CITY OF ALBUQUERQUE

Planning Department
David Campbell, Director

Mayor Timothy M. Keller

November 29, 2018

Olin Brown PE
Bohannan Huston, Inc.
7500 Jefferson St NE
Albuquerque, NM 87109

RE: **Los Metates Erosion Mitigation**
Los Metates Rd NW
Drainage Report Stamp Date: 8/20/18
Hydrology File: C12D001R

Dear Mr. Brown,

Based on the submittal received on 11/21/2018 the above-referenced Grading Plan and Drainage Report are approved for Grading Permit. Please ensure the contractor prepares a SWPPP and submits an eNOI to the EPA prior to construction commencing.

If you have any questions, please contact me at 924-3695 or dpeterson@cabq.gov.

Sincerely,

Dana M. Peterson
Senior Engineer, Planning Dept.
Development Review Services

PO Box 1293

Albuquerque

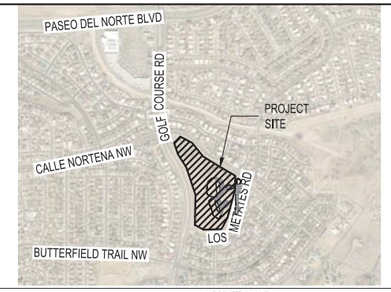
NM 87103

www.cabq.gov

CONSTRUCTION PLANS
FOR
LOS METATES OPEN SPACE EROSION MITIGATION
OCTOBER 2018

90% SUBMITTAL

CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT
Capital Implementation



VICINITY MAP

GENERAL NOTES

1. AN EXCAVATION/CONSTRUCTION PERMITS WILL BE REQUIRED BEFORE BEGINNING ANY WORK WITHIN THE CITY RIGHT-OF-WAY.
2. ALL WORK DETAILED ON THESE PLANS TO BE PERFORMED UNDER CONTRACT SHALL, EXCEPT AS OTHERWISE STATED OR PROVIDED FOR HEREON, BE CONSTRUCTED IN ACCORDANCE WITH THE CITY OF ALBUQUERQUE STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, LATEST EDITION.
3. TWO WORKING DAYS PRIOR TO ANY EXCAVATION, THE CONTRACTOR MUST CONTACT NEW MEXICO ONE CALL SYSTEM (260-1990) FOR LOCATION OF EXISTING UTILITIES.
4. PRIOR TO CONSTRUCTION THE CONTRACTOR SHALL EXCAVATE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL OBSTRUCTIONS, SHOULD A CONFLICT EXIST. THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY SO THAT THE CONFLICT CAN BE RESOLVED WITH A MINIMUM AMOUNT OF DELAY.
5. SEVEN (7) WORKING DAYS PRIOR TO BEGINNING CONSTRUCTION, THE CONTRACTOR SHALL SUBMIT TO CONSTRUCTION COORDINATION DIVISION A DETAILED CONSTRUCTION SCHEDULE. TWO (2) WORKING DAYS PRIOR TO THE START OF CONSTRUCTION, THE CONTRACTOR SHALL OBTAIN A BARRICADING PERMIT FROM THE CONSTRUCTION COORDINATION DIVISION. CONTRACTOR SHALL NOTIFY THE CONSTRUCTION COORDINATION ENGINEER (924-3400) PRIOR TO OCCUPYING AN INTERSECTION. REFER TO SECTION 19 OF THE GENERAL CONDITIONS OF THE STANDARD SPECIFICATIONS.
6. CONTRACTOR SHALL NOTIFY THE ENGINEER NOT LESS THAN SEVEN (7) DAYS PRIOR TO STARTING WORK IN ORDER THAT THE CITY SURVEYOR MAY TAKE NECESSARY MEASURES TO INSURE THE PRESERVATION OF SURVEY MONUMENTS. CONTRACTOR SHALL NOT DISTURB PERMANENT SURVEY MONUMENTS WITHOUT THE CONSENT OF THE CITY SURVEYOR AND SHALL NOTIFY THE CITY SURVEYOR AND BEAR THE EXPENSE OF REPLACING ANY THAT MAY BE DISTURBED WITHOUT PERMISSION. REPLACEMENT SHALL BE DONE ONLY BY THE CITY SURVEYOR. WHEN A CHANGE IS MADE IN THE FINISHED ELEVATIONS OF THE PAVEMENT OF ANY ROADWAY IN WHICH A PERMANENT SURVEY MONUMENT IS LOCATED, CONTRACTOR SHALL, AT HIS OWN EXPENSE, ADJUST THE MONUMENT COVER TO THE NEW GRADE UNLESS OTHERWISE SPECIFIED. REFER TO SECTION 4.4 OF THE GENERAL CONDITIONS OF THE STANDARD SPECIFICATIONS.
7. CONTRACTOR SHALL RECORD DATA ON ALL UTILITY LINES AND ACCESSORIES AS REQUIRED BY ABCWUA FOR THE PREPARATION OF "AS CONSTRUCTED" DRAWINGS. CONTRACTOR SHALL NOT COVER UTILITY LINES AND ACCESSORIES UNTIL ALL DATA HAS BEEN RECORDED.
8. CONTRACTOR SHALL MAINTAIN A GRAFFITI-FREE WORK SITE. CONTRACTOR SHALL PROMPTLY REMOVE ANY GRAFFITI FROM ALL EQUIPMENT, WHETHER PERMANENT OR TEMPORARY.
9. THE CONTRACTOR SHALL COORDINATE WITH THE WATER AUTHORITY SEVEN (7) DAYS IN ADVANCE OF PERFORMING WORK THAT WILL AFFECT THE PUBLIC WATER OR SANITARY SEWER INFRASTRUCTURE. WORK REQUIRING SHUTOFF OF WELL COLLECTORS, TRANSMISSION LINES, OR FACILITIES DESIGNATED AS MASTER PLAN FACILITIES MUST BE COORDINATED WITH THE WATER AUTHORITY 14 DAYS IN ADVANCE OF PERFORMING SUCH WORK. ONLY WATER AUTHORITY CREWS ARE AUTHORIZED TO OPERATE PUBLIC VALVES. SHUTOFF REQUESTS MUST BE MADE ONLINE AT http//www.abcwua.org/Water_Shut_Off_and_Turn_on_Procedures.aspx.

THE FOLLOWING NOTES ALSO APPLY WHEN CHECKED

- ☐ ALL UTILITIES AND UTILITY SERVICE LINES SHALL BE INSTALLED PRIOR TO PAVING.
- ☐ BACKFILL COMPACTION SHALL BE ACCORDING TO SPECIFIED STREET USE.
- ☐ SIDEWALKS AND WHEELCHAIR RAMPS WITHIN THE CURB RETURNS SHALL BE CONSTRUCTED WHEREVER A NEW CURB RETURN IS CONSTRUCTED
- ☐ IF CURB IS DEPRESSED FOR A DRIVEPAD, THE DRIVEPAD SHALL BE CONSTRUCTED PRIOR TO ACCEPTANCE OF CURB AND GUTTER.
- ☐ ALL STORM DRAINAGE FACILITIES SHALL BE COMPLETED PRIOR TO FINAL ACCEPTANCE.
- ☐ THE REQUESTOR OR DEVELOPER SHALL BE RESPONSIBLE FOR REPAIR OR REPLACEMENT OF ALL CURB AND GUTTER OR SIDEWALK DAMAGED AFTER APPROVAL BY THE CITY ENGINEER OF WORK COMPLETED BY THE CONTRACTOR.

SHEET INDEX

DRB #XXXXXX

REV.	SHEETS	CITY ENGINEER	DATE	USER DEPARTMENT	DATE	USER DEPARTMENT	DATE

ENGINEERS STAMP & SIGNATURE	APPROVALS	ENGINEER	DATE	**********
NOT FOR CONSTRUCTION	DRC Chairman			APPROVED FOR CONSTRUCTION
	Transportation			
	Water/Wastewater			
	Hydrology			
	Parks			
	Const. Coord.			
	City Project No.		G1	Sheet 1 Of 4

Bohannan Huston
www.bhinc.com 800.877.5332

BHI JOB NO. 20190034

Tue, 9-Oct-2018 - 6:03:pm, Plotted by: OBROWN
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GENERAL NOTES

1. THE CONTRACTOR SHALL ABIDE BY ALL LOCAL, STATE, AND FEDERAL LAWS, RULES AND REGULATIONS WHICH APPLY TO THE CONSTRUCTION OF THESE IMPROVEMENTS.

2. PRIOR TO CONSTRUCTION, CONTRACTOR SHALL EXCAVATE AND VERIFY THE HORIZONTAL AND VERTICAL LOCATIONS OF ALL POTENTIAL OBSTRUCTIONS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL NOTIFY THE ENGINEER OR CONSTRUCTION OBSERVER SO THAT THE CONFLICT CAN BE RESOLVED WITH A MINIMUM AMOUNT OF DELAY.

3. ALL ELECTRICAL, TELEPHONE, CABLE TV, GAS AND OTHER UTILITY LINES, CABLES AND APPURTENANCES ENCOUNTERED DURING CONSTRUCTION THAT REQUIRE RELOCATION, SHALL BE COORDINATED WITH THAT UTILITY. THE CONTRACTOR SHALL BE RESPONSIBLE FOR COORDINATION OF ALL NECESSARY UTILITY ADJUSTMENTS. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR DELAYS OR INCONVENIENCES CAUSED BY UTILITY COMPANY WORK CREWS. THE CONTRACTOR MAY BE REQUIRED TO RESCHEDULE HIS ACTIVITIES TO ALLOW UTILITY CREWS TO PERFORM THEIR REQUIRED WORK.

4. THE CONTRACTOR IS RESPONSIBLE FOR PROTECTING THE EXISTING UTILITY LINES WITHIN THE CONSTRUCTION AREA. ANY DAMAGE TO EXISTING FACILITIES CAUSED BY CONSTRUCTION ACTIVITY SHALL BE REPAIRED OR REPLACED AT THE CONTRACTOR'S EXPENSE AND APPROVED BY THE CONSTRUCTION OBSERVER.

5. CONSTRUCTION ACTIVITY SHALL BE LIMITED TO THE PROPERTY AND/OR PROJECT LIMITS. ANY DAMAGE TO ADJACENT PROPERTIES RESULTING FROM THE CONSTRUCTION PROCESS IS THE RESPONSIBILITY OF THE CONTRACTOR. ANY COSTS INCURRED FOR REPAIRS SHALL BE THE COST OF THE CONTRACTOR.

6. OVERNIGHT PARKING OF CONSTRUCTION EQUIPMENT SHALL NOT OBSTRUCT DRIVEWAYS OR DESIGNATED TRAFFIC LANES. THE CONTRACTOR SHALL NOT STORE ANY EQUIPMENT OR MATERIAL WITHIN THE PUBLIC RIGHT-OF-WAY.

7. THE CONTRACTOR SHALL OBTAIN ALL THE NECESSARY PERMITS FOR THE PROJECT PRIOR TO COMMENCING CONSTRUCTION (I.E. BARRICADING, SURFACE DISTURBANCE).

8. THE CONTRACTOR SHALL BE RESPONSIBLE TO REPLACE AT HIS EXPENSE ANY AND ALL PROPERTY CORNERS DESTROYED DURING CONSTRUCTION. ALL PROPERTY CORNERS MUST BE RESET BY A REGISTERED LAND SURVEYOR.

9. ALL PERMANENT PAVEMENT MARKING AND TRAFFIC SIGNING SHALL BE FURNISHED AND PLACED BY THE CONTRACTOR PER PLAN.

10. THE CONTRACTOR SHALL COORDINATE WITH THE CITY OF ALBUQUERQUE, DMD CONSTRUCTION COORDINATION DIVISION, PRIOR TO BEGINNING ANY CONSTRUCTION WORK ON OR ADJACENT TO EXISTING STREETS.

11. ALL BARRICADES AND CONSTRUCTION SIGNING SHALL CONFORM TO APPLICABLE SECTIONS OF THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" (MUTCD), U.S. DEPARTMENT OF TRANSPORTATION, LATEST EDITION.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND MAINTAINING CONSTRUCTION SIGNAGE UNTIL THE PROJECT HAS BEEN ACCEPTED BY THE CITY OF ALBUQUERQUE. THE CONTRACTOR SHALL VERIFY THE PROPER LOCATION OF ALL BARRICADING AT THE END AND BEGINNING OF EACH DAY.

13. ALL SAWCUT PAVEMENT SHALL HAVE A UNIFORM EDGE AND BE SPRAYED WITH TACK.

14. THE CONTRACTOR SHALL ASSUME RESPONSIBILITY FOR ANY DAMAGE TO EXISTING PAVEMENTS, SIGNAGE, PAVEMENT MARKINGS, CURB & GUTTER, DRIVE PADS, WHEELCHAIR RAMPS, AND SIDEWALK DURING CONSTRUCTION, APART FROM THOSE SECTIONS INDICATED FOR REMOVAL ON THE PLANS AND SHALL REPAIR OR REPLACE PER COA STANDARDS, AT HIS OWN EXPENSE.

15. ALL EXCAVATION, TRENCHING, AND SHORING ACTIVITIES MUST BE CARRIED-OUT IN ACCORDANCE WITH OSHA 29 CFR 1926.650 SUBPART P.

16. NOT USED

17. THE CONTRACTOR WILL BE RESPONSIBLE FOR DISPOSING OF ALL DEBRIS, INCLUDING, BUT NOT LIMITED TO HAZARDOUS WASTE AT DISPOSAL SITES APPROVED BY GOVERNMENTAL AGENCIES REGULATING THE DISPOSAL OF SUCH MATERIALS.

18. SUBGRADE PREPARATION UNDER SIDEWALKS AND DRIVE PADS NEEDING REPLACEMENT, AND SUBGRADE AND SUBBASE PREPARATION UNDER CURB AND GUTTER NEEDING REPLACEMENT IS CONSIDERED INCIDENTAL TO THE PROJECT AND NO DIRECT PAYMENT SHALL BE MADE FOR THOSE ITEMS OF WORK.

19. THE CONTRACTOR WILL REPLACE ANY STRIPING THAT HAS BEEN RUINED OR REMOVED IN THE COURSE OF CONSTRUCTION.

20. THE CONTRACTOR IS TO EXERCISE CARE TO AVOID DISTURBING ANY EXISTING UNDERGROUND UTILITIES. IT WILL BE HIS RESPONSIBILITY TO COORDINATE WITH THE UTILITY COMPANIES IN ORDER TO PREVENT ANY SERVICE DISRUPTION. SEE SECTION 18 "UTILITIES", CITY OF ALBUQUERQUE, STANDARD SPECIFICATIONS FOR CONTRACTOR REQUIREMENTS.

21. ALL GAS VALVES, GAS MANHOLES, ELECTRICAL MANHOLES, TELEPHONE MANHOLES, AND UTILITY POLES WILL BE ADJUSTED TO GRADE BY EACH UTILITY COMPANY. CONTRACTOR WILL COORDINATE THROUGH CITY UTILITY COORDINATOR.

22. WHEN REMOVAL OF EXISTING CURB AND GUTTER OR SIDEWALK IS REQUIRED, REMOVE BACK TO NEAREST SUITABLE JOINT UNLESS OTHERWISE DIRECTED BY THE CITY FIELD ENGINEER.

23. ALL SUBGRADE, OVEREXCAVATION, BACKFILL, AND FILL SHALL BE PLACED AND / OR COMPACTED PER CITY OF ABLUQUERQUE SPECIFICATIONS.

24. THE CONTRACTOR WILL NOTIFY THE NEW MEXICO ONE CALL SYSTEM IN ACCORDANCE WITH CURRENT STATE STATUTE REQUIREMENTS.

25. CONTRACTOR WILL MAKE ALL WATER VALVES AND MANHOLES WITHIN AREAS IMPACTED BY CONSTRUCTION ACTIVITIES ACCESSIBLE TO THE CITY AT ALL TIMES.

26. CONTRACTOR WILL PLACE BITUMINOUS MATERIAL WITH THE USE OF A LAYDOWN MACHINE WHERE PAVEMENT IS 8 FEET IN WIDTH OR WIDER.

27. ALL SUBGRADE AND SUBBASE MATERIAL ENCOUNTERED IN PAVEMENT REMOVAL AND REPLACEMENT THAT IS DETERMINED BY THE FIELD ENGINEER TO MEET THE SPECIFICATIONS, CAN BE REUSED. HOWEVER, THE MATERIAL WILL BE PROCESSED AND COMPACTED TO MEET MOISTURE CONTENT AND PERCENT COMPACTION REQUIRED BY THE SPECIFICATIONS.

28. CONTRACTOR WILL NOT PAVE OVER ANY SURFACE FEATURE, I.E., GAS VALVE, MANHOLE COVER, ETC. WITHOUT PRIOR APPROVAL FROM THE CITY FIELD ENGINEER.

29. CONTRACTOR WILL CONFINE HIS WORK WITHIN THE CONSTRUCTION EASEMENT LIMITS AND/OR RIGHT-OF-WAY, OR PROVIDE COPIES OF AGREEMENTS WITH ADJACENT LANDOWNERS TO THE CITY OF ALBUQUERQUE.

30. ALL WATER VALVES AND FIRE HYDRANTS REMOVED TO BE SALVAGED AND RETURNED TO THE C.O.A.

31. MINIMUM BOTTOM WIDTH OF TRENCHES FOR RIGID PIPE SHALL BE EQUAL TO THE OUTSIDE DIAMETER PLUS 16 INCHES. BEDDING MATERIAL SHALL BE CLASS II, 111, OR IV UNLESS OTHERWISE SPECIFICALLY NOTED ON THE PLANS.

32. MINIMUM BOTTOM WIDTH OF TRENCHES FOR NON-RIGID PIPE SHALL BE EQUAL TO THE OUTSIDE DIAMETER PLUS 12 INCHES. BEDDING MATERIAL SHALL BE CLASS I, II, OR III.

33. THE CONTRACTOR AGREES TO TAKE NECESSARY SAFETY PRECAUTIONS AS REQUIRED BY FEDERAL, STATE AND LOCAL AUTHORITIES TO PROTECT PEDESTRIAN AND VEHICULAR TRAFFIC IN THE CONSTRUCTION AREA, WHICH INCLUDE BUT ARE NOT LIMITED TO: MAINTAINING ADEQUATE WARNING SIGNS, BARRICADES, LIGHTS, GUARD FENCES, WALKS AND BRIDGES.

34. NOT USED.

35. NOT USED.

36. NOT USED.

37. NOT USED.

38. THE REPLACEMENT OF THE EXISTING UTILITIES AND THE INSTALLATION OF NEW UTILITY LINES WILL BE COMPLETED IN ADVANCE OF STARTING THE PAVEMENT WORK. TEMPORARY PAVEMENT WILL BE PLACED IN ALL TRENCHES REQUIRED FOR THE UTILITY REPLACEMENTS IN THOSE AREAS THAT MUST MAINTAIN TRAFFIC UNTIL THE FINAL PAVEMENT WORK STARTS IN EACH AREA. TEMPORARY STRIPING SHALL BE THE CONTRACTOR'S RESPONSIBILITY. MAINTENANCE OF THE TEMPORARY PAVING AND STRIPING WILL BE AT THE CONTRACTOR'S EXPENSE.

39. ALL FILL SLOPES AND BERMS SHALL BE COMPACTED IN 8" LIFTS TO WITHIN A MINIMUM 95% OF MAXIMUM DRY DENSITY. NO ROCKS LARGER THAN 4" SHALL BE ALLOWED.

40. ANY NEW STREET PAVING, DRIVEWAYS, SIDEWALKS, AND CURB AND GUTTERS REQUIRED DUE TO CONSTRUCTION ACTIVITIES THAT ABUT EXISTING AREAS SHALL MATCH THE ELEVATION OF THOSE AREAS.

41. ALL EXCAVATED MATERIAL THAT IS NOT REQUIRED TO BE REUSED MUST BE REMOVED FROM THE PROJECT AREA WITHIN FOUR DAYS OF EXCAVATION. SPOIL PILES WILL BE ALLOWED ONLY AS DIRECTED BY THE CITY FIELD ENGINEER.

42. THE CONTRACTOR WILL COORDINATE THE CONSTRUCTION ACTIVITIES WITH ALL OTHER CONTRACTORS AND UTILITY COMPANIES WORKING IN THE SAME AREA. THE CONTRACTOR MAY BE REQUIRED TO RESCHEDULE THEIR ACTIVITIES TO ALLOW UTILITY CREWS TO PERFORM THEIR REQUIRED WORK. NO ADDITIONAL COMPENSATION WILL BE ALLOWED FOR DELAYS OR INCONVENIENCE CAUSED BY UTILITY COMPANY WORK CREWS. A CONTRACT EXTENSION MAY BE ALLOWED AS DELINEATED IN CITY OF ALBUQUERQUE STANDARD SPECIFICATIONS.

43. EXISTING MEDIAN CURB AND GUTTER AND STANDARD CURB AND GUTTER, NOT DISTURBED BY CONTRACTOR, BUT OUT OF ALIGNMENT, DISPLACED VERTICALLY, BADLY BROKEN AND/OR DETERIORATED, WILL BE REPLACED AS DIRECTED BY THE FIELD ENGINEER AND PAID FOR AT CONTRACT UNIT PRICES.

