LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

PRELIMINARY SOILS INVESTIGATION
BLEDSOE CREEK STORM DRAIN (LINE 'A')
AND SLOPE REPAIR
HIGHLAND, CALIFORNIA

PROJECT NO. 40155BB.13
MARCH 17, 2020

Prepared For:

City of Highland
27215 Base Line
Highland, California 92346

Attention: Mr. Carlos Zamano

LOR GEOTECHNICAL GROUP, INC.
Soil Engineering ▲ Geology ▲ Environmental

March 17, 2020

City of Highland
27215 Base Line
Highland, California 92346

Attention: Mr. Carlos Zamano, P.E.

Subject: Preliminary Soils Investigation, Bledsoe Creek Storm Drain (Line 'A') and Slope Repair, Highland, California.

LOR Geotechnical Group, Inc., is pleased to present this report summarizing our soils investigation for the subject project. This report was based upon a scope of services generally outlined in our Proposal dated January 8, 2020 and other written and verbal communications.

In summary, it is our opinion that the proposed improvements are feasible from a soils perspective, provided the recommendations presented in the attached report are incorporated into design and construction.

It has been our pleasure to assist you on this project. We look forward to being of further assistance to you as construction begins. Should you have any questions regarding this report, please contact us.

LOR Geotechnical Group, Inc.

Table of Contents

INTRODUCTION

During February and March of 2020, a Preliminary Soils Investigation was performed by LOR Geotechnical Group, Inc., for the proposed Bledsoe Creek Storm Drain (Line 'A') and Slope Repair project, located southeast of the intersection of Highland Avenue and Rockspring Lane in the city of Highland, California.

The purpose of this investigation was to provide a technical evaluation of existing site soils as they pertain to the adequacy of the intended use of the site; to provide an opinion on the feasibility of the site improvements from a soils engineering standpoint; and to develop geotechnical design recommendations regarding the proposed improvements.

PROJECT CONSIDERATIONS

The approximate location of the site in relation to the surrounding region is shown on the attached Index Map, Enclosure A-1, within Appendix A.

The existing site conditions, topography and proposed improvements are illustrated on the referenced Storm Drain Improvements Plans, prepared by Aguilar Consulting, Inc. A copy of Sheet 2 of this plan is presented as Plate 1, Enclosure A-2, within Appendix A. Review of this plan indicates that approximately 190 feet of 48-inch diameter reinforced concrete pipe will be placed for this project to improve the local drainage conditions. Approximately 60 feet of existing concrete storm drain pipe will be removed and replaced from the current terminus of the existing storm drain and 130 feet of storm drain will extend further downslope to the south-southeast to the nearby natural drainage, Bledsoe Creek.

Based upon the referenced site plan, the project will require cuts up to 26 feet and maximum fills up to 10 feet over the top of the pipe to create the proposed graded site conditions. Reconfiguration of the local slope area will be required to construct the site as planned and we understand that all proposed cut and fill slopes will be built at inclinations of 2:1 (horizontal to vertical) or flatter. A cross section along the proposed alignment has been prepared and is presented as Enclosure A-3, within Appendix A.

EXISTING SITE CONDITIONS

The subject site consists of a parcel of land located south of Highland Avenue and east of Rockspring Lane. The upper half of the site consists of a gently sloping plane, falling to the south at about a five percent grade. Beyond this plane, the topography falls abruptly into Bledsoe Gulch, a narrow, steep canyon which widens south of the site. To some extent,

Bledsoe Gulch was created through movement along the San Andreas fault which is thought to cross the northern portion of the project site from southeast to northwest. Based upon our field observations, and review of available geotechnical data, it appears that fills on the order of 35 feet or more were placed at various times across the top end of Bledsoe Gulch and this has resulted in the existing sloping topography observed at the site.

This firm conducted soils investigations of the Community Center site prior to site development (LOR, 2002 and 2003). During our investigations, we documented that fills in excess of 30 feet were present onsite. Our client at the time opted to not remove all of the fill materials for economical and practical considerations and, as reported within our referenced compaction report (LOR, 2004), only minimal removals were conducted within areas of deep fill within the parking lot areas. In addition, our records indicate that we did not provide observation and/or compaction testing service during construction of the subject storm drain.

Highland Avenue, a fully improved roadway, bounds the site on the north with residential land further north. Rockspring Lane, also a fully improved roadway, bounds the site on the west with single family homes further southwest. The East Highlands Ranch Community Center is located to the east.

REVIEW OF AERIAL PHOTOGRAPHS

As noted during our review of historic aerial photographs of the site and vicinity, the site area initially was utilized as part of a citrus grove. During the early to late 1900's, the site generally consisted of the northwest corner of a drainage course, Bledsoe Gulch, which had been offset by the San Andreas fault. Within many local areas, hydraulic mining of the hillsides, using water cannons to generate soil materials, was a common practice used by farmers in order to fill in low areas prior to the planting of trees. It is not clearly evident in the early aerial photographs, but it may be the case that the site area was partially included within an area that was filled in order to create the topographic conditions needed to establish the local citrus grove development.

The site area remained relatively unchanged from the late 1930's through the late 1980's. In the mid to late 1980's, grading for development of the East Highlands Ranch started and, during this time, the groves around the site were removed and a dirt road was graded in just west of the site. Soil piles were stockpiled in areas adjacent to this dirt road and some fill soils were placed just to the northeast of the site. Between 1986 and 1991, significant quantities of fill soils were placed in areas including the site and areas to the

west and north. These fills were apparently placed in connection with grading for the adjacent residential housing tract located to the southwest.

In the early 1990's, relatively minor amounts of fill materials appear to have been placed within the site area and mainly to the west and northwest of the site. By 2005, the Community Center, the existing storm drain and the existing storm drain outlet structure had been built.

