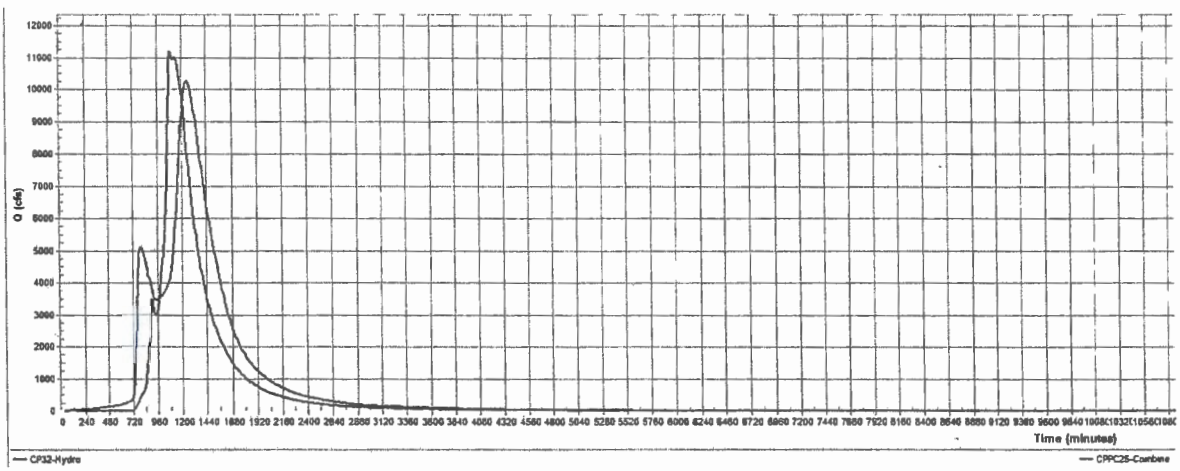
Equation Constants		
Pre	*AREA*	*EVAP*
26	*0.62*	--
130	*0.56*	--
0.1	*0.52*	*2.0*
0.17	*0.52*	*2.0*
0.24	*0.54*	*2.0*
0.27	*0.58*	*2.0*

Calculated By: JTB Date: 3/10/2015

	ID	Type	Area (sq mi)	Discharge cfs 2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
Major Basin GW									
	BD05	Hydrograph	5.810			357	572	773	1,002
	RTBD05	Routed	5.810			337	543	737	962
	BD10	Hydrograph	2.870			237	387	527	691
	CPBD10	Combined	8.690			493	797	1,084	1,414
	RTBD10	Routed	8.690			436	707	978	1,292
	BD15	Hydrograph	3.800			528	859	1,188	1,534
	CPBD15	Combined	12.480			650	1,035	1,423	1,847
	RTBD15	Routed	12.480			478	760	1,053	1,388
	BD20	Hydrograph	6.890			826	1,319	1,811	2,311
	CPBD20	Combined	19.370			1,174	1,865	2,565	3,316
	RTBD20	Routed	19.370			987	1,597	2,262	2,981
	BD25	Hydrograph	3.110			577	918	1,182	1,437
	CPBD25	Combined	22.480			1,375	2,185	3,020	3,900
	RTBD25	Routed	22.480			1,087	1,774	2,466	3,256
	BW05	Hydrograph	4.220			247	360	482	610
	RTBW05	Routed	4.220			183	274	372	473
	RW05	Hydrograph	2.430			342	547	759	973
	RTRW05	Routed	2.430			206	339	481	621
	CP32	Hydrograph	405.130			1,347	3,993	6,918	11,202
	BW10	Hydrograph	2.250			651	931	1,142	1,352
	CPBW10	Combined	414.030			1,353	4,021	6,960	11,275
	RTBW10	Routed	414.030			1,338	4,004	6,942	11,145
	SS05	Hydrograph	4.270			604	1,021	1,372	1,783
	CPSS05	Combined	418.300			1,338	4,015	6,958	11,166
	RTSS05	Routed	418.300			1,315	3,962	6,910	11,040
	PC05	Hydrograph	2.480			556	900	1,219	1,539
	CPPC05	Combined	420.780			1,315	3,968	6,917	11,051
	RTPC05	Routed	420.780			1,229	3,779	6,632	10,707
	PC10	Hydrograph	4.160			784	1,237	1,588	1,927
	CPPC10	Combined	424.940			1,229	3,789	6,644	10,725
	RTPC10	Routed	424.940			1,194	3,707	6,512	10,549
	PC15	Hydrograph	3.800			423	697	956	1,268
	CPPC15	Combined	451.210			1,824	3,776	6,608	10,693
	RTPC15	Routed	451.210			1,340	3,581	6,276	10,204
	PC20	Hydrograph	3.530			878	1,216	1,479	1,754
	RTPC20	Routed	3.530			545	795	1,005	1,249
	PC25	Hydrograph	4.290			519	813	1,070	1,319
	CPPC25	Combined	459.030			1,713	3,602	6,303	10,240


Graph
Graph Envelope Curves
Major Basin GW
Type Peak
Unit
Envelope USGS
Region 11 Northeastern Arizona
Map
100 Year Peak Discharge - Drainage Area
USGS Comparative Graphs - 11 Northeastern Arizona Region
Basin: GW
Peak Discharge (cfs)
1000000
100000
10000
1000
100
10
0.10
1.00
10.00
100.00
1000.00
Drainage Area (sq mi)
Envelope
Region
Low-Mid Elevation
Sub Basins and Combined Data
Info
OK


Graph
Graph Envelope Curves
Major Basin GW
Type Peak
Unit
Envelope USGS
Region 11 Northeastern Arizona
Map
100 Year Unit Discharge - Drainage Area
USGS Comparative Graphs - 11 Northeastern Arizona Region
Basin: GW
Unit Discharge (cfs/sq mi)
1000000
100000
10000
1000
100
10
0.10
1.00
10.00
100.00
1000.00
Drainage Area (sq mi)
Envelope
Region
Low-Mid Elevation
Sub Basins and Combined Data
Info
OK


Q (cfs)
12000
11000
10000
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
0 240 480 720 960 1200 1440 1680 1920 2160 2400 2640 2880 3120 3360 3600 3840 4080 4320 4560 4800 5040 5280 5520 5760 6000 6240 6480 6720 6960 7200 7440 7680 7920 8160 8400 8640 8880 9120 9360 9600
Time (minutes)
CP32-Hydro
CPPC25-Combine

ID	Method	Duration	2 Yr	5 Yr	10 Yr	25 Yr	50 Yr	100 Yr
DEFAULT	CUSTOM	5 MIN	0.210	0.290	0.350	0.420	0.480	0.540
	CUSTOM	10 MIN	0.320	0.450	0.540	0.660	0.750	0.850
	CUSTOM	15 MIN	0.390	0.550	0.660	0.820	0.930	1.050
	CUSTOM	30 MIN	0.490	0.710	0.860	1.060	1.220	1.370
	CUSTOM	1 HOUR	0.590	0.870	1.060	1.310	1.500	1.690
	CUSTOM	2 HOUR	0.710	1.000	1.190	1.460	1.670	1.880
	CUSTOM	3 HOUR	0.780	1.090	1.290	1.570	1.780	2.000
	CUSTOM	6 HOUR	0.930	1.250	1.460	1.760	2.000	2.230
	CUSTOM	12 HOUR	1.140	1.510	1.770	2.130	2.400	2.680
	CUSTOM	24 HOUR	1.350	1.780	2.080	2.490	2.810	3.130

Area ID	Sub Basin Parameters								Rainfall Losses				
	Area (sq mi)	Length (mi)	Slope (ft/mi)	S-Graph	Lca (mi)	Lag (min)	Velocity (f/s)	Kn	IA (in)	DTHETA	PSIF (in)	XKSAT (in/hr)	RTIMP (%)
Major Basin ID: GW													
BD05	5.812	4.45	78.0	DESERT/RANGE	2.24	82.90	4.72	0.055	0.25	0.25	3.83	0.591	15
BD10	2.874	2.86	117.8	DESERT/RANGE	1.53	56.10	4.49	0.055	0.25	0.25	3.79	0.597	15
BD15	3.795	2.88	113.9	DESERT/RANGE	1.48	30.50	8.32	0.030	0.15	0.27	3.22	0.652	15
BD20	6.888	4.04	113.2	DESERT/RANGE	2.02	39.10	9.11	0.030	0.15	0.27	3.29	0.621	15
BD25	3.107	3.39	133.7	DESERT/RANGE	1.85	34.30	8.72	0.030	0.15	0.25	3.90	0.421	16
BW05	4.216	4.54	110.0	DESERT/RANGE	3.02	87.70	4.55	0.055	0.25		2.46	1.487	15
BW10	2.251	2.45	113.6	DESERT/RANGE	1.28	27.10	7.94	0.030	0.15	0.25	4.28	0.336	24
PC05	2.483	1.80	221.8	DESERT/RANGE	0.82	17.90	8.82	0.030	0.15	0.27	3.29	0.624	17
PC10	4.164	3.49	100.1	DESERT/RANGE	1.60	34.60	8.87	0.030	0.15	0.25	3.90	0.421	17
PC15	3.795	3.51	96.4	DESERT/RANGE	1.65	35.30	8.74	0.030	0.15	0.27	3.10	0.712	15
PC20	3.527	4.04	127.9	DESERT/RANGE	2.09	38.70	9.20	0.030	0.15	0.25	4.79	0.257	23
PC25	4.286	4.79	82.9	DESERT/RANGE	2.97	51.20	8.24	0.030	0.15	0.26	3.62	0.496	16
RW05	2.432	2.97	125.3	DESERT/RANGE	1.77	32.40	8.06	0.030	0.15	0.27	3.32	0.605	15
SS05	4.266	2.45	167.3	DESERT/RANGE	1.24	24.90	8.65	0.030	0.15	0.28	3.08	0.719	17

NDOT
Drainage Design Management System
LAND USE
Project Reference: NDOT GREASEWOOD 24HR

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kn	Description
Major Basin ID: GW									
BD05	731	5.8119	100.0	0.25	15	40.0	NORMAL	0.055	Mountain tree and shrubs
		5.8119	**100.0**						
BD10	731	2.8735	100.0	0.25	15	40.0	NORMAL	0.055	Mountain tree and shrubs
		2.8735	**100.0**						
BD15	732	2.4855	65.5	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	1.3097	34.5	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		3.7952	**100.0**						
BD20	732	2.0638	30.0	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	4.8244	70.0	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		6.8882	**100.0**						
BD25	732	0.5599	18.0	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	2.5474	82.0	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		3.1073	**100.0**						
BW05	731	4.2164	100.0	0.25	15	40.0	NORMAL	0.055	Mountain tree and shrubs
		4.2164	**100.0**						
BW10	732	1.8240	81.0	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	0.4272	19.0	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		2.2512	**100.0**						
PC05	732	1.4625	58.9	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	1.0208	41.1	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		2.4833	**100.0**						

* Non default value

NDOT
Drainage Design Management System
LAND USE
Project Reference: NDOT GREASEWOOD 24HR

Sub Basin	Land Use Code	Area (sq mi)	Area (%)	Initial Loss (IA)	Percent Impervious (RTIMP)	Vegetation Cover (%)	DTHETA	Kn	Description
Major Basin ID: GW									
PC10	732	3.8233	91.8	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	0.3411	8.2	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		4.1644	**100.0**						
PC15	732	3.5854	94.5	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	0.2099	5.5	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		3.7953	**100.0**						
PC20	732	3.1050	88.0	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	0.4217	12.0	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		3.5267	**100.0**						
PC25	732	4.0129	93.6	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	0.2733	6.4	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		4.2862	**100.0**						
RW05	732	0.2607	10.7	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	2.1711	89.3	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		2.4318	**100.0**						
SS05	732	2.0576	48.2	0.15	15	5.0	NORMAL	0.030	Mountain Washes
	733	2.2087	51.8	0.15	15	5.0	NORMAL	0.030	Mountain Prairie
		4.2663	**100.0**						

* Non default value

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)	Comments
Major Basin ID: GW									
BD05	715	74	71574	1.389	23.90	0.420	-	100	
	715	84	71584	0.011	0.20	2.000	-	100	
	715	86	71586	4.412	75.90	0.450	-	100	
BD10	715	74	71574	0.528	18.40	0.420	-	100	
	715	80	71580	0.068	2.40	0.340	-	100	
	715	84	71584	0.033	1.10	2.000	-	100	
	715	86	71586	2.246	78.20	0.450	-	100	
BD15	715	15	71515	0.018	0.50	0.900	-	100	
	715	74	71574	0.103	2.70	0.420	-	100	
	715	80	71580	1.204	31.70	0.340	-	100	
	715	84	71584	1.164	30.70	2.000	-	100	
	715	86	71586	1.306	34.40	0.450	-	100	
BD20	715	15	71515	0.006	0.10	0.900	-	100	
	715	65	71565	0.016	0.20	0.800	-	100	
	715	80	71580	4.524	65.70	0.340	-	100	
	715	84	71584	2.329	33.80	2.000	-	100	
	715	86	71586	0.013	0.20	0.450	-	100	
BD25	715	48	71548	0.139	4.50	0.110	20.00	100	
	715	65	71565	0.254	8.20	0.800	-	100	
	715	80	71580	2.375	76.40	0.340	-	100	
	715	84	71584	0.338	10.90	2.000	-	100	
BW05	715	48	71548	0.073	1.70	0.110	20.00	100	
	715	74	71574	0.472	11.20	0.420	-	100	
	715	80	71580	0.096	2.30	0.340	-	100	
	715	84	71584	3.470	82.30	2.000	-	100	
	715	86	71586	0.063	1.50	0.450	-	100	
	715	137	715137	0.043	1.00	0.790	-	100	
BW10	715	48	71548	0.988	43.90	0.110	20.00	100	
	715	74	71574	0.238	10.60	0.420	-	100	
	715	80	71580	0.146	6.50	0.340	-	100	
	715	82	71582	0.026	1.20	2.000	-	100	
	715	84	71584	0.252	11.20	2.000	-	100	
	715	122	715122	0.060	2.70	1.350	-	100	
	715	137	715137	0.541	24.00	0.790	-	100	
PC05	715	6	7156	0.037	1.50	0.100	-	100	
	715	48	71548	0.212	8.50	0.110	20.00	100	
	715	65	71565	0.310	12.50	0.800	-	100	
	715	80	71580	0.766	30.80	0.340	-	100	
	715	84	71584	0.809	32.60	2.000	-	100	
	715	122	715122	0.197	7.90	1.350	-	100	
	715	134	715134	0.153	6.10	0.100	-	100	
PC10	715	6	7156	0.362	8.70	0.100	-	100	
	715	48	71548	0.336	8.10	0.110	20.00	100	
	715	65	71565	1.916	46.00	0.800	-	100	
	715	80	71580	0.482	11.60	0.340	-	100	
	715	84	71584	0.091	2.20	2.000	-	100	
	715	92	71592	0.142	3.40	1.080	-	100	
	715	122	715122	0.296	7.10	1.350	-	100	
	715	134	715134	0.540	13.00	0.100	-	100	
PC15	715	6	7156	0.207	5.50	0.100	-	100	
	715	48	71548	0.020	0.50	0.110	20.00	100	
	715	65	71565	2.178	57.40	0.800	-	100	
	715	80	71580	0.206	5.40	0.340	-	100	
	715	84	71584	0.190	5.00	2.000	-	100	
	715	92	71592	0.613	16.20	1.080	-	100	
	715	94	71594	0.065	1.70	0.130	-	100	
	715	122	715122	0.239	6.30	1.350	-	100	
	715	134	715134	0.078	2.10	0.100	-	100	
PC20	715	48	71548	1.324	37.50	0.110	20.00	100	
	715	65	71565	0.654	18.50	0.800	-	100	
	715	80	71580	0.725	20.60	0.340	-	100	
	715	84	71584	0.134	3.80	2.000	-	100	

Area ID	Book Number	Map Unit	Soil ID	Area (sq mi)	Area (%)	XKSAT	Rock Percent (%)	Effective Rock (%)	Comments
Major Basin ID: GW									
PC20	715	96	71596	0.659	18.70	0.230	-	100	
	715	134	715134	0.030	0.90	0.100	-	100	
PC25	715	6	7156	0.028	0.60	0.100	-	100	
	715	48	71548	0.133	3.10	0.110	20.00	100	
	715	62	71562	0.113	2.60	1.650	-	100	
	715	65	71565	2.216	51.70	0.800	-	100	
	715	80	71580	0.276	6.40	0.340	-	100	
	715	84	71584	0.015	0.30	2.000	-	100	
	715	92	71592	0.258	6.00	1.080	-	100	
	715	94	71594	0.703	16.40	0.130	-	100	
	715	122	715122	0.284	6.60	1.350	-	100	
	715	134	715134	0.262	6.10	0.100	-	100	
RW05	715	74	71574	1.866	76.70	0.420	-	100	
	715	84	71584	0.566	23.30	2.000	-	100	
SS05	715	48	71548	0.368	8.60	0.110	20.00	100	
	715	65	71565	0.047	1.10	0.800	-	100	
	715	80	71580	1.669	39.10	0.340	-	100	
	715	84	71584	1.872	43.90	2.000	-	100	
	715	122	715122	0.151	3.50	1.350	-	100	
	715	134	715134	0.045	1.10	0.100	-	100	
	715	137	715137	0.115	2.70	0.790	-	100	

NDOT
Drainage Design Management System
HEC-1 ROUTING DATA
Project Reference: NDOT GREASEWOOD 24HR

3/11/2015

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
NORMAL DEPTH															
Major Basin GW															
RTBD05	0.040	0.030	0.040	6,873.00	0.0120	-	X:	196.70	252.50	283.30	314.10	330.70	347.30	360.00	366.50
							Y:	6,421.30	6,419.12	6,417.55	6,415.98	6,417.40	6,418.82	6,420.40	6,421.20
RTBD10	0.040	0.030	0.040	11,321.00	0.0114	-	X:	196.70	252.50	283.30	314.10	330.70	347.30	360.00	366.50
							Y:	6,421.30	6,419.12	6,417.55	6,415.98	6,417.40	6,418.82	6,420.40	6,421.20
RTBD15	0.040	0.030	0.040	15,731.00	0.0108	-	X:	-	50.00	74.00	101.00	119.00	146.00	170.00	220.00
							Y:	100.00	93.00	93.00	91.00	91.00	93.00	93.00	100.00
RTBD20	0.040	0.030	0.040	6,074.00	0.0056	-	X:	-	50.00	74.00	101.00	119.00	146.00	170.00	220.00
							Y:	100.00	93.00	93.00	91.00	91.00	93.00	93.00	100.00
RTBD25	0.040	0.030	0.040	11,930.00	0.0086	-	X:	-	50.00	74.00	101.00	119.00	146.00	170.00	220.00
							Y:	100.00	93.00	93.00	91.00	91.00	93.00	93.00	100.00
RTBW05	0.040	0.030	0.040	13,836.00	0.0070	-	X:	-	50.00	74.00	101.00	119.00	146.00	170.00	220.00
							Y:	100.00	93.00	93.00	91.00	91.00	93.00	93.00	100.00
RTBW10	0.040	0.030	0.040	4,636.00	0.0090	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00
RTPC05	0.040	0.030	0.040	12,480.00	0.0032	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00
RTPC10	0.040	0.030	0.040	9,760.00	0.0040	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00
RTPC15	0.040	0.030	0.040	14,725.00	0.0029	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00
RTPC20	0.040	0.030	0.040	5,865.00	0.0036	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00

NDOT
Drainage Design Management System
HEC-1 ROUTING DATA
Project Reference: NDOT GREASEWOOD 24HR

3/11/2015

Route ID	LOB N	Chan N	ROB N	Length (ft)	Slope (ft/ft)	Max Elev (ft)		1.	2.	3.	4.	5.	6.	7.	8.
RTRW05	0.040	0.030	0.040	11,895.00	0.0132	-	X:	-	50.00	74.00	101.00	119.00	146.00	170.00	220.00
							Y:	100.00	93.00	93.00	91.00	91.00	93.00	93.00	100.00
RTSS05	0.040	0.030	0.040	6,136.00	0.0039	-	X:	-	160.00	320.00	410.00	710.00	800.00	960.00	1,120.00
							Y:	100.00	96.00	96.00	93.75	93.75	96.00	96.00	100.00