44. ALL UTILITY LINES WHICH ARE NOT SPECIFICALLY DESIGNATED TO BE REMOVED AND REPLACED ON THE PLANS, WILL BE MAINTAINED IN SERVICE. SHORING, SHEETING AND OTHER MEANS OF SUPPORT SHALL BE EMPLOYED BY THE CONTRACTOR TO PREVENT DAMAGE OR LOSS OF THESE EXISTING UTILITIES AND THESE SHORING, SHEETING, AND SUPPORTS ARE CONSIDERED INCIDENTAL TO THIS PROJECT. BEAM AND CABLE OR OTHER ADEQUATE SUPPORTS WILL BE USED FOR TEMPORARY SUPPORT OF ALL UTILITY LINES WHICH CROSS THE TRENCH. ANY DAMAGE TO EXISTING UTILITIES WILL PROMPTLY BE REPAIRED AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR WILL NOTIFY THE ENGINEER IMMEDIATELY OF ANY SIGNIFICANT DEVIATION OF EXPOSED UTILITIES FROM THE LOCATIONS SHOWN ON THE PLANS SO THAT CONFLICTS CAN BE RESOLVED IN A TIMELY MANNER.

45. ALL INTERFERING PORTIONS OF ABANDONED UTILITY LINES WHICH ARE EXPOSED AS A RESULT OF CONSTRUCTION WILL BE REMOVED AND DISPOSED OF BY THE CONTRACTOR.

46. SHORING COSTS WILL BE CONSIDERED INCIDENTAL TO THE EARTHWORK COSTS.

47. THE TERM REMOVE USED IN THIS PLAN SET INCLUDES THE DISPOSAL OF SAID MATERIAL IN ACCORDANCE WITH CITY OF ALBUQUERQUE SPECIFICATIONS, LATEST EDITION.

48. CONTRACTOR WILL SURVEY AND LOG EXISTING ELEVATIONS OF CURB-AND-GUTTER, SIDEWALK, AND PAVEMENT WHICH WILL BE REMOVED FOR CONSTRUCTION OF IMPROVEMENTS. CONTRACTOR WILL REPLACE REMOVED CURB-AND-GUTTER, SIDEWALK, DRIVE PADS, AND PAVEMENT TO ELEVATIONS PRIOR TO REMOVAL UNLESS OTHERWISE INDICATED ON THE PLANS.

49. ALL CLASSES OF SEEDING SHALL BE IN ACCORDANCE WITH CURRENT C.O.A. SEEDING SPECIFICATIONS.

50. NOT USED

51. ALL EXCAVATION, TRENCHING AND SHORING ACTIVITIES MUST BE CARRIED-OUT IN ACCORDANCE WITH OSHA 29 CFR 1926.650 SUBPART P.

52. IF REQUIRED AND WITH THE APPROVAL OF THE FIELD ENGINEER, THE CONTRACTOR SHALL BE RESPONSIBLE FOR TIMING AND COORDINATION OF WATER SHUTOFF AT LEAST SEVEN (7) WORKING DAYS PRIOR TO CONSTRUCTION. CONTRACTOR SHALL CONTACT THE WATER SYSTEMS DIVISION, 857-8200, TO INITIATE IMPLEMENTATION OF THE NON-PRESSURIZED CONNECTION PLAN.

53. QUANTITIES PROVIDED ON THE PLANS ARE FOR THE CONTRACTOR'S CONVENIENCE ONLY. PLANS SHALL TAKE PRECEDENCE IN ALL CASES.

54. CONTRACTOR SHALL INSTALL ALL FURNISHINGS, FENCES, SPORTS EQUIPMENT, SHADE STRUCTURES, AND OTHER MISCELLANEOUS SITE FURNISHINGS WITH TAMPER PROOF HARDWARE UNLESS OTHERWISE NOTED ON THE PLANS. IN LIEU OF TAMPER PROOF HARDWARE, CONTRACTOR MAY SPOT WELD OR LIQUID WELD HARDWARE UPON PRIOR APPROVAL BY THE OWNER. CONTRACTOR SHALL PROVIDE A SUBMITTAL FOR TAMPER PROOF HARDWARE AND/OR LIQUID WELD PRODUCTS. CONTRACTOR SHALL PAINT TO MATCH ANY SPOT WELDS. CONTRACTOR SHALL CUT OFF BOLT ENDS THAT EXTEND BEYOND 2 THREADS PAST THE NUT. ALL PLAY AREA EQUIPMENT SHALL BE INSTALLED WITH THE MANUFACTURER'S RECOMMENDED HARDWARE.

55. CONTRACTOR SHALL OBTAIN ALL REQUIRED INSPECTIONS OF THE WORK.

56. ENGINEER RECOMMENDS THAT OWNER MAINTAIN EROSION PROTECTION ELEMENTS. ENGINEER RECOMMENDS THAT OWNER INSPECT SITE YEARLY AND AFTER EACH RAINFALL TO IDENTIFY NEW AREAS OF EROSION AND INSTALL ADDITIONAL EROSION PROTECTION AS NEEDED BASED ON ACTUAL OCCURRENCES.

57. MEASURES REQUIRED FOR EROSION AND SEDIMENT CONTROL SHALL BE INCIDENTAL TO THE PROJECT COST.

EROSION CONTROL NOTES

1. NO LAND CLEARING OR GRADING SHALL BEGIN UNTIL ALL EROSION CONTROL MEASURES HAVE BEEN INSTALLED.

2. ALL EXPOSED AREAS NOT TO BE PAVED SHALL BE SEEDED W/ NATIVE GRASS SEEDING AS SPECIFIED BY C.O.A. SPECIFICATION SECTION 1012 WITHIN 30 DAYS OF FINAL GRADING. MULCHING SHALL BE ACCOMPLISHED USING HAY OR STRAW MULCH PER THE ABOVE REFERENCED SPEC.

3. SHOULD CONSTRUCTION STOP FOR LONGER THAN 15 DAYS, THE SITE SHALL BE SEEDED AS SPECIFIED BY C.O.A. SEEDING SPECIFICATIONS.

4. MAINTAIN EROSION CONTROL MEASURES AFTER EACH RAIN.

5. THIS PLAN SHALL NOT BE CONSIDERED ALL INCLUSIVE AS THE CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT SOIL SEDIMENT FROM LEAVING THE SITE.

6. CONTRACTOR SHALL COMPLY WITH ALL STATE AND LOCAL ORDINANCES THAT APPLY.

7. ADDITIONAL EROSION AND SEDIMENT CONTROL MEASURES WILL BE INSTALLED IF DEEMED NECESSARY BY ON SITE INSPECTION.

8. CONTRACTOR SHALL OBTAIN A TOPSOIL DISTURBANCE PERMIT FROM COA ENV. HEALTH. LAND DISTURBING ACTIVITIES SHALL NOT COMMENCE UNTIL APPROVAL TO DO SO HAS BEEN RECEIVED BY GOVERNING AUTHORITIES. CONTRACTOR TO CALL 768-2600 FOR PERMIT ACQUISITION INFORMATION. SURFACE DISTURBANCE PERMIT WILL REQUIRE APPROXIMATELY 10 DAYS TO ACQUIRE.

9. CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL REQUIRED PERMITS, INCLUDING A SWPPP.

10. ALL EXISTING STRUCTURES, FENCING, TREES, AND ETC., WITHIN CONSTRUCTION AREA SHALL BE REMOVED AND DISPOSED OF OFF SITE. ANY BURNING ON SITE SHALL BE SUBJECT TO LOCAL ORDINANCES AND LOWES SPECIFICATIONS.

11. CONTRACTOR SHALL BE RESPONSIBLE TO TAKE WHATEVER MEANS NECESSARY TO ESTABLISH PERMANENT SOIL STABILIZATION.

Bohannan Huston
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BHI JOB NO. 20190034

AS-BUILT INFORMATION
CONTRACTOR DATE
WORK STAKED BY DATE
ACCEPTANCE BY DATE
FIELD VERIFICATION BY DATE
DRAWINGS CORRECTED BY DATE
MICRO-FILM INFORMATION
RECORDED BY DATE
NO. DATE

BENCH MARKS

SURVEY INFORMATION
FIELD NOTES
NO. BY DATE

ENGINEERS SEAL

NOT FOR CONSTRUCTION

NO.	DATE	REMARKS	BY
		DESIGN	DATE 10/2018
		REVISIONS	DATE 10/2018
			DATE 10/2018

DESIGNED BY VCS
DRAWN BY LSM
CHECKED BY OMB

CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT
Capital Implementation

TITLE: LOS METATES OPEN SPACE
EROSION MITIGATION
GENERAL NOTES AND LEGEND

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

City Project No. | Dwg. No. G2 | Sheet 2 Of 4

Tue, 9-Oct-2018 - 6:04:pm, Plotted by: OBROWN
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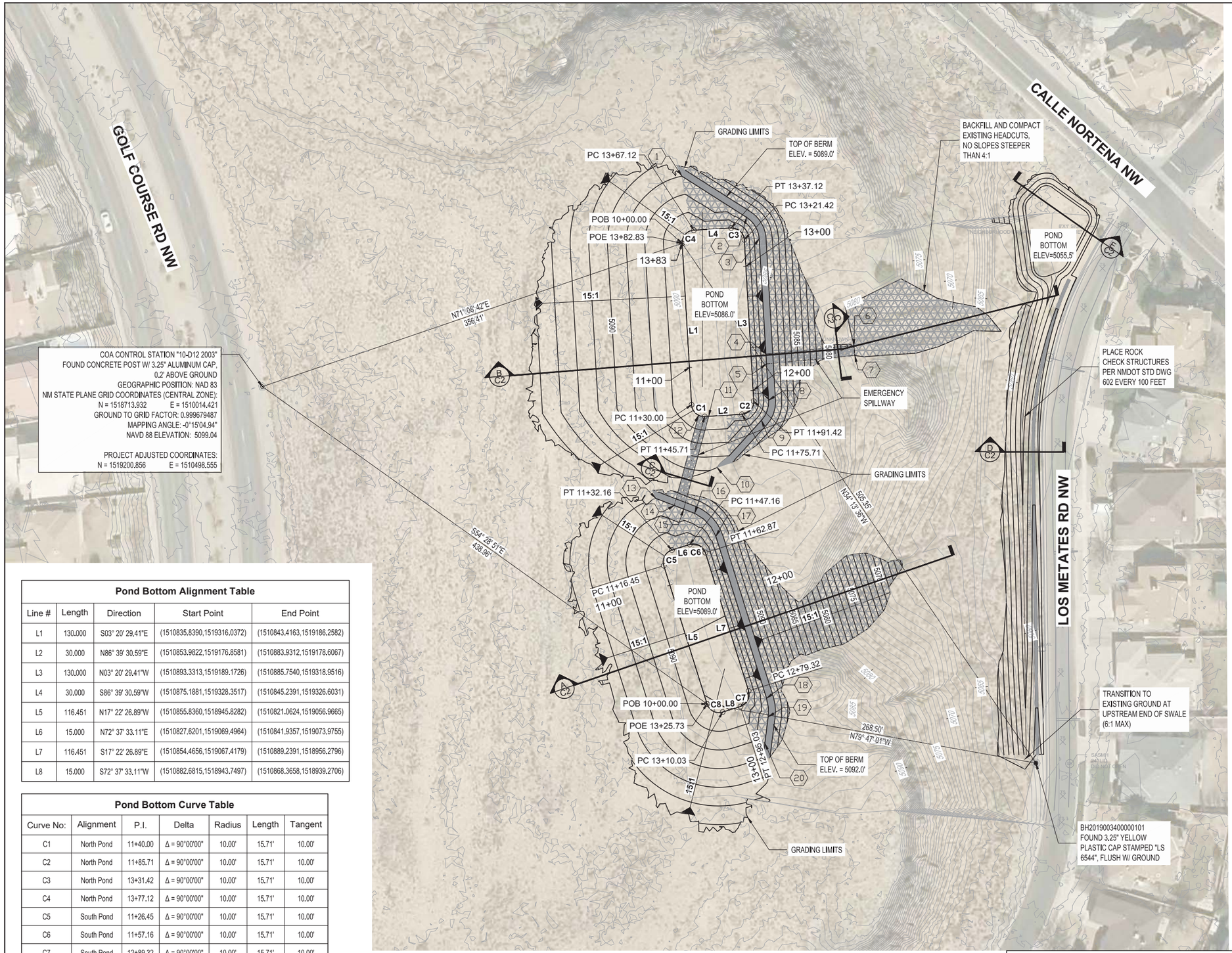

Pond Bottom Alignment Table				
Line #	Length	Direction	Start Point	End Point
L1	130.000	S03° 20' 29.41"E	(1510835.8390,1519316.0372)	(1510843.4163,1519186.2582)
L2	30.000	N86° 39' 30.59"E	(1510853.9822,1519176.8581)	(1510883.9312,1519178.6067)
L3	130.000	N03° 20' 29.41"W	(1510893.3313,1519189.1726)	(1510885.7540,1519318.9516)
L4	30.000	S86° 39' 30.59"W	(1510875.1881,1519328.3517)	(1510845.2391,1519326.6031)
L5	116.451	N17° 22' 26.89"W	(1510855.8360,1518945.8282)	(1510821.0624,1519056.9665)
L6	15.000	N72° 37' 33.11"E	(1510827.6201,1519069.4964)	(1510841.9357,1519073.9755)
L7	116.451	S17° 22' 26.89"E	(1510854.4656,1519067.4179)	(1510889.2391,1518956.2796)
L8	15.000	S72° 37' 33.11"W	(1510882.6815,1518943.7497)	(1510868.3658,1518939.2706)

Pond Bottom Curve Table						
Curve No:	Alignment	P.I.	Delta	Radius	Length	Tangent
C1	North Pond	11+40.00	Δ = 90°00'00"	10.00'	15.71'	10.00'
C2	North Pond	11+85.71	Δ = 90°00'00"	10.00'	15.71'	10.00'
C3	North Pond	13+31.42	Δ = 90°00'00"	10.00'	15.71'	10.00'
C4	North Pond	13+77.12	Δ = 90°00'00"	10.00'	15.71'	10.00'
C5	South Pond	11+26.45	Δ = 90°00'00"	10.00'	15.71'	10.00'
C6	South Pond	11+57.16	Δ = 90°00'00"	10.00'	15.71'	10.00'
C7	South Pond	12+89.32	Δ = 90°00'00"	10.00'	15.71'	10.00'
C8	South Pond	13+20.03	Δ = 90°00'00"	10.00'	15.71'	10.00'

N

40 20 0 40

1" = 40'

NOTES:

1. ALL DISTURBED SLOPES TO BE RESEEDED.
2. ALL NEWLY GRADED SLOPES STEEPER THAN 10:1 TO BE STABILIZED WITH SOIL RETENTION BLANKETS, PER COA STD SPECIFICATIONS SECT 604.

LEGEND:

- PROPOSED RIPRAP
- APPROXIMATE LIMITS, SOIL RETENTION BLANKETS
- TOP OF BERM

Point Table				
⬡	EASTING	NORTHING	ELEV.	DESCRIPTION
1	1510835.62	1519370.02	5089.00	TOP OF BERM
2	1510887.59	1519336.92	5089.00	TOP OF BERM
3	1510897.73	1519319.65	5089.00	TOP OF BERM
4	1510903.14	1519227.08	5089.00	SPILLWAY
5	1510903.61	1519219.08	5089.00	SPILLWAY
6	1510973.80	1519233.85	---	SPILLWAY
7	1510974.56	1519225.89	---	SPILLWAY
8	1510905.31	1519189.87	5089.00	TOP OF BERM
9	1510899.60	1519173.76	5089.00	TOP OF BERM
10	1510863.92	1519135.82	5089.82	TOP OF BERM
11	1510857.17	1519177.04	5086.00	SPILLWAY
12	1510849.09	1519177.82	5086.00	SPILLWAY
13	1510814.66	1519111.03	5092.00	TOP OF BERM
14	1510829.56	1519105.29	5092.00	SPILLWAY
15	1510837.07	1519102.40	5092.00	SPILLWAY
16	1510845.91	1519099.00	5092.00	TOP OF BERM
17	1510862.93	1519080.54	5092.00	TOP OF BERM
18	1510903.68	1518950.32	5092.00	TOP OF BERM
19	1510904.99	1518935.45	5092.00	TOP OF BERM
20	1510902.29	1518914.18	5092.00	TOP OF BERM

AS-BUILT INFORMATION

	DATE
CONTRACTOR	
WORK INSPECTED BY	
NOTES ACCEPTANCE BY	
FIELD VERIFICATION BY	
DRAWINGS CORRECTED BY	

MICRO-FILM INFORMATION

	DATE
RECORDED BY	
NO.	

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEERS SEAL

NOT FOR CONSTRUCTION

REVISIONS

NO.	DATE	BY	REMARKS
			DESIGN
			DESIGNED BY VCS DATE 10/2018
			DRAWN BY LSM DATE 10/2018
			CHECKED BY OMB DATE 10/2018

CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT
Capital Implementation

TITLE:
LOS METATES OPEN SPACE
EROSION MITIGATION
SURVEY CONTROL AND GRADING PLAN

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

City Project No.	Dwg. No.	Sheet	Of
	C1	3	4

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BHI JOB NO. 20190034

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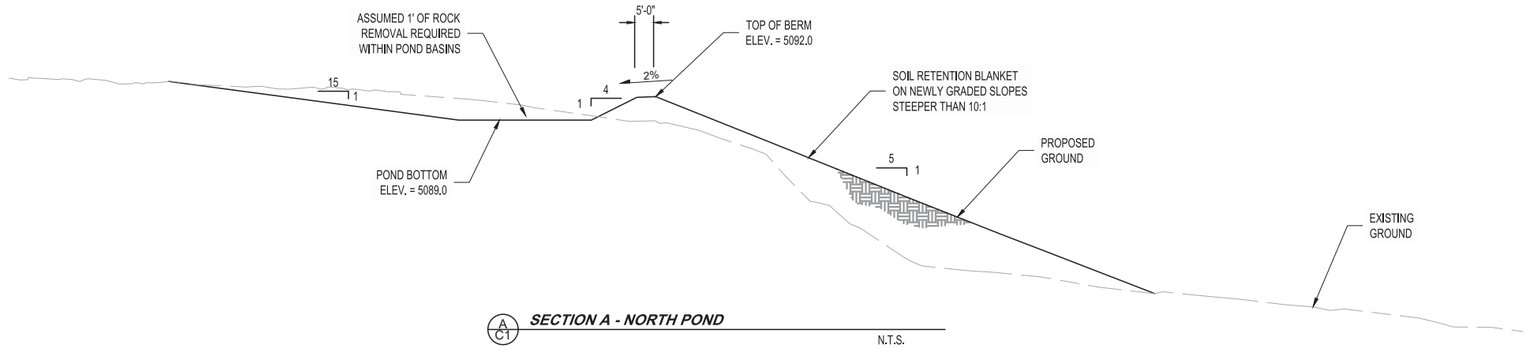

A/C1 **SECTION A - NORTH POND**

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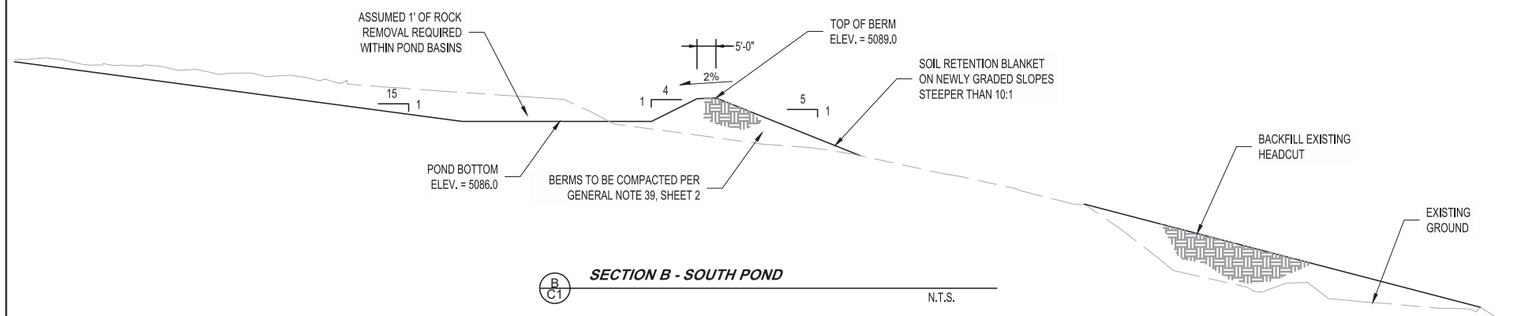

B/C1 **SECTION B - SOUTH POND**

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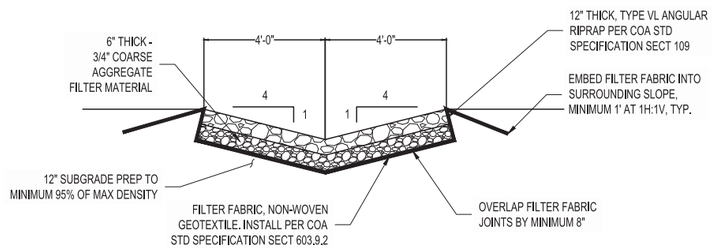

C/C1 **SECTION C - TYPICAL**

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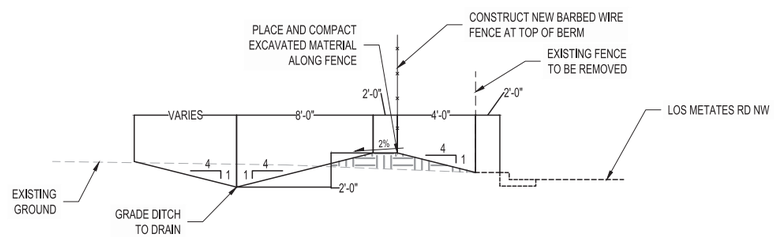
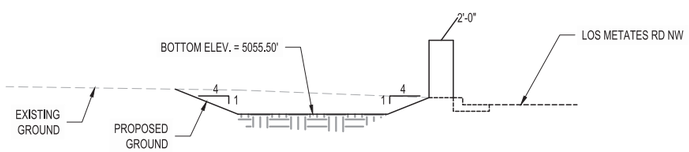


D/C1 **SECTION D - SWALE**

N.T.S.