SUBSURFACE FIELD INVESTIGATION

For this investigation, we conducted subsurface investigation of the existing soils present within and below the area of the proposed and existing storm drain improvements. This work was conducted using hollow-stem auger drilling equipment. The approximate locations of our exploratory borings are presented on the enclosed Plate 1, Enclosure A-2, within Appendix A.

Logs of the subsurface conditions encountered in the exploratory borings were maintained by a geologist from this firm. Due to the presence of subsurface obstructions (large rocks and concrete fragments), the depths of our borings at locations B-1 and B-2 were limited and encountered refusal. Samples of the various soils encountered were obtained from the borings at selected depths and returned to the laboratory in sealed containers for further testing and evaluation. A detailed description of the subsurface field exploration program and the boring logs are presented in Appendix B.

LABORATORY TESTING PROGRAM

Selected soil samples obtained during the field investigation were subjected to laboratory testing to evaluate their physical and engineering properties. Laboratory testing included moisture content, dry density, laboratory compaction, direct shear, and soluble sulfate. A detailed description of the laboratory testing program and the test results are presented in Appendix C.

SUBSURFACE CONDITIONS

As mentioned above, fill materials containing large rocks and pieces of concrete locally hindered our efforts to explore the subsurface conditions at the site. Based upon the results of this investigation and our earlier investigations in areas adjacent to the site, fill materials of varying types and from different times are thought to be present across the area of proposed storm drain improvements and slope repair. The lowermost of these fills is believed to have been derived through hydraulic mining operations and were encountered within our boring B-3, at a depth of approximately 8 feet. The hydraulic fill soils also likely underlie the more recent, boulder and concrete fragment rich, fill soils that we encountered refusal at our boring locations B-1 and B-2, but were able to penetrate. None of the onsite fill materials consist of engineered or compacted fills and are, therefore, considered to be undocumented. Observations made during our drilling operations suggest that oversize (greater than 12-inch diameter) materials are present, particularly within areas near the existing slope, and our laboratory test data shows that the sampled soils were in a loose to medium dense condition. Within one area, at a depth of between approximately 7 and 12 feet below the surface, in boring B-3, the soils had a moderately strong petroleum-type odor. It is not anticipated that the planned excavation will extend to boring B-3. Elsewhere, some of the fill soils had a grayish-color and a fairly strong organic odor but little, if any, visible organic matter.

Natural soils in the form of alluvial deposits were encountered only within our exploratory boring B-3 and at considerable depth. These are present beneath the fill soils in other areas of the site as well. The alluvial soils were generally sandy and medium dense to dense. Groundwater was encountered within our exploratory boring B-3 at a depth of 26 feet below the ground surface.

Cross-section A-A', Enclosure A-3 within Appendix A, depicts our approximation of the subsurface conditions within and along the area of the storm drain. A detailed description of the subsurface conditions as encountered within our exploratory borings is presented on the Boring Logs within Appendix B.

CONCLUSIONS

On the basis of our field investigation and testing program, it is the opinion of LOR Geotechnical Group, Inc., that the proposed improvements are feasible from a soil engineering standpoint, provided the conclusions and recommendations presented in this report are understood and are incorporated within the project throughout design, grading, and construction.

The site is underlain by various units of non-structural fill materials that, based upon our research and site investigation, range from 8 to perhaps 35 or more feet in thickness. The fill soils contain large rocks and pieces of concrete but, at least at the locations explored, do not appear to contain a large amount of deleterious man-made debris. However, soils with a petroleum type odor were noted to be present at depths of between approximately 7 and 12 feet within our boring B-3. Excavation for the proposed storm drain line will not extend to the area of our exploratory boring B-3, but if soils with a petroleum-type odor are encountered elsewhere, environmental evaluation may be warranted.

Although the precise location is unknown, the San Andreas fault has been mapped as traversing the northern portion of the project site. Whether it crosses the existing or proposed storm drain alignment, the pipe is subject to rupture (off-setting and displacement) if and when the San Andreas fault in this area should rupture. No provisions for protection against fault rupture hazard and/or strong seismic shaking are presented or provided herein.

RECOMMENDATIONS

General Site Grading

It is imperative that no clearing and/or grading operations be performed without the presence of a qualified geotechnical engineer and engineering geologist. An on-site, pre-job meeting with the owner, the contractor, geotechnical engineer and engineering geologist should occur prior to all grading related operations. Grading of the subject site should be performed in accordance with the following recommendations as well as applicable portions of the current edition of the Uniform Building Code, and/or applicable local ordinances.

Initial Site Preparation

In order to produce areas exposing competent soils upon which the new sections of storm drain and/or engineered fills would ideally be constructed upon, complete removal of all non-engineered fill materials below and adjacent to the improvements would be required. Considering the existing site conditions, the types of improvements proposed, and information provided by you, we understand that complete removal of the undocumented fill soils may not currently be considered a viable solution from an economical or practical perspective. For these reasons, we have prepared the following recommendations which have provisions for less than complete removal of the underlying, undocumented fill soils. Please bear in mind, however, that our position remains that, within structural areas, all

undocumented fill soils should be removed and replaced with engineered fill materials whenever and wherever feasible.

Following excavation of the proposed storm drain area to a depth of approximately two feet below the proposed flow line elevation, the exposed soils should be evaluated from the geotechnical perspective. The exposed conditions could warrant additional removals. For this reason, we recommend that we be present during this stage of excavation work to evaluate the exposed conditions as based upon observations and/or the results of compaction testing. We will review the conditions with your representative prior to the advancement of additional grading and/or construction. Should the conditions at this elevation be found to be acceptable for supporting the proposed fill and/or improvements, processing of the exposed materials to a depth of 12 inches and compaction of the processed soils to a minimum of 90% relative compaction should take place prior to the placement of suitable engineered fill soils to the proposed bottom of pipe elevation.

