GEO-TEST

GEOTECHNICAL ENGINEERING SERVICES REPORT NO. 1-90712

LISBON AVENUE BOX CULVERT @ SUGAR CHANNEL

RIO RANCHO, NEW MEXICO

PREPARED FOR:

CONLEY ENGINEERING, LLC

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September 3, 2019
Job No. 1-90712

Conley Engineering, LLC
3915 Carlisle Blvd. NE
Albuquerque, NM 87107

ATTN: Patrick J. Conley, P.E.

RE: Geotechnical Engineering Services Report
Lisbon Ave. Box Culvert @ Sugar Channel
Rio Rancho, New Mexico

Dear Mr. Conley:

Submitted herein is the Geotechnical Engineering Services Report for the above referenced project. The report contains the results of our field investigation, laboratory testing, and recommendations for foundation and retaining wall design as well as criteria for site grading, excavation and backfill.

It has been a pleasure to serve you on this project. If you should have any questions, please contact this office.

Respectfully submitted:
GEO-TEST, INC.

Patrick R. Whorton, E.I.

Reviewed by:

Robert D Booth, P.E.

ROBERT D. BOOTH
NEW MEXICO
5711
LICENSED PROFESSIONAL ENGINEER

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INTRODUCTION

This report presents the results of our geotechnical engineering services investigation performed by this firm for the proposed new box culvert beneath Lisbon Ave. at Sugar Channel in Rio Rancho, New Mexico.

The objectives of this investigation were to:

1) Evaluate the nature and engineering properties of the subsurface soils underlying the site.

2) Provide recommendations for foundation and retaining structure design as well as criteria for excavation, fill and general site grading.

The investigation includes subsurface exploration, selected soil sampling, laboratory testing of the samples, performing an engineering analysis and preparation of this report.

PROPOSED CONSTRUCTION

It is understood that the project consists of the replacement of the existing Sugar Channel culvert which runs beneath Lisbon Ave. The existing culvert consists of five 36 inch diameter corrugated metal pipes. These pipes will be replaced with a reinforced cast-in-place concrete box culvert. In addition, associated wing walls will be constructed on the upstream and downstream sides of the culvert as well as a concrete channel lining upstream of the new culvert.

Should project details vary significantly from those outlined above, this firm should be notified for review and possible revision of the recommendations contained herein.

FIELD EXPLORATION

Two (2) exploratory borings were drilled at the site to a depth of 15 feet below existing grade. Locations of the borings are shown on the attached Boring Location Map, Figure 1. The soils encountered in the borings were continuously examined, visually classified and logged during the drilling operation. The boring logs are presented in a following section of this report. Drilling was accomplished using a truck mounted drill rig equipped with 5.5-inch diameter continuous flight hollow stem auger. Subsurface soils were sampled at five foot intervals or less utilizing an open tube split barrel sampler driven by a standard penetration test hammer.

LABORATORY TESTING

Selected samples were tested in the laboratory to determine certain engineering properties of the soils. Moisture contents were determined to evaluate the various soil deposits with depth. The results of these tests are shown on the boring logs.

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Sieve analysis and Atterberg limits tests were performed to aid in soil classification. The results of these tests are presented in the Summary of Laboratory Results and on the individual test reports presented in a following section of this report.

SURFACE CONDITIONS

The site is located in northwest Rio Rancho where Lisbon Ave. crosses Sugar Channel. Sugar Channel is a rough earth channel upstream of Lisbon Ave. and a concrete lined channel downstream. There is an approximate 5 foot elevation difference between the upstream and downstream side. The existing culvert consists of five 36 inch corrugated metal pipes. The existing crossing is in generally good shape with no observed distress due to settlement. The pavement of Lisbon Ave. is in relatively poor shape with multiple transverse and longitudinal cracking observed. However, this cracking was observed throughout the entire length of Lisbon Ave. such that the cracking is likely due to asphalt fatigue and is not related to the existing culvert.

SUBSURFACE SOIL CONDITIONS

As indicated by the exploratory borings, the soils underlying the site consist of poorly graded sands with various amounts of silt. These soils are non-plastic, range from medium dense to dense and extend to the full depth explored.