E/C1 **SECTION E - EAST POND**

N.T.S.

AS-BUILT INFORMATION

	DATE
CONTRACTOR	
WORK INSPECTED BY	
INSPECTIONS ACCEPTANCE BY	
FIELD VERIFICATION BY	
DRAWINGS CORRECTED BY	

MICRO-FILM INFORMATION

	DATE
RECORDED BY	
NO.	

BENCH MARKS

SURVEY INFORMATION

FIELD NOTES

NO.	BY	DATE

ENGINEERS SEAL

NOT FOR CONSTRUCTION

NO.	DATE	REMARKS	BY
		DESIGN	
		REVISIONS	

DESIGNED BY VCS DATE 10/2018
DRAWN BY LSM DATE 10/2018
CHECKED BY OMB DATE 10/2018

CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT
Capital Implementation

TITLE:
LOS METATES OPEN SPACE EROSION MITIGATION GRADING SECTIONS AND DETAILS

DESIGN REVIEW COMMITTEE	CITY ENGINEER APPROVAL	LAST DESIGN UPDATE	MO./DAY/YR.	MO./DAY/YR.

City Project No. | Dwg. No. C2 | Sheet 4 Of 4

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BHI JOB NO. 20190034

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Bohannan Huston

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Spatial Data
Advanced Technologies

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MEMORANDUM

DATE: August 20, 2018

TO: Ms. Susannah Abbey, City of Albuquerque
Mr. Stacy Herrera, City of Albuquerque

FROM: Olin Brown, PE
Caitlin Hone

SUBJECT: **Alternatives Analysis for the Los Metates Open Space**

Introduction

This memo serves as a summary of the hydrologic and hydraulic evaluations and the resulting alternatives analysis for the proposed erosion mitigation within the Los Metates Open Space. The City of Albuquerque's Parks and Recreation Department (the City) contracted Bohannan Huston, Inc. (BHI) to develop an erosion mitigation strategy for several locations within the Los Metates Open Space that have exhibited severe erosion and resulted in significant sediment deposits along the nearby streets and residences.

The Los Metates Open Space is an approximately 17-acre parcel of undeveloped land located between Golf Course Road NW and Los Metates Road NW, south of Calle Nortena NW in western Albuquerque, New Mexico, in Bernalillo County, as shown in Figure 1. The western portions of the parcel are relatively flat with sparse vegetation and no defined flowpaths. These flat areas transition to steep, basalt rock outcrops along the eastern edges of the site. The project location features erosive head-cutting along three small drainage paths. These headcuts have formed as drainage collects throughout the western flat areas above the outcrop, before concentrating in several dominant flowpaths that wind down the basalt rock outcrops. This concentrated flow, steep topography, and limited vegetative cover result in the degradation of the flowpath as sediment is carried to the east and deposited in the flat areas below the outcrops. BHI completed multiple site investigations, including one with City staff, in order to characterize and inform the technical and alternative analyses included herein.

Cultural Resources

Another significant feature within the Los Metates Open Space is the prevalence of culturally historic sites. As the existence of such resources, including historic artifacts and petroglyphs, was well-known and discussed with City staff during project scoping, BHI subcontracted an environmental consulting firm Marron and Associates, an NV5 Company (Marron). Marron completed research of previously recorded culturally significant sites as well as a field survey of the project site to determine if any unrecorded sites existed. A total of five sites were identified—three previously recorded sites were revisited, one previously recorded site was not relocated, and one new site was discovered and registered. The new site can be characterized as an artifact scatter tied to Anglo/Euroamerican occupation of the project area. The artifacts include cans, glass, tile, brick, concrete, and wire. As such, it was recommended by Marron as not eligible for

the National Register of Historic Places (NRHP) and no further treatment is recommended. The remaining sites were identified as outside the project limits and no further treatments were recommended. The complete Cultural Resource report from Marron has been included as Appendix A.

Alternatives Development

BHI completed a hydrologic analysis to determine the 100-year flowrate at each of the three headcut locations. The results of that analysis were in turn used to develop and analyze erosion mitigation strategies. As the property is Open Space, the proposed stabilization measures sought to utilize natural, bioengineered concepts in the hope of minimizing visual and construction impacts to the property.

The hydrologic analysis and resulting flow rates were determined using the standard methodology outlined in the City of Albuquerque Development Process Manual (DPM), Chapter 22. The DPM recommends a simplified method for basins up to 40 acres, using initial abstraction and uniform infiltration precipitation losses to develop area unit discharges for the four types of land treatment. The largest basin in the Los Metates Open Space is 2.36 acres; therefore, this method was used for the hydrologic analysis. Basin delineation was completed using field survey data that was collected by the BHI survey team. BHI also used the most recent Mid-Region Council of Government (MRCOG) surface data to augment the field survey. See Figure 2 for basin delineation.

This hydrologic analysis requires three input variables to determine the Peak Flow of the 100-year storm event: land treatment, precipitation zone, and the area of each basin. The analysis applies a 0.2-hour (10 minutes) time of concentration, and multiplied by an attenuation factor, the treatment of soil that describes the effect of routing. All land areas are described by one of four basic land treatments or by a combination of the four land treatments. The land treatments are described in Table A-4 of the DPM. The Land Treatment used to describe Los Metates is Treatment A – which is generally considered flat, native areas. Bernalillo County's four precipitation zones are indicated in Table A-1, and the Los Metates Open Space is located in Zone 1 as it is west of the Rio Grande. Using the land treatment and the precipitation zone, the 100-year area unit peak discharge can be found using the DPM Table A-8. This unit discharge is then multiplied by the area of each basin to produce the peak flow. The results are shown in the table below.

Table 1 – Peak Flow Calculations

Basin	Area	Precipitation Zone	Land Treatment	100-year Peak Discharge (cfs/ac)	Peak Flow (cfs)
A	1.34	1	A	1.29	1.73
B	2.16	1	A	1.29	2.79
C	2.36	1	A	1.29	3.04

All of these inputs were calculated in the COA DPM spreadsheet which is attached in Appendix B. Based on the results of the hydrologic analysis, BHI has developed three alternative solutions to mitigate the erosion within the Los Metates Open Space. Included in the following section is a brief summary of each alternative, the process and methods by which it was developed and

refined for the project site, and an overview of the benefits and difficulties associated with each proposed alternative's implementation.

Alternative 1 proposes three armored rundown structures constructed at each of the three major headcuts. The approximate footprints of these structures are shown in Figure 3. The run downs would be sized as closely as possible to the existing erosion paths so as to minimize disturbance to the area, while still maintaining adequate hydraulic capacity. They would be constructed with 24-inch diameter grouted basalt boulders, or with sculpted shotcrete, with the intent of looking as natural as possible and blending into the Open Space's existing rock outcrops. Photos of existing run downs and grade control structures are referenced below to conceptually present what the alternative could look like, albeit with significant differences specific to the project site.

Photo 1: Sculpted Shotcrete Grade Control Structure

Photo 2: Stepped Boulder Rundown

The run downs were sized using a publicly-available NRCS spreadsheet Version WI-July-2010, based on *Design of Rock Chutes* by Robinson, Rice, Kadavy, ASAE, 1998. The general geometric parameters of the rundown were decided upon using the existing topography. The intent of the structure's configuration is to create a hydraulic jump at the bottom of the drop, in order to ensure subcritical flow occurs in the channel downstream of the improvements. Alternative 1 will mitigate the erosion due to water flows over the bluff by providing a hardened, lined rundown that is resistant to erosion. However, this alternative would have a significant impact on the Open Space by having three, large engineered structures in a currently natural area in addition to the large disturbance area required for the type of construction activities associated with building the engineered rundowns.

Alternative 2 proposes construction of two earthen berms along the flat areas west of the bluff. These berms would serve to intercept flows that collect in the upper area prior to concentrating and flowing east over the bluff, which is the cause of the current headcutting issues. Berm 1 would retain water from Basin A and B that is causing the two southern headcuts. Berm 2 would retain water from Basin C as shown in Figure 4. This would prevent the water from going over the bluff and continuing the erosion. The runoff would be retained and infiltrated into the ground above the bluff. A 5-foot-wide, 1-foot-deep emergency spillway with 3:1 side slopes armored with Type VL riprap would be included in the pond design. The size of the retention ponds was based of the runoff volumes, as determined by the DPM. The manual criteria require retention ponds to be sized to retain the 100-year, 10-day storm. The calculated runoff volume was increased by an additional 25 percent to account for the accumulation of sediment that would reduce each retention basin's effective storage capacity in a large storm with significant sediment transport.

Table 2 – Retention Pond Storage

	Berm 1	**Berm 2**
Basins	A, B	C
Runoff Volume (CF)	24,274	16,342
Total Pond Storage (CF)	30,343	20,428

The retention berm would prevent further erosion in the open space and therefore also prevent the further deposit of sediment in front of the housing development. Furthermore, it would have minimal impact on the area.

Alternative 3 proposes building a sediment pond at the base of the bluff in the north end of the site as shown in Figure 5. The sediment pond is designed using similar guidelines as outlined for the retention ponds created by the berms in Alternative 2. The storage for the pond is based off the 100-year, 10-day storm with no percolation credit given for volume reduction. Because Alternative 3 is designed as a sediment pond downstream of the headcuts already exhibiting significant sediment transport, the storage of the pond was increased by 50 percent. The total storage of the pond is shown in the table below.

Table 3 – Sediment Pond Storage

	Sediment Pond
Basins	A, B, C
Runoff Volume (CF)	40,616
Total Pond Storage (CF)	60,924

Alternative 3 would prevent the accumulation of sediment that blows off site into neighboring housing developments; however, it would not prevent further erosion of the open space.

Conclusion

In order to mitigate the erosion and sediment deposition that currently occurs within the Los Metates Open Space, BHI completed a hydrologic analysis of the site and completed a hydraulic evaluation of several different alternatives. Each alternative provides a fundamentally different method of mitigating the erosion and sedimentation, and all three options strive to minimize the overall impacts to the site and surrounding historic cultural resources. After an evaluation of each alternative, BHI recommends the City pursue the design and construction of Alternative 2. The berms and retention basins above the basalt bluff and associated erosive headcuts would prevent most runoff from ever developing the potential to significantly erode the steep hillside. This alternative would also likely have the lowest construction cost, simplest construction means and methods, and minimize impacts to much of the site. The rundowns proposed in Alternative 1 would require intensive earthwork, placement and grouting of rock, and multiple construction access locations. Alternative 3 would have a minimal input but would require significant and consistent maintenance efforts to ensure the proper operation of the sediment basin. Furthermore, Alternative 3 would not prevent further erosion at each of the headcuts and instead solely focus on the reduction of sediment accumulation at the northeast corner of the project site. As such, BHI has identified Alternative 2 as the preferred and recommended alternative.

BHI reviewed these alternatives with the City during a meeting on August 2, 2018. During this meeting it was decided to pursue Alternative 2 as the preferred alternative. This option has the least impact on the Open Space while still preventing further runoff from causing significant erosion. The details of Alternative 2 were discussed and, though the City agrees that the construction of the berms and retention basins above the basalt bluff will prevent a majority of the erosion being caused by runoff from the west, the City is still concerned with residual flows generated from rainfall directly impacting the areas of concern. Therefore, along with the construction of the retention ponds at the top of the bluff, the City expressed a desire to implement sediment capture methods along the fence of the Open Space east of the bluff. The City also expressed concern regarding surface treatment and reseeding post-construction. To address this, BHI will include temporary erosion control best management practices (BMP's) for the site, including soil retention blankets to promote the establishment of vegetation. As such, BHI was given direction to proceed with the design process and develop construction plans.

OB/le

Figures

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N

0 150 300

1 in = 300 ft

6200.14- Los Metates Erosion Mitigation

Figure 1

Vicinity Map

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Author: obrown

August 2018

N

50 25 0 50
1" = 50'

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BHI JOB NO. 20190034

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FIELD NOTES
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CONTRACTOR DATE
WORK STARTED BY DATE
WORK COMPLETED DATE
ACCEPTANCE BY DATE
FIELD VERIFICATION BY DATE
DRAWINGS CORRECTED BY DATE

MICRO-FILM INFORMATION
RECORDED BY DATE
NO. DATE

ENGINEERS SEAL

REVISIONS
NO. | DATE | REMARKS | BY

DESIGNED BY Caitlin Hone DATE 7/17/2018
DRAWN BY Caitlin Hone DATE 7/17/2018
CHECKED BY Olin Brown DATE 7/17/2018

CITY OF ALBUQUERQUE
DEPARTMENT OF MUNICIPAL DEVELOPMENT
Capital Implementation

TITLE:
6200.14 LOS METATES EROSION MITIGATION
FIGURE 2: DRAINAGE BASINS

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City Project No. | Dwg. No. | Sheet Of

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1 in = 200 ft

6200.14- Los Metates Erosion Mitigation

Figure 3
Alternative 1

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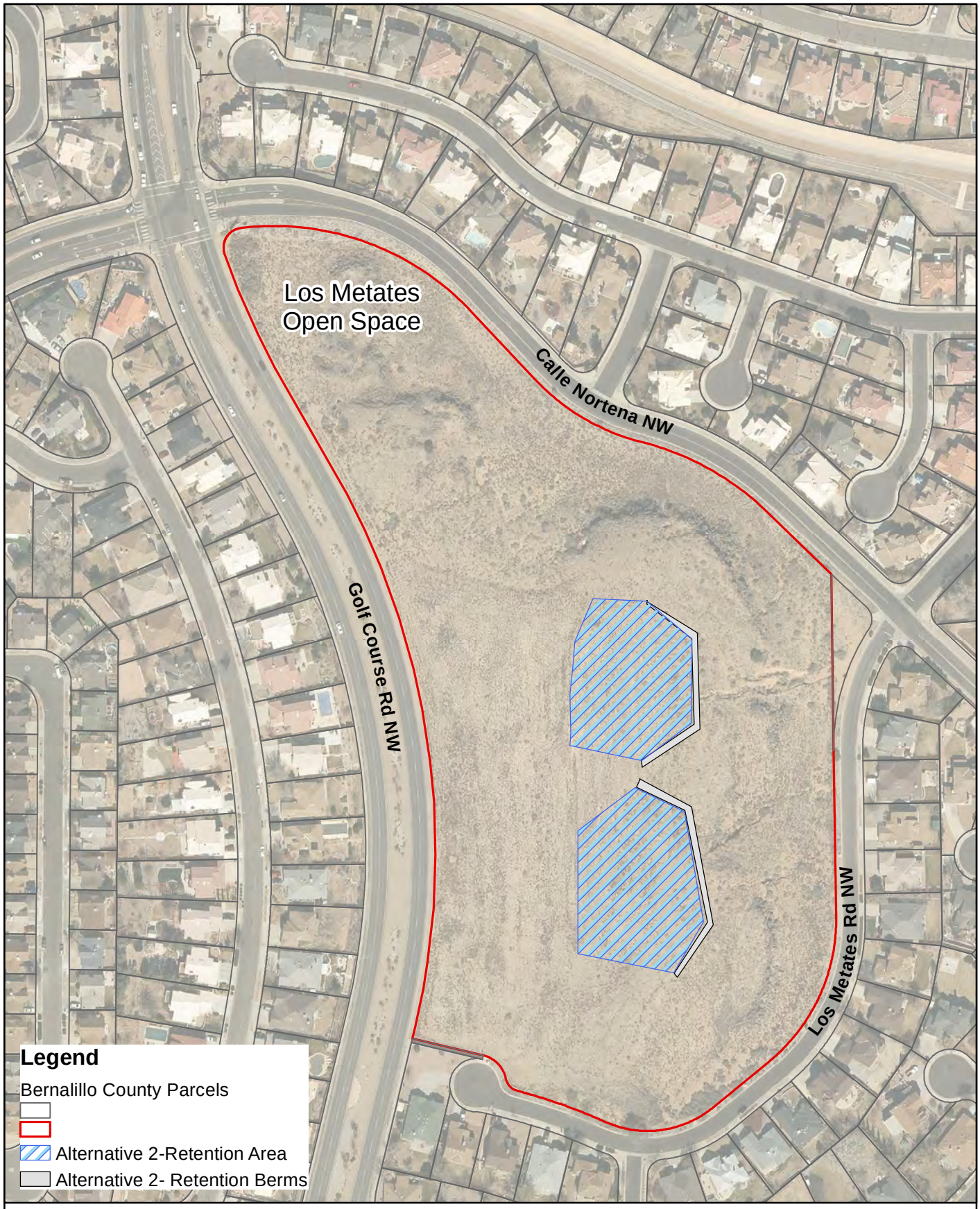
Author: obrown

August 2018



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1 in = 200 ft

6200.14- Los Metates Erosion Mitigation

Figure 4
Alternative 2

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Author: obrown

August 2018

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1 in = 200 ft

6200.14- Los Metates Erosion Mitigation

Figure 5
Alternative 3

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Author: obrown

August 2018

Appendix A

NMCRIS No.140715

CoA Los Metates Erosion Cultural Resources Report

June 28, 2018

Prepared For:
Bohannan Huston, Inc.
7500 Jefferson Street NE, Courtyard 1
Albuquerque, NM 87109

(505) 823-1000

NV5

7511 4th Street NW
Albuquerque, NM 87107
Phone: 505.898.8848

Project No: 444618-1300000.06

MARRON and ASSOCIATES
An NV5 Company

NMCRIS No. 140715

Cultural Resource Report

A 5.24 Acre Cultural Resource Survey for the City of Albuquerque, Los Metates Erosion Bernalillo County, New Mexico

By
Tadhg Kirwan

Edited By
Toni R. Goar
and
Mary Hamel

Under
Permit No. NM-18-160-S
CoA Ordinance No. O-07-72

Prepared for
Bohannan Huston, Inc.
7500 Jefferson Street NE, Courtyard 1
Albuquerque, NM 87109
(505) 823-1000

Prepared by
Marron and Associates, an NV5 company
7511 4th Street NW
Albuquerque, New Mexico 87107

Marron Project No. 444618-1300000.06
June 2018

NMCRIS INVESTIGATION ABSTRACT FORM (NIAF)

1. NMCRIS Activity No.:	2a. Lead (Sponsoring) Agency:	2b. Other Permitting Agency(ies):	3. Lead Agency Report No.:
140715	City of Albuquerque		

4. Title of Report: A 5.24 Cultural Resources Survey for the City of Albuquerque Los Metates Erosion Project, Bernalillo County, New Mexico

Author(s) Tadhg Kirwan

5. Type of Report
☐ **Negative** ☒ **Positive**

6. Investigation Type

☐ Research Design ☒ Survey/Inventory ☐ Test Excavation ☐ Excavation ☐ Collections/Non-Field Study
☐ Overview/Lit Review ☐ Monitoring ☐ Ethnographic study ☐ Site specific visit ☐ Other

7. Description of Undertaking (what does the project entail?):
The City of Albuquerque's Park Department contracted Bohannan Huston, Inc. (BHI) to develop an erosion mitigation strategy for several locations within the Los Metates Open Space that have exhibited severe erosion and sediment transport processes. The Los Metates Open Space is an approximately 17 acre parcel of undeveloped land located between Golf Course Road NW and Los Metates Road NW, south of Calle Nortena NW in western Albuquerque, New Mexico. The site has experienced erosive head-cutting of three small drainage paths within the Open Space as drainage concentrates and flows down the basalt rock outcrops. BHI will complete a hydrologic analysis to determine the flowrate at each of the three headcut locations. The results of that analysis will be used to develop erosion mitigation solutions that utilize natural, bioengineered concepts in the hope of minimizing visual and construction impacts. Ultimately, construction plans will be developed based on the City's selection of a preferred alternative.