If, on the other hand, the soils exposed at a depth of two feet below the proposed flow line elevation are deemed to be unsuitable for supporting fill and/or structural improvements, additional removal operations should take place until soil materials that are suitable as agreed upon and as decided by the City of Highland's representative. At that point, processing and compacting of the bottom soils should proceed as outlined above.

Removals should extend outward from the structural areas at a minimum of a 1:1 projection.

Engineered Compacted Fill

The on-site soils should provide adequate quality fill material, provided they are free from oversized materials, organic matter, and other deleterious materials. Unless approved by the geotechnical engineer, rock or similar irreducible material with a maximum dimension greater than 6-inches should not be buried or placed in fills.

Import fill should be inorganic, non-expansive granular soils free from rocks or lumps greater than 6-inches in maximum dimension. Import fill should be approved by the geotechnical engineer prior to their use.

Fill should be spread in loose lifts no more than 8-inches thick, each lift brought to near optimum moisture content, and then compacted to a relative compaction of at least 90 percent in accordance with ASTM D 1557.

Short Term Excavations

Following the California Occupational and Safety Health Act (CAL-OSHA) requirements, excavations 5-feet deep and greater should be sloped or shored. All excavations and shoring should conform to CAL-OSHA requirements.

Short term excavation 5-feet deep and greater shall conform to Title 8 of the California Code of Regulations. Based on our exploratory borings, it appears that type C soils are the predominant type of soil on the project and all short term excavation should be based on this type of soil. Deviation from the standard short term slopes are permitted using option 4, Design by a Registered Professional Engineer (Section 1541.1). Temporary excavations shall not exceed a 1:1, horizontal to vertical, slope.

Slope Construction

Preliminary data indicates that fill and cut slopes should be constructed no steeper than two horizontal to one vertical. Fill slopes should be overfilled during construction and then cut back to expose fully compacted soil. A suitable alternative would be to compact the slopes during construction, then roll the final slopes to provide dense, erosion-resistant surfaces.

Fill slopes should be properly keyed and benched into competent native materials. The key, constructed into competent materials (where practical) and across the toe of the slope, should be a minimum of 12 to 15 feet wide, a minimum of 2 feet deep into competent materials, and sloped back at 2 percent. Benches should be constructed at approximately 2 to 4 feet vertical intervals. Typical keying and benching operations are presented on Enclosure D-1, within Appendix D. Since the majority of the project areas are anticipated to be underlain by deep loose fills and native soils, complete removals of these materials to expose competent older alluvium are not considered to be practical. Therefore, some subsidence and sloughing should be expected to occur in these areas.

Cut slopes are anticipated to expose undocumented fill soils and possibly some alluvial soils locally. Although these are anticipated to be grossly and surficially stable at inclinations of 2:1 or flatter, geotechnical evaluation of the cut slopes should be conducted during grading of these slopes in order to assess their stability and to provide additional recommendations, as warranted. As discussed further in the following section, maintaining proper drainage along the top of cut and fill slope areas to prevent over-the-slope drainage is crucial to providing slope erosion protection.

Slope Protection

Since the native materials are susceptible to erosion by running water, measures should be provided to prevent surface water from flowing over slope faces. Slopes at the project should be planted with a deep rooted ground cover as soon as possible after completion. The use of succulent ground covers, such as iceplant or sedum, is not recommended. If watering is necessary to sustain plant growth on slopes, then the watering operation should be monitored to assure proper operation of the irrigation system and to prevent over watering.

Settlement

Total settlement of the storm drain pipe cannot be estimated due to the unknown conditions of the underlying fill soils. It is anticipated that much of the settlement has already occurred, however, any future settlement is unpredictable.

Slabs-On-Grade / Rip-Rap Area

To provide adequate support, concrete slabs-on-grade should bear on a minimum of 12 inches of compacted soil. The final pad surfaces should be rolled to provide smooth, dense surfaces upon which to place the concrete.

Slabs to receive moisture sensitive coverings should be provided with a moisture vapor barrier. This barrier may consist of an impermeable membrane. Two inches of sand over the membrane will reduce punctures and aid in obtaining a satisfactory concrete cure. The sand should be moistened just prior to placing of concrete.

The slabs should be protected from rapid and excessive moisture loss which could result in slab curling. Careful attention should be given to slab curing procedures, as the site area is subject to large temperature extremes, humidity, and strong winds.

Wall Pressures

For design of retaining walls unrestrained against movement at the top, we recommend an equivalent fluid density of 47 pounds per cubic foot (pcf) be used. This assumes level backfill consisting of compacted, non-expansive, soils placed against the structures and with the backcut slope extending upward from the base of the stem at 35 degrees from the vertical or flatter.

To avoid over stressing or excessive tilting during placement of backfill behind walls, heavy compaction equipment should not be allowed within the zone delineated by a 45 degree line extending from the base of the wall to the fill surface. The backfill directly behind the walls should be compacted using light equipment such as hand operated vibrating plates and rollers. No material larger than three inches in diameter should be placed in direct contact with the wall.

Wall pressures should be verified prior to construction, when the actual backfill materials and conditions have been determined. Recommended pressures are applicable only to level, properly drained backfill with no additional surcharge loadings. If inclined backfills are proposed, this firm should be contacted to develop appropriate active earth pressure parameters

Sulfate Protection

The results of the sulfate tests conducted on selected sub-grade soils expected to be encountered at foundation levels are presented in Appendix C.

Based on the test results the sulfate exposures of on site soils is considered negligible by the CBC. Therefore, no specific recommendations are given for concrete elements to be in contact with on site soils.