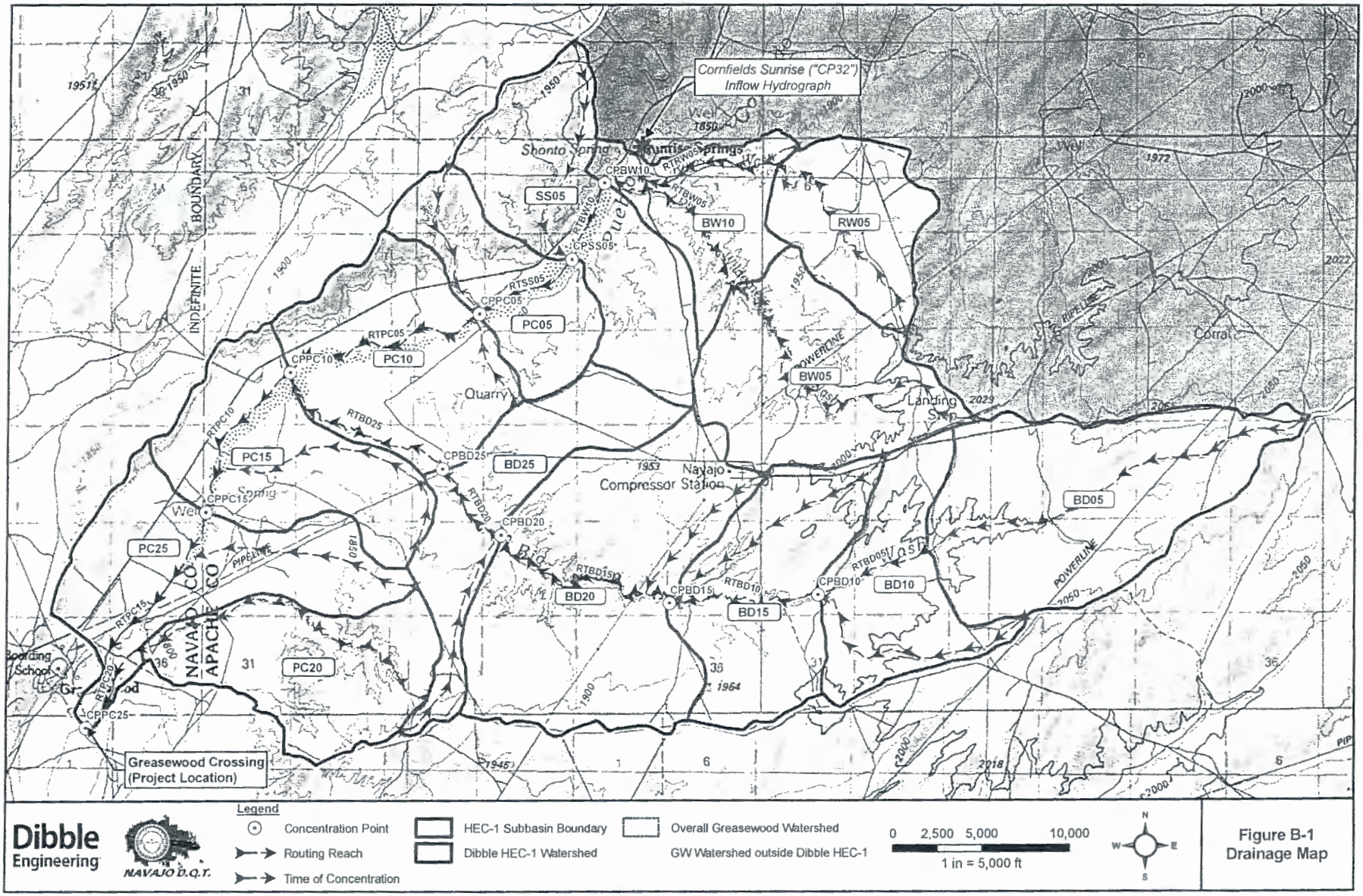


Figure B-1
Drainage Map

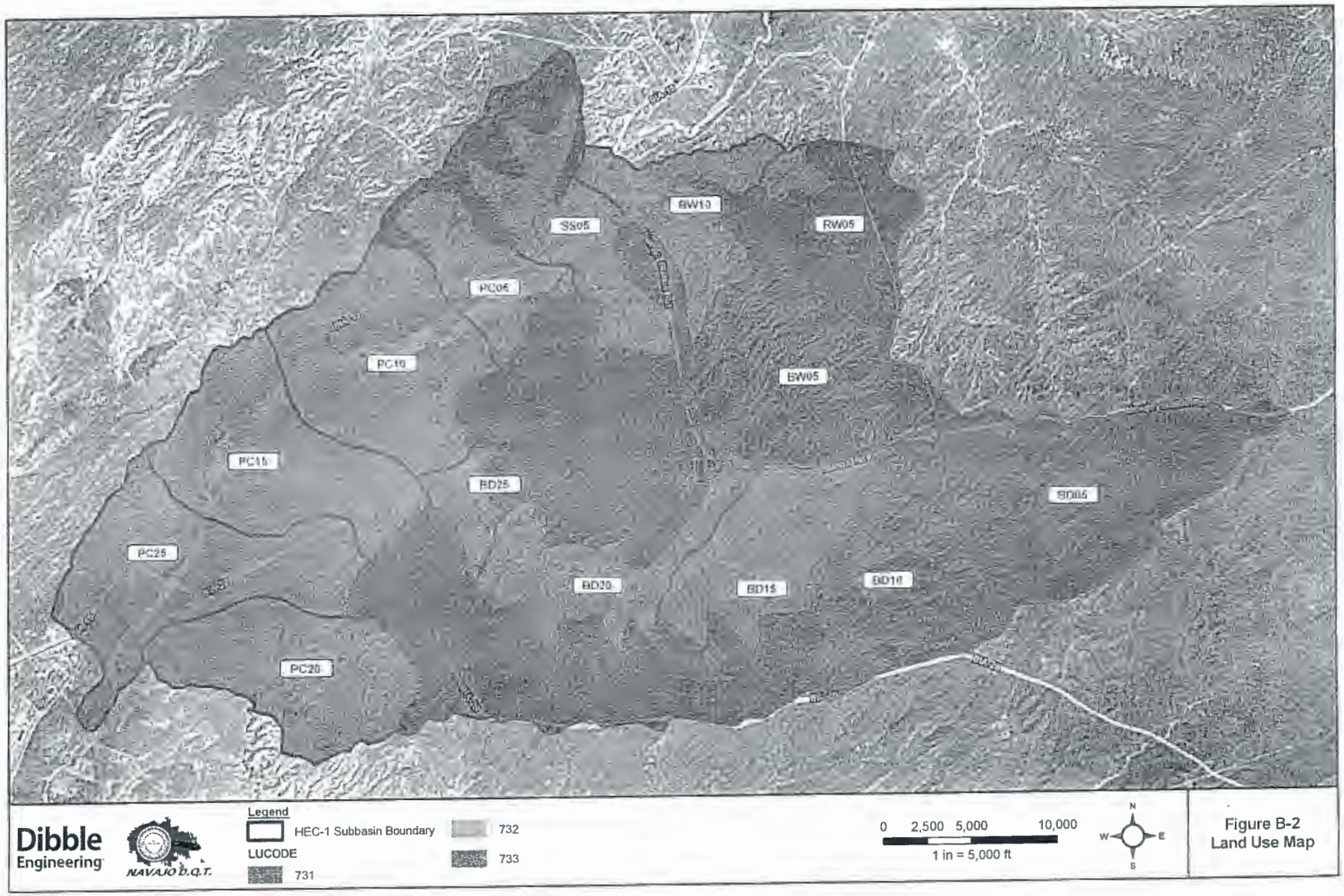


Figure B-2
Land Use Map

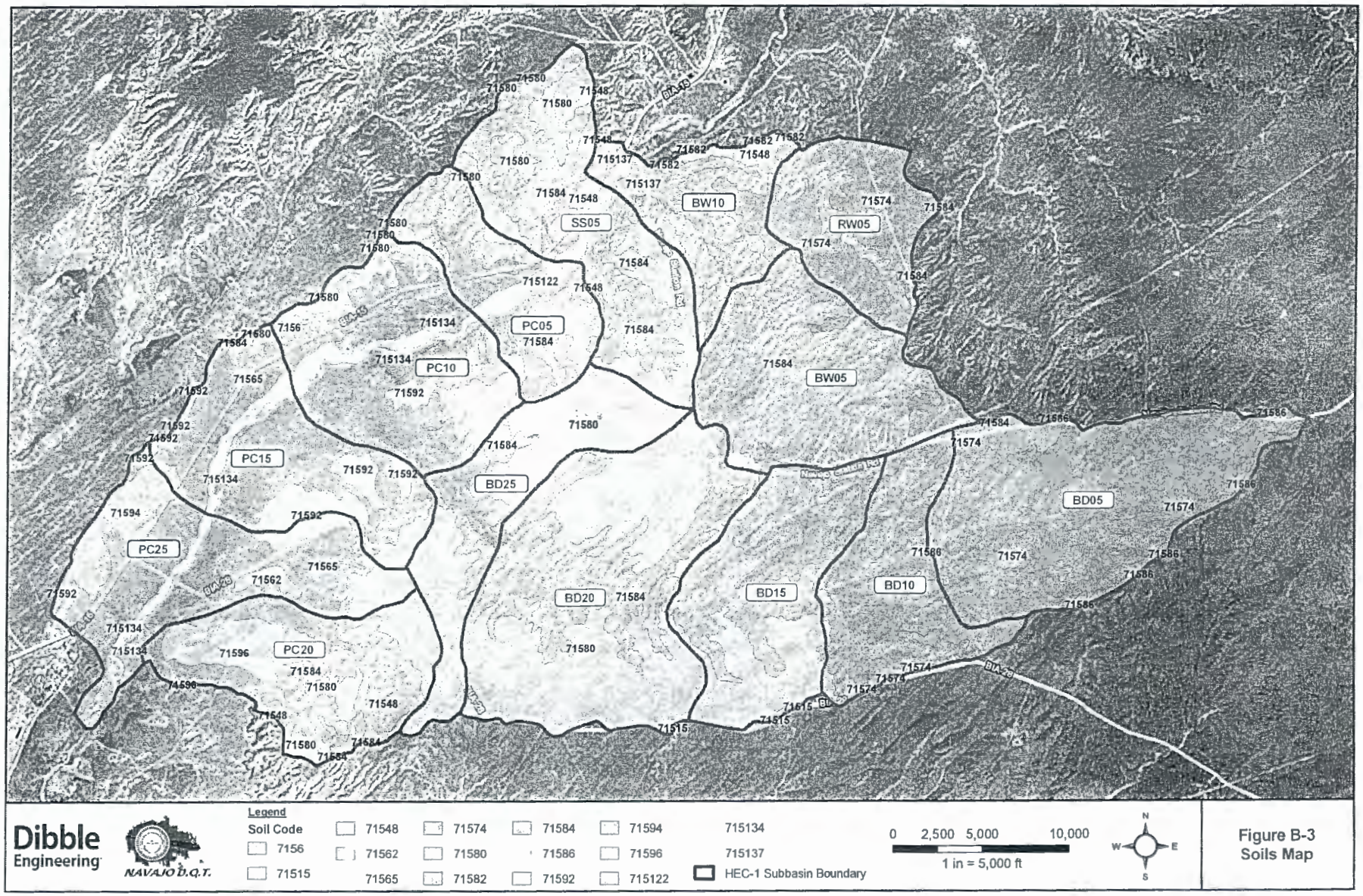


Figure B-3
Soils Map

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   11MAR15  TIME  10:17:30   *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 756-1104              *
*                                       *
*****************************************
```


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

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  1           ID        NDOT
  2           ID        NDOT GREASEWOOD 24HR - NDOT Greasewood Wash 24hr Existing Conditions
  3           ID        100 YEAR
  4           ID        24 Hour Storm
  5           ID        Unit Hydrograph: S-Graph
  6           ID        Storm: Single
  7           ID        03/11/2015
              *DIAGRAM
  8           IT      10  1JAN99       0    2000
  9           IO       5
 10           IN      15
              *
              *

 11           KK    BD05   BASIN
 12           BA   5.812
 13           PB   2.413
 14           PC   0.000   0.002   0.005   0.008   0.011   0.014   0.017   0.020   0.023   0.026
 15           PC   0.029   0.032   0.035   0.038   0.041   0.044   0.048   0.052   0.056   0.060
 16           PC   0.064   0.068   0.072   0.076   0.080   0.085   0.090   0.095   0.100   0.105
 17           PC   0.110   0.115   0.120   0.126   0.133   0.140   0.147   0.155   0.163   0.172
 18           PC   0.181   0.191   0.203   0.218   0.236   0.257   0.283   0.387   0.663   0.707
 19           PC   0.735   0.758   0.776   0.791   0.804   0.815   0.825   0.834   0.842   0.849
 20           PC   0.856   0.863   0.869   0.875   0.881   0.887   0.893   0.898   0.903   0.908
 21           PC   0.913   0.918   0.922   0.926   0.930   0.934   0.938   0.942   0.946   0.950
 22           PC   0.953   0.956   0.959   0.962   0.965   0.968   0.971   0.974   0.977   0.980
 23           PC   0.983   0.986   0.989   0.992   0.995   0.998   1.000
 24           LG    0.25    0.25    3.83    0.59      15
 25           UI       0     236     277     783    1233    1621    2009    2194    2262    2148
 26           UI    1861    1520    1221     998     803     661     511     430     362     257
 27           UI     238     162     162     125      57      57      57      57      57      57
 28           UI      57       0       0       0       0       0       0       0       0       0
 29           UI       0       0       0       0       0       0       0       0       0       0
              *

 30           KK  RTBD05   ROUTE
 31           RS       1    FLOW
 32           RC   0.040   0.030   0.040    6873  0.0120    0.00
 33           RX  196.70  252.50  293.30  314.10  330.70  347.30  360.00  366.50
 34           RY  6421.3 6419.12 6417.55 6415.98 6417.40 6418.82 6420.40 6421.20
              *

 35           KK    BD10   BASIN
 36           BA   2.874
 37           LG    0.25    0.25    3.79    0.60      15
 38           UI       0     172     448     957    1376    1612    1609    1338     978     719
 39           UI     528     378     288     201     147     118      67      42      42      42
 40           UI      42       0       0       0       0       0       0       0       0       0
 41           UI       0       0       0       0       0       0       0       0       0       0
 42           UI       0       0       0       0       0       0       0       0       0       0
              *
```