8. Dates of Investigation: (from: June 12, 2018 **to:** June 12, 2018**)**

9. Report Date: June 2018

10. Performing Agency/Consultant:
Marron and Associates, an NV5 Company
Principal Investigator: Toni R. Goar
Field Supervisor: Tadhg Kirwan
Field Personnel Names: Ardale Delena

11. Performing Agency/Consultant Report No.:
444618-1300000.06

12. Applicable Cultural Resource Permit No(s):
NM 18-160-S

13. Client/Customer (project proponent):
Bohannan Huston, Inc.
Contact: Olin Brown
Address: 7500 Jefferson Street NE, Courtyard 1
Phone: (505) 823-1000

14. Client/Customer Project No.:

15. Land Ownership Status ***(Must be indicated on project map):***

Land Owner	Acres Surveyed	Acres in APE
City of Albuquerque	5.24	5.24
TOTALS		

16 Records Search(es):

Date(s) of ARMS File Review June 11, 2018	**Name of Reviewer(s)** Tadhg Kirwan	
Date(s) of NR/SR File Review June 11, 2018	**Name of Reviewer(s)** Tadhg Kirwan	
Date(s) of Other Agency File Review	**Name of Reviewer(s)**	**Agency**

17. Survey Data:

a. Source Graphics ☐ **NAD 27** ☒ **NAD 83**
☒ **USGS 7.5' (1:24,000) topo map** ☐ **Other topo map, Scale:**
☒ **GPS Unit** **Accuracy** ☐ **<1.0m** ☒ **1-10m** ☐ **10-100m** ☐ **>100m**

b. USGS 7.5' Topographic Map Name **USGS Quad Code**

Los Griegos	35106-B6

c. County(ies): Bernalillo

17. Survey Data (continued):

d. Nearest City or Town: Albuquerque

e. Legal Description:

Township (N/S)	Range (E/W)	Section	¼ ¼ ¼
11N	02E	24	NE, NE, NW.
11N	02E	24	SE, NE, NW.
			, , .
			, , .
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			, , .
			, , .

Projected legal description? Yes ☐ **, No** ☒ **Unplatted** ☐

f. Other Description (e.g. well pad footages, mile markers, plats, land grant name, etc.):

18. Survey Field Methods:
Intensity: ☒ 100% coverage ☐ <100% coverage
Configuration: ☒ block survey units ☐ linear survey units (l x w): ☐ other survey units (specify):
Scope: ☒ non-selective (all sites recorded) ☐ selective/thematic (selected sites recorded)
Coverage Method: ☒ systematic pedestrian coverage ☐ other method (describe)
Survey Interval (m): 15 **Crew Size:** 2 **Fieldwork Dates:** June 12, 2018
Survey Person Hours: 2 **Recording Person Hours:** 2 **Total Hours:** 4
Additional Narrative:

19. Environmental Setting (NRCS soil designation; vegetative community; elevation; etc.):

Topography

The project area lies within the Rio Grande Valley in New Mexico consists of a series of north-south oriented basins that comprise part of the Rio Grande Depression or Rift that stretches across the state. These basins are linked by narrow valleys and structural bedrock constrictions situated at either end of the basins (Kelley 1977:7, 35). The Albuquerque Basin, the largest in the Rio Grande Rift, is 164.1 kilometers (km) (102 miles [mi]) long (north-south) and 40.2 to 64.4 km (25 to 40 mi) wide (east-west). It is bounded on the west by the Colorado Plateau and on the east by the Sandia, Manzano, and Los Pinos fault blocks (i.e., mountains) that tilt eastward. “These mountains consist of granitic igneous rocks of Precambrian age and metamorphic rocks of schist, gneiss, and quartzite on the rugged west face” (Pease 1975:118). The Albuquerque Basin is drained by the Rio Puerco in the west and by the Rio Grande in the east. Both drainages are deeply entrenched into a former high basin surface that is preserved in the West Mesa divide between the two drainages (Kelley 1977:7–8, 35, 43).

The project area is situated on the West Mesa, sometimes referred to as Ceja Mesa, a physiographic division of the Albuquerque Basin. The West Mesa is not a true mesa, but rather a preserved remnant of the former widespread basin surface into which the present Rio Grande is deeply entrenched (Kelley 1977). The basin fill, or Santa Fe Formation, is thousands of feet thick, and composed of sand, silt, mud, and gravel. These deposits date to the Miocene or Pliocene, and contain chert, chalcedony, quartzite, and other lithic raw materials often used by prehistoric inhabitants. The Albuquerque Volcanoes, located nearby on the West Mesa, erupted through the Santa Fe Formation beginning in the Pleistocene, around 190,000 BP (Chronic 1987:52), depositing volcanic flows over a wide area. The volcanic deposits are visible in the project area through the thin cap of later aeolian sediment, and the exposed edge of the flow to the south and east forms a steep escarpment of exposed basalt most famous for bearing thousands of historic and prehistoric petroglyphs.

Soils

Two common soil mapping units are present within the project area, the Alemeda sandy loam and the Madurez-Wink association. The Alemeda is characterized by lava flows, and hillslope with eaolian deposits derived from igneous and sedimentary rock as the parent material. It has an elevation range of 610 m to 1,829 m (2,200 ft to 6,000 ft) amsl with a 0 to 5 percent slope. The Madurez-Wink is characterized by alluvial fans, and fan piedmonts with alluvium derived from igneous and sedimentary rock as the parent material. The Madurez has a 1 to 5 percent slope while the Wink has a 1 to 7 percent slope. Both soils have and elevation range of 427m to 1,829 m (1,400 ft to 6,000 ft) amsl. (US Department of Agriculture Web Soil Survey Data, accessed June 2018).

Climate

The project area has an arid, continental climate characterized by low rainfall, warm summers, and mild winters. The average annual precipitation for Albuquerque is 17.8 to 25.4 centimeter (cm) (7 to 10 inches). Precipitation, 11.4 cm (4.5 inches), occurs mostly from June through October in the form of brief, often heavy thunderstorms. The Gulf of Mexico is the main source of moisture during this period (Houghton 1977:119). During winter, precipitation is provided by eastward-moving Pacific Ocean storms. Most moisture, however, is lost in the mountains west of New Mexico. In general, precipitation varies greatly from month to month and from year to year (Houghton 1977:119).

The average annual temperature is 14° Celsius (C) (57° Fahrenheit [F]). Within the project area, temperatures of at least 32°C (90°F) are reached an average of 75 days annually. The average frost-free season is 190 days. The annual relative humidity averages 43 percent, varying from a high of 60 percent in the early morning to a low of 30 percent in the afternoon. In June, the afternoon relative humidity averages about 20 percent. Winds are primarily southerly in summer and northerly in winter. Although winds are light throughout most of the year, averaging 14.5 km (9 mi) per hour, spring is the windy season. During this time, the winds are mainly from the southwest. In addition, winds entering the Rio Grande Valley through Tijeras Canyon can gust up to 80.5 km (50 mi) per hour (Houghton 1977:95–96).

Vegetation

The project area is within Bailey's (1913:27) Upper Sonoran Zone and Shreve's (1942:236) Chihuahuan Desert as amended by Schmidt (1979). The vegetation of the Rio Grande floodplain (bosque) and West Mesa is variously classified as Plains-Mesa Sand Scrub (Dick-Peddie 1993:124, 128–129), Plains and Great Basin Grassland (Brown 1994:115–121), and Desert Grassland (Castetter 1956). Plains-Mesa Sand Scrub areas occur primarily in former Mesa Grassland sites (Dick-Peddie 1993:128). Drought and overgrazing since 1850 have drastically reduced the grass cover (Dick-Peddie 1993:131). As a result, the various bunchgrasses (e.g., grama species) favored by livestock have been replaced by forbs and shrubs.

Fauna

The prehistoric inhabitants of the area hunted a variety of animals for food, hides, and body parts. All available environmental zones and landforms were exploited. Important game animals included pronghorn, deer, wapiti, bighorn sheep, bison, and leporids—cottontails, jackrabbits. Mammals such as bears, wolves, beavers, bobcats, foxes, and river otters were hunted for their pelts. Turkeys, owls, hawks, eagles, and various perching birds were hunted or raised for their feathers. Quail and waterfowl were procured as secondary food resources. In addition, a more diverse fish fauna was available in the Rio Grande than is currently the case.

20. a. Percent Ground Visibility: 95 **b. Condition of Survey Area (grazed, bladed, undisturbed, etc.):** weather beaten but otherwise undisturbed

21. CULTURAL RESOURCE FINDINGS ☒ **Yes, See Page 3** ☐ **No, Discuss Why:**

22. Required Attachments (check all appropriate boxes):

- ☒ **USGS 7.5 Topographic Map with sites, isolates, and survey area clearly drawn**
- ☒ **Copy of NMCRIS Mapserver Map Check**
- ☒ **LA Site Forms - new sites (*with sketch map & topographic map)***
- ☒ **LA Site Forms (update) - previously recorded & un-relocated sites (*first 2 pages minimum)***
- ☐ **Historic Cultural Property Inventory Forms**
- ☐ **List and Description of isolates, if applicable**
- ☐ **List and Description of Collections, if applicable**

23. Other Attachments:

- ☐ **Photographs and Log**
- ☐ **Other Attachments**

***(Describe)*:**

24. I certify the information provided above is correct and accurate and meets all applicable agency standards.

Principal Investigator/Responsible Archaeologist: Toni R. Goar

Signature _____ **Date** June 27, 2018 **Title (if not PI):**

25. Reviewing Agency: **Reviewer's Name/Date** **Accepted ( ) Rejected ( )** **Tribal Consultation (if applicable):** ☐ **Yes** ☐ **No**	**26. SHPO** **Reviewer's Name/Date:** **HPD Log #:** **SHPO File Location:** **Date sent to ARMS:**

CULTURAL RESOURCE FINDINGS

[fill in appropriate section(s)]

1. NMCRIS Activity No.:	2. Lead (Sponsoring) Agency:	3. Lead Agency Report No.:
140715	City of Albuquerque	

SURVEY RESULTS:

Sites discovered and registered: 1
Sites discovered and NOT registered: 0
Previously recorded sites revisited (*site update form required*): 3
Previously recorded sites not relocated ***(site update form required):*** 1
TOTAL SITES VISITED: 5
Total isolates recorded: 1 **Non-selective isolate recording?** ☐
Total structures recorded (*new and previously recorded, including acequias*): 0

MANAGEMENT SUMMARY: Marron and Associates, an NV5 Company conducted an intensive (100-percent) cultural resource pedestrian block survey on June 12, 2018 on a 2.12 hectares (5.24 acres) segment of the "Los Metates Open Space." Toni Goar served as the Principal Investigator, Tadhg Kirwan served as Field Supervisor, and Ardale R. Delena served as crew member. Tadhg Kirwan and Ardale R. Delena completed the survey in one day. Four person hours were required to complete the survey (not including travel time). The project required a block survey of multiple 15 meter (50 foot) transects for a total of 2.12 hectares (5.24 acres). The fieldwork was conducted under NM Permit No. 18-160-S and City of Albuquerque Ordinance No. O-07-72. One new site (LA 191466) and one new isolated occurrence were recorded, whilst four previously recorded sites (LA 52099, LA 105071, LA 105073, LA 105075), were either not relocated or found outside the project limits.

LA 191466 is a new site associated with Anglo/Euroamerican occupation. The site is an artifact scatter consisting of cans, glass, tile, brick, concrete, and wire. The cans include hole-in-top, sanitary, and church-key opened food and beverage. Glass fragments include iridescent, clear, and green bottle pieces. Bricks, concrete, and tile are machine made. It is recommended as not eligible to the National Register of Historic Places (NRHP). No further treatment is recommended.

LA 52099 is an Ancestral Pueblo artifact scatter with petroglyphs, which was originally recorded by Matthew F. Schmader and John D. Hays in 1985. The site contained an artifact assemblage that consisted of lithic debitage, diagnostic ceramics, bedrock grinding slicks, and petroglyphs. LA 52099 is outside the project limits and, no further treatment is recommended.

LA 105071 is an Ancestral Pueblo room-block rubble pile, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. The site contained an artifact assemblage consisting of lithic debitage, diagnostic ceramics, bedrock grinding slicks, a midden, a hearth with an associated ash stain, and a room-block rubble pile with an associated ramada. LA 105071 is outside the project limits, and no further treatment is recommended.

LA 105073 is an Ancestral Pueblo petroglyph concentration, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. The site contained a petroglyph concentration with fifteen individual images on a vertical surface, most weathered beyond recognition. LA 105073 is outside the project limits, and no further treatment is recommended.

LA 105075 is an Ancestral Pueblo petroglyph concentration, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. This site contained a petroglyph concentration with five individual images on a vertical surface, most weathered beyond recognition. LA 105075 was not relocated, and no further treatment is recommended.

Isolated occurrences do not meet the criteria for eligibility to the NRHP, and no further treatment is recommended.

IF REPORT IS NEGATIVE YOU ARE DONE AT THIS POINT.

SURVEY LA NUMBER LOG

Sites Discovered:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
191466	Site 1	N

Previously recorded revisited sites:

LA No.	Field/Agency No.	Eligible? (Y/N, applicable criteria)
52099	52099	Outside Area
105071	105071	Outside Area
105073	105073	Outside Area
105075	105075	Not Found

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INTRODUCTION

The City of Albuquerque's (CoA) Park Department contracted Bohannan Huston, Inc. (BHI) to develop an erosion mitigation strategy for several locations within the Los Metates Open Space that have exhibited severe erosion and sediment transport processes. The Los Metates Open Space is an approximately 17 acre parcel of undeveloped land located between Golf Course Road NW and Los Metates Road NW, south of Calle Nortena NW in western Albuquerque, New Mexico (Figure 1). The site has experienced erosive head-cutting of three small drainage paths within the Open Space as drainage concentrates and flows down the basalt rock outcrops. BHI will complete a hydrologic analysis to determine the flowrate at each of the three headcut locations. The results of that analysis will be used to develop erosion mitigation solutions that utilize natural, bioengineered concepts in the hope of minimizing visual and construction impacts. Ultimately, construction plans will be developed based on the CoA's selection of a preferred alternative.

Marron and Associates (Marron), an NV5 Company conducted an intensive (100-percent) cultural resource survey on June 12, 2018. Tadhg Kirwan and Ardale R. Delena completed the survey. Toni Goar served as the Principal Investigator, Tadhg Kirwan served as Field Supervisor, and Ardale R. Delena served as crew member for the project. Four-person hours were required to complete the survey (not including travel time). The fieldwork was conducted under NM Permit No. 18-160-S and CoA Ordinance No. O-07-72.

One new site and one new isolated occurrence were recorded, whilst four previously recorded sites, were either not relocated or deemed to be outside the project limits.

LA 191466 is a new site associated with Anglo/Euroamerican occupation. The site is an artifact scatter containing cans, glass, tile, brick, concrete, and wire. It is recommended as not eligible to the National Register of Historic Places (NRHP). No further treatment is recommended.

LA 52099 is an Ancestral Pueblo artifact scatter with petroglyphs. Matthew F. Schmader and John D. Hays originally recorded the site in 1985, as an artifact assemblage that contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, and petroglyphs. LA 52099 is outside the project limits and, no further treatment is recommended.

LA 105071 is an Ancestral Pueblo room-block rubble pile which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. He noted that the site artifact assemblage contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, a midden, a hearth with associated ash stain, and a room-block rubble pile with an associated ramada. LA 105071 is outside the project limits, and no further treatment is recommended.

LA 105073 is an Ancestral Pueblo petroglyph concentration site, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. He noted that the site contained a petroglyph concentration that included fifteen individual images on a vertical surface, most weathered beyond recognition. LA 105073 is outside the project limits, and no further treatment is recommended.

LA 105075 is an Ancestral Pueblo petroglyph concentration site, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies. This site contained a petroglyph concentration with five individual images on a vertical surface, most weathered beyond recognition. LA 105075 was not relocated, and no further treatment is recommended.

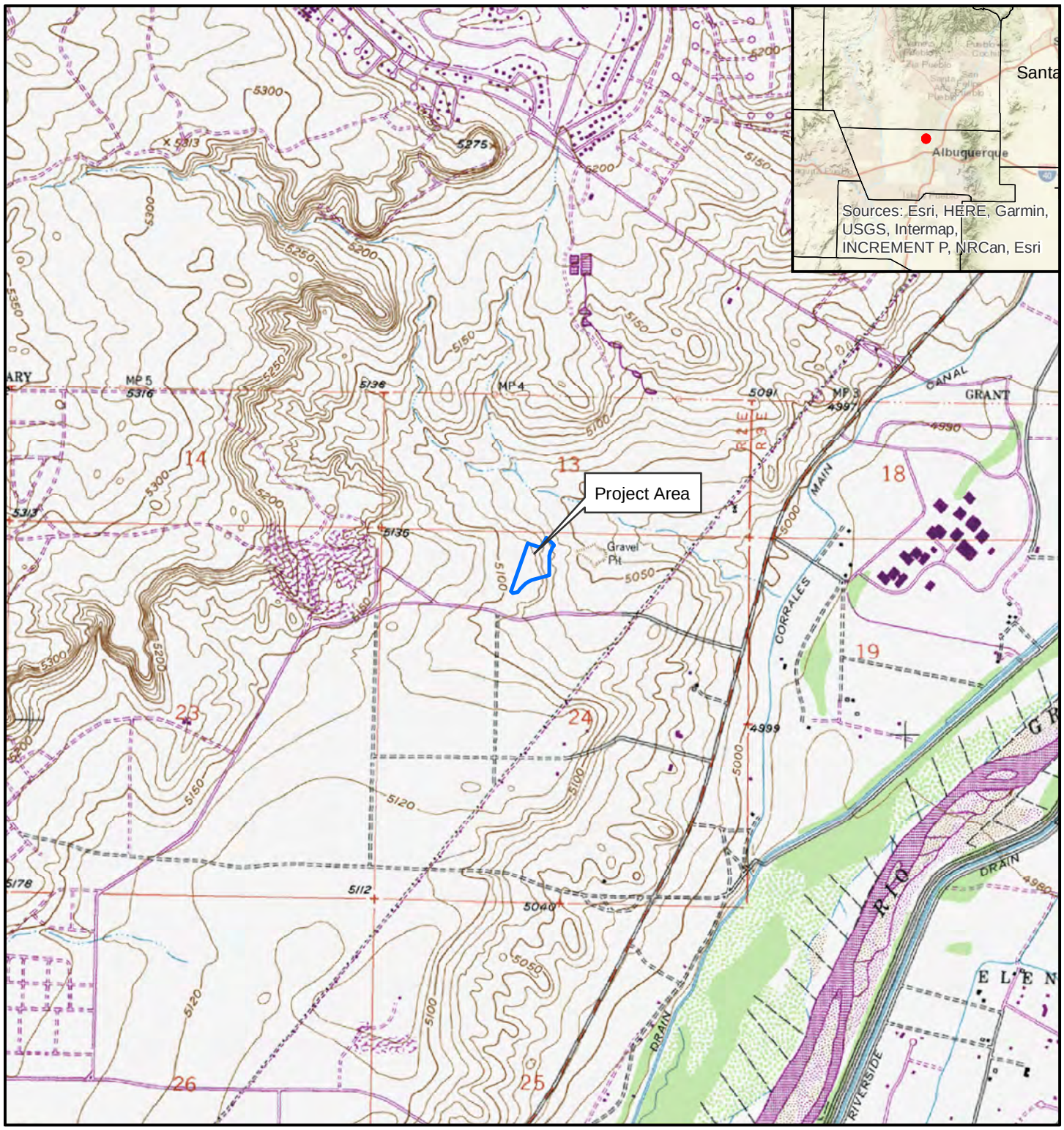
Isolated occurrences do not meet the criteria for eligibility to the NRHP, and no further treatment is recommended.

This undertaking complies with the provisions of the National Historic Preservation Act (NHPA) of 1966, as amended, and applicable regulations. This report is consistent with applicable federal and state standards for cultural resource management. The project was completed under the CoA Ordinance O-07-72.

Project Location

The project area is located on CoA land in Albuquerque, Bernalillo County, New Mexico. The corresponding United States Geological Survey (USGS) 7.5-minute topographic quadrangle is *Los Griegos* (35106-b6; 1996). Legal description for the proposed project is Township 11 North, Range 02 East, Section 24.

As previously noted, the total surveyed space is 2.12 ha (5.24 ac). The Universal Transverse Mercator (UTM) coordinates for the project corners are listed in Table 1.



Area of Disturbance

Los Griegos (35106-B6), NM;
7.5' USGS Quadrangle;
T 11N, R 02E; Sec. 24
Bernalillo County, New Mexico

0 1,000 2,000 3,000 4,000 Feet

0 250 500 750 1,000 Meters

OVERVIEW MAP

FIGURE 1

N

1:24,000

MARRON and ASSOCIATES
An NV5 Company

PROJECT NO.:	444618_3150000.01
REVISED:	6/26/2018
DRAWN BY:	ddelfrate
CHECKED BY:	ddelfrate
FILE NAME:	COA_Los_Metates_Fig1.MXD

CoA Los Metates Erosion Mitigation
Bernalillo County, New Mexico

Table 1 — Project Coordinates

Description	UTMs (NAD 83, Zone 13)	
	Easting	Northing
Northwest Corner	346612	3893657
Northeast Corner	346644	3893627
Southeast Corner	346467	3893417
Southwest Corner	346458	3893425

ENVIRONMENT

The CoA lies within the Mexican Highland Section of the Basin and Range Physiographic Province (Hawley 1986:24). The project area is west of the Rio Grande, the only perennial river in the area. The area is situated at an elevation of approximately 1,701 meters [m] (5,580 feet [ft]) above mean sea level (amsl).

Physiography

The Rio Grande Valley in New Mexico consists of a series of north-south oriented basins that comprise part of the Rio Grande Depression or Rift that stretches across the state. These basins are linked by narrow valleys and structural bedrock constrictions situated at either end of the basins (Kelley 1977:7, 35). The Albuquerque Basin, the largest in the Rio Grande Rift, is 164.1 kilometers (km) (102 miles [mi]) long (north-south) and 40.2 to 64.4 km (25 to 40 mi) wide (east-west). It is bounded on the west by the Colorado Plateau and on the east by the Sandia, Manzano, and Los Pinos fault blocks (i.e., mountains) that tilt eastward. “These mountains consist of granitic igneous rocks of Precambrian age and metamorphic rocks of schist, gneiss, and quartzite on the rugged west face” (Pease 1975:118). The Albuquerque Basin is drained by the Rio Puerco in the west and by the Rio Grande in the east. Both drainages are deeply entrenched into a former high basin surface that is preserved in the West Mesa divide between the two drainages (Kelley 1977:7–8, 35, 43).

