SECTION 50

BONDING

TABLE OF CONTENTS

SECTION	SECTION TITLE	PAGE NUMBER
50	Bonding	50-1
50.1	Determination of Bond	50-1
50.1.1	Maximum Reclamation Requirements	50-1
50.2	Reclamation Cost Estimate	50-1
50.2.1	Reclamation Costs	50-1
50.2.2	Earthmoving	50-2
50.2.2.1	Equipment Selection	50-3
50.2.2.2	Equipment Productivity and Costs	50-3
50.2.2.3	Area 1	50-4
50.2.2.4	Area 2	50-4
50.2.2.5	Area 3	50-5
50.2.2.6	Area 4	50-5
50.2.3	Revegetation	50-6
50.2.4	Miscellaneous	50-6
50.2.5	Indirect Reclamation Costs	50-6
50.2.6	Total Performance Bond Cost	50-6

SECTION 50

BONDING

LIST OF TABLES

TABLE NUMBER	TABLE TITLE
50-1	Reclamation Bond Schedule-not in Text
50-2	Reclamation Bond Adjustment Summary (not in text)

SECTION 50

BONDING

LIST OF FIGURES

FIGURE NUMBER	FIGURE TITLE

SECTION 50

BONDING

LIST OF EXHIBITS

EXHIBIT NUMBER	EXHIBIT TITLE
50-1	Area 2 Hosteen Yazzie Area Post Mining
50-2	Area 2 Mason Barber Areas Post Mining
50-3	Area 3 Lowe Dixon Post Mining Configuration
50-4	Area 4N Post Mining Configuration
50-5	Area 1 Pinto Post Mining Configuration
50-6	Area 2 Hosteen Yazzie North Bond Surface Configuration
50-7	Area 2 Mason Barber South Bond Surface Configuration
50-8	Area 3 Lowe Dixon Bond Surface Configuration
50-9	Area 4N Bond Surface Drop Structure Watershed
50-10	Area 1 Bond Surface Configuration
50-11	Area 2 Hosteen Yazzie Cut Fill Contours
50-12	Area 2 Mason Barber Cut Fill Contours
50-13	Area 3 Lowe Dixon Cut Fill Contours
50-15	Area 2 Hosteen Yazzie Cut Fill Contours
50-16	Area 2 Mason Barber Cut Fill Contours
50-17	Area 3 Lowe Dixon Cut Fill Blocks
50-18	Area 2 Hosteen Yazzie Topdressing Replacement
50-19	Area 4N Cut Fill Contours
50-20	Open
50-21	Area 2 Mason Barber Topdressing Replacement
50-22	Area 3 Lowe Dixon Topdressing Replacement
50-23	Area 2 Hosteen Yazzie Bond Spoil Mitigation
50-24	Area 2 Mason Barber Bond Spoil Mitigation
50-25	Area 3 Lowe Dixon Bond Spoil Mitigation
50-26	Area 4N Topsoil Replacement Bond
50-27	Area 4N Bond Spoil Mitigation
50-28	Area 1 Topdressing Replacement
50-29	Area 1Bond Spoil Mitigation

SECTION 50

BONDING

LIST OF APPENDICES

APPENDIX NUMBER	APPENDIX TITLE
50.A	Topography Channel Stabilization for Bond Reclamation Bond Scenario 2019

SECTION 50

BONDING

LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED
1404	2014 Navajo Mine Permit Renewal	

50 BONDING

50.1 Determination of Bond

The determination of the bond is an estimation of the maximum reclamation cost that the Regulatory Authority would incur in the event of bond forfeiture by Navajo Mine during the permit term ending in 2019. Areas bonded include those areas which will be disturbed in the process of recovering coal from the Permit Area and those facilities that support the mine. The following costs and procedures apply only for determining the bond dollar figure at year 2014 and are not necessarily meant to represent current or future operational practices. Direct costs are calculated in Worksheets 2 through 15 and are totaled in Worksheet 16 in Appendix 32.A. Indirect costs are applied as percentages of the direct cost in Worksheet 16 to achieve a total bond cost.

50.1.1 Maximum Reclamation Requirements

The point at which reclamation liabilities will be greatest occurs during the first year of the five-year term ending in 2019 (see Worksheet 1, Appendix 32.A). Current reclamation activities will be focused in Area 2 and Area 3. Under the bond scenario, after all mining has ceased, Area 1-4 North will be reclaimed concurrently until complete.

For the purposes of this calculation, the disturbed areas have been updated with aerial flight topography and merged with the bond post mining configuration. NTEC will evaluate, and adjust if necessary, the bond amount based on significant permit revisions, mid-term renewals, and permit renewal periods.

The amount of disturbance taking place during the permit term is primarily controlled by strip progression, which is shown on Exhibits 2-1 and 2-2.

Mining activities will continue in Dixon, Lowe, Hosteen/Yazzie pits, and Area 4 North. Areas 2 and 3 are the primary areas for reclamation during the permit term. Pinto Pit has been reclaimed and has been removed from the bond calculations.

50.2 Reclamation Cost Estimate

50.2.1 Reclamation Costs

Reclamation costs are calculated as shown in Appendix 32.A, Worksheets 1 through 16. Reclamation liabilities for Permit Areas will occur in Areas 1, 2, 3, and 4. It is assumed that all final bond pits will progress as scheduled as noted in Exhibits 2-1 and 2-2 and will be stripped to their lowest recoverable coal seam. Reclamation activities will consist of the following:

1. Facility Demolition and Removal
2. Earthmoving

3. Revegetation
4. Miscellaneous

50.2.2 Earthmoving

A post-mining "snapshot" of each Area was projected for year2019, as shown in the Bond Post-Mining Configuration (PMC) Maps, Exhibit 50-1, Exhibit 50-2, Exhibit 50-3, Exhibit 50-4, and Exhibit 50-5. The bond post mining configuration is the surface that represents the planned disturbance based on the current mine plan and has the existing disturbance area updated with aerial topography, which was designed using Earth Technology's 3D-Dig software.

To achieve Bond Final Surface Configuration (BSC) (Exhibits 50-6, Exhibit 50-7, Exhibit 50-8, Exhibit 50-9 and Exhibit 50-10), PMC topography in these areas was altered to create reclaimed surfaces. The BSC surfaces maintain 6.5h: 1v maximum final interior slopes, 4h: 1v maximum outslopes, minimize backfill volumes, and ensure positive drainage as similar as possible to the Final Surface Configurations' (FSC) drainage schemes, Exhibits 34-1 through 34-6.

The next design step was to subtract a computerized grid of the PMC from the BSC using Maptek's Vulcan software. The result is a Cut-Fill Contours map (Exhibit 50-11, Exhibit 50-12, and Exhibit 50-13) with the cut areas shown as red contours, and the fill areas shown as blue contours. The cut and fill areas are then subdivided into polygons and the cut and fills are balanced by taking extra cut to polygons that require fill. The result is the Cut-Fill Blocks map (Exhibit 50-15, Exhibit 50-16, Exhibit 50-17, Exhibit 50-18, Exhibit 50-19 and Exhibit 50-20).

The Vulcan software gives the volume and centroid of each block. The centroids are used to calculate haulage distances and grades, except in the case of deep pits and ramps where haulage is assumed to be to the crest where the material can be pushed over the edge. The haulage profiles and grades are weight averaged by volume to give an average distance and grade for each equipment type for each of Areas 1, 2, 3 and4 North.

All bond earthmoving activities are tabulated in Worksheet 3 as follows:

- Worksheet 3A Dozers
- Worksheet 3B Trucks and Loaders
- Worksheet 3C Scrapers
- Worksheet 3D Graders
- Worksheet 3E Drilling and Blasting of Highwalls

Quantities from these worksheets are used as input to Worksheets 5 through 12 where equipment hours are calculated. Worksheet 13 uses these hours to calculate earthmoving costs. The earthmoving costs are totaled in Worksheet 16, Item 2 (see Figure 12-B-1, Worksheet Flow). In addition to regrade activities, earthmoving includes spoil mitigation, topsoil placement, and concrete disposal.

Once regrading and/or facilities removal activities have been completed in an area, required suitable root zone mitigation and/or topsoil material is placed on these areas. The Industrial Complexes will support all bond activities and will be reclaimed as near to the end of the project as possible.

Suitable spoil and regolith/topdressing material (either stockpiled or in situ) is used to complete the four (4) feet suitable root zone material requirements on spoil surfaces. Stockpiled and/or in-situ regolith/topdressing material is used to complete the topsoil and regolith depth requirement on all reclaimed surfaces as outlined in Table 36-1, (Exhibit 50-18 and Exhibit 50-21, Exhibit 50-22, Exhibit 50-23, Exhibit 50-24, Exhibit 50-25, Exhibit 50-26, Exhibit 50-27, Exhibit 50-28, and Exhibit 50-29).

50.2.2.1 Equipment Selection

Large earthmoving equipment was selected assuming that a large contractor will be doing the reclamation work using their own equipment.

50.2.2.2 Equipment Productivity and Costs

Reclamation activities will take place with a 20-shift per week schedule. Equipment ownership and operating costs are tabulated in Table 12-B-23 taken from CRG-PRIMEDIA Equipment watch, "Cost Reference Guide for Construction Equipment", 1st half - 2014 Edition. Equipment operator wage rates are listed in Table 12-B-24 and were taken from the ACME Inc. Navajo Mine reclamation contract in force for 2014. The wage rates found in the aforementioned Table are greater than suggested wage rates provided by the Office of Navajo Labor Relations, as well as wages found for contracts for similar labor in Davis-Bacon data (1993). To model a conservative approach, the wage rates from the previous Bond calculation (higher than such found labor rates) were unchanged and used for calculation in the total bond cost.

For haul routes greater than 500 ft, scrapers are more economical than dozers. For haul routes greater than 3,000 ft, dump trucks are more economical than scrapers. Dozers are assumed to work alone with no support equipment other than a lowboy for transport. Truck fleets require load and dump dozers, and half-time water truck and grader for haul road maintenance. Scraper fleets require one-eighth time water truck and grader for haul road maintenance. All fleets are assigned light plants for night work. Fuel and lube trucks are included in the fuel costs (TABLE 12-B-23).

Productivities for each particular activity are calculated in Worksheets 5 through 12 (Appendix 32.A) using the material properties and haulage profile pertaining to the task.

50.2.2.3 Area 1

Earthmoving activities for Area 1 will consist of those required for facilities reclamation. Pinto Pit has been completely regraded during the last permit term; see Area 1 Final Surface Configuration, Exhibit 34-2 for reference. The only regrade work remaining consists of road infrastructure.

Stockpiled topsoil will be placed on disturbed areas at a depth of 8.7 inches, as outlined in Table 36-1 with 5 percent spoil mitigation. Exhibit 50-5, Exhibit 50-10, Exhibit 50-20, Exhibit 50-28 and Exhibit 50-29 detail the reclamation plan for Area 1.

50.2.2.4 Area 2

Ramps and pits are used as drainages and spoil material is hauled from South Barber, North Barber, and Hosteen pit and overlook to backfill open pits. In South Barber, CCB may be used to backfill the final pit as a means of contingency for the Four Corners Power Plant CCB disposal. Yazzie Pit requires additional material from the Big Fill railroad embankment and Hosteen for pit backfill. Earthmoving costs for fill material required to develop positive drainage in Permit lands is not included in the bond. Cut and Fill contours for Area 2 are shown on Exhibits 50-11 and Exhibit 50-12. Area 2 regrade material movement is shown on Exhibit 50-15 and Exhibit 50-16.

Material to achieve the required four (4) feet of suitable root zone material/topdressing is available in stockpiled and in-situ reserves within Area 2. Additional material will be hauled as needed from Regolith stockpile(s) in Area 3.

The suitable rootzone and topsoil movement consists of the mitigation of four (4) feet of suitable rootzone material over 2 percent of the surface area, with this four (4) foot total inclusive of the required 5.6 inches of topsoil as outlined in Table 36-1.

Area 2 suitable rootzone material movement is shown on Exhibit 50-23 and Exhibit 50-24.

Topsoil required to achieve the 5.6 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area 2. This is available in stockpile and in-situ reserves. Area 2 topdressing material movement is shown on Exhibit 50-18 and Exhibit 50-21.

50.2.2.5 Area 3

Generally, ramps and pits are used as drainages, spoil material is required from the Dixon Pit area for pit backfill in North Lowe, and Lowe boxcut material is graded to the west. Calculations for material movement and scheduling were performed without the inclusion of Dixon Box-cut Exchange. Pending negotiations with the Navajo Nation, an update will be submitted including the Dixon Box-cut Exchange.

As seen in Exhibit 50-3, a considerable volume of material is to be pre-stripped, or truck stripped, before dragline progression into strip DX74. For calculation purposes, this pre-strip volume was removed from the Post Mining Configuration and added to balance the Bond Surface Configuration (BSC) using Microsoft Excel. The pre-strip volume is accounted for in spreadsheet calculations: however, the cut block "Dixon PS" is not shown in exhibits.

Cut and Fill contours for Area 3 are shown on Exhibits 50-13. Area 3 regrade material movement is shown on Exhibit 50-17.

Area 3 topdressing and spoil mitigation material movement required to achieve four (4) feet of rootzone (including 9.7 inches of topsoil) is shown on Exhibit 50-22 and Exhibit 50-25. As with Areas 1 and 2 it is assumed that 10.8 percent of the disturbed surface areas will require mitigation. The remaining surface areas will receive only the 9.7 inches of topdressing.

50.2.2.6 Area 4

Ramps and pits are used as drainages and spoil material is used to backfill designed open pits and ramps using dozer and front end loader operations. Cut and Fill contours for Area 4 North are shown on Exhibit 50-19. Area 4 North regrade material movement is shown on Exhibit 50-19.

Material to achieve the required four (4) feet of suitable root zone material/topdressing is available in stockpile reserves in southern Area 3. It should be noted that in realistic scenarios, NTEC will remove topsoil material prior to mining, and stockpile such materials for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where NTEC strips without removing topsoil material. In this "Worst Case Scenario", topsoil would be hauled using trucks from Area 3.

The suitable rootzone and topsoil movement consists of the mitigation of four (4) feet of suitable rootzone material over 10.8 percent of the surface area, with this four (4) foot total inclusive of the required 5.7 inches of topsoil as outlined in Table 36-1.

Area 4 North suitable rootzone material movement is shown on Exhibit 50-27. Topsoil required to achieve the 5.7 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area 4 North. This is

available in stockpile reserves in Area 3. Area 4 North topdressing material movement is shown on Exhibit 50-19. It should be noted that in realistic scenarios, NTEC will remove regolith material prior to mining, and stockpile such material for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where NTEC strips without removing regolith material. In this "Worst Case Scenario", mitigation material would be hauled using trucks from Area 3.

50.2.3 Revegetation

After backfilling the pits and ramps the bonded areas will be graded with graders and then these areas and facilities areas will be topsoiled as noted in previous sections. After topsoiling, revegetation activities will initiate. This involves seeding, crimping, mulching and irrigation. Costs are noted on Appendix 32.A, Worksheet 14(A-C).

50.2.4 Miscellaneous

A cost estimate for the riprap necessary to stabilize the reestablished drainage channels associated with the Bond Reclamation Topography was developed in Appendix 50.A. Channel dimensions, riprap sizes and riprap quantities were determined for channel reaches at the mine. Hydrology and channel designs are based on procedures outlined in Reclamation Surface Stabilization Design Handbook for the Navajo Mine (1999).

50.2.5 Indirect Reclamation Costs

Mobilization and demobilization costs are assumed to be 1% of the direct costs, since the reclamation project would be very large. Contingencies are 3% of the direct costs; the engineering redesign fee, the contractor profit and overhead, and the reclamation management fee are set at 1.8%, 10.0% and 3.9% of direct costs respectively, per discussed agreement with OSM staff. A permit maintenance contingency has been included in the bond calculations to cover any projects that are added to the permit within the 2019 permit term, such as roads, ponds, or structures.

50.2.6 Total Performance Bond Cost

The total performance bond cost is the sum of the direct and indirect costs and is shown in Worksheet 16, Appendix 32.A.

References

NTEC Minerals - Navajo Mine. 1992. Reclamation Surface Stabilization Handbook.

Davis-Bacon. 1993. Wage Rates. U.S., Department of Labor, Superintendent of Documents, Government Printing Office, Washington, DC.

Table 50-1 Reclamation Bond Summary[1]

Item	Source	Amount
Total Facility and Structure Removal	Appendix 32.A Worksheet 2	$ 7,883,327
Total Earthmoving Costs	Appendix 32.A Worksheet 13	$ 104,426,760
Total Revegetation Costs	Appendix 32.A Worksheet 14	$ 13,464,032
Total Other Reclamation Activities Costs	Appendix 32.A Worksheet 15	$ 2,481,591
Subtotal: Direct Costs		**$ 128,255,710**
Mobilization and Demobilization	1.00%	$ 1,282,557
Contingencies	3.00%	$ 3,847,671
Engineering Redesign Fee	1.80%	$ 2,308,603
Contractor Profit and Overhead	10.00%	$ 12,825,571
Reclamation Management Fee	3.90%	$ 5,001,973
Permit Maintenance Contingency		$ 2,083,163
Subtotal: Indirect Costs		**$ 27,349,538**
Subtotal: Indirect and Direct Costs		$ 155,605,248
Inflation to 2016 Costs[2]		$ 161,891,544
Grand Total Bond Amount		**$ 161,891,544**

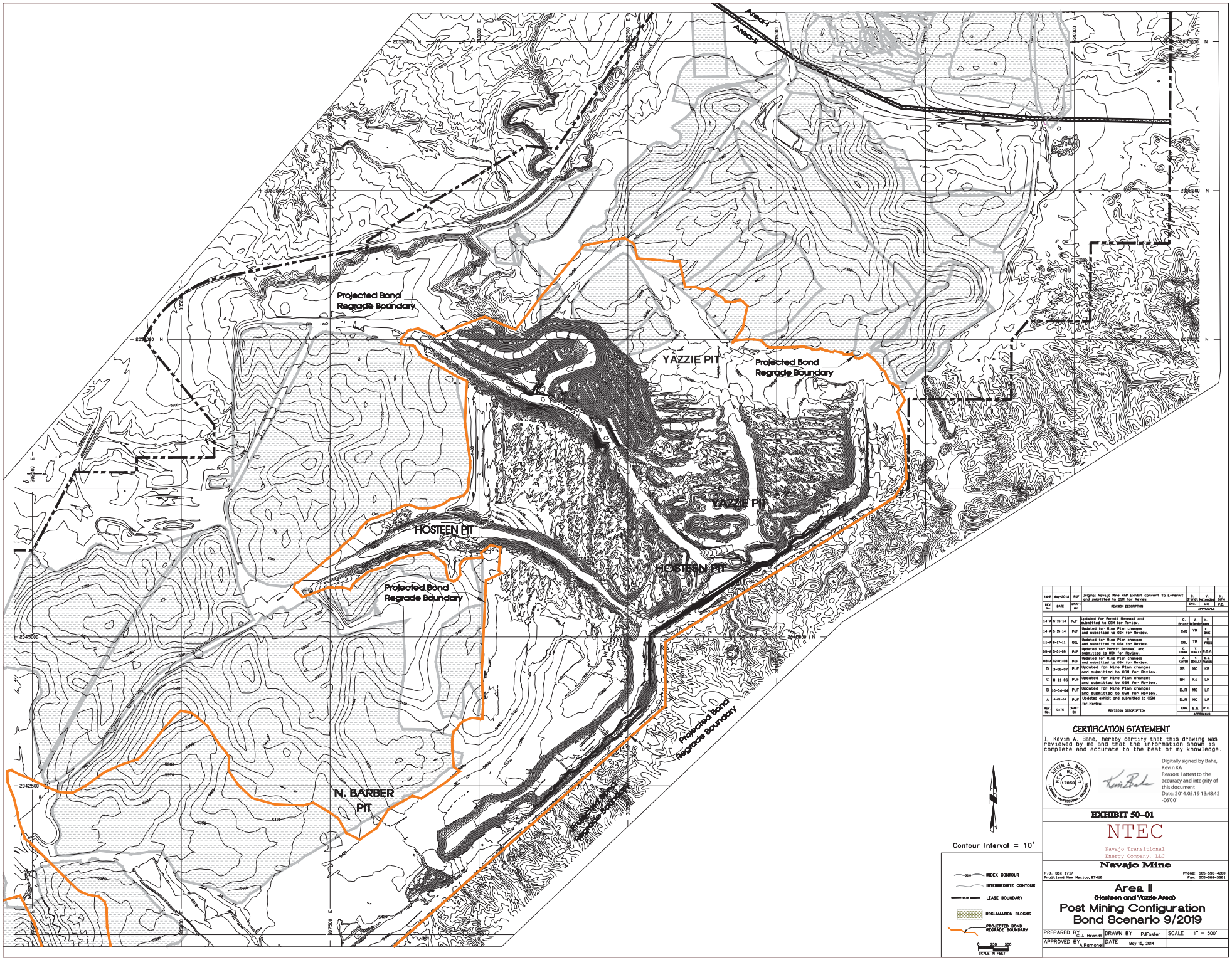
[1]Bond summary information can also be found in Appendix 32.A Worksheet No. 16 and Appendix 50.A.

[2]Inflation rates have been applied to 2015 and 2016 dollars.

Table 50-2 Reclamation Bond Adjustment Summary

Item #	Item	OSM Project ID	ADJ Sum [1]	ADJ Amount
1	Bond Cost Estimate in Approved PAP (Bond Update May 2014)	NM0003F	1, 2	$161,891,544
				$161,891,544

[1] The NTEC initial reclamation bond adjustments summary sheets and worksheets are found in Appendix 32.A.
[2] Section 50 and Appendix 32.A established the base reclamation cost estimate in the permit renewal application.



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	C.O.	P.E.
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. BRANDT	V. MALAMONA	K. BAHE
			APPROVALS			
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C. BRANDT	V. MALAMONA	K. BAHE
14-A	5-15-14	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	CJB	VM	K. BAHE
11-A	6-17-11	GGL	Updated for Mine Plan changes and submitted to OSM for Review.	GGL	TR	B. PEDRO
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	K. LEGAN	VM	K.C.Y. BENALLY
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	K. KARSAN	VM	K.C.Y. BENALLY
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.S.	P.E.
			APPROVALS			

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:48:42 -06'00'

EXHIBIT 50-01

NTEC

Navajo Transitional Energy Company, LLC

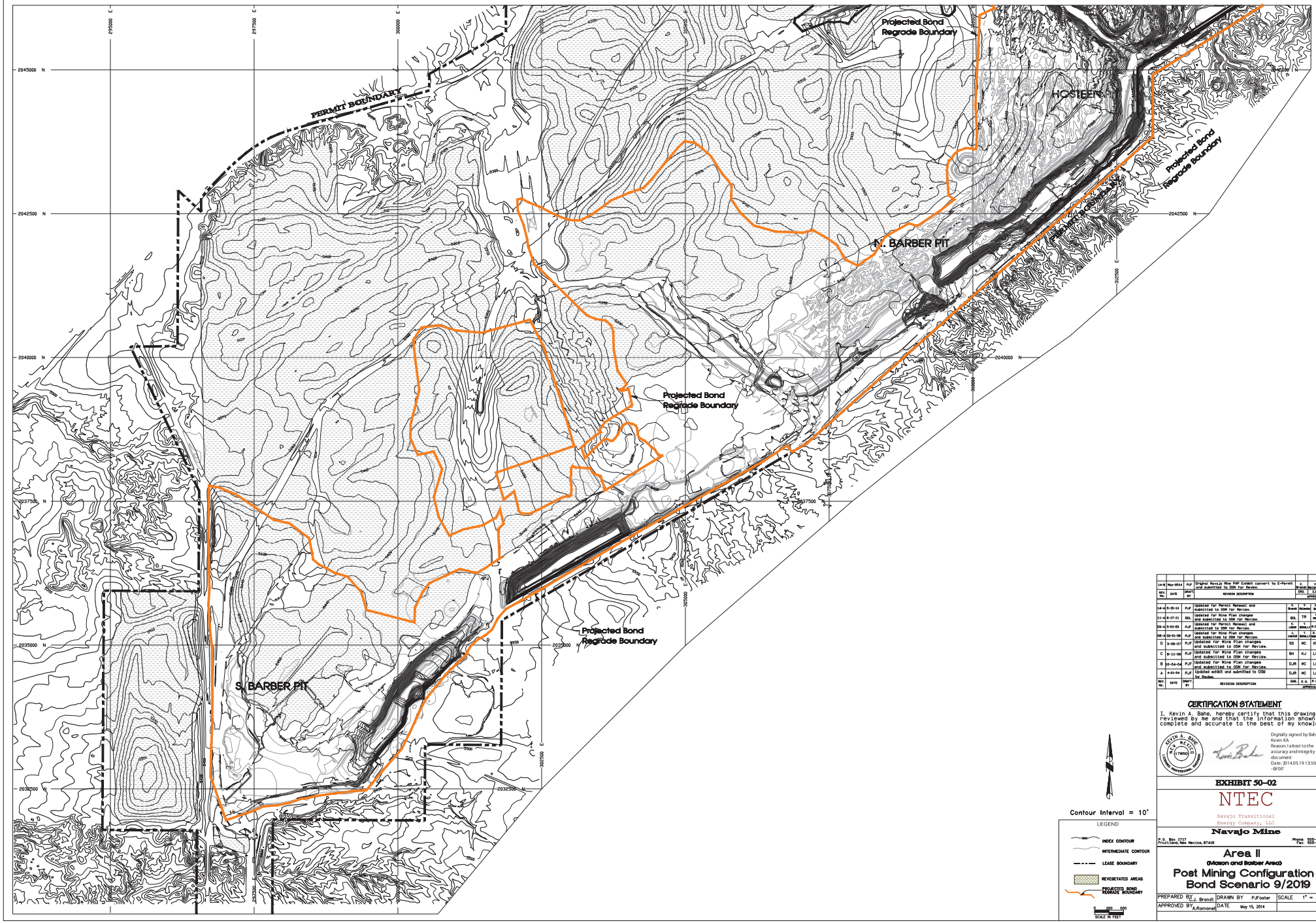
Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-598-3361

Area II
(Hosteen and Yazzie Areas)
Post Mining Configuration Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY	PJFoster	SCALE	1" = 500'
APPROVED BY	A.Ramonal	DATE	May 15, 2014		



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	DWN.	CK.	APPROVALS
14-0	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	V. Romanelli	K. Bahe P.E.
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C. Brandt	V. Romanelli	K. Bahe
11-A	6-17-11	BDL	Updated for Mine Plan changes and submitted to OSM for Review.	BDL	TR	K. Bahe
09-A	5-05-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	P. LEWIS	V. RONALLI	K.E.Y.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	P. LEWIS	V. RONALLI	K.E.Y.
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	e.o.	P.E. APPROVALS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:50:20 -06'00'

EXHIBIT 50-02

NTEC
Navajo Transitional Energy Company, LLC

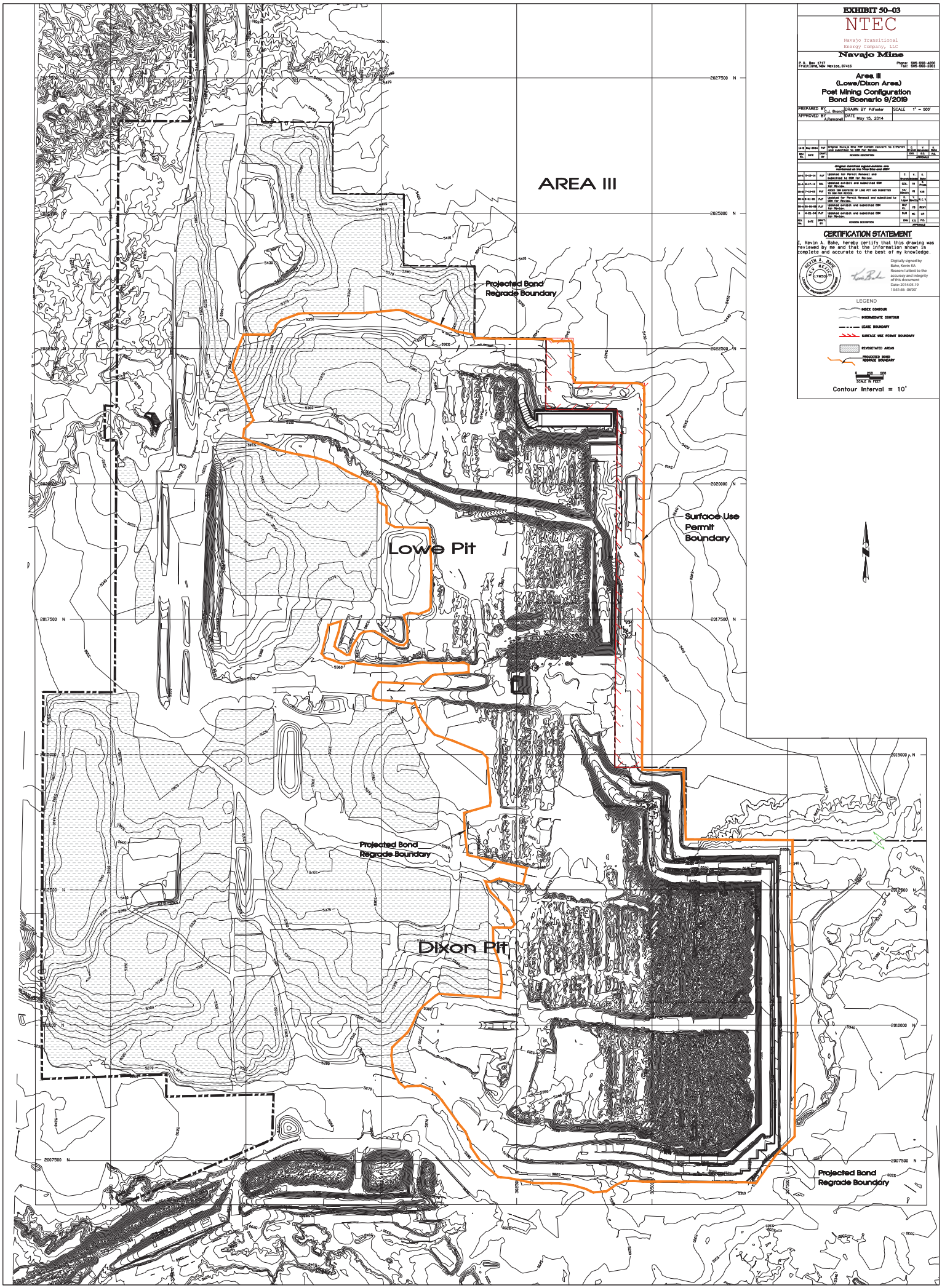
Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-6200
Fax: 505-598-3361

Area II
(Mason and Barber Area)
Post Mining Configuration Bond Scenario 9/2019

PREPARED BY C.J. Brandt	DRAWN BY PJFoster	SCALE	1" = 500'
APPROVED BY A.Ramonelli	DATE May 15, 2014		


AREA III
Projected Bond Regrade Boundary
Lowe Pit
Surface Use Permit Boundary
Projected Bond Regrade Boundary
Dixon Pit
Projected Bond Regrade Boundary
2027500 N
2025000 N
2022500 N
2020000 N
2017500 N
2015000 N
2012500 N
2010000 N
2007500 N
EXHIBIT 50-03
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Area III
(Lowe/Dixon Area)
Post Mining Configuration
Bond Scenario 9/2019
PREPARED BY C.J. Brandt
DRAWN BY P.J.Foster
SCALE 1" = 500'
APPROVED BY A.Ramsnell
DATE May 15, 2014
CERTIFICATION STATEMENT
I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
KEVIN A. BAHE
17850
NEW MEXICO
PROFESSIONAL ENGINEER
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:51:36 -06'00'
LEGEND
INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE BOUNDARY
SURFACE USE PERMIT BOUNDARY
REVEGETATED AREAS
PROJECTED BOND REGRADE BOUNDARY
0 250 500
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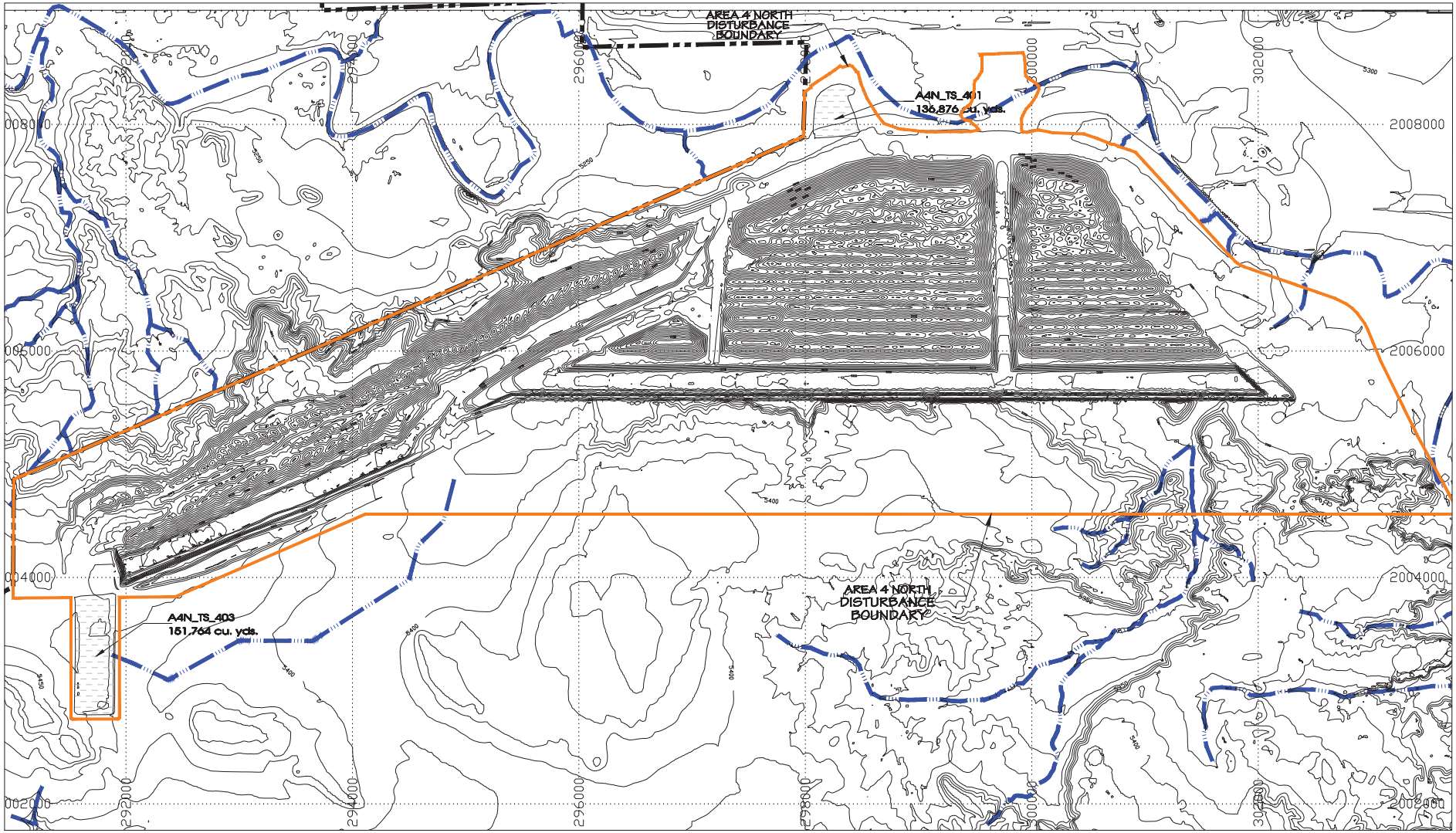

LOCATION MAP

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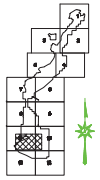


LEGEND

- 5300 — INDEX CONTOUR (50 Ft.)
- INTERMEDIATE CONTOUR (10 Ft.)
- LEASE BOUNDARY
- TOPSOIL STOCKPILE
- DRAINAGE PATTERNS
- SURFACE DISTURBANCE BOUNDARY

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Kevin Bahe

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:52:58 -06'00'

REVISION		DATE
Submitted to OSM for Review	1	05.13.2014
Submitted to OSM for Review	2	May 13, 2014
Submitted to OSM for Review	3	April 15, 2017
Submitted to OSM for Review		
Submitted to OSM for Review	A4-4	5-15-14
Submitted to OSM for Review		
Updated to reflect current conditions and proposed changes to the Permit	14-01	May-2014

PROJECT MANAGER: A. Ramonsli
ENGR. of RECORD: Kevin A. Bahe
REG. No: NM-17850
DRAWN of RECORD:
REG. NO.

PROJECT: A4N Permitting
DATE:
DESIGNED BY: C.J. Brandt
DRAWN BY: PJ Potter
CHECKED BY: C.J. Brandt
APPROVED BY: A. Ramonsli

NTEC
Navajo Transitional Energy Company, LLC
NAVAJO MINE

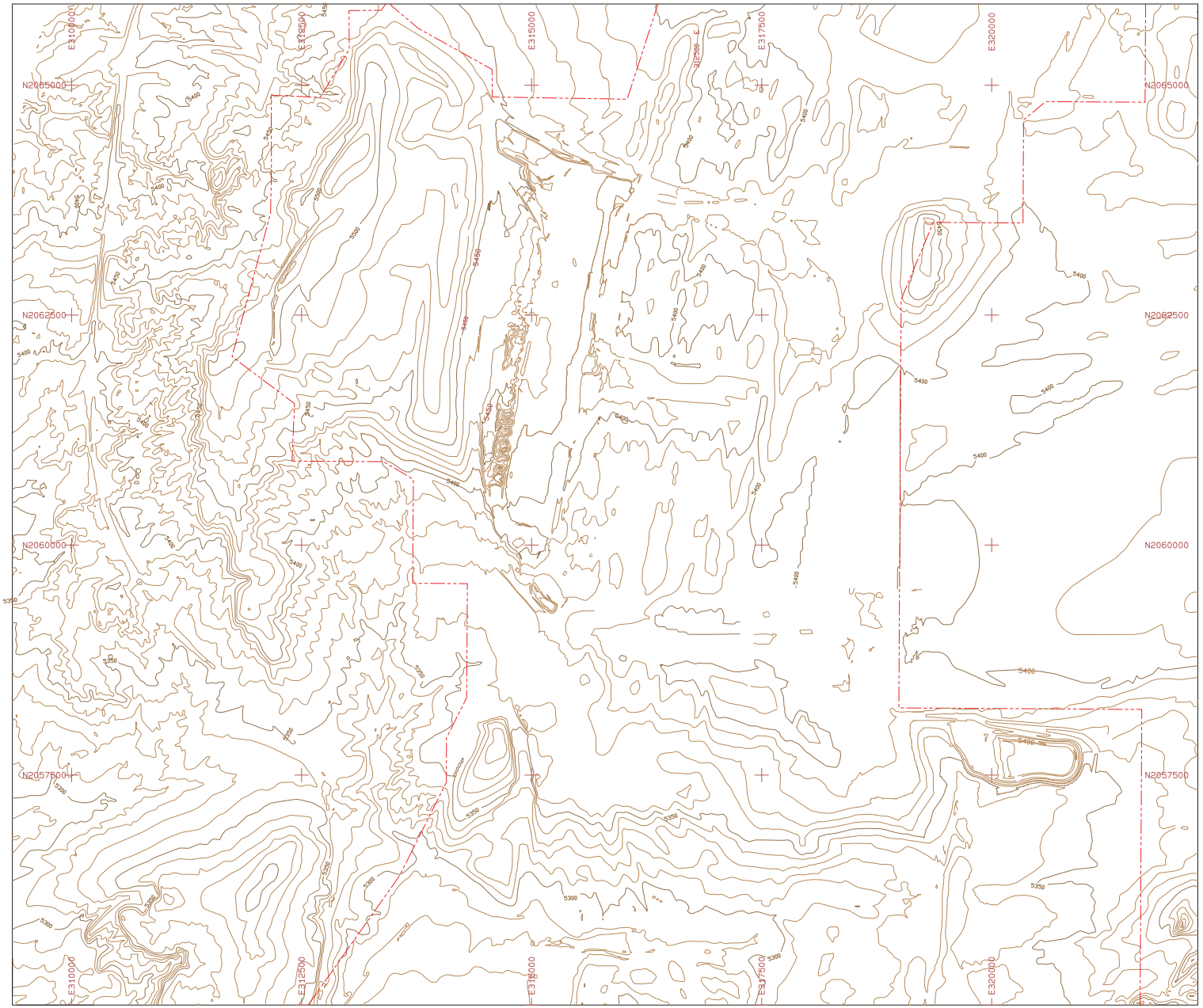
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE: 505-598-4200/FAX: 505-598-3361

LOCATION MAP

EXHIBIT 50-04
AREA 4 NORTH
POST-MINE CONFIGURATION
BOND SCENARIO 9/2019

DRAWING

SHEET 1 OF 1



LEGEND

N

0 250 500
SCALE IN FEET

LEASE/PERMIT BOUNDARY

5300 INDEX CONTOUR

INTERMEDIATE CONTOUR

REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	DRN.	C.A. APPROVAL	V.P. APPROVAL	A.M. APPROVAL
5/14	Mar-2014	PJF	Original Navajo Mine PDP Exhibit convert to E-Permit and submitted to DRM for Review.		C.	V.	A.
REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	DRN.	C.A. APPROVAL	V.P. APPROVAL	A.M. APPROVAL
50-4	4-21-14	CJB	Updated Mine Plan changes and submitted to DRM for Review.	JMT	JM	CMB	
50-4	6-23-14	PJF	Updated for Permit Renewal and submitted to DRM for Review.	JMT	JM	K.A.T.	
B	8-28-18	PJF	Updated Mine Plan changes and submitted to DRM for Review.	MW	KJ	LR	
A	4-21-14	PJF	Updated exhibit and submitted to DRM for review	SJM	MC	LR	
REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	DRN.	C.A. APPROVAL	P.K. APPROVAL	

CERTIFICATION STATEMENT

I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:53:38 -06'00'

EXHIBIT 50-05

NTEC

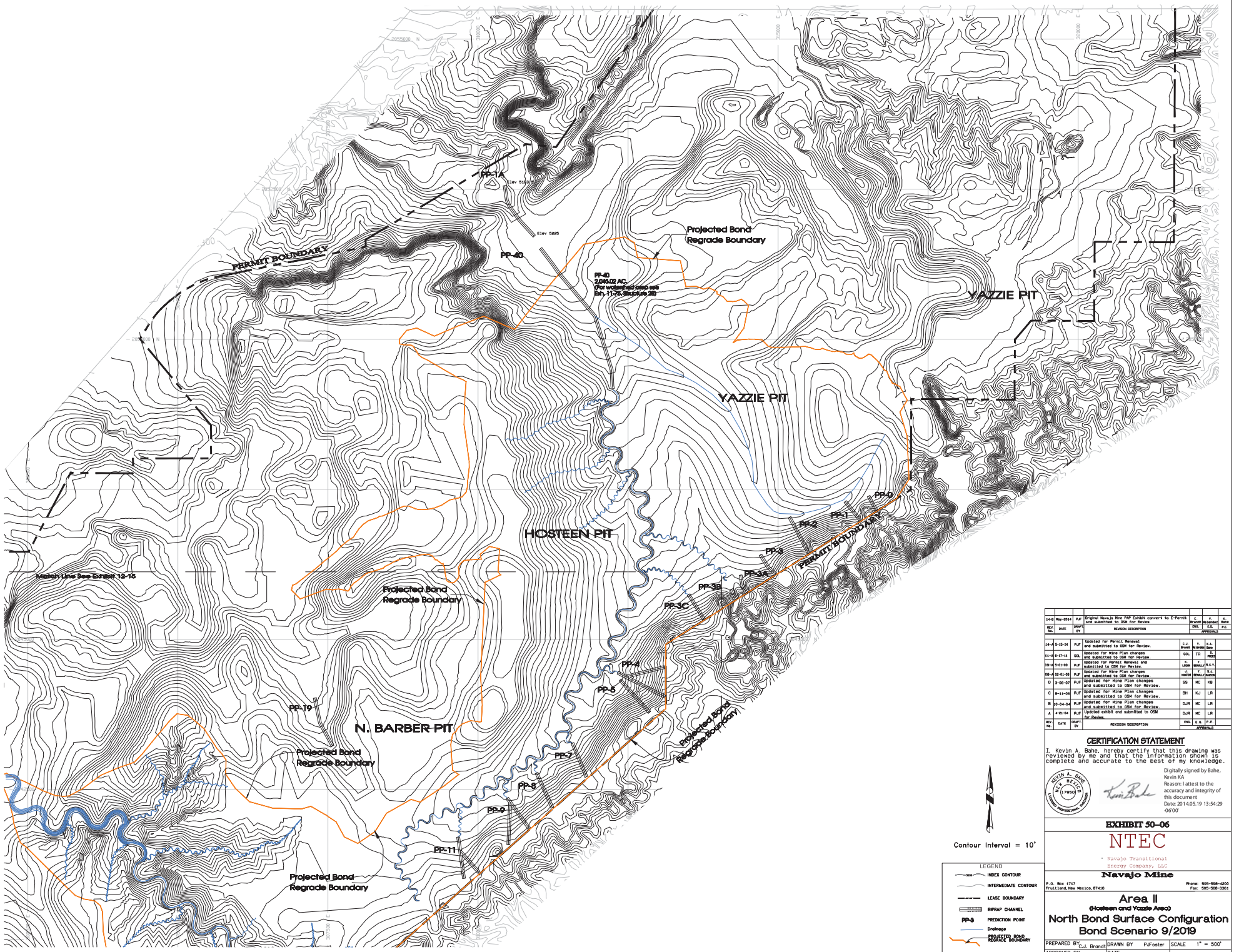
Navajo Transitional
Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-6500
Fax: 505-598-3361

Area 1
Post Mining Configurtion
Bond Scenario 9/2019

PREPARED BY CJB	DRAWN BY CJB	SCALE 1" = 500'
APPROVED BY AMR	DATE 04-29-2014	



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.F.
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	V. Valenzuela	K. Bahe
				APPROVALS		

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.F.
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	V. Valenzuela	K.A. Bahe
11-A	6-17-11	SGL	Updated for Mine Plan changes and submitted to OSM for Review.	SGL	TR	S. MOON
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	K. LOBB	V. SENALLY	R.C.V.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	J. NACON	V. SENALLY	D.J. NABEN
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	NC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	NC	LR
A	4-21-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	NC	LR
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.F.
				APPROVALS		

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO (7850) LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:54:29 -06'00'

EXHIBIT 50-06

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

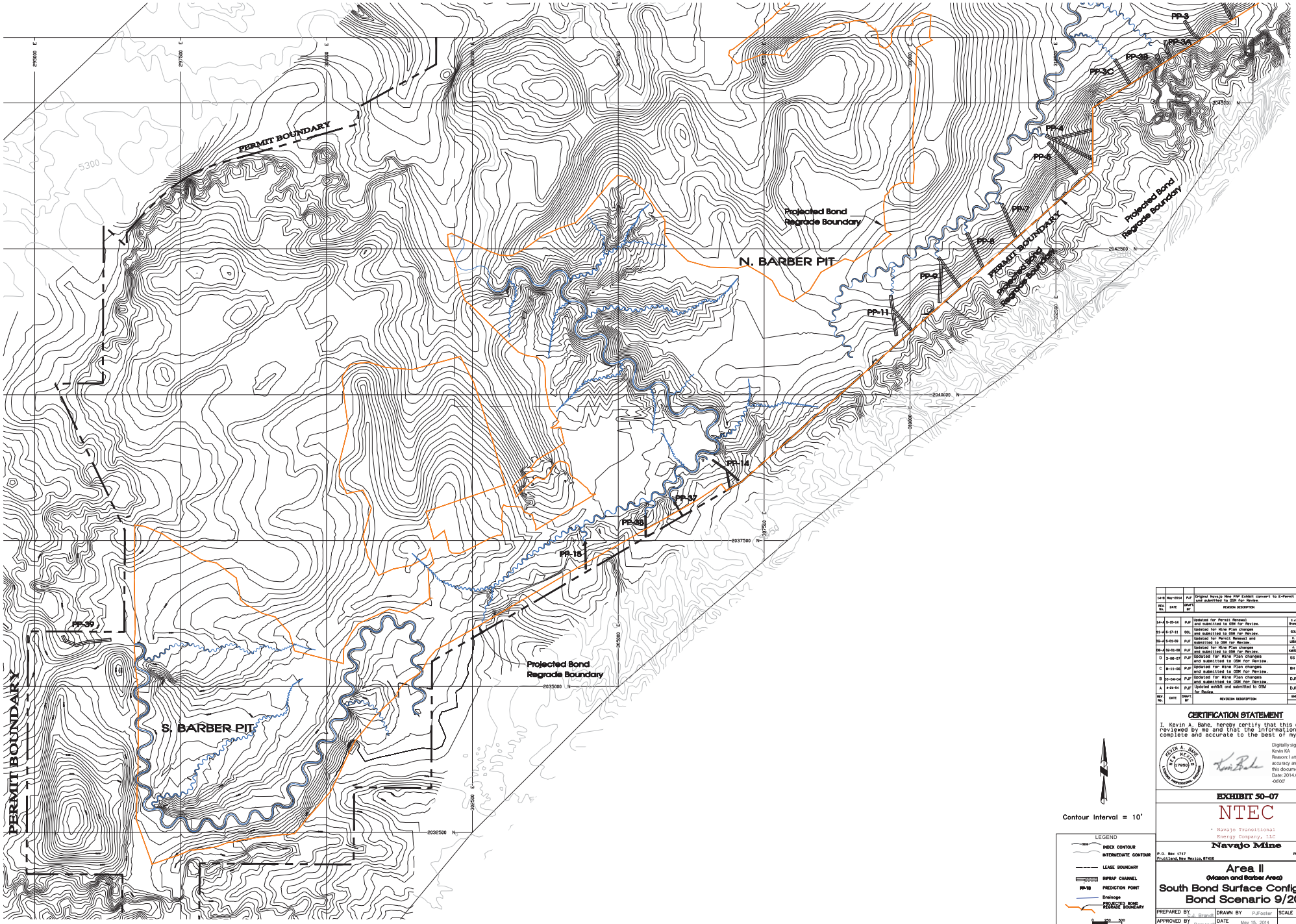
Phone: 505-598-4200
Fax: 505-568-3361

Area II

(Hosteen and Yazzie Area)

North Bond Surface Configuration Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY	PJFoster	SCALE	1" = 500'
APPROVED BY	A. Ramonell	DATE	May 15, 2014		



REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	P.G.	P.E.
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	V. Rojanasakul	K. Bahe

APPROVALS

REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	P.G.	P.E.
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	V. Rojanasakul	K.A. Bahe
11-A	6-17-11	DGL	Updated for Mine Plan changes and submitted to OSM for Review.	DGL	TR	S. PRESS
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	L. LEGAN	T. McNALLY	R.I.Y.
08-A	02-11-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	A. KANTOR	T. McNALLY	E.J. PARSON
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	02-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-23-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR

APPROVALS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE STATE OF NEW MEXICO (7950) REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:55:23 -06'00'

EXHIBIT 50-07

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-568-3361

Area II

(Mason and Barber Area)

South Bond Surface Configuration Bond Scenario 9/2019

PREPARED BY	C. Brandt	DRAWN BY	PJFoster
APPROVED BY	K. Romanek	DATE	May 15, 2014
SCALE	1" = 500'		

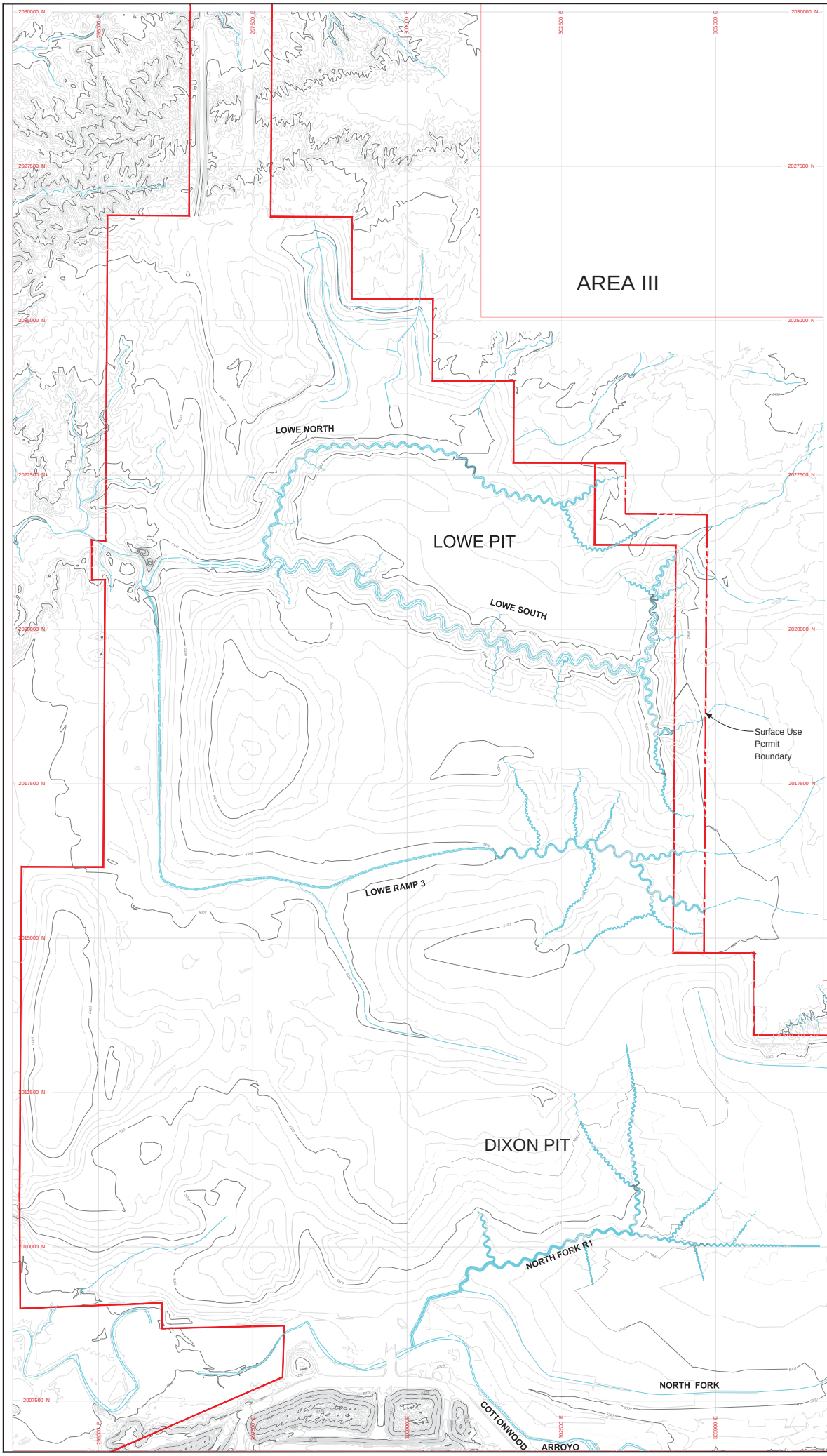


EXHIBIT 50-08

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland,New Mexico,87416

Phone: 505-598-4200
Fax: 505-598-2363

Area III (Lowe/Dixon Area)
Bond Surface Configuration
Bond Scenario 9/2019

PREPARED BY	RCV	DRAWN BY RCV	SCALE: 1" = 500'
APPROVED BY	AR	DATE 4/15/2014	

CERTIFICATION STATEMENT

I, Ron C. Van Valkenburg, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

RON C. VAN VALKENBURG
NEW MEXICO
12141
PROFESSIONAL ENGINEER

Digitally signed by Ron Van Valkenburg
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.16 17:05:42 -06'00'

14-R	5-16-14	RCV	Revised Entire Set for Permit Revisions	CM	YA	RCV
13-R	4-15-14	RCV	Updated w/Mod and submitted DXM for Review	CM	YA	RCV
12-R	4-07-14	CCL	Updated w/Mod and submitted DXM for Review	RCV	YA	RCV
11-R	1-10-08	PJP	REVISED BR EXISTING UP LINE FIT AND CLEARED TO CONFORM REVIEW	PJP	YA	MAR
10-R	10-10-06	PJP	Updated for Permit Renewal and submitted to DXM for Review	PJP	YA	RCV
9-R	05-05-06	PJP	Updated w/Mod and submitted DXM for Review	MAR	YA	RCV
8	2-23-05	PJP	Updated w/Mod and submitted DXM for Review	PJP	MR	JR
Rev	Mod#	Mod Ref	Revision Description	Drawn By	Chk'd By	Appr'd By

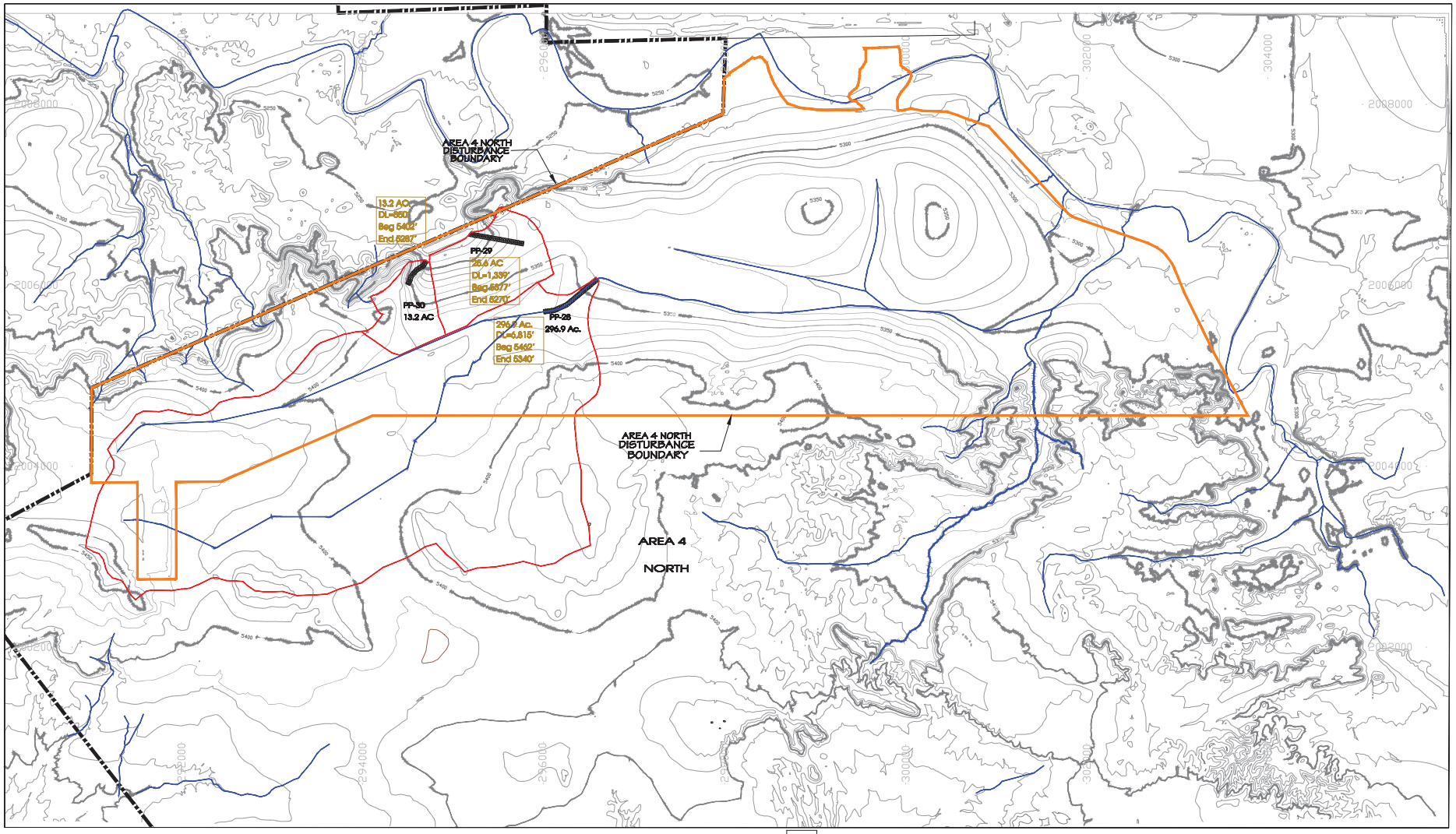
LEGEND

INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE/PERMIT BOUNDARY
DRAINAGE

0 500 1000 1500

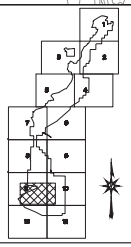
CONTOUR INTERVAL: 10'

NOTES:



LOCATION MAP

SCALE: 1" = 500'



LEGEND

- 5300 — INDEX CONTOUR (50 Ft)
- INTERMEDIATE CONTOUR (10 Ft)
- LEASE BOUNDARY
- RIP-RAP CHANNEL
- PP-3 — PREDICTION POINT
- WATERSHED BOUNDARIES
- DRAINAGE PATTERNS
- SURFACE DISTURBANCE BOUNDARY

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — LICENSED PROFESSIONAL ENGINEER

Kevin Bahe

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:56:43 -06'00'

REVISION		DATE
Submitted to DOE for Review	1	Oct 17, 2004
Updated for Permit Renewal and Submitted	2	Mar 15, 2009
Updated for Permit Revision and Submitted	3	April 24, 2012
Updated for Permit Renewal and Submitted	14-A	5-15-14
Original Design Map of Area 4 North converted to a Current Topographic Map in Feet	14-B	May-2014

PROJECT: A4N Permitting
DATE:
DESIGNED BY: C.J. Brandt
DRAWN BY: P.J.Foster
CHECKED BY: C.J. Brandt
APPROVED BY: A. Ramonell

PROJECT MANAGER: A. Ramonell
ENGR. of RECORD: Kevin A. Bahe
REG. NO 06-17850
STATE of RECORD:
REG. NO.

NTEC
Navajo Transitional Energy Company, LLC

NAVAJO MINE

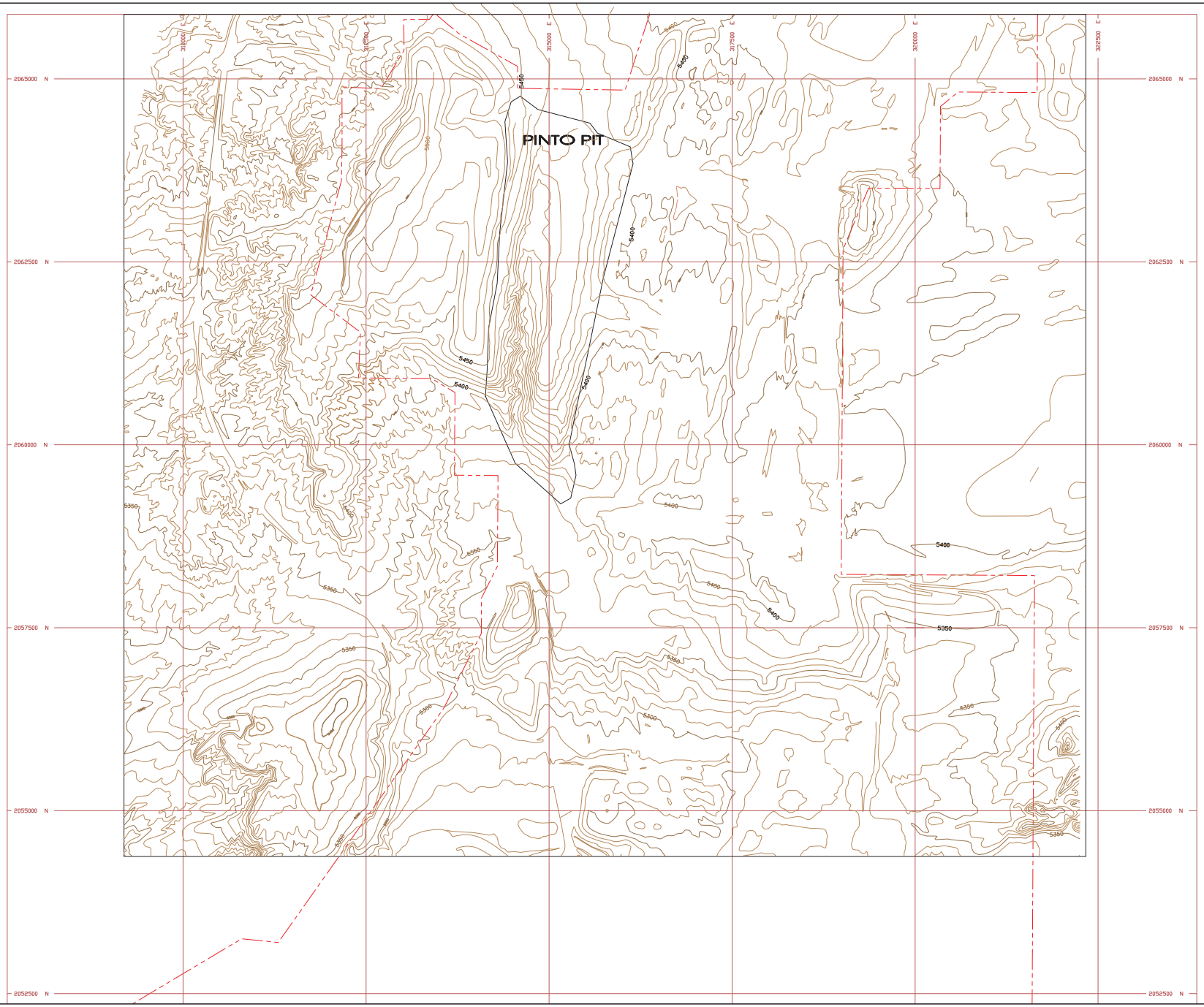
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3561

LOCATION MAP

EXHIBIT 50-09 AREA-4N
BOND SURFACE CONFIGURATION AND DROP STRUCTURE W/WATERSHED BOUNDARY
BOND SCENARIO 9/2019

DRAWING

SHEET 1 OF 1



LEGEND

N

0 250 500
SCALE IN FEET

5300 INDEX CONTOUR

INTERMEDIATE CONTOUR

LEASE BOUNDARY

REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	K.A.	P.E.
				APPROVALS		
6-0	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	JJ	KA	JL Kim
5-4	4-21-14	CJB	Updated Mine Plan changes and submitted to OSM for Review.	JJ	KA	KAB
5-3	8-12-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	JJ	KA	KAB
5	1-11-07	PJF	Updated to reflect PCI CO. OWNERSHIP CHANGE and SUBMITTED to OSM FOR REVIEW AND APPROVAL.	LR	KJ	LR
4	9-29-06	PJF	Updated Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
3	4-21-04	PJF	Updated exhibit and submitted to OSM for review	DJR	BC	LR

CERTIFICATION STATEMENT

I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:57:42 -06'00'

EXHIBIT 50-10

NTEC

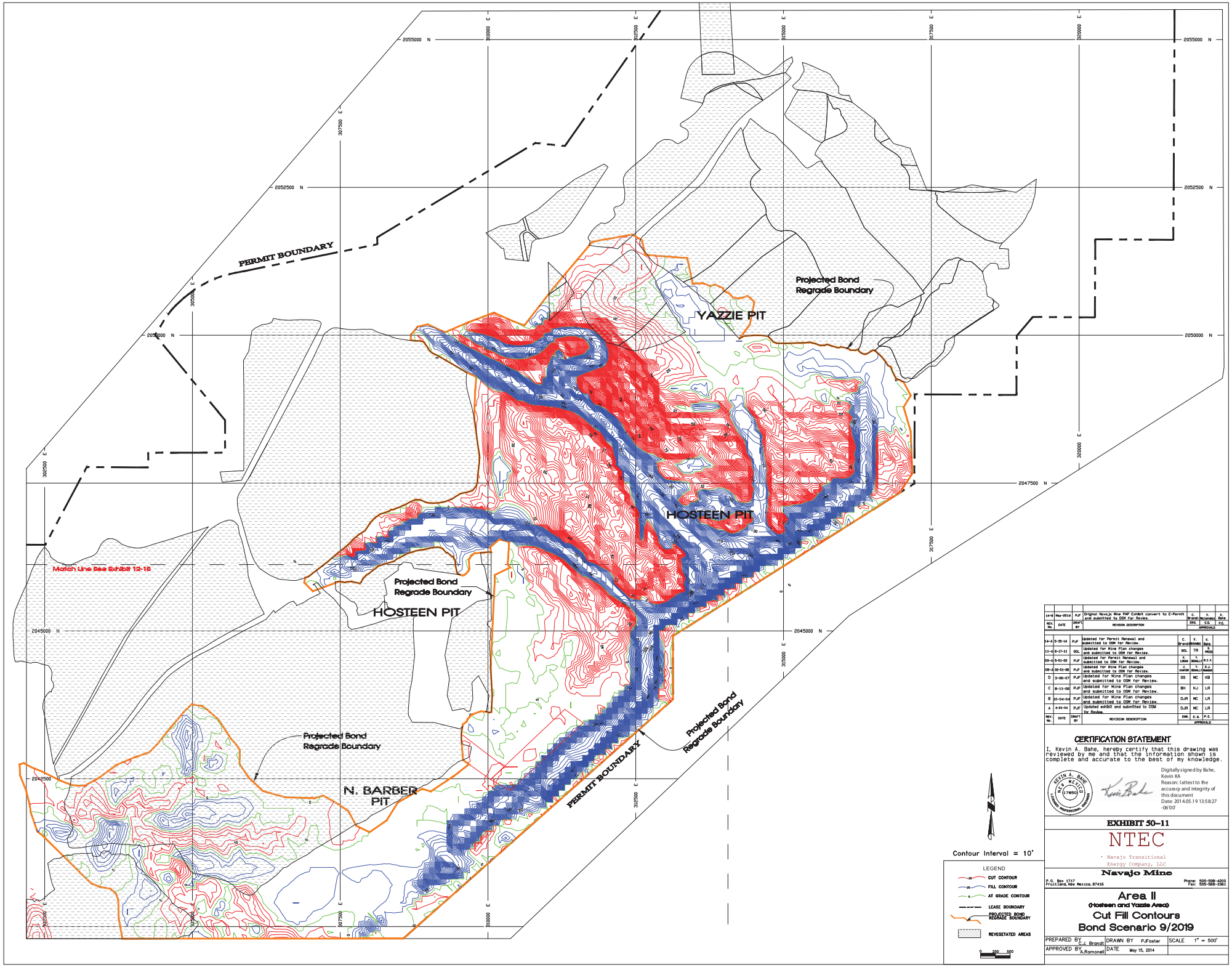
Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

Area 1
Bond Surface Configuration
Bond Scenario 9/2019

PREPARED BY CJB	DRAWN BY CJB	SCALE 1"= 500'
APPROVED BY AMR	DATE 04-29-2014	



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	C.O.	V.P.	K.A.
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	Ramonell	Bahe	

APPROVALS

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	C.O.	V.P.	K.A.
14-A	5-05-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C. Brandt	RAMONELL	K. Bahe	
11-A	6-17-11	GGL	Updated for Mine Plan changes and submitted to OSM for Review.	GGL	TR	S. PRESS	
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	R. LUNAN	RONALLY	R.C.V.	
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	HANTON	RONALLY	R.A. RAMONE	
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB	
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR	
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR	
A	4-23-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR	
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.	

APPROVALS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:58:27 -06'00'

EXHIBIT 50-11

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

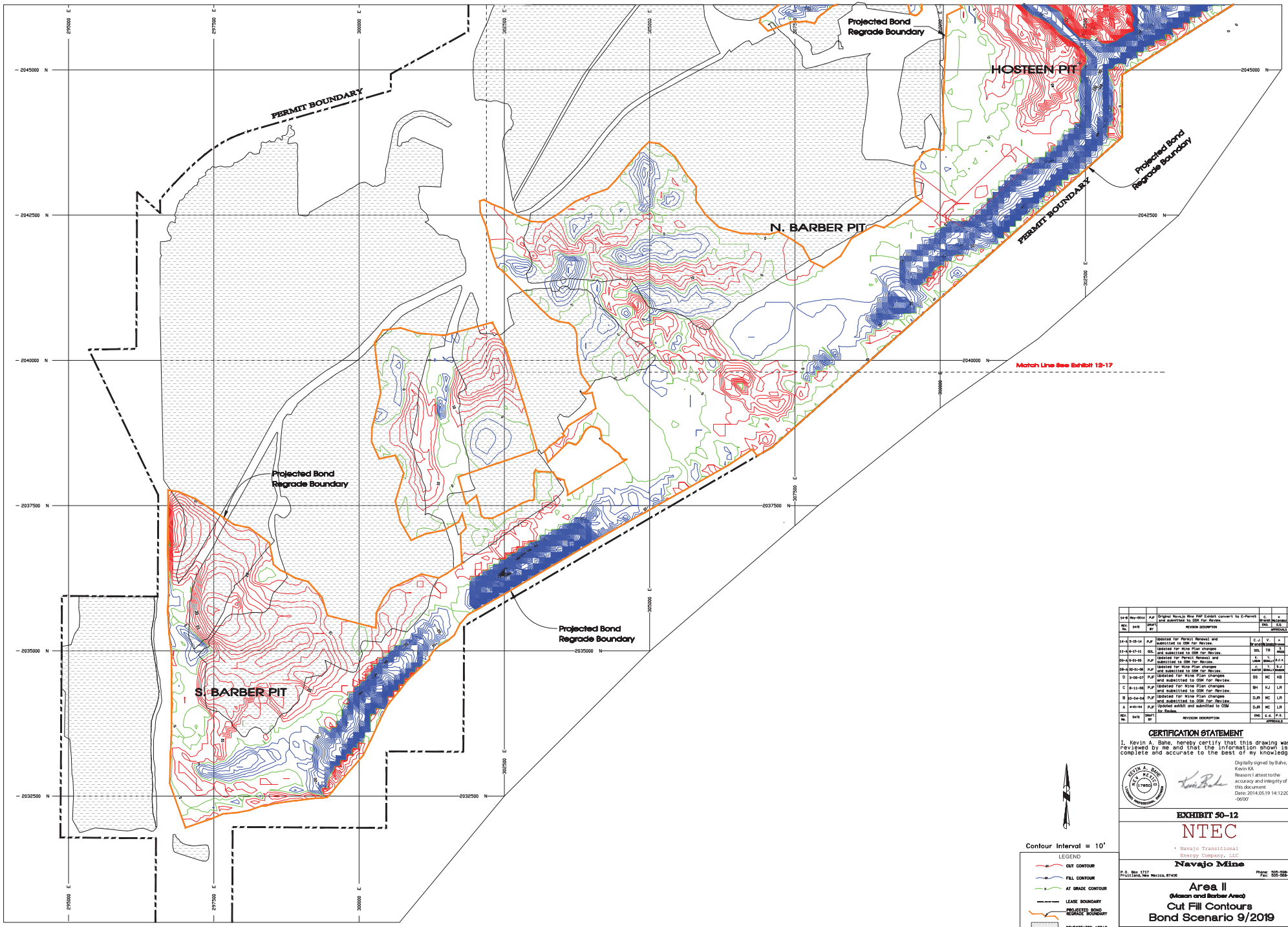
Phone: 505-598-4200
Fax: 505-598-3561

Area II

(Hosteen and Yazzie Area)

Cut Fill Contours
Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY PJFoster	SCALE 1" = 500'
APPROVED BY	A.Ramonell	DATE May 15, 2014	



REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
14-0	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	Y. Melendez	K. Bahe
REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
				APPROVALS		
14-A	9-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C. J. Brandt	Y. Melendez	A. Erickson
11-A	6-17-11	GDL	Updated for Mine Plan changes and submitted to OSM for Review.	GDL	TR	K. Bahe
09-A	9-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	L. LOAN	Y. MONALLY	K.C.Y.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	L. AARON	Y. MONALLY	D.J. PARKER
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-01-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:12:20 -06'00'

EXHIBIT 50-12

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4503
Fax: 505-598-3261

Area II

(Mason and Barber Area)

Cut Fill Contours
Bond Scenario 9/2019

PREPARED BY C.J.Brandt	DRAWN BY PJFoster	SCALE 1" = 500'	
APPROVED BY A.Erickson	DATE May 15, 2014		

Contour Interval = 10'

LEGEND

- CUT CONTOUR
- FILL CONTOUR
- AT GRADE CONTOUR
- LEASE BOUNDARY
- PROJECTED BOND REGRADE BOUNDARY
- REVEGETATED AREAS

0 250 500
SCALE IN FEET

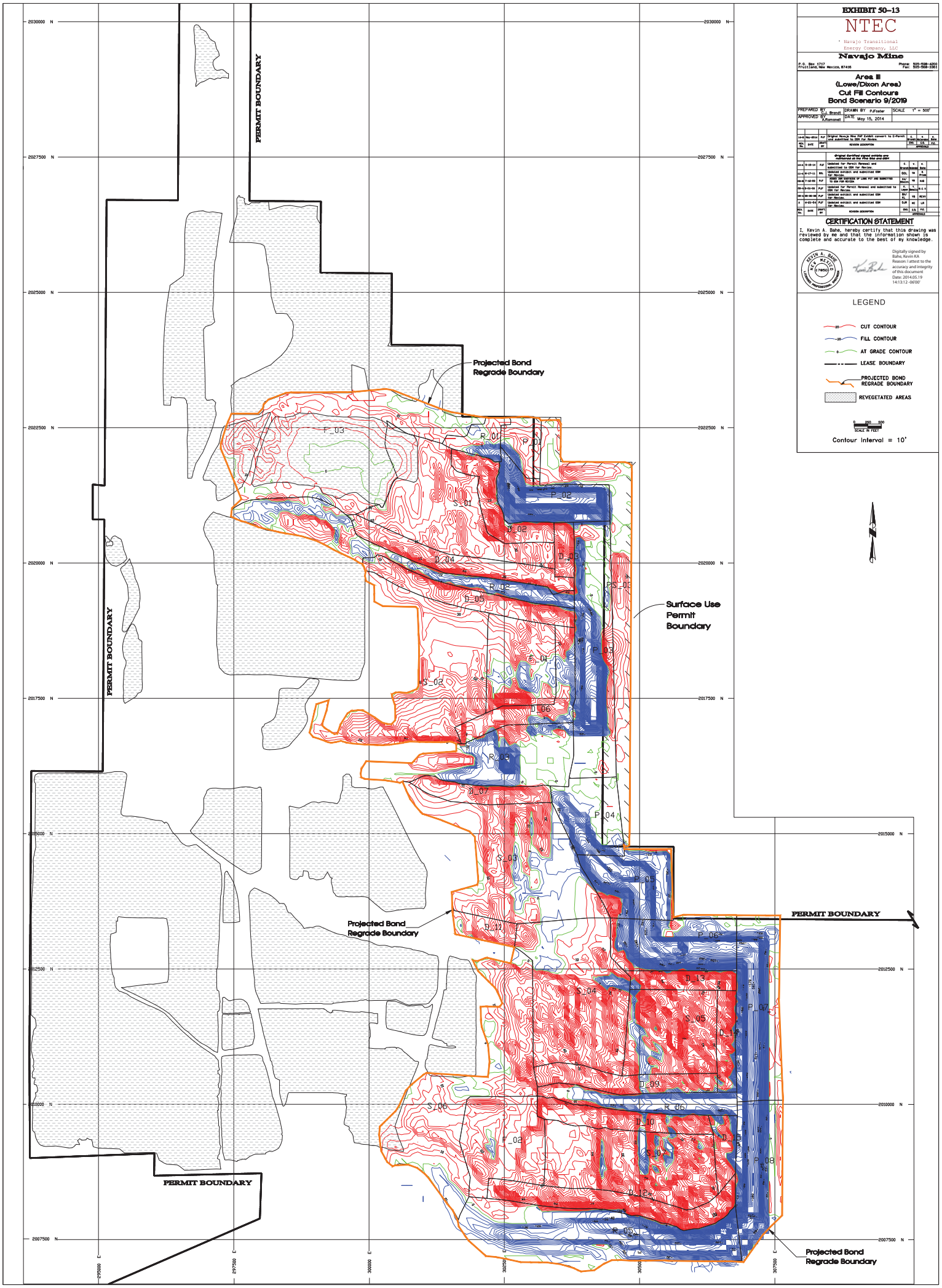


EXHIBIT 50-13
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4000
Fax: 505-598-3361
Area III
(Lowe/Dixon Area)
Cut Fill Contours
Bond Scenario 9/2019
PREPARED BY C.J. Brandt
DRAWN BY P.J.Foster
SCALE 1" = 500'
APPROVED BY K.Rumonel
DATE May 15, 2014
REV. NO. DATE DRAFT BY REVISION DESCRIPTION CHK. APPROVALS
Original Certified signed exhibits are maintained at the Mine Site and ADEM.
CERTIFICATION STATEMENT
I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:13:12 -06'00'
LEGEND
CUT CONTOUR
FILL CONTOUR
AT GRADE CONTOUR
LEASE BOUNDARY
PROJECTED BOND REGRADE BOUNDARY
REVEGETATED AREAS
SCALE IN FEET
Contour Interval = 10'
PERMIT BOUNDARY
Projected Bond Regrade Boundary
Surface Use Permit Boundary
2030000 N
2027500 N
2025000 N
2022500 N
2020000 N
2017500 N
2015000 N
2012500 N
2010000 N
2007500 N
295000 E
297500 E
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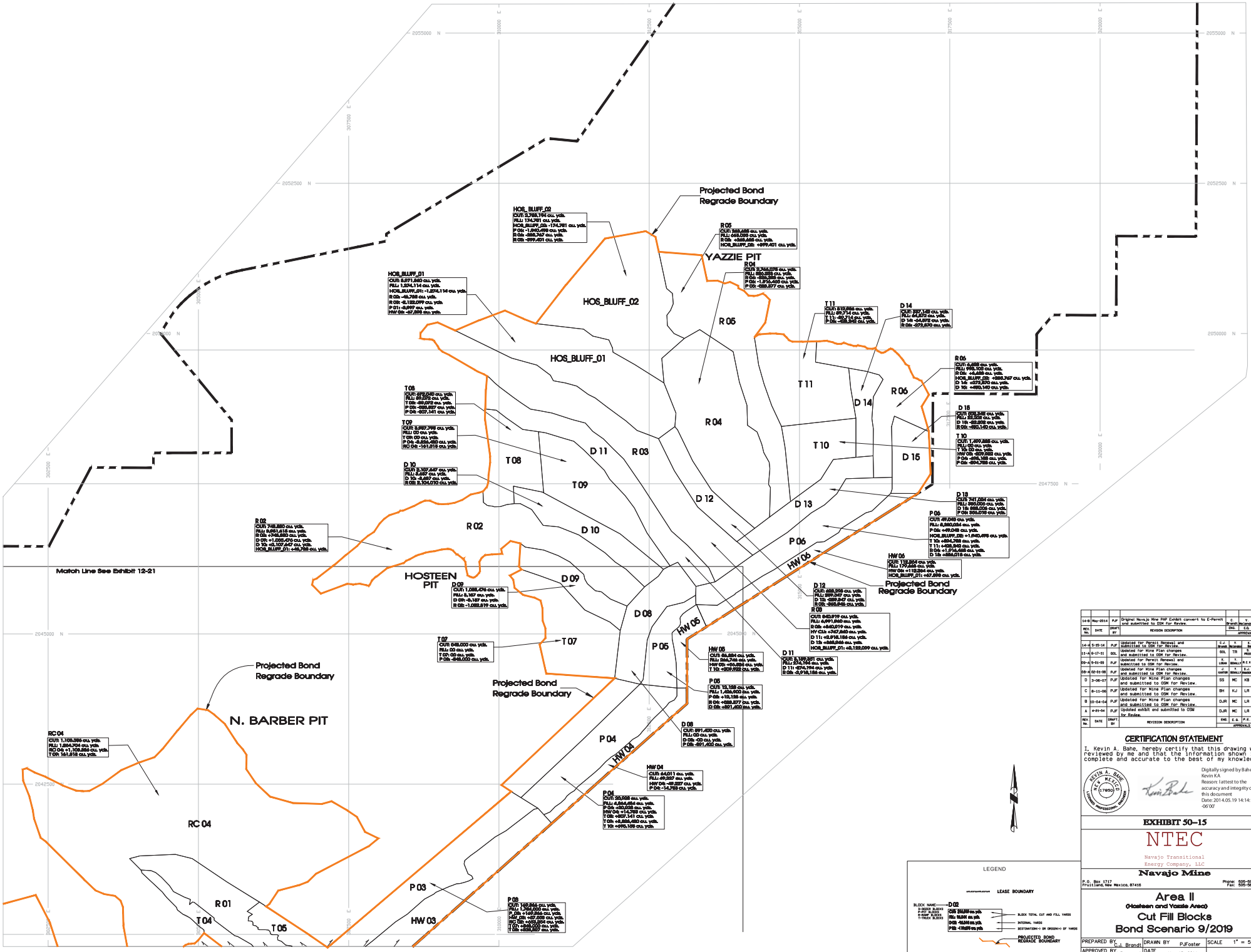
302500 E
305000 E
307500 E



REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
14-G	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C.J. Brandt	Y. Melendez	K. Bahe

APPROVALS

REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
14-H	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	Y. Melendez	K.A. Bahe
11-H	6-17-11	GGL	Updated for Mine Plan changes and submitted to OSM for Review.	GGL	TR	PEER
09-H	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	Y. LOBAN	Y. BENALLY	R.C.A.
08-H	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	J. SANTON	Y. BENALLY	E.C. PARSON
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-01-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR

APPROVALS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin K.A.
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:14:13 -06'00'

EXHIBIT 50-15

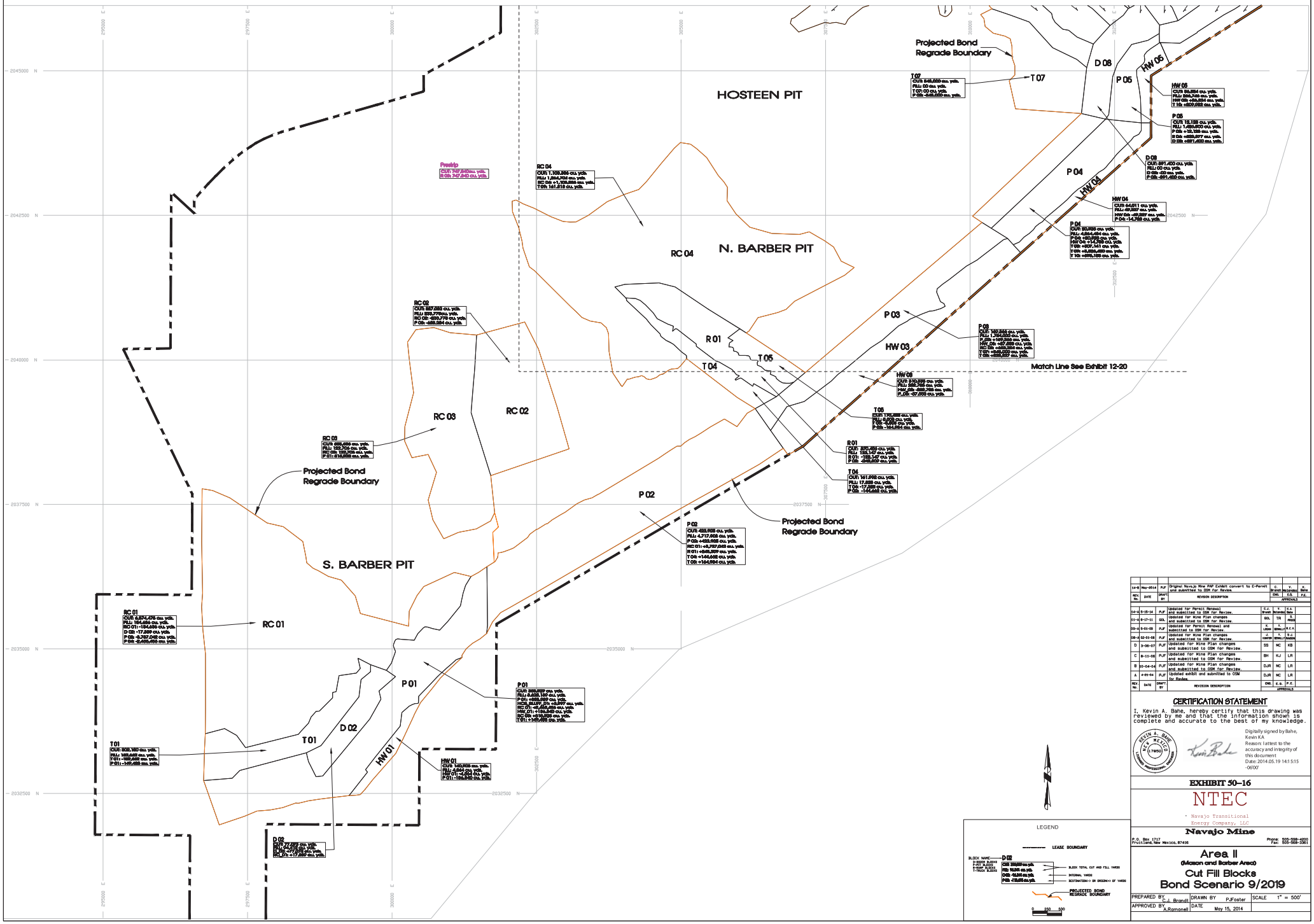
NTEC
Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

Area II
(Hosteen and Yazzie Area)
Cut Fill Blocks
Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY	PJFoster	SCALE	1" = 500'
APPROVED BY	A.Romanelli	DATE	May 15, 2014		



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	E.C. ENGL	Y. REVIEWED	K. Bahe P.E.
				APPROVALS		
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to ODM for Review.			
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to ODM for Review.	C.J. Brandt	Y. Rodriguez	K.A. Bahe
11-A	8-17-11	SDL	Updated for Mine Plan changes and submitted to ODM for Review.	SDL	TR	S. PEDRO
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to ODM for Review.	K. LEGE	L. SENILLY	R.C.K.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to ODM for Review.	J. YAZZIE	L. SENILLY	D.C. RANDALL
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to ODM for Review.	SS	MC	KB
C	8-15-06	PJF	Updated for Mine Plan changes and submitted to ODM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to ODM for Review.	DJR	MC	LR
A	4-01-04	PJF	Updated exhibit and submitted to ODM for Review.	DJR	MC	LR
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG	E.A.	P.E.
				APPROVALS		

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — Licensed Professional Engineer

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:15:15 -06'00'

EXHIBIT 50–16

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4203
Fax: 505-598-3361

Area II

(Mason and Barber Area)

Cut Fill Blocks
Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY	PJFoster
SCALE	1" = 500'		
APPROVED BY	A.Ramonell	DATE	May 15, 2014

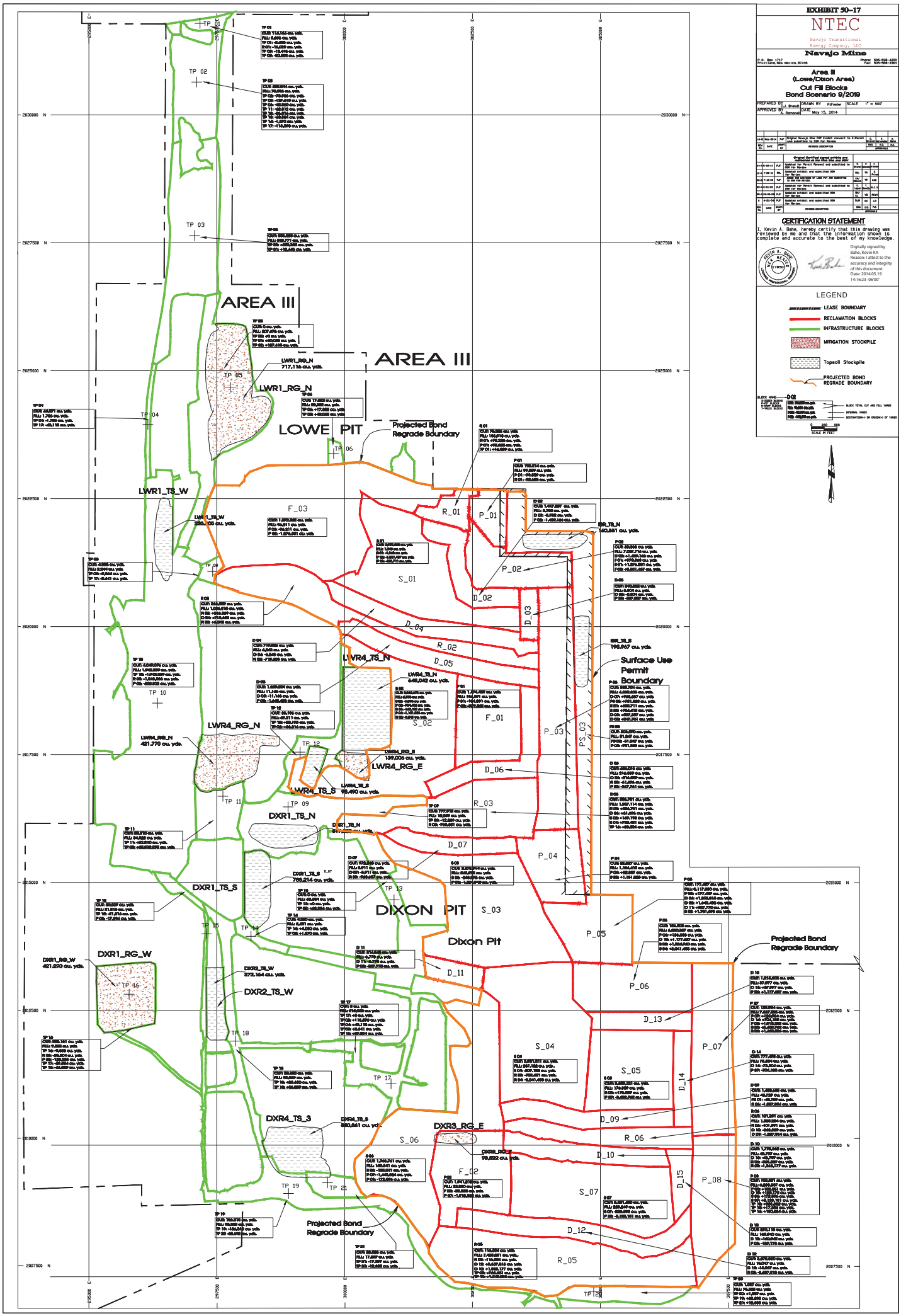


EXHIBIT 50-17
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4825
Fax: 505-598-3912
Area II
(Lowe/Dixon Area)
Cut Fill Blocks
Bond Scenario 9/2019
PREPARED BY: A. Brand
DRAWN BY: P.J.Foster
SCALE: 1" = 500'
APPROVED BY: A. Ramonal
DATE: May 15, 2014
CERTIFICATION STATEMENT
I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:16:23 -06'00'
LEGEND
LEASE BOUNDARY
RECLAMATION BLOCKS
INFRASTRUCTURE BLOCKS
MITIGATION STOCKPILE
Topsoil Stockpile
PROJECTED BOND REGRADE BOUNDARY
SCALE IN FEET
AREA III
AREA III
LOWE PIT
DIXON PIT
Dixon Pit
Projected Bond Regrade Boundary
Projected Bond Regrade Boundary
Projected Bond Regrade Boundary
Surface Use Permit Boundary
LWR1_RG_N
717,116 cu. yds.
LWR1_TS_W
LWR4_TS_N
LWR4_RG_N
LWR4_TS_S
LWR4_RG_E
DXR1_TS_N
DXR1_TS_S
DXR1_RG_W
DXR2_TS_W
DXR4_TS_3
DXR3_RG_E
F_03
S_01
S_02
F_01
S_03
S_04
S_05
S_06
S_07
F_02
R_01
P_01
P_02
D_02
D_03
D_04
R_02
D_05
P_03
PS_03
D_06
R_03
D_07
P_04
P_05
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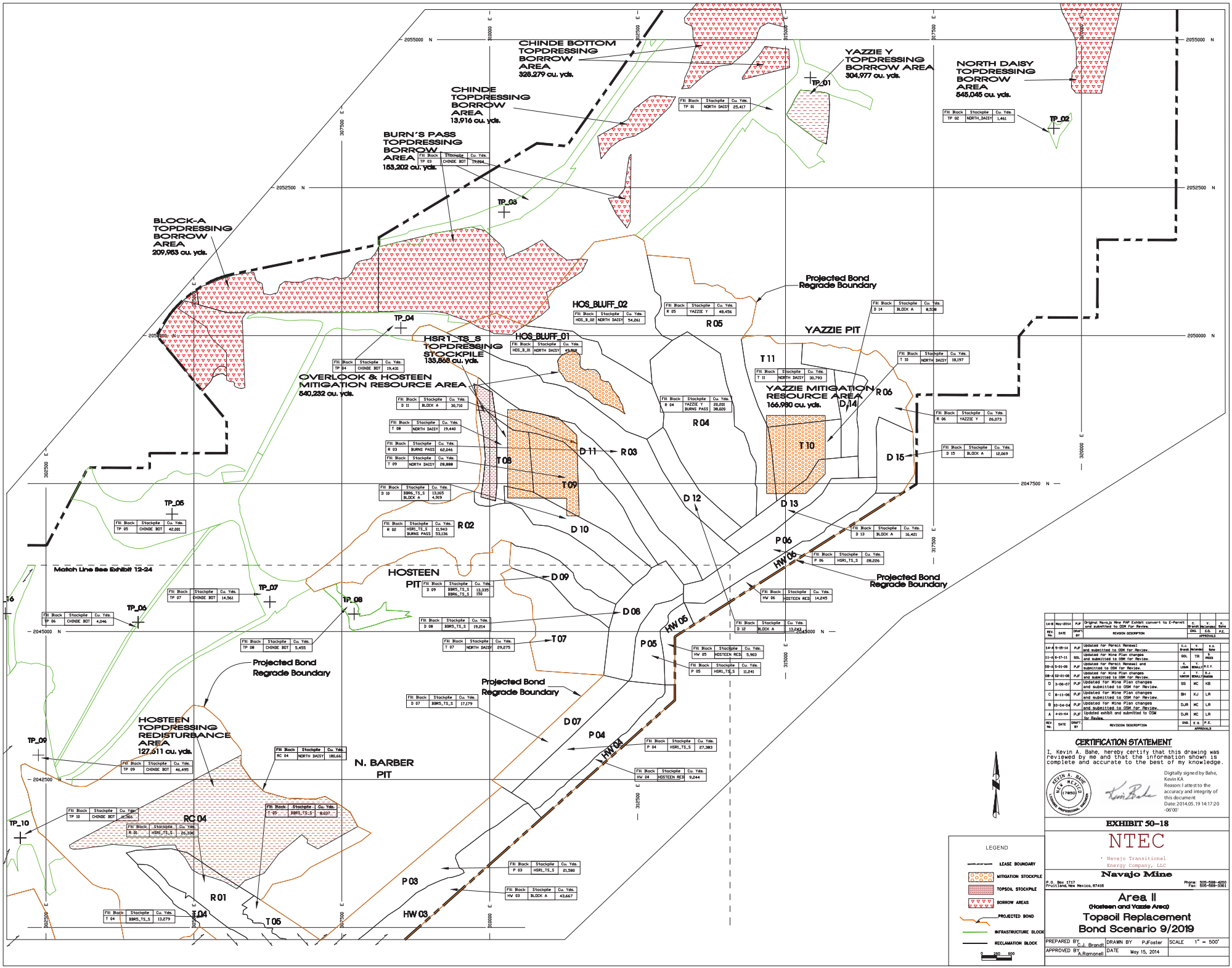
D_15
P_08
D_12
R_05



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	CHK.	G.S.	P.E.
				APPROVALS		
14-0	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	Y. Reinder	K.A. Bahe
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	Y. Reinder	K.A. Bahe
11-A	6-17-11	GGL	Updated for Mine Plan changes and submitted to OSM for Review.	GGL	TR	S. MCCO
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	A. LUGAN	T. BENALLY	R.C.Y.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	J. KANTOR	T. BENALLY	R.J. BARGEN
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-01-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR
REV No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
				APPROVALS		

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 REGISTERED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:17:20 -06'00'