1 HEC-1 INPUT PAGE 2

```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

 43           KK  CPBD10 COMBINE
 44           HC       2
```

```
                *
45              KK  RTBD10   ROUTE
46              RS       1     FLOW
47              RC   0.040   0.030   0.040   11321   0.0114     0.00
48              RX  196.70  252.50  283.30  314.10  330.70   347.30  360.00  366.50
49              RY  6421.3 6419.12 6417.55 6415.98 6417.40  6418.82 6420.40 6421.20
                *
50              KK    BD15    BASIN
51              BA   3.795
52              LG    0.15     0.27     3.22     0.65       15
53              UI       0      677     2586     3892     3271     1892     1052      600      335      163
54              UI     102      102        0        0        0        0        0        0        0        0
55              UI       0        0        0        0        0        0        0        0        0        0
56              UI       0        0        0        0        0        0        0        0        0        0
57              UI       0        0        0        0        0        0        0        0        0        0
                *
58              KK  CPBD15  COMBINE
59              HC       2
                *
60              KK  RTBD15   ROUTE
61              RS       1     FLOW
62              RC   0.040   0.030   0.040   15731   0.0108     0.00
63              RX    0.00   50.00   74.00  101.00  119.00   146.00  170.00  220.00
64              RY  100.00   93.00   93.00   91.00   91.00    93.00   93.00  100.00
                *
65              KK    BD20    BASIN
66              BA   6.888
67              LG    0.15     0.27     3.29     0.62       15
68              UI       0      705     2716     4790     5615     4638     2994     1924     1215      775
69              UI     488      323      144      144      144        0        0        0        0        0
70              UI       0        0        0        0        0        0        0        0        0        0
71              UI       0        0        0        0        0        0        0        0        0        0
72              UI       0        0        0        0        0        0        0        0        0        0
                *
73              KK  CPBD20  COMBINE
74              HC       2
                *
75              KK  RTBD20   ROUTE
76              RS       1     FLOW
77              RC   0.040   0.030   0.040    6074   0.0056     0.00
78              RX    0.00   50.00   74.00  101.00  119.00   146.00  170.00  220.00
79              RY  100.00   93.00   93.00   91.00   91.00    93.00   93.00  100.00
                *
1                                          HEC-1 INPUT                                          PAGE   3
LINE            ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
80              KK    BD25    BASIN
81              BA   3.107
82              LG    0.15     0.25     3.90     0.42       16
83              UI       0      426     1638     2704     2746     1819     1097      657      392      234
84              UI     124       74       74        0        0        0        0        0        0        0
85              UI       0        0        0        0        0        0        0        0        0        0
86              UI       0        0        0        0        0        0        0        0        0        0
87              UI       0        0        0        0        0        0        0        0        0        0
                *
88              KK  CPBD25  COMBINE
89              HC       2
                *
90              KK  RTBD25   ROUTE
91              RS       1     FLOW
92              RC   0.040   0.030   0.040   11930   0.0086     0.00
93              RX    0.00   50.00   74.00  101.00  119.00   146.00  170.00  220.00
94              RY  100.00   93.00   93.00   91.00   91.00    93.00   93.00  100.00
                *
95              KK    BW05    BASIN
96              BA   4.216
97              LG    0.25     0.00     2.46     1.49       15
98              UI       0      162      162      507      779     1063     1297     1460     1551     1523
99              UI    1406     1173      952      786      647      529      433      346      293      248
100             UI     180      172      112      111      108       39       39       39       39       39
101             UI      39       39       39        0        0        0        0        0        0        0
102             UI       0        0        0        0        0        0        0        0        0        0
                *
103             KK  RTBW05   ROUTE
104             RS       1     FLOW
105             RC   0.040   0.030   0.040   13836   0.0070     0.00
106             RX    0.00   50.00   74.00  101.00  119.00   146.00  170.00  220.00
107             RY  100.00   93.00   93.00   91.00   91.00    93.00   93.00  100.00
                *
108             KK    RW05    BASIN
109             BA   2.432
110             LG    0.15     0.27     3.32     0.61       15
```

```
111          UI        0      373     1458     2303     2146     1323      770      454      253      156
112          UI       62       62        0        0        0        0        0        0        0        0
113          UI        0        0        0        0        0        0        0        0        0        0
114          UI        0        0        0        0        0        0        0        0        0        0
115          UI        0        0        0        0        0        0        0        0        0        0
             *

116          KK   RTRW05    ROUTE
117          RS        1     FLOW
118          RC    0.040    0.030    0.040    11895   0.0132     0.00
119          RX     0.00    50.00    74.00   101.00   119.00   146.00   170.00   220.00
120          RY   100.00    93.00    93.00    91.00    91.00    93.00    93.00   100.00
             *
1                                          HEC-1 INPUT                                          PAGE  4

LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

121          KK     CP32   HYDRO
122          IN       10
123          BA   405.13
124          QI        0        0        0        0        0        0        0        0        0        0
125          QI        0        0        0        0        1        1        1        1        1        1
126          QI        1        1        1        1        1        1        1        1        1        1
127          QI        1        1        1        1        1        2        2        2        2        2
128          QI        2        2        2        2        2        2        2        2        2        2
129          QI        2        2        2        2        2        2        2        2        2        3
130          QI        3        3        3        3        3        3        3        3        4        4
131          QI        4        8       28       67      117      174      235      299      364      429
132          QI      494      557      619      706      837     1157     1546     1969     2273     3030
133          QI     3496     3406     3253     3102     2992     2977     3117     3335     3613     3949
134          QI     4340     4763     5175     5596     6101     6838     8039     9799    11044    11202
135          QI    11096    10981    10941    10976    11003    10945    10793    10605    10403    10153
136          QI     9839     9487     9117     8744     8373     8009     7656     7315     6988     6675
137          QI     6374     6084     5812     5554     5311     5082     4864     4659     4464     4277
138          QI     4104     3944     3798     3657     3490     3348     3218     3097     2983     2874
139          QI     2769     2670     2576     2488     2402     2318     2238     2163     2101     2028
140          QI     1953     1883     1817     1754     1696     1639     1585     1532     1482     1435
141          QI     1388     1345     1303     1263     1224     1188     1152     1118     1086     1055
142          QI     1024      996      968      942      916      891      868      845      822      801
143          QI      784      766      743      720      701      682      665      648      631      616
144          QI      600      586      571      557      544      531      518      506      495      484
145          QI      472      462      452      442      432      422      413      404      395      387
146          QI      378      370      362      354      347      339      332      326      319      312
147          QI      306      300      294      288      282      277      271      266      261      256
148          QI      251      246      242      237      233      228      224      220      216      212
149          QI      208      204      200      197      193      190      186      183      180      177
150          QI      174      170      168      165      162      159      156      154      151      149
151          QI      146      144      142      139      137      135      133      131      129      127
152          QI      125      123      121      119      117      115      114      112      110      108
153          QI      107      105      103      102      100       99       97       96       94       93
154          QI       92       90       89       88       87       85       84       83       82       81
155          QI       80       79       78       77       75       74       74       73       72       71
156          QI       70       69       68       67       66       65       65       64       63       62
157          QI       61       61       60       59       58       58       57       56       55       55
158          QI       54       54       53       52       52       51       50       50       49       49
159          QI       48       48       47       47       46       46       45       45       44       44
160          QI       43       43       42       42       41       41       41       40       40       39
161          QI       39       38       38       38       37       37       36       36       36       35
162          QI       35       35       34       34       34       33       33       33       32       32
163          QI       32       31       31       31       30       30       30       30       29       29
164          QI       29       28       28       28       28       27       27       27       27       26
165          QI       26       26       26       26       25       25       25       25       24       24
166          QI       24       24       24       23       23       23       23       23       22       22
167          QI       22       22       22       22       21       21       21       21       21       20
168          QI       20       20       20       20       20       20       19       19       19       19
169          QI       19       19       18       18       18       18       18       18       18       17
170          QI       17       17       17       17       17       17       17       16       16       16
171          QI       16       16       16       16       16       16       15       15       15       15
172          QI       15       15       15       15       15       14       14       14       14       14
173          QI       14       14       14       14       14       13       13       13       13       13
174          QI       13       13       13       13       13       13       12       12       12       12
1                                          HEC-1 INPUT                                          PAGE  5

LINE         ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

175          QI       12       12       12       12       12       12       12       12       12       11
176          QI       11       11       11       11       11       11       11       11       11       11
177          QI       11       11       11       10       10       10       10       10       10       10
178          QI       10       10       10       10       10       10       10       10       10        9
179          QI        9        9        9        9        9        9        9        9        9        9
180          QI        9        9        9        9        9        9        9        9        8        8
181          QI        8        8        8        8        8        8        8        8        8        8
182          QI        8        8        8        8        8        8        8        8        8        8
183          QI        7        7        7        7        7        7        7        7        7        7
184          QI        7        7        7        7        7        7        7        7        7        7
185          QI        7        7        7        7        7        6        6        6        6        6
186          QI        6        6        6        6        6        6        6        6        6        6
187          QI        6        6        6        6        6        6        6        6        6        6
188          QI        6        6        6        6        6        6        6        6        5        5
189          QI        5        5        5        5        5        5        5        5        5        5
190          QI        5        5        5        5        5        5        5        5        5        5
191          QI        5        5        5        5        5        5        5        5        5        5
192          QI        5        5        5        5        5        5        5        5        5        4
193          QI        4        4        4        4        4        4        4        4        4        4
194          QI        4        4        4        4        4        4        4        4        4        4
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195          QI        4        4        4        4        4        4        4        4        4        4
196          QI        4        4        4        4        4        4        4        4        4        4
197          QI        4        4        4        4        4        4        4        4        4        4
198          QI        4        4        4        4        4        3        3        3        3        3
199          QI        3        3        3        3        3        3        3        3        3        3
200          QI        3        3        3        3        3        3        3        3        3        3
201          QI        3        3        3        3        3        3        3        3        3        3
202          QI        3        3        3        3        3        3        3        3        3        3
203          QI        3        3        3        3        3        3        3        3        3        3
             *
204          IN       15
             *

205          KK     BW10    BASIN
206          BA    2.251
207          LG     0.15     0.25     4.28     0.34       24
208          UI        0      523     1959     2599     1744      915      482      243      118       68
209          UI        0        0        0        0        0        0        0        0        0        0
210          UI        0        0        0        0        0        0        0        0        0        0
211          UI        0        0        0        0        0        0        0        0        0        0
212          UI        0        0        0        0        0        0        0        0        0        0
             *

213          KK   CPBW10  COMBINE
214          HC        4
             *

215          KK   RTBW10    ROUTE
216          RS        1     FLOW
217          RC    0.040    0.030    0.040     4636   0.0090     0.00
218          RX     0.00   160.00   320.00   410.00   710.00   800.00   960.00  1120.00
219          RY   100.00    96.00    96.00    93.75    93.75    96.00    96.00   100.00
             *
```
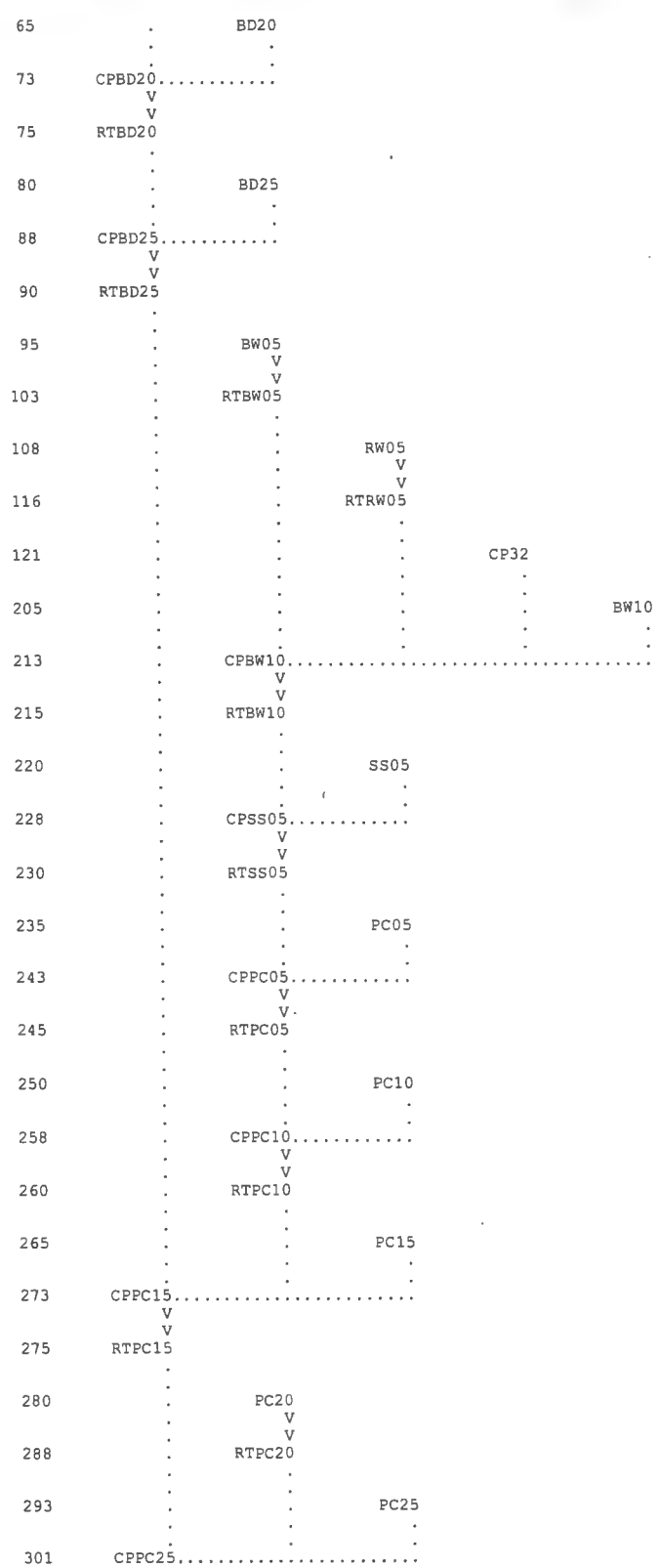



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

220          KK     SS05    BASIN
221          BA    4.266
222          LG     0.15     0.28     3.08     0.72       17
223          UI        0     1215     4348     5156     2959     1461      731      345      140      140
224          UI        0        0        0        0        0        0        0        0        0        0
225          UI        0        0        0        0        0        0        0        0        0        0
226          UI        0        0        0        0        0        0        0        0        0        0
227          UI        0        0        0        0        0        0        0        0        0        0
             *

228          KK   CPSS05  COMBINE
229          HC        2
             *

230          KK   RTSS05    ROUTE
231          RS        1     FLOW
232          RC    0.040    0.030    0.040     6136   0.0039     0.00
233          RX     0.00   160.00   320.00   410.00   710.00   800.00   960.00  1120.00
234          RY   100.00    96.00    96.00    93.75    93.75    96.00    96.00   100.00
             *

235          KK     PC05    BASIN
236          BA    2.483
237          LG     0.15     0.27     3.29     0.62       17
238          UI        0     1506     4172     2477      931      348      114        0        0        0
239          UI        0        0        0        0        0        0        0        0        0        0
240          UI        0        0        0        0        0        0        0        0        0        0
241          UI        0        0        0        0        0        0        0        0        0        0
242          UI        0        0        0        0        0        0        0        0        0        0
             *

243          KK   CPPC05  COMBINE
244          HC        2
             *

245          KK   RTPC05    ROUTE
246          RS        1     FLOW
247          RC    0.040    0.030    0.040    12480   0.0032     0.00
248          RX     0.00   160.00   320.00   410.00   710.00   800.00   960.00  1120.00
249          RY   100.00    96.00    96.00    93.75    93.75    96.00    96.00   100.00
             *

250          KK     PC10    BASIN
251          BA    4.164
252          LG     0.15     0.25     3.90     0.42       17
253          UI        0      560     2156     3572     3675     2461     1495      898      536      322
254          UI      180       99       99        0        0        0        0        0        0        0
255          UI        0        0        0        0        0        0        0        0        0        0
256          UI        0        0        0        0        0        0        0        0        0        0
257          UI        0        0        0        0        0        0        0        0        0        0
             *
```



```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

258          KK   CPPC10  COMBINE
259          HC        2
```

```
                *
          260   KK  RTPC10   ROUTE
          261   RS       1   FLOW
          262   RC   0.040   0.030   0.040    9760  0.0040    0.00
          263   RX    0.00  160.00  320.00  410.00  710.00  800.00  960.00 1120.00
          264   RY  100.00   96.00   96.00   93.75   93.75   96.00   96.00  100.00
                *
          265   KK    PC15   BASIN
          266   BA   3.795
          267   LG    0.15    0.27    3.10    0.71      15
          268   UI       0     490    1884    3147    3328    2302    1407     850     523     310
          269   UI     191      88      88       0       0       0       0       0       0       0
          270   UI       0       0       0       0       0       0       0       0       0       0
          271   UI       0       0       0       0       0       0       0       0       0       0
          272   UI       0       0       0       0       0       0       0       0       0       0
                *
          273   KK  CPPC15 COMBINE
          274   HC       3
                *
          275   KK  RTPC15   ROUTE
          276   RS       1   FLOW
          277   RC   0.040   0.030   0.040   14725  0.0029    0.00
          278   RX    0.00  160.00  320.00  410.00  710.00  800.00  960.00 1120.00
          279   RY  100.00   96.00   96.00   93.75   93.75   96.00   96.00  100.00
                *
          280   KK    PC20   BASIN
          281   BA   3.527
          282   LG    0.15    0.25    4.79    0.26      23
          283   UI       0     370    1423    2495    2904    2360    1509     969     603     388
          284   UI     241     152      75      75      75       0       0       0       0       0
          285   UI       0       0       0       0       0       0       0       0       0       0
          286   UI       0       0       0       0       0       0       0       0       0       0
          287   UI       0       0       0       0       0       0       0       0       0       0
                *
          288   KK  RTPC20   ROUTE
          289   RS       1   FLOW
          290   RC   0.040   0.030   0.040    5865  0.0036    0.00
          291   RX    0.00  160.00  320.00  410.00  710.00  800.00  960.00 1120.00
          292   RY  100.00   96.00   96.00   93.75   93.75   96.00   96.00  100.00
                *
1                                          HEC-1 INPUT                                    PAGE  8
         LINE   ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
          293   KK    PC25   BASIN
          294   BA   4.286
          295   LG    0.15    0.26    3.62    0.50      16
          296   UI       0     282     863    1731    2412    2698    2440    1800    1283     912
          297   UI     640     471     320     221     191      69      69      69      69       0
          298   UI       0       0       0       0       0       0       0       0       0       0
          299   UI       0       0       0       0       0       0       0       0       0       0
          300   UI       0       0       0       0       0       0       0       0       0       0
                *
          301   KK  CPPC25 COMBINE
          302   HC       3
                *
          303   ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK

 INPUT
  LINE      (V) ROUTING          (---->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR        (<----) RETURN OF DIVERTED OR PUMPED FLOW

    11        BD05
                V
                V
    30      RTBD05
              .
              .
    35        .         BD10
              .           .
              .           .
    43      CPBD10............
                V
                V
    45      RTBD10
              .
              .
    50        .         BD15
              .           .
              .           .
    58      CPBD15............
                V
                V
    60      RTBD15
              .
              .
```



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*         609 SECOND STREET             *
*       DAVIS, CALIFORNIA 95616         *
*****************************************
```

* RUN DATE 11MAR15 TIME 10:17:30 *
*
*****

* (916) 756-1104 *
*
*****

NDOT
NDOT GREASEWOOD 24HR - NDOT Greasewood Wash 24hr Existing Conditions
100 YEAR
24 Hour Storm
Unit Hydrograph: S-Graph
Storm: Single
03/11/2015

9 IO OUTPUT CONTROL VARIABLES

IPRNT	5	PRINT CONTROL
IPLOT	0	PLOT CONTROL
QSCAL	0.	HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA

NMIN	10	MINUTES IN COMPUTATION INTERVAL
IDATE	1JAN99	STARTING DATE
ITIME	0000	STARTING TIME
NQ	2000	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	14JAN99	ENDING DATE
NDTIME	2110	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL 0.17 HOURS
TOTAL TIME BASE 333.17 HOURS

ENGLISH UNITS

DRAINAGE AREA	SQUARE MILES
PRECIPITATION DEPTH	INCHES
LENGTH, ELEVATION	FEET
FLOW	CUBIC FEET PER SECOND
STORAGE VOLUME	ACRE-FEET
SURFACE AREA	ACRES
TEMPERATURE	DEGREES FAHRENHEIT

1

RUNOFF SUMMARY
FLOW IN CUBIC FEET PER SECOND
TIME IN HOURS, AREA IN SQUARE MILES

	OPERATION	STATION	PEAK FLOW	TIME OF PEAK	AVERAGE FLOW FOR MAXIMUM PERIOD 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
+	HYDROGRAPH AT	BD05	1002.	13.33	328.	98.	33.	5.81		
+ +	ROUTED TO	RTBD05	962.	13.50	327.	98.	33.	5.81	6418.87	13.50
+	HYDROGRAPH AT	BD10	691.	12.83	162.	48.	16.	2.87		
+	2 COMBINED AT	CPBD10	1414.	13.17	487.	147.	49.	8.69		
+ +	ROUTED TO	RTBD10	1292.	13.50	485.	146.	49.	8.69	6419.22	13.50
+	HYDROGRAPH AT	BD15	1534.	12.50	217.	65.	22.	3.80		
+	2 COMBINED AT	CPBD15	1847.	12.50	697.	211.	71.	12.48		
+ +	ROUTED TO	RTBD15	1388.	13.67	691.	210.	71.	12.48	93.82	13.67
+	HYDROGRAPH AT	BD20	2311.	12.67	402.	120.	40.	6.89		
+	2 COMBINED AT	CPBD20	3316.	12.67	1083.	328.	111.	19.37		
+ +	ROUTED TO	RTBD20	2981.	12.83	1081.	328.	111.	19.37	95.40	12.83
+	HYDROGRAPH AT	BD25	1437.	12.50	216.	63.	21.	3.11		
+	2 COMBINED AT	CPBD25	3900.	12.67	1292.	391.	132.	22.48		
+ +	ROUTED TO	RTBD25	3256.	13.00	1285.	391.	132.	22.48	95.16	13.00

	HYDROGRAPH AT								
+		BW05	610.	13.33	212.	65.	22.	4.22	
	ROUTED TO								
+		RTBW05	473.	13.83	208.	65.	22.	4.22	
+									93.03 13.83
	HYDROGRAPH AT								
+		RW05	973.	12.50	142.	42.	14.	2.43	
	ROUTED TO								
+		RTRW05	621.	12.83	141.	42.	14.	2.43	
+									93.00 12.83
	HYDROGRAPH AT								
+		CP32	11202.	18.17	8269.	3308.	1156.	405.13	
	HYDROGRAPH AT								
+		BW10	1352.	12.50	190.	58.	19.	2.25	
	4 COMBINED AT								
+		CPBW10	11275.	18.17	8325.	3444.	1209.	414.03	
	ROUTED TO								
+		RTBW10	11145.	18.33	8318.	3441.	1209.	414.03	
+									96.69 18.33
	HYDROGRAPH AT								
+		SS05	1783.	12.33	242.	74.	25.	4.27	
	2 COMBINED AT								
+		CPSS05	11166.	18.33	8335.	3500.	1233.	418.30	
	ROUTED TO								
+		RTSS05	11040.	19.17	8311.	3495.	1233.	418.30	
+									97.28 19.17
	HYDROGRAPH AT								
+		PC05	1539.	12.33	152.	46.	15.	2.48	
	2 COMBINED AT								
+		CPPC05	11051.	19.17	8320.	3530.	1248.	420.78	
	ROUTED TO								
+		RTPC05	10707.	19.83	8211.	3513.	1248.	420.78	
+									97.39 19.83
	HYDROGRAPH AT								
+		PC10	1927.	12.50	296.	87.	29.	4.16	
	2 COMBINED AT								
+		CPPC10	10725.	19.83	8227.	3584.	1276.	424.94	
	ROUTED TO								
+		RTPC10	10549.	20.17	8167.	3572.	1276.	424.94	
+									97.18 20.17
	HYDROGRAPH AT								
+		PC15	1268.	12.50	206.	62.	21.	3.80	
	3 COMBINED AT								
+		CPPC15	10693.	20.17	8300.	3983.	1428.	451.21	
	ROUTED TO								
+		RTPC15	10204.	20.83	8153.	3965.	1428.	451.21	
+									97.39 20.83
	HYDROGRAPH AT								
+		PC20	1754.	12.50	314.	94.	31.	3.53	
	ROUTED TO								
+		RTPC20	1249.	12.83	310.	93.	31.	3.53	
+									94.92 12.83
	HYDROGRAPH AT								
+		PC25	1319.	12.83	281.	83.	28.	4.29	
	3 COMBINED AT								
+		CPPC25	10240.	20.83	8187.	4116.	1486.	459.03	

*** NORMAL END OF HEC-1 ***

Appendix C
Hydraulic Analysis

Procedure

General

Three levels of procedures for estimation of channel degradation depth are described in the following paragraphs. The first level of analysis provides an initial estimate of the potential scour depth to consider for design of structures to be placed near a streambed or along the banks of a channel. This first level of analysis is recommended only for channel reaches that are expected to be in general balance with the surrounding system -- i.e. no major disturbances (dams, bridges, encroachments, etc..) are evident in the site vicinity -- and where the desire is to establish a "safe" scour depth to allow for the concentration of flows that can naturally occur within channels composed of erodible material. The Level II procedures provided are methods for demonstrating the site specific limits to erosion potential, involving computations which require local hydraulic information and sediment size distributions, or historical evidence of channel performance. The third level of procedures outlined will provide more definitive determination of channel stability in the reaches under study. This level of analysis is recommended in areas where local flow characteristics are complex, where the channel has been redirected or otherwise modified by acts of man, or where the safety of local paralleling or crossing structures is of high concern.

Level I

This level of analysis requires the following information :

> Peak discharge associated with the 100-year flood (Q_{100}). May be estimated using simplified methodologies such as ADWR State Standard #2 (SS 2-96), USGS regression equations, or other appropriate local or more detailed methods.