The project area is on the West Mesa, sometimes referred to as Ceja Mesa, a physiographic division of the Albuquerque Basin. The West Mesa is not a true mesa, but rather a preserved remnant of the former widespread basin surface into which the present Rio Grande is deeply entrenched (Kelley 1977). The basin fill, or Santa Fe Formation, is thousands of feet thick, and composed of sand, silt, mud, and gravel. These deposits date to the Miocene or Pliocene, and contain chert, chalcedony, quartzite, and other lithic raw materials often used by prehistoric inhabitants. The Albuquerque Volcanoes, located nearby on the West Mesa, erupted through the Santa Fe Formation beginning in the Pleistocene, around 190,000 BP (Chronic 1987:52), depositing volcanic flows over a wide area. The volcanic deposits are visible in the project area through the thin cap of later aeolian sediment, and the exposed edge of the flow to the south and east forms a steep escarpment of exposed basalt most famous for bearing thousands of historic and prehistoric petroglyphs.

Soils

Two common soil mapping units are present within the project area, the Alameda sandy loam and the Madurez-Wink association. The Alameda is characterized by lava flows, and hillslopes with aeolian deposits derived from igneous and sedimentary rock as the parent material. It has an elevation range of 610 m to 1,829 m (2,200 ft to 6,000 ft) amsl with a 0 to 5 percent slope. The Madurez-Wink is characterized by alluvial fans, and fan piedmonts with alluvium derived from igneous and sedimentary rock as the parent material. The Madurez has a 1 to 5 percent slope while the Wink has a 1 to 7 percent slope. Both soils have an elevation range of 427m to 1,829 m (1,400 ft to 6,000 ft) amsl. (US Department of Agriculture Web Soil Survey Data, 2018).

Climate

The project area has an arid, continental climate characterized by low rainfall, warm summers, and mild winters. The average annual precipitation for Albuquerque is 17.8 to 25.4 centimeter (cm) (7 to 10 inches). Precipitation averages 11.4 cm (4.5 inches) and occurs mostly from June through October in the form of brief, often heavy thunderstorms. The Gulf of Mexico is the main source of moisture during this period (Houghton 1977:119). During winter, precipitation is provided by eastward-moving Pacific Ocean storms. Most moisture, however, is lost in the mountains west of New Mexico. In general, precipitation varies greatly from month to month and from year to year (Houghton 1977:119).

The average annual temperature is 14° Celsius (C) (57° Fahrenheit [F]). Within the project area, temperatures of at least 32°C (90°F) are reached an average of 75 days annually. The average frost-free season is 190 days. The annual relative humidity averages 43 percent, varying from a high of 60 percent in the early morning to a low of 30 percent in the afternoon. In June, the afternoon relative humidity averages about 20 percent. Winds are primarily southerly in summer and northerly in winter. Although winds are light throughout most of the year, averaging 14.5 km (9 mi) per hour, spring is the windy season. During this time, the winds are mainly from the southwest. In addition, winds entering the Rio Grande Valley through Tijeras Canyon can gust up to 80.5 km (50 mi) per hour (Houghton 1977:95–96).

Vegetation

The project area is within Bailey's (1913:27) Upper Sonoran Zone and Shreve's (1942:236) Chihuahuan Desert as amended by Schmidt (1979). The vegetation of the Rio Grande floodplain (bosque) and West Mesa is variously classified as Plains-Mesa Sand Scrub (Dick-Peddie 1993:124, 128–129), Plains and Great Basin Grassland (Brown 1994:115–121), and Desert Grassland (Castetter 1956). Plains-Mesa Sand Scrub areas occur primarily in former Mesa Grassland sites (Dick-Peddie 1993:128). Drought and overgrazing since 1850 have drastically reduced the grass cover (Dick-Peddie 1993:131). As a result, the various bunchgrasses (e.g., grama species) favored by livestock have been replaced by forbs and shrubs.

Fauna

The prehistoric inhabitants of the area hunted a variety of animals for food, hides, and body parts. All available environmental zones and landforms were exploited. Important game animals included pronghorn, deer, wapiti, bighorn sheep, bison, and leporids—cottontails, jackrabbits. Mammals such as bears, wolves, beavers, bobcats, foxes, and river otters were hunted for their pelts. Turkeys, owls, hawks, eagles, and various perching birds were hunted or raised for their feathers. Quail and waterfowl were

procured as secondary food resources. In addition, a more diverse fish fauna was available in the Rio Grande than is currently the case.

CULTURAL OVERVIEW

The project area was extensively used prehistorically. The most notable prehistoric and early historic aspect of the cultural environment are the frequency of petroglyphs found on exposed basalt surfaces throughout the area, especially along the escarpment south of the project area where Petroglyph National Monument is located. In addition to petroglyphs, the area contains artifact scatters, agricultural features, and similar indications of more prosaic pursuits.

The project area lies in the Middle Rio Grande Valley. The prehistory and history of this area consist of four major cultural-temporal periods—Paleoindian, Archaic, Ancestral Pueblo, and Historic. Cordell (1979) and Lintz et al. (1988) have provided excellent general cultural overviews for the area. More detailed summaries are available for the Paleoindian (Judge 1973), Archaic (Irwin-Williams 1973), Late Archaic/Early Ancestral Pueblo (Reinhart 1968), Ancestral Pueblo (Wendorf and Reed 1955), and historic (Simmons 1982) periods.

The Paleoindian Period (9500 to 5500 BC)

The Paleoindian period is the earliest well-documented human occupation in the Southwest. It is divided into three subperiods—Clovis (10,000 to 9000 BC), Folsom (9000 to 8000 BC), and Plano (8000 to 5500 BC)—named for different cultural groupings. Each subperiod is characterized by stylistically distinct projectile points found associated with now-extinct forms of late Pleistocene and early Holocene megafauna. In addition, Paleoindian sites are typically identified by chipped-stone assemblages that exhibit a very refined and standardized technology (Frison 1991).

Judge's (1973) investigations of the Middle Rio Grande Valley documented Paleoindian occupation of the area throughout the entire temporal span of the period. Paleoindian exploitation of this area was less intense, however, than that of the Great Plains. In general, Paleoindian sites in the Middle Rio Grande Valley were occupied for short periods, probably not more than several weeks at a time. In addition, the region may have been abandoned periodically due to the paucity of game (Judge 1973:310–311). Within the Albuquerque area, Paleoindian materials are most commonly found as isolated surface finds of partial or complete diagnostic projectile points. Some assemblages with stratified deposits, however, have been identified in the region (Judge 1973). Substantial work has been done on Paleoindian sites near the Boca Negra Wash north of the project area (e.g., Huckell and Kilby 2002a, Holliday et al. 2006).

Boca Negra was located near a playa that is thought to have once exhibited lush vegetation that would have attracted large numbers of bison (Huckell and Kilby 2002a:23). Excavations conducted by the University of New Mexico yielded a variety of stone tools in addition to fragmented bison tooth enamel (Kurota 2006). Other Paleoindian projectile points and sites that have been recorded on the West Mesa (Brandi 1999; Marshall 1995), including Deann's Site (Huckell and Kilby 2002b), correspond well to Judge's (1973) initial theory that the playas were closely associated with Paleoindian occupation (Kurota 2006:7).

Archaic Period (5500 BC to AD 600)

The climate became more arid during the Archaic. Although the mobile hunting and gathering economy of the Paleoindian period continued, there was a shift towards resource diversification (Judge 1982:49). The resource base included a variety of plants and the modern suite of Southwest fauna. The greater dependence on plant foods was reflected in the increased presence of ground-stone during the Archaic. Distinctive Archaic artifacts include a variety of stemmed or corner-notched, dart point styles, basin metates, and one-hand manos. Although varied, the remainder of the stone tool assemblage—scrapers, drills, choppers, knives—is undiagnostic, and chipping debris is abundant (Cordell 1984, 1997). Archaic populations of the Middle Rio Grande most likely had a primary dependence on plant foods, a seasonally mobile settlement pattern, and a flexible social structure in which group size and composition varied in response to changing economic opportunities. Areas where the density and distribution of key plant resources were predictable on a seasonal basis were reoccupied (Judge 1982:49).

The Archaic period in the Middle Rio Grande is represented by the Oshara tradition, (Irwin-Williams 1973). The Oshara phases may reflect successive adaptations to fluctuating climatic conditions between 5500 BC and AD 400 that culminated in the emergence of the Ancestral Puebloan tradition between AD 400 and 600.

A large-scale survey of the Petroglyph National Monument between 1992 and 1994, which identified 15 newly recorded sites with diagnostic Archaic materials, two previously recorded sites with Archaic materials, and another 16 sites recorded as possibly dating to the Archaic period pending further investigation (Brandi 1999; Raymond 2010). This survey also documented 15 diagnostic Archaic projectile points located as isolated occurrences. Prior to this survey, only one Archaic site had been documented within the Petroglyph National Monument boundaries (Brandi 1999:116). Diagnostic Archaic materials included San Jose style, Bajada style, and Jay style projectile points and bases, among others.

Ancestral Pueblo Period (AD 400–1540)

The Ancestral Pueblo period was an era of increasing dependence on cultigens such as maize, beans, and squash. It was marked by population growth, greater residential sedentism, the appearance of the bow and arrow, pottery, increasing dependence on storage of foods, and developments in architecture and sociopolitical organization.

Developmental (AD 400–1200)

In the Middle Rio Grande Valley, the early Developmental period posited by Wendorf and Reed (1955) subsumes the Basketmaker III through Pueblo I periods of the Pecos Classification system, and the late Developmental period subsumes the Pueblo II to early Pueblo III periods. Schmader (1994) provides a comprehensive overview of the early Ancestral Pueblo period in the Albuquerque area.

During the early Developmental period, agriculture became the dominant subsistence strategy (Cordell 1979). Lino Gray was the major ceramic type. At later sites, Alma Neck-banded, Kiatuthlanna Black-on-white, La Plata Black-on-red, and Abajo Black-on-orange were also present (Wendorf and Reed 1955:138).

The artifact inventory includes basketry, matting, sandals, turquoise pendants, *Olivella* shell beads, one-hand manos, and basin and slab metates. Specialized storage facilities increased in frequency and

ground-stone morphology changed. Dwellings increased in size, were more substantial, and were likely to be occupied for longer periods both during the year and from year to year (Cordell 1979:42).

Early Developmental sites in the Albuquerque area typically consist of one to four pit structures that are generally round or round with a slight concavity on the eastern side. Both interior and exterior storage facilities are present. Central hearths, sometimes with adobe collars, are present. Ventilator shafts are oriented toward the east. Roof support posts are variable, with two or four posts common (Cordell 1979:42–43). The late Developmental period is marked by the appearance of Red Mesa Black-on-white, but no changes in architecture (Cordell 1979). Later in this period, Socorro Black-on-white appears.

Some projects documenting the Developmental period in the Albuquerque area include Reinhart (1968), Frisbie (1967), Schmader (1990, 1991), Marshall (1995) and the previously mentioned Petroglyph National Monument survey on the West Mesa (Brandi 1999). This survey located three sites that exhibited diagnostic Developmental ceramics while another seven sites were classified as possibly dating to this period pending further investigation (Brandi 1999:26-27). Another previously recorded site also contained Basketmaker III-Pueblo I ceramics, while plain gray ceramics were recorded as isolated occurrences throughout the project area, which reaffirms the use of the Monument's landscape during the Developmental period (Brandi 1999:26).

Coalition (AD 1200-1325)

Wendorf and Reed's (1955) Coalition period is equivalent to the Pueblo III and early Pueblo IV periods of the Pecos Classification. The beginning of this period coincides with a shift from mineral to organic paint for ceramics. This period, however, is characterized by a great diversity of painted ceramic types. In the Albuquerque area, these include Santa Fe Black-on-white, Galisteo Black-on-white, some St. Johns Polychrome, and a persistence of Kwahe'e Black-on-white (Cordell 1979:43–44). Later in the Coalition period, Wiyo Black-on-white and Heshotauthla Polychrome also appear.

This period is also marked by architectural diversity as evidenced by the transition to substantial above ground structures. Although pit structures were still used, surface masonry and jacal roomblocks of varying sizes became dominant. In the Albuquerque area, roomblocks sometimes incorporated rectangular kivas (Cordell 1979:44).

Sites are generally situated immediately adjacent to major drainages and arable land, away from upland settings. Frisbie (1967) believes this settlement pattern change may reflect an adjustment both to population expansion in the central Rio Grande Valley and to a decrease in agricultural land resulting from rainfall change and arroyo cutting.

Results from Brandi's 1992 to 1994 survey identified four sites that contained ceramics diagnostic of a Late Developmental/Coalition occupation; while assemblages from an additional 11 sites might contain Coalition ceramic types as well (Brandi 1999:28). While it is thought that the Albuquerque area might have been lightly settled during the Coalition period (Anschuetz 1984; Raymond 2010), there are other Coalition period sites that have been documented in the Albuquerque area. Several late Developmental/Coalition sites have been recorded at Kirtland Air Force Base, but the area was abandoned in the late Coalition period (Acklen et al. 1995). In addition, the Coors Road Site (Sullivan and Akins 1994)

and the Meade Avenue Site (Marshall and Marshall 1994) both date to this period, as well as a variety of Coalition sites in Tijeras Canyon (Cordell 1979) and around the Corrales area.

Classic (AD 1325–1540)

The beginning of the Classic period corresponds with the introduction of glaze-decorated, red-slipped ceramics (Wendorf and Reed 1955:153). The population of the northern Rio Grande attained its maximum prehistoric extent during this period. An "elaboration" of material culture was expressed by mural paintings, decorated pipes, stone effigies, the variety of vessel forms, elaborate stone axes, and carved bone tools (Cordell 1979:45). The richly-detailed kiva murals preserved at Kuaua (Dutton 1963) and Pottery Mound (Hibben 1955, 1975) are examples of this cultural elaboration in the Albuquerque area. Ditch irrigation along major rivers probably commenced during this period. In addition, a variety of farming techniques were used (Lang 1977). The observed land-use pattern suggests primary occupation of the pueblos with numerous outlying fields and frequent logistical forays to procure a variety of wild faunal and floral resources (Gerow 1990:13).

During the Classic period, the scattered hamlets coalesced to form nuclear villages in the Rio Grande Valley (Marshall 1989:14). The dramatic population increases are attributed both to indigenous growth and to an influx of peoples from the San Juan region. The marked population instability of the Rio Grande Valley during this period is cited as evidence for this migration (Cordell 1979:103). Widespread trade networks and alliances were standard features of the Puebloan adaptive system. Consequently, as groups in the San Juan region were forced to abandon the area, these networks facilitated entry into the Rio Grande area (Cordell 1979:103). The union of these populations in the Albuquerque area signaled the inception of the ancestral Southern Tiwa (Marshall 1989:15). Some Classic-period settlements in the general vicinity of the project area are Corrales Pueblo, Kuaua Pueblo, Santiago Pueblo, Alameda Pueblo, and Calabacillas Pueblo. All these pueblos are located on benches or in the floodplain adjacent to the Rio Grande (Raymond 2010).

The Classic period terminated when European incursions began to directly affect Rio Grande peoples (Cordell 1979:45). During the hiatus between Coronado's expedition of AD 1540 to 1542 and major Spanish colonization, which began in AD 1598, Puebloan populations in the Rio Grande area probably declined as the result of diseases (e.g., measles, smallpox) introduced by various Spanish expeditions. Consequently, fewer villages were occupied when Spanish colonization efforts began in earnest (Marshall 1989:16).

Evidence of large Classic period sites along the West Mesa has been identified adjacent to the Rio Grande at Piedras Marcadas and Montaño Pueblos, while several smaller Classic period sites have been identified within the Petroglyph National Monument by Beal (1976), Clifton (1985), Rodgers (1978, 1983), Schmader (1986), Schmader and Hays (1986), and Stiner (1986) among others (Brandi 1999). Prior to Brandi's 1992 to 1994 survey of Petroglyph Monument, 10,423 petroglyphs and 65 sites were documented on the east face of the escarpment, and it was estimated that approximately 90 percent of the petroglyphs and 78 percent of the sites all contained a Classic period component (Brandi 1999:29). During the survey, an additional 55 sites contained Classic period components along with six previously recorded sites, and 16 sites with possible Classic period affiliations pending further research (Brandi 1999:30).

Historic Period (AD 1540–Present)

The 1540–1542 *entrada* of Francisco Vasquez de Coronado was the first official European entry into the present Albuquerque area. At that time, Coronado's expedition found 12 large pueblos clustered along the Rio Grande between present-day Bernalillo and Isleta, and two to four smaller villages to the south. The pueblos, occupied by southern Tiwa groups, were referred to collectively as the Tiguex Province.

After the Coronado expedition, the Spanish ignored New Mexico for almost 40 years. The Rodríguez-Chamuscado expedition of 1581 traveled up the Rio Grande as far north as Galisteo Creek (Ortiz 1979:280) and included the bison plains east of the Pecos River. In 1582, Antonio de Espejo and Fray Bernaldino Beltrán led an expedition to discover the fate of the priests from the previous expedition. After reaching the Tiwa pueblos and learning that the priests had been killed, the expedition went to Pecos Pueblo and then followed the Pecos River to Mexico. In 1590, Gaspar Castaño de Sosa led an unauthorized expedition up the Pecos River to Pecos Pueblo and then to the villages of the upper Rio Grande. He was arrested by a pursuing Spanish force and taken back to Mexico. Another unauthorized, ill-fated expedition occurred in 1593 when Captain Francisco Leyva de Bonilla and Juan de Humaña led a small group of soldiers looking for gold up the Rio Grande to San Ildefonso and eastward onto the plains of Kansas where Bonilla was killed during a quarrel with Humaña. Later, Indians killed the rest of the party. Juan de Oñate, leading a group of 400 soldiers, friars, and colonists into the Rio Grande Valley in 1598, founded the first European settlement—San Gabriel—in New Mexico. This settlement, near the confluence of the Rio Grande and Rio Chama, was the first capital and marked the beginning of a permanent Spanish presence in the region. In 1610, the capital was founded in Santa Fe, after San Gabriel was flooded (Athearn 1992:3–4; Jenkins and Schroeder 1974:17, 19; Roberts and Roberts 1988:29–37).

Although Spanish settlement of the Rio Grande Valley and adjacent areas increased steadily between 1610 and 1680, life was far from peaceful. Quarreling between religious and civil leaders was common. Also, settlers commonly established haciendas close to pueblos, which were required to furnish labor under the *encomienda* system, although Spain had officially abolished the system. By 1675, rumors of a possible Indian revolt reached authorities in Santa Fe. Drought, famine, and increased Apache attacks and the suppression added to the tension between settlers and the pueblos and the suppression of Puebloan religion by the Franciscans. As a result, the pueblos revolted in 1680, and the Spaniards were expelled from New Mexico for 12 years. The reconquest of New Mexico (1692–1696) was under the leadership of Governor Diego de Vargas Zapata y Lujan Ponce de León. With the reestablishment of Spanish rule in New Mexico under Vargas, Spain became committed to the region and the *encomienda* system was no longer used (Athearn 1992:8–9, 15; Jenkins and Schroeder 1974:20, 22–23).

The dominant Spanish settlement pattern in the New Mexico of the 1600s was dispersed, consisting of isolated farms, ranches, and hamlets throughout the rural areas (Simmons 1969:10). Several dozen estancias—later abandoned during the Pueblo Revolt—had been established near present-day Bernalillo and between the pueblos of Sandia and Isleta by the mid-1660s. Spanish settlement of the Albuquerque area, however, largely post-dates the reconquest. The population of Albuquerque, founded in 1706 by Governor Francisco Cuervo y Valdés with 12 (Armijo 1929:274) or 19 (Simmons 1980:201; 1982:89) families, and its surrounding communities grew rapidly during the early 1700s. By 1750, colonists were petitioning for land on the Rio Puerco to the west. During the 1700s and the early 1800s, Albuquerque

was primarily a farming and ranching area. Because of its position along the Camino Real, however, Albuquerque became a staging area for trading caravans to Mexico. Consequently, merchants, traders, and weavers settled in the area.

When American traders attempted to establish trade with the Taos and Santa Fe areas in the early 1800s, they were arrested and Spanish authorities confiscated their goods. The trade situation changed in 1821, when Mexico declared its independence from Spain. The previous prohibition against trade with the US was dropped and open trade became possible and legal. William Becknell of Missouri began trading in the fall of 1821 (Athearn 1992:90). Becknell's route, the Mountain Branch of the Santa Fe Trail, crossed northeastern New Mexico by way of Raton Pass. The Santa Fe Trail served as a major trade route between the United States and New Mexico, as well as Mexico, from 1821 until the coming of the railroad. The first railroad entered New Mexico at Raton Pass in December 1878 (Myrick 1990: xiv, 4).