EXHIBIT 50-18

NTEC

Navajo Transitional Energy Company, LLC

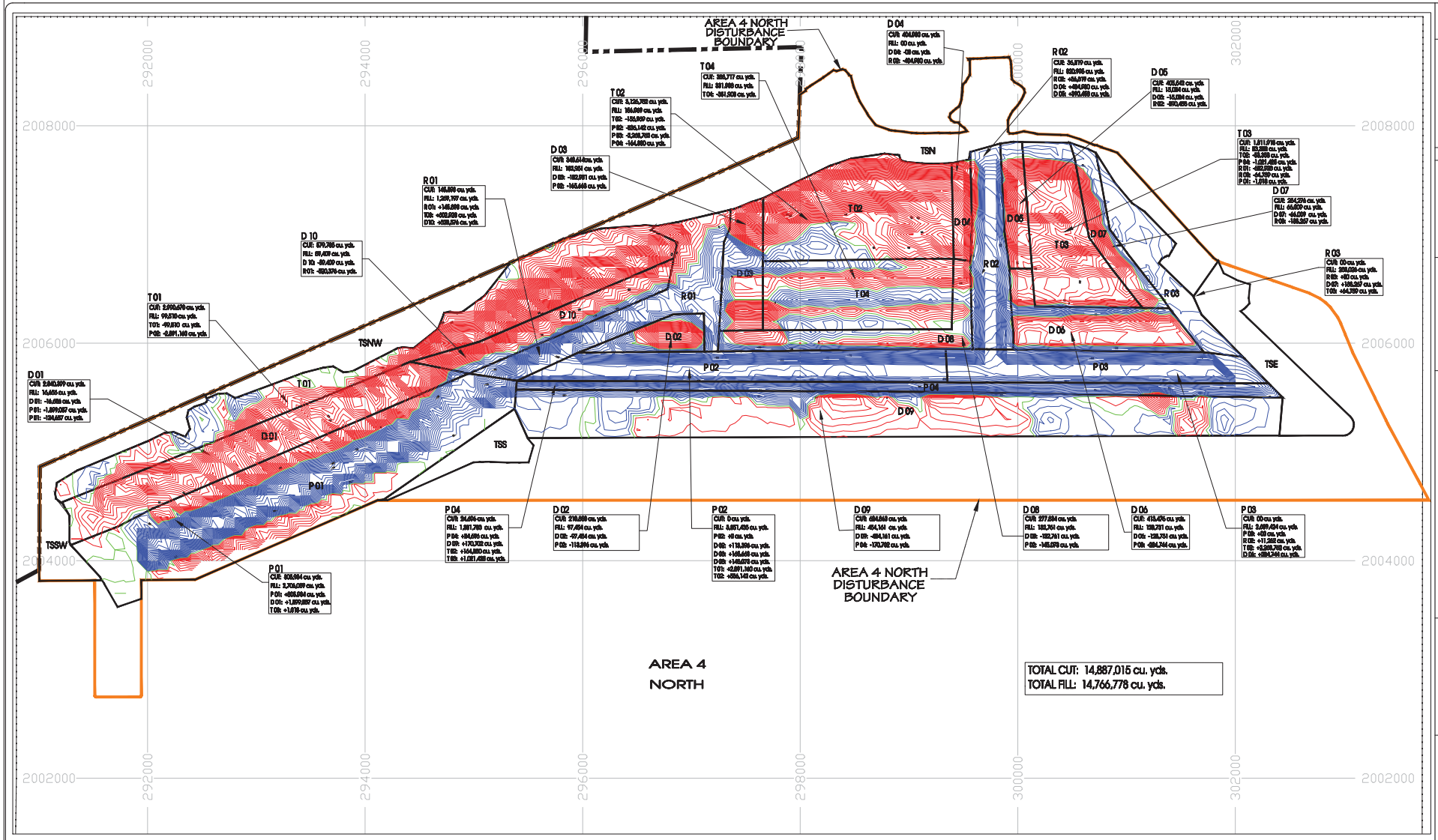
Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4000
Fax: 505-598-3861

Area II
(Hosteen and Yazzie Area)
Topsoil Replacement Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY PJFoster	SCALE 1" = 500'
APPROVED BY	A.Ramonell	DATE May 15, 2014	



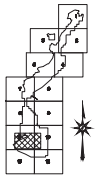
BLOCK NAME → D 02

D-DOZER BLOCKS
P-PIT BLOCKS
R-RAMP BLOCKS
T-TRUCK BLOCKS

CUT: 216,019 cu. yds.	BLOCK TOTAL CUT AND FILL YARDS
FILL: 96,344 cu. yds.	
D 02: -96,344 cu. yds.	INTERNAL YARDS
P 02: -119,675 cu. yds.	DESTINATION(-) OR ORIGIN(+) OF YARDS

LOCATION MAP

SCALE: 1"=400'



LEGEND

- CUT CONTOUR
- FILL CONTOUR
- GRADE CONTOUR
- LEASE BOUNDARY
- SURFACE DISTURBANCE BOUNDARY

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:18:11 -06'00'

REVISION	DATE
1 Submitted to MM for Review.	Oct. 15, 2004
2 Updated for Permit Renewal and submitted to MMD for Review.	Mar. 31, 2009
3 Updated for Permit Revision and submitted to MMD for Review.	April 23, 2012
(4-4) Updated for Permit Renewal and Revision.	Mar. 28, 2014
(4-5) Original Mylar Map Plot Plans converted to E-Plans for Electronic Filing.	May - 2014

PROJECT: AM Permitting
DATE:
DESIGNED BY: C.J. Brandt
DRAWN BY: PJ Foster
CHECKED BY: C.J. Brandt
APPROVED BY: K.A. Bahe

PROJECT MANAGER: A. Rosenvall

NTEC
Navajo Transitional Energy Company, LLC

NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3261

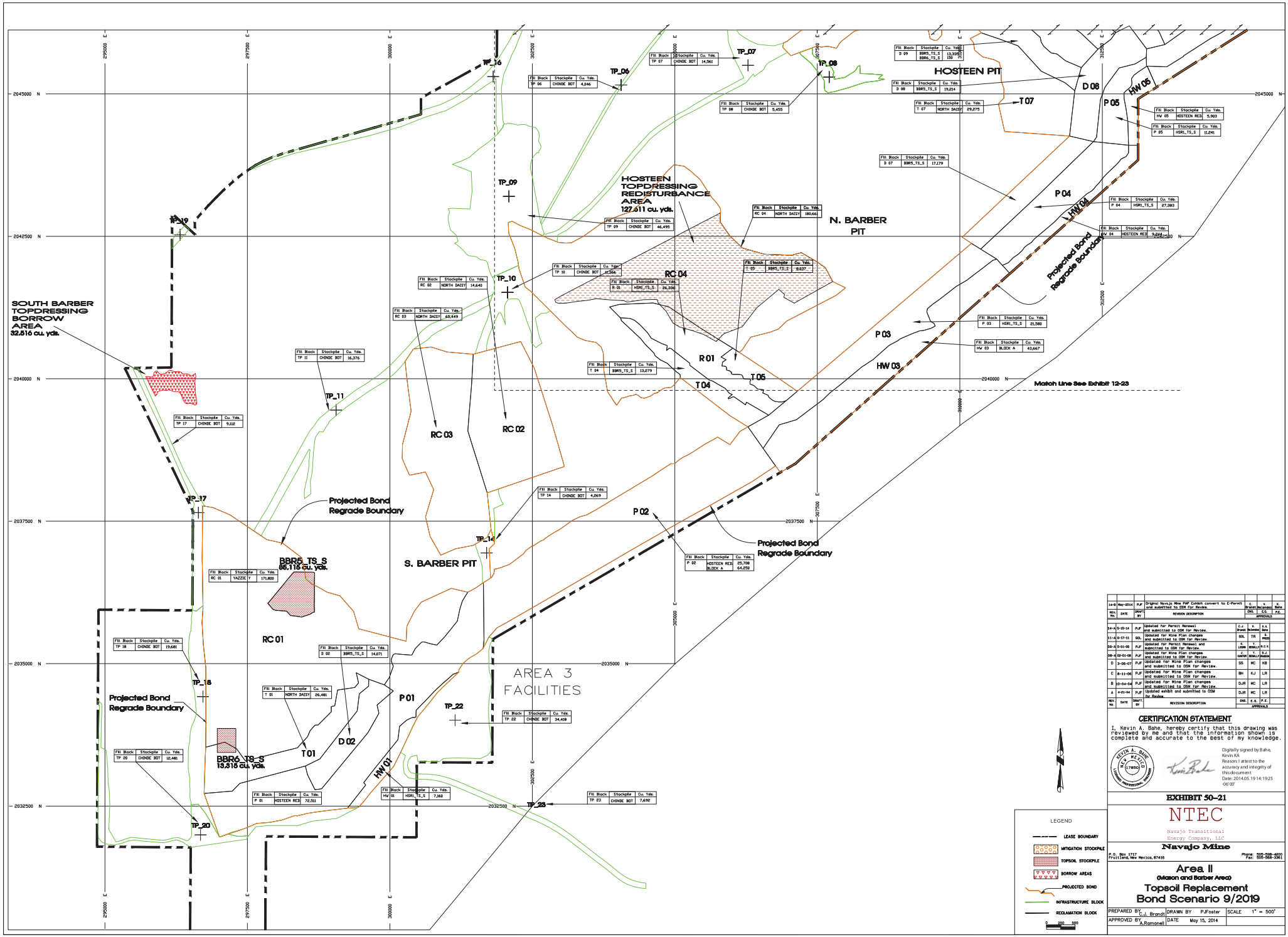
LOCATION MAP

EXHIBIT 50-19 AREA-4N

CUT/FILL CONTOURS AND BLOCKS
BOND SCENARIO 9/2019

DRAWING

SHEET 1 OF 1



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	DWG.	Ch.	E
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Brandt	Y. Reynosa	K. Bahe
				APPROVALS		
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	K. Schmoe	K.A. Bahe
11-A	8-17-11	SGL	Updated for Mine Plan changes and submitted to OSM for Review.	SGL	TR	E. PAYNE
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	K. LOGAN	Y. REYNOLDS	R.C.Y.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	J. SAWYER	Y. REYNOLDS	R.J. /PARSON
D	3-05-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-01-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR
REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	DWG	K.B.	P.C.
				APPROVALS		

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:19:25 -06'00'

EXHIBIT 50-21

NTEC
Navajo Transitional Energy Company, LLC

Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-6200
Fax: 505-598-3361

Area II
(Mason and Barber Area)
Topsoil Replacement
Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY PJFoster	SCALE 1" = 500'
APPROVED BY	A.Ramonell	DATE May 15, 2014	

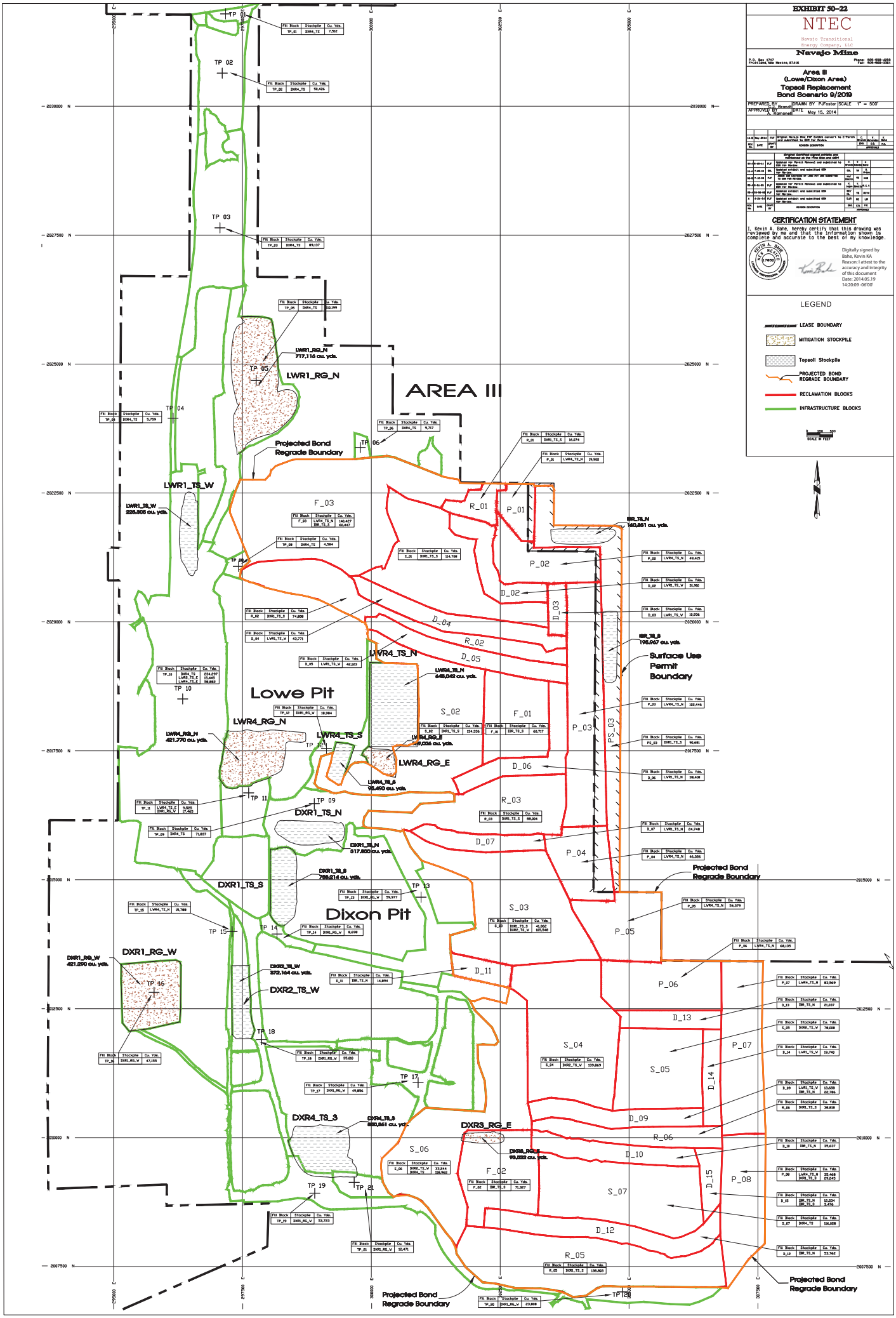


EXHIBIT 50-22
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4505
Fax: 505-598-3321
Area III
(Lowe/Dixon Area)
Topsoil Replacement
Bond Scenario 9/2019
PREPARED BY: A. Brandt
APPROVED BY: A. Ramonell
DRAWN BY: PJFoster
SCALE: 1" = 500'
DATE: May 15, 2014
CERTIFICATION STATEMENT
I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:20:09 -06'00'
LEGEND
LEASE BOUNDARY
MITIGATION STOCKPILE
Topsoil Stockpile
PROJECTED BOND REGRADE BOUNDARY
RECLAMATION BLOCKS
INFRASTRUCTURE BLOCKS
SCALE IN FEET
AREA III
Lowe Pit
Dixon Pit
LWR1_RG_N
717,116 cu. yds.
LWR1_TS_W
228,906 cu. yds.
Projected Bond Regrade Boundary
LWR4_RG_N
421,770 cu. yds.
LWR4_TS_N
LWR4_TS_S
LWR4_RG_E
LWR4_TS_E
DXR1_TS_N
317,800 cu. yds.
DXR1_TS_S
DXR1_RG_W
421,290 cu. yds.
DXR2_TS_W
DXR4_TS_3
DXR3_RG_E
Surface Use Permit Boundary
F_03
R_01
P_01
P_02
D_02
D_03
D_04
R_02
D_05
S_02
F_01
P_03
PS_03
D_06
R_03
D_07
P_04
S_03
P_05
D_11
P_06
D_13
P_07
S_04
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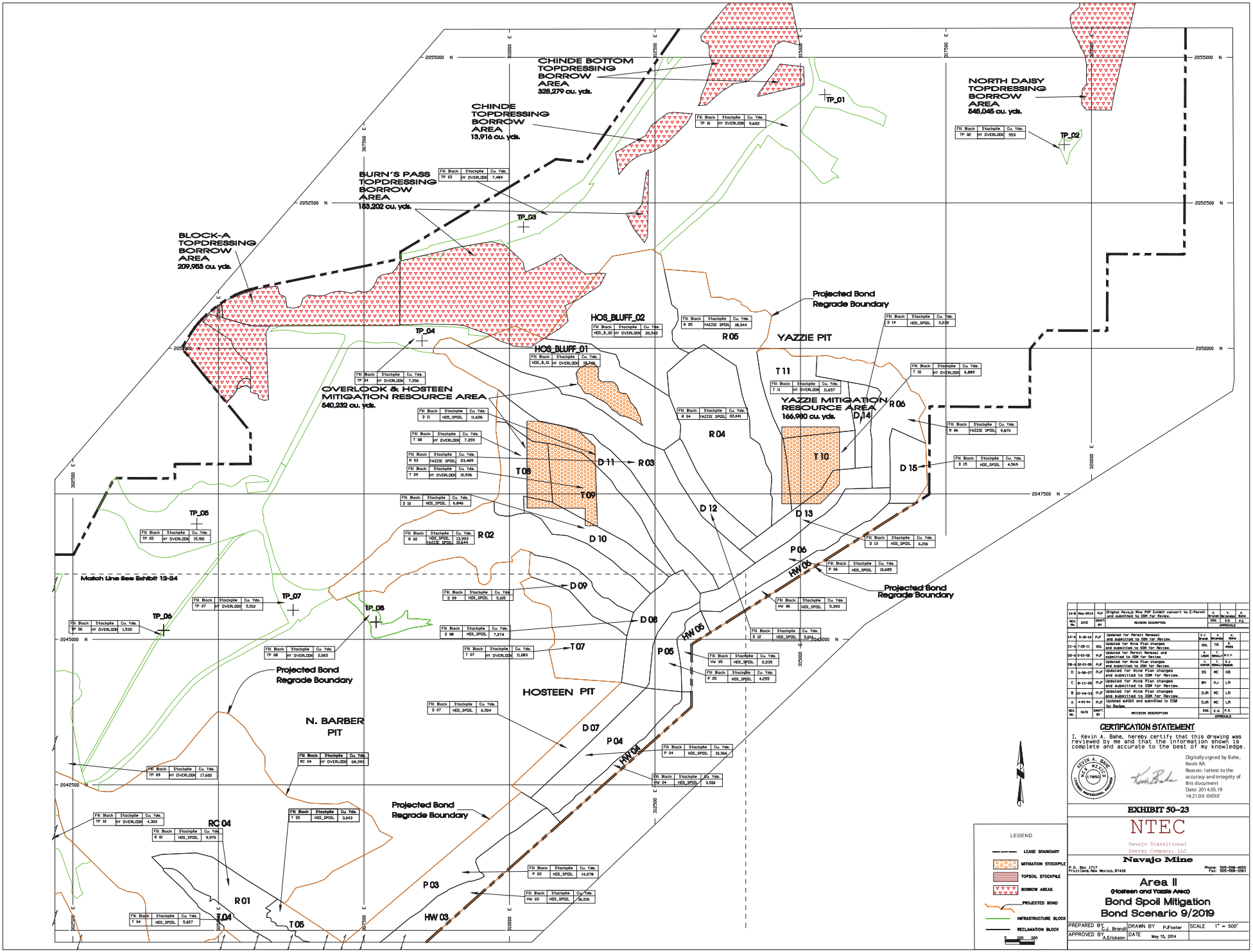
D_15
P_08
D_12
R_05



REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.O.	P.E.
14-B	Mar-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.	C. Bryan	V. McGregor	K. Bahe

APPROVALS

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.O.	P.E.
14-A	6-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	K. McGregor	K. Bahe
11-A	7-29-11	GGL	Updated for Mine Plan changes and submitted to OSM for Review.	GGL	TR	MBB
10-A	5-01-08	PJF	Updated for Permit Renewal and submitted to OSM for Review.	T. LUBN	T. BENALLY	R.C.V.
08-A	02-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	T. KAYON	T. BENALLY	R.C. McGREGOR
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	05-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-09-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR

APPROVALS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17850 — LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:21:00 -06'07'

EXHIBIT 50-23

NTEC
Navajo Transitional Energy Company, LLC

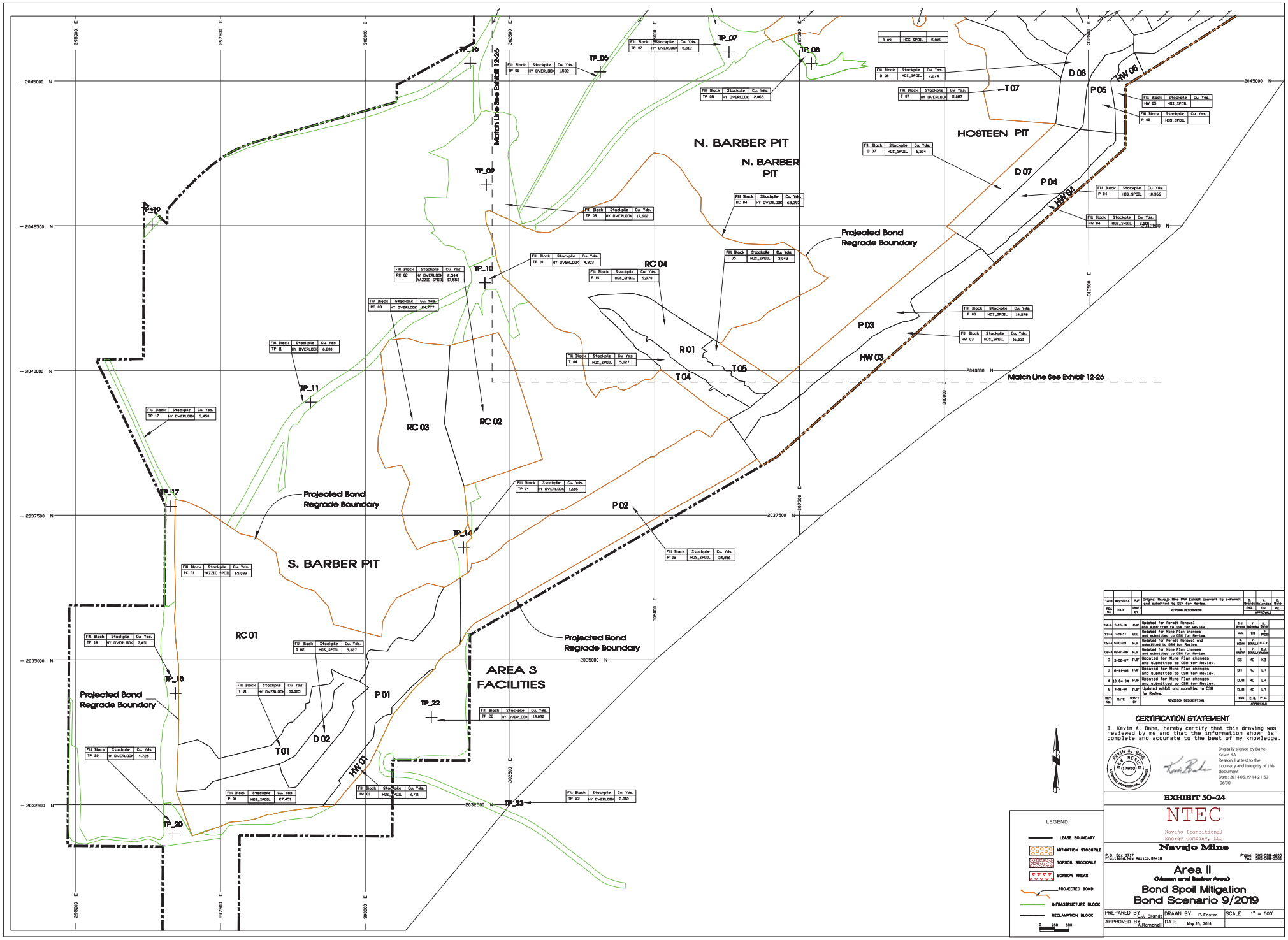
Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-598-3361

Area II
(Hosteen and Yazzie Area)

Bond Spoil Mitigation
Bond Scenario 9/2019

PREPARED BY	C.J. Brandt	DRAWN BY PJFoster	SCALE 1" = 500'
APPROVED BY	A.Erickson	DATE May 15, 2014	



REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	C.J. Brandt ENG.	Y. Reiterman C.S.	K. Bahe P.E.
				APPROVALS		
14-B	May-2014	PJF	Original Navajo New PAP Exhibit convert to E-Permit and submitted to OSM for Review.			
14-A	5-15-14	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C.J. Brandt	Y. Reiterman	K. Bahe
11-A	7-29-11	SCL	Updated for Mine Plan changes and submitted to OSM for Review.	SCL	TR	R. MEEK
09-A	5-21-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	C. LEWIS	Y. BENALLY	K.A.B.
08-A	08-01-08	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	J. SANTON	Y. BENALLY	K.J. Austin
D	3-06-07	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	SS	MC	KB
C	8-11-06	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated exhibit and submitted to OSM for Review.	DJR	MC	LR
REV. NO.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	C.S.	P.E.
				APPROVALS		

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17890 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:21:50 -06'00'

EXHIBIT 50-24

NTEC

Navajo Transitional Energy Company, LLC

Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416

Phone: 505-598-4200
Fax: 505-598-3361

Area II

(Mission and Barber Areas)

Bond Spoil Mitigation
Bond Scenario 9/2019

PREPARED BY C.J. Brandt	DRAWN BY PJFoster	SCALE	1" = 500'
APPROVED BY A.Ramonell	DATE May 15, 2014		

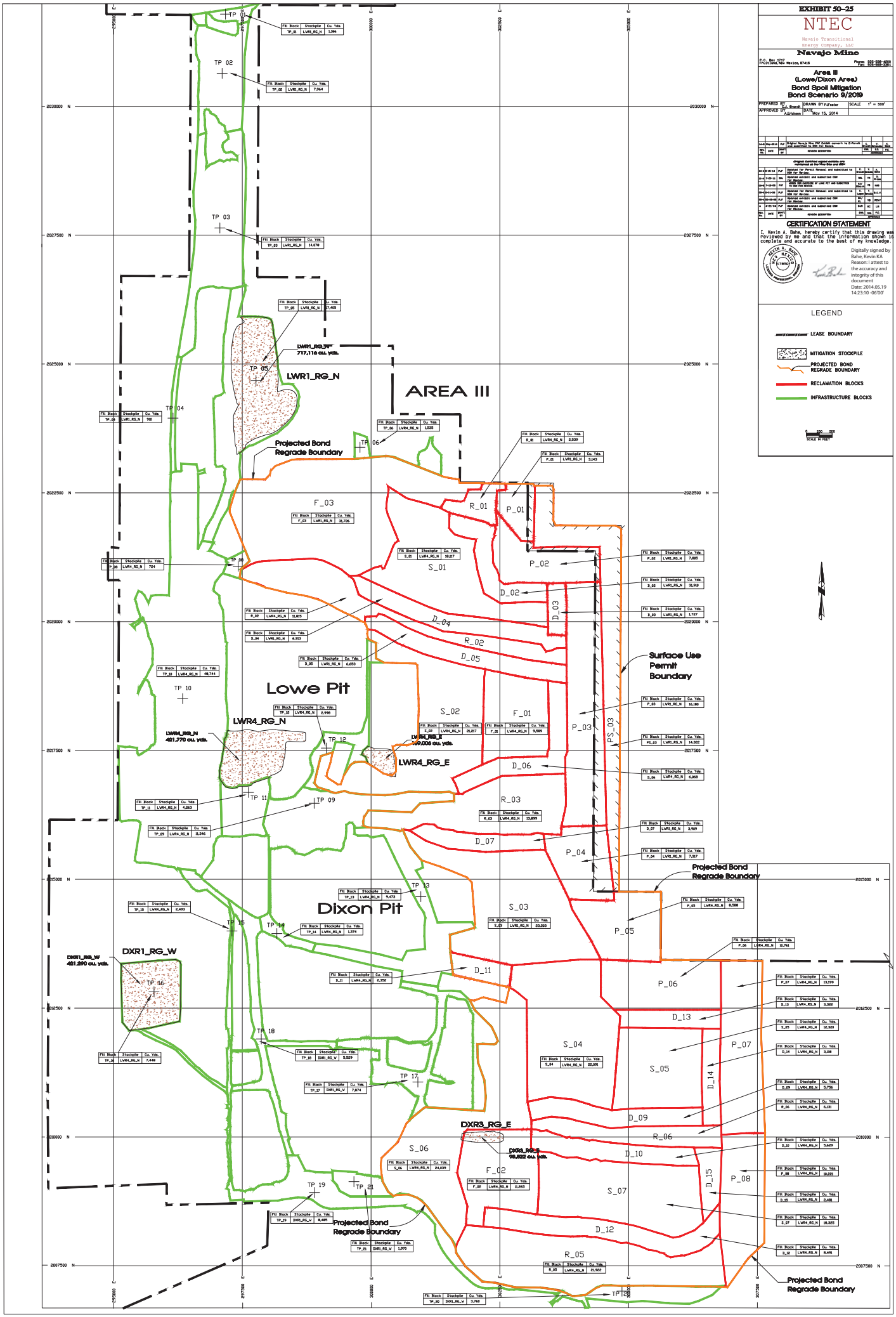


EXHIBIT 50-25
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1727
Fruitland, New Mexico, 87416
Phone: 505-598-4000
Fax: 505-598-3261
Area III
(Lowe/Dixon Area)
Bond Spoil Mitigation
Bond Scenario 9/2019
PREPARED BY: Brandi
APPROVED BY: A.Erickson
DRAWN BY: P.J.Foster
DATE: May 15, 2014
SCALE: 1" = 500'
REVISION DESCRIPTION
CERTIFICATION STATEMENT
I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:23:10 -06'00'
LEGEND
LEASE BOUNDARY
MITIGATION STOCKPILE
PROJECTED BOND REGRADE BOUNDARY
RECLAMATION BLOCKS
INFRASTRUCTURE BLOCKS
SCALE IN FEET
AREA III
Lowe Pit
Dixon Pit
LWR1_RG_N
717,116 cu. yds.
LWR4_RG_N
421,370 cu. yds.
LWR4_RG_E
DXR1_RG_W
421,890 cu. yds.
DXR3_RG_E
98,822 cu. yds.
Projected Bond Regrade Boundary
Surface Use Permit Boundary
TP 01
TP 02
TP 03
TP 04
TP 05
TP 06
TP 09
TP 10
TP 11
TP 12
TP 13
TP 14
TP 15
TP 16
TP 17
TP 18
TP 19
TP 21
F_03
R_01
P_01
P_02
S_01
D_02
D_03
D_04
R_02
D_05
S_02
F_01
P_03
PS_03
D_06
R_03
D_07
P_04
S_03
P_05
P_06
D_11
D_13
S_04
P_07
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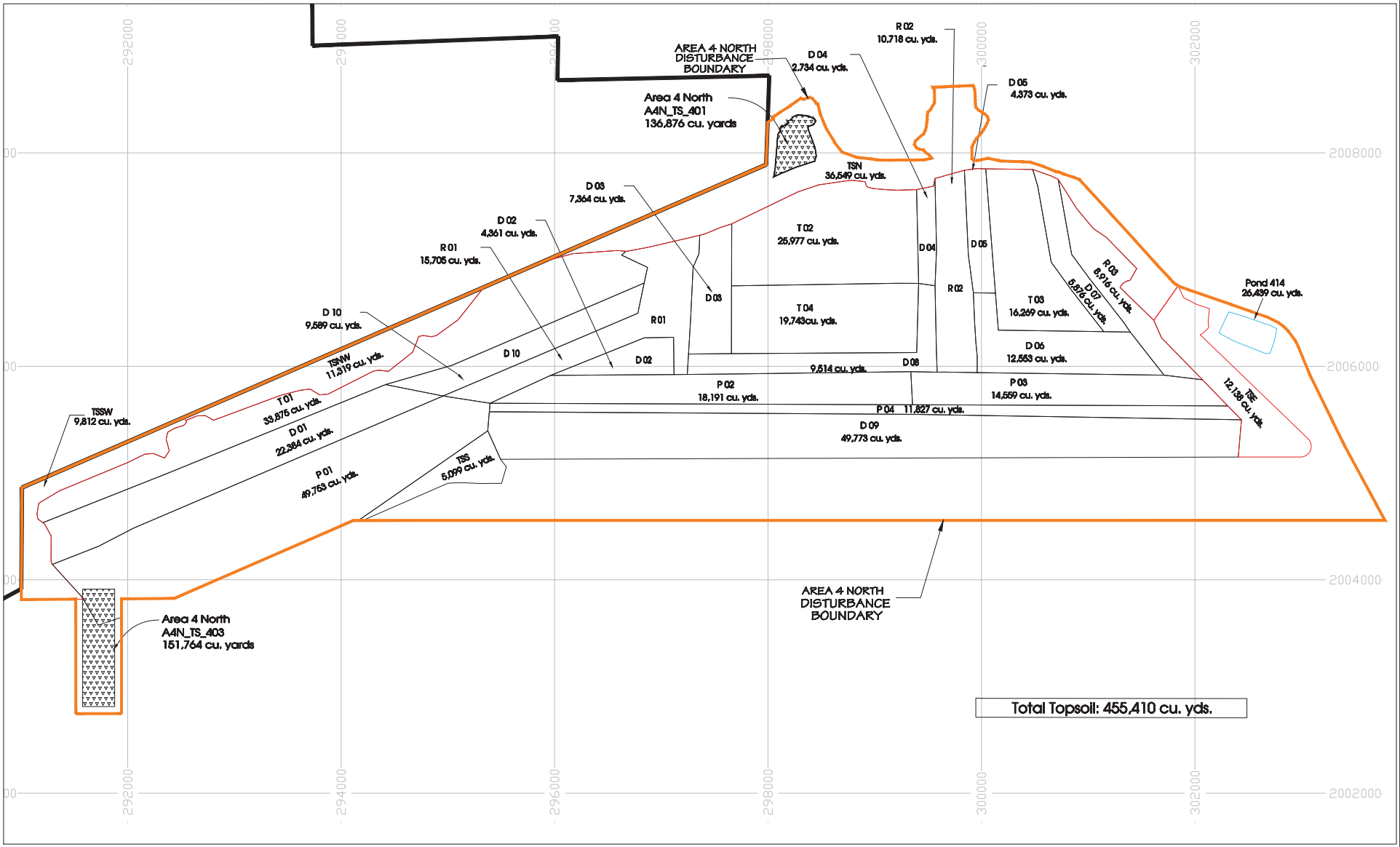
D_12
R_05



LOCATION MAP

SCALE: 1" = 400'

LEGEND

- TOPSPOIL STOCKPILE
- LEASE BOUNDARY
- A4N PONDS
- SURFACE DISTURBANCE BOUNDARY
- DISTURBANCE BLOCKS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE NEW MEXICO 17850 LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:24:19 -06'00'

REVISION		DATE
1	Submitted to DMM for Review.	Oct. 15, 2004
2	Updated for Permit Renewal and Submitted to DMM for Review.	Mar 24, 2009
3	Updated for Permit Revision and Submitted to DMM for Review.	April 24, 2011
4	Updated for Permit Renewal and Submitted to DMM for Review.	Mar 18, 2014
4-A	Updated to DMM for Review. Changes to Pond 414 and Pond 415 were made at request of DMM for Review.	May 2014

PROJECT: A4N Remodeling
DATE:
DESIGNED BY: C.J. Brandt
DRAWN BY: Author
CHECKED BY: C.J. Brandt
APPROVED BY: K.A. Bahe
PROJECT MANAGER: A. Redmond

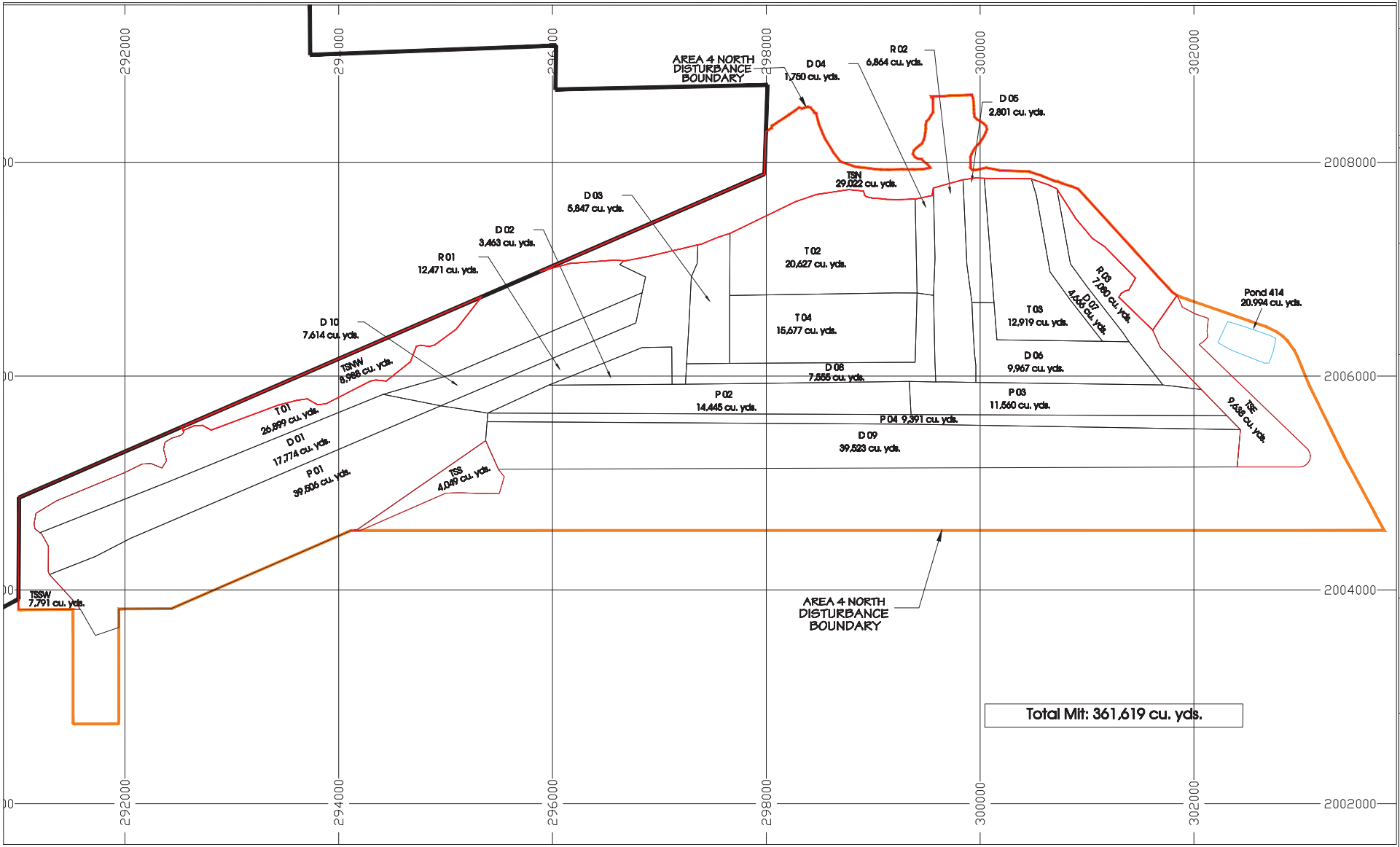
NTEC
Navajo Transitional Energy Company, LLC
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE 505-598-4200/FAX 505-598-3361

LOCATION MAP

EXHIBIT 50-26 AREA-4N
TOPSOIL REPLACEMENT
BOND SCENARIO 9/2019

DRAWING

SHEET 1 OF 1



LOCATION MAP

SCALE: 1" = 400'

LEGEND

- LEASE BOUNDARY
- SURFACE DISTURBANCE BOUNDARY
- A4N PONDS
- DISTURBANCE BLOCKS

CERTIFICATION STATEMENT

I, Kevin A. Bahe, hereby certify that this drawing was reviewed by me and that the information shown is complete and accurate to the best of my knowledge.

KEVIN A. BAHE — NEW MEXICO — 17950 — LICENSED PROFESSIONAL ENGINEER

Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:25:02 -06'00'

REVISION	DATE
1 Submitted to OSM for Review.	JULY 28, 2011
2 Updated for Permit Renewal and Submitted to OSM for Review.	JULY 28, 2011
3 Updated for Permit Renewal and Submitted to OSM for Review.	JULY 28, 2011
A&4 Updated for Permit Renewal and Submitted to OSM for Review.	MAY 28, 2014
14-01 Updated for Pond 414 Cross convert to 2 Ponds and Submitted to OSM for Review.	MAY 28, 2014

PROJECT: A4N Permitting
DATE:
DESIGNED BY: C.J. Brandt
DRAWN BY: R.P.Walker
CHECKED BY: C.J. Brandt
APPROVED BY: K.A.Bahe

PROJECT MANAGER: A. Hagwall

NTEC
Navajo Transitional Energy Company, LLC

NAVAJO MINE

PO BOX 1717, FRUITLAND, NEW MEXICO, 87416 / PHONE: 505-598-4205/FAX: 505-598-3361

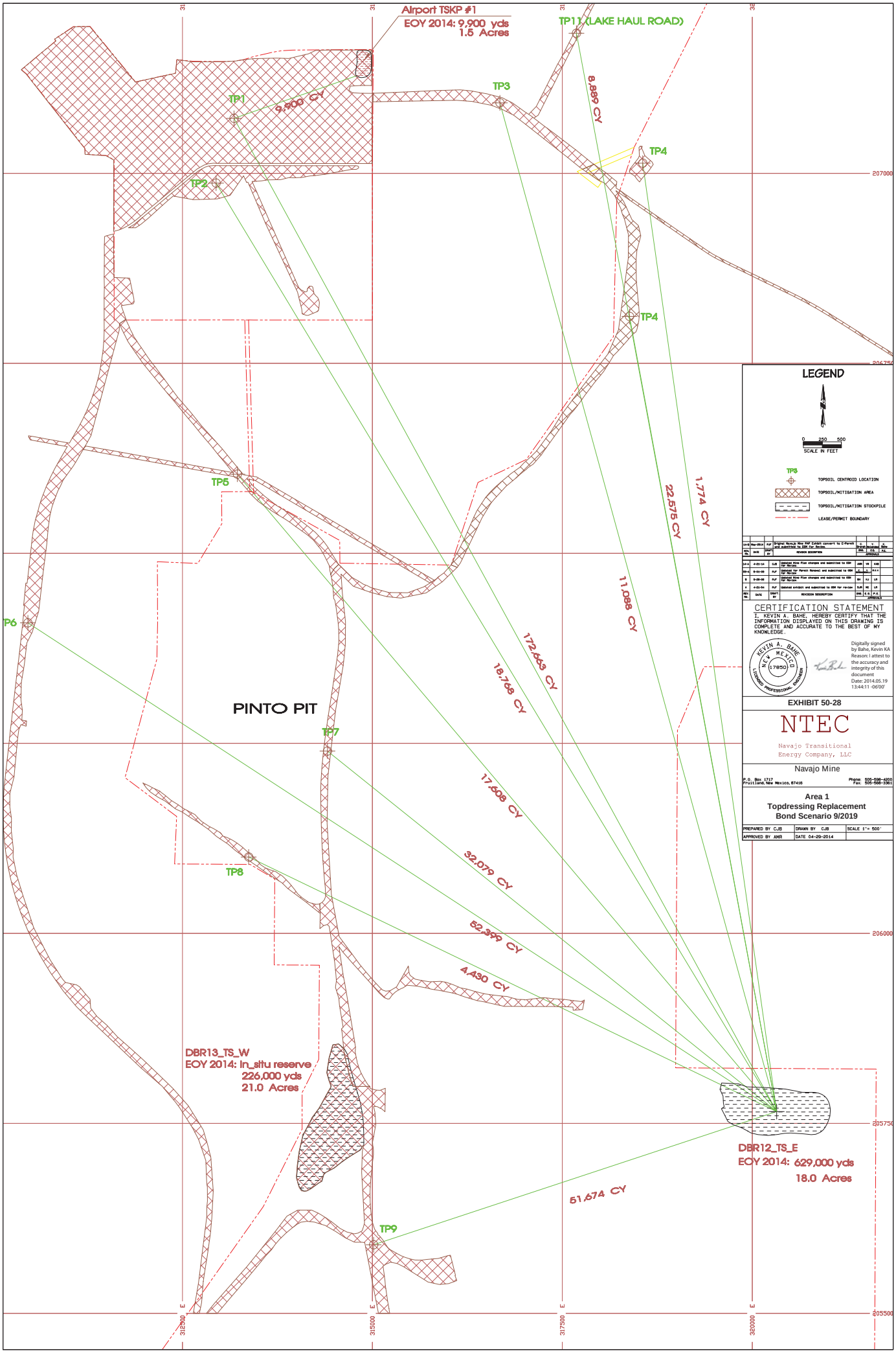
LOCATION MAP

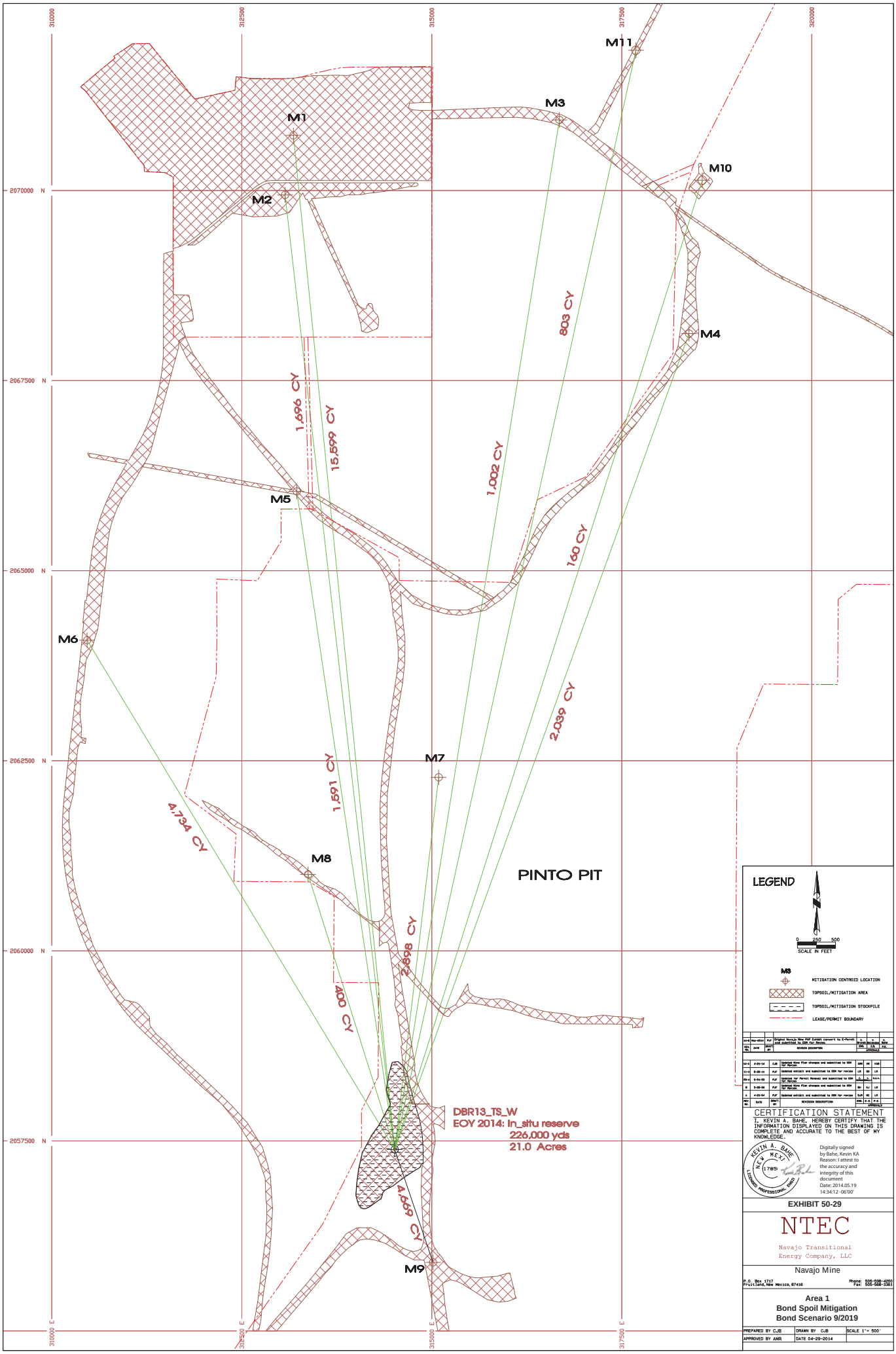
EXHIBIT 30-27 AREA-4N

BOND SPOIL MITIGATION
BOND SCENARIO 9/2019

DRAWING

SHEET 1 OF 1


Airport TSKP #1
EOY 2014: 9,900 yds
1.5 Acres
TP11 (LAKE HAUL ROAD)
TP1
TP2
TP3
TP4
TP5
TP6
TP7
TP8
TP9
9,900 CY
8,889 CY
22,575 CY
1,774 CY
11,088 CY
172,663 CY
18,768 CY
17,608 CY
32,079 CY
62,399 CY
4,430 CY
51,674 CY
PINTO PIT
DBR13_TS_W
EOY 2014: In_situ reserve
226,000 yds
21.0 Acres
DBR12_TS_E
EOY 2014: 629,000 yds
18.0 Acres
207000
206750
206000
205750
205500
312500 E
315000 E
317500 E
320000 E
LEGEND
0 250 500
SCALE IN FEET
TP3
TOPSOIL CENTROID LOCATION
TOPSOIL/MITIGATION AREA
TOPSOIL/MITIGATION STOCKPILE
LEASE/PERMIT BOUNDARY
CERTIFICATION STATEMENT
I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.
KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 13:44:11 -06'00'
EXHIBIT 50-28
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4800
Fax: 505-566-3361
Area 1
Topdressing Replacement
Bond Scenario 9/2019
PREPARED BY CJB
DRAWN BY CJB
SCALE 1"= 500'
APPROVED BY AMR
DATE 04-29-2014


310000
312500
315000
317500
320000
2070000 N
2067500 N
2065000 N
2062500 N
2060000 N
2057500 N
310000 E
312500 E
315000 E
317500 E
M1
M2
M3
M4
M5
M6
M7
M8
M9
M10
M11
803 CY
1,696 CY
15,599 CY
1,002 CY
160 CY
2,039 CY
1,591 CY
4,734 CY
2,898 CY
400 CY
4,699 CY
PINTO PIT
DBR13_TS_W
EOY 2014: In_situ reserve
226,000 yds
21.0 Acres
LEGEND
0 250 500
SCALE IN FEET
M3
MITIGATION CENTROID LOCATION
TOPSOIL/MITIGATION AREA
TOPSOIL/MITIGATION STOCKPILE
LEASE/PERMIT BOUNDARY
CERTIFICATION STATEMENT
I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.
KEVIN A. BAHE
NEW MEXICO
14785
LICENSED PROFESSIONAL ENGINEER
Digitally signed by Bahe, Kevin KA
Reason: I attest to the accuracy and integrity of this document
Date: 2014.05.19 14:34:12 -06'00'
EXHIBIT 50-29
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-6200
Fax: 505-598-3261
Area 1
Bond Spoil Mitigation
Bond Scenario 9/2019
PREPARED BY CJB
DRAWN BY CJB
SCALE 1"= 500'
APPROVED BY AMR
DATE 04-29-2014

Appendix 50.A

Topography Channel Stabilization

For Bond Reclamation

Bond Scenario 2019

Navajo Transitional Energy Company

Navajo Mine

Fruitland, New Mexico

May 2014

TOPOGRAPHY CHANNEL STABILIZATION
FOR BOND RECLAMATION
BOND SCENARIO 2014

Introduction

Protective lining requirements were developed for the stabilization of the drainage channels associated with Bond Reclamation Topography at the Navajo Mine. A cost estimate for the materials and installation is also provided for use in reclamation bond determination.