Construction Monitoring

Post investigative services are an important and necessary continuation of this investigation. Project plans and specifications should be reviewed prior to construction to confirm that the intent of the recommendations presented herein have been incorporated into the design. Additional expansion testing and testing for on-site pavement design should be performed after the site is rough graded.

During construction, sufficient and timely geotechnical observation and testing should be provided to correlate the findings of this investigation with the actual subsurface conditions exposed during construction. Items requiring attendance or observation and testing include, but are not necessarily limited to, the following:

- Site pre-grade meeting;
- Site preparations and clearing;

- Site removals and over-excavations, including approval of the fill areas and bottoms of excavation prior to filling.

- Preparation of site for engineered fill, including scarifying and compacting prior to fill placement.

- Full-time observation and testing during placement of engineered compacted fill and backfill, including approval of fill materials and the performance of sufficient density tests to evaluate the degree of compaction being achieved.

LIMITATIONS

This report contains geotechnical conclusions and recommendations developed solely for use by the City of Highland and their design consultants, for the purposes described earlier. It may not contain sufficient information for other uses or the purposes of other parties. The contents should not be extrapolated to other areas or used for other facilities without consulting LOR Geotechnical Group, Inc.

The recommendations are based on interpretations of the subsurface conditions concluded from information gained from subsurface explorations, and a surficial site reconnaissance. The interpretations may differ from actual subsurface conditions, which can vary horizontally and vertically across the site. Due to possible subsurface variations, all aspects of field construction addressed in this report should be observed and tested by the project geotechnical consultant.

If parties other than LOR Geotechnical Group, Inc., provide construction monitoring services, they must be notified that they will be required to assume responsibility for the geotechnical phase of the project being completed by concurring with the recommendations provided in this report or by providing alternative recommendations.

The report was prepared using generally accepted geotechnical engineering practices under the direction of a state licensed geotechnical engineer. No warranty, expressed or implied, is made as to conclusions and professional advice included in this report. Any persons using this report for bidding or construction purposes should perform such independent investigations as deemed 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.

TIME LIMITATIONS

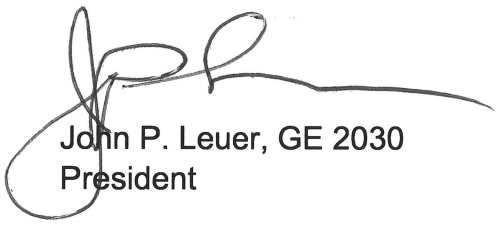
The findings of this report are valid as of this date. Changes in the condition of a property can, however, occur with the passage of time, whether they be due to natural processes or the work of man on this or adjacent properties. In addition, changes in the Standards-of-Practice and/or Governmental Codes may occur. Due to such changes, the findings of this report may be invalidated wholly or in part by changes beyond our control. Therefore, this report should not be relied upon after a significant amount of time without a review by LOR Geotechnical Group, Inc., verifying the suitability of the conclusions and recommendations.

CLOSURE

It has been a pleasure to assist you with this project. We look forward to being of further assistance to you as construction begins. Should conditions be encountered during construction that appear to be different than indicated by this report, please contact this office immediately in order that we might evaluate their effect.

Should you have any questions regarding this report, please contact us.

Respectfully submitted,
LOR Geotechnical Group, Inc.



John P. Leuer, GE 2030
President

RMM:JPL:ss

Distribution: Addressee (2) and via email: czamano@cityofhighland.org

REFERENCES

Aguilar Consulting, Inc., 2020, Bledsoe Creek, Storm Drain (Line 'A') and Slope Repair Plan, 95% Plan Submittal.

LOR Geotechnical Group, Inc., 2002, Preliminary Soils Investigation, Proposed Community Center, Planning Area 24, East Highlands Ranch, Highland, California, Project No. 40155.114, dated December 19, 2002.