The establishment of the Republic of Texas in 1836 and the annexation of Texas by the United States in 1844 led to poor relations between Mexico and the United States and eventually resulted in the outbreak of war in 1846. New Mexico was captured by General Stephen Watts Kearny's military force. The Treaty of Guadalupe Hidalgo, which ended the Mexican War in 1848, ceded nearly all of present-day New Mexico to the United States. The Territory of New Mexico was created in 1846 and New Mexico became a state in 1912 (Jenkins and Schroeder 1974).

The arrival of the Atchison, Topeka and Santa Fe Railway (AT&SF) in 1880 allowed greater economic growth. The railroad's depot and yards were built a little more than a mile east of the plaza (Old Town). Consequently, a new town site (New Town) was planned and built around the railroad facilities (Simmons 1982:218, 224).

PREVIOUS ARCHAEOLOGICAL RESEARCH

An electronic search of the Museum of New Mexico Archaeological Records Management System (ARMS) on June 11, 2018 revealed 10 previously recorded sites within 0.5 km (0.3 mi) of the project area (Table 2). Four of the 10 previously recorded sites are shown by ARMS to be within the project area and are further discussed in the results section of this report. In addition, two cultural resource surveys were conducted within 0.5 km (0.3 mi) of the project area (Table 3). Published listings for the State Register of Cultural Properties (SRCP) and the NRHP were consulted; no registered property was located within the project area.

Table 2 — Previously Recorded Sites within 0.5 km (0.3 mi) of the Project Area

LA No.	Description	Cultural Affiliation	Eligibility
52091	Lithic quarry	Unknown	Not entered
52099	Artifact scatter with petroglyphs	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered

LA No.	Description	Cultural Affiliation	Eligibility
105068	Artifact scatter with features – pit, ramada	Pueblo: Contact to Spanish Colonial (AD 1539 – 1680)	Not entered
105069	Petroglyph	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105070	Petroglyph	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105071	Artifact scatter with features – fieldhouse rubble mound, ramada, hearth, midden	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105072	Artifact scatter	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105073	Petroglyph	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105074	Petroglyph	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered
105075	Petroglyph	Ancestral Pueblo: Pueblo IV (AD 1300 – 1600)	Not entered

Table 3 — Previous Archaeological Surveys within 0.5 km (0.3 mi) of the Project Area

NMCRIS No.	Description	Acres	No. of Sites	Author, Date
10659	Las Imagines: The Archaeology of Albuquerque's West Mesa Escarpment	1100.00	90	Schmader, Matthew F. and John D. Hays, 1986
45906	An Archaeological Survey of the Hughes Estate Property Addition, Taylor Ranch Subdivision, Albuquerque, New Mexico.	400.00	8	Ward, Albert E., 1986

FIELD METHODS

Tadhg Kirwan and Ardale R. Delena conducted the cultural resource survey on June 12, 2018, under NM Permit No. 18-160-S and CoA Ordinance No. O-07-72. Toni Goar served as Principal Investigator. The project required four person-hours to complete (not including travel). The project required block surveys of multiple 15 m (50 ft) transects for a total surveyed space of 2.12 ha (5.24 ac). The weather was pleasant and sunny. Ground visibility was 95 to 100 percent.

Archaeological sites are defined by the presence of either a cultural feature or 10 or more artifacts older than 50 years and separated by no more than 20 m (66 ft). Areas where cultural materials are sparse (fewer than 10 items) and are 50 years old or older are recorded as isolated occurrences. Archaeological sites are sketch-mapped and digitally recorded. Digital maps are created using a Global Positioning System

(GPS) unit with submeter accuracy. Each map includes the site boundary and the locations of the datum, any features identified, artifact concentrations, important or diagnostic artifacts, drainages or other landscape features, and topographic contours. Each site is photographed, in addition to any cultural features or tools.

Sites were recorded on LA site forms. If a previous datum was found, it was re-used. If not, a rebar datum with an aluminum cap stamped with the site number was placed at each site, provided the site was not in an area prone to vehicle traffic.

All artifacts were analyzed in the field unless more than 50 artifacts of a given class (lithic, prehistoric ceramic, and historic) were present, in which case a sample of at least 50 was analyzed. Lithic and ceramic artifacts were analyzed using standard in-field techniques. Lithic analysis included identifying raw material, size range, presence or absence of cortex, and type of artifact. Ceramic analysis included identifying type and shape of vessel, paint or surface treatment characteristics, and a count. Ceramics, projectile points, and other diagnostic artifacts were identified by type and cultural affiliation when sufficient attributes for a reliable determination were present.

Isolated occurrences were recorded on an isolated occurrence form, analyzed in entirety, and location coordinates were recorded with a Trimble GPS device.

Following field investigations, all GPS data were downloaded and differentially corrected to ensure submeter accuracy. Project area maps and site maps were produced using shapefiles created from the downloaded data and existing background layers. In addition, digital photographs were downloaded.

RESULTS

During the current investigation, one previously recorded archaeological site, one new site, and one new isolated occurrence were within project area. Three previously recorded archaeological sites were found to be located outside the project area. Maps and UTM coordinates for the resources are provided in Appendix A.

Previously Recorded Sites/Outside Project Area

LA 52099

Field Number:	LA 52099
Site Type:	Artifact scatter with petroglyphs
Land Status:	CoA
Affiliation:	Ancestral Pueblo: Pueblo IV to Pueblo V (AD 1300 – 1600)
NRHP Recommendation:	Not evaluated
Project Recommendation:	No further treatment

LA 52099 is an Ancestral Pueblo artifact scatter with petroglyphs. Originally recorded by Matthew F. Schmader and John D. Hays in 1985 under NMCRIS activity number 10659. Schmader noted the artifact assemblage contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, and petroglyphs. Artifacts were collected and curated at the Museum of New Mexico.

Marron attempted to revisit the site during the current investigation but found the site to be outside the project boundary based on the original site form and map information. Currently the site is located within a modern subdivision. No further treatment is recommended.

LA 105071

Field Number:	LA 105071
Site Type:	Room-block rubble pile with features
Land Status:	CoA
Affiliation:	Ancestral Pueblo: Pueblo IV to Pueblo V (AD 1300 – 1600)
NRHP Recommendation:	Not evaluated
Project Recommendation:	No further treatment

LA 105071 is an Ancestral Pueblo room-block rubble pile with features, originally recorded by the Center for Anthropological Studies (Ward, Albert E. 1986; NMCRIS 45906). The original recording noted the artifact assemblage contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, a midden, a hearth with associated ash stain, and a room-block rubble pile with associated ramada. Artifacts were collected and curated at the Center for Anthropological Studies.

Marron attempted to revisit the site during the current investigation but found the site to be outside the project boundary based on the original site form and map information. Currently the site is located within a modern subdivision. No further treatment is recommended.

LA 105073

Field Number:	LA 105073
Site Type:	Petroglyph
Land Status:	CoA
Affiliation:	Ancestral Pueblo: Pueblo IV to Pueblo V (AD 1325 – 1600)
NRHP Recommendation:	Not evaluated
Project Recommendation:	No further treatment

LA 105073 is an Ancestral Pueblo petroglyph concentration site, originally recorded by the Center for Anthropological Studies (Ward, Albert E. 1986; NMCRIS 45906). The original records noted the petroglyph concentration containing 15 individual images on a vertical surface, most weathered beyond recognition. Photographs were taken and curated at the Center for Anthropological Studies.

Marron attempted to revisit the site during the current investigation but found the site to be outside the project boundary based on the original site form and map information. Currently the site is located within a modern subdivision. No further treatment is recommended.

Previously Recorded Sites/Not Found

LA 105075

Field Number:	LA 105075
Site Type:	Petroglyph
Land Status:	CoA
Affiliation:	Ancestral Pueblo: Pueblo IV to Pueblo V (AD 1325 – 1600)
NRHP Recommendation:	Not evaluated
Project Recommendation:	No further treatment

LA 105075 is an Ancestral Pueblo petroglyph concentration site, originally recorded by the Center for Anthropological Studies (Ward, Albert E. 1986; NMCRIS 45906). The original recordings noted the petroglyph concentration contained five individual images on a vertical surface, most weathered beyond recognition. Photographs were taken and curated at the Center for Anthropological Studies.

Marron attempted to revisit the site during the current investigation but could not relocate the site based on the original site form and map information. No further treatment is recommended.

Newly Recorded Sites

LA 191466

Field Number:	Field site 1
Site Type:	Artifact scatter
Land Status:	CoA
Affiliation:	Anglo/Euroamerican: (AD 1880 – 1920)
NRHP Recommendation:	Not eligible
Project Recommendation:	No further treatment

LA 191466 is a historic artifact scatter located at the foot of a basalt outcrop within a drainage area (Figures 2 and A4). The sediments consist of lightly compacted aeolian distributed very pale brown (10YR 6/8, Munsell) sand with basalt cobbles. Vegetation within the site environment consists of juniper, various bushes, cactus, and forbs. Surface visibility is 100 percent. The site measures 40 m by 10 m (131 ft by 32 ft), and contains an area of 400 m^2 (4,192 ft^2). It is located at an elevation of 1,553 m (5,096 ft) amsl. The site is estimated to be 90 percent intact.

Figure 2 — LA 191466 Site Overview, View Southwest

Artifacts

The entire observable surface assemblage (n=71) was analyzed and includes; cans, glass, tile, brick, concrete, and wire (Table 4). The cans include hole-in-top, sanitary, and church-key opened beverage. Glass fragments include iridescent, clear, and green bottle pieces. Bricks are machine made.

Table 3 — LA 191466 Historic Artifact Assemblage

Material	Artifact Type	Description	Count
Metal	Can	Church-key opened, beverage	6
Metal	Can	3 inch diameter, crushed	7
Metal	Can	Hole-in-top, crushed	1
Metal	Can	Fragments	9
Metal	Can	Neck fragment, metal screw on cap	1
Metal	Wire	Bailing wire fragment	1
Glass	Bottle	Iridescent, fragments, neck with metal screw on cap	17
Glass	Bottle	Green fragments	6
Glass	Bottle	Clear fragments	8
Brick	Construction	Red, fragments	3
Concrete	Construction	Gray, fragments	6
Tile	Construction	Turquoise obverse, cream reverse	6
Total			**71**

Shovel Test

Shovel Test 1 was placed in the center of the site. It was excavated to a depth of 15 cm below the surface and was terminated when basalt bedrock was encountered. All sediments were homogenous aeolian sands. This test was negative for subsurface cultural materials.

Evaluation

LA 191466 is a historic trash scatter. No features were found. Artifacts include cans, bottle glass, and construction material. Potential for subsurface cultural material is limited as it is located on aeolian sands with a depth of only 15 cm. Sediments on the site are aeolian blow sand mixed with basalt pebbles. One shovel test was conducted on the site which returned results of negative for subsurface cultural deposits. Based on the hole-in-top cans the site tentatively dates to the Anglo/Euroamerican: Statehood to Recent (1920s to 1960s) period. The site is likely a single dumping episode. LA 191466 is, therefore, recommended as not eligible to the NRHP.

Impacts and Treatment Recommendations

LA 191466 is located within the project footprint. It is, however, recommended as not eligible to the NRHP. No further treatment is recommended.

Isolated Occurrences

One isolated occurrence was identified within the project area, summarized in Table 5. Isolated occurrences do not meet the criteria for eligibility to the NRHP and no further treatment is recommended.

Table 4 — Isolated Occurrence Summary

IO No.	Setting	Description
1	Desert scrub	1 gray rhyolite cortical core reduction flake, 15% cortex, 4+ cm in size

CULTURAL RESOURCE MANAGEMENT

Marron conducted an intensive (100 percent) cultural resource survey on June 12, 2018. Tadhg Kirwan and Ardale R. Delena completed the survey. Toni Goar served as the Principal Investigator for the project, Tadhg Kirwan served as Field Supervisor, and Ardale R. Delena served as crew member. Four person hours were required to complete the survey, not including travel time. The fieldwork was conducted under Permit No. NM-18-160-S and CoA Ordinance No. O-07-72. The project required a block survey of multiple 15 m transects for a total surveyed space of 5.24 ac (2.12 ha).

Table 6 summarizes the cultural resources found during the survey and recommendations for these resources. One new site, four previously recorded sites, and one isolated occurrence were recorded. The isolated occurrence does not meet eligibility criteria to the NRHP, and no further treatment is recommended.

LA 52099 is an Ancestral Pueblo artifact scatter with petroglyphs, which was originally recorded by Matthew F. Schmader and John D. Hays 1985, who noted the artifact assemblage contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, and petroglyphs. LA 52099 is outside the project limits, and no further treatment is recommended.

LA 105071 is an Ancestral Pueblo room-block rubble pile, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies Albuquerque, who noted the site artifact assemblage contained lithic debitage, diagnostic ceramics, bedrock grinding slicks, a midden, a hearth with associate ash stain, and a room-block rubble pile with an associated ramada. LA 105071 is outside the project limits, and no further treatment is recommended.

LA 105073 is an Ancestral Pueblo petroglyph concentration, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies, who noted the petroglyph concentration contained 15 individual images on a vertical surface, most weathered beyond recognition. LA 105073 is outside the project limits, and no further treatment is recommended.

LA 105075 is an Ancestral Pueblo petroglyph concentration, which was originally recorded by Albert Ward in 1986 whilst employed by the Center for Anthropological Studies, who noted the petroglyph concentration contained five individual images on a vertical surface, most weathered beyond recognition. LA 105075 was not relocated, and no further treatment is recommended.

LA 191466 is a new site associated with Anglo/Euroamerican occupation. The site is an artifact scatter containing cans, glass, tile, brick, concrete, and wire. It is recommended as not eligible to the NRHP, and no further treatment is recommended.

Table 5 — Cultural Resource Summary

Resource No.	Type	NRHP Eligibility Recommendation	Treatment Recommendation
LA 52099	Artifact scatter with petroglyphs	Not evaluated	No further treatment
LA 105071	Rubble mound	Not evaluated	No further treatment
LA 105073	Petroglyphs	Not evaluated	No further treatment
LA 105075	Petroglyphs	Not evaluated	No further treatment
LA 191466	Artifact scatter	Not eligible	No further treatment

In the event that cultural resource materials are uncovered during construction or earth-disturbing activities, work in the area should cease immediately and the CoA and the State Historic Preservation Officer (SHPO) will be notified. The CoA and SHPO will determine the necessary steps to evaluate, document, protect, or remove the material or remains, in compliance with the law.

REFERENCES CITED

Acklen, J. C., J. A. Easkovich, D. V. Hill, R. D. Holmes, W. B. Hudspeth, D. L. Larson, P. D. Le Tourneau, D. P. Staley, and C. A. Turnbow
1995 *Data Recovery at the LA 100419 and LA 100420 Albuquerque International Airport Expansion, Bernalillo County, New Mexico.* TRC Mariah Associates Report No. 11288-0020. Albuquerque.

Anschuetz, Kurt F.
1984 *Prehistoric Change In Tijeras Canyon, New Mexico*. M.A. Thesis, University of New Mexico, Albuquerque.

Armijo, Isidoro (translator)
1929 *Noticias* of Juan Candelaria. *New Mexico Historical Review* 4(3):274–297.

Athearn, Frederic J.
1992 *A Forgotten Kingdom: The Spanish Frontier in Colorado and New Mexico, 1540–1821.* Second edition. Cultural Resource Series No. 29. Colorado State Office, Bureau of Land Management, Denver.

Bailey, Vernon
1913 *Life Zones and Crop Zones of New Mexico.* North American Fauna No. 35. U.S. Department of Agriculture, Bureau of Biological Survey, Washington, D.C.

Beal, J. D.
1976 *An Archaeological Survey of "The Volcanoes" West of Albuquerque, New Mexico*. School of American Research, Santa Fe.

Brandi, James M.
1999 *Results of the 1992-1994 Archeological Resource Inventory Petroglyph National Monument.* U.S. National Park Service Intermountain Support Office. NMCRIS 62400.

Brown, David E.
1994 Plains and Great Basin Grasslands. In *Biotic Communities: Southwestern United States and Northwestern Mexico,* edited by David E. Brown, pp. 115–121. University of Utah Press, Salt Lake City.

Castetter, Edward F.
1956 The Vegetation of New Mexico. *New Mexico Quarterly* 26(3):256–288.

Chronic, Halka
1987 *Roadside Geology of New Mexico*. Mountain Press Publishing Company, Missoula, Montana.

Clifton, Don
1985 *An Archaeological Survey of Proposed Paseo del Norte, Albuquerque, NM.* New Mexico State Highway Department, Santa Fe.

Cordell, Linda S.
1979 *A Cultural Resources Overview of the Middle Rio Grande Valley, New Mexico.* USDA Forest Service, Albuquerque and USDI Bureau of Land Management, Santa Fe. U.S. Government Printing Office, Washington, D.C.

1984 *Prehistory of the Southwest.* Academic Press, New York.

1997 *Archaeology of the Southwest.* 2nd edition. Academic Press, San Diego.

Dick-Peddie, William A.
1993 *New Mexico Vegetation: Past, Present, and Future.* University of New Mexico Press, Albuquerque.

Dutton, Bertha P.
1963 *Sun Father's Way: The Kiva Mural of Kuaua, a Pueblo Ruin, Coronado State Monument, New Mexico.* University of New Mexico Press, Albuquerque.

Frisbie, Theodore R.
1967 The Excavation and Interpretation of the Artificial Leg Basketmaker III–Pueblo I Sites near Corrales, New Mexico. Unpublished M.A. thesis. Department of Anthropology, University of New Mexico, Albuquerque.

Frison, George C.
1991 *Prehistoric Hunters of the High Plains.* 2nd edition. Academic Press, New York.

Gerow, Peggy A.
1990 An Archeological Survey of Proposed Kirtland Air Force Base Program Areas, Bernalillo County, New Mexico. Office of Contract Archeology, University of New Mexico, Albuquerque.

Hawley, John W.
1986 Physiographic Provinces. In *New Mexico in Maps,* edited by Jerry L. Williams, pp. 23–27. 2nd edition. University of New Mexico Press, Albuquerque.

Hibben, Frank C.
1955 Excavations at Pottery Mound, New Mexico. *American Antiquity* 21(2):179–180.

1975 *Kiva Art of the Anasazi at Pottery Mound.* K.C. Publications, Las Vegas.

Holliday, Vance T., Bruce B. Huckell, James M. Mayer, and Stephen L. Forman
2006 Geoarchaeology of the Boca Negra Wash Area, Albuquerque Basin, New Mexico. *Geoarchaeology*, 21:765-802.

Houghton, Frank E.
1977 Climate. In *Soil Survey of Bernalillo County and Parts of Sandoval and Valencia Counties, New Mexico*, by Leroy W. Hacker, pp. 95–96. U.S. Department of Agriculture, Soil Conservation Service, Washington, D.C.

Huckell, B.B., and J.D. Kilby
2002a Boca Negra Wash: A New Folsom Site in the Middle Rio Grande Valley, New Mexico. Current Research in the Pleistocene 17:45-47.

2002b Folsom Point Production at the Rio Rancho Site, New Mexico. In *Folsom Technology and Lifeways*, ed. By J. E. Clark and M. B. Collins, pp. 11-29. Lithic Technology Special Publication No. 4, University of Tulsa.

Irwin-Williams, Cynthia
1973 *The Oshara Tradition: Origins of Anasazi Culture.* Contributions in Anthropology 5(1). Eastern New Mexico University, Portales.

Jenkins, Myra Ellen, and Albert H. Schroeder
1974 *A Brief History of New Mexico.* University of New Mexico Press, Albuquerque.

Judge, W. James
1973 Paleoindian Occupation of the Central Rio Grande Valley in New Mexico. University of New Mexico Press, Albuquerque.

1982 The PaleoIndian and Basketmaker Periods: An Overview and Some Research Problems. In *The San Juan Tomorrow: Planning for Conservation of Cultural Resources in the San Juan Basin,* edited by Fred Plog and Walter Wait, pp. 5–57. National Park Service, Southwest Region, Santa Fe.

Kelley, Vincent C.
1977 *Geology of Albuquerque Basin, New Mexico.* Memoir 33. New Mexico Bureau of Mines and Mineral Resources, Socorro.

Kurota, Alexander
2006 Cultural Resources Survey of 40 Acres for the CNM Rio Rancho Campus, Sandoval County, New Mexico

Lang, Richard W.
1977 The Prehistoric Pueblo Cultural Sequence in the Northern Rio Grande. Paper presented at the 50th Pecos Conference, Pecos, New Mexico.

Lintz, Christopher, Amy Earls, Nicholas Trierweiler, and Jan Biella
1988 An Assessment of Cultural Resource Studies Conducted at Kirtland Air Force Base, Bernalillo County, New Mexico. Mariah Associates, Inc., Albuquerque.

Marshall, Michael P.
1989 Archaeological Investigations in the Rio Medio District of the Rio Grande Valley, New Mexico. New Mexico Historic Preservation Division, Santa Fe.

1995 *The Paseo de Volcan Cultural Resource Management Project: A Sample Survey and Records Search for the Proposed Alternate Corridors in Bernalillo and Sandoval Counties, New Mexico*. Cibola Research Consultants Report No. 116.

Marshall M.P. and C. L. Marshall
1994 *Archaeological Investigations at Three Sites within the Proposed Rio Bravo Blvd. and Paseo de Volcan Corridors, Bernalillo County, New Mexico*. Cibola Research Consultants, Corrales.

Myrick, David F.
1990 *New Mexico's Railroads: A Historical Survey.* Revised edition. University of New Mexico Press, Albuquerque.