Hydrology and channel designs are based on procedures outlined in Reclamation Surface Stabilization Design Handbook for the Navajo Mine (Navajo Mine, 1992). Peak flow estimates were developed at prediction points within the Area II, Area III and Area IV North mining areas (see EXHIBITS 50.A-1, 50.A-2 (sheet 1 and 2), and 50-09). Prediction Points 1-19 and 37-40 are located in Area II, structures LNDS1, LR3DS1, LNDS4, LNDS5, LSDS1, LR3DS2, NF02-NF06, NFD 01-NFD 07 are located in Area III, and prediction points 28 through 30 are in Area IV North. Prediction Points 4a, 4b, 6, 10, 12, 13, 20 and 21-31 were removed; they are not required due to changes in the bond surface and drainage patterns. The peak discharges were used to evaluate the channel stability at each prediction point. Protective lining requirements were developed based on channel slope, expected peak flow rates and channel dimensions. The cost estimates for materials and installation were developed using unit costs associated with recent placement of riprap and gabions at Navajo Mine.

Hydrology

Peak flow estimates were developed using the SEDCAD 4.0 computer model. The estimates are based on the 100 yr–6 hr storm event for intermittent and perennial streams (watersheds > 640 acres); and the 10 yr–6 hr storm event for ephemeral streams (watersheds < 640 acres). If a drop structure was found to be required for a drainage area <640 acres, that structure was upgraded from a 10yr-6hr storm event to a 100yr-6hr storm event. Each lined channel was designed to be stable and to safely pass the peak discharge during the applicable design storm event.

Watersheds were developed and measured from USGS topographic quad sheets and topography of the bond reclamation areas. Soil types and the associated hydrologic soil group classification for the undisturbed portions of the watersheds were taken from the San Juan County Soil Survey, Eastern Part (USDA-SCS, 1980). The watershed data for each prediction point is presented in TABLE A. The watershed areas are on drawings in this Appendix.

Curve numbers for the undisturbed soils were taken from Table 26-9 in the Navajo Mine PAP. Curve numbers for the reclaimed areas were taken from Table 18-6 (Area II), Table 18-7 (Area III), and Table 18-8 (Area IV) in the Navajo Mine PAP.

Hydrologic curve numbers were developed as an aerially weighted average of the curve numbers for undisturbed and disturbed soils occurring within the watersheds.

The time of concentration (T_c) for each prediction point was determined by the Modified Kirpich method. The SEDCAD 4.0 hydrology data sheets are located in this Appendix.

Channel Proportioning

The prediction points were located at the drainages entering the reclaimed areas along the highwall and on channel slopes greater than 2% for watersheds within the reclaimed area. The main channels with slopes less than 2% will be constructed using an earth channel design. Channel slopes and lengths were measured from the bond reclamation topography.

The SEDCAD 4.0 computer model was used to proportion the channels and compute the riprap sizes. Channel side slopes of 3:1 were used in the designs. A minimum freeboard of 1.0 foot was used. FIGURE 1 shows a typical riprap/gabion channel section listing the hydraulic dimensions. The lengths of entrance and exit aprons were calculated as 5 times the exit channel flow depth with a minimum length of 15 feet. Riprap layer thickness was designed as 1.5 times the D_{50} of the riprap. A minimum riprap size of D_{50} equal to 0.5 feet was used. A filter fabric was utilized

in lieu of a graded sand and gravel filter beneath the riprap. Channel hydraulic dimensions for each prediction point are presented in TABLE B for Area II and TABLE C for Area III and Area IV North. The SEDCAD 4.0 channel proportioning sheets are located in this Appendix.

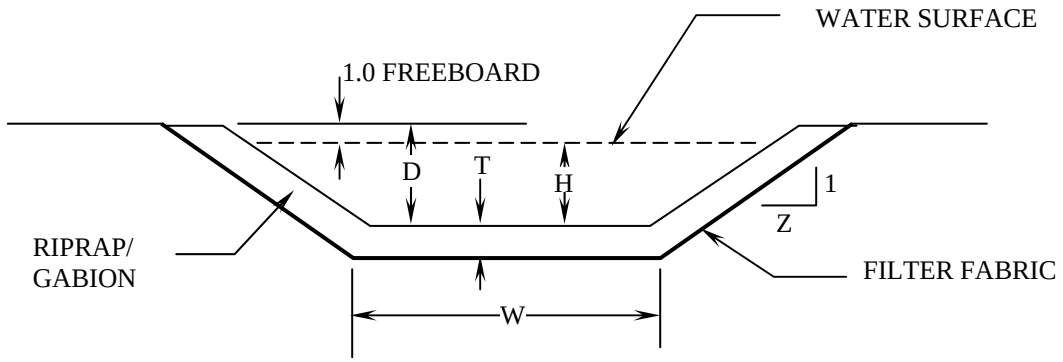
The availability of rock size greater than D_{50} equal to 9-inch is very limited in the local area. Therefore, if results from the hydraulic analysis specifies rip-rap size of D_{50} equal to 12-inch or greater, gabions filled with either D_{50} equal 4-inch or 6-inch rock will be used in lieu of the size specified. If a gabion structure is required the design of the structure is attach to the Sedcad output reports.

Cost Estimate

The riprap and gabion cost are based on the cost of material, labor, and equipment associated with recent riprap/gabion placement at the Navajo Mine. The cost for placing the filter fabric was developed by using the cost of geotextile fabric (200-lb tensile strength) from RS Means "Heavy Construction Cost Data – 2014". The unit costs used are presented on Table D and E.

The cost for placing the filter fabric was developed by using the cost of geotextile fabric (200-lb tensile strength) from RS Means "Heavy Construction Cost Data – 2014".

The estimated material and installation costs for each reach of riprap or gabion lined channel are presented in TABLE D for Area II and TABLE E for Area III and Area IV North. Channel lengths include apron lengths.



D = Channel Depth

H = Flow Depth

T = Riprap/Gabion Layer Thickness

W = Channel Bottom Width

Z = Side Slope (Z:1)

FIGURE 1

TYPICAL CHANNEL SECTION

TABLE A
WATERSHED DATA

						Soil Classification, Hydrologic Soil Group, and Curve Number (CN)			
Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	Soil Type	% of Area	Hydrologic Gp.	CN
PP0	10.8	1,497.0	5,465	5,325	140	Ba	100	D	91
PP1	343.1	11,066.0	5,655	5,309	346	Ba	100	D	91
PP1A[(1)]	27,456.6	62,720.0	5,890	5,190	700	Refer to Appendix 18.S			
PP2	8.3	1,021.0	5,401	5,300	101	Ba	100	D	91
PP3	12.4	1,250.0	5,440	5,335	105	Ba	100	D	91
PP3A	6.5	933.0	5,435	5,355	80	Ba	100	D	91
PP3B	63.4	3,231.0	5,530	5,355	175	Ba	100	D	91
PP3C	12.3	1,028.0	5,460	5,365	95	Ba	100	D	91
PP4	25.9	1,871.0	5,482	5,360	122	Ba	100	D	91
PP5	78.1	3,407.0	5,575	5,385	190	Ba	100	D	91
PP7	151.0	4,976.0	5,645	5,385	260	Ba	100	D	91
PP8	34.5	2,522.0	5,605	5,400	205	Ba	100	D	91
PP9	69.8	3,702.0	5,620	5,400	220	Ba	100	D	91
PP11	28.5	2,016.0	5,512	5,405	107	Ba	100	D	91
PP14	326.2	8,403.0	5,650	5,385	265	Ba	100	D	91
PP15	77.1	3,600.0	5,540	5,408	132	Ba	100	D	91
PP18	117.3	4,222.0	5,465	5,320	145	Reclaimed	100	n/a	76
PP19	83.4	2,679	5,415	5,350	65	Reclaimed	100	n/a	76

TABLE A (Cont'd)
WATERSHED DATA

						Soil Classification, Hydrologic Soil Group, and Curve Number (CN)			
Predicition Point	Watershed Area (ac)	Drainage Length (ft)	High Pt. Elev. (ft)	Low Pt. Elev. (ft)	Delta Elev. (ft)	Soil Type (1)	% of Area	Hydrologic Gp. (2)	CN (3)
PP37	532.8	7,022	5,604	5,386	218	Refer to Appendix 41.Q			
PP38	128.8	5,538	5,597	5,395	202	Refer to Appendix 41.Q			
PP39	1,199.3	30,305	5,650	5,355	295	Refer to Appendix 41.I			
PP40	2,045.0	22,580	5,650	5,235	415	Refer to Appendix 18.S			

TABLE B

AREA II CHANNEL HYDRAULIC DIMENSIONS

Prediction Point	Q_{100} (cfs) *Q_{10}	Slope (%)	Bottom Width (ft)	Side Slope (Z:1)	Flow Depth (ft)	D_{50} (ft)	Riprap/ Gabion Thickness (ft)
PP0	26.5	9.2	6.0	3.0	1.4	0.8	1.5
PP1(1)	229.0	9.1	9.0	3.0	2.2	0.5	1.0
PP1A(1)	1830.1	3.1	50.0	3.0	3.2	0.3	0.6
PP2	20.4	9.6	6.0	3.0	1.3	0.5	1.0
PP3	30.2	7.2	6.0	3.0	1.4	0.8	1.5
PP3A	15.9	7.0	6.0	3.0	1.3	0.5	1.0
PP3B	102.3	9.4	11.0	3.0	1.7	0.8	1.5
PP3C	30.2	6.6	6.0	3.0	1.4	0.5	1.0
PP4	41.8	10.0	6.0	3.0	1.5	0.8	1.1
PP5	126.1	11.8	15.0	3.0	1.7	0.8	1.1
PP7(1)	227.4	9.2	19.0	3.0	1.8	0.3	0.6
PP8	84.6	8.9	10.0	3.0	1.7	0.8	1.5
PP9	112.6	7.6	12.0	3.0	1.8	0.8	1.5
PP11	70.0	5.0	7.0	3.0	1.8	0.8	1.5
PP14(1)	307.9	5.8	10.0	3.0	2.5	0.4	0.8
PP15	115.4	4.6	11.0	3.0	1.9	0.8	1.5
PP18	*12.8	2.4	6.0	3.0	1.5	0.5	0.8
PP19	*48.4	2.3	6.0	3.0	1.5	0.5	0.8
PP37(1)	468.0	4.5	10.0	3.0	3.0	0.4	0.8
PP38	168.8	2.9	14.0	3.0	2.1	0.8	1.5
PP-39	60.9	4.2	6.0	3.0	1.8	0.8	1.5
PP40	407.6	2.1	7.0	3.0	4.5	0.3	0.6

(1) Gabion structure

TABLE C

AREA III AND AREA IV NORTH CHANNEL HYDRAULIC DIMENSIONS

Prediction Point	Q_{100} (cfs) *Q_{10}	Slope (%)	Bottom Width (ft)	Side Slope (Z:1)	Flow Depth (ft)	D_{50} (ft)	Riprap Thickness (ft)
LNDS1(1)	985.0	1.8	20.0	3.0	3.0	1.0	0.6
LR3DS1(1)	304.8	2.8	12.0	3.0	2.4	1.5	0.6
LNDS4(2)	212.0	7.1	10.0	3.0	1.4	1.8	2.5
LNDS5(2)	471.0	8.0	14.0	3.0	1.8	2.5	4.0
LSDS1(1)	658.0	12.5	14.0	3.0	2.0	1.0	1.6
LR3DS2(1)	192.6	5.3	14.0	3.0	2.1	1.0	0.6
NF02	80.7	5.5	8.0	3.0	0.4	0.5	1.0
NF03	53.1	1.5	10.0	3.0	0.5	0.5	1.0
NF04	27.3	15.0	10.0	3.0	0.2	0.5	1.0
NF05	11.5	15.6	8.0	3.0	0.1	0.5	1.0
NF06	20.2	20.7	8.0	3.0	0.2	0.8	1.0
NFD 01	12.6	15.8	4.0	3.0	0.2	1.0	1.0
NFD 02(1)	60.5	24.0	12.0	3.0	0.3	1.0	1.0
NFD 03	14.8	20.5	5.0	3.0	0.2	1.0	1.0
NFD 04	5.6	24.0	6.0	3.0	0.1	0.8	1.0
NFD 05	17.5	21.5	7.0	3.0	0.2	0.8	1.0
NFD 06	4.1	23.5	6.0	3.0	0.04	0.8	1.0
NFD 07	20.5	10.7	6.0	3.0	0.3	0.8	1.0
PP28	23.6	3.5	7.0	3.0	0.3	0.5	0.8
PP29	7.8	10.7	7.0	3.0	0.1	0.5	0.8
PP30	8.2	18.3	7.0	3.0	0.1	0.8	1.2

(1) Gabion structure
(2) See Exhibit 34-11 As-built Sheet 1 and 2 for drop structures

TABLE D
AREA II RIPRAP COST ESTIMATE

Prediction Point	Riprap Channel Length (ft)	D_{50} (ft)	Riprap/Gabion Thickness (ft)	Channel Depth (ft)	Bottom Width (ft)	Side Slopes (Z:1)	Filter Fabric (SF)	Riprap/Gabion (CY)	Cost ($)
PP0	273	0.75	1.5	1.4	6.0	3.0	3,962	220	$ 15,847
PP1(1)	395	0.50	1.0	2.2	9.0	3.0	9,013	334	$ 42,796
PP1A(1)	1002	0.33	0.6	3.2	50.0	3.0	70,764	1,573	$ 208,124
PP2	677	0.50	1.0	1.3	6.0	3.0	9,535	353	$ 26,153
PP3	415	0.75	1.5	1.4	6.0	3.0	6,176	343	$ 24,702
PP3A	315	0.50	1.0	1.3	6.0	3.0	4,378	162	$ 12,009
PP3B	181	0.75	1.5	1.7	11.0	3.0	3,944	219	$ 15,775
PP3C	486	0.50	1.0	1.4	6.0	3.0	7,263	269	$ 19,922
PP4	1556	0.75	1.1	1.5	6.0	3.0	23,924	997	$ 73,136
PP5	728	0.75	1.1	1.7	15.0	3.0	18,580	774	$ 56,802
PP7(1)	608	0.33	0.6	1.8	19.0	3.0	18,571	413	$ 54,620
PP8	638	0.75	1.5	1.7	10.0	3.0	13,014	723	$ 52,047
PP9	1331	0.75	1.5	1.8	12.0	3.0	30,860	1,714	$ 123,422
PP11	1164	0.75	1.5	1.8	7.0	3.0	21,022	1,168	$ 84,078
PP14(1)	872	0.40	0.8	2.5	10.0	3.0	22,130	656	$ 85,088
PP15	477	0.75	1.5	1.9	11.0	3.0	10,805	600	$ 43,215
PP18	2530	0.50	0.8	1.5	6.0	3.0	38,899	1,153	$ 87,148
PP19	870	0.50	0.8	1.5	6.0	3.0	13,376	396	$ 29,968
						Totals	**326,217**	**12,067**	**$ 1,054,853**
PP37(1)	269	0.40	0.8	3.0	10.0	3.0	7,638	226	$ 29,365
PP38	374	0.75	1.5	2.1	14.0	3.0	10,151	564	$ 40,599
PP39	900	0.75	1.5	1.8	6.0	3.0	15,221	846	$ 60,877
PP40(1)	2800	0.33	0.6	4.5	7.0	3.0	97,580	2,168	$ 286,994
						Subtotals	**130,590**	**3,804**	**$ 417,834**
						Totals	**456,807**	**15,871**	**$ 1,472,687**

(1) Gabion Structure

Unit Cost Installed

	Unit	$/Unit
Riprap	CY	$ 67.85
Filter Fabric	SF	$ 0.23
Gabion	CY	$ 122.00

TABLE E

AREA III AND AREA IV NORTH RIPRAP COST ESTIMATE

Area III

Prediction Point	Riprap Channel Length (ft)	D50 (ft)	Riprap/Gabion Thickness (ft)	Channel Depth (ft)	Bottom Width (ft)	Side Slopes (Z:1)	Filter Fabric (SF)	Riprap/Gabion (CY)	Cost ($)
LNDS1(1)	610	1.00	0.6	3.0	20.0	3.0	23,684	526	$ 69,659
LR3DS1(1)	1140	1.50	0.6	2.4	12.0	3.0	30,989	689	$ 91,141
LNDS4	385	1.75	2.5	1.4	10.0	3.0	7,261	672	$ 47,287
LNDS5	396	2.50	4.0	1.8	14.0	3.0	10,066	1,491	$ 103,500
LSDS1(1)	200	1.00	1.6	2.0	14.0	3.0	5,305	314	$ 39,576
LR3DS2(1)	432	1.00	0.6	2.1	14.0	3.0	11,885	246	$ 32,806
NF02	580	0.50	1.0	0.40	8.0	3.0	6,183	229	$ 16,959
NF03	815	0.50	1.0	0.50	10.0	3.0	10,860	402	$ 29,788
NF04	395	0.50	1.0	0.20	10.0	3.0	4,535	168	$ 12,438
NF05	270	0.50	1.0	0.10	8.0	3.0	2,380	88	$ 6,528
NF06	390	0.75	1.0	0.20	8.0	3.0	3,678	136	$ 10,088
NFD 01	57	1.00	1.0	0.20	4.0	3.0	304	11	$ 833
NFD 02(1)	38	1.00	1.0	0.30	12.0	3.0	538	20	$ 2,552
NFD 03	40	1.00	1.0	0.20	5.0	3.0	254	9	$ 697
NFD 04	70	0.75	1.0	0.10	6.0	3.0	474	18	$ 1,299
NFD 05	34	0.75	1.0	0.20	7.0	3.0	286	11	$ 784
NFD 06	32	0.75	1.0	0.04	6.0	3.0	205	8	$ 561
NFD 07	48	0.75	1.0	0.30	6.0	3.0	384	14	$ 1,053
						Subtotals	**77,306**	**5,053**	**$ 467,552**

Area IV North

PP28	912	0.50	0.8	1.2	6.0	3.0	12,339	366	$ 27,645
PP29	1472	0.50	0.8	1.5	12.0	3.0	31,685	939	$ 70,986
PP30	329	0.50	0.8	1.0	9.0	3.0	5,058	150	$ 11,333
						Subtotals	**49,083**	**1,454**	**$ 109,963**
						Totals	**126,388**	**6,508**	**$ 577,515**

(1) Gabion Structure

Unit Cost Installed

	Unit		$/Unit
Riprap	CY	$	67.85
Filter Fabric	SF	$	0.23
Gabion	CY	$	122.00

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Bond Scenario 9/2019

Prediction Point PP-0, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-0

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	10.800	10.800	26.49	1.05

Structure Detail:

Structure #1 (Riprap Channel)

PP-0

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	9.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	26.49 cfs	
Depth:	0.36 ft	1.36 ft
Top Width:	8.18 ft	14.18 ft
Velocity*:		
X-Section Area:	2.58 sq ft	
Hydraulic Radius:	0.311 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	10.800	0.065	0.000	0.000	91.000	M	26.49	1.046
	Σ	**10.800**						**26.49**	**1.046**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	11.84	45.00	380.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	8.50	95.00	1,117.00	8.740	0.035
#1	**1**	**Time of Concentration:**					**0.065**

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Bond Scenario 9 / 2019

Prediction Point PP-1, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-1

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	343.100	343.100	228.96	21.03

Structure Detail:

Structure #1 (Riprap Channel)

PP-1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
9.00	3.0:1	3.0:1	9.1	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	228.96 cfs	
Depth:	1.17 ft	2.17 ft
Top Width:	16.04 ft	22.04 ft
Velocity*:		
X-Section Area:	14.69 sq ft	
Hydraulic Radius:	0.895 ft	
Froude Number*:		
Manning's n*:		
Dmin:	7.00 in	
D50:	21.00 in	
Dmax:	26.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	343.100	0.737	0.000	0.000	87.300	M	228.96	21.030
	Σ	**343.100**						**228.96**	**21.030**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	55.00	1,583.00	1.860	0.236
		8. Large gullies, diversions, and low flowing streams	3.07	291.00	9,483.00	5.250	0.501
#1	**1**	**Time of Concentration:**					**0.737**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1

Folder:
Date: 07/26/2012

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	9.10	Froude number	2.73
Discharge [ft3/s]	228.96	Cross section [ft2]	15.27
Water level [ft]	1.21	Wetted perimeter [ft]	16.65
Average velocity [ft/s]	15.00	Hydraulic radius [ft]	0.92

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	6.80	10.28	1.00							
3.1	6.80			5.00	2.93	GabionMats 12"	N	5.34	6.53	Y
4	9.00	16.90	1.00							
4.1	9.00			5.00	2.93	GabionMats 12"	N	7.00	7.01	Y
5	6.80	10.28	1.00							
5.1	6.80			5.00	2.93	GabionMats 12"	N	5.34	6.53	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1

Folder:
Date: 07/26/2012

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Materials used

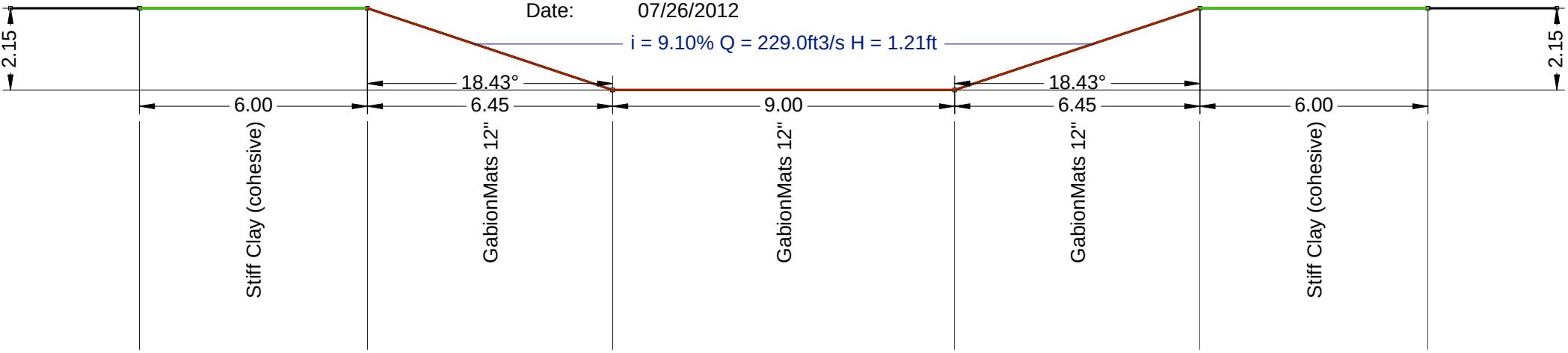
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
GabionMats 12"	0.0301	7.01	N	5.90	0.98	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1

Folder:
Date: 07/26/2012



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Bond Scenario 9 / 2019

The 100 yr - 6 hr peak flow from the Chinde Arroyo post-mine hydrology model at Structure 23 was used to design the drop structure at PP-1A. The full report is presented in Appendix 50.A The hydrology model and drainage subdivisions area presented in Appendix 50.A-1.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#42	1.386	0.156	S1
Null	#3	==>	#5	0.000	0.000	S3
Null	#4	==>	#5	0.000	0.000	S4
Null	#5	==>	#6	0.778	0.334	S5
Null	#6	==>	#40	1.263	0.275	S6
Null	#7	==>	#44	0.622	0.321	S7
Null	#8	==>	#44	0.379	0.327	S8 at PP-11
Null	#9	==>	#44	0.205	0.345	S9 at PP-9
Null	#10	==>	#44	0.108	0.367	S10 at PP-8
Null	#11	==>	#44	0.035	0.389	S11 at PP-7
Null	#12	==>	#27	0.346	0.347	S12 at PP-5
Null	#13	==>	#27	0.429	0.325	S13 at PP-4
Null	#14	==>	#38	0.749	0.206	S14
Null	#15	==>	#41	0.000	0.000	S15
Null	#16	==>	#38	0.043	0.404	S16
Null	#17	==>	#32	0.000	0.000	S17
Null	#18	==>	#40	0.434	0.164	S18
Null	#19	==>	#33	0.000	0.000	S19
Null	#21	==>	#27	0.256	0.341	S21 at PP-3B
Null	#22	==>	#30	0.493	0.224	S22
Null	#23	==>	#24	0.494	0.312	S23 at PP-1A
Null	#24	==>	End	0.000	0.000	S24
Null	#25	==>	#28	0.678	0.320	S25 at PP-1
Null	#26	==>	#29	0.164	0.191	S26
Null	#27	==>	#45	0.340	0.311	S27
Null	#28	==>	#23	0.101	0.361	S28
Null	#29	==>	#40	0.660	0.307	S29
Null	#30	==>	#33	0.000	0.000	S30
Null	#31	==>	#32	0.274	0.297	S31
Null	#32	==>	#23	0.403	0.327	S32
Null	#33	==>	#18	0.510	0.309	S33
Null	#34	==>	#38	0.601	0.202	S34
Null	#35	==>	#23	0.080	0.367	S35
Null	#36	==>	#27	0.202	0.356	S36 at PP-3C
Null	#37	==>	#4	1.717	0.316	S37
Null	#38	==>	#39	0.165	0.329	S38 at Doby Channel
Null	#39	==>	#15	0.342	0.321	S39 at Doby Permanent Imp.
Null	#40	==>	#41	0.000	0.000	S40

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#41	==>	#32	0.216	0.318	S41
Null	#42	==>	#3	1.479	0.221	S42
Null	#43	==>	#30	0.289	0.246	S43
Null	#44	==>	#27	0.609	0.308	S44
Null	#45	==>	#28	0.174	0.349	S45
Null	#46	==>	#28	0.532	0.347	S46 at PP-3A
Null	#47	==>	#28	0.515	0.342	S47 at PP-3
Null	#48	==>	#28	0.587	0.321	S48 at PP-2
Null	#49	==>	#28	0.669	0.328	S49 at PP-0

#35 *Null*					
		#26 *Null*			
	#29 *Null*				
				#43 *Null*	
				#22 *Null*	
			#30 *Null*		
			#19 *Null*		
		#33 *Null*			
	#18 *Null*				
				#37 *Null*	
			#4 *Null*		
					#1 *Null*
				#42 *Null*	
			#3 *Null*		
		#5 *Null*			

				#6 *Null*			
		#40 *Null*					
						#34 *Null*	
						#16 *Null*	
						#14 *Null*	
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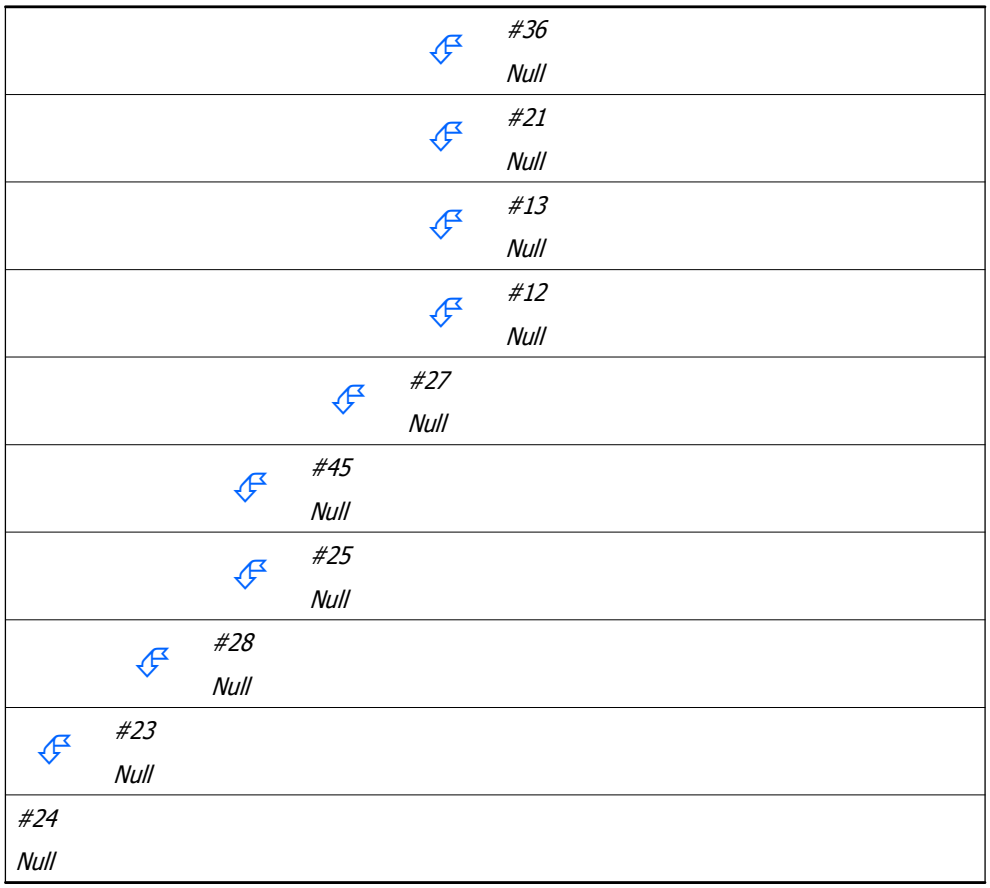

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	5. Nearly bare and untilled, and alluvial valley fans	0.60	23.00	3,844.22	0.77	1.386
#1	**Muskingum K:**					**1.386**
#5	8. Large gullies, diversions, and low flowing streams	1.30	124.00	9,554.00	3.41	0.778
#5	**Muskingum K:**					**0.778**
#6	8. Large gullies, diversions, and low flowing streams	0.48	45.00	9,415.70	2.07	1.263
#6	**Muskingum K:**					**1.263**
#7	8. Large gullies, diversions, and low flowing streams	1.03	70.00	6,812.80	3.04	0.622
#7	**Muskingum K:**					**0.622**
#8	8. Large gullies, diversions, and low flowing streams	1.14	50.00	4,371.40	3.20	0.379
#8	**Muskingum K:**					**0.379**
#9	8. Large gullies, diversions, and low flowing streams	1.60	45.00	2,810.50	3.79	0.205
#9	**Muskingum K:**					**0.205**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	8. Large gullies, diversions, and low flowing streams	2.45	45.00	1,836.50	4.69	0.108
#10	**Muskingum K:**					**0.108**
#11	8. Large gullies, diversions, and low flowing streams	3.93	30.00	762.50	5.95	0.035
#11	**Muskingum K:**					**0.035**
#12	8. Large gullies, diversions, and low flowing streams	1.66	80.00	4,821.90	3.86	0.346
#12	**Muskingum K:**					**0.346**
#13	8. Large gullies, diversions, and low flowing streams	1.12	55.00	4,901.50	3.17	0.429
#13	**Muskingum K:**					**0.429**
#14	5. Nearly bare and untilled, and alluvial valley fans	1.43	46.00	3,212.06	1.19	0.749
#14	**Muskingum K:**					**0.749**
#16	8. Large gullies, diversions, and low flowing streams	5.68	64.00	1,127.00	7.14	0.043
#16	**Muskingum K:**					**0.043**
#18	8. Large gullies, diversions, and low flowing streams	0.08	1.00	1,298.19	0.83	0.434
#18	**Muskingum K:**					**0.434**
#21	8. Large gullies, diversions, and low flowing streams	1.49	50.00	3,365.00	3.65	0.256
#21	**Muskingum K:**					**0.256**
#22	5. Nearly bare and untilled, and alluvial valley fans	1.92	47.00	2,453.50	1.38	0.493
#22	**Muskingum K:**					**0.493**
#23	8. Large gullies, diversions, and low flowing streams	0.88	44.00	5,006.00	2.81	0.494
#23	**Muskingum K:**					**0.494**
#25	8. Large gullies, diversions, and low flowing streams	1.03	76.00	7,403.00	3.03	0.678
#25	**Muskingum K:**					**0.678**
#26	5. Nearly bare and untilled, and alluvial valley fans	1.12	7.00	623.30	1.05	0.164
#26	**Muskingum K:**					**0.164**
#27	8. Large gullies, diversions, and low flowing streams	0.87	30.00	3,432.70	2.80	0.340
#27	**Muskingum K:**					**0.340**
#28	8. Large gullies, diversions, and low flowing streams	2.16	35.00	1,618.04	4.41	0.101
#28	**Muskingum K:**					**0.101**
#29	8. Large gullies, diversions, and low flowing streams	0.81	52.00	6,415.80	2.70	0.660
#29	**Muskingum K:**					**0.660**
#31	8. Large gullies, diversions, and low flowing streams	0.69	17.00	2,459.00	2.49	0.274

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#31	**Muskingum K:**					**0.274**
#32	8. Large gullies, diversions, and low flowing streams	1.14	53.00	4,654.00	3.20	0.403
#32	**Muskingum K:**					**0.403**
#33	8. Large gullies, diversions, and low flowing streams	0.83	42.00	5,032.70	2.74	0.510
#33	**Muskingum K:**					**0.510**
#34	5. Nearly bare and untilled, and alluvial valley fans	1.32	33.00	2,492.07	1.15	0.601
#34	**Muskingum K:**					**0.601**
#35	8. Large gullies, diversions, and low flowing streams	2.44	33.00	1,354.01	4.68	0.080
#35	**Muskingum K:**					**0.080**
#36	8. Large gullies, diversions, and low flowing streams	1.96	60.00	3,062.00	4.19	0.202
#36	**Muskingum K:**					**0.202**
#37	5. Nearly bare and untilled, and alluvial valley fans	1.35	55.00	4,071.00	1.16	0.974
	8. Large gullies, diversions, and low flowing streams	1.49	146.00	9,792.00	3.66	0.743
#37	**Muskingum K:**					**1.717**
#38	8. Large gullies, diversions, and low flowing streams	1.19	23.00	1,938.00	3.26	0.165
#38	**Muskingum K:**					**0.165**
#39	8. Large gullies, diversions, and low flowing streams	1.04	39.00	3,758.00	3.05	0.342
#39	**Muskingum K:**					**0.342**
#41	8. Large gullies, diversions, and low flowing streams	0.99	23.00	2,325.20	2.98	0.216
#41	**Muskingum K:**					**0.216**
#42	5. Nearly bare and untilled, and alluvial valley fans	1.84	132.00	7,189.15	1.35	1.479
#42	**Muskingum K:**					**1.479**
#43	5. Nearly bare and untilled, and alluvial valley fans	2.73	47.00	1,722.00	1.65	0.289
#43	**Muskingum K:**					**0.289**
#44	8. Large gullies, diversions, and low flowing streams	0.83	50.00	5,994.90	2.73	0.609
#44	**Muskingum K:**					**0.609**
#45	8. Large gullies, diversions, and low flowing streams	1.71	42.00	2,456.80	3.92	0.174
#45	**Muskingum K:**					**0.174**
#46	8. Large gullies, diversions, and low flowing streams	1.65	122.00	7,378.00	3.85	0.532
#46	**Muskingum K:**					**0.532**
#47	8. Large gullies, diversions, and low flowing streams	1.50	102.00	6,814.00	3.67	0.515

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#47	**Muskingum K:**					**0.515**
#48	8. Large gullies, diversions, and low flowing streams	1.04	67.00	6,452.00	3.05	0.587
#48	**Muskingum K:**					**0.587**
#49	8. Large gullies, diversions, and low flowing streams	1.17	92.00	7,838.00	3.25	0.669
#49	**Muskingum K:**					**0.669**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#35	105.000	105.000	90.41	4.68	294.7	67,189	42.39	28.59
#26	217.200	217.200	293.53	16.84	1,712.3	102,780	8.09	5.69
#29	26.000	243.200	282.87	19.36	1,714.3	93,056	6.48	4.40
#43	809.500	809.500	143.18	33.86	389.7	11,471	4.58	3.37
#22	163.500	163.500	185.62	12.13	1,092.0	91,488	4.87	3.42
#30	142.400	1,115.400	247.35	56.63	1,662.4	64,764	8.95	2.94
#19	451.400	451.400	229.24	26.27	1,188.2	45,487	24.94	17.96
#33	0.000	1,566.800	472.33	82.90	2,850.7	55,253	17.07	7.70
#18	126.600	1,693.400	464.22	86.30	2,848.6	53,606	16.26	7.26
#37	3,024.600	3,024.600	212.29	97.91	516.9	5,262	1.04	0.78
#4	2,965.700	5,990.300	754.26	207.15	1,678.1	10,606	4.22	2.36
#1	755.100	755.100	125.01	25.58	210.0	8,215	3.43	2.52
#42	2,360.600	3,115.700	240.07	110.64	497.6	4,766	1.16	0.80
#3	1,550.000	4,665.700	341.85	184.57	924.0	7,844	2.16	1.01
#5	0.000	10,656.000	976.83	391.72	2,602.1	9,817	3.48	1.73
#6	2,008.700	12,664.700	1,228.78	485.77	6,276.6	63,341	10.31	1.53
#40	231.000	14,832.300	1,400.49	600.43	11,161.1	67,647	12.78	2.55
#34	235.300	235.300	22.80	5.65	28.7	5,038	1.78	1.32
#16	1,570.700	1,570.700	141.75	40.02	189.6	4,698	1.52	1.13
#14	6,695.200	6,695.200	336.25	231.98	1,659.7	21,089	7.20	1.81
#38	0.000	8,501.199	407.42	277.65	1,877.9	15,109	5.14	1.71
#39	0.000	8,501.199	406.29	277.65	1,877.9	322,705	109.71	1.71
#15	539.400	9,040.600	428.54	292.09	1,989.1	14,393	4.88	1.71
#41	0.000	23,872.900	1,743.15	892.52	13,150.2	44,696	9.45	2.28
#31	148.400	148.400	72.81	3.99	112.6	31,382	19.86	13.00
#17	939.500	939.500	175.15	28.18	402.9	29,770	14.97	5.25
#32	153.600	25,114.400	1,776.95	928.81	13,594.1	37,591	8.26	2.36
#49	10.780	10.780	26.44	1.04	99.0	91,072	23.64	17.54
#48	8.290	8.290	20.33	0.80	73.8	88,347	22.94	17.01
#47	12.350	12.350	30.29	1.20	115.3	92,515	24.02	17.82
#46	6.480	6.480	15.89	0.63	56.0	85,862	22.29	16.53
#11	151.040	151.040	227.39	11.76	1,200.4	102,828	9.93	7.00
#10	34.470	34.470	84.55	3.34	322.4	92,672	24.06	17.85
#9	69.790	69.790	112.64	5.50	500.9	91,390	10.83	7.70
#8	28.530	28.530	69.98	2.76	242.7	84,555	21.95	16.28
#7	201.870	201.870	224.36	15.03	1,377.8	92,955	4.55	3.20
#44	201.750	687.450	584.88	53.99	4,500.7	1,682,639	347.57	12.34

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#36	12.330	12.330	30.24	1.19	92.8	75,109	19.50	14.45
#21	63.380	63.380	102.30	4.99	569.7	113,398	13.43	9.57
#13	25.880	25.880	41.77	2.04	110.8	55,323	6.55	4.65
#12	78.130	78.130	126.11	6.16	416.0	68,437	8.11	5.75
#27	210.960	1,078.130	643.72	74.02	5,864.9	2,424,149	489.40	11.49
#45	15.500	1,093.630	627.59	75.52	5,769.6	86,816	16.59	10.50
#25	343.070	343.070	228.94	21.03	1,311.3	62,941	0.00	0.00
#28	570.420	2,045.020	888.17	115.51	7,876.5	2,312,423	424.95	9.03
#23	192.200	27,456.620	1,830.13	1,054.15	21,937.1	1,446,411	311.34	3.27
#24	201.360	27,657.980	1,821.22	1,069.19	22,819.8	93,869	18.02	2.99

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Particle Size Distribution(s) at Each Structure

Structure #35 (S35):

Size (mm)	In/Out
2.0000	100.000%
0.1000	44.229%
0.0500	25.063%
0.0020	16.217%
0.0010	0.000%

Structure #26 (S26):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	78.190%
0.0010	0.000%

Structure #29 (S29):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.589%
0.0500	98.033%
0.0020	82.891%
0.0010	0.000%

Structure #43 (S43):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	59.498%
0.0020	38.499%

Size (mm)	In/Out
0.0010	0.000%

Structure #22 (S22):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	85.043%
0.0010	0.000%

Structure #30 (S30):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.514%
0.0020	73.088%
0.0010	0.000%

Structure #19 (S19):

Size (mm)	In/Out
2.0000	100.000%
0.1000	65.869%
0.0500	37.326%
0.0020	24.152%
0.0010	0.000%

Structure #33 (S33):

Size (mm)	In/Out
2.0000	100.000%
0.1000	85.773%
0.0500	68.343%
0.0020	52.690%
0.0010	0.000%

Structure #18 (S18):

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.241%
0.0500	69.135%
0.0020	53.312%
0.0010	0.000%

Structure #37 (S37):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.097%
0.0020	58.298%
0.0010	0.000%

Structure #4 (S4):

Size (mm)	In/Out
2.0000	100.000%
0.1000	86.776%
0.0500	59.783%
0.0020	38.683%
0.0010	0.000%

Structure #1 (S1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	56.763%
0.0020	36.729%
0.0010	0.000%

Structure #42 (S42):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.574%
0.0500	81.532%
0.0020	55.454%

Size (mm)	In/Out
0.0010	0.000%

Structure #3 (S3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	73.419%
0.0020	55.840%
0.0010	0.000%

Structure #5 (S5):

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.472%
0.0500	64.625%
0.0020	44.776%
0.0010	0.000%

Structure #6 (S6):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.470%
0.0500	85.170%
0.0020	72.733%
0.0010	0.000%

Structure #40 (S40):

Size (mm)	In/Out
2.0000	100.000%
0.1000	94.594%
0.0500	82.558%
0.0020	68.683%
0.0010	0.000%

Structure #34 (S34):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	66.412%
0.0020	42.973%
0.0010	0.000%

Structure #16 (S16):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	70.868%
0.0020	45.856%
0.0010	0.000%

Structure #14 (S14):

Size (mm)	In/Out
2.0000	100.000%
0.1000	86.489%
0.0500	66.278%
0.0020	46.287%
0.0010	0.000%

Structure #38 (S38 at Doby Channel):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.059%
0.0500	66.743%
0.0020	46.193%
0.0010	0.000%

Structure #39 (S39 at Doby Permanent Imp.):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.059%
0.0500	66.743%
0.0020	46.193%

Size (mm)	In/Out
0.0010	0.000%

Structure #15 (S15):

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.100%
0.0500	66.691%
0.0020	46.501%
0.0010	0.000%

Structure #41 (S41):

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.914%
0.0500	80.158%
0.0020	65.328%
0.0010	0.000%

Structure #31 (S31):

Size (mm)	In/Out
2.0000	100.000%
0.1000	43.704%
0.0500	23.089%
0.0020	18.141%
0.0010	0.000%

Structure #17 (S17):

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.122%
0.0500	41.977%
0.0020	31.094%
0.0010	0.000%

Structure #32 (S32):

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.699%
0.0500	79.099%
0.0020	64.363%
0.0010	0.000%

Structure #49 (S49 at PP-0):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #48 (S48 at PP-2):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #47 (S47 at PP-3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #46 (S46 at PP-3A):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%

Size (mm)	In/Out
0.0010	0.000%

Structure #11 (S11 at PP-7):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	73.603%
0.0010	0.000%

Structure #10 (S10 at PP-8):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #9 (S9 at PP-9):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #8 (S8 at PP-11):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #7 (S7):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	86.231%
0.0010	0.000%

Structure #44 (S44):

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.112%
0.0500	82.120%
0.0020	64.351%
0.0010	0.000%

Structure #36 (S36 at PP-3C):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #21 (S21 at PP-3B):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #13 (S13 at PP-4):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%

Size (mm)	In/Out
0.0010	0.000%

Structure #12 (S12 at PP-5):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #27 (S27):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.569%
0.0500	83.335%
0.0020	64.210%
0.0010	0.000%

Structure #45 (S45):

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.272%
0.0500	84.838%
0.0020	65.371%
0.0010	0.000%

Structure #25 (S25 at PP-1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #28 (S28):

Size (mm)	In/Out
2.0000	100.000%
0.1000	89.835%
0.0500	83.959%
0.0020	68.394%
0.0010	0.000%

Structure #23 (S23 at PP-1A):

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.324%
0.0500	79.715%
0.0020	64.830%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.965%
0.0500	82.805%
0.0020	67.514%
0.0010	0.000%

Structure Detail:

Structure #35 (Null)

S35

Structure #26 (Null)

S26

Structure #29 (Null)

S29

Structure #43 (Null)

S43

Structure #22 (Null)

S22

Structure #30 (Null)

S30

Structure #19 (Null)

S19

Structure #33 (Null)

S33

Structure #18 (Null)

S18

Structure #37 (Null)

S37

Structure #4 (Null)

S4

Structure #1 (Null)

S1

Structure #42 (Null)

S42

Structure #3 (Null)

S3

Structure #5 (Null)

S5

Structure #6 (Null)

S6

Structure #40 (Null)

S40

Structure #34 (Null)

S34

Structure #16 (Null)

S16

Structure #14 (Null)

S14

Structure #38 (Null)

S38 at Doby Channel

Structure #39 (Null)

S39 at Doby Permanent Imp.