No free groundwater was encountered in the borings and soil moisture contents were relatively low throughout the extent of the borings.

CONCLUSIONS AND RECOMMENDATIONS

The near surface soils underlying the site were found to be medium dense to dense non-plastic sands which in their present condition are considered suitable to provide reliable support of the proposed box culvert base and wing-walls on a self-supporting mat-type foundation. As the exploratory borings were not located directly beneath the proposed culvert location due the existing CMP culverts, it is unknown if subsurface soils beneath the existing culvert share these same characteristics. Based on the profile established by this investigation, the relatively close proximity of the exploratory borings to the existing culvert and experience in the area, it is considered likely that the deeper subsurface soils beneath the existing culvert are similar to those encountered in the borings and as such are considered suitable to provide adequate support of the culvert. However, it is considered possible that post-demolition, the near surface soils at the culvert site will be disturbed such that they may not have the capacity to provide adequate support of the new box culvert. Foundations bearing on these soils may be susceptible to excessive differential settlements, particularly upon significant moisture increases. However, with site preparation and very careful moisture protection, as recommended in a following section of this report, the proposed structure can be supported on a mat foundation bearing directly on properly compacted structural fill.

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The site preparation would involve an overexcavation of the existing soils throughout the area to such an extent as to provide for at least 12 inches of properly compacted, non-expansive structural fill below all foundations. The limits of the overexcavation should also extend laterally from the foundation perimeters a distance equal to the depth of fill beneath their bases. The exposed native soils at the base of the excavation should be densified prior to placement of structural fill. The native soils may be blended and used as structural fill provided, they meet the structural fill requirements outlined in the Site Grading section of this report. Detailed recommendations for foundation design and the required site grading are presented in the following sections of this report.

CULVERT FOUNDATION

A reinforced concrete mat foundation bearing directly on a minimum of 12 inches of properly compacted non-expansive structural fill is recommended for the support of the box culvert and associated wing-walls. An allowable soil bearing pressure of 1,500 pounds per square foot (psf) should not be exceeded in foundation design. This bearing pressure applies to full dead plus realistic live loads and can be safely increased by one-third for totals loads including wind and seismic forces.

A modulus of subgrade reaction of 150 pounds per square inch per inch of deflection (pci) is recommended for use in a non-rigid design such as a two-dimensional finite element method.

The mat foundation should be reinforced with top and bottom steel, as appropriate, to provide structural continuity and to span local load irregularities. It is essential that the mat foundation pad be observed by a representative of the geotechnical engineer prior to placement of reinforcing steel.

Total settlement of the mat foundation designed and constructed as recommended herein are estimated not to exceed ½ inch for the soil moisture contents encountered during this investigation or moisture contents introduced during construction. Differential movements should be less than 75 percent of total movements. Significant post-construction moisture increases in the supporting soils could create additional movements and could cause excessive movements, at least in some areas of the site. Accordingly, the moisture protection provisions as recommended in a following section of this report are considered critical for the satisfactory performance of the culvert and wing-walls.

CHANNEL LINING AND CUT-OFF WALL

The upstream concrete channel lining should be founded on a minimum of 8 inches of properly compacted native soils or structural fill meeting the requirements outlined in the Site Grading section of this report. As most of the onsite soils meet the requirements for structural fill minimal earthwork is

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anticipated to prepare the existing channel for lining, however, some processing may be required.

A concrete cut-off wall should be constructed at the upstream end of the channel lining. The wall should be established a minimum of 2 feet below the nearest adjacent grade bearing on a minimum of 8 inches of properly compacted native soil prepared as outlined in the Site Grading section of this report.

LATERAL SOIL PRESSURES

Resistance to lateral forces will be provided by soil friction between the base of foundations and the soil and by passive earth resistance against the sides of the foundations. A coefficient of friction of 0.40 should be used for computing the lateral resistance between bases of foundations and the soil. A passive soil resistance equivalent to a fluid weighing 375 pounds per cubic foot should be used for analysis.