Ortiz, Alfonso
1979 San Juan Pueblo. In *Southwest,* edited by Alfonso Ortiz, pp. 278–295. Handbook of North American Indians, vol. 9, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Pease, Douglas S.
1975 *Soil Survey of Valencia County, New Mexico, Eastern Part.* U.S. Department of Agriculture, Soil Conservation Service and U.S. Department of the Interior, Bureau of Indian Affairs, Washington, D.C.

Raymond, Gerry (edited)
2010 *Report on 1988 Data Recovery at the Montano Site Complex, LA 33223, City of Albuquerque, New Mexico and Subsequent Analysis of Collections.* Criterion Environmental Consulting, NMCRIS No. 116852.

Reinhart, Theodore R.
1968 Late Archaic Cultures of the Middle Rio Grande Valley, New Mexico: A Study of the Process of Culture Change. Unpublished Ph.D. dissertation. Department of Anthropology, University of New Mexico, Albuquerque.

Roberts, Susan A., and Calvin A. Roberts
1988 *New Mexico.* University of New Mexico Press, Albuquerque.

Rodgers, James
1978 *The Boca Negra Park Project: An Intensive Archaeological Survey in Bernalillo County, New Mexico.* Center for Anthropological Studies, Albuquerque.

1983 *The Volcano Park (Southern) Archaeological Project, Bernalillo County, New Mexico.* Scientific Archaeological Services.

Schmader, Matthew F.
1986 *Archaeological Resources of the Piedras Marcadas Arroyo Area.* Rio Grande Consultants, Albuquerque.

1990 *At the River's Edge: Early Puebloan Adaption in the Middle Rio Grande Valley. Report on the 1988 Field Season. Rio Grande Consultants, Albuquerque.*

1991 *At the River's Edge: Early Puebloan Adaption in the Middle Rio Grande Valley. Report on the 1989 Field Season. Rio Grande Consultants, Albuquerque*

1994 *Early Puebloan Site Structure and Technological Organization in the Middle Rio Grande Valley, New Mexico*. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

Schmader, Matthew F. and John D. Hays
1986 *Las Imagines: The Archaeology of Albuquerque West Mesa Escarpment*. City of Albuquerque, Open Space Division.

Schmidt, R. H., Jr.
1979 A Climatic Delineation of the Real Chihuahuan Desert. *Journal of Arid Environments* 2:243–250.

Shreve, Forrest
1942 The Desert Vegetation of North America. *Botanical Review* 8(4):195–246.

Simmons, Marc
1969 Settlement Patterns and Village Plans in Colonial New Mexico. *Journal of the West* 3(1).

1980 Governor Cuervo and the Beginnings of Albuquerque; Another Look. *New Mexico Historical Review* 55(3):189–207.

1982 *Albuquerque: A Narrative History.* University of New Mexico Press, Albuquerque.

Stiner, Mary C.
1986 Ecology of the West Mesa Escarpment. In *Las Imagines: The Archaeology of Albuquerque West Mesa Escarpment,* by Matthew Schmader and John Hays. City of Albuquerque, Open Space Division.

Sullivan, R.B. and N.J. Akins
1994 Archaeological Investigations at LA 15260: the Coors Road Site, Bernalillo County, New Mexico. Office of Archaeological Studies, *Archaeological Notes 147*. Museum of New Mexico, Santa Fe.

United States Department of Agriculture, Natural Resources Conservation Service
2018 Custom soil survey, Bernalillo County, New Mexico. Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey, Website (accessed 2018): http://websoilsurvey.nrcs.usda.gov/.

Ward, Albert E.
1986 An Archaeological Survey of the Hughes Estate Property Addition, Taylor Ranch Subdivision, Albuquerque, New Mexico. Unpublished manuscript. Center for Anthropological Studies, Albuquerque, New Mexico.

Wendorf, Fred, and Erik Reed
1955 An Alternative Reconstruction of Northern Rio Grande Prehistory. *El Palacio* 62(5–6):131–173.

APPENDIX A:
CULTURAL RESOURCES LOCATION DATA

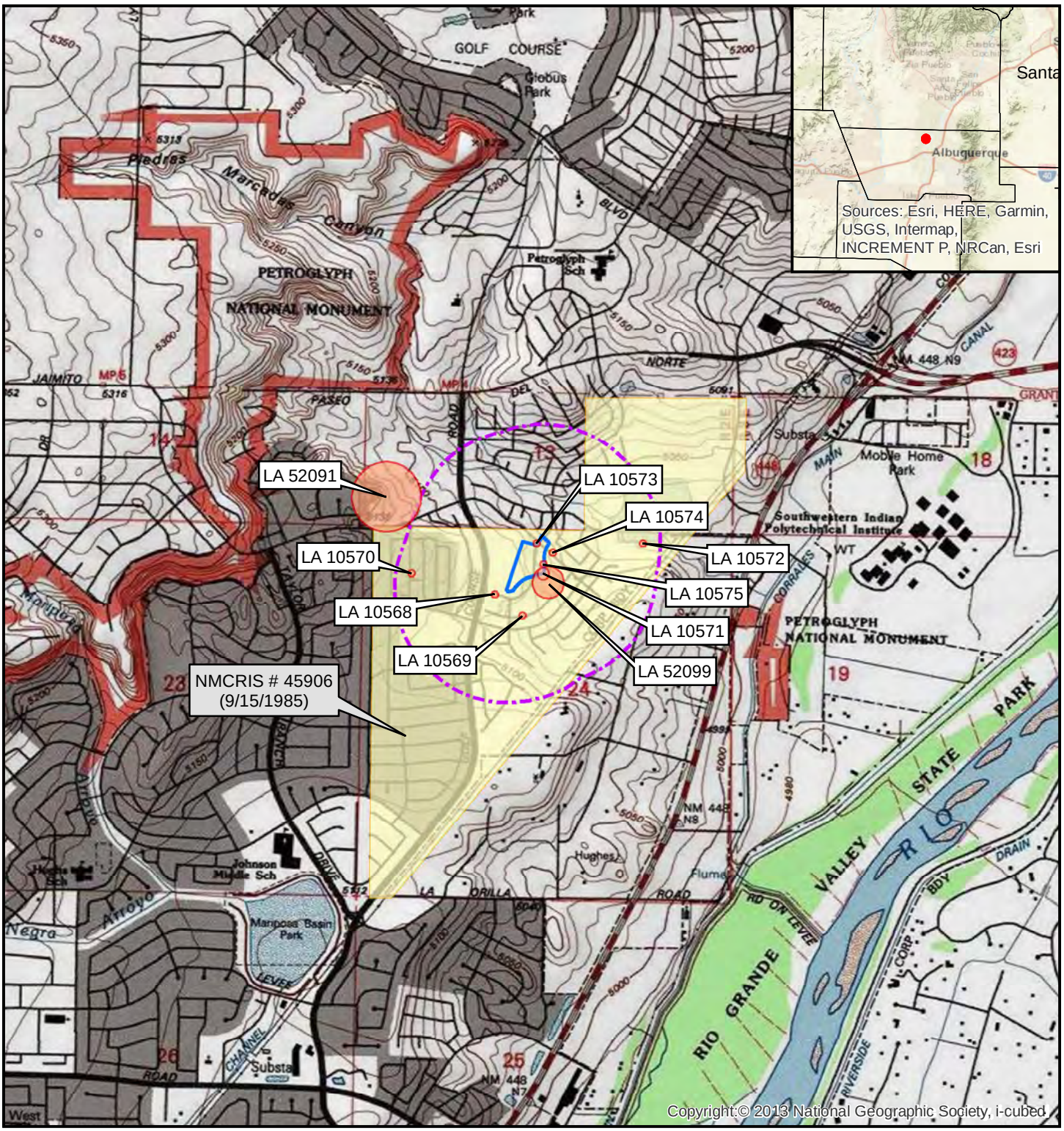
Confidential: The public disclosure of the location of archaeological sites is prohibited by Section 18-6-11.1 New Mexico Statutes Annotated 1978 and by 36 CFR 296.18.

Table A.1 – Resource UTM Coordinates (NAD 83, Zone 13)

Resource No.	Easting	Northing
LA 191466	346603	3893576

Table A.2 – Isolated Resources UTM Coordinates (NAD 83, Zone 13)

IO No.	Easting	Northing
1	346477	3893441



Project Area

ARMS Buffer (500m)

Previously Recorded Site

Previous Survey

Los Griegos (35106-B6), NM;
7.5' USGS Quadrangle;
T 11N, R 02E; Sec. 24
Bernalillo County, New Mexico

0 2,000 4,000 Feet

0 600 1,200 Meters

FILE SEARCH MAP

FIGURE A1

N

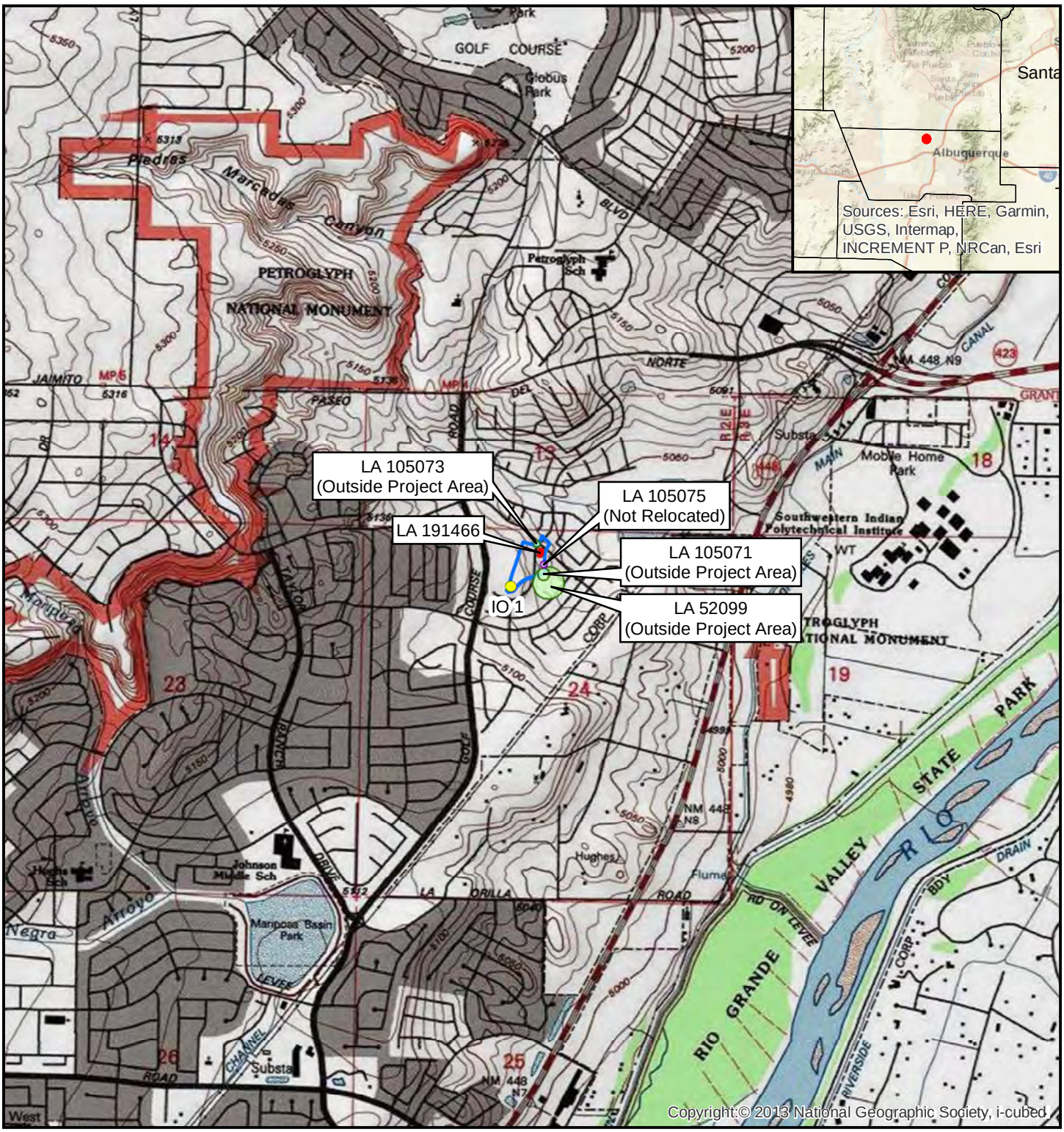
1:24,000

MARRON and ASSOCIATES
An NV5 Company

PROJECT NO.:	444618_3150000.01
REVISED:	6/26/2018
DRAWN BY:	ddelfrate
CHECKED BY:	ddelfrate

FILE NAME:
COA_Los_Metates_FigA1.MXD

CoA Los Metates Erosion Mitigation
Bernalillo County, New Mexico



Project Area

Site Boundary

Previously Recorded Site Not Relocated

Previously Recorded Site Outside Project Area

Isolate

Los Griegos (35106-B6), NM;
7.5' USGS Quadrangle;
T 11N, R 02E; Sec. 24
Bernalillo County, New Mexico

0 2,000 4,000 Feet

0 600 1,200 Meters

RESULTS MAP

FIGURE A2

N

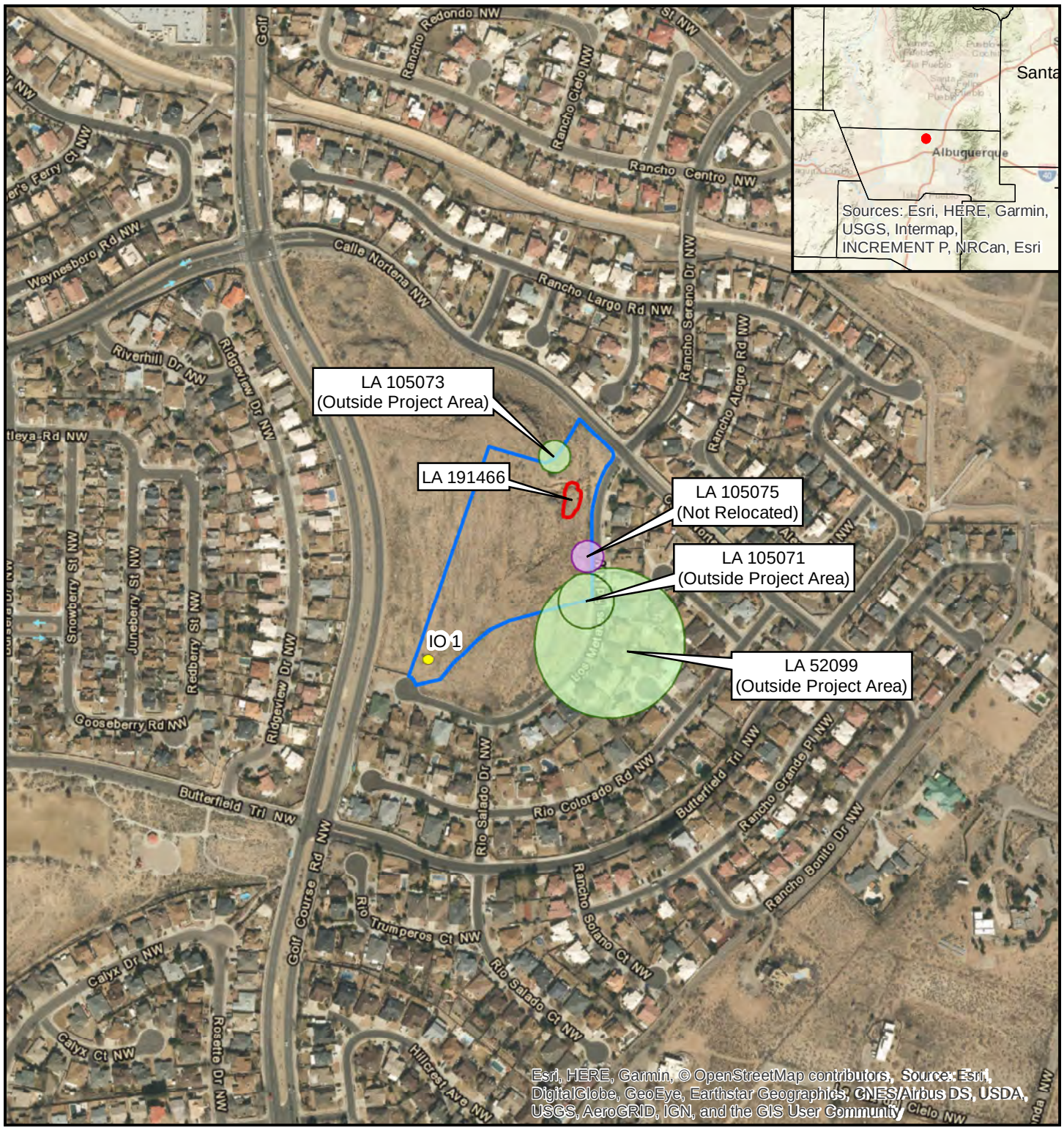
1:24,000

MARRON and ASSOCIATES
An NV5 Company

PROJECT NO.:	444618_3150000.01
REVISED:	6/26/2018
DRAWN BY:	ddelfrate
CHECKED BY:	ddelfrate

FILE NAME:
COA_Los_Metates_FigA2.MXD

CoA Los Metates Erosion Mitigation
Bernalillo County, New Mexico



Project Area

Site Boundary

Previously Recorded Site Not Relocated

Previously Recorded Site Outside Project Area

Isolate

0 400 800 Feet

0 125 250 Meters

Los Griegos (35106-B6), NM;
7.5' USGS Quadrangle;
T 11N, R 02E; Sec. 24
Bernalillo County, New Mexico

RESULTS MAP

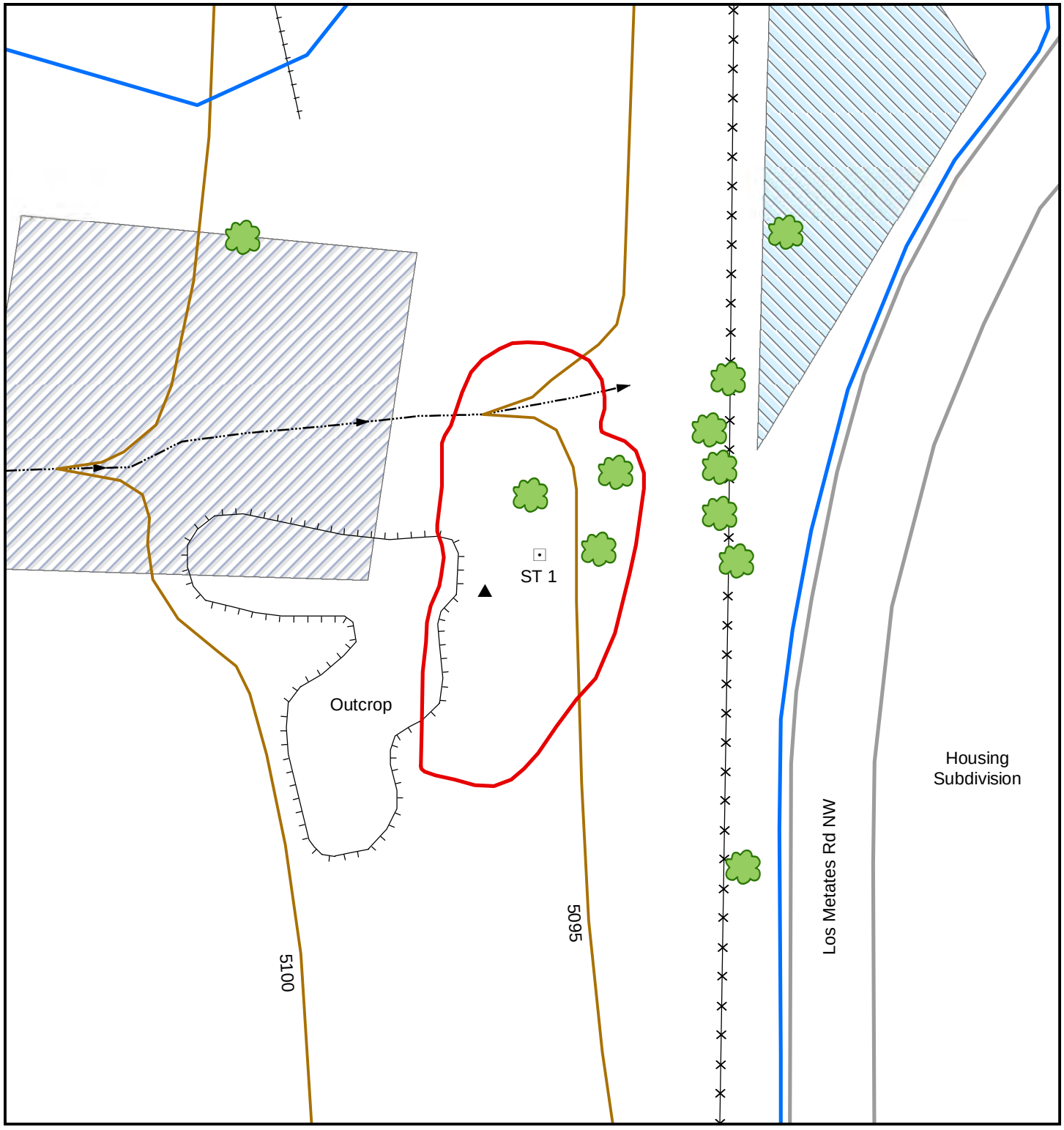
FIGURE A3

1:5,000

MARRON and ASSOCIATES
An NV5 Company

PROJECT NO.:	444618_3150000.01
REVISED:	6/26/2018
DRAWN BY:	ddelfrate
CHECKED BY:	ddelfrate
FILE NAME:	COA_Los_Metates_FigA3.MXD