Structure #15 (Null)

S15

Structure #41 (Null)

S41

Structure #31 (Null)

S31

Structure #17 (Null)

S17

Structure #32 (Null)

S32

Structure #49 (Null)

S49 at PP-0

Structure #48 (Null)

S48 at PP-2

Structure #47 (Null)

S47 at PP-3

Structure #46 (Null)

S46 at PP-3A

Structure #11 (Null)

S11 at PP-7

Structure #10 (Null)

S10 at PP-8

Structure #9 (Null)

S9 at PP-9

Structure #8 (Null)

S8 at PP-11

Structure #7 (Null)

S7

Structure #44 (Null)

S44

Structure #36 (Null)

S36 at PP-3C

Structure #21 (Null)

S21 at PP-3B

Structure #13 (Null)

S13 at PP-4

Structure #12 (Null)

S12 at PP-5

Structure #27 (Null)

S27

Structure #45 (Null)

S45

Structure #25 (Null)

S25 at PP-1

Structure #28 (Null)

S28

Structure #23 (Null)

S23 at PP-1A

Structure #24 (Null)

S24

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#35	1	105.000	0.255	0.000	0.000	82.400	M	90.41	4.680
	Σ	**105.000**						**90.41**	**4.680**
#26	1	217.200	0.311	0.000	0.000	91.000	M	293.53	16.840
	Σ	**217.200**						**293.53**	**16.840**
#29	1	26.000	0.083	0.000	0.000	91.000	M	63.77	2.517
	Σ	**243.200**						**282.87**	**19.357**
#43	1	809.500	2.463	0.000	0.000	81.600	M	143.18	33.863
	Σ	**809.500**						**143.18**	**33.863**
#22	1	163.500	0.425	0.000	0.000	90.300	M	185.62	12.132
	Σ	**163.500**						**185.62**	**12.132**
#30	1	142.400	0.245	0.000	0.000	90.300	M	200.93	10.634
	Σ	**1,115.400**						**247.35**	**56.629**
#19	1	451.400	1.009	0.000	0.000	86.500	M	229.24	26.272
	Σ	**451.400**						**229.24**	**26.272**
#33	Σ	**1,566.800**						**472.33**	**82.901**
#18	1	126.600	0.592	0.000	0.000	75.700	M	40.53	3.397
	Σ	**1,693.400**						**464.22**	**86.298**
#37	1	3,024.600	5.355	0.000	0.000	78.100	M	212.29	97.907
	Σ	**3,024.600**						**212.29**	**97.907**
#4	1	654.900	1.236	0.423	0.345	79.900	M	176.18	24.261
	2	699.700	1.092	0.423	0.345	78.500	M	184.60	23.363
	3	547.300	0.989	0.423	0.345	78.100	M	150.28	17.725
	4	1,063.800	1.498	0.000	0.000	81.400	M	276.84	43.892
	Σ	**5,990.300**						**754.26**	**207.147**
#1	1	755.100	2.032	0.000	0.000	78.700	M	125.01	25.584
	Σ	**755.100**						**125.01**	**25.584**
#42	1	1,327.100	2.923	3.078	0.144	77.200	M	144.33	40.069
	2	894.200	3.620	0.000	0.000	82.100	M	118.76	38.738
	3	139.300	1.214	0.000	0.000	82.600	M	46.72	6.249
	Σ	**3,115.700**						**240.07**	**110.640**
#3	1	1,550.000	2.670	0.000	0.000	83.500	M	294.26	73.934

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**4,665.700**						**341.85**	**184.574**
#5	Σ	**10,656.000**						**976.83**	**391.721**
#6	1	505.100	2.338	0.620	0.328	76.200	M	60.61	14.086
	2	638.400	4.585	0.478	0.304	78.800	M	54.07	21.791
	3	557.000	2.219	0.000	0.000	88.100	M	169.37	35.883
	4	308.200	0.485	0.478	0.304	89.900	M	318.21	22.286
	Σ	**12,664.700**						**1,228.78**	**485.767**
#40	1	190.700	1.159	0.000	0.000	75.700	M	37.93	5.108
	2	40.300	0.082	0.757	0.302	91.000	M	98.85	3.902
	Σ	**14,832.300**						**1,400.49**	**600.432**
#34	1	235.300	2.496	0.000	0.000	74.400	M	22.80	5.651
	Σ	**235.300**						**22.80**	**5.651**
#16	1	1,570.700	2.944	0.000	0.000	75.100	M	141.75	40.016
	Σ	**1,570.700**						**141.75**	**40.016**
#14	1	2,999.900	5.968	5.461	0.261	77.600	M	184.13	93.439
	2	1,855.400	3.914	1.286	0.322	78.800	M	179.79	63.334
	3	730.800	1.418	0.000	0.000	85.400	M	265.60	39.576
	4	1,109.100	2.763	1.418	0.312	78.000	M	134.96	35.631
	Σ	**6,695.200**						**336.25**	**231.979**
#38	Σ	**8,501.199**						**407.42**	**277.646**
#39	Σ	**8,501.199**						**406.29**	**277.646**
#15	1	539.400	1.116	0.000	0.000	75.700	M	110.36	14.444
	Σ	**9,040.600**						**428.54**	**292.090**
#41	Σ	**23,872.900**						**1,743.15**	**892.522**
#31	1	148.400	0.298	0.000	0.000	75.700	M	72.81	3.989
	Σ	**148.400**						**72.81**	**3.989**
#17	1	823.800	1.069	0.713	0.220	75.700	M	174.02	22.069
	2	115.700	0.456	0.000	0.000	85.000	M	89.66	6.108
	Σ	**939.500**						**175.15**	**28.177**
#32	1	118.100	0.555	0.108	0.329	75.700	M	39.51	3.165
	2	35.500	0.245	0.000	0.000	75.700	M	19.21	0.960
	Σ	**25,114.400**						**1,776.95**	**928.814**
#49	1	10.780	0.065	0.000	0.000	91.000	M	26.44	1.044

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**10.780**						**26.44**	**1.044**
#48	1	8.290	0.045	0.000	0.000	91.000	M	20.33	0.803
	Σ	**8.290**						**20.33**	**0.803**
#47	1	12.350	0.059	0.000	0.000	91.000	M	30.29	1.196
	Σ	**12.350**						**30.29**	**1.196**
#46	1	6.480	0.048	0.000	0.000	91.000	M	15.89	0.627
	Σ	**6.480**						**15.89**	**0.627**
#11	1	151.040	0.223	0.000	0.000	91.000	M	227.39	11.765
	Σ	**151.040**						**227.39**	**11.765**
#10	1	34.470	0.114	0.000	0.000	91.000	M	84.55	3.338
	Σ	**34.470**						**84.55**	**3.338**
#9	1	69.790	0.147	0.000	0.000	91.000	M	112.64	5.499
	Σ	**69.790**						**112.64**	**5.499**
#8	1	28.530	0.100	0.000	0.000	91.000	M	69.98	2.762
	Σ	**28.530**						**69.98**	**2.762**
#7	1	201.870	0.448	0.000	0.000	90.400	M	224.36	15.035
	Σ	**201.870**						**224.36**	**15.035**
#44	1	201.750	0.552	0.000	0.000	91.000	M	206.85	15.587
	Σ	**687.450**						**584.88**	**53.985**
#36	1	12.330	0.045	0.000	0.000	91.000	M	30.24	1.194
	Σ	**12.330**						**30.24**	**1.194**
#21	1	63.380	0.148	0.000	0.000	91.000	M	102.30	4.994
	Σ	**63.380**						**102.30**	**4.994**
#13	1	25.880	0.150	0.000	0.000	91.000	M	41.77	2.039
	Σ	**25.880**						**41.77**	**2.039**
#12	1	78.130	0.143	0.000	0.000	91.000	M	126.11	6.157
	Σ	**78.130**						**126.11**	**6.157**
#27	1	210.960	0.549	0.000	0.000	75.700	M	71.09	5.655
	Σ	**1,078.130**						**643.72**	**74.024**
#45	1	15.500	0.077	0.000	0.000	91.000	M	38.02	1.501
	Σ	**1,093.630**						**627.59**	**75.524**
#25	1	343.070	0.737	0.000	0.000	87.300	M	228.94	21.028

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**343.070**						**228.94**	**21.028**
#28	1	349.420	0.740	0.000	0.000	75.700	M	95.67	9.365
	2	221.000	0.613	0.253	0.339	75.700	M	69.05	5.923
	Σ	**2,045.020**						**888.17**	**115.510**
#23	1	192.200	0.380	0.000	0.000	75.700	M	82.13	5.150
	Σ	**27,456.620**						**1,830.13**	**1,054.154**
#24	1	201.360	0.410	0.000	0.000	90.400	M	234.07	15.038
	Σ	**27,657.980**						**1,821.22**	**1,069.193**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#35	1	0.220	125.00	9.30	0.3080	1.0000	2	294.7	67,189	42.39	28.59
	Σ							**294.7**	**67,189**	**42.39**	**28.59**
#26	1	0.209	75.00	12.70	0.3940	1.0000	3	1,712.3	102,780	8.09	5.69
	Σ							**1,712.3**	**102,780**	**8.09**	**5.69**
#29	1	0.210	150.00	7.20	0.3990	1.0000	3	146.6	56,711	14.72	10.90
	Σ							**1,714.3**	**93,056**	**6.48**	**4.40**
#43	1	0.183	200.00	3.30	0.3520	1.0000	2	389.7	11,471	4.58	3.37
	Σ							**389.7**	**11,471**	**4.58**	**3.37**
#22	1	0.205	100.00	11.40	0.3870	1.0000	3	1,092.0	91,488	4.87	3.42
	Σ							**1,092.0**	**91,488**	**4.87**	**3.42**
#30	1	0.207	200.00	3.70	0.2070	1.0000	3	181.1	17,861	1.61	1.12
	Σ							**1,662.4**	**64,764**	**8.95**	**2.94**
#19	1	0.187	150.00	7.70	0.3940	1.0000	2	1,188.2	45,487	24.94	17.96
	Σ							**1,188.2**	**45,487**	**24.94**	**17.96**
#33	Σ							**2,850.7**	**55,253**	**17.07**	**7.70**
#18	1	0.190	175.00	4.30	0.3150	1.0000	1	72.1	22,410	13.17	9.11
	Σ							**2,848.6**	**53,606**	**16.26**	**7.26**
#37	1	0.150	400.00	2.00	0.3220	1.0000	2	516.9	5,262	1.04	0.78
	Σ							**516.9**	**5,262**	**1.04**	**0.78**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#4	1	0.160	400.00	2.00	0.3320	1.0000	2	234.4	9,756	4.86	3.52
	2	0.130	200.00	3.50	0.3070	1.0000	2	238.7	10,355	5.25	3.79
	3	0.147	200.00	3.70	0.2900	1.0000	2	205.0	11,764	6.08	4.38
	4	0.121	175.00	4.20	0.2900	1.0000	2	509.0	11,685	5.59	4.07
	Σ							**1,678.1**	**10,606**	**4.22**	**2.36**
#1	1	0.147	300.00	2.80	0.3070	1.0000	2	210.0	8,215	3.43	2.52
	Σ							**210.0**	**8,215**	**3.43**	**2.52**
#42	1	0.142	300.00	2.10	0.3360	1.0000	2	238.9	5,856	1.99	1.49
	2	0.167	400.00	1.20	0.3480	1.0000	2	173.1	4,453	1.44	1.06
	3	0.180	400.00	1.60	0.3370	1.0000	2	49.1	7,980	4.08	2.95
	Σ							**497.6**	**4,766**	**1.16**	**0.80**
#3	1	0.179	300.00	2.00	0.3420	1.0000	2	616.6	8,321	3.29	2.42
	Σ							**924.0**	**7,844**	**2.16**	**1.01**
#5	Σ							**2,602.1**	**9,817**	**3.48**	**1.73**
#6	1	0.170	200.00	3.30	0.3350	1.0000	2	130.2	9,164	3.46	2.56
	2	0.176	200.00	3.70	0.3370	1.0000	2	180.7	8,222	2.01	1.49
	3	0.196	100.00	10.70	0.3770	1.0000	3	1,627.0	44,766	0.00	0.00
	4	0.203	100.00	10.60	0.3800	1.0000	3	1,824.4	82,026	3.21	2.29
	Σ							**6,276.6**	**63,341**	**10.31**	**1.53**
#40	1	0.190	175.00	4.40	0.3150	1.0000	1	89.3	17,739	9.28	6.69
	2	0.210	150.00	7.20	0.3990	1.0000	3	239.5	61,073	15.86	11.48
	Σ							**11,161.1**	**67,647**	**12.78**	**2.55**
#34	1	0.109	300.00	2.60	0.3650	1.0000	2	28.7	5,038	1.78	1.32
	Σ							**28.7**	**5,038**	**1.78**	**1.32**
#16	1	0.120	400.00	1.70	0.3520	1.0000	2	189.6	4,698	1.52	1.13
	Σ							**189.6**	**4,698**	**1.52**	**1.13**
#14	1	0.175	400.00	1.30	0.3310	1.0000	2	385.8	4,094	0.66	0.50
	2	0.175	300.00	2.00	0.3170	1.0000	2	388.8	6,076	1.73	1.28
	3	0.189	175.00	4.70	0.3530	1.0000	2	992.0	25,169	12.69	9.22
	4	0.256	300.00	2.10	0.3050	1.0000	2	352.6	9,774	3.48	2.58
	Σ							**1,659.7**	**21,089**	**7.20**	**1.81**
#38	Σ							**1,877.9**	**15,109**	**5.14**	**1.71**
#39	Σ							**1,877.9**	**322,705**	**109.71**	**1.71**
#15	1	0.190	200.00	3.30	0.3150	1.0000	1	194.2	13,679	7.21	5.19

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**1,989.1**	**14,393**	**4.88**	**1.71**
#41	Σ							**13,150.2**	**44,696**	**9.45**	**2.28**
#31	1	0.190	175.00	4.43	0.3150	1.0000	1	112.6	31,382	19.86	13.00
	Σ							**112.6**	**31,382**	**19.86**	**13.00**
#17	1	0.190	200.00	3.20	0.3150	1.0000	1	308.7	14,065	7.48	5.45
	2	0.197	150.00	6.30	0.2820	1.0000	2	193.0	33,226	20.21	13.98
	Σ							**402.9**	**29,770**	**14.97**	**5.25**
#32	1	0.190	300.00	3.00	0.3150	1.0000	1	48.3	16,133	9.56	6.61
	2	0.190	300.00	2.40	0.3150	1.0000	1	13.4	15,832	10.16	6.57
	Σ							**13,594.1**	**37,591**	**8.26**	**2.36**
#49	1	0.210	75.00	14.40	0.3990	1.0000	3	99.0	91,072	23.64	17.54
	Σ							**99.0**	**91,072**	**23.64**	**17.54**
#48	1	0.210	75.00	14.40	0.3990	1.0000	3	73.8	88,347	22.94	17.01
	Σ							**73.8**	**88,347**	**22.94**	**17.01**
#47	1	0.210	75.00	14.40	0.3990	1.0000	3	115.3	92,515	24.02	17.82
	Σ							**115.3**	**92,515**	**24.02**	**17.82**
#46	1	0.210	75.00	14.40	0.3990	1.0000	3	56.0	85,862	22.29	16.53
	Σ							**56.0**	**85,862**	**22.29**	**16.53**
#11	1	0.204	75.00	12.80	0.3960	1.0000	3	1,200.4	102,828	9.93	7.00
	Σ							**1,200.4**	**102,828**	**9.93**	**7.00**
#10	1	0.210	75.00	13.10	0.3990	1.0000	3	322.4	92,672	24.06	17.85
	Σ							**322.4**	**92,672**	**24.06**	**17.85**
#9	1	0.210	100.00	10.60	0.3990	1.0000	3	500.9	91,390	10.83	7.70
	Σ							**500.9**	**91,390**	**10.83**	**7.70**
#8	1	0.210	75.00	12.40	0.3990	1.0000	3	242.7	84,555	21.95	16.28
	Σ							**242.7**	**84,555**	**21.95**	**16.28**
#7	1	0.211	100.00	11.10	0.3920	1.0000	3	1,377.8	92,955	4.55	3.20
	Σ							**1,377.8**	**92,955**	**4.55**	**3.20**
#44	1	0.210	150.00	6.90	0.3990	1.0000	1	857.0	56,113	35.62	25.20
	Σ							**4,500.7**	**1,682,639**	**347.57**	**12.34**
#36	1	0.210	75.00	12.20	0.3990	1.0000	3	92.8	75,109	19.50	14.45
	Σ							**92.8**	**75,109**	**19.50**	**14.45**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#21	1	0.210	75.00	14.40	0.3990	1.0000	3	569.7	113,398	13.43	9.57
	Σ							**569.7**	**113,398**	**13.43**	**9.57**
#13	1	0.210	150.00	6.90	0.3990	1.0000	3	110.8	55,323	6.55	4.65
	Σ							**110.8**	**55,323**	**6.55**	**4.65**
#12	1	0.201	150.00	8.00	0.3940	1.0000	3	416.0	68,437	8.11	5.75
	Σ							**416.0**	**68,437**	**8.11**	**5.75**
#27	1	0.190	150.00	6.70	0.3150	1.0000	1	185.5	34,664	20.58	14.16
	Σ							**5,864.9**	**2,424,149**	**489.40**	**11.49**
#45	1	0.190	175.00	5.90	0.3150	1.0000	1	52.4	34,304	23.97	17.72
	Σ							**5,769.6**	**86,816**	**16.59**	**10.50**
#25	1	0.186	100.00	10.46	0.3770	1.0000	3	1,311.3	62,941	0.00	0.00
	Σ							**1,311.3**	**62,941**	**0.00**	**0.00**
#28	1	0.190	175.00	5.90	0.3150	1.0000	1	278.0	30,664	17.43	12.28
	2	0.190	175.00	5.90	0.3150	1.0000	1	179.2	31,444	18.39	12.87
	Σ							**7,876.5**	**2,312,423**	**424.95**	**9.03**
#23	1	0.190	150.00	6.70	0.3150	1.0000	1	190.9	40,345	24.99	16.67
	Σ							**21,937.1**	**1,446,411**	**311.34**	**3.27**
#24	1	0.211	100.00	11.10	0.3920	1.0000	3	1,408.8	95,098	5.39	3.79
	Σ							**22,819.8**	**93,869**	**18.02**	**2.99**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.45	103.00	2,312.00	2.110	0.304
		8. Large gullies, diversions, and low flowing streams	2.03	110.00	5,414.45	4.270	0.352
		5. Nearly bare and untilled, and alluvial valley fans	1.57	97.00	6,194.12	1.250	1.376
#1	**1**	**Time of Concentration:**					**2.032**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.32	140.00	10,633.45	1.140	2.590
		8. Large gullies, diversions, and low flowing streams	5.53	113.00	2,042.00	7.050	0.080
#3	**1**	**Time of Concentration:**					**2.670**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.72	60.00	3,483.10	1.310	0.738

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.45	94.00	6,477.39	3.610	0.498
#4	**1**	**Time of Concentration:**					**1.236**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	5.90	110.00	1,863.01	2.420	0.213
		8. Large gullies, diversions, and low flowing streams	1.43	163.00	11,361.26	3.590	0.879
#4	**2**	**Time of Concentration:**					**1.092**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	5.81	100.00	1,722.00	2.400	0.199
		8. Large gullies, diversions, and low flowing streams	2.04	248.00	12,174.16	4.280	0.790
#4	**3**	**Time of Concentration:**					**0.989**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	4.95	105.00	2,123.01	2.220	0.265
		8. Large gullies, diversions, and low flowing streams	1.96	366.00	18,657.28	4.200	1.233
#4	**4**	**Time of Concentration:**					**1.498**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.36	125.00	9,201.32	1.160	2.203
		8. Large gullies, diversions, and low flowing streams	3.46	94.00	2,715.03	5.580	0.135
#6	**1**	**Time of Concentration:**					**2.338**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	0.88	130.00	14,813.12	0.930	4.424
		8. Large gullies, diversions, and low flowing streams	4.76	181.00	3,801.00	6.540	0.161
#6	**2**	**Time of Concentration:**					**4.585**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	0.70	35.00	5,028.01	0.830	1.682
		8. Large gullies, diversions, and low flowing streams	2.49	228.00	9,161.04	4.730	0.537
#6	**3**	**Time of Concentration:**					**2.219**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	73.00	1,752.02	2.040	0.238
		8. Large gullies, diversions, and low flowing streams	3.61	183.00	5,073.04	5.690	0.247
#6	**4**	**Time of Concentration:**					**0.485**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	42.00	852.50	2.210	0.107
		8. Large gullies, diversions, and low flowing streams	2.93	185.00	6,312.20	5.130	0.341
#7	**1**	**Time of Concentration:**					**0.448**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	5.03	12.00	238.70	2.240	0.029
		8. Large gullies, diversions, and low flowing streams	5.35	95.00	1,777.10	6.930	0.071
#8	**1**	**Time of Concentration:**					**0.100**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	1	5. Nearly bare and untilled, and alluvial valley fans	20.30	20.00	98.50	4.500	0.006
		8. Large gullies, diversions, and low flowing streams	5.55	200.00	3,604.00	7.060	0.141
#9	**1**	**Time of Concentration:**					**0.147**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	21.56	105.00	487.10	4.640	0.029
		8. Large gullies, diversions, and low flowing streams	4.91	100.00	2,035.10	6.650	0.085
#10	**1**	**Time of Concentration:**					**0.114**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.06	45.00	320.00	3.750	0.023
		8. Large gullies, diversions, and low flowing streams	4.63	215.00	4,646.90	6.450	0.200
#11	**1**	**Time of Concentration:**					**0.223**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	16.38	25.00	152.60	4.040	0.010
		8. Large gullies, diversions, and low flowing streams	5.07	165.00	3,254.40	6.750	0.133
#12	**1**	**Time of Concentration:**					**0.143**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	27.00	777.50	1.860	0.116
		8. Large gullies, diversions, and low flowing streams	8.69	95.00	1,093.40	8.840	0.034
#13	**1**	**Time of Concentration:**					**0.150**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	1.01	216.00	21,486.12	1.000	5.968
#14	**1**	**Time of Concentration:**					**5.968**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	1.41	235.00	16,630.10	1.180	3.914
#14	**2**	**Time of Concentration:**					**3.914**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	2.19	43.00	1,966.00	1.470	0.371
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**3**	**Time of Concentration:**					**1.418**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	1.08	112.00	10,345.00	1.040	2.763
#14	**4**	**Time of Concentration:**					**2.763**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	1.51	43.00	2,851.08	1.220	0.649
		8. Large gullies, diversions, and low flowing streams	2.54	42.00	1,652.04	4.780	0.096
		8. Large gullies, diversions, and low flowing streams	1.03	42.00	4,065.04	3.040	0.371
#15	**1**	**Time of Concentration:**					**1.116**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.30	105.00	8,103.10	1.130	1.991
		8. Large gullies, diversions, and low flowing streams	0.15	6.00	3,981.42	1.160	0.953
#16	**1**	**Time of Concentration:**					**2.944**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	2.55	70.00	2,746.30	1.590	0.479
		8. Large gullies, diversions, and low flowing streams	1.66	137.00	8,228.09	3.870	0.590
#17	**1**	**Time of Concentration:**					**1.069**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	4.36	149.00	3,419.07	2.080	0.456
#17	**2**	**Time of Concentration:**					**0.456**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	2.56	25.00	977.70	1.590	0.170
		8. Large gullies, diversions, and low flowing streams	1.06	50.00	4,705.29	3.090	0.422
#18	**1**	**Time of Concentration:**					**0.592**
#19	1	5. Nearly bare and untilled, and alluvial valley fans	4.92	45.00	914.00	2.210	0.114
		8. Large gullies, diversions, and low flowing streams	2.64	185.00	7,019.00	4.870	0.400
		5. Nearly bare and untilled, and alluvial valley fans	1.12	21.00	1,872.15	1.050	0.495
#19	**1**	**Time of Concentration:**					**1.009**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	30.00	307.10	3.120	0.027
		8. Large gullies, diversions, and low flowing streams	4.96	145.00	2,924.38	6.680	0.121
#21	**1**	**Time of Concentration:**					**0.148**
#22	1	5. Nearly bare and untilled, and alluvial valley fans	4.15	54.00	1,300.01	2.030	0.177
		8. Large gullies, diversions, and low flowing streams	3.22	155.00	4,807.09	5.380	0.248
#22	**1**	**Time of Concentration:**					**0.425**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	6.91	43.00	622.00	2.620	0.065
		8. Large gullies, diversions, and low flowing streams	2.65	147.00	5,545.07	4.880	0.315
#23	**1**	**Time of Concentration:**					**0.380**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	5.30	55.00	1,038.01	2.300	0.125
		8. Large gullies, diversions, and low flowing streams	3.06	191.00	6,252.04	5.240	0.331
#24	**1**	**Time of Concentration:**					**0.410**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	55.00	1,583.00	1.860	0.236
		8. Large gullies, diversions, and low flowing streams	3.07	291.00	9,483.00	5.250	0.501

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	**1**	**Time of Concentration:**					**0.737**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	9.72	75.00	772.00	3.110	0.068
		8. Large gullies, diversions, and low flowing streams	3.54	175.00	4,938.06	5.640	0.243
#26	**1**	**Time of Concentration:**					**0.311**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	22.00	475.80	2.150	0.061
		8. Large gullies, diversions, and low flowing streams	1.58	105.00	6,636.00	3.770	0.488
#27	**1**	**Time of Concentration:**					**0.549**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	2.41	30.00	1,246.00	1.550	0.223
		8. Large gullies, diversions, and low flowing streams	1.19	72.00	6,071.40	3.260	0.517
#28	**1**	**Time of Concentration:**					**0.740**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	8.54	125.00	1,463.00	2.920	0.139
		8. Large gullies, diversions, and low flowing streams	0.78	35.00	4,506.00	2.640	0.474
#28	**2**	**Time of Concentration:**					**0.613**
#29	1	8. Large gullies, diversions, and low flowing streams	3.10	49.00	1,581.61	5.280	0.083
#29	**1**	**Time of Concentration:**					**0.083**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	5.85	40.00	684.20	2.410	0.078
		8. Large gullies, diversions, and low flowing streams	2.10	55.00	2,622.00	4.340	0.167
#30	**1**	**Time of Concentration:**					**0.245**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.79	25.00	895.90	1.670	0.149
		9. Small streams flowing bankfull	1.16	60.00	5,192.70	9.670	0.149
#31	**1**	**Time of Concentration:**					**0.298**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	5.14	35.00	681.00	2.260	0.083
		8. Large gullies, diversions, and low flowing streams	2.98	88.00	2,957.08	5.170	0.158
		5. Nearly bare and untilled, and alluvial valley fans	1.83	28.00	1,528.05	1.350	0.314
#32	**1**	**Time of Concentration:**					**0.555**
#32	2	8. Large gullies, diversions, and low flowing streams	0.96	25.00	2,601.10	2.940	0.245
#32	**2**	**Time of Concentration:**					**0.245**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	1.50	164.00	10,964.76	1.220	2.496
#34	**1**	**Time of Concentration:**					**2.496**
#35	1	8. Large gullies, diversions, and low flowing streams	3.24	144.00	4,442.11	5.400	0.228

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	8.78	26.00	296.00	2.960	0.027
#35	**1**	**Time of Concentration:**					**0.255**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	8.73	20.00	229.10	2.950	0.021
		8. Large gullies, diversions, and low flowing streams	9.39	75.00	798.50	9.190	0.024
#36	**1**	**Time of Concentration:**					**0.045**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	1.16	240.00	20,629.19	1.070	5.355
#37	**1**	**Time of Concentration:**					**5.355**
#40	1	5. Nearly bare and untilled, and alluvial valley fans	3.09	22.00	711.21	1.750	0.112
		8. Large gullies, diversions, and low flowing streams	0.66	61.00	9,198.59	2.440	1.047
#40	**1**	**Time of Concentration:**					**1.159**
#40	2	8. Large gullies, diversions, and low flowing streams	5.10	103.00	2,019.72	6.770	0.082
#40	**2**	**Time of Concentration:**					**0.082**
#42	1	5. Nearly bare and untilled, and alluvial valley fans	3.45	93.00	2,694.01	1.850	0.404
		8. Large gullies, diversions, and low flowing streams	2.37	100.00	4,211.05	4.620	0.253
		5. Nearly bare and untilled, and alluvial valley fans	1.17	103.00	8,811.70	1.080	2.266
#42	**1**	**Time of Concentration:**					**2.923**
#42	2	5. Nearly bare and untilled, and alluvial valley fans	0.62	63.00	10,166.21	0.780	3.620
#42	**2**	**Time of Concentration:**					**3.620**
#42	3	5. Nearly bare and untilled, and alluvial valley fans	1.24	60.00	4,853.19	1.110	1.214
#42	**3**	**Time of Concentration:**					**1.214**
#43	1	5. Nearly bare and untilled, and alluvial valley fans	1.12	93.00	8,290.98	1.050	2.193
		8. Large gullies, diversions, and low flowing streams	3.42	185.00	5,404.14	5.550	0.270
#43	**1**	**Time of Concentration:**					**2.463**
#44	1	5. Nearly bare and untilled, and alluvial valley fans	9.26	17.00	183.60	3.040	0.016
		8. Large gullies, diversions, and low flowing streams	1.63	120.00	7,383.30	3.820	0.536
#44	**1**	**Time of Concentration:**					**0.552**
#45	1	5. Nearly bare and untilled, and alluvial valley fans	4.08	17.00	416.50	2.020	0.057
		8. Large gullies, diversions, and low flowing streams	2.47	135.00	5,464.70	4.710	0.322
#45	**1**	**Time of Concentration:**					**0.077**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#46	1	5. Nearly bare and untilled, and alluvial valley fans	6.02	15.00	249.00	2.450	0.028
		8. Large gullies, diversions, and low flowing streams	9.50	65.00	684.00	9.240	0.020
#46	**1**	**Time of Concentration:**					**0.048**
#47	1	5. Nearly bare and untilled, and alluvial valley fans	9.17	30.00	327.00	3.020	0.030
		8. Large gullies, diversions, and low flowing streams	8.13	75.00	923.00	8.550	0.029
#47	**1**	**Time of Concentration:**					**0.059**
#48	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	26.00	266.00	3.120	0.023
		8. Large gullies, diversions, and low flowing streams	9.93	75.00	755.00	9.450	0.022
#48	**1**	**Time of Concentration:**					**0.045**
#49	1	5. Nearly bare and untilled, and alluvial valley fans	11.84	45.00	380.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	8.50	95.00	1,117.00	8.740	0.035
#49	**1**	**Time of Concentration:**					**0.065**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.18	3.800	0.423
#4	**1**	**Muskingum K:**					**0.423**
#4	2	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.18	3.800	0.423
#4	**2**	**Muskingum K:**					**0.423**
#4	3	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.00	3.800	0.423
#4	**3**	**Muskingum K:**					**0.423**
#6	1	8. Large gullies, diversions, and low flowing streams	1.16	84.00	7,218.35	3.230	0.620
#6	**1**	**Muskingum K:**					**0.620**
#6	2	8. Large gullies, diversions, and low flowing streams	0.77	35.00	4,531.33	2.630	0.478
#6	**2**	**Muskingum K:**					**0.478**
#6	4	8. Large gullies, diversions, and low flowing streams	0.77	35.00	4,531.33	2.630	0.478
#6	**4**	**Muskingum K:**					**0.478**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	0.99	153.00	15,503.09	0.990	4.349
		8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,564.29	3.850	0.545

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**1**	**Muskingum K:**					**5.461**
#14	2	8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,564.29	3.850	0.545
		5. Nearly bare and untilled, and alluvial valley fans	1.46	11.00	755.02	1.200	0.174
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**2**	**Muskingum K:**					**1.286**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	2.19	43.00	1,966.00	1.470	0.371
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.00	1.040	0.567
#14	**4**	**Muskingum K:**					**1.418**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	1.80	62.00	3,443.10	1.340	0.713
#17	**1**	**Muskingum K:**					**0.713**
#28	2	8. Large gullies, diversions, and low flowing streams	1.43	47.00	3,281.00	3.590	0.253
#28	**2**	**Muskingum K:**					**0.253**
#32	1	8. Large gullies, diversions, and low flowing streams	1.18	15.00	1,268.00	3.260	0.108
#32	**1**	**Muskingum K:**					**0.108**
#40	2	8. Large gullies, diversions, and low flowing streams	0.75	53.00	7,067.40	2.590	0.757
#40	**2**	**Muskingum K:**					**0.757**
#42	1	5. Nearly bare and untilled, and alluvial valley fans	0.48	37.00	7,646.20	0.690	3.078
#42	**1**	**Muskingum K:**					**3.078**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1A

Folder:
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Run n.1

Gradient [%]	3.10	Froude number	1.91
Discharge [ft3/s]	1830.13	Cross section [ft2]	121.63
Water level [ft]	2.15	Wetted perimeter [ft]	63.63
Average velocity [ft/s]	15.05	Hydraulic radius [ft]	1.91

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	11.07	9.58	1.00							
3.1	11.07			5.00	1.31	Reno mattress 6"	N	3.24	4.36	Y
4	50.00	15.75	1.00							
4.1	50.00			5.00	1.31	Reno mattress 6"	N	4.25	4.68	Y
5	11.07	9.58	1.00							
5.1	11.07			5.00	1.31	Reno mattress 6"	N	3.24	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1A

Folder:
Date: 08/07/2012

Notice
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Materials used

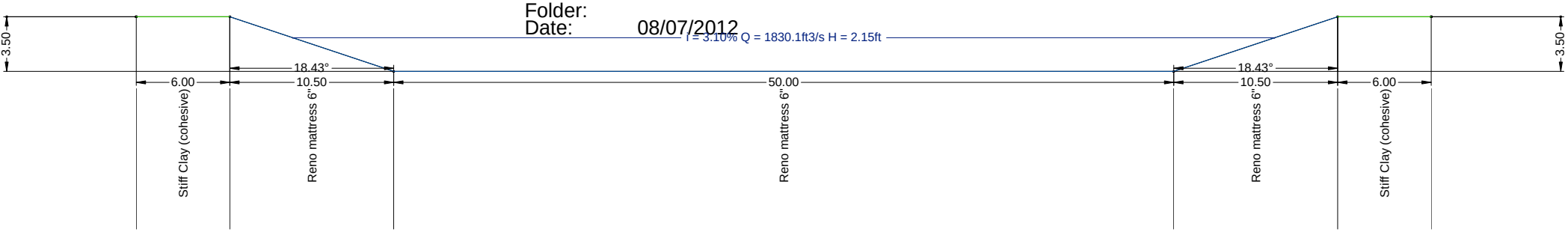
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-1A

Folder:
Date: 08/07/2012



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Bond Scenario 9 / 2014

Prediction Point PP-2, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

CJB

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Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-2

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	8.300	8.300	20.36	0.80

Structure Detail:

Structure #1 (Riprap Channel)

PP-2

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	9.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.36 cfs	
Depth:	0.29 ft	1.29 ft
Top Width:	7.76 ft	13.76 ft
Velocity*:		
X-Section Area:	2.02 sq ft	
Hydraulic Radius:	0.257 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	8.300	0.045	0.000	0.000	91.000	M	20.36	0.804
	Σ	**8.300**						**20.36**	**0.804**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	26.00	266.00	3.120	0.023
		8. Large gullies, diversions, and low flowing streams	9.93	75.00	755.00	9.450	0.022
#1	**1**	**Time of Concentration:**					**0.045**

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Bond Scenario 9 / 2019

Prediction Point PP-3, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-3

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.300	12.300	30.17	1.19

Structure Detail:

Structure #1 (Riprap Channel)

PP-3

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	30.17 cfs	
Depth:	0.42 ft	1.42 ft
Top Width:	8.55 ft	14.55 ft
Velocity*:		
X-Section Area:	3.09 sq ft	
Hydraulic Radius:	0.356 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.300	0.059	0.000	0.000	91.000	M	30.17	1.191
	Σ	**12.300**						**30.17**	**1.191**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	9.17	30.00	327.00	3.020	0.030
		8. Large gullies, diversions, and low flowing streams	8.13	75.00	923.00	8.550	0.029
#1	**1**	**Time of Concentration:**					**0.059**

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Bond Scenario

Prediction Point PP-3A, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-3A

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.500	6.500	15.94	0.63

Structure Detail:

Structure #1 (Riprap Channel)

PP-3A

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	7.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	15.94 cfs	
Depth:	0.26 ft	1.26 ft
Top Width:	7.58 ft	13.58 ft
Velocity*:		
X-Section Area:	1.79 sq ft	
Hydraulic Radius:	0.233 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	6.500	0.048	0.000	0.000	91.000	M	15.94	0.629
	Σ	**6.500**						**15.94**	**0.629**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.02	15.00	249.00	2.450	0.028
		8. Large gullies, diversions, and low flowing streams	9.50	65.00	684.00	9.240	0.020
#1	**1**	**Time of Concentration:**					**0.048**

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Bond Scenario 9 / 2019

Prediction Point PP-3B, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-3B

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	63.380	63.380	102.30	4.99

Structure Detail:

Structure #1 (Riprap Channel)

PP-3B

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
11.00	3.0:1	3.0:1	9.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	102.30 cfs	
Depth:	0.71 ft	1.71 ft
Top Width:	15.23 ft	21.23 ft
Velocity*:		
X-Section Area:	9.26 sq ft	
Hydraulic Radius:	0.599 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	63.380	0.148	0.000	0.000	91.000	M	102.30	4.994
	Σ	**63.380**						**102.30**	**4.994**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	30.00	307.10	3.120	0.027
		8. Large gullies, diversions, and low flowing streams	4.96	145.00	2,924.30	6.680	0.121
#1	**1**	**Time of Concentration:**					**0.148**

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Bond Scenario 9 / 2019

Prediction Point PP-3C, for watershed data see Appendix 50.A, Exhibit 50.A-1

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Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-3C

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	12.330	12.330	30.24	1.19

Structure Detail:

Structure #1 (Riprap Channel)

PP-3C

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	6.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	30.24 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	8.60 ft	14.60 ft
Velocity*:		
X-Section Area:	3.16 sq ft	
Hydraulic Radius:	0.362 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	12.330	0.045	0.000	0.000	91.000	M	30.24	1.194
	Σ	**12.330**						**30.24**	**1.194**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.73	20.00	229.10	2.950	0.021
		8. Large gullies, diversions, and low flowing streams	9.39	75.00	798.50	9.190	0.024
#1	**1**	**Time of Concentration:**					**0.045**

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Prediction Point PP-4, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-4

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	25.880	25.880	41.77	2.04

Structure Detail:

Structure #1 (Riprap Channel)

PP-4

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	41.77 cfs	
Depth:	0.50 ft	1.50 ft
Top Width:	8.97 ft	14.97 ft
Velocity*:		
X-Section Area:	3.71 sq ft	
Hydraulic Radius:	0.406 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	25.880	0.150	0.000	0.000	91.000	M	41.77	2.039
	Σ	**25.880**						**41.77**	**2.039**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	27.00	777.50	1.860	0.116
		8. Large gullies, diversions, and low flowing streams	8.69	95.00	1,093.40	8.840	0.034
#1	**1**	**Time of Concentration:**					**0.150**

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Bond Scenario 9/2019

Prediction Point PP-5, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-5

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	78.130	78.130	126.11	6.16

Structure Detail:

Structure #1 (Riprap Channel)

PP-5

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
15.00	3.0:1	3.0:1	11.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	126.11 cfs	
Depth:	0.65 ft	1.65 ft
Top Width:	18.93 ft	24.93 ft
Velocity*:		
X-Section Area:	11.10 sq ft	
Hydraulic Radius:	0.580 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	78.130	0.143	0.000	0.000	91.000	M	126.11	6.157
	Σ	**78.130**						**126.11**	**6.157**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	16.38	25.00	152.60	4.040	0.010
		8. Large gullies, diversions, and low flowing streams	5.07	165.00	3,254.40	6.750	0.133
#1	**1**	**Time of Concentration:**					**0.143**

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Bond Scenario 9/2019

Prediction Point PP-7, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-7

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	151.040	151.040	227.39	11.76

Structure Detail:

Structure #1 (Riprap Channel)

PP-7

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
19.00	3.0:1	3.0:1	9.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	227.39 cfs	
Depth:	0.98 ft	1.98 ft
Top Width:	24.87 ft	30.87 ft
Velocity*:		
X-Section Area:	21.46 sq ft	
Hydraulic Radius:	0.852 ft	
Froude Number*:		
Manning's n*:		
Dmin:	5.00 in	
D50:	15.00 in	
Dmax:	18.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	151.040	0.223	0.000	0.000	91.000	M	227.39	11.765
	Σ	**151.040**						**227.39**	**11.765**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	14.06	45.00	320.00	3.750	0.023
		8. Large gullies, diversions, and low flowing streams	4.63	215.00	4,646.94	6.450	0.200
#1	**1**	**Time of Concentration:**					**0.223**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-7

Folder:
Date: 8/06/2012

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Run n.1

Gradient [%]	9.20	Froude number	2.78
Discharge [ft3/s]	227.39	Cross section [ft2]	17.02
Water level [ft]	0.80	Wetted perimeter [ft]	24.03
Average velocity [ft/s]	13.36	Hydraulic radius [ft]	0.71

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	5.69	8.50	1.00							
3.1	5.69			2.50	2.25	Reno mattress 6"	N	3.55	4.36	Y
4	19.00	13.97	1.00							
4.1	19.00			2.50	2.25	Reno mattress 6"	N	4.66	4.68	Y
5	5.69	8.50	1.00							
5.1	5.69			2.50	2.25	Reno mattress 6"	N	3.55	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-7

Folder:
Date: 8/06/2012

Notice
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Materials used

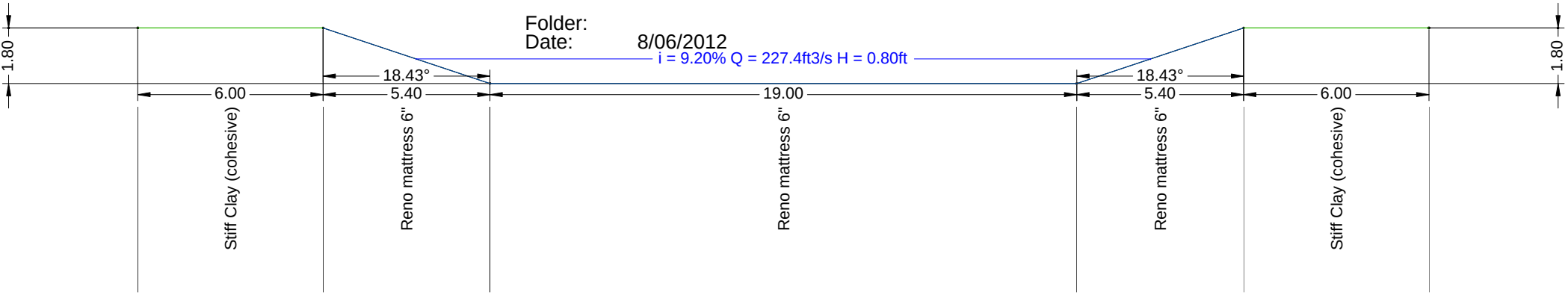
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-7

Folder:
Date: 8/06/2012



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Bond Scenario 9 / 2019

Prediction Point PP-8, for watershed data see Appendix 50.A, Exhibit 50.A-1

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Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-8

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	34.470	34.470	84.55	3.34

Structure Detail:

Structure #1 (Riprap Channel)

PP-8

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	8.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	84.55 cfs	
Depth:	0.65 ft	1.65 ft
Top Width:	13.89 ft	19.89 ft
Velocity*:		
X-Section Area:	7.74 sq ft	
Hydraulic Radius:	0.549 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	34.470	0.114	0.000	0.000	91.000	M	84.55	3.338
	Σ	**34.470**						**84.55**	**3.338**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	21.56	105.00	487.10	4.640	0.029
		8. Large gullies, diversions, and low flowing streams	4.91	100.00	2,035.10	6.650	0.085
#1	**1**	**Time of Concentration:**					**0.114**

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Bond Scenario 9 / 2019

Prediction Point PP-9, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-9

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	69.790	69.790	112.64	5.50

Structure Detail:

Structure #1 (Riprap Channel)

PP-9

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	7.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	112.64 cfs	
Depth:	0.77 ft	1.77 ft
Top Width:	16.64 ft	22.64 ft
Velocity*:		
X-Section Area:	11.07 sq ft	
Hydraulic Radius:	0.656 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	69.790	0.147	0.000	0.000	91.000	M	112.64	5.499
	Σ	**69.790**						**112.64**	**5.499**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	20.30	20.00	98.50	4.500	0.006
		8. Large gullies, diversions, and low flowing streams	5.55	200.00	3,604.00	7.060	0.141
#1	**1**	**Time of Concentration:**					**0.147**

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Bond Scenario 9 / 2019

Prediction Point PP-11, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-11

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	28.530	28.530	69.98	2.76

Structure Detail:

Structure #1 (Riprap Channel)

PP-11

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.00	3.0:1	3.0:1	5.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	69.98 cfs	
Depth:	0.77 ft	1.77 ft
Top Width:	11.60 ft	17.60 ft
Velocity*:		
X-Section Area:	7.12 sq ft	
Hydraulic Radius:	0.601 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	28.530	0.100	0.000	0.000	91.000	M	69.98	2.762
	Σ	**28.530**						**69.98**	**2.762**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.03	12.00	238.70	2.240	0.029
		8. Large gullies, diversions, and low flowing streams	5.35	95.00	1,777.10	6.930	0.071
#1	**1**	**Time of Concentration:**					**0.100**

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Bond Scenario 9 / 2019

Prediction Point PP-14, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-14

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	326.150	326.150	307.89	23.14

Structure Detail:

Structure #1 (Riprap Channel)

PP-14

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	5.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	307.89 cfs	
Depth:	1.42 ft	2.42 ft
Top Width:	18.52 ft	24.52 ft
Velocity*:		
X-Section Area:	20.26 sq ft	
Hydraulic Radius:	1.067 ft	
Froude Number*:		
Manning's n*:		
Dmin:	7.00 in	
D50:	21.00 in	
Dmax:	26.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	188.000	0.460	0.128	0.351	88.500	M	183.01	12.436
	2	45.200	0.206	0.128	0.351	91.000	M	69.21	3.498
	3	92.950	0.287	0.000	0.000	91.000	M	129.32	7.204
	Σ	**326.150**						**307.89**	**23.138**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.44	73.00	1,643.03	2.100	0.217
		8. Large gullies, diversions, and low flowing streams	2.89	129.00	4,465.05	5.090	0.243
#1	**1**	**Time of Concentration:**					**0.460**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	7.60	63.00	829.00	2.750	0.083
		8. Large gullies, diversions, and low flowing streams	3.36	82.00	2,442.00	5.490	0.123
#1	**2**	**Time of Concentration:**					**0.206**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	4.52	53.00	1,173.00	2.120	0.153
		8. Large gullies, diversions, and low flowing streams	2.72	65.00	2,389.00	4.940	0.134
#1	**3**	**Time of Concentration:**					**0.287**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.79	33.00	1,848.01	4.000	0.128
#1	**1**	**Muskingum K:**					**0.128**
#1	2	8. Large gullies, diversions, and low flowing streams	1.79	33.00	1,848.01	4.000	0.128
#1	**2**	**Muskingum K:**					**0.128**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-14

Folder:
Date: 8/10/2012

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Run n.1

Gradient [%]	5.80	Froude number	2.44
Discharge [ft3/s]	307.89	Cross section [ft2]	21.02
Water level [ft]	1.46	Wetted perimeter [ft]	19.24
Average velocity [ft/s]	14.65	Hydraulic radius [ft]	1.09

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	9.49	10.12	1.00							
3.1	9.49			2.50	2.02	Reno mattress 9"	N	4.11	5.23	Y
4	10.00	16.64	1.00							
4.1	10.00			2.50	2.02	Reno mattress 9"	N	5.39	5.62	Y
5	9.49	10.12	1.00							
5.1	9.49			2.50	2.02	Reno mattress 9"	N	4.11	5.23	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-14

Folder:
Date: 8/10/2012

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Materials used

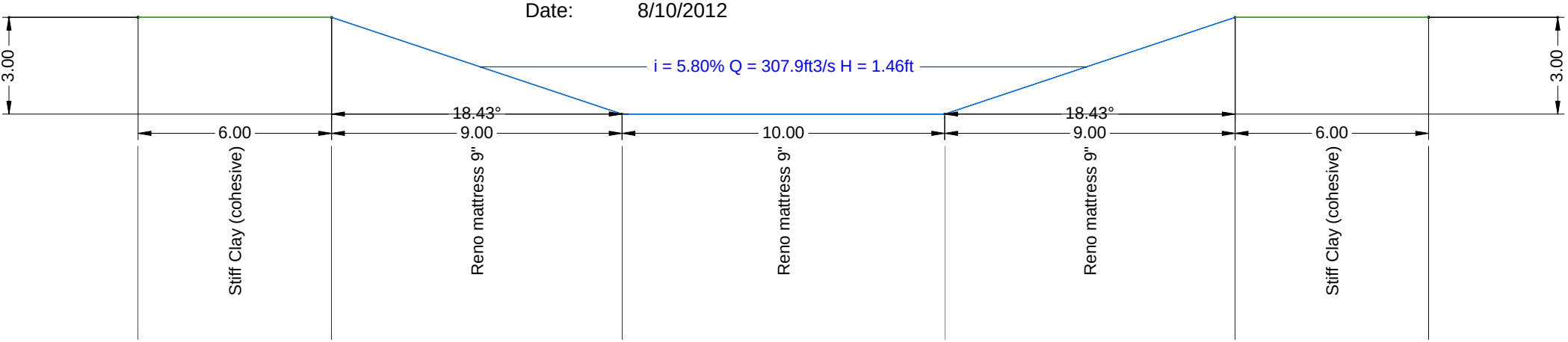
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 9"	0.0277	5.62	N	4.73	0.76	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-14

Folder:
Date: 8/10/2012



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Bond Scenario 9 / 2019

Prediction Point PP-15, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

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Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-15

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	77.070	77.070	115.37	6.01

Structure Detail:

Structure #1 (Riprap Channel)

PP-15

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
11.00	3.0:1	3.0:1	4.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	115.37 cfs	
Depth:	0.85 ft	1.85 ft
Top Width:	16.09 ft	22.09 ft
Velocity*:		
X-Section Area:	11.49 sq ft	
Hydraulic Radius:	0.702 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	77.070	0.228	0.000	0.000	91.000	M	115.37	6.007
	Σ	**77.070**						**115.37**	**6.007**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.81	22.00	577.00	1.950	0.082
		8. Large gullies, diversions, and low flowing streams	3.64	110.00	3,023.05	5.720	0.146
#1	**1**	**Time of Concentration:**					**0.228**

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Bond Scenario 9 / 2019

Prediction Point PP-18, for watershed data see Appendix 50.A, Exhibit 50.A-1

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Fruitland, NM

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General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-18

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	113.200	113.200	12.75	0.72

Structure Detail:

Structure #1 (Riprap Channel)

PP-18

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	2.4	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.75 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	7.42 ft	13.42 ft
Velocity*:		
X-Section Area:	1.59 sq ft	
Hydraulic Radius:	0.212 ft	
Froude Number*:		
Manning's n*:		
Dmin:	1.00 in	
D50:	3.00 in	
Dmax:	3.75 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	113.200	0.258	0.000	0.000	76.000	M	12.75	0.721
	Σ	**113.200**						**12.75**	**0.721**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	8.41	45.00	535.00	2.900	0.051
		8. Large gullies, diversions, and low flowing streams	2.71	100.00	3,687.00	4.940	0.207
#1	**1**	**Time of Concentration:**					**0.258**

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Bond Scenario 9 / 2019

Prediction Point PP-19, for watershed data see Appendix 50.A, Exhibit 50.A-1

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General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.230 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP19

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	403.300	403.300	48.41	2.58

Structure Detail:

Structure #1 (Riprap Channel)

PP19

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	2.3	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	48.41 cfs	
Depth:	0.64 ft	1.64 ft
Top Width:	9.84 ft	15.84 ft
Velocity*:		
X-Section Area:	5.07 sq ft	
Hydraulic Radius:	0.505 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	403.300	0.231	0.000	0.000	76.000	M	48.41	2.576
	Σ	**403.300**						**48.41**	**2.576**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.28	25.00	398.00	2.500	0.044
		8. Large gullies, diversions, and low flowing streams	5.77	280.00	4,853.00	7.200	0.187
#1	**1**	**Time of Concentration:**					**0.231**

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Bond Scenario 9 / 2019

Prediction Point PP-37, for watershed data see Appendix 50.A, Exhibit 50.A-1

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Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-37

#1
Chan'l

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	532.830	532.830	467.96	36.31

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Structure Detail:

Structure #1 (Riprap Channel)

PP-37

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	4.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	467.96 cfs	
Depth:	1.80 ft	2.80 ft
Top Width:	20.79 ft	26.79 ft
Velocity*:		
X-Section Area:	27.70 sq ft	
Hydraulic Radius:	1.296 ft	
Froude Number*:		
Manning's n*:		
Dmin:	10.00 in	
D50:	30.00 in	
Dmax:	37.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	76.900	0.300	0.000	0.000	91.000	M	105.34	5.959
	2	191.890	0.448	0.000	0.000	88.900	M	194.42	13.019
	3	124.600	0.335	0.176	0.352	89.000	M	145.94	8.542
	4	139.440	0.402	0.325	0.347	87.700	M	138.68	8.793
	Σ	**532.830**						**467.96**	**36.313**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.48	70.00	1,081.01	2.540	0.118
		8. Large gullies, diversions, and low flowing streams	2.65	85.00	3,204.04	4.880	0.182
#1	**1**	**Time of Concentration:**					**0.300**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.31	15.00	649.01	1.520	0.118
		8. Large gullies, diversions, and low flowing streams	3.19	203.00	6,373.02	5.350	0.330
#1	**2**	**Time of Concentration:**					**0.448**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	3.37	15.00	445.01	1.830	0.067
		8. Large gullies, diversions, and low flowing streams	3.33	176.00	5,291.00	5.470	0.268
#1	**3**	**Time of Concentration:**					**0.335**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	1.36	15.00	1,102.04	1.160	0.263
		8. Large gullies, diversions, and low flowing streams	4.84	160.00	3,303.05	6.600	0.139
#1	**4**	**Time of Concentration:**					**0.402**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	3	8. Large gullies, diversions, and low flowing streams	1.83	47.00	2,573.00	4.050	0.176
#1	**3**	**Muskingum K:**					**0.176**
#1	4	8. Large gullies, diversions, and low flowing streams	1.65	74.00	4,495.20	3.840	0.325

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**4**	**Muskingum K:**					**0.325**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-37

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Date: 8/10/2012

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Run n.1

Gradient [%]	4.50	Froude number	2.24
Discharge [ft3/s]	467.96	Cross section [ft2]	30.83
Water level [ft]	1.95	Wetted perimeter [ft]	22.31
Average velocity [ft/s]	15.18	Hydraulic radius [ft]	1.38

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	9.49	10.79	1.00							
3.1	9.49			2.50	1.78	Reno mattress 9"	N	4.25	5.23	Y
4	10.00	17.74	1.00							
4.1	10.00			2.50	1.78	Reno mattress 9"	N	5.58	5.62	Y
5	9.49	10.79	1.00							
5.1	9.49			2.50	1.78	Reno mattress 9"	N	4.25	5.23	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-37

Folder:
Date: 8/10/2012

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Materials used

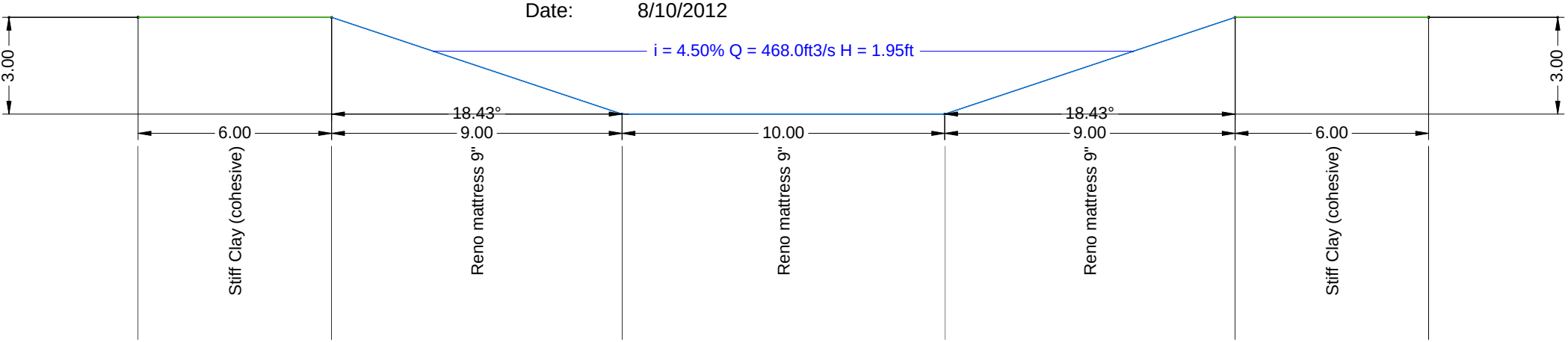
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 9"	0.0277	5.62	N	4.73	0.76	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-37