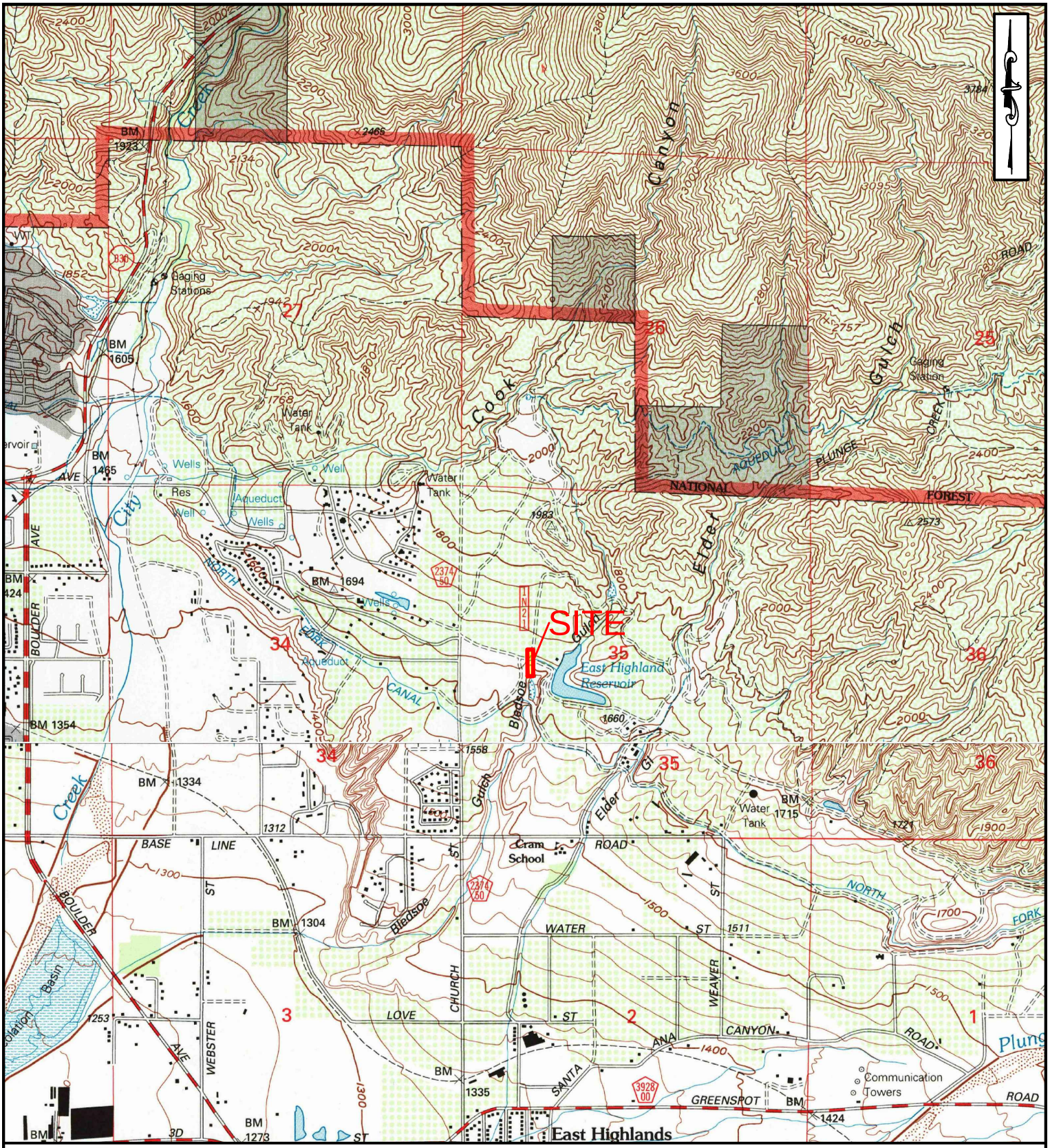
LOR Geotechnical Group, Inc., 2003, Supplemental Subsurface Soils Investigation, Proposed Community Center, Planning Area 24, East Highlands Ranch, Highland, California, Project No. 40155A.114, dated April 7, 2003.

LOR Geotechnical Group, Inc., 2004, Compaction Report, Site Improvements, Community Center, Planning Area 24, East Highlands Ranch, Highland, California, Project No. 40155G.86, dated December 27, 2004.

LOR Geotechnical Group, Inc., 2013, Geotechnical Evaluation of Damaged Storm Drain System, Western Side of East Highlands Ranch Community Center, Highland, California, Project No. 40155BB.1, dated April 15, 2013.

APPENDIX A

Index Map, Cross Section and Boring Location Map, and Cross Section A-A'



INDEX MAP

PROJECT: BLEDSOE CREEK STORM DRAIN (LINE 'A') AND SLOPE REPAIR, HIGHLAND, CALIFORNIA	**PROJECT NO:** 40155BB.13
CLIENT: CITY OF HIGHLAND	**ENCLOSURE:** A-1
LOR Geotechnical Group, Inc.	**DATE:** MARCH 2020
	SCALE: 1" = 2,000'

CROSS SECTION AND BORING LOCATION MAP

PROJECT NO:	40155BB.13
ENCLOSURE:	A-2
DATE:	MARCH 2020
SCALE:	1" ≈ 25'