The total scour depth, d_s, is the combination of general degradation and long term degradation and can be computed as follows:

$$d_s = d_{gs} + d_{lts}$$

where:

d_s = Total scour depth, in feet
d_{gs} = General degradation, in feet
d_{lts} = Long term degradation, in feet

General degradation can be computed as follows:

$$d_{gs} = 0.157(Q_{100})^{0.4} \quad \text{for straight channel reaches.}$$

and

$$d_{gs} = 0.219(Q_{100})^{0.4} \quad \text{for channel reaches with curvature.}$$

The second equation will give the worst-case scour for channel curvature, and is not recommended unless significant curvature is evident along the channel reach.

Long term degradation can be computed as follows:

$$d_{lts} = 0.02(Q_{100})^{0.6}$$

This equation for long term degradation should only be used when no downstream controls exist within the channel system.

The total scour depth, d_s, should be applied to the lowest point in the local cross section for determination of the elevation to which scour will occur.

For Level I, the minimum total scour depth, d_s, shall be 3 feet.

Level II

The Level II approaches presented below may be used to demonstrate the ability of the existing channel system to resist degradation, and to justify a lesser burial requirement than that computed using the Level I equations.

Erodibility evaluation

Three procedures for determination of the erodibility of local channel material under computed hydraulic conditions are presented in the ADWR's State Standard for Lateral Migration Setback Allowance for Riverine Floodplains in Arizona. These procedures are: (1) the allowable velocity approach; (2) the tractive stress approach; and, (3) the tractive power approach. One or more of these procedures can be used to demonstrate the adequacy of the material of which the channel is composed to resist the erosive action of the flow under 100 year flow conditions.

Armoring potential evaluation.

An evaluation of relative channel stability can be made by evaluating incipient motion parameters and determining armoring potential. The definition of incipient motion is based on the critical or threshold condition where hydrodynamic forces acting on a grain of sediment have reached a value that, if increased even slightly, will move the grain. Under critical conditions, or at the point of incipient motion, the hydrodynamic forces acting on the grain are just balanced by the resisting forces of the particle. For given hydrodynamic forces, or equivalently for a given discharge, incipient motion conditions will exist for a single particle size. Particles smaller than this will be transported downstream and particles equal to or larger than this will remain in place.

Dibble Engineering

Channel Degradation Estimation for Alluvial Channels in Arizona - Level 1 Analysis

State Standard 5-96, September 1996, Guideline #2, Pgs 40-41

The total scour depth, d_s, is the combination of general degradation and long term degradation and can be computed as follows:

$$d_s = d_{gs} + d_{lts}$$

where:

d_s = Total scour depth, in feet
d_{gs} = General degradation, in feet
d_{lts} = Long term degradation, in feet

Input Parameters (10 Yr):

Q_{10}= 1849.0 cfs
Channel Type: Straight

$d_{gs} = 0.157(Q_{100})^{0.4}$ for straight channel reaches.
$d_{gs} = 0.219(Q_{100})^{0.4}$ for channel reaches with curvature.
$d_{lts} = 0.02(Q_{100})^{0.6}$

General Degradation
d_{gs}= 3.2 ft

Long Term Degradation
d_{lts}= 1.8 ft

Total Scour Depth (Q10)
d_s= 5.0 ft

Input Parameters (100 Yr):

Q_{100}= 10236.0 cfs
Channel Type: Straight

General Degradation
d_{gs}= 6.3 ft

Long Term Degradation
d_{lts}= 5.1 ft

Total Scour Depth (Q100)
d_s= 11.4 ft

Calculated By: JTB Date: 3/10/2015

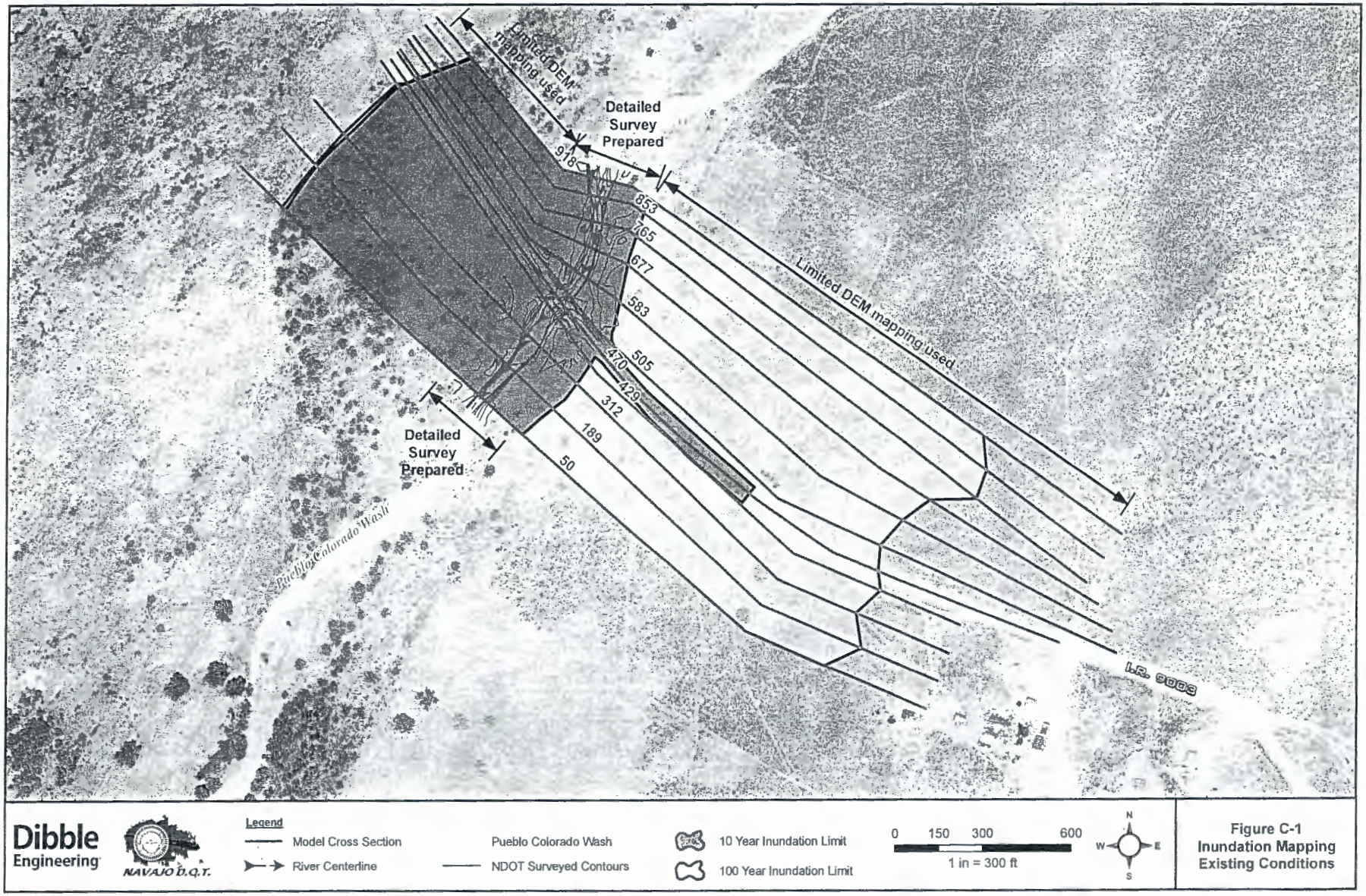
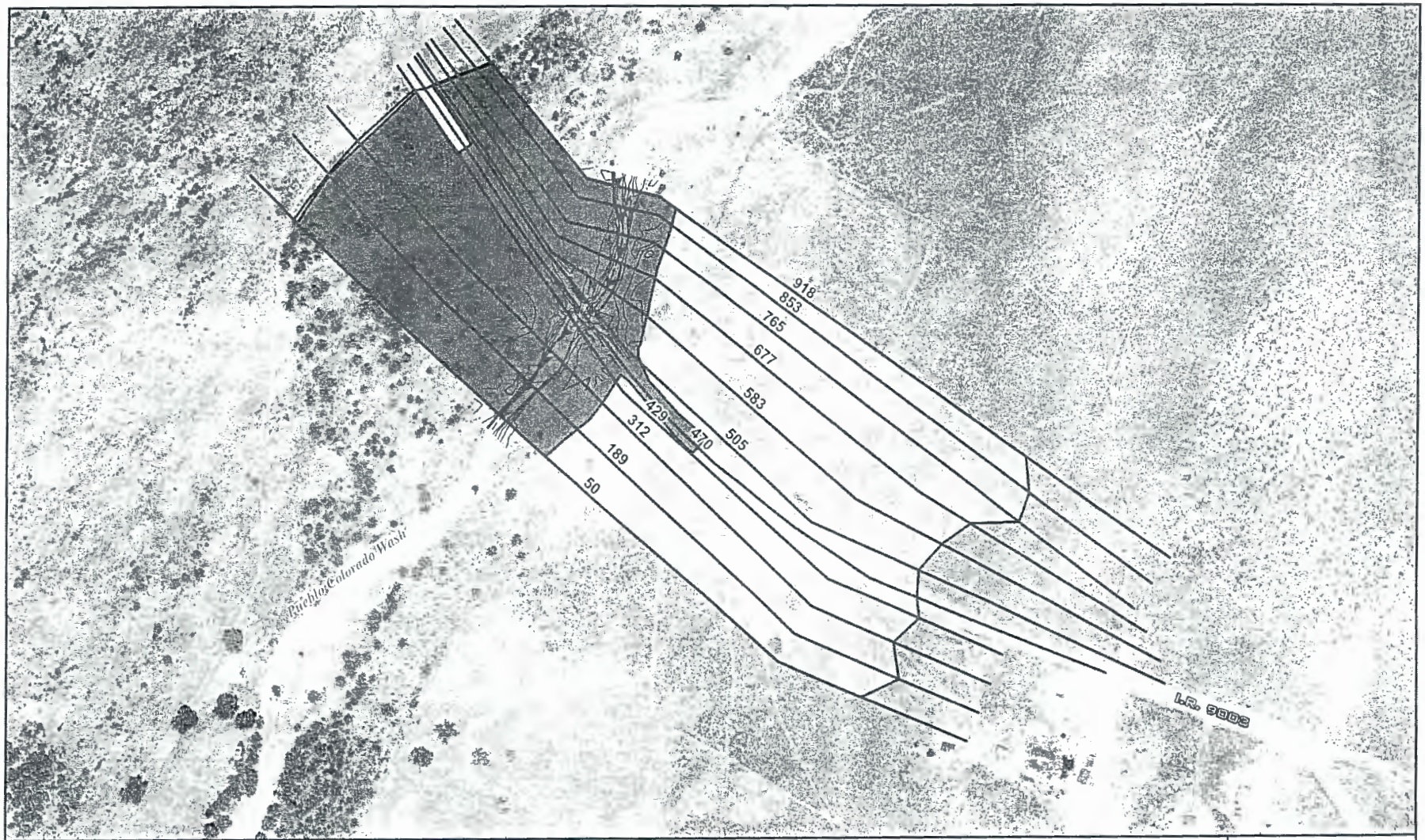


Figure C-1
Inundation Mapping
Existing Conditions



Dibble Engineering

NAVAJO D.O.T.

Legend

- Model Cross Section
- River Centerline
- Pueblo Colorado Wash
- NDOT Surveyed Contours
- 10YR
- 100YR