Folder:
Date: 8/10/2012



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Bond Scenario 9 / 2019

Prediction Point PP-38, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

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Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	PP-38

#1
Chan'l

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	128.800	128.800	168.83	10.00

Structure Detail:

Structure #1 (Riprap Channel)

PP-38

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	3.0:1	3.0:1	2.9	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	168.83 cfs	
Depth:	1.08 ft	2.08 ft
Top Width:	20.49 ft	26.49 ft
Velocity*:		
X-Section Area:	18.65 sq ft	
Hydraulic Radius:	0.895 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	128.800	0.337	0.000	0.000	91.000	M	168.83	9.995
	Σ	**128.800**						**168.83**	**9.995**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.18	52.00	842.00	2.480	0.094
		8. Large gullies, diversions, and low flowing streams	3.19	150.00	4,696.01	5.360	0.243
#1	**1**	**Time of Concentration:**					**0.337**

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Bond Scenario 9 / 2019

Prediction Point PP-39, for watershed data see Appendix 50.A, Exhibit 50.A-1

Revised May 2014

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Fruitland, NM

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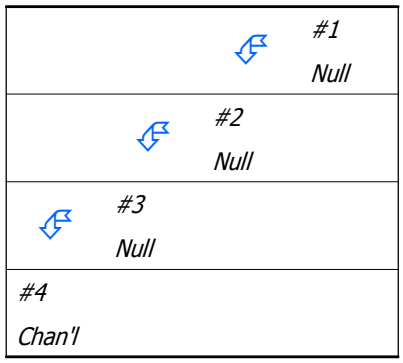
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.584	0.282	
Null	#2	==>	#3	1.820	0.239	
Null	#3	==>	#4	0.078	0.361	
Channel	#4	==>	End	0.000	0.000	PP-39



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.54	25.00	4,629.62	2.20	0.584
#1	**Muskingum K:**					**0.584**
#2	8. Large gullies, diversions, and low flowing streams	0.27	28.00	10,225.92	1.56	1.820
#2	**Muskingum K:**					**1.820**
#3	8. Large gullies, diversions, and low flowing streams	2.16	27.00	1,249.99	4.40	0.078
#3	**Muskingum K:**					**0.078**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	680.330	680.330	59.33	10.71
#2	117.850	798.180	83.12	14.81
#3	321.430	1,119.610	60.80	17.16
#4	79.640	1,199.250	60.94	17.76

Structure Detail:

Structure #1 (Null)

Structure #2 (Null)

Structure #3 (Null)

Structure #4 (Riprap Channel)

PP-39

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	4.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	60.94 cfs	
Depth:	0.75 ft	1.75 ft
Top Width:	10.51 ft	16.51 ft
Velocity*:		
X-Section Area:	6.21 sq ft	
Hydraulic Radius:	0.577 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	680.330	1.679	0.000	0.000	81.800	M	59.33	10.712
	Σ	**680.330**						**59.33**	**10.712**
#2	1	117.850	0.215	0.000	0.000	89.800	M	83.11	4.096
	Σ	**798.180**						**83.12**	**14.808**
#3	1	106.920	0.624	0.000	0.000	75.600	M	7.94	0.782
	2	214.510	1.143	0.539	0.250	75.600	M	10.50	1.571
	Σ	**1,119.610**						**60.80**	**17.161**
#4	1	79.640	0.188	0.000	0.000	75.700	M	12.64	0.599
	Σ	**1,199.250**						**60.94**	**17.760**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.11	30.00	2,700.30	1.050	0.714
		8. Large gullies, diversions, and low flowing streams	1.47	185.00	12,615.40	3.630	0.965
#1	**1**	**Time of Concentration:**					**1.679**
#2	1	8. Large gullies, diversions, and low flowing streams	2.46	90.00	3,654.00	4.700	0.215
#2	**1**	**Time of Concentration:**					**0.215**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.56	12.00	766.90	1.250	0.170
		8. Large gullies, diversions, and low flowing streams	0.99	48.00	4,864.79	2.970	0.454
#3	**1**	**Time of Concentration:**					**0.624**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	8.00	1,182.40	0.820	0.400
		8. Large gullies, diversions, and low flowing streams	0.60	37.30	6,208.40	2.320	0.743
#3	**2**	**Time of Concentration:**					**1.143**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	6.61	10.00	151.30	2.570	0.016
		8. Large gullies, diversions, and low flowing streams	3.93	145.00	3,688.80	5.940	0.172
#4	**1**	**Time of Concentration:**					**0.188**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	2	8. Large gullies, diversions, and low flowing streams	0.32	10.70	3,300.00	1.700	0.539
#3	**2**	**Muskingum K:**					**0.539**

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Bond Scenario 9/2019

The 100yr-6hr peak flow from the Chinde Arroyo post-mine hydrology model at Structure 28 was used to design the drop structure at PP-40. The full report is presented in Appendix 50.A The hydrology model and drainage subdivisions area presented in Appendix 50.A-1.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

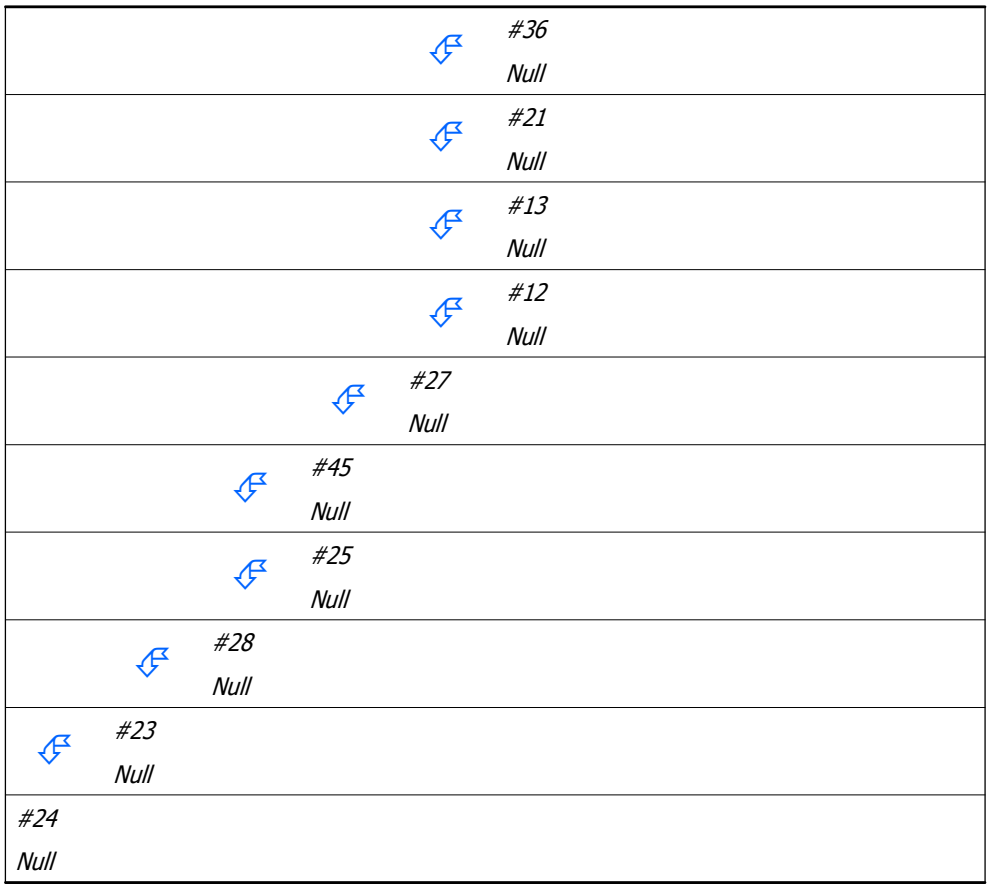
Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#42	1.386	0.156	S1
Null	#3	==>	#5	0.000	0.000	S3
Null	#4	==>	#5	0.000	0.000	S4
Null	#5	==>	#6	0.778	0.334	S5
Null	#6	==>	#40	1.263	0.275	S6
Null	#7	==>	#44	0.622	0.321	S7
Null	#8	==>	#44	0.379	0.327	S8 at PP-11
Null	#9	==>	#44	0.205	0.345	S9 at PP-9
Null	#10	==>	#44	0.108	0.367	S10 at PP-8
Null	#11	==>	#44	0.035	0.389	S11 at PP-7
Null	#12	==>	#27	0.346	0.347	S12 at PP-5
Null	#13	==>	#27	0.429	0.325	S13 at PP-4
Null	#14	==>	#38	0.749	0.206	S14
Null	#15	==>	#41	0.000	0.000	S15
Null	#16	==>	#38	0.043	0.404	S16
Null	#17	==>	#32	0.000	0.000	S17
Null	#18	==>	#40	0.434	0.164	S18
Null	#19	==>	#33	0.000	0.000	S19
Null	#21	==>	#27	0.256	0.341	S21 at PP-3B
Null	#22	==>	#30	0.493	0.224	S22
Null	#23	==>	#24	0.494	0.312	S23 at PP-1A
Null	#24	==>	End	0.000	0.000	S24
Null	#25	==>	#28	0.678	0.320	S25 at PP-1
Null	#26	==>	#29	0.164	0.191	S26
Null	#27	==>	#45	0.340	0.311	S27
Null	#28	==>	#23	0.101	0.361	S28
Null	#29	==>	#40	0.660	0.307	S29
Null	#30	==>	#33	0.000	0.000	S30
Null	#31	==>	#32	0.274	0.297	S31
Null	#32	==>	#23	0.403	0.327	S32
Null	#33	==>	#18	0.510	0.309	S33
Null	#34	==>	#38	0.601	0.202	S34
Null	#35	==>	#23	0.080	0.367	S35
Null	#36	==>	#27	0.202	0.356	S36 at PP-3C
Null	#37	==>	#4	1.717	0.316	S37
Null	#38	==>	#39	0.165	0.329	S38 at Doby Channel
Null	#39	==>	#15	0.342	0.321	S39 at Doby Permanent Imp.
Null	#40	==>	#41	0.000	0.000	S40

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#41	==>	#32	0.216	0.318	S41
Null	#42	==>	#3	1.479	0.221	S42
Null	#43	==>	#30	0.289	0.246	S43
Null	#44	==>	#27	0.609	0.308	S44
Null	#45	==>	#28	0.174	0.349	S45
Null	#46	==>	#28	0.532	0.347	S46 at PP-3A
Null	#47	==>	#28	0.515	0.342	S47 at PP-3
Null	#48	==>	#28	0.587	0.321	S48 at PP-2
Null	#49	==>	#28	0.669	0.328	S49 at PP-0

#35 *Null*
#26 *Null*
#29 *Null*
#43 *Null*
#22 *Null*
#30 *Null*
#19 *Null*
#33 *Null*
#18 *Null*
#37 *Null*
#4 *Null*
#1 *Null*
#42 *Null*
#3 *Null*
#5 *Null*

#6 *Null*
#40 *Null*
#34 *Null*
#16 *Null*
#14 *Null*
#38 *Null*
#39 *Null*
#15 *Null*
#41 *Null*
#31 *Null*
#17 *Null*
#32 *Null*
#49 *Null*
#48 *Null*
#47 *Null*
#46 *Null*
#11 *Null*
#10 *Null*
#9 *Null*
#8 *Null*
#7 *Null*
#44 *Null*



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	5. Nearly bare and untilled, and alluvial valley fans	0.60	23.00	3,844.22	0.77	1.386
#1	**Muskingum K:**					**1.386**
#5	8. Large gullies, diversions, and low flowing streams	1.30	124.00	9,554.00	3.41	0.778
#5	**Muskingum K:**					**0.778**
#6	8. Large gullies, diversions, and low flowing streams	0.48	45.00	9,415.70	2.07	1.263
#6	**Muskingum K:**					**1.263**
#7	8. Large gullies, diversions, and low flowing streams	1.03	70.00	6,812.80	3.04	0.622
#7	**Muskingum K:**					**0.622**
#8	8. Large gullies, diversions, and low flowing streams	1.14	50.00	4,371.40	3.20	0.379
#8	**Muskingum K:**					**0.379**
#9	8. Large gullies, diversions, and low flowing streams	1.60	45.00	2,810.50	3.79	0.205
#9	**Muskingum K:**					**0.205**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	8. Large gullies, diversions, and low flowing streams	2.45	45.00	1,836.50	4.69	0.108
#10	**Muskingum K:**					**0.108**
#11	8. Large gullies, diversions, and low flowing streams	3.93	30.00	762.50	5.95	0.035
#11	**Muskingum K:**					**0.035**
#12	8. Large gullies, diversions, and low flowing streams	1.66	80.00	4,821.90	3.86	0.346
#12	**Muskingum K:**					**0.346**
#13	8. Large gullies, diversions, and low flowing streams	1.12	55.00	4,901.50	3.17	0.429
#13	**Muskingum K:**					**0.429**
#14	5. Nearly bare and untilled, and alluvial valley fans	1.43	46.00	3,212.06	1.19	0.749
#14	**Muskingum K:**					**0.749**
#16	8. Large gullies, diversions, and low flowing streams	5.68	64.00	1,127.00	7.14	0.043
#16	**Muskingum K:**					**0.043**
#18	8. Large gullies, diversions, and low flowing streams	0.08	1.00	1,298.19	0.83	0.434
#18	**Muskingum K:**					**0.434**
#21	8. Large gullies, diversions, and low flowing streams	1.49	50.00	3,365.00	3.65	0.256
#21	**Muskingum K:**					**0.256**
#22	5. Nearly bare and untilled, and alluvial valley fans	1.92	47.00	2,453.50	1.38	0.493
#22	**Muskingum K:**					**0.493**
#23	8. Large gullies, diversions, and low flowing streams	0.88	44.00	5,006.00	2.81	0.494
#23	**Muskingum K:**					**0.494**
#25	8. Large gullies, diversions, and low flowing streams	1.03	76.00	7,403.00	3.03	0.678
#25	**Muskingum K:**					**0.678**
#26	5. Nearly bare and untilled, and alluvial valley fans	1.12	7.00	623.30	1.05	0.164
#26	**Muskingum K:**					**0.164**
#27	8. Large gullies, diversions, and low flowing streams	0.87	30.00	3,432.70	2.80	0.340
#27	**Muskingum K:**					**0.340**
#28	8. Large gullies, diversions, and low flowing streams	2.16	35.00	1,618.04	4.41	0.101
#28	**Muskingum K:**					**0.101**
#29	8. Large gullies, diversions, and low flowing streams	0.81	52.00	6,415.80	2.70	0.660
#29	**Muskingum K:**					**0.660**
#31	8. Large gullies, diversions, and low flowing streams	0.69	17.00	2,459.00	2.49	0.274

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#31	**Muskingum K:**					**0.274**
#32	8. Large gullies, diversions, and low flowing streams	1.14	53.00	4,654.00	3.20	0.403
#32	**Muskingum K:**					**0.403**
#33	8. Large gullies, diversions, and low flowing streams	0.83	42.00	5,032.70	2.74	0.510
#33	**Muskingum K:**					**0.510**
#34	5. Nearly bare and untilled, and alluvial valley fans	1.32	33.00	2,492.07	1.15	0.601
#34	**Muskingum K:**					**0.601**
#35	8. Large gullies, diversions, and low flowing streams	2.44	33.00	1,354.01	4.68	0.080
#35	**Muskingum K:**					**0.080**
#36	8. Large gullies, diversions, and low flowing streams	1.96	60.00	3,062.00	4.19	0.202
#36	**Muskingum K:**					**0.202**
#37	5. Nearly bare and untilled, and alluvial valley fans	1.35	55.00	4,071.00	1.16	0.974
	8. Large gullies, diversions, and low flowing streams	1.49	146.00	9,792.00	3.66	0.743
#37	**Muskingum K:**					**1.717**
#38	8. Large gullies, diversions, and low flowing streams	1.19	23.00	1,938.00	3.26	0.165
#38	**Muskingum K:**					**0.165**
#39	8. Large gullies, diversions, and low flowing streams	1.04	39.00	3,758.00	3.05	0.342
#39	**Muskingum K:**					**0.342**
#41	8. Large gullies, diversions, and low flowing streams	0.99	23.00	2,325.20	2.98	0.216
#41	**Muskingum K:**					**0.216**
#42	5. Nearly bare and untilled, and alluvial valley fans	1.84	132.00	7,189.15	1.35	1.479
#42	**Muskingum K:**					**1.479**
#43	5. Nearly bare and untilled, and alluvial valley fans	2.73	47.00	1,722.00	1.65	0.289
#43	**Muskingum K:**					**0.289**
#44	8. Large gullies, diversions, and low flowing streams	0.83	50.00	5,994.90	2.73	0.609
#44	**Muskingum K:**					**0.609**
#45	8. Large gullies, diversions, and low flowing streams	1.71	42.00	2,456.80	3.92	0.174
#45	**Muskingum K:**					**0.174**
#46	8. Large gullies, diversions, and low flowing streams	1.65	122.00	7,378.00	3.85	0.532
#46	**Muskingum K:**					**0.532**
#47	8. Large gullies, diversions, and low flowing streams	1.50	102.00	6,814.00	3.67	0.515

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#47	**Muskingum K:**					**0.515**
#48	8. Large gullies, diversions, and low flowing streams	1.04	67.00	6,452.00	3.05	0.587
#48	**Muskingum K:**					**0.587**
#49	8. Large gullies, diversions, and low flowing streams	1.17	92.00	7,838.00	3.25	0.669
#49	**Muskingum K:**					**0.669**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#35	105.000	105.000	90.41	4.68	294.7	67,189	42.39	28.59
#26	217.200	217.200	293.53	16.84	1,712.3	102,780	8.09	5.69
#29	26.000	243.200	282.87	19.36	1,714.3	93,056	6.48	4.40
#43	809.500	809.500	143.18	33.86	389.7	11,471	4.58	3.37
#22	163.500	163.500	185.62	12.13	1,092.0	91,488	4.87	3.42
#30	142.400	1,115.400	247.35	56.63	1,662.4	64,764	8.95	2.94
#19	451.400	451.400	229.24	26.27	1,188.2	45,487	24.94	17.96
#33	0.000	1,566.800	472.33	82.90	2,850.7	55,253	17.07	7.70
#18	126.600	1,693.400	464.22	86.30	2,848.6	53,606	16.26	7.26
#37	3,024.600	3,024.600	212.29	97.91	516.9	5,262	1.04	0.78
#4	2,965.700	5,990.300	754.26	207.15	1,678.1	10,606	4.22	2.36
#1	755.100	755.100	125.01	25.58	210.0	8,215	3.43	2.52
#42	2,360.600	3,115.700	240.07	110.64	497.6	4,766	1.16	0.80
#3	1,550.000	4,665.700	341.85	184.57	924.0	7,844	2.16	1.01
#5	0.000	10,656.000	976.83	391.72	2,602.1	9,817	3.48	1.73
#6	2,008.700	12,664.700	1,228.78	485.77	6,276.6	63,341	10.31	1.53
#40	231.000	14,832.300	1,400.49	600.43	11,161.1	67,647	12.78	2.55
#34	235.300	235.300	22.80	5.65	28.7	5,038	1.78	1.32
#16	1,570.700	1,570.700	141.75	40.02	189.6	4,698	1.52	1.13
#14	6,695.200	6,695.200	336.25	231.98	1,659.7	21,089	7.20	1.81
#38	0.000	8,501.199	407.42	277.65	1,877.9	15,109	5.14	1.71
#39	0.000	8,501.199	406.29	277.65	1,877.9	322,705	109.71	1.71
#15	539.400	9,040.600	428.54	292.09	1,989.1	14,393	4.88	1.71
#41	0.000	23,872.900	1,743.15	892.52	13,150.2	44,696	9.45	2.28
#31	148.400	148.400	72.81	3.99	112.6	31,382	19.86	13.00
#17	939.500	939.500	175.15	28.18	402.9	29,770	14.97	5.25
#32	153.600	25,114.400	1,776.95	928.81	13,594.1	37,591	8.26	2.36
#49	10.780	10.780	26.44	1.04	99.0	91,072	23.64	17.54
#48	8.290	8.290	20.33	0.80	73.8	88,347	22.94	17.01
#47	12.350	12.350	30.29	1.20	115.3	92,515	24.02	17.82
#46	6.480	6.480	15.89	0.63	56.0	85,862	22.29	16.53
#11	151.040	151.040	227.39	11.76	1,200.4	102,828	9.93	7.00
#10	34.470	34.470	84.55	3.34	322.4	92,672	24.06	17.85
#9	69.790	69.790	112.64	5.50	500.9	91,390	10.83	7.70
#8	28.530	28.530	69.98	2.76	242.7	84,555	21.95	16.28
#7	201.870	201.870	224.36	15.03	1,377.8	92,955	4.55	3.20
#44	201.750	687.450	584.88	53.99	4,500.7	1,682,639	347.57	12.34

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#36	12.330	12.330	30.24	1.19	92.8	75,109	19.50	14.45
#21	63.380	63.380	102.30	4.99	569.7	113,398	13.43	9.57
#13	25.880	25.880	41.77	2.04	110.8	55,323	6.55	4.65
#12	78.130	78.130	126.11	6.16	416.0	68,437	8.11	5.75
#27	210.960	1,078.130	643.72	74.02	5,864.9	2,424,149	489.40	11.49
#45	15.500	1,093.630	627.59	75.52	5,769.6	86,816	16.59	10.50
#25	343.070	343.070	228.94	21.03	1,311.3	62,941	0.00	0.00
#28	570.420	2,045.020	888.17	115.51	7,876.5	2,312,423	424.95	9.03
#23	192.200	27,456.620	1,830.13	1,054.15	21,937.1	1,446,411	311.34	3.27
#24	201.360	27,657.980	1,821.22	1,069.19	22,819.8	93,869	18.02	2.99

Particle Size Distribution(s) at Each Structure

Structure #35 (S35):

Size (mm)	In/Out
2.0000	100.000%
0.1000	44.229%
0.0500	25.063%
0.0020	16.217%
0.0010	0.000%

Structure #26 (S26):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	78.190%
0.0010	0.000%

Structure #29 (S29):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.589%
0.0500	98.033%
0.0020	82.891%
0.0010	0.000%

Structure #43 (S43):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	59.498%
0.0020	38.499%

Size (mm)	In/Out
0.0010	0.000%

Structure #22 (S22):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	85.043%
0.0010	0.000%

Structure #30 (S30):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.514%
0.0020	73.088%
0.0010	0.000%

Structure #19 (S19):

Size (mm)	In/Out
2.0000	100.000%
0.1000	65.869%
0.0500	37.326%
0.0020	24.152%
0.0010	0.000%

Structure #33 (S33):

Size (mm)	In/Out
2.0000	100.000%
0.1000	85.773%
0.0500	68.343%
0.0020	52.690%
0.0010	0.000%

Structure #18 (S18):

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.241%
0.0500	69.135%
0.0020	53.312%
0.0010	0.000%

Structure #37 (S37):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	90.097%
0.0020	58.298%
0.0010	0.000%

Structure #4 (S4):

Size (mm)	In/Out
2.0000	100.000%
0.1000	86.776%
0.0500	59.783%
0.0020	38.683%
0.0010	0.000%

Structure #1 (S1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	56.763%
0.0020	36.729%
0.0010	0.000%

Structure #42 (S42):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.574%
0.0500	81.532%
0.0020	55.454%

Size (mm)	In/Out
0.0010	0.000%

Structure #3 (S3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	73.419%
0.0020	55.840%
0.0010	0.000%

Structure #5 (S5):

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.472%
0.0500	64.625%
0.0020	44.776%
0.0010	0.000%

Structure #6 (S6):

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.470%
0.0500	85.170%
0.0020	72.733%
0.0010	0.000%

Structure #40 (S40):

Size (mm)	In/Out
2.0000	100.000%
0.1000	94.594%
0.0500	82.558%
0.0020	68.683%
0.0010	0.000%

Structure #34 (S34):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	66.412%
0.0020	42.973%
0.0010	0.000%

Structure #16 (S16):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	70.868%
0.0020	45.856%
0.0010	0.000%

Structure #14 (S14):

Size (mm)	In/Out
2.0000	100.000%
0.1000	86.489%
0.0500	66.278%
0.0020	46.287%
0.0010	0.000%

Structure #38 (S38 at Doby Channel):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.059%
0.0500	66.743%
0.0020	46.193%
0.0010	0.000%

Structure #39 (S39 at Doby Permanent Imp.):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.059%
0.0500	66.743%
0.0020	46.193%

Size (mm)	In/Out
0.0010	0.000%

Structure #15 (S15):

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.100%
0.0500	66.691%
0.0020	46.501%
0.0010	0.000%

Structure #41 (S41):

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.914%
0.0500	80.158%
0.0020	65.328%
0.0010	0.000%

Structure #31 (S31):

Size (mm)	In/Out
2.0000	100.000%
0.1000	43.704%
0.0500	23.089%
0.0020	18.141%
0.0010	0.000%

Structure #17 (S17):

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.122%
0.0500	41.977%
0.0020	31.094%
0.0010	0.000%

Structure #32 (S32):

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.699%
0.0500	79.099%
0.0020	64.363%
0.0010	0.000%

Structure #49 (S49 at PP-0):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #48 (S48 at PP-2):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #47 (S47 at PP-3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #46 (S46 at PP-3A):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%

Size (mm)	In/Out
0.0010	0.000%

Structure #11 (S11 at PP-7):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	73.603%
0.0010	0.000%

Structure #10 (S10 at PP-8):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #9 (S9 at PP-9):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #8 (S8 at PP-11):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #7 (S7):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	86.231%
0.0010	0.000%

Structure #44 (S44):

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.112%
0.0500	82.120%
0.0020	64.351%
0.0010	0.000%

Structure #36 (S36 at PP-3C):

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #21 (S21 at PP-3B):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #13 (S13 at PP-4):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%

Size (mm)	In/Out
0.0010	0.000%

Structure #12 (S12 at PP-5):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.333%
0.0020	70.788%
0.0010	0.000%

Structure #27 (S27):

Size (mm)	In/Out
2.0000	100.000%
0.1000	88.569%
0.0500	83.335%
0.0020	64.210%
0.0010	0.000%

Structure #45 (S45):

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.272%
0.0500	84.838%
0.0020	65.371%
0.0010	0.000%

Structure #25 (S25 at PP-1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #28 (S28):

Size (mm)	In/Out
2.0000	100.000%
0.1000	89.835%
0.0500	83.959%
0.0020	68.394%
0.0010	0.000%

Structure #23 (S23 at PP-1A):

Size (mm)	In/Out
2.0000	100.000%
0.1000	91.324%
0.0500	79.715%
0.0020	64.830%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.965%
0.0500	82.805%
0.0020	67.514%
0.0010	0.000%

Structure Detail:

Structure #35 (Null)

S35

Structure #26 (Null)

S26

Structure #29 (Null)

S29

Structure #43 (Null)

S43

Structure #22 (Null)

S22

Structure #30 (Null)

S30

Structure #19 (Null)

S19

Structure #33 (Null)

S33

Structure #18 (Null)

S18

Structure #37 (Null)

S37

Structure #4 (Null)

S4

Structure #1 (Null)

S1

Structure #42 (Null)

S42

Structure #3 (Null)

S3

Structure #5 (Null)

S5

Structure #6 (Null)

S6

Structure #40 (Null)

S40

Structure #34 (Null)

S34

Structure #16 (Null)

S16

Structure #14 (Null)

S14

Structure #38 (Null)

S38 at Doby Channel

Structure #39 (Null)

S39 at Doby Permanent Imp.

Structure #15 (Null)

S15

Structure #41 (Null)

S41

Structure #31 (Null)

S31

Structure #17 (Null)

S17

Structure #32 (Null)

S32

Structure #49 (Null)

S49 at PP-0

Structure #48 (Null)

S48 at PP-2

Structure #47 (Null)

S47 at PP-3

Structure #46 (Null)

S46 at PP-3A

Structure #11 (Null)

S11 at PP-7

Structure #10 (Null)

S10 at PP-8

Structure #9 (Null)

S9 at PP-9

Structure #8 (Null)

S8 at PP-11

Structure #7 (Null)

S7

Structure #44 (Null)

S44

Structure #36 (Null)

S36 at PP-3C

Structure #21 (Null)

S21 at PP-3B

Structure #13 (Null)

S13 at PP-4

Structure #12 (Null)

S12 at PP-5

Structure #27 (Null)

S27

Structure #45 (Null)

S45

Structure #25 (Null)

S25 at PP-1

Structure #28 (Null)

S28

Structure #23 (Null)

S23 at PP-1A

Structure #24 (Null)

S24

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#35	1	105.000	0.255	0.000	0.000	82.400	M	90.41	4.680
	Σ	**105.000**						**90.41**	**4.680**
#26	1	217.200	0.311	0.000	0.000	91.000	M	293.53	16.840
	Σ	**217.200**						**293.53**	**16.840**
#29	1	26.000	0.083	0.000	0.000	91.000	M	63.77	2.517
	Σ	**243.200**						**282.87**	**19.357**
#43	1	809.500	2.463	0.000	0.000	81.600	M	143.18	33.863
	Σ	**809.500**						**143.18**	**33.863**
#22	1	163.500	0.425	0.000	0.000	90.300	M	185.62	12.132
	Σ	**163.500**						**185.62**	**12.132**
#30	1	142.400	0.245	0.000	0.000	90.300	M	200.93	10.634
	Σ	**1,115.400**						**247.35**	**56.629**
#19	1	451.400	1.009	0.000	0.000	86.500	M	229.24	26.272
	Σ	**451.400**						**229.24**	**26.272**
#33	Σ	**1,566.800**						**472.33**	**82.901**
#18	1	126.600	0.592	0.000	0.000	75.700	M	40.53	3.397
	Σ	**1,693.400**						**464.22**	**86.298**
#37	1	3,024.600	5.355	0.000	0.000	78.100	M	212.29	97.907
	Σ	**3,024.600**						**212.29**	**97.907**
#4	1	654.900	1.236	0.423	0.345	79.900	M	176.18	24.261
	2	699.700	1.092	0.423	0.345	78.500	M	184.60	23.363
	3	547.300	0.989	0.423	0.345	78.100	M	150.28	17.725
	4	1,063.800	1.498	0.000	0.000	81.400	M	276.84	43.892
	Σ	**5,990.300**						**754.26**	**207.147**
#1	1	755.100	2.032	0.000	0.000	78.700	M	125.01	25.584
	Σ	**755.100**						**125.01**	**25.584**
#42	1	1,327.100	2.923	3.078	0.144	77.200	M	144.33	40.069
	2	894.200	3.620	0.000	0.000	82.100	M	118.76	38.738
	3	139.300	1.214	0.000	0.000	82.600	M	46.72	6.249
	Σ	**3,115.700**						**240.07**	**110.640**
#3	1	1,550.000	2.670	0.000	0.000	83.500	M	294.26	73.934

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**4,665.700**						**341.85**	**184.574**
#5	Σ	**10,656.000**						**976.83**	**391.721**
#6	1	505.100	2.338	0.620	0.328	76.200	M	60.61	14.086
	2	638.400	4.585	0.478	0.304	78.800	M	54.07	21.791
	3	557.000	2.219	0.000	0.000	88.100	M	169.37	35.883
	4	308.200	0.485	0.478	0.304	89.900	M	318.21	22.286
	Σ	**12,664.700**						**1,228.78**	**485.767**
#40	1	190.700	1.159	0.000	0.000	75.700	M	37.93	5.108
	2	40.300	0.082	0.757	0.302	91.000	M	98.85	3.902
	Σ	**14,832.300**						**1,400.49**	**600.432**
#34	1	235.300	2.496	0.000	0.000	74.400	M	22.80	5.651
	Σ	**235.300**						**22.80**	**5.651**
#16	1	1,570.700	2.944	0.000	0.000	75.100	M	141.75	40.016
	Σ	**1,570.700**						**141.75**	**40.016**
#14	1	2,999.900	5.968	5.461	0.261	77.600	M	184.13	93.439
	2	1,855.400	3.914	1.286	0.322	78.800	M	179.79	63.334
	3	730.800	1.418	0.000	0.000	85.400	M	265.60	39.576
	4	1,109.100	2.763	1.418	0.312	78.000	M	134.96	35.631
	Σ	**6,695.200**						**336.25**	**231.979**
#38	Σ	**8,501.199**						**407.42**	**277.646**
#39	Σ	**8,501.199**						**406.29**	**277.646**
#15	1	539.400	1.116	0.000	0.000	75.700	M	110.36	14.444
	Σ	**9,040.600**						**428.54**	**292.090**
#41	Σ	**23,872.900**						**1,743.15**	**892.522**
#31	1	148.400	0.298	0.000	0.000	75.700	M	72.81	3.989
	Σ	**148.400**						**72.81**	**3.989**
#17	1	823.800	1.069	0.713	0.220	75.700	M	174.02	22.069
	2	115.700	0.456	0.000	0.000	85.000	M	89.66	6.108
	Σ	**939.500**						**175.15**	**28.177**
#32	1	118.100	0.555	0.108	0.329	75.700	M	39.51	3.165
	2	35.500	0.245	0.000	0.000	75.700	M	19.21	0.960
	Σ	**25,114.400**						**1,776.95**	**928.814**
#49	1	10.780	0.065	0.000	0.000	91.000	M	26.44	1.044

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**10.780**						**26.44**	**1.044**
#48	1	8.290	0.045	0.000	0.000	91.000	M	20.33	0.803
	Σ	**8.290**						**20.33**	**0.803**
#47	1	12.350	0.059	0.000	0.000	91.000	M	30.29	1.196
	Σ	**12.350**						**30.29**	**1.196**
#46	1	6.480	0.048	0.000	0.000	91.000	M	15.89	0.627
	Σ	**6.480**						**15.89**	**0.627**
#11	1	151.040	0.223	0.000	0.000	91.000	M	227.39	11.765
	Σ	**151.040**						**227.39**	**11.765**
#10	1	34.470	0.114	0.000	0.000	91.000	M	84.55	3.338
	Σ	**34.470**						**84.55**	**3.338**
#9	1	69.790	0.147	0.000	0.000	91.000	M	112.64	5.499
	Σ	**69.790**						**112.64**	**5.499**
#8	1	28.530	0.100	0.000	0.000	91.000	M	69.98	2.762
	Σ	**28.530**						**69.98**	**2.762**
#7	1	201.870	0.448	0.000	0.000	90.400	M	224.36	15.035
	Σ	**201.870**						**224.36**	**15.035**
#44	1	201.750	0.552	0.000	0.000	91.000	M	206.85	15.587
	Σ	**687.450**						**584.88**	**53.985**
#36	1	12.330	0.045	0.000	0.000	91.000	M	30.24	1.194
	Σ	**12.330**						**30.24**	**1.194**
#21	1	63.380	0.148	0.000	0.000	91.000	M	102.30	4.994
	Σ	**63.380**						**102.30**	**4.994**
#13	1	25.880	0.150	0.000	0.000	91.000	M	41.77	2.039
	Σ	**25.880**						**41.77**	**2.039**
#12	1	78.130	0.143	0.000	0.000	91.000	M	126.11	6.157
	Σ	**78.130**						**126.11**	**6.157**
#27	1	210.960	0.549	0.000	0.000	75.700	M	71.09	5.655
	Σ	**1,078.130**						**643.72**	**74.024**
#45	1	15.500	0.077	0.000	0.000	91.000	M	38.02	1.501
	Σ	**1,093.630**						**627.59**	**75.524**
#25	1	343.070	0.737	0.000	0.000	87.300	M	228.94	21.028

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**343.070**						**228.94**	**21.028**
#28	1	349.420	0.740	0.000	0.000	75.700	M	95.67	9.365
	2	221.000	0.613	0.253	0.339	75.700	M	69.05	5.923
	Σ	**2,045.020**						**888.17**	**115.510**
#23	1	192.200	0.380	0.000	0.000	75.700	M	82.13	5.150
	Σ	**27,456.620**						**1,830.13**	**1,054.154**
#24	1	201.360	0.410	0.000	0.000	90.400	M	234.07	15.038
	Σ	**27,657.980**						**1,821.22**	**1,069.193**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#35	1	0.220	125.00	9.30	0.3080	1.0000	2	294.7	67,189	42.39	28.59
	Σ							**294.7**	**67,189**	**42.39**	**28.59**
#26	1	0.209	75.00	12.70	0.3940	1.0000	3	1,712.3	102,780	8.09	5.69
	Σ							**1,712.3**	**102,780**	**8.09**	**5.69**
#29	1	0.210	150.00	7.20	0.3990	1.0000	3	146.6	56,711	14.72	10.90
	Σ							**1,714.3**	**93,056**	**6.48**	**4.40**
#43	1	0.183	200.00	3.30	0.3520	1.0000	2	389.7	11,471	4.58	3.37
	Σ							**389.7**	**11,471**	**4.58**	**3.37**
#22	1	0.205	100.00	11.40	0.3870	1.0000	3	1,092.0	91,488	4.87	3.42
	Σ							**1,092.0**	**91,488**	**4.87**	**3.42**
#30	1	0.207	200.00	3.70	0.2070	1.0000	3	181.1	17,861	1.61	1.12
	Σ							**1,662.4**	**64,764**	**8.95**	**2.94**
#19	1	0.187	150.00	7.70	0.3940	1.0000	2	1,188.2	45,487	24.94	17.96
	Σ							**1,188.2**	**45,487**	**24.94**	**17.96**
#33	Σ							**2,850.7**	**55,253**	**17.07**	**7.70**
#18	1	0.190	175.00	4.30	0.3150	1.0000	1	72.1	22,410	13.17	9.11
	Σ							**2,848.6**	**53,606**	**16.26**	**7.26**
#37	1	0.150	400.00	2.00	0.3220	1.0000	2	516.9	5,262	1.04	0.78
	Σ							**516.9**	**5,262**	**1.04**	**0.78**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#4	1	0.160	400.00	2.00	0.3320	1.0000	2	234.4	9,756	4.86	3.52
	2	0.130	200.00	3.50	0.3070	1.0000	2	238.7	10,355	5.25	3.79
	3	0.147	200.00	3.70	0.2900	1.0000	2	205.0	11,764	6.08	4.38
	4	0.121	175.00	4.20	0.2900	1.0000	2	509.0	11,685	5.59	4.07
	Σ							**1,678.1**	**10,606**	**4.22**	**2.36**
#1	1	0.147	300.00	2.80	0.3070	1.0000	2	210.0	8,215	3.43	2.52
	Σ							**210.0**	**8,215**	**3.43**	**2.52**
#42	1	0.142	300.00	2.10	0.3360	1.0000	2	238.9	5,856	1.99	1.49
	2	0.167	400.00	1.20	0.3480	1.0000	2	173.1	4,453	1.44	1.06
	3	0.180	400.00	1.60	0.3370	1.0000	2	49.1	7,980	4.08	2.95
	Σ							**497.6**	**4,766**	**1.16**	**0.80**
#3	1	0.179	300.00	2.00	0.3420	1.0000	2	616.6	8,321	3.29	2.42
	Σ							**924.0**	**7,844**	**2.16**	**1.01**
#5	Σ							**2,602.1**	**9,817**	**3.48**	**1.73**
#6	1	0.170	200.00	3.30	0.3350	1.0000	2	130.2	9,164	3.46	2.56
	2	0.176	200.00	3.70	0.3370	1.0000	2	180.7	8,222	2.01	1.49
	3	0.196	100.00	10.70	0.3770	1.0000	3	1,627.0	44,766	0.00	0.00
	4	0.203	100.00	10.60	0.3800	1.0000	3	1,824.4	82,026	3.21	2.29
	Σ							**6,276.6**	**63,341**	**10.31**	**1.53**
#40	1	0.190	175.00	4.40	0.3150	1.0000	1	89.3	17,739	9.28	6.69
	2	0.210	150.00	7.20	0.3990	1.0000	3	239.5	61,073	15.86	11.48
	Σ							**11,161.1**	**67,647**	**12.78**	**2.55**
#34	1	0.109	300.00	2.60	0.3650	1.0000	2	28.7	5,038	1.78	1.32
	Σ							**28.7**	**5,038**	**1.78**	**1.32**
#16	1	0.120	400.00	1.70	0.3520	1.0000	2	189.6	4,698	1.52	1.13
	Σ							**189.6**	**4,698**	**1.52**	**1.13**
#14	1	0.175	400.00	1.30	0.3310	1.0000	2	385.8	4,094	0.66	0.50
	2	0.175	300.00	2.00	0.3170	1.0000	2	388.8	6,076	1.73	1.28
	3	0.189	175.00	4.70	0.3530	1.0000	2	992.0	25,169	12.69	9.22
	4	0.256	300.00	2.10	0.3050	1.0000	2	352.6	9,774	3.48	2.58
	Σ							**1,659.7**	**21,089**	**7.20**	**1.81**
#38	Σ							**1,877.9**	**15,109**	**5.14**	**1.71**
#39	Σ							**1,877.9**	**322,705**	**109.71**	**1.71**
#15	1	0.190	200.00	3.30	0.3150	1.0000	1	194.2	13,679	7.21	5.19

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**1,989.1**	**14,393**	**4.88**	**1.71**
#41	Σ							**13,150.2**	**44,696**	**9.45**	**2.28**
#31	1	0.190	175.00	4.43	0.3150	1.0000	1	112.6	31,382	19.86	13.00
	Σ							**112.6**	**31,382**	**19.86**	**13.00**
#17	1	0.190	200.00	3.20	0.3150	1.0000	1	308.7	14,065	7.48	5.45
	2	0.197	150.00	6.30	0.2820	1.0000	2	193.0	33,226	20.21	13.98
	Σ							**402.9**	**29,770**	**14.97**	**5.25**
#32	1	0.190	300.00	3.00	0.3150	1.0000	1	48.3	16,133	9.56	6.61
	2	0.190	300.00	2.40	0.3150	1.0000	1	13.4	15,832	10.16	6.57
	Σ							**13,594.1**	**37,591**	**8.26**	**2.36**
#49	1	0.210	75.00	14.40	0.3990	1.0000	3	99.0	91,072	23.64	17.54
	Σ							**99.0**	**91,072**	**23.64**	**17.54**
#48	1	0.210	75.00	14.40	0.3990	1.0000	3	73.8	88,347	22.94	17.01
	Σ							**73.8**	**88,347**	**22.94**	**17.01**
#47	1	0.210	75.00	14.40	0.3990	1.0000	3	115.3	92,515	24.02	17.82
	Σ							**115.3**	**92,515**	**24.02**	**17.82**
#46	1	0.210	75.00	14.40	0.3990	1.0000	3	56.0	85,862	22.29	16.53
	Σ							**56.0**	**85,862**	**22.29**	**16.53**
#11	1	0.204	75.00	12.80	0.3960	1.0000	3	1,200.4	102,828	9.93	7.00
	Σ							**1,200.4**	**102,828**	**9.93**	**7.00**
#10	1	0.210	75.00	13.10	0.3990	1.0000	3	322.4	92,672	24.06	17.85
	Σ							**322.4**	**92,672**	**24.06**	**17.85**
#9	1	0.210	100.00	10.60	0.3990	1.0000	3	500.9	91,390	10.83	7.70
	Σ							**500.9**	**91,390**	**10.83**	**7.70**
#8	1	0.210	75.00	12.40	0.3990	1.0000	3	242.7	84,555	21.95	16.28
	Σ							**242.7**	**84,555**	**21.95**	**16.28**
#7	1	0.211	100.00	11.10	0.3920	1.0000	3	1,377.8	92,955	4.55	3.20
	Σ							**1,377.8**	**92,955**	**4.55**	**3.20**
#44	1	0.210	150.00	6.90	0.3990	1.0000	1	857.0	56,113	35.62	25.20
	Σ							**4,500.7**	**1,682,639**	**347.57**	**12.34**
#36	1	0.210	75.00	12.20	0.3990	1.0000	3	92.8	75,109	19.50	14.45
	Σ							**92.8**	**75,109**	**19.50**	**14.45**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#21	1	0.210	75.00	14.40	0.3990	1.0000	3	569.7	113,398	13.43	9.57
	Σ							**569.7**	**113,398**	**13.43**	**9.57**
#13	1	0.210	150.00	6.90	0.3990	1.0000	3	110.8	55,323	6.55	4.65
	Σ							**110.8**	**55,323**	**6.55**	**4.65**
#12	1	0.201	150.00	8.00	0.3940	1.0000	3	416.0	68,437	8.11	5.75
	Σ							**416.0**	**68,437**	**8.11**	**5.75**
#27	1	0.190	150.00	6.70	0.3150	1.0000	1	185.5	34,664	20.58	14.16
	Σ							**5,864.9**	**2,424,149**	**489.40**	**11.49**
#45	1	0.190	175.00	5.90	0.3150	1.0000	1	52.4	34,304	23.97	17.72
	Σ							**5,769.6**	**86,816**	**16.59**	**10.50**
#25	1	0.186	100.00	10.46	0.3770	1.0000	3	1,311.3	62,941	0.00	0.00
	Σ							**1,311.3**	**62,941**	**0.00**	**0.00**
#28	1	0.190	175.00	5.90	0.3150	1.0000	1	278.0	30,664	17.43	12.28
	2	0.190	175.00	5.90	0.3150	1.0000	1	179.2	31,444	18.39	12.87
	Σ							**7,876.5**	**2,312,423**	**424.95**	**9.03**
#23	1	0.190	150.00	6.70	0.3150	1.0000	1	190.9	40,345	24.99	16.67
	Σ							**21,937.1**	**1,446,411**	**311.34**	**3.27**
#24	1	0.211	100.00	11.10	0.3920	1.0000	3	1,408.8	95,098	5.39	3.79
	Σ							**22,819.8**	**93,869**	**18.02**	**2.99**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.45	103.00	2,312.00	2.110	0.304
		8. Large gullies, diversions, and low flowing streams	2.03	110.00	5,414.45	4.270	0.352
		5. Nearly bare and untilled, and alluvial valley fans	1.57	97.00	6,194.12	1.250	1.376
#1	**1**	**Time of Concentration:**					**2.032**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.32	140.00	10,633.45	1.140	2.590
		8. Large gullies, diversions, and low flowing streams	5.53	113.00	2,042.00	7.050	0.080
#3	**1**	**Time of Concentration:**					**2.670**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.72	60.00	3,483.10	1.310	0.738

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.45	94.00	6,477.39	3.610	0.498
#4	**1**	**Time of Concentration:**					**1.236**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	5.90	110.00	1,863.01	2.420	0.213
		8. Large gullies, diversions, and low flowing streams	1.43	163.00	11,361.26	3.590	0.879
#4	**2**	**Time of Concentration:**					**1.092**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	5.81	100.00	1,722.00	2.400	0.199
		8. Large gullies, diversions, and low flowing streams	2.04	248.00	12,174.16	4.280	0.790
#4	**3**	**Time of Concentration:**					**0.989**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	4.95	105.00	2,123.01	2.220	0.265
		8. Large gullies, diversions, and low flowing streams	1.96	366.00	18,657.28	4.200	1.233
#4	**4**	**Time of Concentration:**					**1.498**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.36	125.00	9,201.32	1.160	2.203
		8. Large gullies, diversions, and low flowing streams	3.46	94.00	2,715.03	5.580	0.135
#6	**1**	**Time of Concentration:**					**2.338**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	0.88	130.00	14,813.12	0.930	4.424
		8. Large gullies, diversions, and low flowing streams	4.76	181.00	3,801.00	6.540	0.161
#6	**2**	**Time of Concentration:**					**4.585**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	0.70	35.00	5,028.01	0.830	1.682
		8. Large gullies, diversions, and low flowing streams	2.49	228.00	9,161.04	4.730	0.537
#6	**3**	**Time of Concentration:**					**2.219**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	4.17	73.00	1,752.02	2.040	0.238
		8. Large gullies, diversions, and low flowing streams	3.61	183.00	5,073.04	5.690	0.247
#6	**4**	**Time of Concentration:**					**0.485**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	42.00	852.50	2.210	0.107
		8. Large gullies, diversions, and low flowing streams	2.93	185.00	6,312.20	5.130	0.341
#7	**1**	**Time of Concentration:**					**0.448**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	5.03	12.00	238.70	2.240	0.029
		8. Large gullies, diversions, and low flowing streams	5.35	95.00	1,777.10	6.930	0.071
#8	**1**	**Time of Concentration:**					**0.100**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#9	1	5. Nearly bare and untilled, and alluvial valley fans	20.30	20.00	98.50	4.500	0.006
		8. Large gullies, diversions, and low flowing streams	5.55	200.00	3,604.00	7.060	0.141
#9	**1**	**Time of Concentration:**					**0.147**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	21.56	105.00	487.10	4.640	0.029
		8. Large gullies, diversions, and low flowing streams	4.91	100.00	2,035.10	6.650	0.085
#10	**1**	**Time of Concentration:**					**0.114**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.06	45.00	320.00	3.750	0.023
		8. Large gullies, diversions, and low flowing streams	4.63	215.00	4,646.90	6.450	0.200
#11	**1**	**Time of Concentration:**					**0.223**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	16.38	25.00	152.60	4.040	0.010
		8. Large gullies, diversions, and low flowing streams	5.07	165.00	3,254.40	6.750	0.133
#12	**1**	**Time of Concentration:**					**0.143**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	27.00	777.50	1.860	0.116
		8. Large gullies, diversions, and low flowing streams	8.69	95.00	1,093.40	8.840	0.034
#13	**1**	**Time of Concentration:**					**0.150**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	1.01	216.00	21,486.12	1.000	5.968
#14	**1**	**Time of Concentration:**					**5.968**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	1.41	235.00	16,630.10	1.180	3.914
#14	**2**	**Time of Concentration:**					**3.914**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	2.19	43.00	1,966.00	1.470	0.371
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**3**	**Time of Concentration:**					**1.418**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	1.08	112.00	10,345.00	1.040	2.763
#14	**4**	**Time of Concentration:**					**2.763**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	1.51	43.00	2,851.08	1.220	0.649
		8. Large gullies, diversions, and low flowing streams	2.54	42.00	1,652.04	4.780	0.096
		8. Large gullies, diversions, and low flowing streams	1.03	42.00	4,065.04	3.040	0.371
#15	**1**	**Time of Concentration:**					**1.116**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.30	105.00	8,103.10	1.130	1.991
		8. Large gullies, diversions, and low flowing streams	0.15	6.00	3,981.42	1.160	0.953
#16	**1**	**Time of Concentration:**					**2.944**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	2.55	70.00	2,746.30	1.590	0.479
		8. Large gullies, diversions, and low flowing streams	1.66	137.00	8,228.09	3.870	0.590
#17	**1**	**Time of Concentration:**					**1.069**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	4.36	149.00	3,419.07	2.080	0.456
#17	**2**	**Time of Concentration:**					**0.456**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	2.56	25.00	977.70	1.590	0.170
		8. Large gullies, diversions, and low flowing streams	1.06	50.00	4,705.29	3.090	0.422
#18	**1**	**Time of Concentration:**					**0.592**
#19	1	5. Nearly bare and untilled, and alluvial valley fans	4.92	45.00	914.00	2.210	0.114
		8. Large gullies, diversions, and low flowing streams	2.64	185.00	7,019.00	4.870	0.400
		5. Nearly bare and untilled, and alluvial valley fans	1.12	21.00	1,872.15	1.050	0.495
#19	**1**	**Time of Concentration:**					**1.009**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	30.00	307.10	3.120	0.027
		8. Large gullies, diversions, and low flowing streams	4.96	145.00	2,924.38	6.680	0.121
#21	**1**	**Time of Concentration:**					**0.148**
#22	1	5. Nearly bare and untilled, and alluvial valley fans	4.15	54.00	1,300.01	2.030	0.177
		8. Large gullies, diversions, and low flowing streams	3.22	155.00	4,807.09	5.380	0.248
#22	**1**	**Time of Concentration:**					**0.425**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	6.91	43.00	622.00	2.620	0.065
		8. Large gullies, diversions, and low flowing streams	2.65	147.00	5,545.07	4.880	0.315
#23	**1**	**Time of Concentration:**					**0.380**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	5.30	55.00	1,038.01	2.300	0.125
		8. Large gullies, diversions, and low flowing streams	3.06	191.00	6,252.04	5.240	0.331
#24	**1**	**Time of Concentration:**					**0.410**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	3.47	55.00	1,583.00	1.860	0.236
		8. Large gullies, diversions, and low flowing streams	3.07	291.00	9,483.00	5.250	0.501