Lateral pressure against retaining walls will depend upon their degree of restraint. Walls which are restrained so as to limit movement at the top of the wall to less than 0.001 times the height of the wall should be designed for an 'at rest' earth pressure of 55 pounds per square foot of depth. Walls free to move at the top should be designed using an 'active' earth pressure equal to 35 pounds per square foot per foot of depth. These recommended lateral pressures are applicable to a condition of horizontal backfill without surcharge loads. Analysis of earth pressures produced by sloping backfill or surcharge loads can be provided by this firm upon request.

The lateral pressures presented above assume no build up of hydrostatic pressures behind the walls. To prevent the buildup of hydrostatic pressures, adequate weep holes should be provided or composite drainage systems such as Miradrain or equivalent can be installed on the backside of the walls prior to backfilling. The drainage layer should be connected to a collector pipe at the base of the walls and routed to a sump or to a positive gravity drain.

Retaining wall backfill should meet the structural fill specifications outlined in the Site Grading section of this report. During backfilling, the contractor should be limited to the use of hand operated compaction equipment within a zone of about 3 feet horizontally from the back of the walls. The use of heavier equipment could apply lateral pressures well in excess of the recommended design earth pressure, particularly over the upper portions of the walls.

EXCAVATION

Excavated slopes for foundation and utility construction should be designed and constructed in accordance with 29 CFR 1926, Subpart P, and any applicable state or local regulations. Excavated temporary and permanent slopes should not exceed 2 to 1 (horizontal to vertical).

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Excavation of the surficial soils can be readily accomplished using normal earthmoving equipment.

SITE GRADING

The following general guidelines should be included in the project construction specifications to provide a basis for quality control during site grading. It is recommended that all structural fill and backfill be placed and compacted under engineering observation and in accordance with the following:

1) After demolition and removal of the existing CMP culverts, the existing site soils throughout the site should be overexcavated to such an extent as to remove all loosened or disturbed soils and to provide for at least 12 inches of properly compacted structural fill beneath the new mat foundation. The overexcavation limits should extend laterally beyond the foundation perimeters equal to the depth of fill beneath its base. The soils exposed at the base of the overexcavation should be densified before placement of structural fill.

2) After the required overexcavation, the exposed cut surface should be densified. Densification of the exposed native soils should consist of scarifying to a depth of 8 inches, moisture conditioning to the optimum moisture content or above and compacting the subgrade to a minimum of 95 percent of maximum dry density as determined in accordance with ASTM D-1557.

3) The results of this investigation indicate that most of the on-site soils will meet the criteria for structural fill, however, some blending may be required.

4) All structural fill and backfill should be free of vegetation and debris and contain no rocks larger than 3 inches. Gradation of the backfill material, as determined in accordance with ASTM D-422, should be as follows:

Size	Percent Passing
3 inch	100
No. 4	60 - 100
No. 200	10 - 35

5) The plasticity index of the structural fill should be no greater than 15 when tested in accordance with ASTM D-4318.

6) Structural fill consisting of soils approved by the geotechnical engineer, shall be placed in 8 inch loose lifts and compacted with approved compaction equipment. Loose lifts should be reduced to 4 inches if hand held compaction equipment is used. All compaction of fill or backfill shall be accomplished to a minimum of 95 percent of the maximum dry density as determined in accordance with ASTM D-1557. The moisture content of

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the structural fill during compaction should be within 2 percent of the optimum moisture content.

7) Tests for degree of compaction should be determined by the ASTM D-1556 method or ASTM D-6938. Observation and field tests should be carried on during fill and backfill placement by the geotechnical engineer to assist the contractor in obtaining the required degree of compaction. If less than 95 percent is indicated, additional compaction effort should be made with adjustment of the moisture content as necessary until 95 percent compaction is obtained.

MOISTURE PROTECTION

Precautions should be taken during and after construction to minimize moisture increase of near surface foundation soils. Accumulations of excessive moisture can weaken or cause other changes in the soils supporting the foundations. This can cause differential movement of the foundations and can result in cosmetic or structural damage to the culvert.

Positive drainage should be established away from the culvert wing-walls. A typical adequate slope is 6 inches in the first 5 feet with positive drainage being provided from those points to streets, pavement or natural water courses. If necessary to provide positive drainage, the drainage area should be raised above adjacent grades with structural fill.