CITY OF HIGHLAND

BLEDSOE CREEK STORM DRAIN (LINE 'A') AND SLOPE REPAIR, HIGHLAND, CALIFORNIA

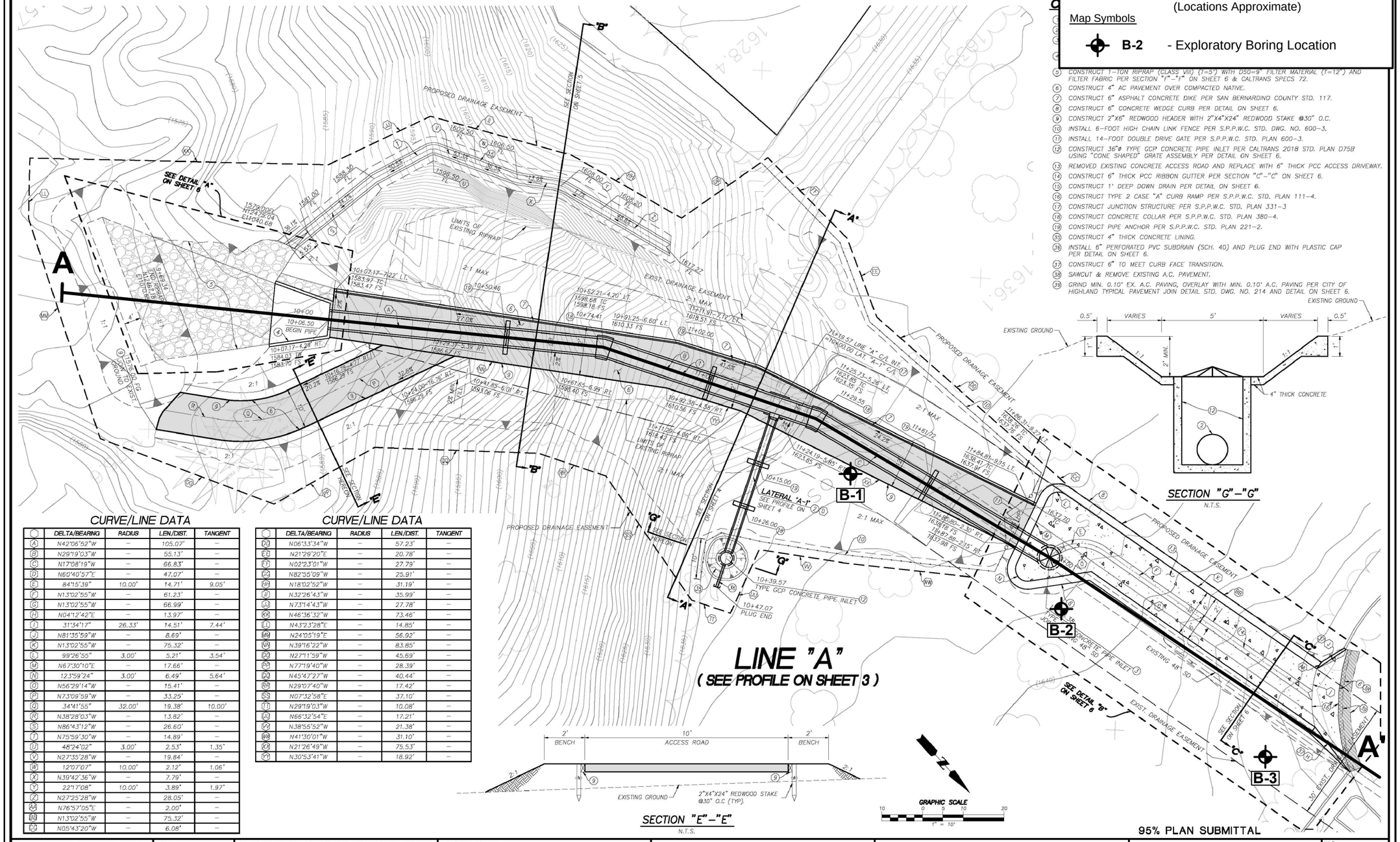
Legend

(Locations Approximate)

Map Symbols

B-2 - Exploratory Boring Location

9. CONSTRUCT 1-TON RIPRAP (CLASS VIII) (T=5') WITH D50=9" FILTER MATERIAL (T=12") AND FILTER FABRIC PER SECTION "F"-"F" ON SHEET 6 & CALTRANS SPECS 72.
6. CONSTRUCT 4" AC PAVEMENT OVER COMPACTED NATIVE.
7. CONSTRUCT 6" ASPHALT CONCRETE DIKE PER SAN BERNARDINO COUNTY STD. 117.
8. CONSTRUCT 6" CONCRETE WEDGE CURB PER DETAIL ON SHEET 6.
9. CONSTRUCT 2"X6" REDWOOD HEADER WITH 2"X4"X24" REDWOOD STAKE @30" O.C.
10. INSTALL 6-FOOT HIGH CHAIN LINK FENCE PER S.P.P.W.C. STD. DWG. NO. 600-3.
11. INSTALL 14-FOOT DOUBLE DRIVE GATE PER S.P.P.W.C. STD. PLAN 600-3.
12. CONSTRUCT 36"ø TYPE GCP CONCRETE PIPE INLET PER CALTRANS 2018 STD. PLAN D75B USING "CONE SHAPED" GRATE ASSEMBLY PER DETAIL ON SHEET 6.
13. REMOVED EXISTING CONCRETE ACCESS ROAD AND REPLACE WITH 6" THICK PCC ACCESS DRIVEWAY.
14. CONSTRUCT 6" THICK PCC RIBBON GUTTER PER SECTION "C"-"C" ON SHEET 6.
15. CONSTRUCT 1' DEEP DOWN DRAIN PER DETAIL ON SHEET 6.
16. CONSTRUCT TYPE 2 CASE "A" CURB RAMP PER S.P.P.W.C. STD. PLAN 111-4.
17. CONSTRUCT JUNCTION STRUCTURE PER S.P.P.W.C. STD. PLAN 331-3
18. CONSTRUCT CONCRETE COLLAR PER S.P.P.W.C. STD. PLAN 380-4.
19. CONSTRUCT PIPE ANCHOR PER S.P.P.W.C. STD. PLAN 221-2.
35. CONSTRUCT 4" THICK CONCRETE LINING.
36. INSTALL 6" PERFORATED PVC SUBDRAIN (SCH. 40) AND PLUG END WITH PLASTIC CAP PER DETAIL ON SHEET 6.
37. CONSTRUCT 6" TO MEET CURB FACE TRANSITION.
38. SAWCUT & REMOVE EXISTING A.C. PAVEMENT.
39. GRIND MIN. 0.10' EX. A.C. PAVING, OVERLAY WITH MIN. 0.10' A.C. PAVING PER CITY OF HIGHLAND TYPICAL PAVEMENT JOIN DETAIL STD. DWG. NO. 214 AND DETAIL ON SHEET 6.



CURVE/LINE DATA

	DELTA/BEARING	RADIUS	LEN/DIST.	TANGENT
A	N42°06'52"W	–	105.07'	–
B	N29°19'03"W	–	55.13'	–
C	N17°08'19"W	–	66.83'	–
D	N60°40'57"E	–	47.07'	–
E	84°15'39"	10.00'	14.71'	9.05'
F	N13°02'55"W	–	61.23'	–
G	N13°02'55"W	–	66.99'	–
H	N04°12'42"E	–	13.97'	–
I	31°34'17"	26.33'	14.51'	7.44'
J	N81°35'59"W	–	8.69'	–
K	N13°02'55"W	–	75.32'	–
L	99°26'55"	3.00'	5.21'	3.54'
M	N67°30'10"E	–	17.66'	–
N	123°59'24"	3.00'	6.49'	5.64'
O	N56°29'14"W	–	15.41'	–
P	N73°09'59"W	–	33.25'	–
Q	34°41'55"	32.00'	19.38'	10.00'
R	N38°28'03"W	–	13.82'	–
S	N86°43'12"W	–	26.60'	–
T	N75°59'30"W	–	14.89'	–
U	48°24'02"	3.00'	2.53'	1.35'
V	N27°35'28"W	–	19.84'	–
W	12°07'07"	10.00'	2.12'	1.06'
X	N39°42'36"W	–	7.79'	–
Y	22°17'08"	10.00'	3.89'	1.97'
Z	N27°25'28"W	–	28.05'	–
AA	N76°57'05"E	–	2.00'	–
BB	N13°02'55"W	–	75.32'	–
CC	N05°43'20"W	–	6.08'	–