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#25	**1**	**Time of Concentration:**					**0.737**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	9.72	75.00	772.00	3.110	0.068
		8. Large gullies, diversions, and low flowing streams	3.54	175.00	4,938.06	5.640	0.243
#26	**1**	**Time of Concentration:**					**0.311**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	22.00	475.80	2.150	0.061
		8. Large gullies, diversions, and low flowing streams	1.58	105.00	6,636.00	3.770	0.488
#27	**1**	**Time of Concentration:**					**0.549**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	2.41	30.00	1,246.00	1.550	0.223
		8. Large gullies, diversions, and low flowing streams	1.19	72.00	6,071.40	3.260	0.517
#28	**1**	**Time of Concentration:**					**0.740**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	8.54	125.00	1,463.00	2.920	0.139
		8. Large gullies, diversions, and low flowing streams	0.78	35.00	4,506.00	2.640	0.474
#28	**2**	**Time of Concentration:**					**0.613**
#29	1	8. Large gullies, diversions, and low flowing streams	3.10	49.00	1,581.61	5.280	0.083
#29	**1**	**Time of Concentration:**					**0.083**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	5.85	40.00	684.20	2.410	0.078
		8. Large gullies, diversions, and low flowing streams	2.10	55.00	2,622.00	4.340	0.167
#30	**1**	**Time of Concentration:**					**0.245**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.79	25.00	895.90	1.670	0.149
		9. Small streams flowing bankfull	1.16	60.00	5,192.70	9.670	0.149
#31	**1**	**Time of Concentration:**					**0.298**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	5.14	35.00	681.00	2.260	0.083
		8. Large gullies, diversions, and low flowing streams	2.98	88.00	2,957.08	5.170	0.158
		5. Nearly bare and untilled, and alluvial valley fans	1.83	28.00	1,528.05	1.350	0.314
#32	**1**	**Time of Concentration:**					**0.555**
#32	2	8. Large gullies, diversions, and low flowing streams	0.96	25.00	2,601.10	2.940	0.245
#32	**2**	**Time of Concentration:**					**0.245**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	1.50	164.00	10,964.76	1.220	2.496
#34	**1**	**Time of Concentration:**					**2.496**
#35	1	8. Large gullies, diversions, and low flowing streams	3.24	144.00	4,442.11	5.400	0.228

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	8.78	26.00	296.00	2.960	0.027
#35	**1**	**Time of Concentration:**					**0.255**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	8.73	20.00	229.10	2.950	0.021
		8. Large gullies, diversions, and low flowing streams	9.39	75.00	798.50	9.190	0.024
#36	**1**	**Time of Concentration:**					**0.045**
#37	1	5. Nearly bare and untilled, and alluvial valley fans	1.16	240.00	20,629.19	1.070	5.355
#37	**1**	**Time of Concentration:**					**5.355**
#40	1	5. Nearly bare and untilled, and alluvial valley fans	3.09	22.00	711.21	1.750	0.112
		8. Large gullies, diversions, and low flowing streams	0.66	61.00	9,198.59	2.440	1.047
#40	**1**	**Time of Concentration:**					**1.159**
#40	2	8. Large gullies, diversions, and low flowing streams	5.10	103.00	2,019.72	6.770	0.082
#40	**2**	**Time of Concentration:**					**0.082**
#42	1	5. Nearly bare and untilled, and alluvial valley fans	3.45	93.00	2,694.01	1.850	0.404
		8. Large gullies, diversions, and low flowing streams	2.37	100.00	4,211.05	4.620	0.253
		5. Nearly bare and untilled, and alluvial valley fans	1.17	103.00	8,811.70	1.080	2.266
#42	**1**	**Time of Concentration:**					**2.923**
#42	2	5. Nearly bare and untilled, and alluvial valley fans	0.62	63.00	10,166.21	0.780	3.620
#42	**2**	**Time of Concentration:**					**3.620**
#42	3	5. Nearly bare and untilled, and alluvial valley fans	1.24	60.00	4,853.19	1.110	1.214
#42	**3**	**Time of Concentration:**					**1.214**
#43	1	5. Nearly bare and untilled, and alluvial valley fans	1.12	93.00	8,290.98	1.050	2.193
		8. Large gullies, diversions, and low flowing streams	3.42	185.00	5,404.14	5.550	0.270
#43	**1**	**Time of Concentration:**					**2.463**
#44	1	5. Nearly bare and untilled, and alluvial valley fans	9.26	17.00	183.60	3.040	0.016
		8. Large gullies, diversions, and low flowing streams	1.63	120.00	7,383.30	3.820	0.536
#44	**1**	**Time of Concentration:**					**0.552**
#45	1	5. Nearly bare and untilled, and alluvial valley fans	4.08	17.00	416.50	2.020	0.057
		8. Large gullies, diversions, and low flowing streams	2.47	135.00	5,464.70	4.710	0.322
#45	**1**	**Time of Concentration:**					**0.077**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#46	1	5. Nearly bare and untilled, and alluvial valley fans	6.02	15.00	249.00	2.450	0.028
		8. Large gullies, diversions, and low flowing streams	9.50	65.00	684.00	9.240	0.020
#46	**1**	**Time of Concentration:**					**0.048**
#47	1	5. Nearly bare and untilled, and alluvial valley fans	9.17	30.00	327.00	3.020	0.030
		8. Large gullies, diversions, and low flowing streams	8.13	75.00	923.00	8.550	0.029
#47	**1**	**Time of Concentration:**					**0.059**
#48	1	5. Nearly bare and untilled, and alluvial valley fans	9.77	26.00	266.00	3.120	0.023
		8. Large gullies, diversions, and low flowing streams	9.93	75.00	755.00	9.450	0.022
#48	**1**	**Time of Concentration:**					**0.045**
#49	1	5. Nearly bare and untilled, and alluvial valley fans	11.84	45.00	380.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	8.50	95.00	1,117.00	8.740	0.035
#49	**1**	**Time of Concentration:**					**0.065**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.18	3.800	0.423
#4	**1**	**Muskingum K:**					**0.423**
#4	2	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.18	3.800	0.423
#4	**2**	**Muskingum K:**					**0.423**
#4	3	8. Large gullies, diversions, and low flowing streams	1.61	93.00	5,787.00	3.800	0.423
#4	**3**	**Muskingum K:**					**0.423**
#6	1	8. Large gullies, diversions, and low flowing streams	1.16	84.00	7,218.35	3.230	0.620
#6	**1**	**Muskingum K:**					**0.620**
#6	2	8. Large gullies, diversions, and low flowing streams	0.77	35.00	4,531.33	2.630	0.478
#6	**2**	**Muskingum K:**					**0.478**
#6	4	8. Large gullies, diversions, and low flowing streams	0.77	35.00	4,531.33	2.630	0.478
#6	**4**	**Muskingum K:**					**0.478**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	0.99	153.00	15,503.09	0.990	4.349
		8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,564.29	3.850	0.545

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**1**	**Muskingum K:**					**5.461**
#14	2	8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,564.29	3.850	0.545
		5. Nearly bare and untilled, and alluvial valley fans	1.46	11.00	755.02	1.200	0.174
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.12	1.040	0.567
#14	**2**	**Muskingum K:**					**1.286**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	2.19	43.00	1,966.00	1.470	0.371
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	1.08	23.00	2,124.00	1.040	0.567
#14	**4**	**Muskingum K:**					**1.418**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	1.80	62.00	3,443.10	1.340	0.713
#17	**1**	**Muskingum K:**					**0.713**
#28	2	8. Large gullies, diversions, and low flowing streams	1.43	47.00	3,281.00	3.590	0.253
#28	**2**	**Muskingum K:**					**0.253**
#32	1	8. Large gullies, diversions, and low flowing streams	1.18	15.00	1,268.00	3.260	0.108
#32	**1**	**Muskingum K:**					**0.108**
#40	2	8. Large gullies, diversions, and low flowing streams	0.75	53.00	7,067.40	2.590	0.757
#40	**2**	**Muskingum K:**					**0.757**
#42	1	5. Nearly bare and untilled, and alluvial valley fans	0.48	37.00	7,646.20	0.690	3.078
#42	**1**	**Muskingum K:**					**3.078**

Title: Bond Scenario 9/2019
Description: Prediction Point PP-40

Folder:
Date: 08/10/2012

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Run n.1

Gradient [%]	0.50	Froude number	0.80
Discharge [ft3/s]	407.64	Cross section [ft2]	61.02
Water level [ft]	3.49	Wetted perimeter [ft]	29.09
Average velocity [ft/s]	6.68	Hydraulic radius [ft]	2.10

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	14.71	5.31	1.00							
3.1	14.71			5.00	0.53	Reno mattress 6"	N	0.85	4.36	Y
4	7.00	8.73	1.00							
4.1	7.00			5.00	0.53	Reno mattress 6"	N	1.11	4.68	Y
5	14.71	5.31	1.00							
5.1	14.71			5.00	0.53	Reno mattress 6"	N	0.85	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-40

Folder:
Date: 08/10/2012

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Run n.2

Gradient [%]	2.05	Froude number	1.55
Discharge [ft3/s]	407.64	Cross section [ft2]	36.17
Water level [ft]	2.50	Wetted perimeter [ft]	22.79
Average velocity [ft/s]	11.27	Hydraulic radius [ft]	1.59

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
2	6.00	0.00	1.00							
2.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	14.71	8.60	1.00							
3.1	14.71			5.00	1.06	Reno mattress 6"	N	2.48	4.36	Y
4	7.00	14.13	1.00							
4.1	7.00			5.00	1.06	Reno mattress 6"	N	3.26	4.68	Y
5	14.71	8.60	1.00							
5.1	14.71			5.00	1.06	Reno mattress 6"	N	2.48	4.36	Y
6	6.00	0.00	1.00							
6.1	6.00			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Prediction Point PP-40

Folder:
Date: 08/10/2012

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Materials used

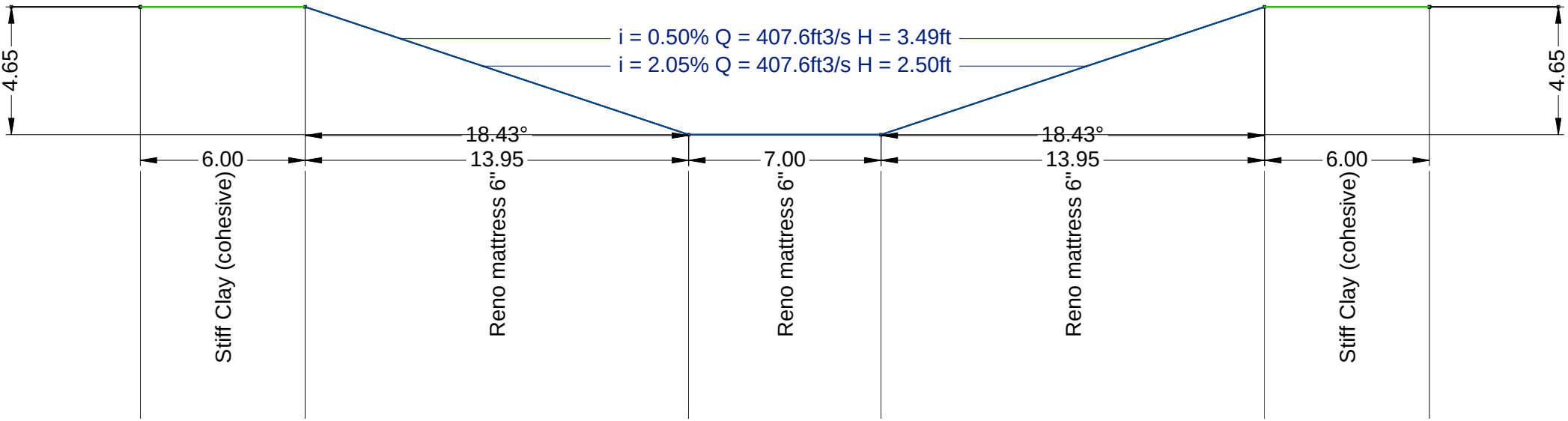
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Prediction Point PP-40

Folder:
Date: 08/10/2012



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Bond Scenario 9/2019

Drop Structure LNDS1, for watershed data see appendix 50.A Exhibit 50.A-2 sheet 1.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

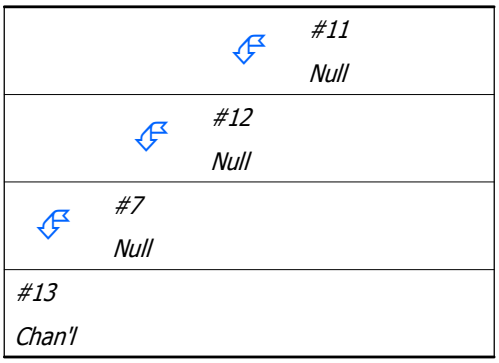
Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#5	0.000	0.000	
Null	#2	==>	#9	0.000	0.000	LNDS2
Null	#3	==>	#9	0.000	0.000	LNDS3
Null	#4	==>	#11	0.033	0.332	LSDS1
Null	#5	==>	#15	0.466	0.323	
Null	#6	==>	#14	0.413	0.291	
Null	#7	==>	#13	0.000	0.000	
Null	#8	==>	#5	0.000	0.000	
Null	#9	==>	#14	0.159	0.290	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#12	0.221	0.313	
Null	#12	==>	#7	1.453	0.249	
Channel	#13	==>	End	0.000	0.000	LNDS1
Null	#14	==>	#15	0.482	0.309	
Null	#15	==>	#13	0.000	0.000	

				#3 Null
				#2 Null
			#9 Null	
			#6 Null	
		#14 Null		
			#8 Null	
			#1 Null	
		#5 Null		
	#15 Null			
				#10 Null
				#4 Null



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	8. Large gullies, diversions, and low flowing streams	1.27	5.10	401.80	3.37	0.033
#4	**Muskingum K:**					**0.033**
#5	8. Large gullies, diversions, and low flowing streams	1.08	56.40	5,221.73	3.11	0.466
#5	**Muskingum K:**					**0.466**
#6	8. Large gullies, diversions, and low flowing streams	0.63	22.10	3,527.40	2.37	0.413
#6	**Muskingum K:**					**0.413**
#9	8. Large gullies, diversions, and low flowing streams	0.61	8.20	1,341.00	2.34	0.159
#9	**Muskingum K:**					**0.159**
#11	8. Large gullies, diversions, and low flowing streams	0.90	20.50	2,269.80	2.85	0.221
#11	**Muskingum K:**					**0.221**
#12	8. Large gullies, diversions, and low flowing streams	0.32	28.30	8,841.00	1.69	1.453
#12	**Muskingum K:**					**1.453**
#14	8. Large gullies, diversions, and low flowing streams	0.85	40.80	4,792.79	2.76	0.482
#14	**Muskingum K:**					**0.482**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#3	816.910	816.910	527.91	51.63
#2	835.810	835.810	245.28	40.11
#9	0.000	1,652.720	734.18	91.75
#6	108.350	108.350	55.48	5.69
#14	77.460	1,838.530	778.55	100.21
#8	226.170	226.170	110.21	8.11
#1	390.690	390.690	113.81	17.86
#5	0.000	616.860	204.91	25.98
#15	148.590	2,603.980	921.23	131.50
#10	702.280	702.280	265.50	41.20
#4	725.590	725.590	438.54	46.33
#11	0.000	1,427.870	597.00	87.52
#12	265.360	1,693.230	684.65	99.04
#7	460.800	2,154.030	669.45	115.50
#13	0.000	4,758.010	985.00	247.00

Structure Detail:

Structure #3 (Null)

LNDS3

Structure #2 (Null)

LNDS2

Structure #9 (Null)

Structure #6 (Null)

Structure #14 (Null)

Structure #8 (Null)

Structure #1 (Null)

Structure #5 (Null)

Structure #15 (Null)

Structure #10 (Null)

Structure #4 (Null)

LSDS1

Structure #11 (Null)

Structure #12 (Null)

Structure #7 (Null)

Structure #13 (Riprap Channel)

LNDS1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	1.8	1.00		

Riprap Channel Results:

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Simons/OSM Method - Mild Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	985.00 cfs	
Depth:	0.00 ft	
Top Width:	0.00 ft	
Velocity:	0.00 fps	
X-Section Area:	0.00 sq ft	
Hydraulic Radius:	0.000 ft	
Froude Number:	0.00	
Manning's n:	0.0000	
Dmin:	0.00 in	
D50:	0.00 in	
Dmax:	0.00 in	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#3	1	256.900	2.056	0.489	0.335	83.500	M	58.16	11.783
	2	138.800	0.315	0.489	0.335	89.900	M	170.35	9.737
	3	54.800	0.221	0.489	0.335	93.000	M	89.23	4.685
	4	98.600	0.277	0.210	0.349	89.900	M	126.87	6.929
	5	111.900	0.466	0.210	0.349	92.700	M	135.82	9.326
	6	38.300	0.159	0.325	0.328	93.000	M	66.37	3.314
	7	117.610	0.635	0.000	0.000	84.700	M	70.08	5.859
	Σ	**816.910**						**527.91**	**51.633**
#2	1	549.100	2.696	0.358	0.372	80.300	M	78.10	20.043
	2	185.910	0.606	0.101	0.367	88.300	M	146.34	11.748
	3	100.800	0.312	0.000	0.000	92.500	M	143.55	8.321
	Σ	**835.810**						**245.28**	**40.112**
#9	**Σ**	**1,652.720**						**734.18**	**91.745**
#6	1	108.350	0.861	0.000	0.000	85.500	M	55.48	5.694
	Σ	**108.350**						**55.48**	**5.694**
#14	1	77.460	0.535	0.000	0.000	80.000	M	36.42	2.769
	Σ	**1,838.530**						**778.55**	**100.209**
#8	1	160.810	0.349	0.285	0.273	80.000	M	97.60	5.772
	2	65.360	0.404	0.000	0.000	80.000	M	36.58	2.343
	Σ	**226.170**						**110.21**	**8.115**
#1	1	307.470	2.002	0.000	0.000	81.200	M	59.87	11.988
	2	83.220	0.325	0.083	0.355	90.000	M	101.46	5.876
	Σ	**390.690**						**113.81**	**17.863**
#5	**Σ**	**616.860**						**204.91**	**25.978**
#15	1	148.590	0.512	0.000	0.000	80.000	M	71.91	5.316
	Σ	**2,603.980**						**921.23**	**131.503**
#10	1	470.600	1.257	0.389	0.361	87.000	M	202.43	27.305
	2	231.680	0.890	0.000	0.000	87.500	M	133.01	13.891
	Σ	**702.280**						**265.50**	**41.196**
#4	1	166.700	1.257	0.539	0.354	81.100	M	46.56	6.454
	2	66.500	1.396	0.539	0.354	82.600	M	19.21	2.865
	3	96.300	0.818	0.397	0.340	90.200	M	70.32	6.862

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	4	53.100	0.766	0.397	0.340	93.000	M	48.64	4.505
	5	112.200	0.199	0.361	0.349	92.700	M	183.87	9.378
	6	56.900	0.398	0.164	0.365	93.000	M	75.67	4.839
	7	89.500	0.238	0.164	0.365	91.900	M	135.03	7.163
	8	84.390	0.692	0.000	0.000	84.900	M	48.16	4.262
	∑	**725.590**						**438.54**	**46.328**
#11	**∑**	**1,427.870**						**597.00**	**87.525**
#12	1	265.360	0.993	0.000	0.000	82.700	M	100.09	11.517
	∑	**1,693.230**						**684.65**	**99.041**
#7	1	339.750	3.161	0.000	0.000	80.000	M	41.33	12.129
	2	121.050	0.500	0.057	0.363	80.000	M	59.48	4.331
	∑	**2,154.030**						**669.45**	**115.500**
#13	**∑**	**4,758.010**						**985.00**	**247.004**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.96	58.00	6,051.12	0.970	1.732
		8. Large gullies, diversions, and low flowing streams	3.30	174.40	5,290.94	5.440	0.270
#1	**1**	**Time of Concentration:**					**2.002**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.61	28.00	1,072.30	1.610	0.185
		8. Large gullies, diversions, and low flowing streams	4.29	135.00	3,149.86	6.210	0.140
#1	**2**	**Time of Concentration:**					**0.325**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.06	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.11	3.300	0.193
#2	**1**	**Time of Concentration:**					**2.696**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	1.98	29.00	1,466.64	1.400	0.291
		8. Large gullies, diversions, and low flowing streams	2.80	160.00	5,710.41	5.020	0.315
#2	**2**	**Time of Concentration:**					**0.606**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.58	44.60	799.71	2.360	0.094
		8. Large gullies, diversions, and low flowing streams	3.30	141.80	4,294.75	5.450	0.218

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	**3**	**Time of Concentration:**					**0.312**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.29	0.890	1.810
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.04	5.450	0.246
#3	**1**	**Time of Concentration:**					**2.056**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.02	2.220	0.190
		8. Large gullies, diversions, and low flowing streams	2.98	70.00	2,345.12	5.180	0.125
#3	**2**	**Time of Concentration:**					**0.315**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	6.42	83.00	1,293.01	2.530	0.141
		8. Large gullies, diversions, and low flowing streams	3.21	50.00	1,559.04	5.370	0.080
#3	**3**	**Time of Concentration:**					**0.221**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	8.98	60.00	668.00	2.990	0.062
		8. Large gullies, diversions, and low flowing streams	2.82	110.00	3,900.15	5.030	0.215
#3	**4**	**Time of Concentration:**					**0.277**
#3	5	5. Nearly bare and untilled, and alluvial valley fans	4.11	50.00	1,216.01	2.020	0.167
		8. Large gullies, diversions, and low flowing streams	1.86	82.00	4,404.10	4.090	0.299
#3	**5**	**Time of Concentration:**					**0.466**
#3	6	5. Nearly bare and untilled, and alluvial valley fans	9.01	53.00	588.00	3.000	0.054
		8. Large gullies, diversions, and low flowing streams	1.64	24.00	1,463.05	3.840	0.105
#3	**6**	**Time of Concentration:**					**0.159**
#3	7	5. Nearly bare and untilled, and alluvial valley fans	1.59	32.00	2,016.25	1.250	0.448
		8. Large gullies, diversions, and low flowing streams	1.99	56.80	2,853.98	4.230	0.187
#3	**7**	**Time of Concentration:**					**0.635**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.14	1.030	0.873
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.49	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.257**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.37	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.02	6.070	0.102
#4	**2**	**Time of Concentration:**					**1.396**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.18	0.960	0.717

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.04	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.818**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.02	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.11	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.766**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.05	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.199**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.398**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.24	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.238**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	1.78	54.30	3,056.39	1.330	0.638
		8. Large gullies, diversions, and low flowing streams	3.72	41.90	1,126.61	5.780	0.054
#4	**8**	**Time of Concentration:**					**0.692**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.29	40.40	3,143.10	1.130	0.772
		8. Large gullies, diversions, and low flowing streams	2.50	37.90	1,518.50	4.730	0.089
#6	**1**	**Time of Concentration:**					**0.861**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	0.24	10.00	4,125.41	0.490	2.338
		8. Large gullies, diversions, and low flowing streams	1.01	90.80	8,951.98	3.020	0.823
#7	**1**	**Time of Concentration:**					**3.161**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	0.95	10.00	1,048.98	0.970	0.300
		8. Large gullies, diversions, and low flowing streams	2.18	70.00	3,203.80	4.430	0.200
#7	**2**	**Time of Concentration:**					**0.500**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	1.66	15.00	902.41	1.280	0.195
		8. Large gullies, diversions, and low flowing streams	4.42	154.50	3,493.65	6.300	0.154
#8	**1**	**Time of Concentration:**					**0.349**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	2	5. Nearly bare and untilled, and alluvial valley fans	3.49	71.00	2,033.80	1.860	0.303
		8. Large gullies, diversions, and low flowing streams	2.55	44.40	1,742.47	4.780	0.101
#8	**2**	**Time of Concentration:**					**0.404**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.14	1.030	0.873
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.49	4.650	0.384
#10	**1**	**Time of Concentration:**					**1.257**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	92.00	3,718.22	1.570	0.657
		8. Large gullies, diversions, and low flowing streams	2.19	82.00	3,739.34	4.440	0.233
#10	**2**	**Time of Concentration:**					**0.890**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	1.66	61.10	3,681.40	1.280	0.798
		8. Large gullies, diversions, and low flowing streams	2.28	72.50	3,186.30	4.520	0.195
#12	**1**	**Time of Concentration:**					**0.993**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	2.63	20.70	786.80	1.620	0.134
		8. Large gullies, diversions, and low flowing streams	0.62	21.30	3,413.90	2.360	0.401
#14	**1**	**Time of Concentration:**					**0.535**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	6.05	34.59	571.59	2.450	0.064
		8. Large gullies, diversions, and low flowing streams	1.17	60.80	5,213.50	3.230	0.448
#15	**1**	**Time of Concentration:**					**0.512**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.95	24.40	1,252.60	4.180	0.083
#1	**2**	**Muskingum K:**					**0.083**
#2	1	8. Large gullies, diversions, and low flowing streams	2.70	172.00	6,363.70	4.930	0.358
#2	**1**	**Muskingum K:**					**0.358**
#2	2	8. Large gullies, diversions, and low flowing streams	2.44	41.80	1,709.61	4.690	0.101
#2	**2**	**Muskingum K:**					**0.101**
#3	1	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.60	3.440	0.489
#3	**1**	**Muskingum K:**					**0.489**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	2	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.60	3.440	0.489
#3	**2**	**Muskingum K:**					**0.489**
#3	3	8. Large gullies, diversions, and low flowing streams	1.32	80.00	6,060.60	3.440	0.489
#3	**3**	**Muskingum K:**					**0.489**
#3	4	8. Large gullies, diversions, and low flowing streams	1.73	51.60	2,985.24	3.940	0.210
#3	**4**	**Muskingum K:**					**0.210**
#3	5	8. Large gullies, diversions, and low flowing streams	1.73	51.60	2,985.24	3.940	0.210
#3	**5**	**Muskingum K:**					**0.210**
#3	6	8. Large gullies, diversions, and low flowing streams	1.16	44.00	3,788.20	3.230	0.325
#3	**6**	**Muskingum K:**					**0.325**
#4	1	8. Large gullies, diversions, and low flowing streams	1.88	150.00	7,979.14	4.110	0.539
#4	**1**	**Muskingum K:**					**0.539**
#4	2	8. Large gullies, diversions, and low flowing streams	1.88	150.00	7,979.14	4.110	0.539
#4	**2**	**Muskingum K:**					**0.539**
#4	3	8. Large gullies, diversions, and low flowing streams	1.45	75.00	5,159.60	3.610	0.397
#4	**3**	**Muskingum K:**					**0.397**
#4	4	8. Large gullies, diversions, and low flowing streams	1.45	75.00	5,159.60	3.610	0.397
#4	**4**	**Muskingum K:**					**0.397**
#4	5	8. Large gullies, diversions, and low flowing streams	1.72	88.00	5,117.17	3.930	0.361
#4	**5**	**Muskingum K:**					**0.361**
#4	6	8. Large gullies, diversions, and low flowing streams	2.34	63.50	2,719.48	4.580	0.164
#4	**6**	**Muskingum K:**					**0.164**
#4	7	8. Large gullies, diversions, and low flowing streams	2.34	63.50	2,719.48	4.580	0.164
#4	**7**	**Muskingum K:**					**0.164**
#7	2	8. Large gullies, diversions, and low flowing streams	2.25	20.80	926.40	4.490	0.057
#7	**2**	**Muskingum K:**					**0.057**
#8	1	8. Large gullies, diversions, and low flowing streams	0.47	9.89	2,109.63	2.050	0.285
#8	**1**	**Muskingum K:**					**0.285**
#10	1	8. Large gullies, diversions, and low flowing streams	2.19	136.00	6,217.71	4.430	0.389
#10	**1**	**Muskingum K:**					**0.389**

Title: Bond Scenario 9/2019
Description: Drop Structure LNDS1

Folder:
Date: 3/22/2013

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	1.81	Froude number	1.51
Discharge [ft3/s]	985.00	Cross section [ft2]	78.87
Water level [ft]	2.71	Wetted perimeter [ft]	38.13
Average velocity [ft/s]	12.49	Hydraulic radius [ft]	2.07

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	1.80	0.00	1.00							
1.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N
2	25.50	0.00	1.00							
2.1	25.50			-	-	Stiff Clay (cohesive)	N	-	-	N
3	12.65	8.53	1.00							
3.1	12.65			5.00	1.00	Reno mattress 6"	N	2.38	4.36	Y
4	21.00	14.02	1.00							
4.1	21.00			5.00	1.00	Reno mattress 6"	N	3.12	4.68	Y
5	12.65	8.53	1.00							
5.1	12.65			5.00	1.00	Reno mattress 6"	N	2.38	4.36	Y
6	25.50	0.00	1.00							
6.1	25.50			-	-	Stiff Clay (cohesive)	N	-	-	N
7	1.80	0.00	1.00							
7.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Drop Structure LNDS1

Folder:
Date: 3/22/2013

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Materials used

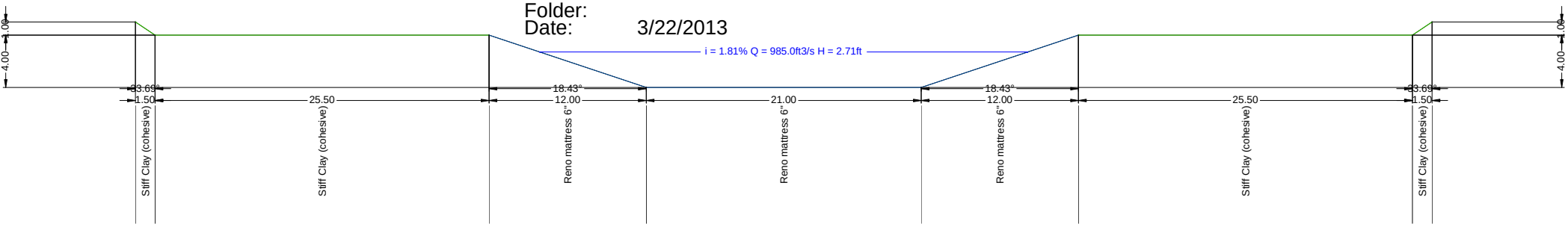
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Drop Structure LNDS1

Folder:
Date: 3/22/2013



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Bond Scenario 09/2019

Drop Structures LR3DS1 and LR3DS2, for watershed data see Appendix 50.A, Exhibit 50.A-1 sheet 1.

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#5	0.129	0.337	LR3DS2 (S5A)
Null	#2	==>	#3	1.249	0.285	Point S22
Channel	#3	==>	End	0.000	0.000	LR3DS1 (S11)
Null	#4	==>	#5	0.221	0.330	Point S5B
Null	#5	==>	#2	0.501	0.249	Point S5

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.39	22.90	1,646.17	3.53	0.129
#1	**Muskingum K:**					**0.129**
#2	8. Large gullies, diversions, and low flowing streams	0.57	58.00	10,168.00	2.26	1.249
#2	**Muskingum K:**					**1.249**
#4	8. Large gullies, diversions, and low flowing streams	1.22	32.20	2,638.00	3.31	0.221
#4	**Muskingum K:**					**0.221**
#5	8. Large gullies, diversions, and low flowing streams	0.32	9.70	3,048.39	1.69	0.501
#5	**Muskingum K:**					**0.501**

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#4	119.020	119.020	37.57	4.85
#1	681.190	681.190	192.58	39.09
#5	82.990	883.200	221.04	46.91
#2	125.260	1,008.460	223.71	51.39
#3	1,071.810	2,080.270	304.79	90.46

Structure Detail:

Structure #4 (Null)

Point S5B

Structure #1 (Riprap Channel)

LR3DS2 (S5A)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
14.00	3.0:1	3.0:1	5.2	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	192.58 cfs	
Depth:	1.15 ft	2.15 ft
Top Width:	20.88 ft	26.88 ft
Velocity*:		
X-Section Area:	20.01 sq ft	
Hydraulic Radius:	0.941 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Null)

Point S5

Structure #2 (Null)

Point S22

Structure #3 (Riprap Channel)

LR3DS1 (S11)

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	2.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	304.79 cfs	
Depth:	1.42 ft	2.42 ft
Top Width:	20.54 ft	26.54 ft
Velocity*:		
X-Section Area:	23.17 sq ft	
Hydraulic Radius:	1.103 ft	
Froude Number*:		
Manning's n*:		
Dmin:	6.00 in	
D50:	18.00 in	
Dmax:	22.50 in	

Velocity and Manning's n calculations may not apply for this method.

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#4	1	119.020	1.150	0.000	0.000	81.800	M	37.57	4.846
	Σ	**119.020**						**37.57**	**4.846**
#1	1	87.500	0.372	0.346	0.340	91.500	M	110.06	6.769
	2	123.090	0.494	0.000	0.000	81.800	M	69.91	5.022
	3	470.600	1.591	0.499	0.340	87.000	M	168.22	27.297
	Σ	**681.190**						**192.58**	**39.088**
#5	1	82.990	0.407	0.000	0.000	80.000	M	46.25	2.975
	Σ	**883.200**						**221.04**	**46.910**
#2	1	125.260	0.499	0.000	0.000	80.000	M	61.63	4.482
	Σ	**1,008.460**						**223.71**	**51.391**
#3	1	251.200	1.784	0.800	0.301	80.000	M	48.88	8.968
	2	138.320	1.198	0.796	0.303	80.000	M	36.72	4.939
	3	224.760	0.668	0.499	0.312	80.000	M	91.05	8.037
	4	192.520	0.521	0.408	0.317	80.000	M	92.12	6.888
	5	121.630	0.543	0.408	0.317	82.200	M	67.01	5.097
	6	143.380	0.311	0.000	0.000	80.000	M	92.26	5.142
	Σ	**2,080.270**						**304.79**	**90.462**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	0.67	3.90	582.08	0.810	0.199
		8. Large gullies, diversions, and low flowing streams	2.05	55.00	2,680.05	4.290	0.173
#1	**1**	**Time of Concentration:**					**0.372**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	1.40	5.00	357.01	1.180	0.084
		8. Large gullies, diversions, and low flowing streams	1.48	80.00	5,393.01	3.650	0.410
#1	**2**	**Time of Concentration:**					**0.494**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	0.92	36.00	3,920.28	0.950	1.146
		8. Large gullies, diversions, and low flowing streams	2.29	166.00	7,258.09	4.530	0.445
#1	**3**	**Time of Concentration:**					**1.591**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	0.99	53.10	5,361.40	2.980	0.499
#2	**1**	**Time of Concentration:**					**0.499**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.07	18.00	1,686.02	1.030	0.454
		8. Large gullies, diversions, and low flowing streams	0.19	12.00	6,276.15	1.310	1.330
#3	**1**	**Time of Concentration:**					**1.784**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	1.08	30.00	2,774.18	1.030	0.748
		8. Large gullies, diversions, and low flowing streams	0.69	28.00	4,040.40	2.490	0.450
#3	**2**	**Time of Concentration:**					**1.198**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	2.71	62.00	2,289.00	1.640	0.387
		8. Large gullies, diversions, and low flowing streams	1.12	36.00	3,207.41	3.170	0.281
#3	**3**	**Time of Concentration:**					**0.668**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	2.58	63.00	2,438.08	1.600	0.423
		8. Large gullies, diversions, and low flowing streams	2.00	30.00	1,500.00	4.240	0.098
#3	**4**	**Time of Concentration:**					**0.521**
#3	5	5. Nearly bare and untilled, and alluvial valley fans	3.22	45.00	1,399.03	1.790	0.217
		8. Large gullies, diversions, and low flowing streams	1.23	48.00	3,898.00	3.320	0.326
#3	**5**	**Time of Concentration:**					**0.543**
#3	6	5. Nearly bare and untilled, and alluvial valley fans	8.20	111.00	1,353.01	2.860	0.131
		8. Large gullies, diversions, and low flowing streams	1.45	34.00	2,344.01	3.610	0.180
#3	**6**	**Time of Concentration:**					**0.311**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.14	50.00	4,391.35	1.060	1.150
#4	**1**	**Time of Concentration:**					**1.150**
#5	1	8. Large gullies, diversions, and low flowing streams	0.99	43.30	4,371.08	2.980	0.407
#5	**1**	**Time of Concentration:**					**0.407**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.45	65.00	4,497.02	3.600	0.346
#1	**1**	**Muskingum K:**					**0.346**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	3	8. Large gullies, diversions, and low flowing streams	1.45	94.00	6,487.23	3.610	0.499
#1	**3**	**Muskingum K:**					**0.499**
#3	1	8. Large gullies, diversions, and low flowing streams	0.74	55.00	7,431.42	2.580	0.800
#3	**1**	**Muskingum K:**					**0.800**
#3	2	8. Large gullies, diversions, and low flowing streams	0.76	57.00	7,488.17	2.610	0.796
#3	**2**	**Muskingum K:**					**0.796**
#3	3	8. Large gullies, diversions, and low flowing streams	0.89	45.00	5,072.13	2.820	0.499
#3	**3**	**Muskingum K:**					**0.499**
#3	4	8. Large gullies, diversions, and low flowing streams	0.97	42.00	4,340.18	2.950	0.408
#3	**4**	**Muskingum K:**					**0.408**
#3	5	8. Large gullies, diversions, and low flowing streams	0.97	42.00	4,340.18	2.950	0.408
#3	**5**	**Muskingum K:**					**0.408**

Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS1

Folder:
Date: 3/22/2013

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	2.83	Froude number	1.71
Discharge [ft3/s]	256.26	Cross section [ft2]	24.41
Water level [ft]	1.48	Wetted perimeter [ft]	21.39
Average velocity [ft/s]	10.50	Hydraulic radius [ft]	1.14

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	1.80	0.00	1.00							
1.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N
2	1.50	0.00	1.00							
2.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
3	7.91	7.14	1.00							
3.1	7.91			5.00	1.25	Reno mattress 6"	N	2.04	4.36	Y
4	12.00	11.74	1.00							
4.1	12.00			5.00	1.25	Reno mattress 6"	N	2.67	4.68	Y
5	7.91	7.14	1.00							
5.1	7.91			5.00	1.25	Reno mattress 6"	N	2.04	4.36	Y
6	1.50	0.00	1.00							
6.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
7	1.80	0.00	1.00							
7.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS1

Folder:
Date: 3/22/2013

Notice
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Materials used

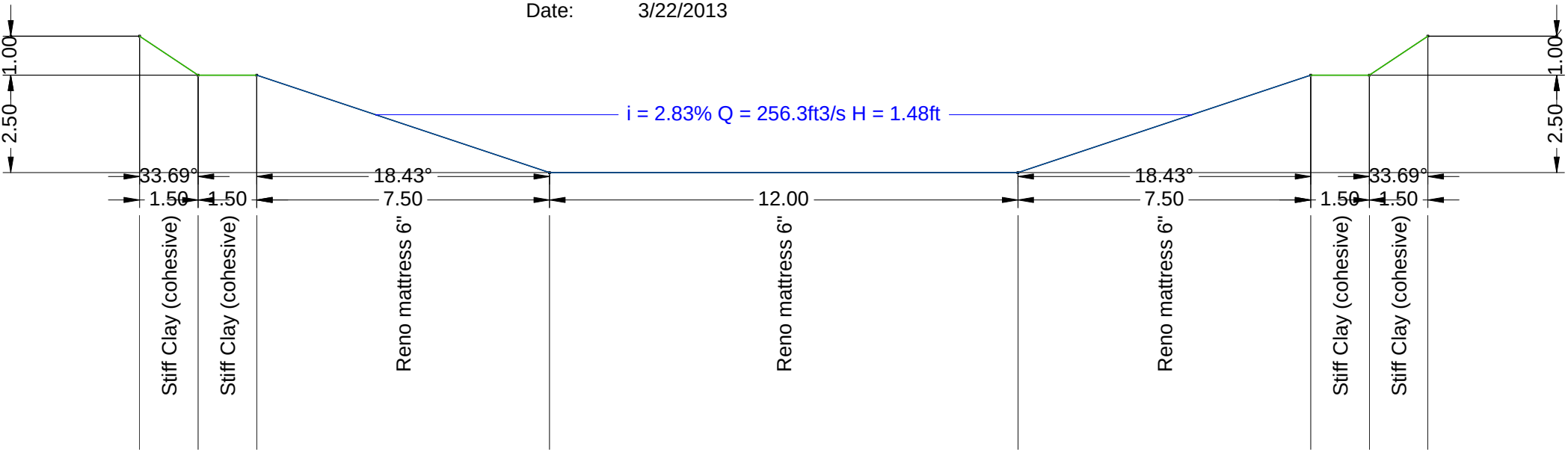
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS1

Folder:
Date: 3/22/2013



Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS2

Folder:
Date: 3/27/2014

Notice
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Run n.1

Gradient [%]	5.20	Froude number	2.18
Discharge [ft3/s]	192.58	Cross section [ft2]	16.94
Water level [ft]	1.00	Wetted perimeter [ft]	20.31
Average velocity [ft/s]	11.37	Hydraulic radius [ft]	0.83

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	1.80	0.00	1.00							
1.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N
2	1.50	0.00	1.00							
2.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
3	7.91	7.43	1.00							
3.1	7.91			5.00	1.69	Reno mattress 6"	N	2.51	4.36	Y
4	14.00	12.21	1.00							
4.1	14.00			5.00	1.69	Reno mattress 6"	N	3.30	4.68	Y
5	7.91	7.43	1.00							
5.1	7.91			5.00	1.69	Reno mattress 6"	N	2.51	4.36	Y
6	1.50	0.00	1.00							
6.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
7	1.80	0.00	1.00							
7.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS2

Folder:
Date: 3/27/2014

Notice
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Materials used

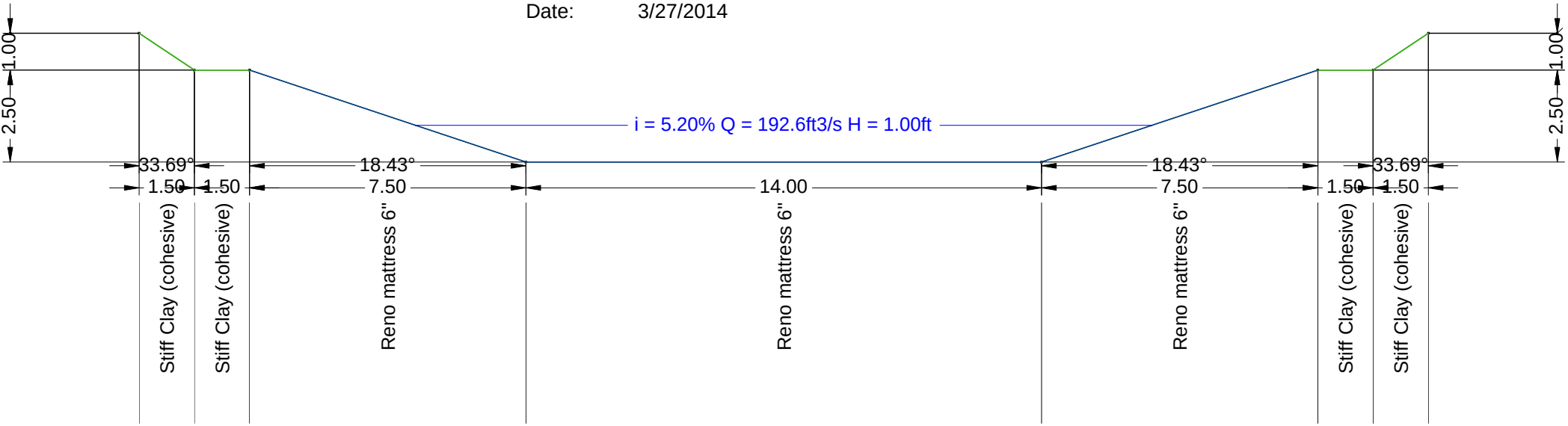
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Drop Structure LR3DS2

Folder:
Date: 3/27/2014



Drop Structure LNDS4, Capacity Design for 100 yr-6 hr Storm Event

Material: Riprap Material

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
10.00	3.0:1	3.0:1	7.1	0.0400	1.00			15.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	212.00 cfs	
Depth:	1.43 ft	2.43 ft
Top Width:	18.55 ft	24.55 ft
Velocity:	10.42 fps	
X-Section Area:	20.36 sq ft	
Hydraulic Radius:	1.070	
Froude Number:	1.75	

03/13/03

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Riprap 2.0

AREA III RECLAIMED CHANNELS

PROGRAM OUTPUT

*** The following input parameters were used to calculate ***
Average Velocity and Maximum Flow Depth for this Run.

Discharge, ft/sec	146.0
Bottom Width, ft	10.00
Left Channel Side Slope	3.0 H:1V
Right Channel Side Slope	3.0 H:1V
Bottom Manning's "n"	0.0385
Left Manning's "n"	0.0385
Right Manning's "n"	0.0385
Channel Longitudinal Slope	0.11500

========== **ASCE Method** ==========

Input Parameters:

Run Name: LNDS4 Description: Lowe North Drop Str. 4 (LNR3 Sta. 10+06 to 6+25)

Local Depth Averaged Velocity, ft/sec	11.41
Unit Weight of Stone, lbs/cu ft	165.00
Cotangent of Sideslope	3.00

Output Results:

Computed D50, ft	0.90

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	0.74
Specific Weight, pcf	165.00
Layer Thickness, ft	1.75
Selected Minimum D30, ft	0.85
Selected Minimum D90, ft	1.23

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	185	463
W50	93	137
W15	29	69

========== **USBR Method** ==========

Input Parameters:

Run Name: LNDS4 Description: Lowe North Drop Str. 4 (LNR3 Sta. 10+06 to 6+25)

Average Channel Velocity, ft/sec 11.19

Output Results:

Computed D50, ft 1.77

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	1.45
Specific Weight, pcf	165.00
Layer Thickness, ft	3.00
Selected Minimum D30, ft	1.46
Selected Minimum D90, ft	2.12

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	933	2,333
W50	467	690
W15	146	345

========== **Isbash Method** ==========

Input Parameters:

Run Name: LNDS4 Description: Lowe North Drop Str. 4 (LNR3 Sta. 10+06 to 6+25)

Average Channel Velocity, ft/sec	11.19
Unit Weight of Stone, lbs/cu ft	165.00
Turbulence Level	High

Output Results:

Computed D50, ft 1.60

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	1.31
Specific Weight, pcf	165.00
Layer Thickness, ft	2.75
Selected Minimum D30, ft	1.34
Selected Minimum D90, ft	1.94

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	719	1,797
W50	359	532
W15	112	266

========== **HEC-11 Method** ==========

Input Parameters:

Run Name: LNDS4 Description: Lowe North Drop Str. 4 (LNR3 Sta. 10+06 to 6+25)

Average Channel Velocity, ft/sec	11.19
Average Flow Depth, ft	1.00
Unit Weight of Stone, lbs/cu ft	165.00
Material Angle of Repose, ø	39.00
Cotangent of Sideslope	3.00
Safety Factor	1.25

Output Results:

Computed D50, ft 1.86

*** Using FHWA Gradation ***

Gradation Class 1/2 ton
Layer Thickness, ft 3.38

Percent Smaller by Size	Rock Size, ft	Rock Size, lbs
D100	2.85	2,000
D50	2.25	1,000
D5	1.80	500

- The rip-rap is designed for the peak flow from the 25 year-6 hour storm event. The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77. The Sedcad results are presented in Appendix 11-X. LNDS4 is a rip-rapped drop structure, which will be located downstream of Structure 2 (Sedcad hydrology model)
- The riprap size required is D50=1.75 foot rock, this size rock is available in very limited quantity in the local area. Smaller size rock was placed and grouted with concrete.
- **From the updated hydrology for the October 2006 FSC revision the 25 yr-6 hr peak flow is 144 cfs, which is less than the design flow above. The rip-rap size specified is conservative; therefore the rip-rap sizing was not updated for the new flow.**

Drop Structure LNDS5, Capacity Design for 100 yr-6 hr Storm Event

Material: Riprap Material

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
14.00	3.0:1	3.0:1	8.0	0.0400	1.00			15.0

	w/o Freeboard	w/ Freeboard
Design Discharge:	471.00 cfs	
Depth:	1.83 ft	2.83 ft
Top Width:	25.00 ft	31.00 ft
Velocity:	13.17 fps	
X-Section Area:	35.77 sq ft	
Hydraulic Radius:	1.397	
Froude Number:	1.94	

03/13/03

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87416

Riprap 2.0

AREA III RECLAIMED CHANNELS

PROGRAM OUTPUT

*** The following input parameters were used to calculate ***
Average Velocity and Maximum Flow Depth for this Run.

Discharge, ft/sec	327.0
Bottom Width, ft	14.00
Left Channel Side Slope	3.0 H:1V
Right Channel Side Slope	3.0 H:1V
Bottom Manning's "n"	0.0412
Left Manning's "n"	0.0412
Right Manning's "n"	0.0412
Channel Longitudinal Slope	0.11500

========== **ASCE Method** ==========

Input Parameters:

Run Name: LNDS5 Description: Lowe North Drop Str. 5 (LNR4 Sta. 6+01 to 2+00)

Local Depth Averaged Velocity, ft/sec	12.94
Unit Weight of Stone, lbs/cu ft	165.00
Cotangent of Sideslope	3.00

Output Results:

Computed D50, ft	1.16

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	0.95
Specific Weight, pcf	165.00
Layer Thickness, ft	2.00
Selected Minimum D30, ft	0.97
Selected Minimum D90, ft	1.41

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	276	691
W50	138	205
W15	43	102

========== **USBR Method** ==========

Input Parameters:

Run Name: LNDS5 Description: Lowe North Drop Str. 5 (LNR4 Sta. 6+01 to 2+00)

Average Channel Velocity, ft/sec 12.94

Output Results:

Computed D50, ft 2.38

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	1.95
Specific Weight, pcf	165.00
Layer Thickness, ft	4.50
Selected Minimum D30, ft	2.19
Selected Minimum D90, ft	3.17

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	3,149	7,873
W50	1,575	2,330
W15	492	1,165

========== **Isbash Method** ==========

Input Parameters:

Run Name: LNDS5 Description: Lowe North Drop Str. 5 (LNR4 Sta. 6+01 to 2+00)

Average Channel Velocity, ft/sec	12.94
Unit Weight of Stone, lbs/cu ft	165.00
Turbulence Level	High

Output Results:

Computed D50, ft 2.14

*** Using Gradation from COE ETL 1110-2-120 ***

Computed D30, ft	1.75
Specific Weight, pcf	165.00
Layer Thickness, ft	4.00
Selected Minimum D30, ft	1.95
Selected Minimum D90, ft	2.82

Percent Lighter by Weight	Stone Weight, lbs Minimum	Maximum
W100	2,212	5,529
W50	1,106	1,637
W15	346	818

========== **HEC-11 Method** ==========

Input Parameters:

Run Name: LNDS5 Description: Lowe North Drop Str. 5 (LNR4 Sta. 6+01 to 2+00)

Average Channel Velocity, ft/sec	12.94
Average Flow Depth, ft	1.39
Unit Weight of Stone, lbs/cu ft	165.00
Material Angle of Repose, ø	39.00
Cotangent of Sideslope	3.00
Safety Factor	1.20

Output Results:

Computed D50, ft 2.30

*** Using FHWA Gradation ***

Gradation Class 1 ton
Layer Thickness, ft 4.28

Percent Smaller by Size	Rock Size, ft	Rock Size, lbs
D100	3.60	4,000
D50	2.85	2,000
D5	2.25	1,000

- The rip-rap is designed for the peak flow from the 25 year-6 hour storm event. The drainage subdivisions used to model the hydrology is presented on Exhibit 11-77. The Sedcad results are presented in Appendix 11-X. LNDS5 is a rip-rapped drop structure, which will be located downstream of Structure 3 (Sedcad hydrology model).
- The riprap size required is D50=2.5 foot rock, this size rock is available in very limited quantity in the local area. Smaller size rock was placed and grouted with concrete. The grouted rock will be broken up to resemble d50=2.5 foot rock.
- **From the updated hydrology for the October 2006 FSC revision the 25 yr-6 hr peak flow is 331 cfs, which is approximately equal to the design flow above. The rip-rap size specified should be sufficient, therefore the rip-rap sizing was not updated for the new flow.**

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Bond Scenario 09/2019

Drop Structure LSDS1, for watershed data see Appendix 50.A-2 exhibit 50.A-2 sheet 1.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo MIne
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NM TYPE II 70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

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Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	End	0.000	0.000	LSDS1

#1
Chan'l

Copyright 1998 -2010 Pamela J. Schwab

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	949.100	949.100	658.04	59.92

Structure Detail:

Structure #1 (Riprap Channel)

LSDS1

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
20.00	3.0:1	3.0:1	12.5	1.00		

Riprap Channel Results:

PADER Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	658.04 cfs	
Depth:	1.98 ft	2.98 ft
Top Width:	31.91 ft	37.91 ft
Velocity:	12.77 fps	
X-Section Area:	51.51 sq ft	
Hydraulic Radius:	1.582 ft	
Froude Number:	1.77	
Manning's n:	0.0560	
Dmin:	7.00 in	
D50:	12.00 in	
Dmax:	18.00 in	

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	166.700	0.954	0.486	0.357	81.100	M	57.26	6.454
	2	66.500	0.946	0.486	0.357	82.600	M	25.79	2.866
	3	96.300	0.921	0.334	0.345	90.200	M	64.65	6.860
	4	53.100	0.177	0.334	0.345	93.000	M	91.03	4.583
	5	112.200	0.358	0.281	0.346	92.700	M	153.41	9.376
	6	56.900	0.260	0.134	0.346	93.000	M	88.24	4.853
	7	89.500	0.429	0.134	0.346	91.900	M	108.05	7.110
	8	69.400	0.393	0.000	0.000	84.900	M	55.96	3.512
	9	238.500	0.545	0.000	0.000	87.500	M	190.21	14.305
	Σ	**949.100**						**658.04**	**59.919**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.26	39.00	3,087.00	1.120	0.765
		8. Large gullies, diversions, and low flowing streams	2.92	102.00	3,497.00	5.120	0.189
#1	**1**	**Time of Concentration:**					**0.954**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	1.04	33.00	3,166.00	1.020	0.862
		8. Large gullies, diversions, and low flowing streams	3.97	72.00	1,813.00	5.970	0.084
#1	**2**	**Time of Concentration:**					**0.946**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.18	0.960	0.717
		8. Large gullies, diversions, and low flowing streams	3.55	147.00	4,145.00	5.640	0.204
#1	**3**	**Time of Concentration:**					**0.921**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	11.72	30.00	256.00	3.420	0.020
		8. Large gullies, diversions, and low flowing streams	3.19	97.00	3,042.00	5.350	0.157
#1	**4**	**Time of Concentration:**					**0.177**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	2.77	20.00	721.00	1.660	0.120
		8. Large gullies, diversions, and low flowing streams	3.48	167.00	4,794.00	5.590	0.238
#1	**5**	**Time of Concentration:**					**0.358**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	6	5. Nearly bare and untilled, and alluvial valley fans	3.84	18.00	469.00	1.950	0.066
		8. Large gullies, diversions, and low flowing streams	1.79	50.00	2,799.00	4.000	0.194
#1	**6**	**Time of Concentration:**					**0.260**
#1	7	5. Nearly bare and untilled, and alluvial valley fans	1.17	6.50	556.00	1.080	0.143
		8. Large gullies, diversions, and low flowing streams	2.19	100.00	4,572.00	4.430	0.286
#1	**7**	**Time of Concentration:**					**0.429**
#1	8	5. Nearly bare and untilled, and alluvial valley fans	0.97	9.00	930.04	0.980	0.263
		8. Large gullies, diversions, and low flowing streams	2.33	50.00	2,148.13	4.570	0.130
#1	**8**	**Time of Concentration:**					**0.393**
#1	9	5. Nearly bare and untilled, and alluvial valley fans	2.82	30.00	1,062.00	1.680	0.175
		8. Large gullies, diversions, and low flowing streams	1.84	100.00	5,431.00	4.070	0.370
#1	**9**	**Time of Concentration:**					**0.545**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	2.00	148.00	7,409.00	4.230	0.486
#1	**1**	**Muskingum K:**					**0.486**
#1	2	8. Large gullies, diversions, and low flowing streams	2.00	148.00	7,409.00	4.230	0.486
#1	**2**	**Muskingum K:**					**0.486**
#1	3	8. Large gullies, diversions, and low flowing streams	1.60	73.00	4,564.21	3.790	0.334
#1	**3**	**Muskingum K:**					**0.334**
#1	4	8. Large gullies, diversions, and low flowing streams	1.60	73.00	4,564.00	3.790	0.334
#1	**4**	**Muskingum K:**					**0.334**
#1	5	8. Large gullies, diversions, and low flowing streams	1.63	63.00	3,868.00	3.820	0.281
#1	**5**	**Muskingum K:**					**0.281**
#1	6	8. Large gullies, diversions, and low flowing streams	1.62	30.00	1,848.00	3.820	0.134
#1	**6**	**Muskingum K:**					**0.134**
#1	7	8. Large gullies, diversions, and low flowing streams	1.62	30.00	1,848.00	3.820	0.134
#1	**7**	**Muskingum K:**					**0.134**

Title: Bond Scenario 9/2019
Description: Drop Structure LSDS1

Folder:
Date: 3/27/2014

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	12.50	Froude number	3.27
Discharge [ft3/s]	658.04	Cross section [ft2]	32.85
Water level [ft]	1.36	Wetted perimeter [ft]	28.63
Average velocity [ft/s]	20.03	Hydraulic radius [ft]	1.15

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	3.61	0.00	1.00							
1.1	3.61			-	-	Stiff Clay (cohesive)	N	-	-	N
2	11.00	0.00	1.00							
2.1	11.00			-	-	Stiff Clay (cohesive)	N	-	-	N
3	7.91	13.05	1.00							
3.1	7.91			5.00	4.30	Gabions 18"	N	8.27	9.15	Y
4	20.00	21.46	1.00							
4.1	20.00			5.00	4.30	Gabions 18"	N	10.85	9.83	Y
5	7.91	13.05	1.00							
5.1	7.91			5.00	4.30	Gabions 18"	N	8.27	9.15	Y
6	11.00	0.00	1.00							
6.1	11.00			-	-	Stiff Clay (cohesive)	N	-	-	N
7	3.61	0.00	1.00							
7.1	3.61			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Drop Structure LSDS1

Folder:
Date: 3/27/2014

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Materials used

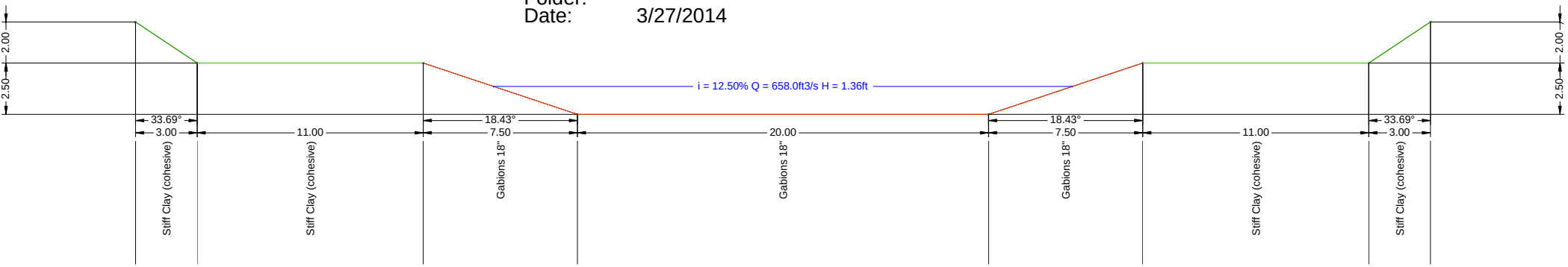
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Gabions 18"	0.0301	9.83	N	8.27	1.64	165.51		0.140

Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Drop Structure LSDS1

Folder:
Date: 3/27/2014



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Bond Scenario 9 / 2019

Dixon Drop Structures North Fork. Refer to Exh 50.A-2 sheet 2 for drop structure locations.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#7	0.000	0.000	NF-01 Drop Structure
Channel	#2	==>	#7	0.000	0.000	NF-02 Drop Structure
Channel	#3	==>	#2	0.000	0.000	NF-03 Drop Structure
Channel	#4	==>	#7	0.000	0.000	NF-04 Drop Structure
Channel	#5	==>	#7	0.000	0.000	NF-05 Drop Structure
Channel	#6	==>	#7	0.000	0.000	NF-06 Drop Structure
Null	#7	==>	End	0.000	0.000	

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#6	8.600	8.600	20.19	0.78
#5	7.500	7.500	11.49	0.56
#4	17.800	17.800	27.26	1.32
#3	45.200	45.200	53.08	3.28
#2	20.200	65.400	80.66	4.75
#1	22.700	22.700	53.30	2.07
#7	0.000	122.000	167.59	9.47

Structure Detail:

Structure #6 (Riprap Channel)

NF-06 Drop Structure

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	20.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.19 cfs	
Depth:	0.18 ft	1.18 ft
Top Width:	9.05 ft	15.05 ft
Velocity*:		
X-Section Area:	1.50 sq ft	
Hydraulic Radius:	0.164 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Riprap Channel)

NF-05 Drop Structure

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
8.00	3.0:1	3.0:1	15.6	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	11.49 cfs	
Depth:	0.14 ft	1.14 ft
Top Width:	8.82 ft	14.82 ft
Velocity*:		
X-Section Area:	1.15 sq ft	
Hydraulic Radius:	0.130 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Riprap Channel)

NF-04 Drop Structure

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	15.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	27.26 cfs	
Depth:	0.24 ft	1.24 ft
Top Width:	11.41 ft	17.41 ft
Velocity*:		
X-Section Area:	2.52 sq ft	
Hydraulic Radius:	0.219 ft	
Froude Number*:		
Manning's n*:		
Dmin:	2.00 in	
D50:	6.00 in	
Dmax:	7.50 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Erodible Channel)

NF-03 Drop Structure

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
10.00	3.0:1	3.0:1	1.5	0.0300	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	53.08 cfs	
Depth:	0.87 ft	1.87 ft
Top Width:	15.22 ft	21.22 ft
Velocity:	4.83 fps	
X-Section Area:	10.98 sq ft	
Hydraulic Radius:	0.708 ft	
Froude Number:	1.00	

Structure #2 (Riprap Channel)

NF-02 Drop Structure

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	3.0:1	3.0:1	5.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	80.66 cfs	
Depth:	0.65 ft	1.65 ft
Top Width:	13.91 ft	19.91 ft
Velocity*:		
X-Section Area:	7.80 sq ft	
Hydraulic Radius:	0.552 ft	
Froude Number*:		

	w/o Freeboard	w/ Freeboard
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Erodible Channel)

NF-01 Drop Structure

Trapezoidal Erodible Channel Inputs:

Material: Graded loam to cobbles when noncolloidal

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)	Limiting Velocity (fps)
10.00	3.0:1	3.0:1	0.6	0.0300	1.00			5.0

Erodible Channel Results:

	w/o Freeboard	w/ Freeboard
Design Discharge:	53.30 cfs	
Depth:	1.13 ft	2.13 ft
Top Width:	16.76 ft	22.76 ft
Velocity:	3.53 fps	
X-Section Area:	15.08 sq ft	
Hydraulic Radius:	0.881 ft	
Froude Number:	0.66	

Structure #7 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#6	1	8.600	0.094	0.000	0.000	90.500	M	20.19	0.783
	Σ	**8.600**						**20.19**	**0.783**
#5	1	7.500	0.161	0.000	0.000	90.500	M	11.49	0.556
	Σ	**7.500**						**11.49**	**0.556**
#4	1	17.800	0.147	0.000	0.000	90.500	M	27.26	1.319
	Σ	**17.800**						**27.26**	**1.319**
#3	1	45.200	0.380	0.000	0.000	90.500	M	53.08	3.282
	Σ	**45.200**						**53.08**	**3.282**
#2	1	20.200	0.209	0.000	0.000	90.500	M	29.16	1.470
	Σ	**65.400**						**80.66**	**4.752**
#1	1	22.700	0.113	0.000	0.000	90.500	M	53.30	2.066
	Σ	**22.700**						**53.30**	**2.066**
#7	Σ	**122.000**						**167.59**	**9.475**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	6.96	8.00	115.00	2.630	0.012
		8. Large gullies, diversions, and low flowing streams	3.52	72.00	2,048.00	5.620	0.101
#1	**1**	**Time of Concentration:**					**0.113**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	2.07	15.00	725.00	1.430	0.140
		8. Large gullies, diversions, and low flowing streams	3.79	55.00	1,453.00	5.830	0.069
#2	**1**	**Time of Concentration:**					**0.209**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	0.92	10.00	1,090.00	0.950	0.318
		8. Large gullies, diversions, and low flowing streams	4.28	60.00	1,402.00	6.200	0.062
#3	**1**	**Time of Concentration:**					**0.380**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.60	8.00	500.00	1.260	0.110
		8. Large gullies, diversions, and low flowing streams	5.32	50.00	940.00	6.910	0.037

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	**1**	**Time of Concentration:**					**0.147**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.00	5.00	500.00	1.000	0.138
		8. Large gullies, diversions, and low flowing streams	7.25	50.00	690.00	8.070	0.023
#5	**1**	**Time of Concentration:**					**0.161**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.48	5.00	337.00	1.210	0.077
		8. Large gullies, diversions, and low flowing streams	7.00	35.00	500.00	7.930	0.017
#6	**1**	**Time of Concentration:**					**0.094**

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Bond Scenario 9 / 2019

North Fork Diversion Channel Drop Structures. Hydrology model and designs for rip-rapped downdrains. Refer to Exhibit 50.A-2 sheet 2 for watershed subdivisions and structure locations.

Revised May 2014

CJB

Navajo Transitional Energy Company
Navajo Mine
Fruitland, NM

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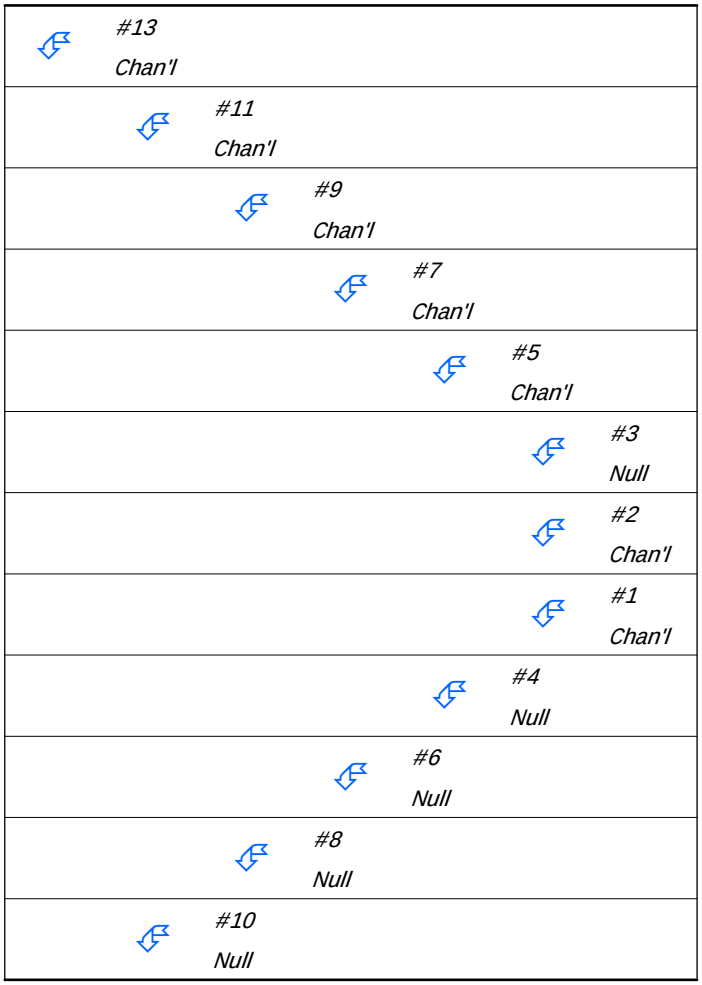
General Information

Storm Information:

Storm Type:	NRCS TYPE II-70
Design Storm:	100 yr - 6 hr
Rainfall Depth:	1.960 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Channel	#1	==>	#4	0.041	0.236	NFD-01 Downdrain @ Sta. 1+59
Channel	#2	==>	#4	0.000	0.000	NFD-02 Downdrain @ Sta. 3+54
Null	#3	==>	#4	0.000	0.000	Downdrain @ Sta. 3+92 in Sandstone
Null	#4	==>	#6	0.063	0.237	
Channel	#5	==>	#6	0.000	0.000	NFD-03 Downdrain @ Sta. 7+42
Null	#6	==>	#8	0.045	0.237	
Channel	#7	==>	#8	0.000	0.000	NFD-04 Downdrain @ Sta. 9+89
Null	#8	==>	#10	0.199	0.237	
Channel	#9	==>	#10	0.000	0.000	NFD-05 Downdrain @ Sta. 20+84
Null	#10	==>	#12	0.093	0.237	
Channel	#11	==>	#12	0.000	0.000	NFD-06 Downdrain @ Sta. 26+15
Null	#12	==>	#14	0.070	0.238	
Channel	#13	==>	#14	0.000	0.000	NFD-07 Downdrain @ Sta. 29+88
Null	#14	==>	End	0.000	0.000	



	#12 *Null*
#14 *Null*	

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.26	0.58	225.00	1.52	0.041
#1	**Muskingum K:**					**0.041**
#2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#2	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.26	0.92	350.07	1.53	0.063
#4	**Muskingum K:**					**0.063**
#6	8. Large gullies, diversions, and low flowing streams	0.26	0.66	252.00	1.53	0.045
#6	**Muskingum K:**					**0.045**
#8	8. Large gullies, diversions, and low flowing streams	0.26	2.89	1,098.00	1.53	0.199
#8	**Muskingum K:**					**0.199**
#10	8. Large gullies, diversions, and low flowing streams	0.26	1.35	515.00	1.53	0.093
#10	**Muskingum K:**					**0.093**
#12	8. Large gullies, diversions, and low flowing streams	0.26	1.03	390.00	1.54	0.070
#12	**Muskingum K:**					**0.070**

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Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#13	8.020	8.020	20.47	0.85
#11	1.620	1.620	4.13	0.17
#9	6.850	6.850	17.48	0.73
#7	2.190	2.190	5.59	0.23
#5	5.780	5.780	14.75	0.61
#3	2.250	2.250	5.74	0.24
#2	37.760	37.760	60.47	3.24
#1	4.920	4.920	12.56	0.52
#4	0.000	44.930	71.96	4.00
#6	0.000	50.710	78.48	4.61
#8	0.000	52.900	84.07	4.85
#10	0.000	59.750	73.62	5.57
#12	0.000	61.370	71.70	5.75
#14	0.000	69.390	73.23	6.60

Structure Detail:

Structure #13 (Riprap Channel)

NFD-07 Downdrain @ Sta. 29+88

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	10.7	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	20.47 cfs	
Depth:	0.29 ft	1.29 ft
Top Width:	7.71 ft	13.71 ft
Velocity*:		
X-Section Area:	1.96 sq ft	
Hydraulic Radius:	0.251 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #11 (Riprap Channel)

NFD-06 Downdrain @ Sta. 26+15

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	23.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	4.13 cfs	
Depth:	0.04 ft	1.04 ft
Top Width:	6.27 ft	12.27 ft
Velocity*:		
X-Section Area:	0.27 sq ft	
Hydraulic Radius:	0.044 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #9 (Riprap Channel)

NFD-05 Downdrain @ Sta. 20+84

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
7.00	3.0:1	3.0:1	21.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	17.48 cfs	
Depth:	0.16 ft	1.16 ft
Top Width:	7.96 ft	13.96 ft
Velocity*:		
X-Section Area:	1.20 sq ft	
Hydraulic Radius:	0.150 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #7 (Riprap Channel)

NFD-04 Downdrain @ Sta. 9+89

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	24.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	5.59 cfs	
Depth:	0.06 ft	1.06 ft
Top Width:	6.33 ft	12.33 ft
Velocity*:		
X-Section Area:	0.34 sq ft	
Hydraulic Radius:	0.054 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #5 (Riprap Channel)

NFD-03 Downdrain @ Sta. 7+42

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	20.5	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	14.75 cfs	

	w/o Freeboard	w/ Freeboard
Depth:	0.15 ft	1.15 ft
Top Width:	6.93 ft	12.93 ft
Velocity*:		
X-Section Area:	1.00 sq ft	
Hydraulic Radius:	0.143 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #3 (Null)

Downdrain @ Sta. 3+92 in Sandstone

Structure #2 (Riprap Channel)

NFD-02 Downdrain @ Sta. 3+54

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
12.00	3.0:1	3.0:1	24.0	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	60.47 cfs	
Depth:	0.27 ft	1.27 ft
Top Width:	13.65 ft	19.65 ft
Velocity*:		
X-Section Area:	3.52 sq ft	
Hydraulic Radius:	0.257 ft	
Froude Number*:		
Manning's n*:		
Dmin:	4.00 in	
D50:	12.00 in	
Dmax:	15.00 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #1 (Riprap Channel)

NFD-01 Downdrain @ Sta. 1+59

Trapezoidal Riprap Channel Inputs:

Material: Riprap

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
6.00	3.0:1	3.0:1	15.8	1.00		

Riprap Channel Results:

Simons/OSM Method - Steep Slope Design

	w/o Freeboard	w/ Freeboard
Design Discharge:	12.56 cfs	
Depth:	0.16 ft	1.16 ft
Top Width:	6.99 ft	12.99 ft
Velocity*:		
X-Section Area:	1.07 sq ft	
Hydraulic Radius:	0.152 ft	
Froude Number*:		
Manning's n*:		
Dmin:	3.00 in	
D50:	9.00 in	
Dmax:	11.25 in	

Velocity and Manning's n calculations may not apply for this method.

Structure #4 (Null)

Structure #6 (Null)

Structure #8 (Null)

Structure #10 (Null)

Structure #12 (Null)

Structure #14 (Null)

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#13	1	8.020	0.110	0.000	0.000	93.000	M	20.47	0.853
	Σ	**8.020**						**20.47**	**0.853**
#11	1	1.620	0.029	0.000	0.000	93.000	M	4.13	0.172
	Σ	**1.620**						**4.13**	**0.172**
#9	1	6.850	0.049	0.000	0.000	93.000	M	17.48	0.728
	Σ	**6.850**						**17.48**	**0.728**
#7	1	2.190	0.048	0.000	0.000	93.000	M	5.59	0.233
	Σ	**2.190**						**5.59**	**0.233**
#5	1	5.780	0.079	0.000	0.000	93.000	M	14.75	0.615
	Σ	**5.780**						**14.75**	**0.615**
#3	1	2.250	0.035	0.000	0.000	93.000	M	5.74	0.239
	Σ	**2.250**						**5.74**	**0.239**
#2	1	37.760	0.235	0.000	0.000	93.000	M	60.47	3.235
	Σ	**37.760**						**60.47**	**3.235**
#1	1	4.920	0.104	0.000	0.000	93.000	M	12.56	0.523
	Σ	**4.920**						**12.56**	**0.523**
#4	Σ	**44.930**						**71.96**	**3.998**
#6	Σ	**50.710**						**78.48**	**4.612**
#8	Σ	**52.900**						**84.07**	**4.845**
#10	Σ	**59.750**						**73.62**	**5.574**
#12	Σ	**61.370**						**71.70**	**5.746**
#14	Σ	**69.390**						**73.23**	**6.599**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.35	20.00	460.00	2.080	0.061
		8. Large gullies, diversions, and low flowing streams	1.98	13.00	658.00	4.210	0.043
#1	**1**	**Time of Concentration:**					**0.104**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	3.56	32.00	900.00	1.880	0.132
		8. Large gullies, diversions, and low flowing streams	2.06	33.00	1,601.00	4.300	0.103
#2	**1**	**Time of Concentration:**					**0.235**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	23.00	23.00	100.00	4.790	0.005
		8. Large gullies, diversions, and low flowing streams	2.37	12.00	506.00	4.610	0.030
#3	**1**	**Time of Concentration:**					**0.035**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	6.18	21.00	340.00	2.480	0.038
		8. Large gullies, diversions, and low flowing streams	1.91	12.00	627.00	4.150	0.041
#5	**1**	**Time of Concentration:**					**0.079**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	6.67	20.00	300.00	2.580	0.032
		8. Large gullies, diversions, and low flowing streams	2.46	7.00	284.00	4.700	0.016
#7	**1**	**Time of Concentration:**					**0.048**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	10.33	31.00	300.00	3.210	0.025
		8. Large gullies, diversions, and low flowing streams	2.44	10.00	409.00	4.690	0.024
#9	**1**	**Time of Concentration:**					**0.049**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	7.00	14.00	200.00	2.640	0.021
		8. Large gullies, diversions, and low flowing streams	3.37	6.00	178.00	5.500	0.008
#11	**1**	**Time of Concentration:**					**0.029**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.67	11.00	300.00	1.910	0.043
		8. Large gullies, diversions, and low flowing streams	2.38	27.00	1,133.00	4.630	0.067
#13	**1**	**Time of Concentration:**					**0.110**

Title: Bond Scenario 9/2019
Description: Drop Structure NFD-02

Folder:
Date: 4/16/2014

Notice
Maccaferri is not responsible for the drawings and the calculations trasmitted, since they should be intended as general design outlines and advice,aiming only to the best use of the products.

Run n.1

Gradient [%]	24.00	Froude number	3.93
Discharge [ft3/s]	60.47	Cross section [ft2]	4.70
Water level [ft]	0.36	Wetted perimeter [ft]	14.27
Average velocity [ft/s]	12.86	Hydraulic radius [ft]	0.33

Stretch	Length [ft]	V [ft/s]	K	Vadm [ft/s]	Vb [ft/s]	Material	V	tau max [lb/ft2]	tau adm [lb/ft2]	GeoFil
1	1.80	0.00	1.00							
1.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N
2	1.50	0.00	1.00							
2.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
3	7.91	8.08	1.00							
3.1	7.91			5.00	3.64	Reno mattress 6"	N	4.19	4.36	Y
4	12.00	13.29	1.00							
4.1	12.00			5.00	3.64	Reno mattress 6"	N	5.49	4.68	Y
5	7.91	8.08	1.00							
5.1	7.91			5.00	3.64	Reno mattress 6"	N	4.19	4.36	Y
6	1.50	0.00	1.00							
6.1	1.50			-	-	Stiff Clay (cohesive)	N	-	-	N
7	1.80	0.00	1.00							
7.1	1.80			-	-	Stiff Clay (cohesive)	N	-	-	N

Title: Bond Scenario 9/2019
Description: Drop Structure NFD-02

Folder:
Date: 4/16/2014

Notice
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Materials used

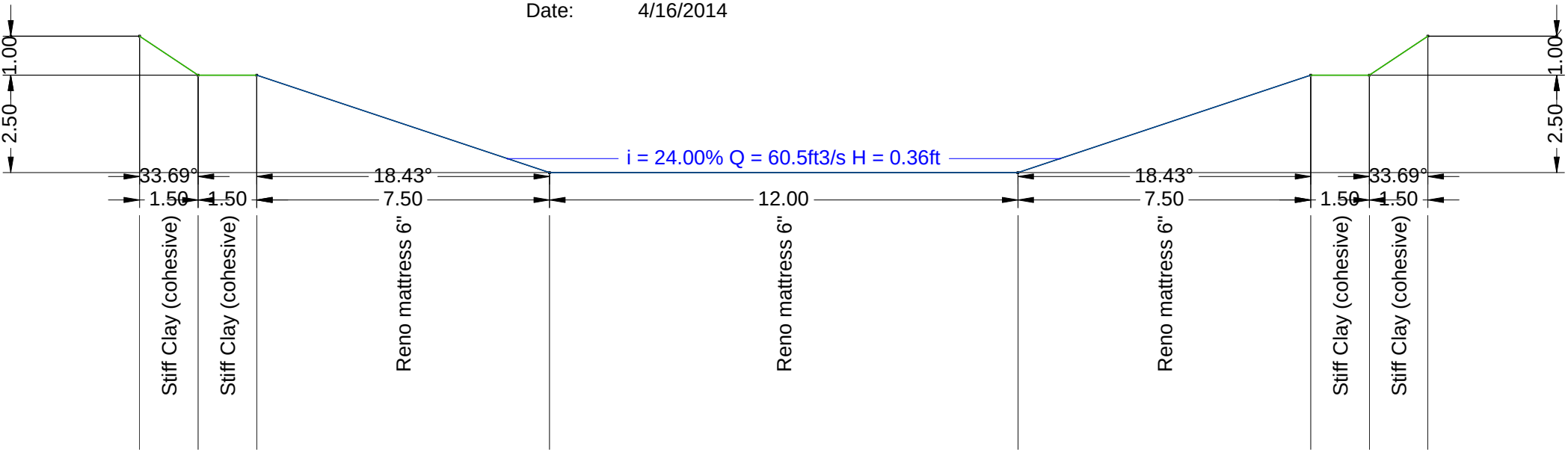
Description	Roughness	Allow. shear stress [lb/ft2]	V	Rock d50 [inch]	Thickness [ft]	Rockfill unit we [lb/ft3]	Time [h]	C Shields
Stiff Clay (cohesive)	0.0250	0.46	Y					
Reno mattress 6"	0.0277	4.68	N	3.94	0.56	165.51		0.140

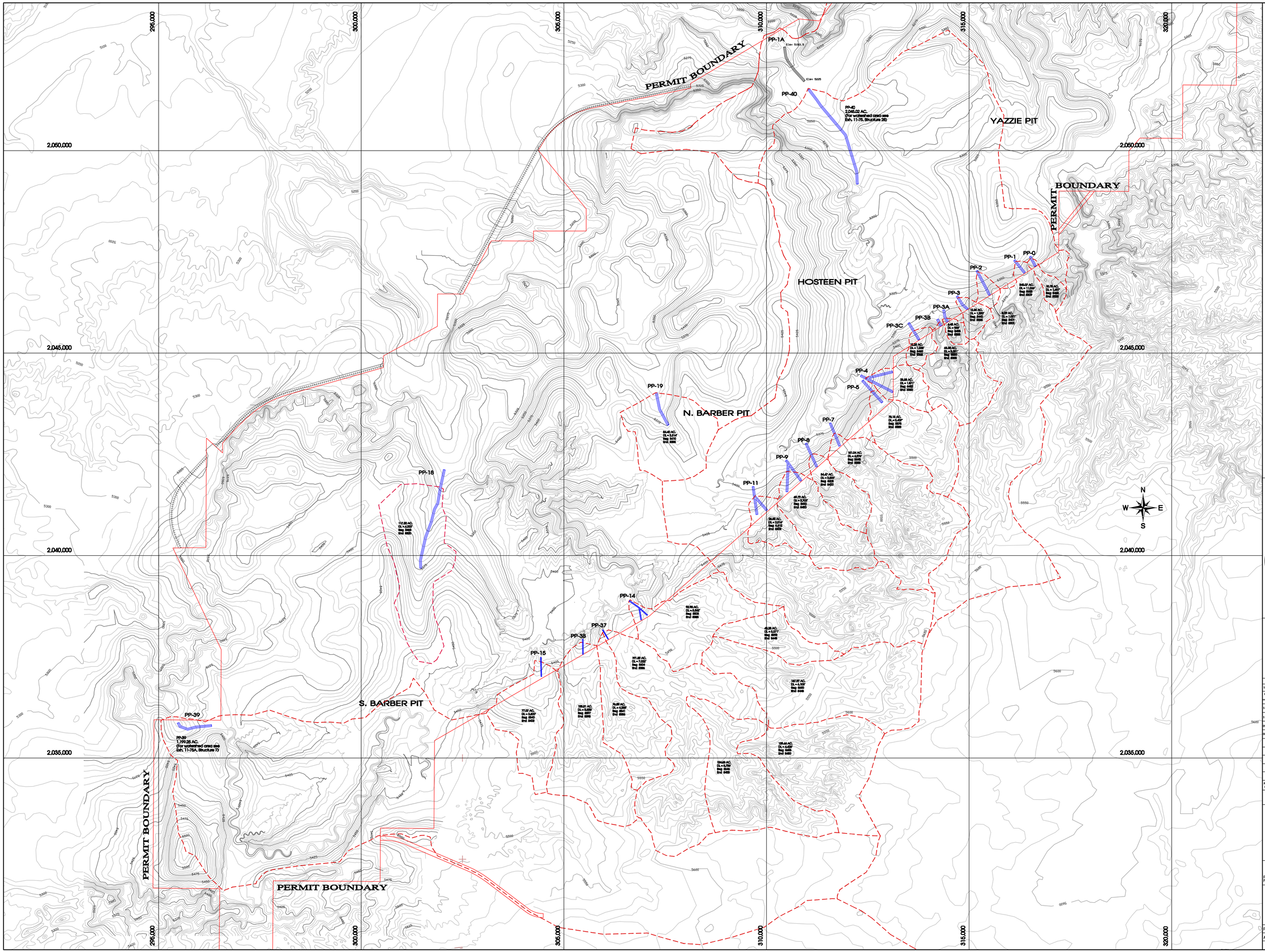
Macra1 2006

Maccaferri River Analysis
Bank Protections

Title: Bond Scenario 9/2019
Description: Drop Structure NFD-02

Folder:
Date: 4/16/2014





LEGEND

5300	INDEX CONTOUR
	INTERMEDIATE CONTOUR
	PERMIT/LEASE BOUNDARY
PP-23	PREDICTION POINT
	RIPRAP STRUCTURE
	WATERSHED BOUNDARY

CERTIFICATION STATEMENT

I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER

500 0 500 1000

CONTOUR INTERVAL: 05'

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
				C. BROOK	M. LIVING	K. Bahe
14-B	May-2014	PJF	Original Navajo Mine PAP Exhibit convert to E-Permit and submitted to OSM for Review.			

APPROVALS

REV. No.	DATE	DRAFT BY	REVISION DESCRIPTION	ENG.	E.G.	P.E.
14-A	4-17-14	PJF	Updated Exhibit for Permit Renewal and submitted to OSM for Review. BSC was changed to match FSC.	CJB	VM	KAB
11-A	8-26-11	PJF	Updated for Mine Plan changes, and submitted to OSM for Review.	M.LIVING	M.LIVING	M.LIVING
09-A	5-01-09	PJF	Updated for Permit Renewal and submitted to OSM for Review.	M.LIVING	M.LIVING	M.LIVING
08-A	02-01-08	PJF	Updated for Mine plan changes, and submitted to OSM for Review.	LJV/ RCVV	M.L.	RCVV
E	3-06-07	PJF	Updated for Mine plan changes, and submitted to OSM for Review.	SS	MC	KB
D	11-15-05	PJF	Updated for Mine plan changes, and submitted to OSM for Review.	BH	KJ	LR
C	8-11-06	PJF	Updated for Mine Plan changes. Modified Drop structures PI, PG, PS, PA. Added PSA submitted to OSM for Review.	BH	KJ	LR
B	10-04-04	PJF	Updated for Mine Plan changes. Modified Drop structures PI, PG, PS, and submitted to OSM for Review.	DJR	MC	LR
A	4-21-04	PJF	Updated Exhibit and submitted to OSM for Review.	DJR	MC	LR

EXHIBIT 50.A–1

NTEC

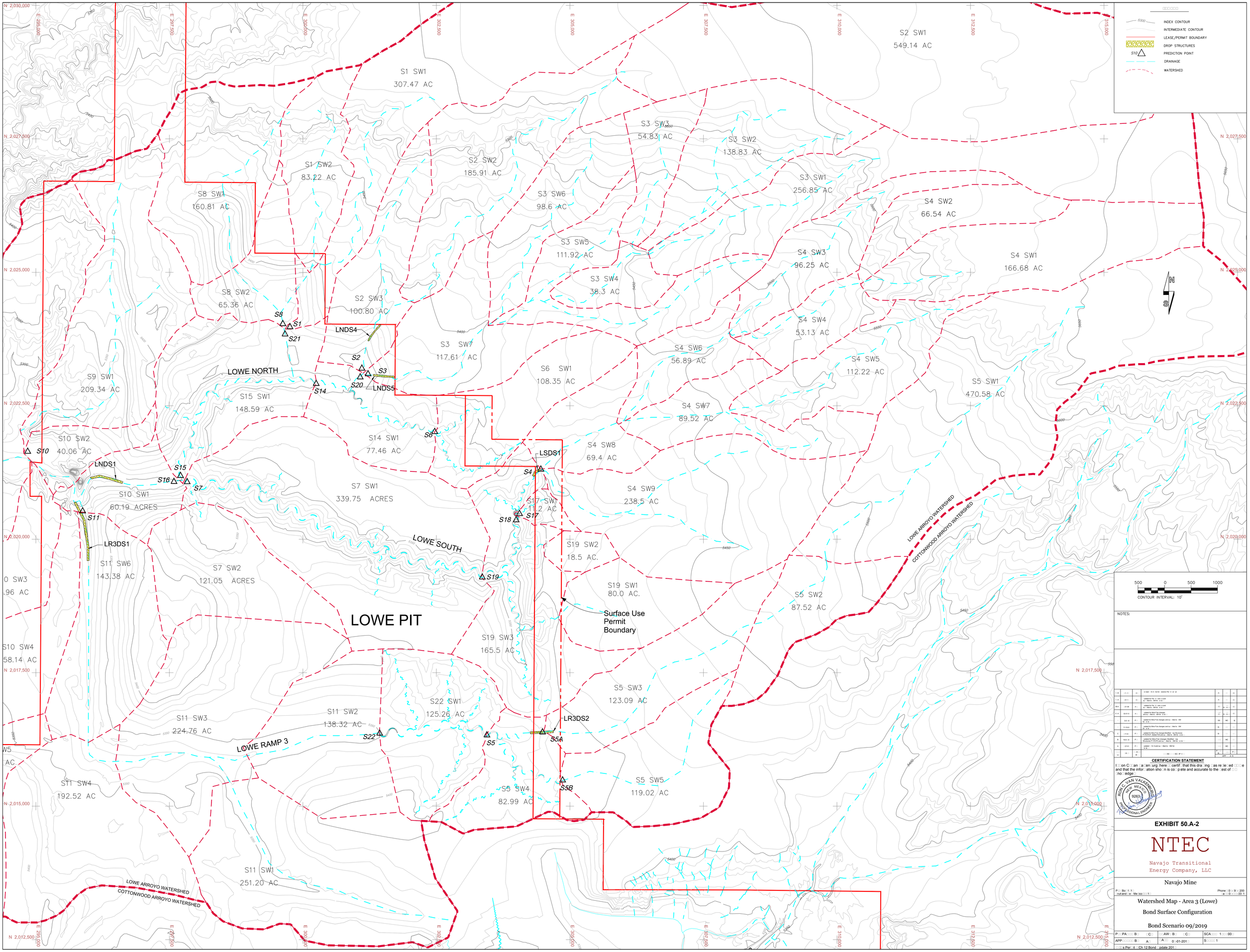
Navajo Transitional
Energy Company, LLC

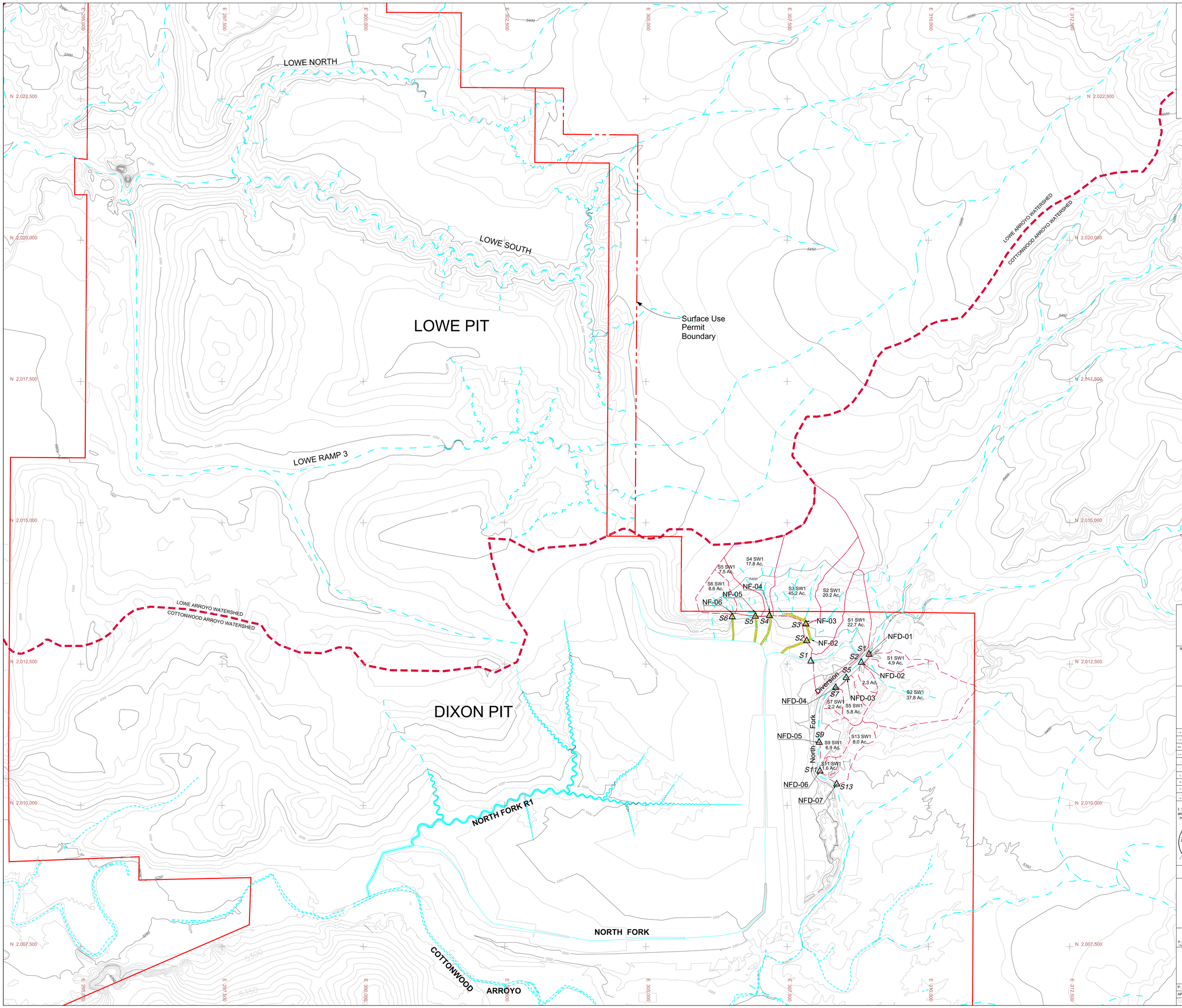
Navajo Mine

P.O. Box 1717
Fruitland, New Mexico, 87416
Phone: 505-598-4200
Fax: 505-568-3361

Watershed Map
Area II
Bond Surface Configuration
Bond Scenario 9/2019

PREPARED BY CJB	DRAWN BY CJB	SCALE 1"= 1000'
APPROVED BY KAB	DATE 04-17-2014	


INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE/PERMIT BOUNDARY
DROP STRUCTURES
PREDICTION POINT
DRAINAGE
WATERSHED
S1 SW1
307.47 AC
S2 SW1
549.14 AC
S1 SW2
83.22 AC
S2 SW2
185.91 AC
S3 SW3
54.83 AC
S3 SW2
138.83 AC
S3 SW1
256.85 AC
S8 SW1
160.81 AC
S3 SW6
98.6 AC
S4 SW2
66.54 AC
S3 SW5
111.92 AC
S4 SW3
96.25 AC
S4 SW1
166.68 AC
S3 SW4
38.3 AC
S8 SW2
65.36 AC
S2 SW3
100.80 AC
S4 SW4
53.13 AC
S3 SW7
117.61 AC
S4 SW6
56.89 AC
S4 SW5
112.22 AC
S6 SW1
108.35 AC
S9 SW1
209.34 AC
S5 SW1
470.58 AC
S15 SW1
148.59 AC
S4 SW7
89.52 AC
S10 SW2
40.06 AC
S14 SW1
77.46 AC
S4 SW8
69.4 AC
S7 SW1
339.75 ACRES
S4 SW9
238.5 AC
S17 SW1
11.2 AC
S10 SW1
60.19 ACRES
S19 SW2
18.5 AC.
S11 SW6
143.38 AC
S7 SW2
121.05 ACRES
S19 SW1
80.0 AC.
S5 SW2
87.52 AC
LOWE PIT
S19 SW3
165.5 AC
S10 SW4
58.14 AC
S5 SW3
123.09 AC
S22 SW1
125.26 AC
S11 SW3
224.76 AC
S11 SW2
138.32 AC
S5 SW4
82.99 AC
S5 SW5
119.02 AC
S11 SW4
192.52 AC
S11 SW1
251.20 AC
LOWE NORTH
LOWE SOUTH
LOWE RAMP 3
LNDS4
LNDS5
LSDS1
LNDS1
LR3DS1
LR3DS2
S8
S1
S21
S2
S3
S20
S14
S6
S10
S15
S16
S7
S11
S4
S18
S17
S19
S22
S5
S5A
S5B
Surface Use Permit Boundary
LOWE ARROYO WATERSHED
COTTONWOOD ARROYO WATERSHED
N 2,030,000
N 2,027,500
N 2,025,000
N 2,022,500
N 2,020,000
N 2,017,500
N 2,015,000
N 2,012,500
E 295,000
E 297,500
E 300,000
E 302,500
E 305,000
E 307,500
E 310,000
E 312,500
E 315,000
500 0 500 1000
CONTOUR INTERVAL: 10'
NOTES:
CERTIFICATION STATEMENT
RON C. VAN VALKENBURG
NEW MEXICO
9263
PROFESSIONAL ENGINEER
EXHIBIT 50.A-2
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
Watershed Map - Area 3 (Lowe)
Bond Surface Configuration
Bond Scenario 09/2019


INDEX CONTOUR
INTERMEDIATE CONTOUR
LEASE/PERMIT BOUNDARY
DROP STRUCTURES
PREDICTION POINT
DRAINAGE
WATERSHED
LOWE NORTH
LOWE SOUTH
LOWE PIT
LOWE RAMP 3
Surface Use Permit Boundary
LOWE ARROYO WATERSHED
COTTONWOOD ARROYO WATERSHED
DIXON PIT
NORTH FORK R1
NORTH FORK
COTTONWOOD ARROYO
Diversion
North Fork
NF-01
NF-02
NF-03
NF-04
NF-05
NF-06
NFD-01
NFD-02
NFD-03
NFD-04
NFD-05
NFD-06
NFD-07
S1 SW1 22.7 Ac.
S1 SW1 4.9 Ac.
S2 SW1 20.2 Ac.
S2 SW1 37.8 Ac.
S3 SW1 45.2 Ac.
S4 SW1 17.8 Ac.
S5 SW1 7.5 Ac.
S6 SW1 8.6 Ac.
S7 SW1 2.2 Ac.
S5 SW1 5.8 Ac.
2.3 Ac.
S9 SW1 6.9 Ac.
S11 SW1 1.6 Ac.
S13 SW1 8.0 Ac.
N 2,022,500
N 2,020,000
N 2,017,500
N 2,015,000
N 2,012,500
N 2,010,000
N 2,007,500
E 295,000
E 297,500
E 300,000
E 302,500
E 305,000
E 307,500
E 310,000
E 312,500
500 0 500 1000
CONTOUR INTERVAL: 10'
NOTES:
CERTIFICATION STATEMENT
I hereby certify that this drawing was prepared and that the information shown is complete and accurate to the best of my knowledge.
RON C. VAN VALKENBURG
NEW MEXICO
12263
PROFESSIONAL ENGINEER
EXHIBIT 50.A-2
NTEC
Navajo Transitional Energy Company, LLC
Navajo Mine
Watershed Map - Area 3 (Dixon)
Bond Surface Configuration
Bond Scenario 09/2019