The foregoing recommendations should only be considered minimum requirements for overall site development. It is recommended that a civil/drainage engineer be consulted for more detailed grading and drainage recommendations.

FOUNDATION REVIEW AND INSPECTION

This report has been prepared to aid in the evaluation of this site and to assist in the design of this project. It is recommended that the geotechnical engineer be provided the opportunity to review the final design drawings and specifications in order to determine whether the recommendations in this report are applicable to the final design. Review of the final design drawings and specifications should be noted in writing by the geotechnical engineer.

In order to permit correlation between the conditions encountered during construction and to confirm recommendations presented herein, it is recommended that the geotechnical engineer be retained to perform continuous observations and testing during the earthwork portion of this project. Observation and testing should be performed during construction to confirm that suitable fill soils are placed upon competent materials and properly compacted and foundation elements penetrate the recommended soils.

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CLOSURE

Our conclusions, recommendations and opinions presented herein are:

1) Based upon our evaluation and interpretation of the findings of the field and laboratory program.

2) Based upon an interpolation of soil conditions between and beyond the explorations.

3) Subject to confirmation of the conditions encountered during construction.

4) Based upon the assumption that sufficient observation will be provided during construction.

5) Prepared in accordance with generally accepted professional geotechnical engineering principles and practice.

This report has been prepared for the sole use of Conley Engineering, LLC specifically to aid in the design of the proposed Lisbon Ave. Box Culvert at Sugar Channel in Rio Rancho, New Mexico, and not for use by any third parties without consent.

We make no other warranty, either expressed or implied. Any person using this report for bidding or construction purposes should perform such independent investigation as they deem necessary to satisfy themselves as to the surface and subsurface conditions to be encountered and the procedures to be used in the performance of work on this project. If conditions encountered during construction appear to be different than indicated by this report, this office should be notified.

All soil samples will be discarded 60 days after the date of this report unless we receive a specific request to retain the samples for a longer period of time.

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BORING LOCATION MAP

Lisbon Ave. Box Culvert
Rio Rancho, New Mexico
Job No. 1-90712

Figure 1

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GEOTECHNICAL ENGINEERING
AND MATERIAL TESTING

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Project: Libon Ave. Box Culvert
Date: 08/14/2019 Project No: 1-90712
Elevation: Type: 5.5" OD HSA

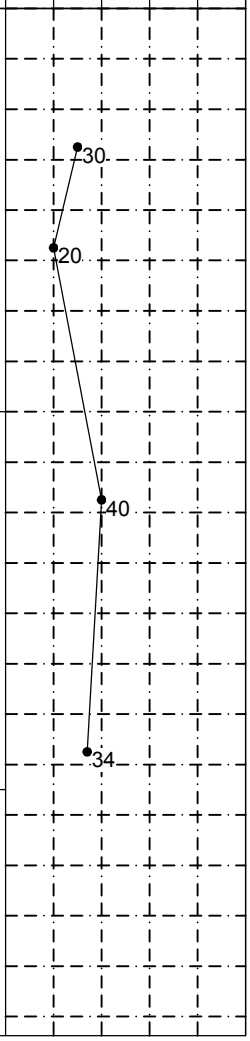
LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 1

During Drilling: none After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
			SS	8-14-16 30	4		SM	SILTY SAND, non-plastic, medium dense, dry, light brown
5			SS	10-9-11 20	3			
10			SS	15-20-20 40	4		SP	POORLY GRADED SAND, non-plastic, dense, dry, light brown
15			SS	12-14-20 34	4			
								Stopped Auger @ 14 feet Stopped Sampler @ 15.5 feet
20								



LOG OF TEST BORING 1-90712 LIBON BOX CULVERT.GPJ GEO TEST.GDT 8/25/19

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
AMSL - Above Mean Sea Level
CS - Continuous Sampler
UD - Undisturbed
ST - Shelby Tube

Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

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Project: Libon Ave. Box Culvert
Date: 08/14/2019 Project No: 1-90712
Elevation: Type: 5.5" OD HSA