CURVE/LINE DATA

	DELTA/BEARING	RADIUS	LEN/DIST.	TANGENT
DD	N06°33'34"W	–	57.23'	–
EE	N21°29'20"E	–	20.78'	–
FF	N02°23'01"W	–	27.79'	–
GG	N82°55'09"W	–	25.91'	–
HH	N18°02'52"W	–	31.19'	–
JJ	N32°26'43"W	–	35.99'	–
JJ	N73°14'43"W	–	27.78'	–
KK	N46°36'32"W	–	73.46'	–
LL	N43°23'28"E	–	14.85'	–
MM	N24°05'19"E	–	56.92'	–
NN	N39°16'22"W	–	83.85'	–
OO	N27°11'59"W	–	45.69'	–
PP	N77°19'40"W	–	28.39'	–
QQ	N45°47'27"W	–	40.44'	–
RR	N29°07'40"W	–	17.42'	–
SS	N07°32'58"E	–	37.10'	–
TT	N29°19'03"W	–	10.08'	–
UU	N66°32'54"E	–	17.21'	–
VV	N38°55'52"W	–	21.38'	–
WW	N41°30'01"W	–	31.10'	–
XX	N21°26'49"W	–	75.53'	–
YY	N30°53'41"W	–	18.92'	–

LINE "A"

(SEE PROFILE ON SHEET 3)

SECTION "E"-"E"
N.T.S.

GRAPHIC SCALE
10 0 5 10 20
1" = 10'

SECTION "G"-"G"
N.T.S.

95% PLAN SUBMITTAL

Underground Service Alert of Southern California
Call: TOLL FREE 8-1-1
TWO WORKING DAYS BEFORE YOU DIG

SEAL:
REGISTERED PROFESSIONAL ENGINEER — CESAR V. AGUILAR — No. 41579 — EXP. 03/31/20 — CIVIL — STATE OF CALIFORNIA

PLAN PREPARED UNDER THE SUPERVISION OF:
ACI — AGUILAR CONSULTING INC.
2155 CHICAGO AVENUE, SUITE 304
RIVERSIDE, CA 92507
PH. (951) 300-1431 FAX (951) 300-1435

BENCH MARK:
CITY OF HIGHLAND BM NO. 00558
MONUMENT: 1-1/2" BRASS CAP IN SOUTH END OF CONCRETE CATCH BASIN, 78' NORTH OF CENTERLINE OF GREENSPOT ROAD AND 32.5' EAST OF CENTERLINE OF CHURCH STREET.
ELEVATION = 1327.363 DATUM: NAVD29

REVISIONS

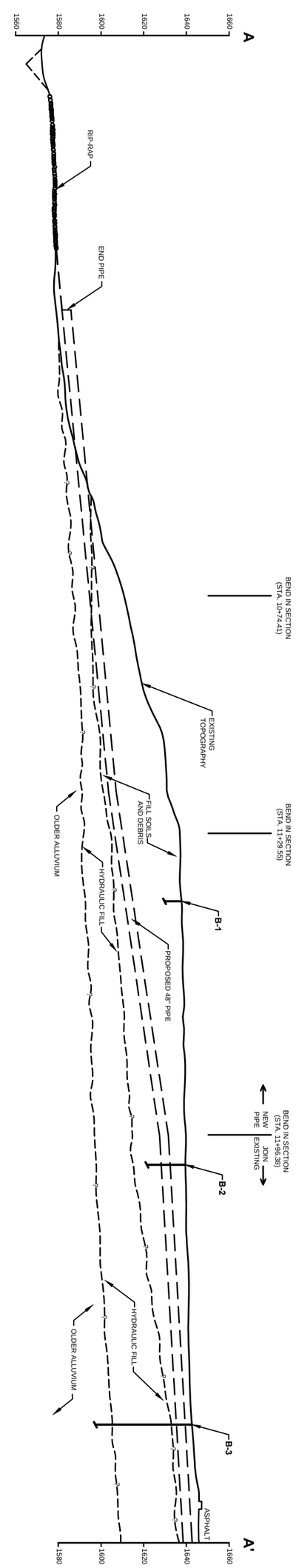
CITY OF HIGHLAND
DRAWN: RVB DESIGNED: LVB CHECKED: CVA
RECOMMENDED BY: CARLOS ZAMANO DATE RCE ____ EXP. __/__/__
APPROVED BY: ERNEST WONG, CITY ENGINEER DATE RCE 37413, EXP. 6/30/20

STORM DRAIN IMPROVEMENT PLANS
BLEDSOE CREEK STORM DRAIN (LINE 'A') AND SLOPE REPAIR PLAN

W.O.
SCALE:
FILE NO.
SHEET 2 OF 8

PROJECT:
CLIENT:

LOR Geotechnical Group, Inc.