0 150 300 600

1 in = 300 ft

N W E S

Figure C-2
Inundation Mapping
ALT 1 - Wet Crossing

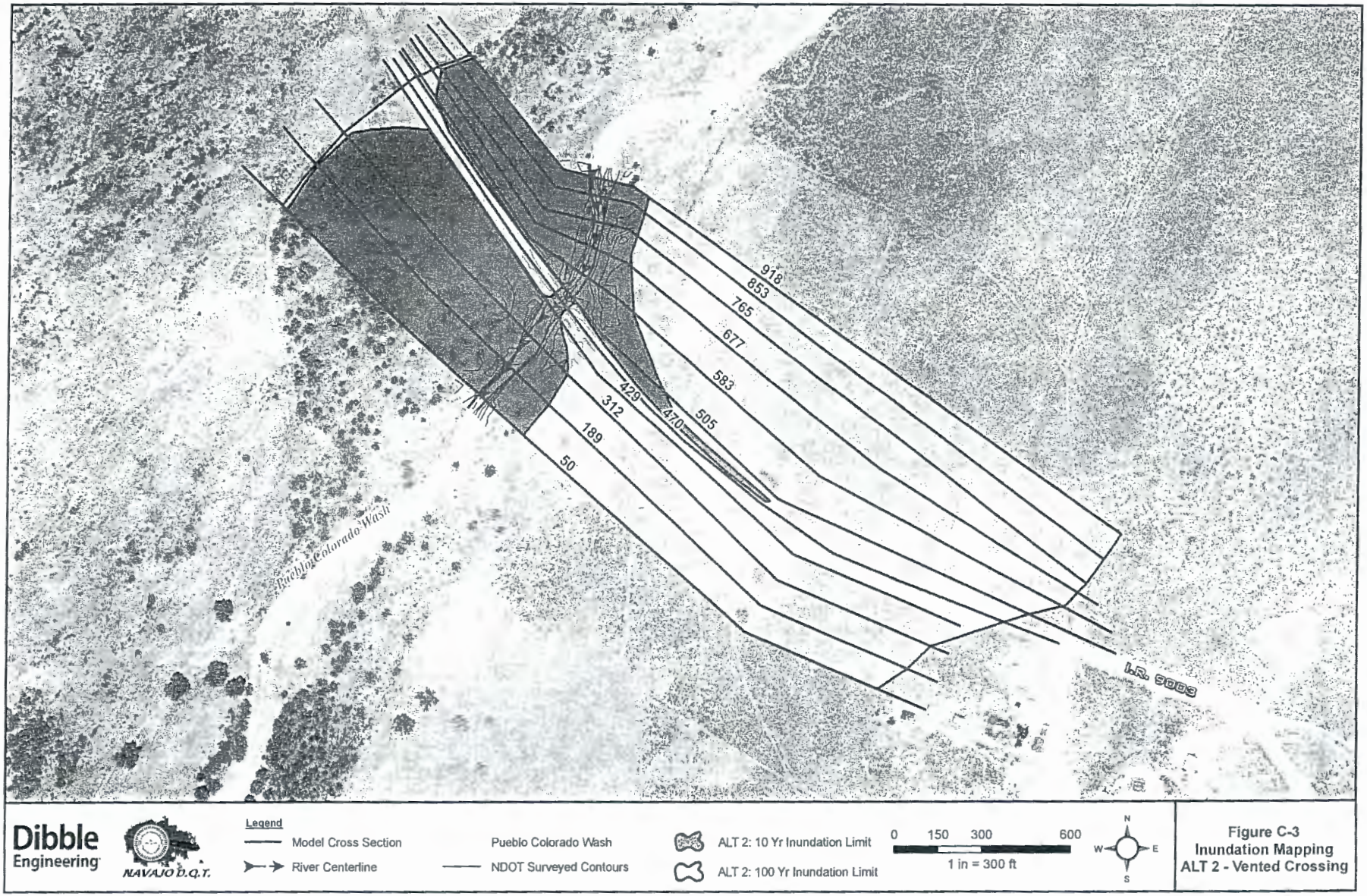


Figure C-3
Inundation Mapping
ALT 2 - Vented Crossing

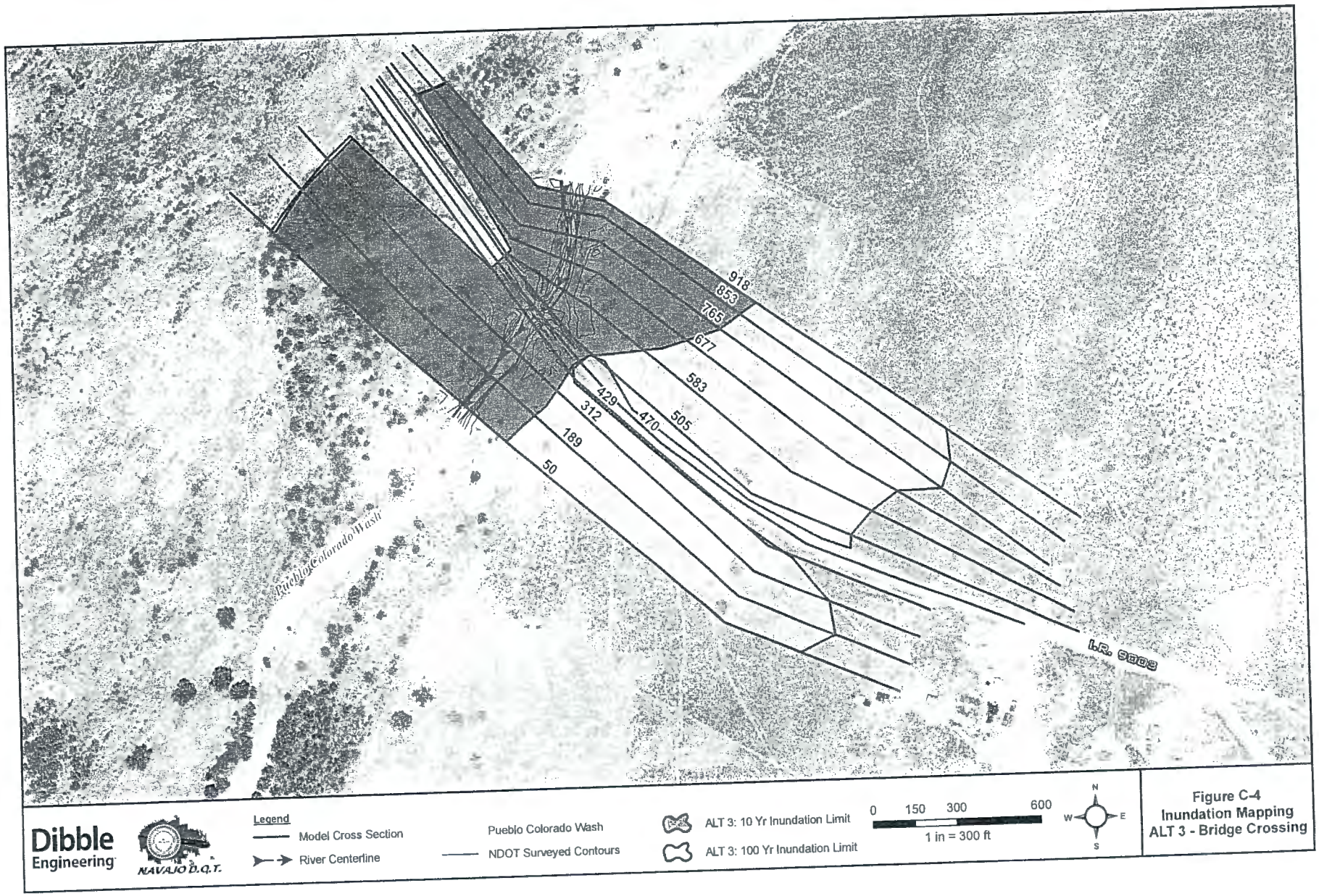
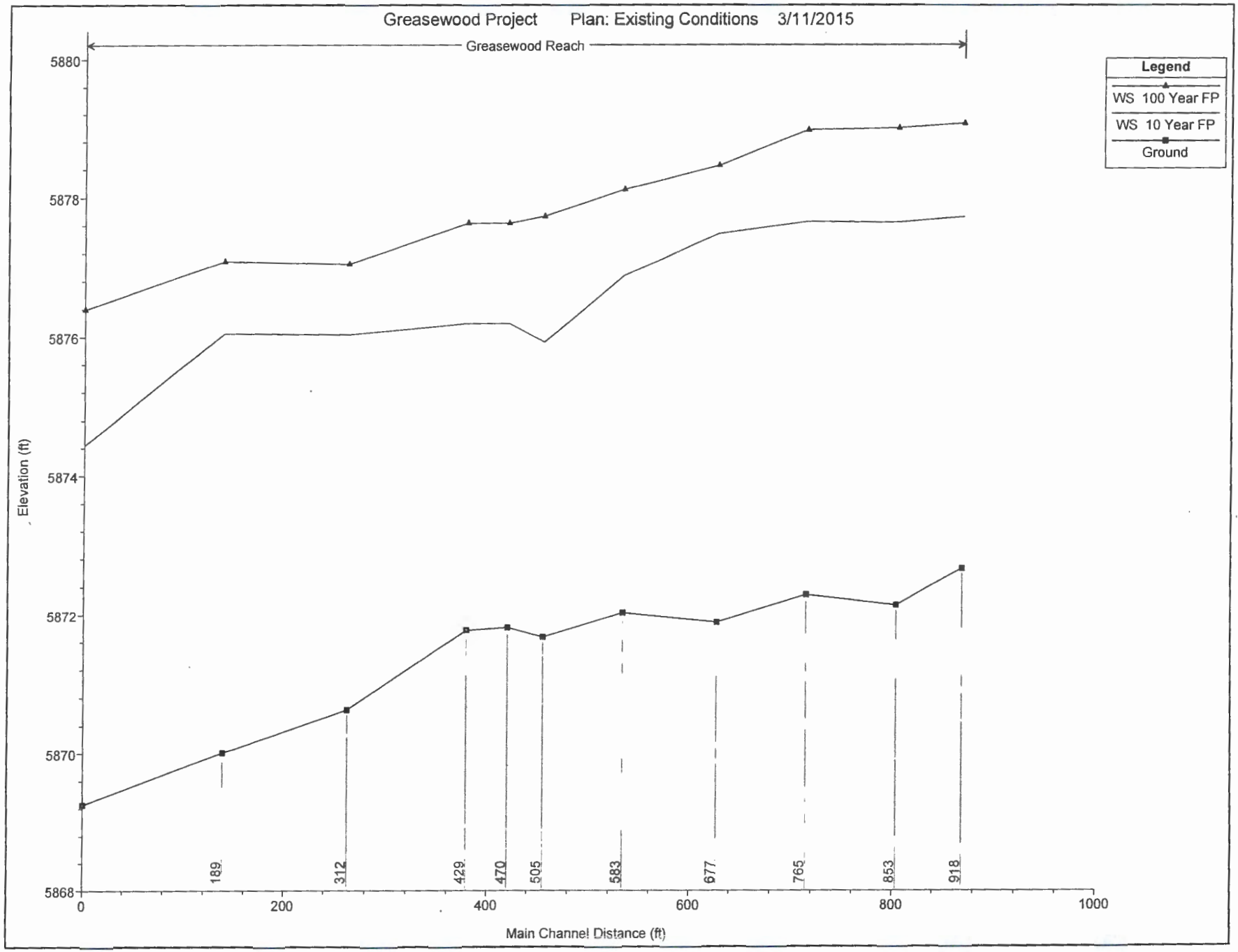
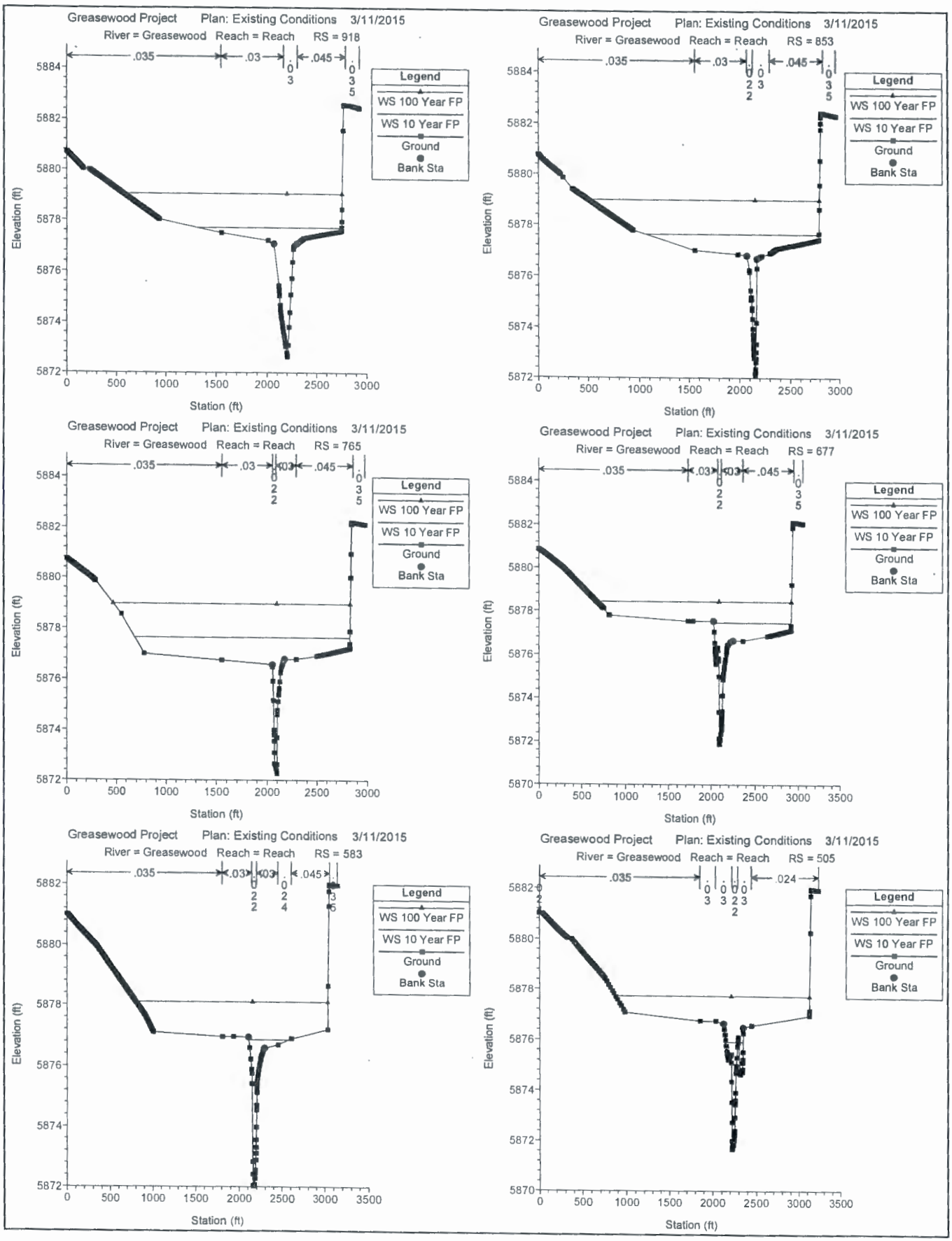


Figure C-4
Inundation Mapping
ALT 3 - Bridge Crossing


Greasewood Project Plan: Existing Conditions 3/11/2015
Greasewood Reach
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Elevation (ft)
5880
5878
5876
5874
5872
5870
5868
189
312
429
470
505
583
677
765
853
918
0
200
400
600
800
1000
Main Channel Distance (ft)

HEC-RAS Plan: EXIST River: Greasewood Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	918	10 Year FP	1849.00	5872.64	5877.70		5877.81	0.000835	2.71	960.39	1443.53	0.30
Reach	918	100 Year FP	10236.00	5872.64	5879.05		5879.27	0.001632	5.00	3546.81	2193.91	0.44
Reach	853	10 Year FP	1849.00	5872.12	5877.63		5877.75	0.000915	3.62	1128.22	1732.36	0.37
Reach	853	100 Year FP	10236.00	5872.12	5878.99		5879.16	0.001362	5.63	3915.38	2302.42	0.48
Reach	765	10 Year FP	1849.00	5872.27	5877.64		5877.67	0.000392	2.23	1873.26	2147.59	0.25
Reach	765	100 Year FP	10236.00	5872.27	5878.96		5879.06	0.000806	4.01	4851.13	2371.08	0.36
Reach	677	10 Year FP	1849.00	5871.88	5877.47		5877.61	0.001025	3.42	856.14	884.56	0.43
Reach	677	100 Year FP	10236.00	5871.88	5878.44		5878.90	0.003544	7.42	2745.44	2255.13	0.77
Reach	583	10 Year FP	1849.00	5872.02	5876.86	5876.86	5877.44	0.002333	6.17	338.03	465.67	0.85
Reach	583	100 Year FP	10236.00	5872.02	5878.10	5878.10	5878.60	0.003340	8.14	2715.48	2241.83	0.85
Reach	505	10 Year FP	1849.00	5871.67	5875.90	5875.90	5876.63	0.006265	6.86	269.67	192.25	1.02
Reach	505	100 Year FP	10236.00	5871.67	5877.72	5877.72	5878.23	0.003682	7.48	2456.62	2254.71	0.77
Reach	470	10 Year FP	1849.00	5871.81	5876.18		5876.20	0.000120	1.39	2029.77	1767.49	0.15
Reach	470	100 Year FP	10236.00	5871.81	5877.63		5877.70	0.000319	2.95	5064.22	2319.06	0.26
Reach	429	10 Year FP	1849.00	5871.77	5876.19		5876.19	0.000090	0.99	2747.61	2120.92	0.11
Reach	429	100 Year FP	10236.00	5871.77	5877.63		5877.68	0.000316	2.44	6014.40	2398.29	0.22
Reach	312	10 Year FP	1849.00	5870.62	5876.02		5876.16	0.000534	3.03	710.75	858.24	0.39
Reach	312	100 Year FP	10236.00	5870.62	5877.03	5877.03	5877.56	0.002491	7.12	2774.67	2387.42	0.74
Reach	189	10 Year FP	1849.00	5870.01	5876.04	5874.70	5876.08	0.000280	2.05	1876.02	2133.28	0.22
Reach	189	100 Year FP	10236.00	5870.01	5877.08		5877.23	0.001159	4.71	4310.81	2482.73	0.44
Reach	50	10 Year FP	1849.00	5869.26	5874.44	5874.22	5875.85	0.004995	9.53	194.07	58.97	0.93
Reach	50	100 Year FP	10236.00	5869.26	5876.40	5876.40	5876.92	0.004177	8.32	2607.94	2414.08	0.89


Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 918
.035 .03 .045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 853
.035 .03 .045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 765
.035 .03 .03 .045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 677
.035 .03 .03 .045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 583
.035 .03 .03 .045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 505
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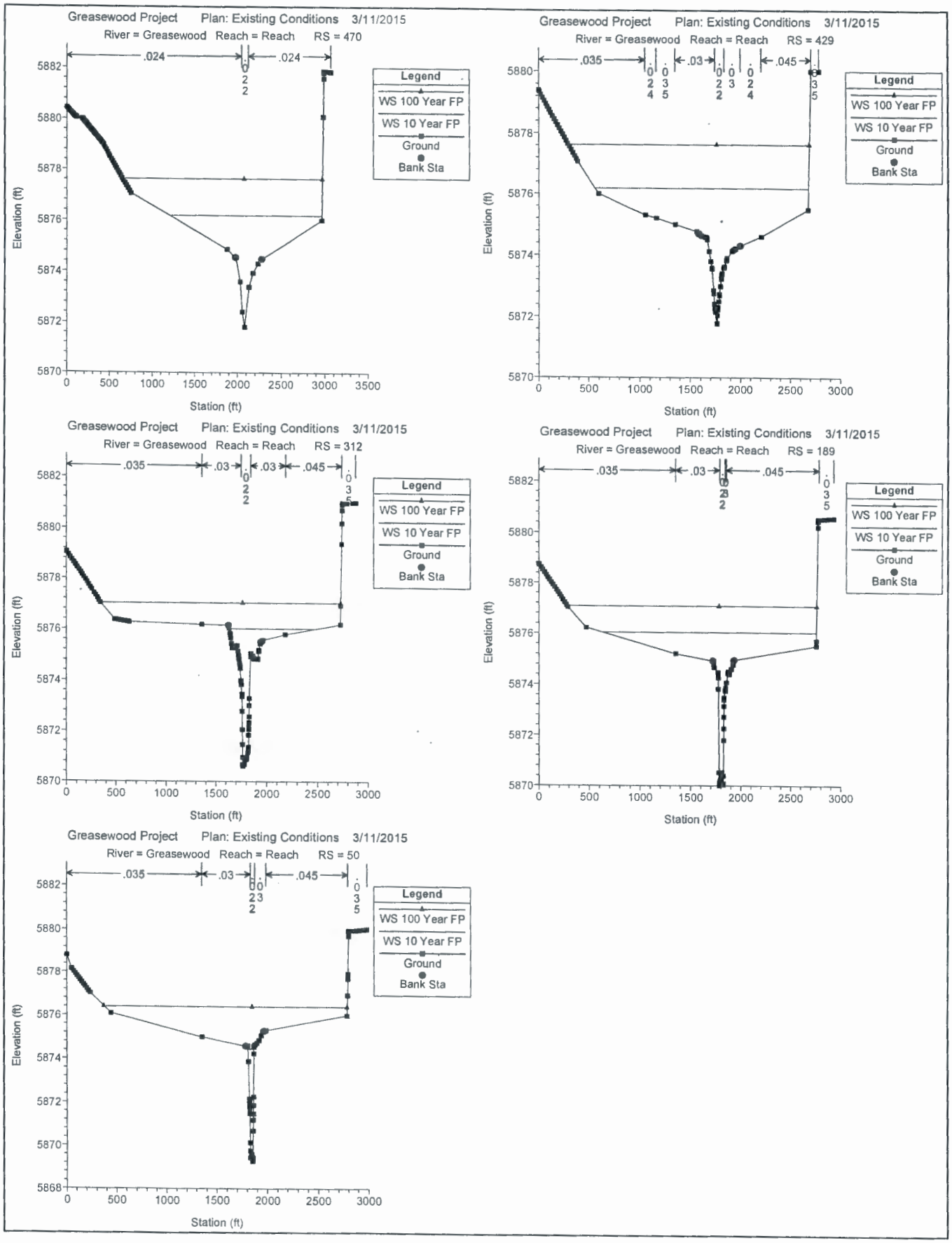
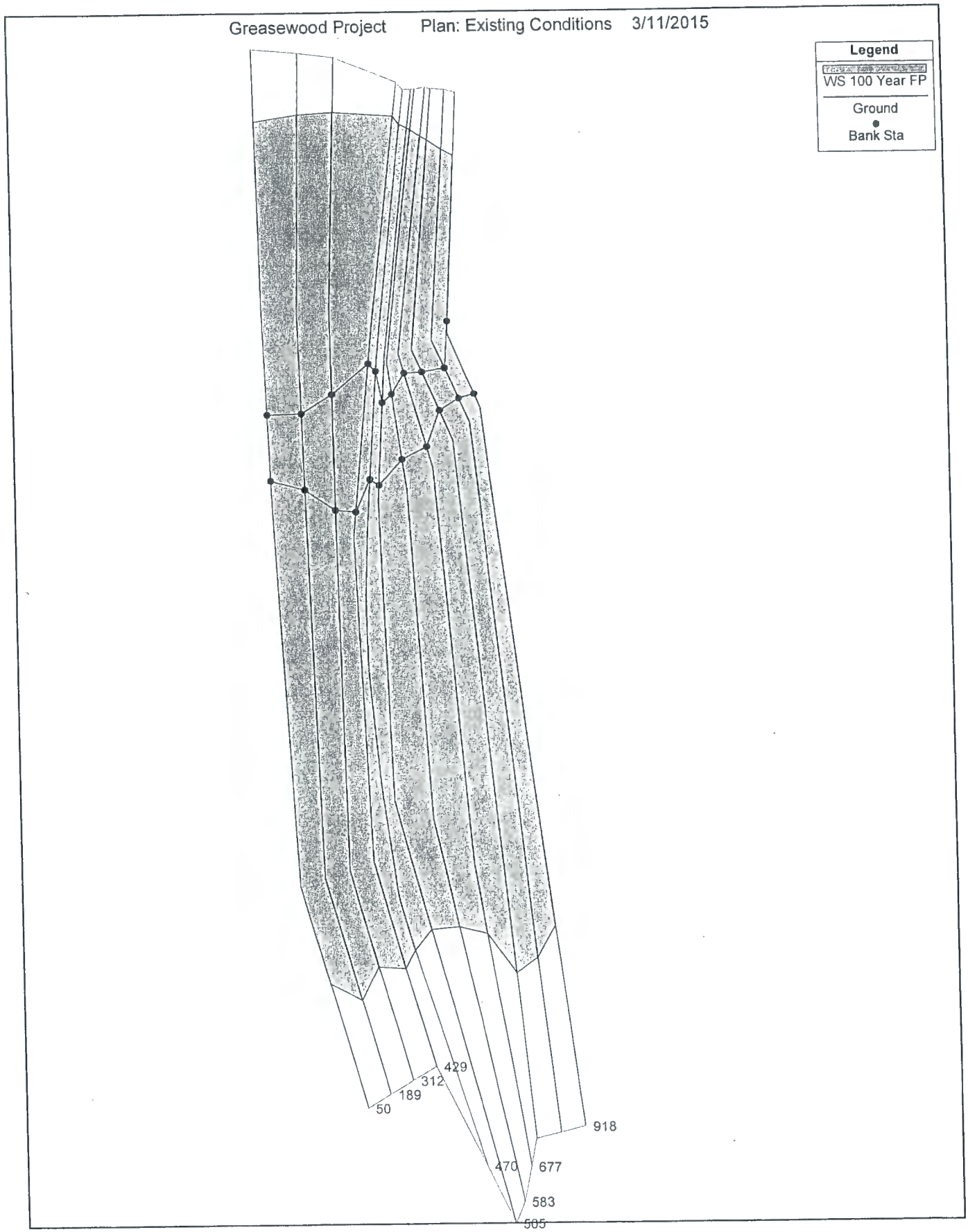
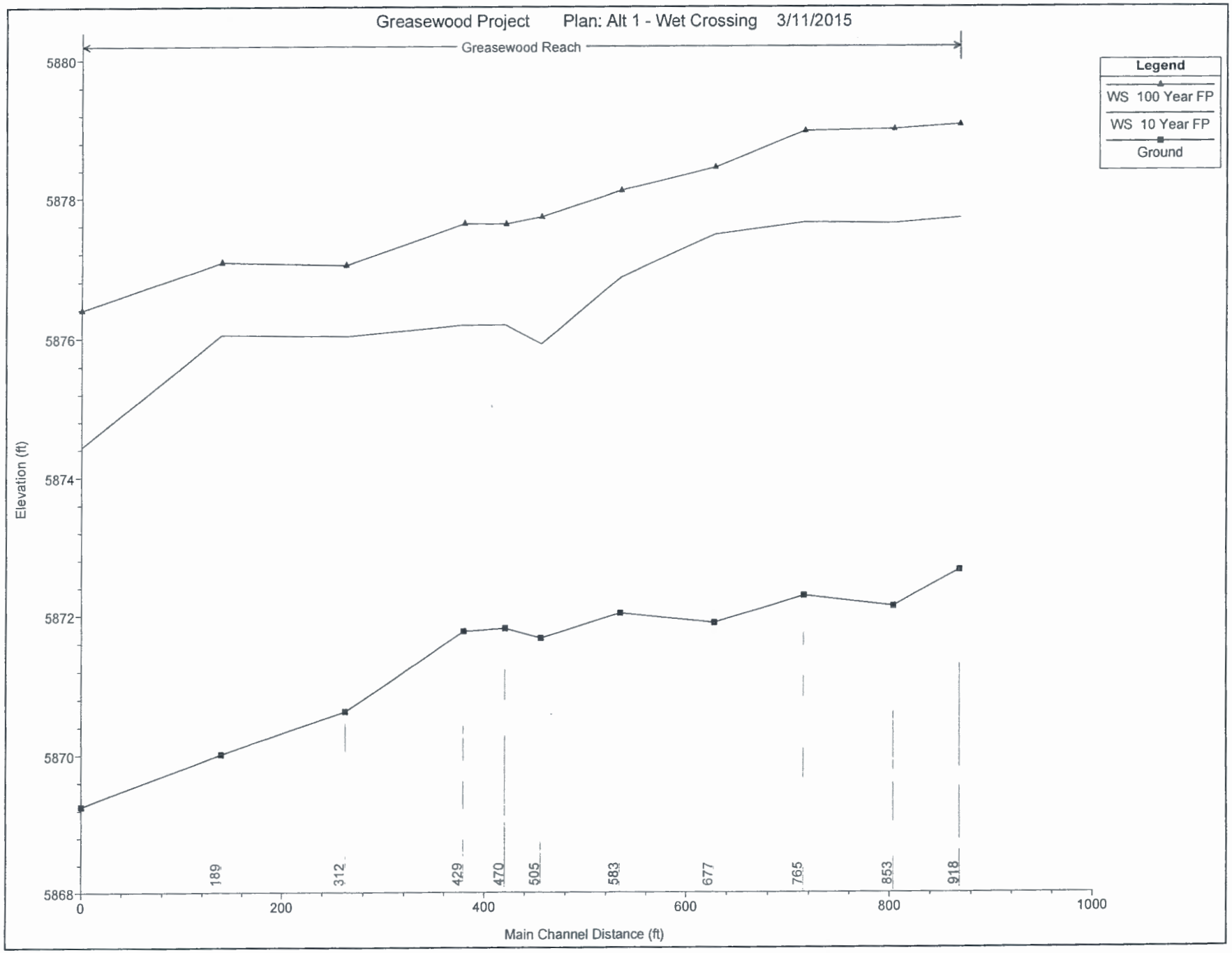
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)


Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 470
.024
.024
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 429
.035
.03
.045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 312
.035
.03
.03
.045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 189
.035
.03
.045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)
Greasewood Project Plan: Existing Conditions 3/11/2015
River = Greasewood Reach = Reach RS = 50
.035
.03
.045
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
Station (ft)

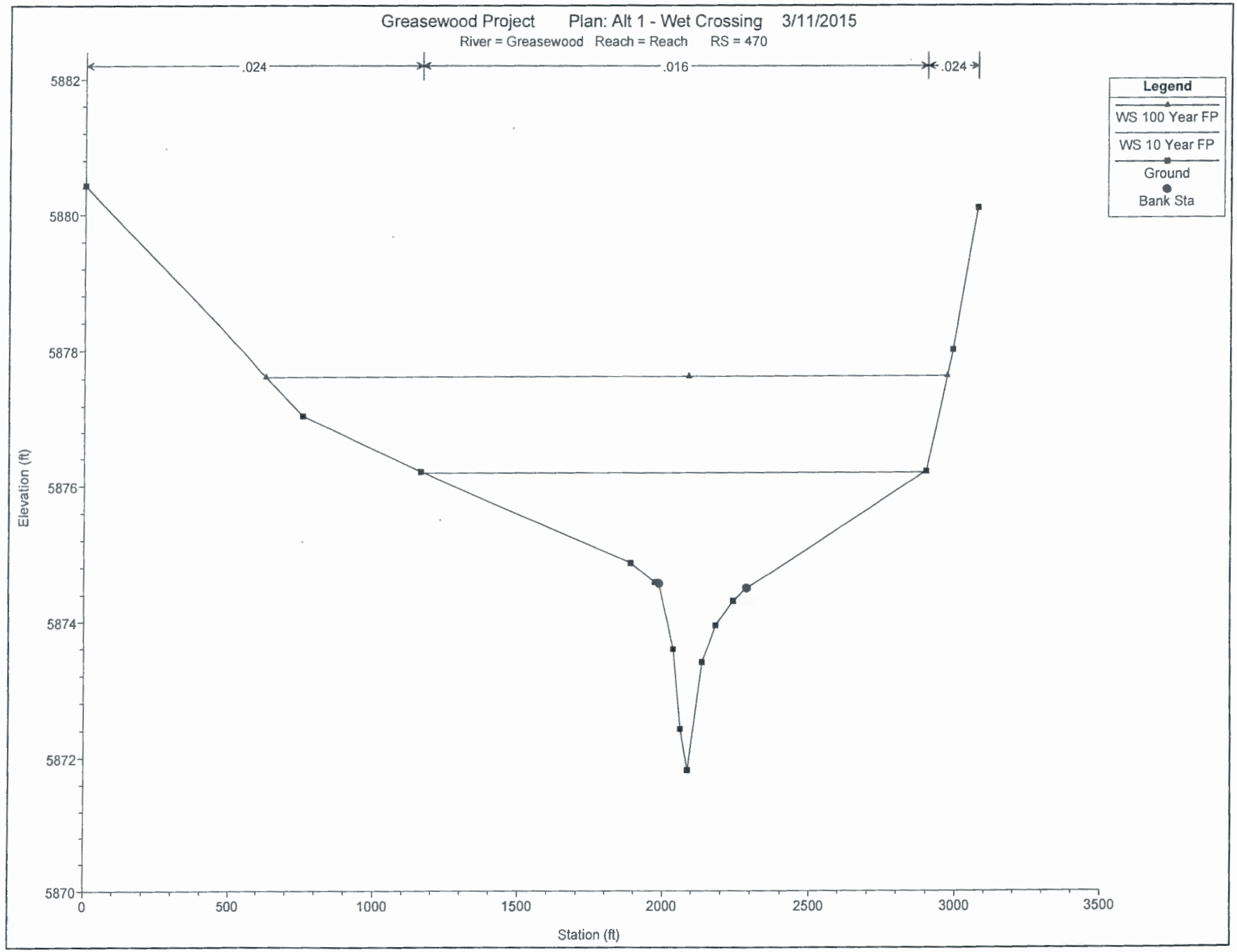
Greasewood Project Plan: Existing Conditions 3/11/2015

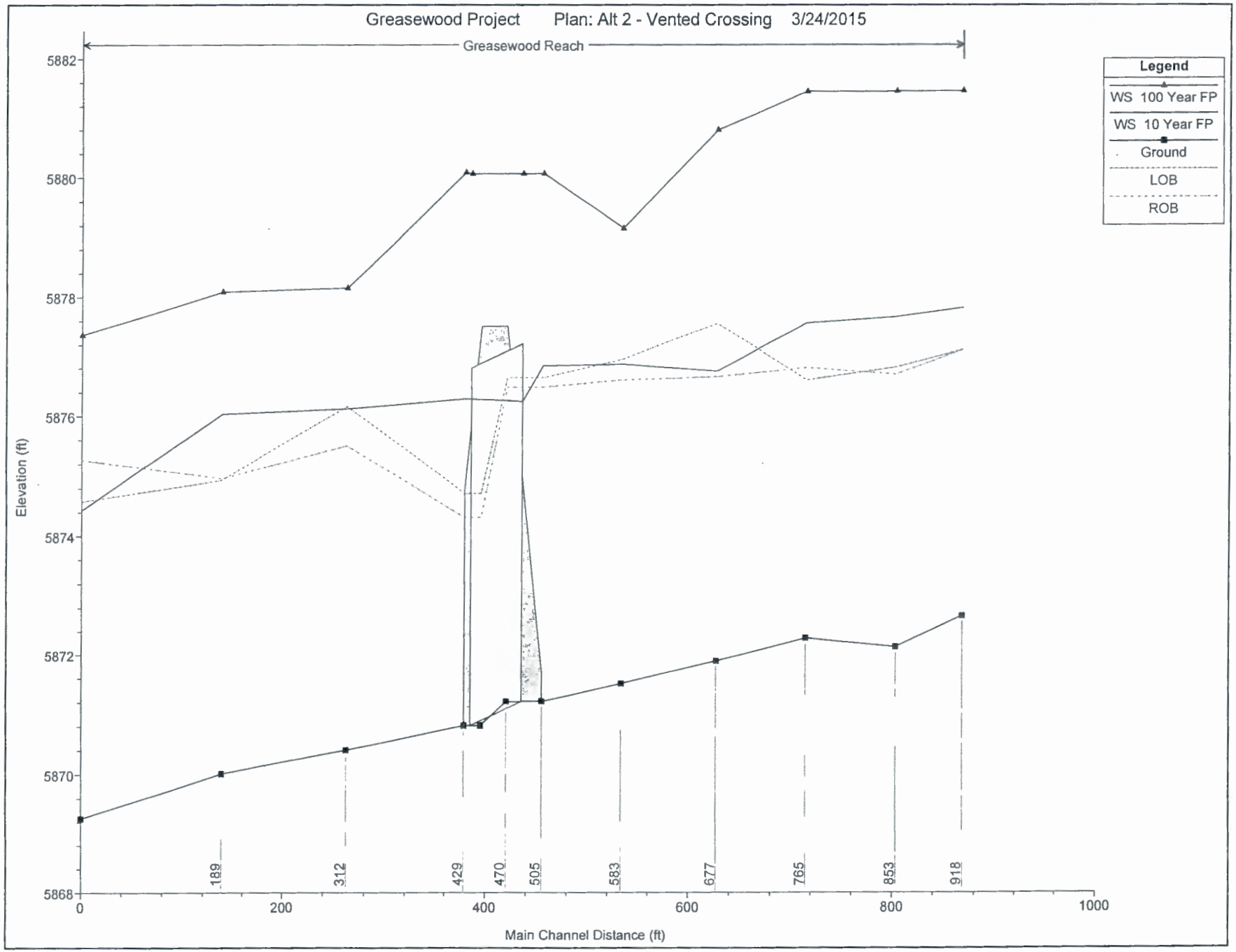



Greasewood Project Plan: Alt 1 - Wet Crossing 3/11/2015
Greasewood Reach
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Elevation (ft)
5880
5878
5876
5874
5872
5870
5868
189
312
429
470
505
583
677
765
853
918
0
200
400
600
800
1000
Main Channel Distance (ft)

HEC-RAS Plan: ALT1-WET River: Greasewood Reach: Reach

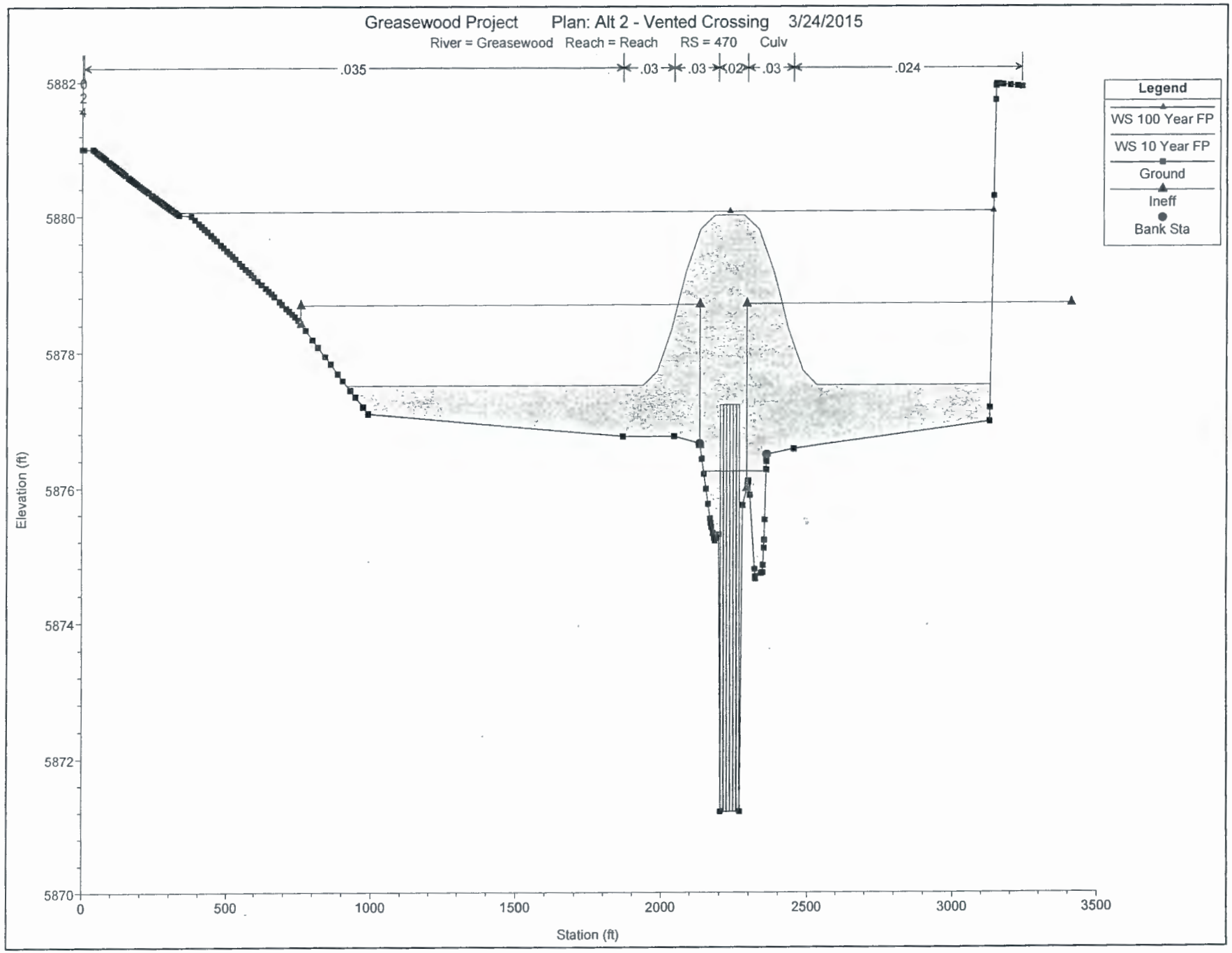
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	918	10 Year FP	1849.00	5872.64	5877.70		5877.81	0.000835	2.71	960.39	1443.53	0.30
Reach	918	100 Year FP	10236.00	5872.64	5879.05		5879.27	0.001632	5.00	3546.81	2193.91	0.44
Reach	853	10 Year FP	1849.00	5872.12	5877.63		5877.75	0.000915	3.62	1128.22	1732.36	0.37
Reach	853	100 Year FP	10236.00	5872.12	5878.99		5879.16	0.001362	5.63	3915.38	2302.42	0.48
Reach	765	10 Year FP	1849.00	5872.27	5877.64		5877.67	0.000392	2.23	1873.26	2147.59	0.25
Reach	765	100 Year FP	10236.00	5872.27	5878.96		5879.06	0.000806	4.01	4851.13	2371.08	0.36
Reach	677	10 Year FP	1849.00	5871.88	5877.47		5877.61	0.001025	3.42	856.14	884.56	0.43
Reach	677	100 Year FP	10236.00	5871.88	5878.44		5878.90	0.003544	7.42	2745.44	2255.13	0.77
Reach	583	10 Year FP	1849.00	5872.02	5876.86	5876.86	5877.44	0.002333	6.17	338.03	465.67	0.85
Reach	583	100 Year FP	10236.00	5872.02	5878.10	5878.10	5878.60	0.003340	8.14	2715.48	2241.83	0.85
Reach	505	10 Year FP	1849.00	5871.67	5875.90	5875.90	5876.63	0.006265	6.86	269.67	192.25	1.02
Reach	505	100 Year FP	10236.00	5871.67	5877.72	5877.72	5878.23	0.003682	7.48	2456.62	2254.71	0.77
Reach	470	10 Year FP	1849.00	5871.81	5876.18		5876.20	0.000065	1.42	1921.00	1721.60	0.15
Reach	470	100 Year FP	10236.00	5871.81	5877.62		5877.70	0.000155	2.94	4913.60	2342.38	0.26
Reach	429	10 Year FP	1849.00	5871.77	5876.19		5876.19	0.000090	0.99	2747.61	2120.92	0.11
Reach	429	100 Year FP	10236.00	5871.77	5877.63		5877.68	0.000316	2.44	6014.40	2398.29	0.22
Reach	312	10 Year FP	1849.00	5870.62	5876.02		5876.16	0.000534	3.03	710.75	858.24	0.39
Reach	312	100 Year FP	10236.00	5870.62	5877.03	5877.03	5877.56	0.002491	7.12	2774.67	2387.42	0.74
Reach	189	10 Year FP	1849.00	5870.01	5876.04	5874.70	5876.08	0.000280	2.05	1876.02	2133.28	0.22
Reach	189	100 Year FP	10236.00	5870.01	5877.08		5877.23	0.001159	4.71	4310.81	2482.73	0.44
Reach	50	10 Year FP	1849.00	5869.26	5874.44	5874.22	5875.85	0.004995	9.53	194.07	58.97	0.93
Reach	50	100 Year FP	10236.00	5869.26	5876.40	5876.40	5876.92	0.004177	8.32	2607.94	2414.08	0.89

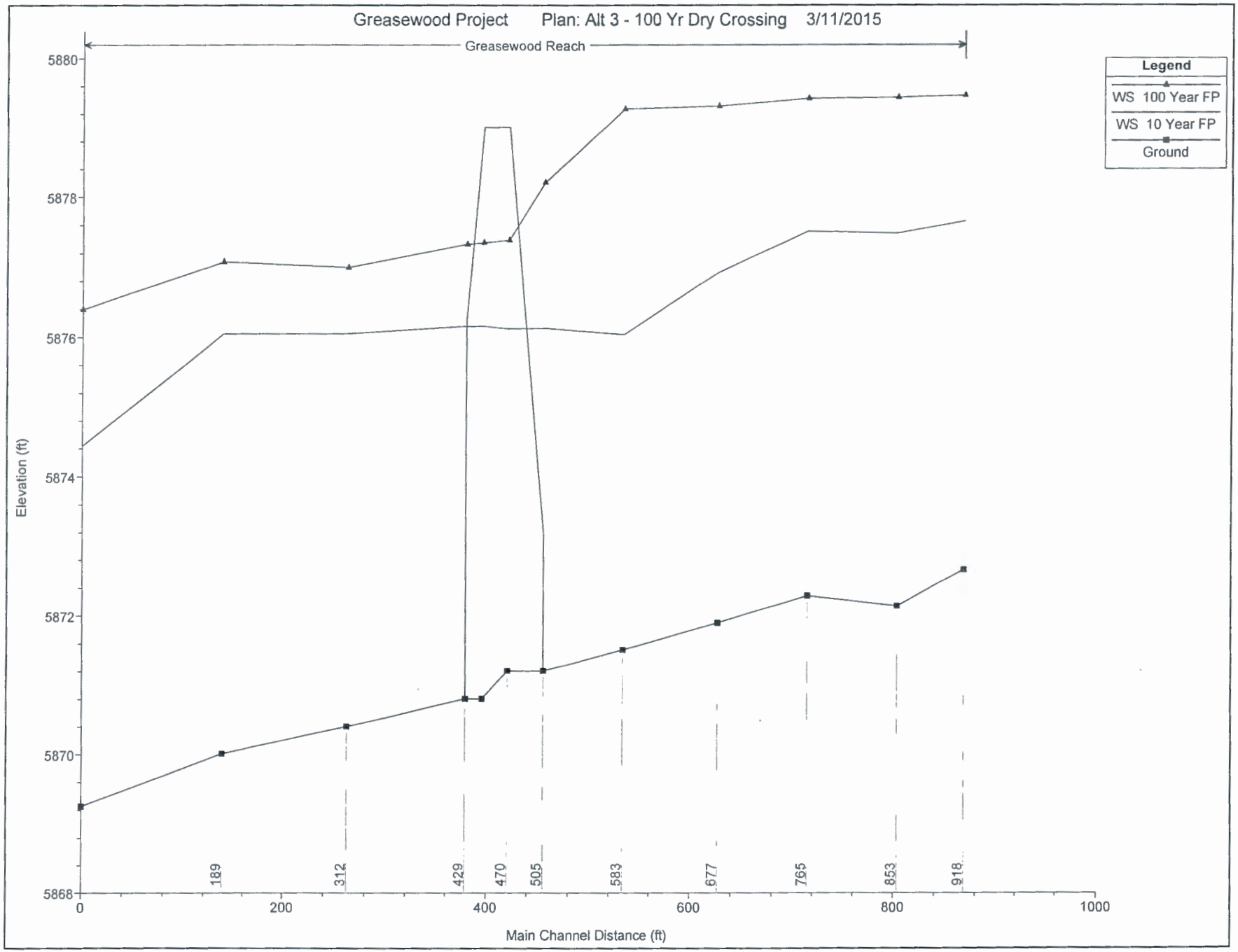

Greasewood Project Plan: Alt 1 - Wet Crossing 3/11/2015
River = Greasewood Reach = Reach RS = 470
.024
.016
.024
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Bank Sta
Elevation (ft)
5882
5880
5878
5876
5874
5872
5870
0
500
1000
1500
2000
2500
3000
3500
Station (ft)


Greasewood Project Plan: Alt 2 - Vented Crossing 3/24/2015
Greasewood Reach
Legend
WS 100 Year FP
WS 10 Year FP
Ground
LOB
ROB
Elevation (ft)
5882
5880
5878
5876
5874
5872
5870
5868
189
312
429
470
505
583
677
765
853
918
0
200
400
600
800
1000
Main Channel Distance (ft)