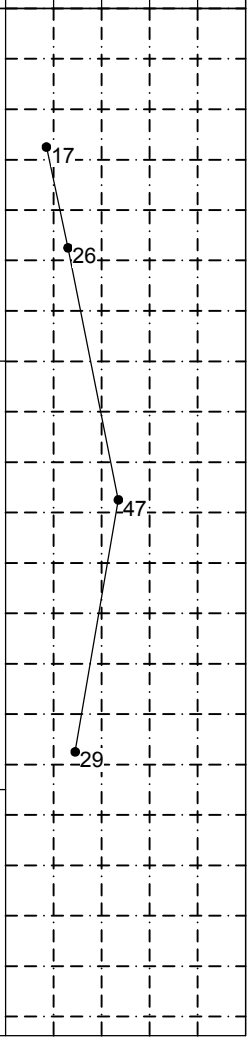
LOG OF TEST BORINGS

GROUNDWATER DEPTH

NO: 2

During Drilling: none After 24 Hours:

DEPTH (Ft)	LOG	SAMPLE INTERVAL	TYPE	N. BLOWS/FT	MOISTURE %	DRY DENSITY (pcf)	USC	DESCRIPTION
			SS	6-8-9 17	3		SP-SM	POORLY GRADED SAND with SILT, non-plastic, medium dense, dry, light brown
5			SS	8-13-13 26	2			
10			SS	15-21-26 47	3		SM	SILTY SAND, non-plastic, dense to medium dense, dry, light brown
15			SS	6-12-17 29	3			Stopped Auger @ 14 feet Stopped Sampler @ 15.5 feet
20								



LOG OF TEST BORING 1-90712 LIBON BOX CULVERT.GPJ GEO TEST.GDT 8/25/19

LEGEND

SS - Split Spoon
AC - Auger Cuttings
UD/SL - Undisturbed Sleeve
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Stratification lines represent approximate boundaries between soil types. Transitions may be gradual. Water level readings have been made at times and under conditions stated. Fluctuations of groundwater may occur due to factors other than those present at the time measurments were made.

SUMMARY OF LABORATORY RESULTS

						SIEVE ANALYSIS PERCENT PASSING											
TEST HOLE	DEPTH (FEET)	UNIFIED CLASS	(%) MOIST	LL	PI	NO 200	NO 100	NO 40	NO 10	NO 4	3/8"	1/2"	3/4"	1"	1 1/2"	2"	4"
1	3.0	SM	3.5	NP	NP	13	39	72	87	92	94	95	97	100			
1	5.0		3.5														
1	10.0		3.6														
1	15.0	SP	3.9	NP	NP	4	18	74	98	99	100						
2	3.0		2.6														
2	5.0	SP-SM	1.6	NP	NP	7	22	53	84	93	98	99	100				
2	10.0	SM	2.7	NP	NP	15	35	73	92	97	99	100					
2	15.0		2.9														