CoA Los Metates Erosion Mitigation
Bernalillo County, New Mexico



Project Area
Proposed Drop Structure
Proposed Sediment Pond
Site Boundary
Basalt Outcrop

Drainage
Fenceline
Paved Road
Contour

Datum
Shovel Test
Vegetation

0 30 60 Feet
0 10 20 Meters

LA 191466 SITE MAP

FIGURE A4

1:400

MARRON and ASSOCIATES
An NV5 Company

PROJECT NO.:	444618_3150000.01
REVISED:	6/26/2018
DRAWN BY:	ddelfrate
CHECKED BY:	ddelfrate
FILE NAME:	COA_Los_Metates_FigA4_LA_191466.MXD

CoA Los Metates Erosion Mitigation
Bernalillo County, New Mexico


18
19
VALLEY

Appendix B

TABLE 1

20180034 LOS METATES FIELD SITE - HYDROLOGIC CALCULATIONS

		This table is based on the DPM Section 22.2, Zone: 1								
SUB-BASIN	Area	Area	Land Treatment Percentages				Q(100)	Q(100)	WT E	$V(100)_{360}$	$V(100)_{10d}$
ID	(SQ. FT)	(AC.)	A	B	C	D	(cfs/ac.)	(cfs)	(inches)	(CF)	(CF)
Basin A	58256	1.34	100.0%	0.0%	0.0%	0.0%	1.29	1.73	*0.44*	*2136*	*9272*
Basin B	94253	2.16	100.0%	0.0%	0.0%	0.0%	1.29	2.79	*0.44*	*3456*	*15002*
Basin C	102675	2.36	100.0%	0.0%	0.0%	0.0%	1.29	3.04	*0.44*	*3765*	*16342*

****NOTE: Did not do a volume reduction for the 10day storm for any percolation.**

Rock Chute Design Data

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Los Metates Basin C **County:** Bernalillo
Designer: Caitlin Hone **Checked by:**
Date: July 9, 2018 **Date:**

Input Geometry:

→ Upstream Channel	→ Chute		→ Downstream Channel
Bw = 10.0 ft.	Bw = 10.0 ft.		Bw = 10.0 ft.
Side slopes = 6.0 (m:1)	Factor of safety = 1.20 (F_s)	1.2 Min	Side slopes = 6.0 (m:1)
Velocity n-value = 0.033	Side slopes = 3.0 (m:1) →	2.0:1 max.	Velocity n-value = 0.033
Bed slope = 0.0400 ft./ft.	Bed slope (6:1) = 0.167 ft./ft →	3.0:1 max.	Bed slope = 0.0100 ft./ft.
Note: n value = a) velocity n from waterway program	Freeboard = 1.0 ft. →		
or b) computed mannings n for channel	Outlet apron depth, d = 1.0 ft.		Base flow = 3.0 cfs

Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):

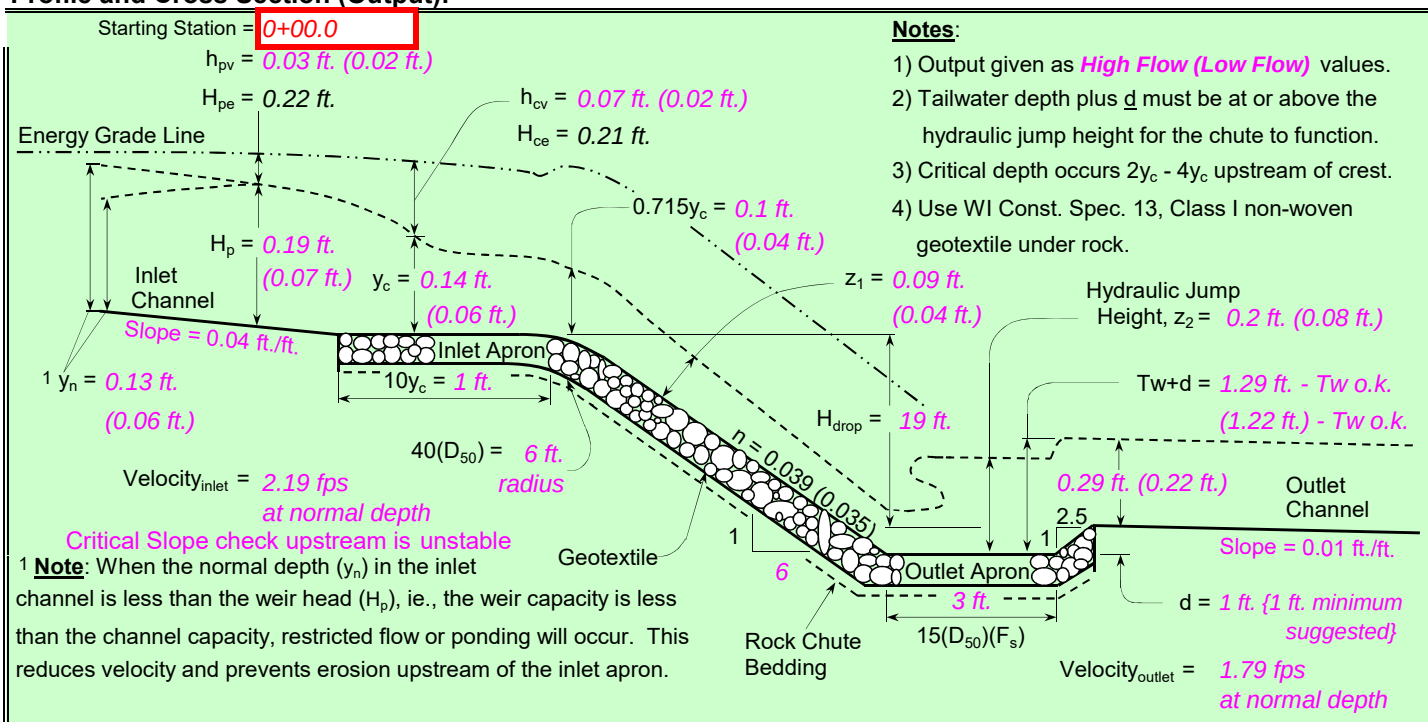
Apron elev. --- Inlet = 5085.0 ft. ------- Outlet = 5065.0 ft. --- (H_{drop} = 19 ft.)

Q_{high} = Runoff from design storm capacity from Table 2, FOTG Standard 410
Q_5 = Runofff from a 5-year,24-hour storm.

Q_{high} = 3.0 cfs High flow storm through chute → Tw (ft.) = Program
Q_5 = 0.8 cfs Low flow storm through chute → Tw (ft.) = Program

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*
***Input tailwater (Tw)**:* 0.17 1.20

Profile and Cross Section (Output):

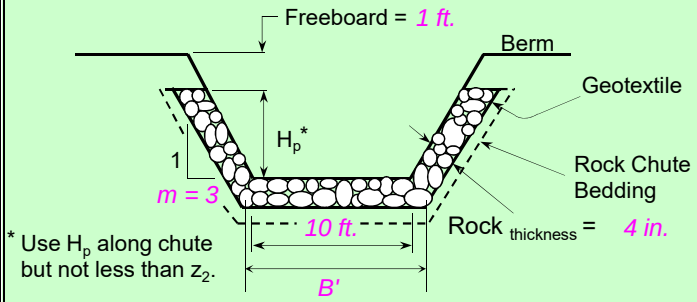


Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use WI Const. Spec. 13, Class I non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute

Typical Cross Section



* Use H_p along chute but not less than z_2.

	0.3 cfs/ft.	Equivalent unit discharge
F_S =	1.20	Factor of safety (multiplier)
z_1 =	0.09 ft.	Normal depth in chute
n-value =	0.039	Manning's roughness coefficient
$D_{50}(F_s)$ =	2 in.	Minimum Design D50*
$2(D_{50})(F_s)$ =	4 in.	Rock chute thickness
Tw + d =	1.29 ft.	Tailwater above outlet apron
z_2 =	0.2 ft.	Hydraulic jump height
*** The outlet	will	function adequately

High Flow Storm Information

Rock Chute Design Data

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Los Metates Basin B **County:** Bernalillo
Designer: Caitlin Hone **Checked by:**
Date: July 9, 2018 **Date:**

Input Geometry:

→ Upstream Channel	→ Chute		→ Downstream Channel
Bw = 10.0 ft.	Bw = 10.0 ft.		Bw = 10.0 ft.
Side slopes = 6.0 (m:1)	Factor of safety = 1.20 (F_s)	1.2 Min	Side slopes = 6.0 (m:1)
Velocity n-value = 0.033	Side slopes = 3.0 (m:1) →	2.0:1 max.	Velocity n-value = 0.033
Bed slope = 0.0200 ft./ft.	Bed slope (6:1) = 0.167 ft./ft →	3.0:1 max.	Bed slope = 0.0100 ft./ft.
Note: n value = a) velocity n from waterway program	Freeboard = 1.0 ft. →		
or b) computed mannings n for channel	Outlet apron depth, d = 1.0 ft.		Base flow = 3.0 cfs

Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):

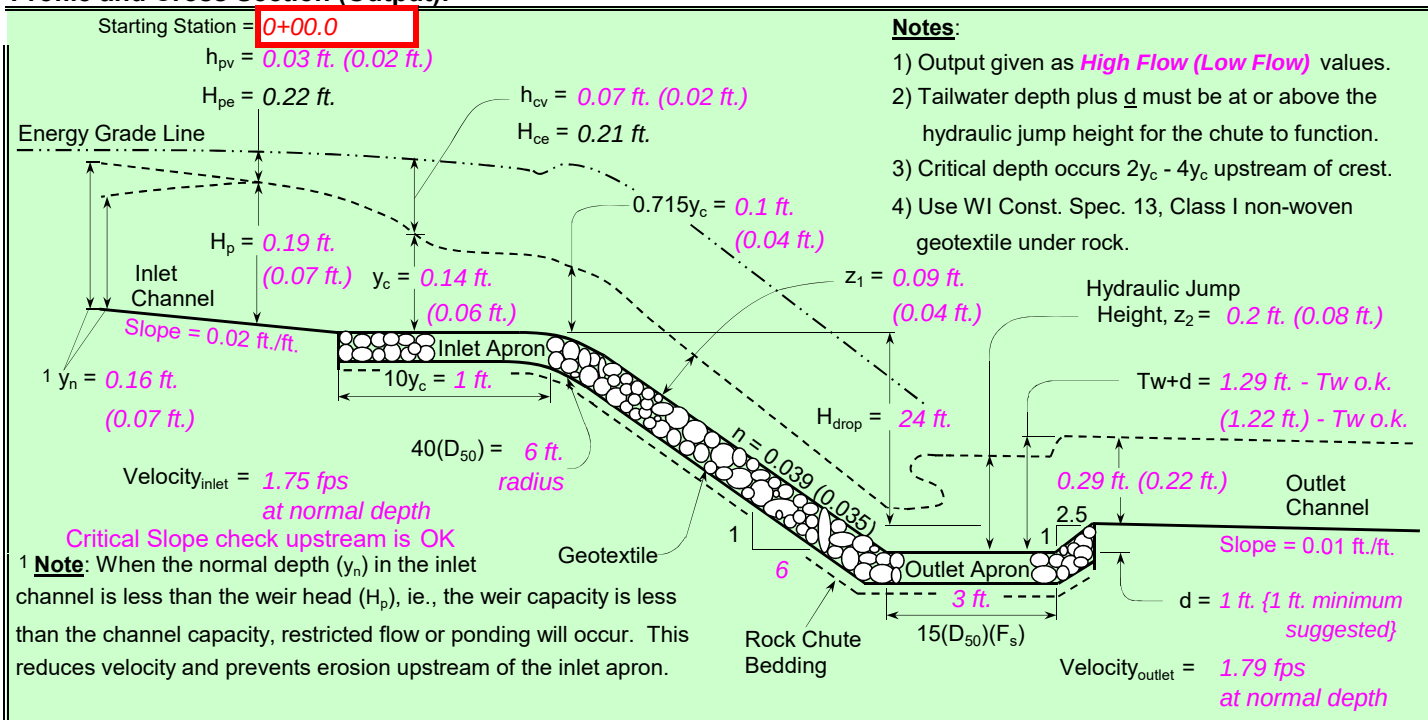
Apron elev. --- Inlet = 5090.0 ft. ------- Outlet 5065.0 ft. --- (H_{drop} = 24 ft.)

Q_{high} = Runoff from design storm capacity from Table 2, FOTG Standard 410
Q_5 = Runofff from a 5-year,24-hour storm.

Q_{high} = 3.0 cfs High flow storm through chute → Tw (ft.) = Program
Q_5 = 0.8 cfs Low flow storm through chute → Tw (ft.) = Program

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*
***Input tailwater (Tw)**:* 0.17 1.20

Profile and Cross Section (Output):

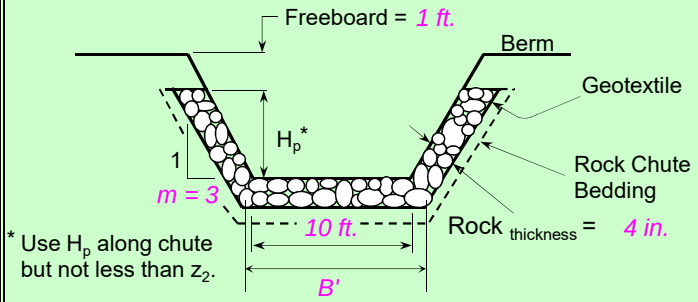


Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use WI Const. Spec. 13, Class I non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute

Typical Cross Section



* Use H_p along chute but not less than z_2.

	0.29 cfs/ft.	Equivalent unit discharge
F_S =	1.20	Factor of safety (multiplier)
z_1 =	0.09 ft.	Normal depth in chute
n-value =	0.039	Manning's roughness coefficient
$D_{50}(F_s)$ =	2 in.	Minimum Design D50*
$2(D_{50})(F_s)$ =	4 in.	Rock chute thickness
Tw + d =	1.29 ft.	Tailwater above outlet apron
z_2 =	0.2 ft.	Hydraulic jump height
*** The outlet	will	function adequately

High Flow Storm Information

Rock Chute Design Data

(Version WI-July-2010, Based on Design of Rock Chutes by Robinson, Rice, Kadavy, ASAE, 1998)

Project: Los Matates Basin A **County:** Bernalillo
Designer: Caitlin Hone **Checked by:**
Date: July 9, 2018 **Date:**

Input Geometry:

→ Upstream Channel	→ Chute		→ Downstream Channel
Bw = 5.0 ft.	Bw = 5.0 ft.		Bw = 5.0 ft.
Side slopes = 6.0 (m:1)	Factor of safety = 1.20 (F_s)	1.2 Min	Side slopes = 6.0 (m:1)
Velocity n-value = 0.033	Side slopes = 3.0 (m:1) →	2.0:1 max.	Velocity n-value = 0.033
Bed slope = 0.0300 ft./ft.	Bed slope (6:1) = 0.167 ft./ft →	3.0:1 max.	Bed slope = 0.0100 ft./ft.
Note: n value = a) velocity n from waterway program	Freeboard = 1.0 ft. →		
or b) computed mannings n for channel	Outlet apron depth, d = 1.0 ft.		Base flow = 2.0 cfs

Design Storm Data (Table 2, FOTG, WI-NRCS Grade Stabilization Structure No. 410):

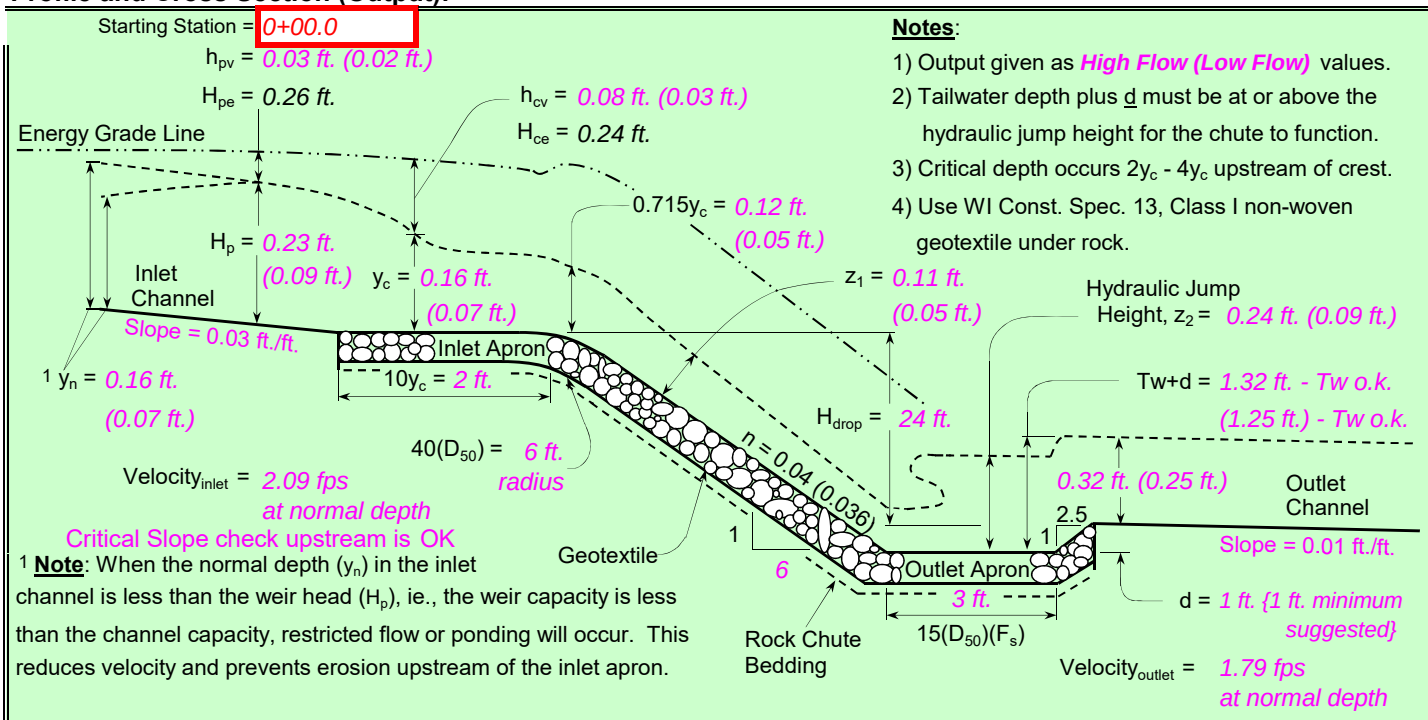
Apron elev. --- Inlet = 5090.0 ft. ------- Outlet 5065.0 ft. --- (H_{drop} = 24 ft.)

Q_{high} = Runoff from design storm capacity from Table 2, FOTG Standard 410
Q_5 = Runofff from a 5-year,24-hour storm.

Q_{high} = 2.0 cfs High flow storm through chute → Tw (ft.) = Program
Q_5 = 0.5 cfs Low flow storm through chute → Tw (ft.) = Program

***Note**: The total required capacity is routed through the chute (principal spillway) or in combination with an auxiliary spillway.*
***Input tailwater (Tw)**:* 0.17 1.20

Profile and Cross Section (Output):

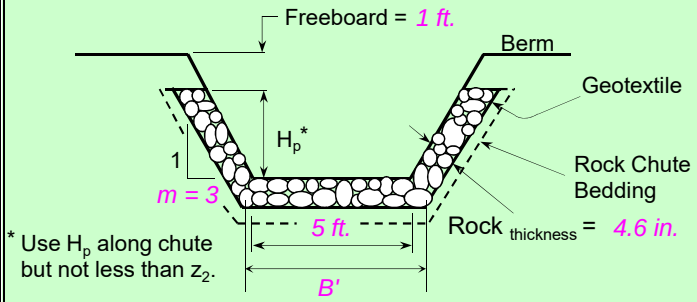


Notes:
1) Output given as ***High Flow (Low Flow)*** values.
2) Tailwater depth plus d must be at or above the hydraulic jump height for the chute to function.
3) Critical depth occurs 2y_c - 4y_c upstream of crest.
4) Use WI Const. Spec. 13, Class I non-woven geotextile under rock.

[1] **Note**: When the normal depth (y_n) in the inlet channel is less than the weir head (H_p), ie., the weir capacity is less than the channel capacity, restricted flow or ponding will occur. This reduces velocity and prevents erosion upstream of the inlet apron.

Profile Along Centerline of Chute

Typical Cross Section



* Use H_p along chute but not less than z_2.

	0.38 cfs/ft.	Equivalent unit discharge
F_S =	1.20	Factor of safety (multiplier)
z_1 =	0.11 ft.	Normal depth in chute
n-value =	0.04	Manning's roughness coefficient
$D_{50}(F_s)$ =	2.3 in.	Minimum Design D50*
$2(D_{50})(F_s)$ =	4.6 in.	Rock chute thickness
Tw + d =	1.32 ft.	Tailwater above outlet apron
z_2 =	0.24 ft.	Hydraulic jump height
*** The outlet	will	function adequately

High Flow Storm Information