HEC-RAS Plan: ALT2-Vented River: Greasewood Reach: Reach

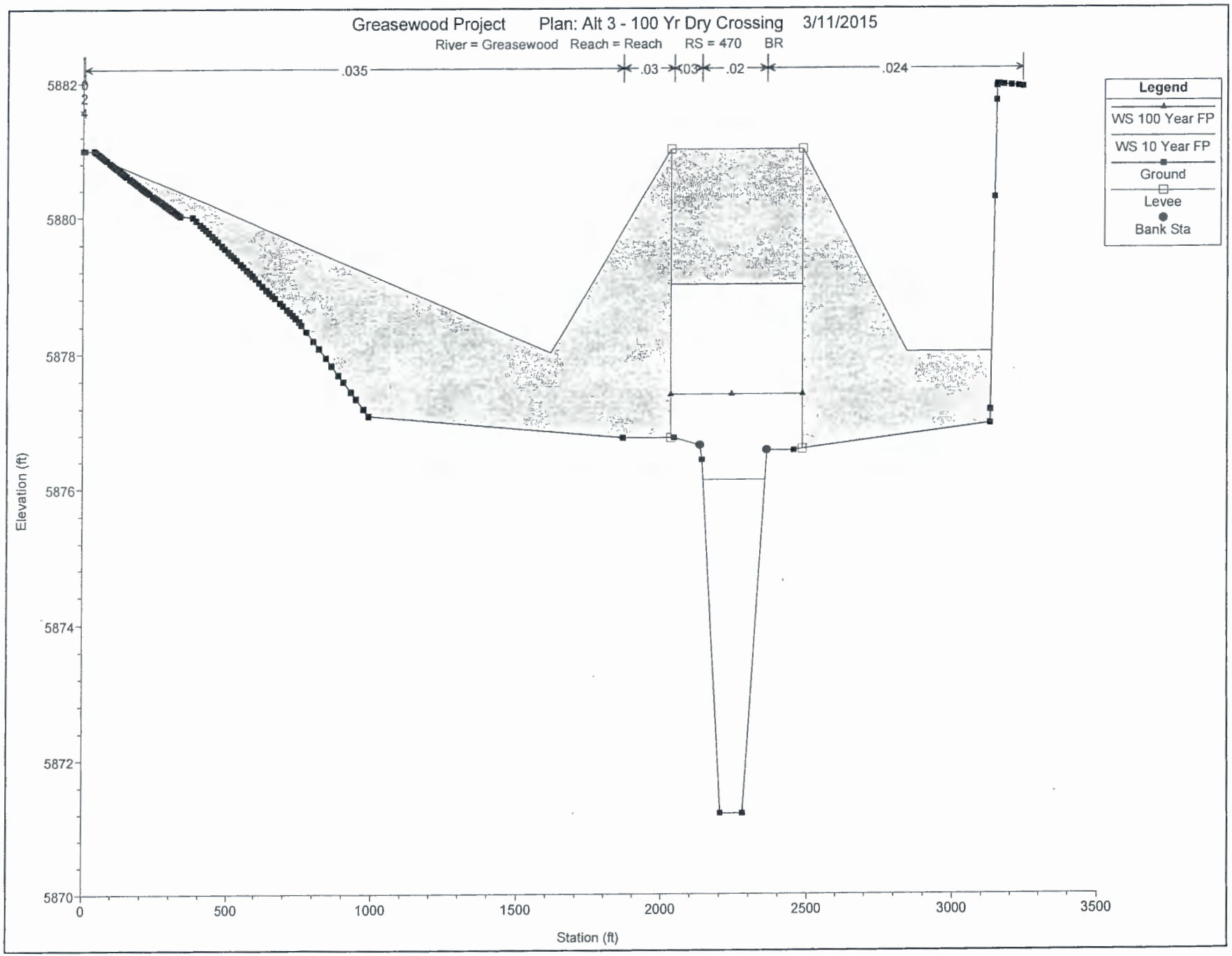
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	918	10 Year FP	1849.00	5872.64	5877.79	5875.83	5877.88	0.000743	2.62	909.02	1545.76	0.28
Reach	918	100 Year FP	10236.00	5872.64	5881.45	5878.64	5881.48	0.000131	1.94	8064.78	2772.16	0.14
Reach	853	10 Year FP	1849.00	5872.12	5877.65	5877.35	5877.82	0.001124	4.03	774.89	1748.06	0.42
Reach	853	100 Year FP	10236.00	5872.12	5881.45	5878.76	5881.48	0.000119	2.26	8177.14	2805.54	0.15
Reach	765	10 Year FP	1849.00	5872.27	5877.54	5877.17	5877.71	0.001282	3.94	702.53	2132.96	0.45
Reach	765	100 Year FP	10236.00	5872.27	5881.44	5878.73	5881.47	0.000101	1.92	8626.17	2848.63	0.13
Reach	677	10 Year FP	1849.00	5871.88	5876.73	5876.73	5877.46	0.004592	6.85	269.76	448.33	1.00
Reach	677	100 Year FP	10236.00	5871.88	5880.79	5879.47	5881.39	0.001543	6.85	1757.51	2908.34	0.52
Reach	583	10 Year FP	1849.00	5871.50	5876.86	5874.09	5877.08	0.000447	3.78	489.56	463.26	0.37
Reach	583	100 Year FP	10236.00	5871.50	5879.14	5878.95	5881.06	0.002757	11.44	992.41	2501.67	0.86
Reach	505	10 Year FP	1849.00	5871.20	5876.83	5874.04	5877.04	0.000403	3.62	510.70	1299.45	0.36
Reach	505	100 Year FP	10236.00	5871.20	5880.06	5878.68	5880.09	0.000102	2.22	8449.90	2821.82	0.16
Reach	470		Culvert									
Reach	429	10 Year FP	1849.00	5870.80	5876.27		5876.28	0.000051	0.98	3050.27	2138.62	0.10
Reach	429	100 Year FP	10236.00	5870.80	5880.08		5880.09	0.000034	1.24	12502.83	2789.27	0.09
Reach	312	10 Year FP	1849.00	5870.40	5876.11	5872.97	5876.24	0.000329	2.82	656.20	987.48	0.27
Reach	312	100 Year FP	10236.00	5870.40	5878.14	5877.17	5879.64	0.002221	9.80	1044.33	2580.33	0.74
Reach	189	10 Year FP	1849.00	5870.01	5876.02	5874.27	5876.18	0.000692	3.22	662.08	2117.16	0.35
Reach	189	100 Year FP	10236.00	5870.01	5878.08	5877.41	5879.18	0.003377	8.97	1335.53	2656.84	0.73
Reach	50	10 Year FP	1849.00	5869.26	5874.43	5874.24	5875.85	0.005003	9.53	193.95	58.95	0.93
Reach	50	100 Year FP	10236.00	5869.26	5877.36	5877.36	5878.61	0.004910	10.22	1345.15	2613.55	0.94


Greasewood Project Plan: Alt 2 - Vented Crossing 3/24/2015
River = Greasewood Reach = Reach RS = 470 Culv
.035
.03
.03
.02
.03
.024
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Ineff
Bank Sta
Elevation (ft)
5882
5880
5878
5876
5874
5872
5870
0
500
1000
1500
2000
2500
3000
3500
Station (ft)

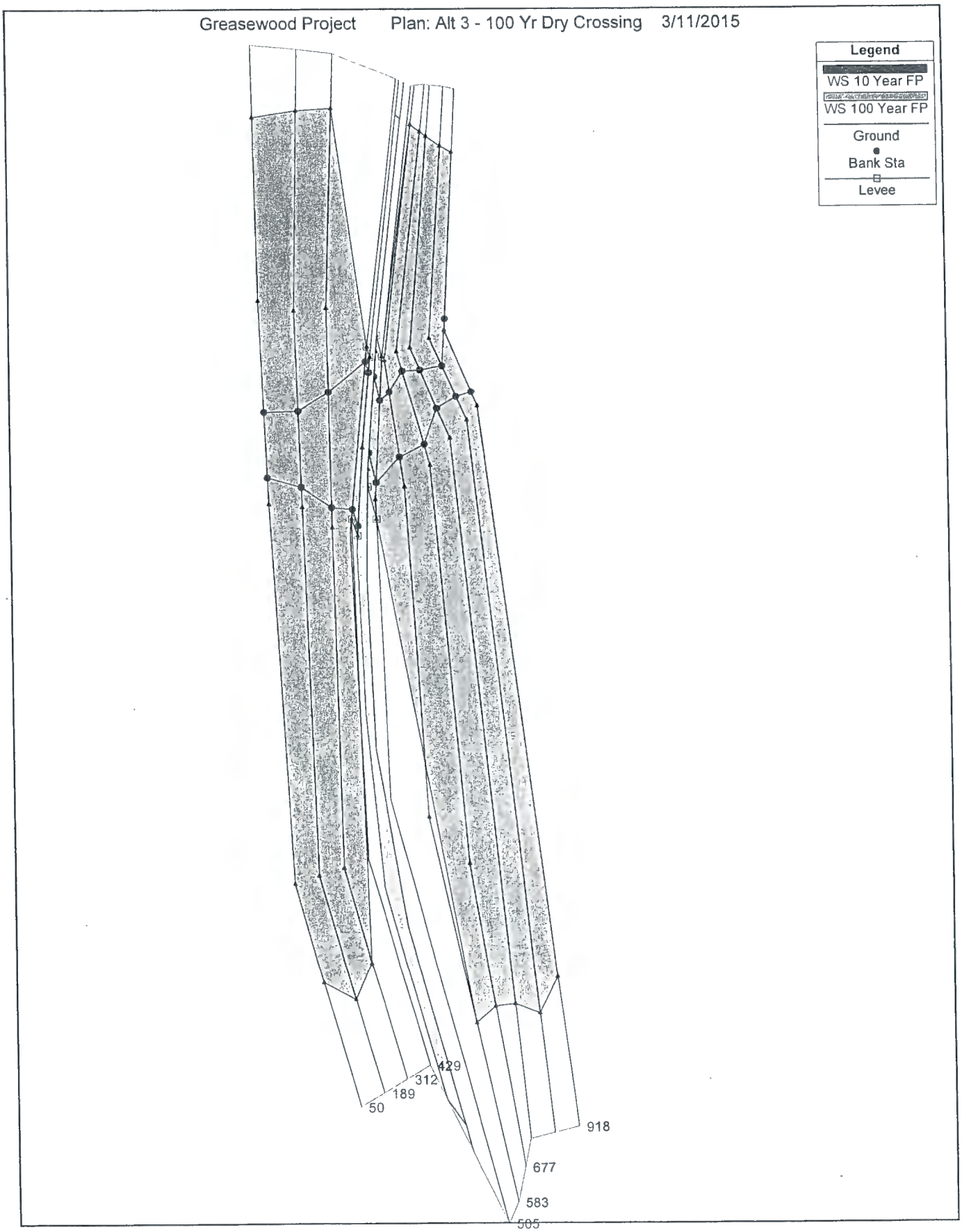

Greasewood Project Plan: Alt 3 - 100 Yr Dry Crossing 3/11/2015
Greasewood Reach
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Elevation (ft)
5880
5878
5876
5874
5872
5870
5868
0
200
400
600
800
1000
Main Channel Distance (ft)
189
312
429
470
505
583
677
765
853
918

HEC-RAS Plan: ALT 3 100yr River: Greasewood Reach: Reach

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach	918	10 Year FP	1849.00	5872.64	5877.65		5877.76	0.000944	2.85	883.91	1378.61	0.31
Reach	918	100 Year FP	10236.00	5872.64	5879.46		5879.58	0.000885	3.93	4472.48	2341.46	0.33
Reach	853	10 Year FP	1849.00	5872.12	5877.47	5877.34	5877.68	0.001447	4.42	875.21	1610.65	0.47
Reach	853	100 Year FP	10236.00	5872.12	5879.43		5879.53	0.000708	4.33	4966.50	2462.99	0.35
Reach	765	10 Year FP	1849.00	5872.27	5877.50		5877.56	0.000600	2.68	1584.19	2126.91	0.31
Reach	765	100 Year FP	10236.00	5872.27	5879.41		5879.47	0.000443	3.17	5941.59	2462.86	0.27
Reach	677	10 Year FP	1849.00	5871.88	5876.92	5876.92	5877.41	0.003317	5.75	391.97	679.03	0.84
Reach	677	100 Year FP	10236.00	5871.88	5879.30		5879.42	0.000816	4.05	4783.55	2469.55	0.37
Reach	583	10 Year FP	1849.00	5871.50	5876.02		5876.39	0.000796	4.82	383.40	98.68	0.43
Reach	583	100 Year FP	10236.00	5871.50	5879.26		5879.37	0.000368	3.99	5677.86	2530.46	0.31
Reach	505	10 Year FP	1849.00	5871.20	5876.12	5873.45	5876.23	0.000248	2.62	706.80	211.32	0.25
Reach	505	100 Year FP	10236.00	5871.20	5878.20	5877.35	5879.09	0.001249	7.88	1529.47	450.00	0.61
Reach	470		Bridge									
Reach	429	10 Year FP	1849.00	5870.80	5876.15	5872.85	5876.17	0.000083	1.30	1469.90	480.00	0.13
Reach	429	100 Year FP	10236.00	5870.80	5877.32	5875.56	5877.73	0.000959	5.20	2033.10	480.00	0.43
Reach	312	10 Year FP	1849.00	5870.40	5876.04		5876.14	0.000313	2.48	857.37	888.11	0.29
Reach	312	100 Year FP	10236.00	5870.40	5876.99	5876.98	5877.53	0.001957	6.94	2811.00	2379.51	0.68
Reach	189	10 Year FP	1849.00	5870.01	5876.04	5874.70	5876.08	0.000280	2.05	1876.02	2133.28	0.22
Reach	189	100 Year FP	10236.00	5870.01	5877.08		5877.23	0.001159	4.71	4310.81	2482.73	0.44
Reach	50	10 Year FP	1849.00	5869.26	5874.44	5874.22	5875.85	0.004995	9.53	194.07	58.97	0.93
Reach	50	100 Year FP	10236.00	5869.26	5876.40	5876.40	5876.92	0.004177	8.32	2607.94	2414.08	0.89


Greasewood Project Plan: Alt 3 - 100 Yr Dry Crossing 3/11/2015
River = Greasewood Reach = Reach RS = 470 BR
.035
.03
.03
.02
.024
Legend
WS 100 Year FP
WS 10 Year FP
Ground
Levee
Bank Sta
Elevation (ft)
5882
5880
5878
5876
5874
5872
5870
0
500
1000
1500
2000
2500
3000
3500
Station (ft)

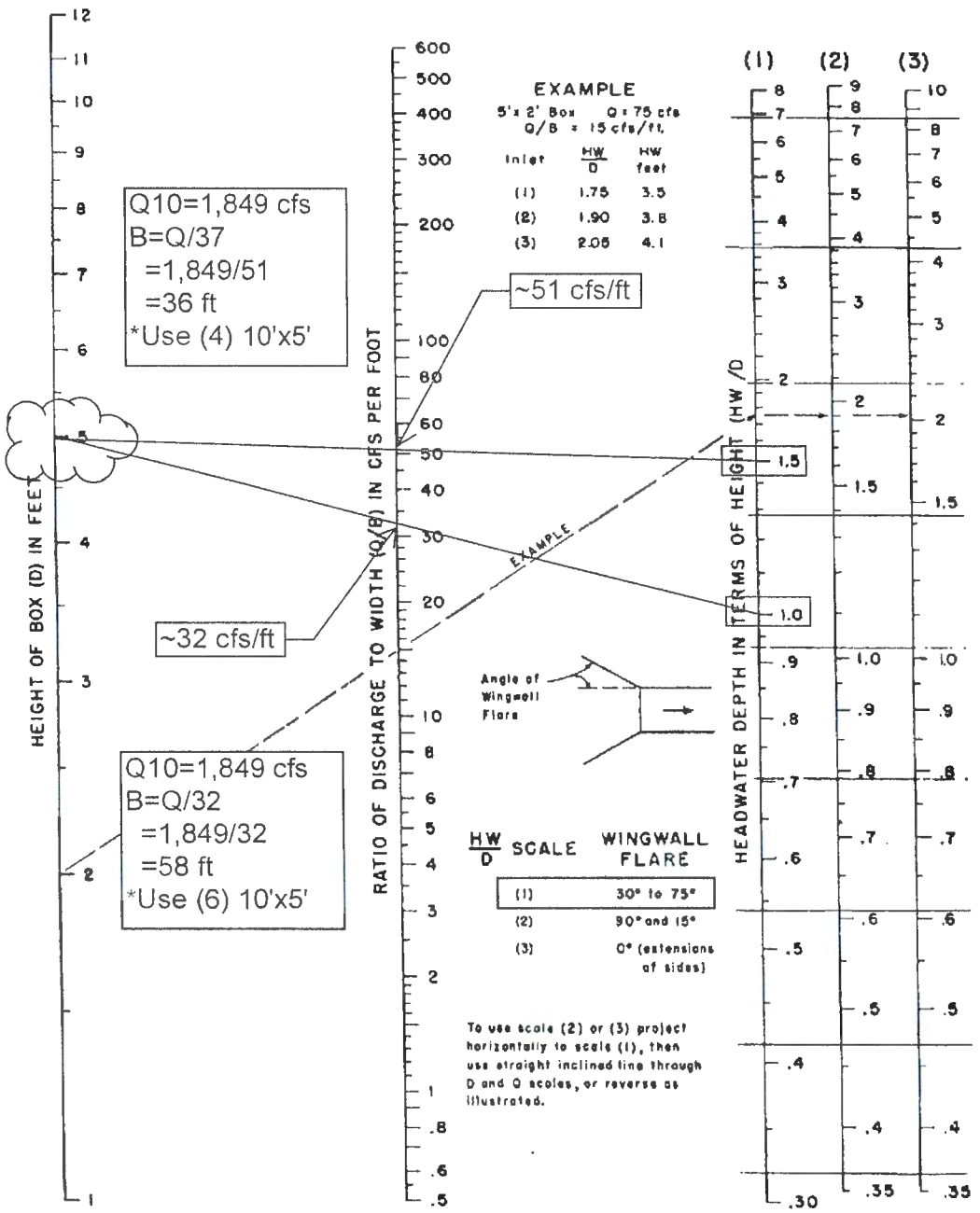
Greasewood Project Plan: Alt 3 - 100 Yr Dry Crossing 3/11/2015