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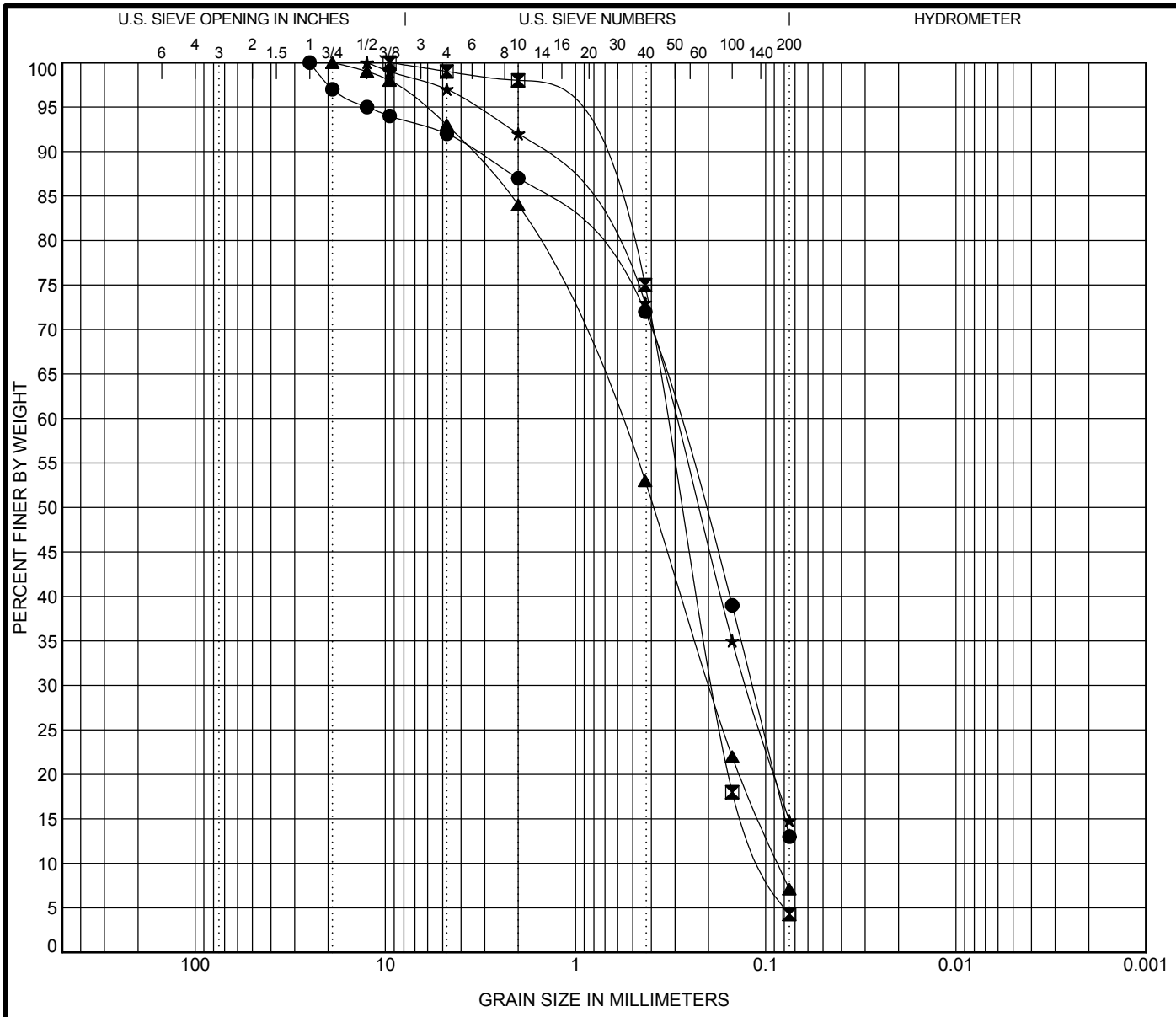
LL = LIQUID LIMIT
PI = PLASTICITY INDEX
NP = NON PLASTIC or NO VALUE

Project: Libon Ave. Box Culvert
Location: Rio Rancho, NM
Number: 1-90712

SUMMARY OF LABORATORY RESULTS 1-90712 LIBON BOX CULVERT.GPJ GEO TEST.GDT 8/25/19



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	1	3.0	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		
⊠	1	15.0	**POORLY GRADED SAND(SP)**	**NP**	**NP**	**NP**	**1.07**	**3.26**
▲	2	5.0	**POORLY GRADED SAND with SILT(SP-SM)**	**NP**	**NP**	**NP**	**0.74**	**7.09**
★	2	10.0	**SILTY SAND(SM)**	**NP**	**NP**	**NP**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	1	3.0	**25**	**0.293**	**0.118**		**8.0**	**79.0**	**13.0**	
⊠	1	15.0	**9.5**	**0.326**	**0.187**	**0.1**	**1.0**	**94.7**	**4.3**	
▲	2	5.0	**19**	**0.608**	**0.197**	**0.086**	**7.0**	**85.9**	**7.1**	
★	2	10.0	**12.5**	**0.3**	**0.126**		**3.0**	**82.2**	**14.8**	

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GRAIN SIZE DISTRIBUTION

Project: Libon Ave. Box Culvert

Location: Rio Rancho, NM

Number: 1-90712

US GRAIN SIZE 1-90712 LIBON BOX CULVERT.GPJ GEO TEST.GDT 8/25/19