Appendix D

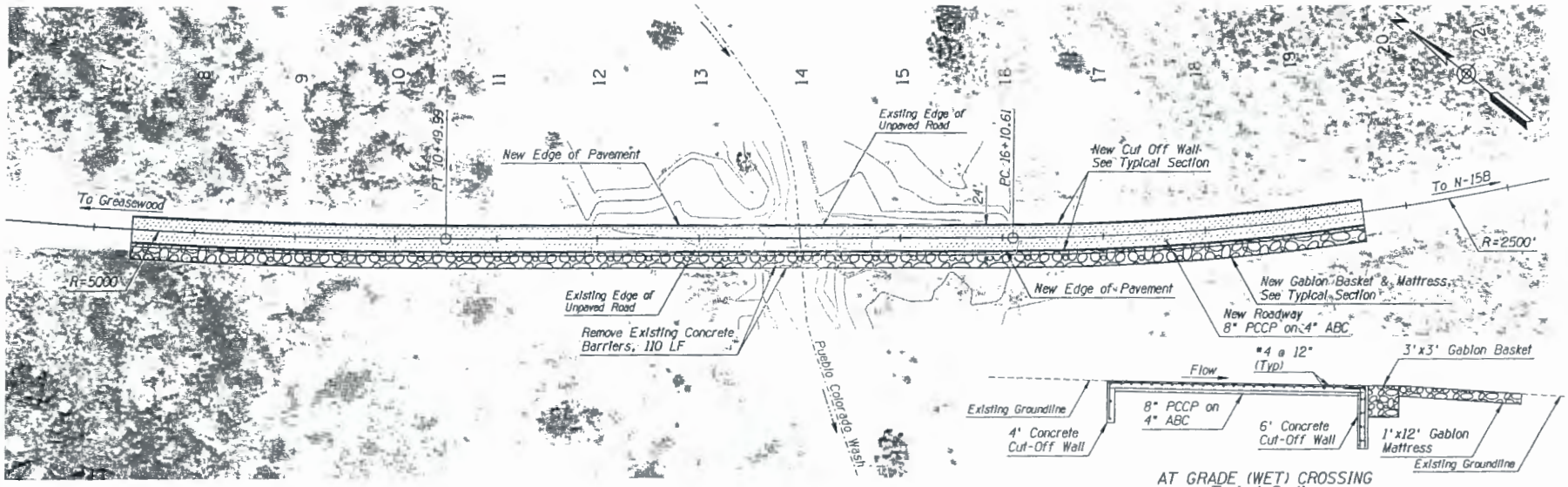
Alternatives Analysis

CHART 8B

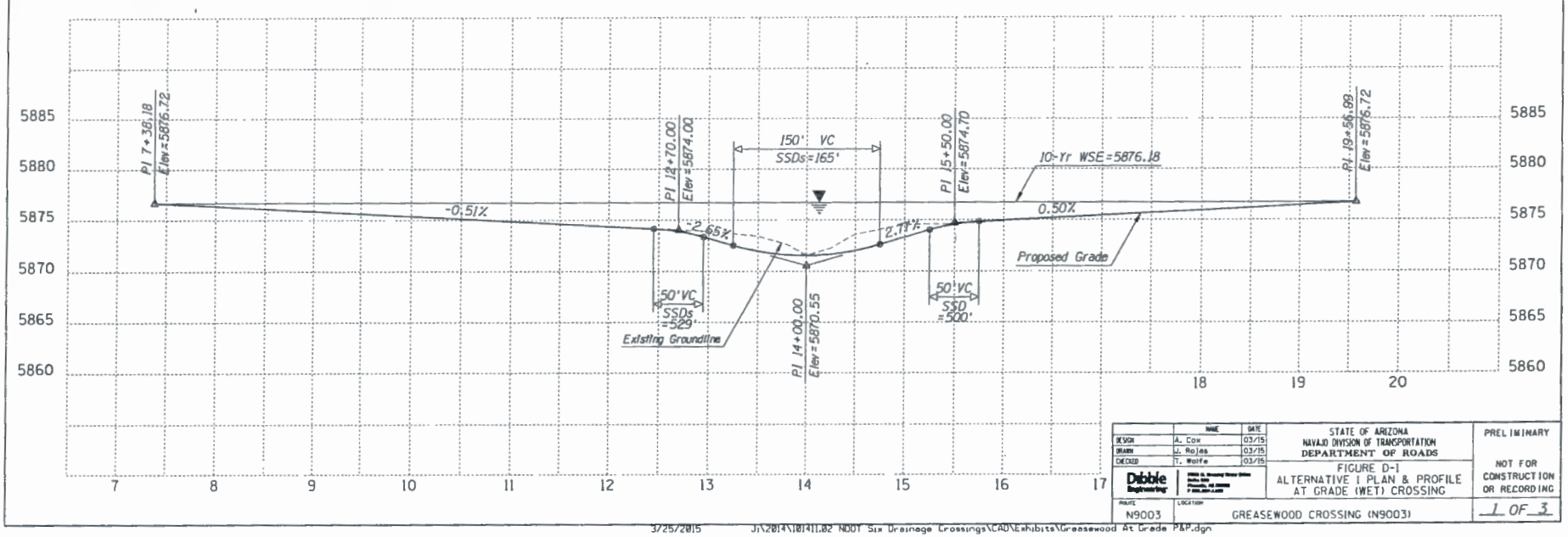


HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963



AT GRADE (WET) CROSSING
Typical Section



	NAME	DATE
DESIGN	A. Cox	03/15
DRAWN	J. Rojas	03/15
CHECKED	T. Wolfe	03/15

Dibble Engineering

STATE OF ARIZONA
NAVAJO DIVISION OF TRANSPORTATION
DEPARTMENT OF ROADS

FIGURE D-1
ALTERNATIVE I PLAN & PROFILE
AT GRADE (WET) CROSSING

PRELIMINARY

NOT FOR CONSTRUCTION OR RECORDING

ROUTE: N9003
LOCATION: GREASEWOOD CROSSING (N9003)

1 OF 3

3/25/2015 J:\2014\10411.02 NDOT Six Drainage Crossings\CAD\Exhibits\Greasewood At Grade P&P.dgn

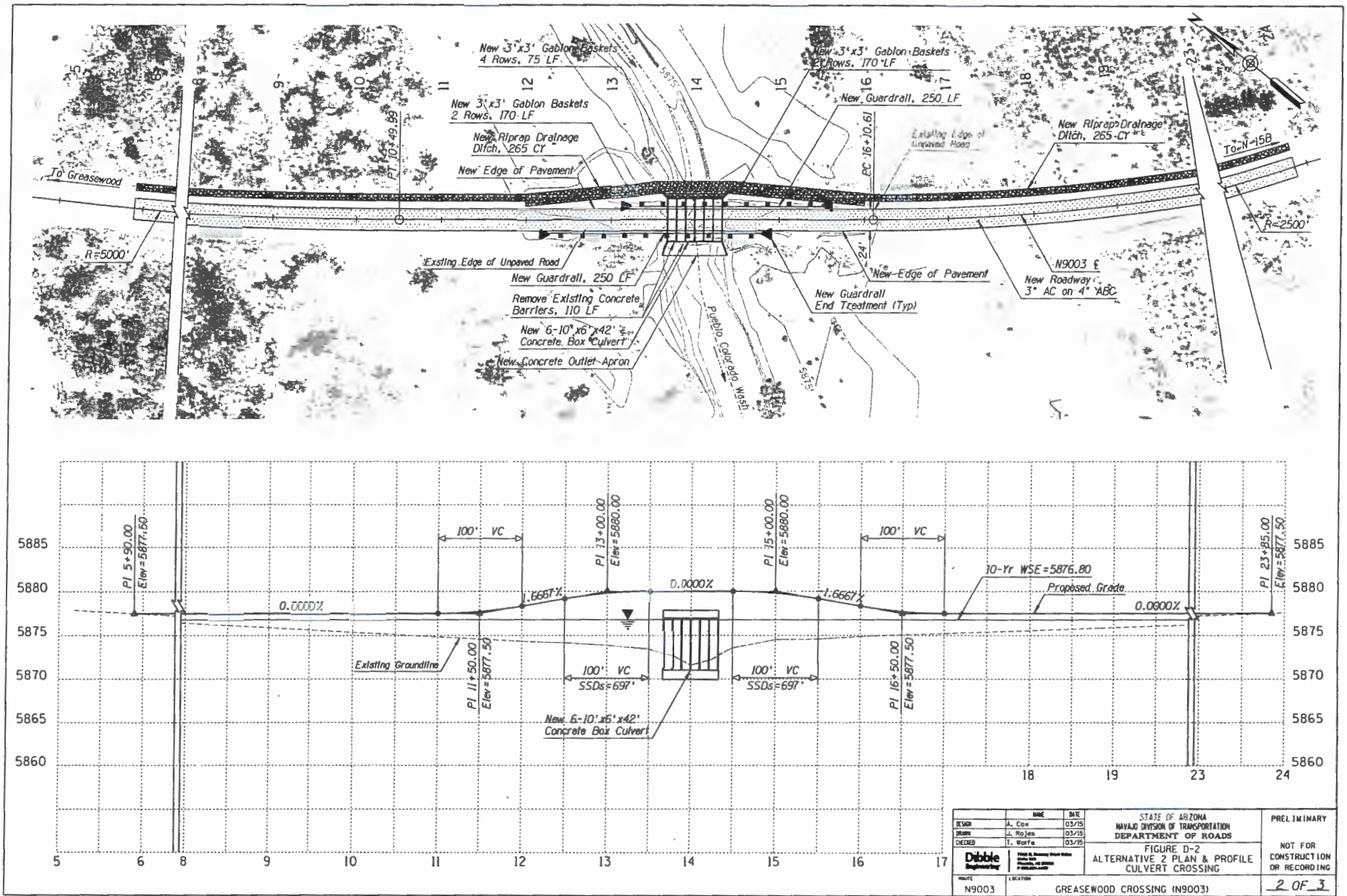
Navajo Department of Transportation

Greasewood At-Grade (Wet) Wash Crossing
Preliminary Opinion of Probable Construction Cost

NDOT Contract No: C010778

3/24/2015

ITEM NO	DESCRIPTION	UNIT	APPROX QUANTITY	UNIT PRICE	AMOUNT
1	Remove Concrete Barrier	LF	110	$10.00	$1,100.00
2	Aggregate Base Course, Class D	CY	500	$50.00	$25,000.00
3	Class C Structural Concrete	CY	1,080	$400.00	$432,000.00
4	Reinforcing Steel	LB	58,250	$1.50	$87,375.00
5	Riprap (Gabions)	CY	950	$175.00	$166,250.00
				Construction Sub-Total	***$711,725.00***
				Design Contingency (20%)	***$142,345.00***
				PROJECT CONSTRUCTION TOTAL	***$854,070.00***



	NAME	DATE
DESIGN	A. Cox	03/15
DRAWN	L. Rojas	03/15
CHECKED	T. Wolfe	03/15

Dibble Engineering

STATE OF ARIZONA
NAVAJO DIVISION OF TRANSPORTATION
DEPARTMENT OF ROADS

FIGURE D-2
ALTERNATIVE 2 PLAN & PROFILE
CULVERT CROSSING

PRELIMINARY

NOT FOR CONSTRUCTION OR RECORDING

ROUTE	LOCATION
N9003	GREASEWOOD CROSSING (N9003)

3/25/2015 J:\2014\10411.02 NDOT Six Drainage Crossings\CAD\Exhibits\Greasewood Culvert P&P.dgn

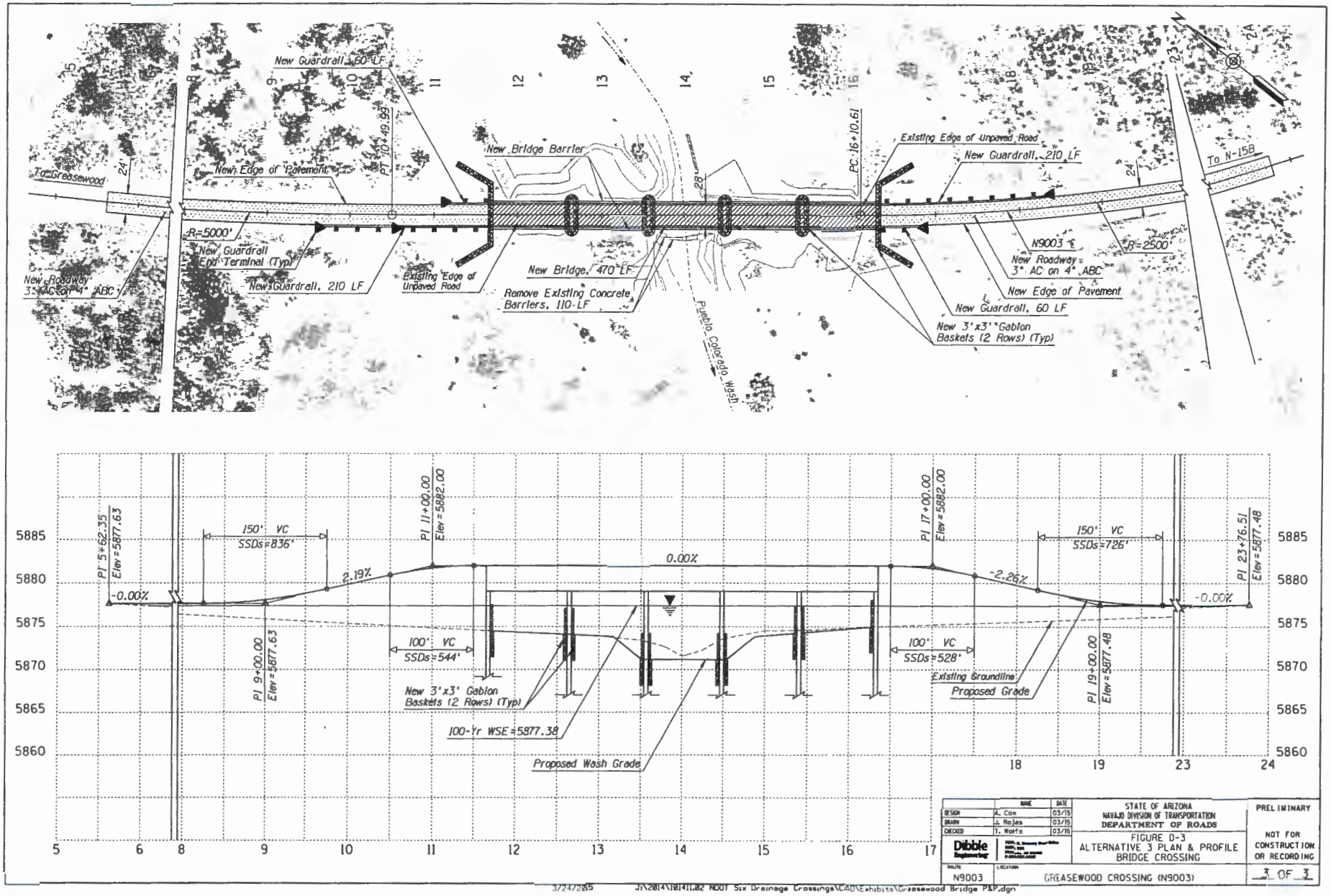
Navajo Department of Transportation

Greasewood Culvert Wash Crossing
Preliminary Opinion of Probable Construction Cost

NDOT Contract No: C010778

3/24/2015

ITEM NO	DESCRIPTION	UNIT	APPROX QUANTITY	UNIT PRICE	AMOUNT
1	Remove Concrete Barrier	LF	110	$10.00	$1,100.00
2	Aggregate Base Course, Class D	CY	540	$50.00	$27,000.00
3	AC Pavement	TON	800	$100.00	$80,000.00
4	Class C Structural Concrete	CY	320	$400.00	$128,000.00
5	Reinforcing Steel	LB	42,130	$1.50	$63,195.00
6	Riprap (Gabions)	CY	330	$175.00	$57,750.00
7	Riprap (Drainage Ditch)	CY	530	$110.00	$58,300.00
8	Guardrail	LF	500	$25.00	$12,500.00
9	Guardrail End Terminal	EA	4	$4,000.00	$16,000.00
				Construction Sub-Total	***$443,845.00***
				Design Contingency (20%)	***$88,769.00***
				PROJECT CONSTRUCTION TOTAL	***$532,614.00***



	NAME	DATE
DESIGN	A. Cox	03/15
DRAWN	J. Rojas	03/15
CHECKED	T. Wolfe	03/15

Dibble Engineering

STATE OF ARIZONA
NAVAJO DIVISION OF TRANSPORTATION
DEPARTMENT OF ROADS

FIGURE D-3
ALTERNATIVE 3 PLAN & PROFILE
BRIDGE CROSSING

PRELIMINARY

NOT FOR CONSTRUCTION OR RECORDING

ROUTE: N9003
LOCATION: GREASEWOOD CROSSING (N9003)

3 OF 3

3/24/2015 J:\2014\10141.82 NDOT Six Drainage Crossings\CADD\Exhibits\Greasewood Bridge P&P.dgn

Navajo Department of Transportation

Greasewood Bridge Wash Crossing
Preliminary Opinion of Probable Construction Cost

NDOT Contract No: C010778

3/24/2015

ITEM NO	DESCRIPTION	UNIT	APPROX QUANTITY	UNIT PRICE	AMOUNT
1	Remove Concrete Barrier	LF	110	$10.00	$1,100.00
2	Aggregate Base Course, Class D	CY	400	$50.00	$20,000.00
3	AC Pavement	TON	600	$100.00	$60,000.00
4	Bridge	SF	13,160	$110.00	$1,447,600.00
5	Riprap (Gabions)	CY	530	$175.00	$92,750.00
6	Guardrail	LF	540	$25.00	$13,500.00
7	Guardrail End Terminal	EA	4	$4,000.00	$16,000.00
				Construction Sub-Total	***$1,650,950.00***
				Design Contingency (20%)	***$330,190.00***
				PROJECT CONSTRUCTION TOTAL	***$1,981,140.00***

23rd NAVAJO NATION COUNCIL
NAABIK'ÍYÁTI' COMMITTEE REPORT
Fourth Year 2018

The **NAABIK'ÍYÁTI' COMMITTEE** to whom has been assigned:

NAVAJO LEGISLATIVE BILL #0136-18

An Action Relating to Resources and Development Committee, Budget and Finance Committee, Naabik'íyáti' Committee and the Navajo Nation Council; Approving Supplemental Funding from the Unreserved, Undesignated Fund Balance in the Amount of Two Million Eighty Thousand Two Hundred and Ninety-Seven Dollars ($2,080,297.00) for the Construction of the Greasewood Springs Bridge, Navajo Route N9003; Waiving 12 N.N.C. §§ 820 (I) and 860 (C) Relating to the Capital Improvement Process

Sponsored by: Honorable Lee Jack, Sr.

Has had it under consideration and reports the same **PASSED AND REFERRED TO THE NAVAJO NATION COUNCIL**

Respectfully Submitted,

Honorable LoRenzo C. Bates, Chairman
NAABIK'ÍYÁTI' COMMITTEE

18 DECEMBER 2018

MAIN MOTION:

Motioned by: Honorable Kee Allen Begay, Jr.
Seconded by: Honorable Jimmy Yellowhair

Vote: 15 in Favor, 03 Opposed (Chairman Bates Not Voting)

NAVAJO NATION

RCS# 1146

12/18/2018

Naa'bik'iyati Committee

08:21:55 PM

Amd# to Amd#

PASSED

MOT Begay, K

SEC Yellowhair

Legislation 0136-18 Approving Supplement Funding from the UUFB in the Amount....

Yea : 15 **Nay : 3** **Excused : 0** **Not Voting : 6**

Yea : 15

Begay, K	Crotty	Jack	Phelps
BeGaye, N	Daniels	Kieyoomia	Slim
Bennett	Filfred	Perry	Yellowhair
Brown	Hale	Pete	

Nay : 3

Smith	Tso	Damon

Excused : 0

Not Voting : 6

Bates	Chee	Tsosie	Yazzie
Begay, NM	Shepherd		

23rd NAVAJO NATION COUNCIL
ACTION REPORT
Fourth Year 2018

The **NAVAJO NATION COUNCIL** to whom has been assigned:

NAVAJO LEGISLATIVE BILL #0136-18

An Action Relating to Resources and Development Committee, Budget and Finance Committee; Naabik'íyáti' Committee and the Navajo Nation Council; Approving Supplemental Funding from the Unreserved, Undesignated Fund Balance in the Amount of Two Million Eighty Thousand Two Hundred and Ninety-Seven Dollars ($2,080,297.00) for the Construction of the Greasewood Springs Bridge, Navajo Route No. N9003; Waiving 2 N.N.C. §§ 820(I) and 860(C) Relating to the Capital Improvement Process

Sponsored by: Honorable Lee Jack, Sr.

Has had it under consideration and reports the same was **TABLED AND REMAINS WITH THE NAVAJO NATION COUNCIL.**

Respectfully Submitted,

Honorable LoRenzo C. Bates, Speaker
23rd NAVAJO NATION COUNCIL

20 DECEMBER 2018

TABLING MOTION:
Motion to Table Legislation 0136-18 to the next Navajo Nation Council Session.
Motioned by: Honorable Walter Phelps
Seconded by: Honorable Herman M. Daniels
Vote: 15 in favor, 00 opposed (Speaker Bates Not Voting)

MAIN MOTION:
Motioned by: Honorable Jimmy Yellowhair
Seconded by: Honorable Raymond Smith, Jr.
Vote: PENDING VOTE

NAVAJO NATION

RCS# 1362

12/20/2018

Special Session

05:30:41 PM

Amd# to Amd# Table Legislation 0136-18 to the next NNC session

PASSED

MOT Phelps

SEC Daniels

Yea : 15 **Nay : 0** **Excused : 0** **Not Voting : 9**

Yea : 15

Begay, K	Chee	Jack	Slim
BeGaye, N	Crotty	Kieyoomia	Smith
Bennett	Damon	Phelps	Yellowhair
Brown	Daniels	Shepherd	

Nay : 0

Excused : 0

Not Voting : 9

Bates	Hale	Pete	Tsosie
Begay, NM	Perry	Tso	Yazzie
Filfred			