CROSS SECTION A-A'

PROJECT:	BLEDSOE CREEK STORM DRAIN (LINE 'A') AND SLOPE REPAIR, HIGHLAND, CALIFORNIA	**PROJECT NO:**	40155BB.13
CLIENT:	CITY OF HIGHLAND	**ENCLOSURE:**	A-3
LOR Geotechnical Group, Inc.		**DATE:**	MARCH 2020
		SCALE:	1" ≈ 50'

APPENDIX B

Field Investigation and Boring Logs

APPENDIX B
FIELD INVESTIGATION

Subsurface Exploration

The site was investigated on February 28, 2020 and consisted of advancing three exploratory borings to depths between 7 feet and 45.5 feet below the existing ground surface. The approximate locations of the borings are shown on the enclosed Plate, Enclosure A-2, within Appendix A.

The drilling exploration was conducted with a Mobile B-61drill rig equipped with 8 inch diameter hollow stem auger. The soils were continuously logged by an engineering geologist from this firm who inspected the site, maintained detailed logs of the borings, obtained undisturbed, as well as disturbed, soil samples for evaluation and testing, and classified the soils by visual examination in accordance with the Unified Soil Classification System.

Relatively undisturbed samples of the subsoils were obtained at selected intervals in the borings by driving a steel split-barrel sampler using a 140 pound automatic trip hammer dropping 3 inches. The maximum depth between the samples obtained was five feet. The soil samples were retained in brass sample rings of 2.41 inches in diameter and 1.00 inch in height, and placed in sealed plastic containers. Disturbed soil samples were obtained at selected levels within the borings and placed in sealed containers for transport to the laboratory.

All samples obtained were taken to our laboratory for storage and testing. Detailed logs of the borings are presented on the enclosed Boring Logs, Enclosures B-1 through B-3. A Boring Log Legend and Soil Classification Chart are presented on Enclosures B-I and B-ii, respectively.

CONSISTENCY OF SOIL

SANDS

SPT BLOWS	CONSISTENCY
0-4	Very Loose
4-10	Loose
10-30	Medium Dense
30-50	Dense
Over 50	Very Dense

COHESIVE SOILS

SPT BLOWS	CONSISTENCY
0-2	Very Soft
2-4	Soft
4-8	Medium
8-15	Stiff
15-30	Very Stiff
30-60	Hard
Over 60	Very Hard

SAMPLE KEY

Symbol	Description
	INDICATES CALIFORNIA SPLIT SPOON SOIL SAMPLE INDICATES BULK SAMPLE INDICATES SAND CONE OR NUCLEAR DENSITY TEST INDICATES STANDARD PENETRATION TEST (SPT) SOIL SAMPLE

TYPES OF LABORATORY TESTS

1	Atterberg Limits
2	Consolidation
3	Direct Shear (undisturbed or remolded)
4	Expansion Index
5	Hydrometer
6	Organic Content
7	Proctor (4", 6", or Cal216)
8	R-value
9	Sand Equivalent
10	Sieve Analysis
11	Soluble Sulfate Content
12	Swell
13	Wash 200 Sieve

BORING LOG LEGEND

PROJECT: BLEDSOE CREEK STORM DRAIN LINE (LINE 'A') AND SLOPE REPAIR	**PROJECT NO.:** 40155BB.13
CLIENT: CITY OF HIGHLAND	**ENCLOSURE:** B-i
LOR Geotechnical Group, Inc.	**DATE:** MARCH 2020

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

PARTICLE SIZE LIMITS

BOULDERS	COBBLES	GRAVEL		SAND			SILT OR CLAY
		COARSE	FINE	COARSE	MEDIUM	FINE	

12" 3" 3/4" No. 4 No. 10 No. 40 200

(U.S. STANDARD SIEVE SIZE)

SOIL CLASSIFICATION CHART

PROJECT: BLEDSOE CREEK STORM DRAIN LINE (LINE 'A') AND SLOPE REPAIR	**PROJECT NO.:** 40155BB.13
CLIENT: CITY OF HIGHLAND	**ENCLOSURE:** B-ii
LOR Geotechnical Group, Inc.	**DATE:** MARCH 2020

LOG OF BORING B-1

DEPTH IN FEET	TEST DATA: SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
0								SM	@ 0 feet, FILL:SILTY SAND, approximately 5% cobbles, 15% gravel, 10% coarse grained sand, 20% medium grained sand, 30% fine grained sand, 20% silty fines, brown, damp, loose to medium dense.
									Abundant rocks from 2-4'
	6		8.4		101.1				
5									END BORING @ 7'
									Fill to 7+'
									No groundwater
									No bedrock
									1st attempt: refusal on rocks @ 7'
									2nd attempt: refusal on mostly concrete and rocks @ 6'
									3rd attempt: refusal on concrete and rocks @ 5.5'
10									

PROJECT:	**Storm Drain Modifications**	PROJECT NUMBER:	**40155BB.13**
CLIENT:	**City of Highland**	ELEVATION:	
LOR GEOTECHNICAL GROUP INC.		DATE DRILLED:	**February 28, 2020**
		EQUIPMENT:	**Mobile B-61**
		HOLE DIA.: **8"**	ENCLOSURE: **B-1**

LOG OF BORING B-2

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	27	3, 7, 11	9.9		124.6			SM	@ 0 feet, SILTY SAND with GRAVEL, approximately 5% cobbles, 15% gravel, 20% coarse grained sand, 30% medium grained sand, 15% fine grained sand, 15% silty fines, brown, moist, loose. Local rocks/concrete from 2-4'
5	41		10.7		118.0				@ 6 feet, becomes dark grayish-brown in color, moderately to strong organic odor @ 7 feet, trace of plastic, rocks and concrete scattered below 7'
10	46 for 5"								@ 10 feet, no recovery (broken concrete)
15	35		2.3		115.6				@ 15 feet, sample likely disturbed (broken rock fragments)
20									END BORING @ 18' due to refusal on rocks 18+' Fill No groundwater No bedrock 1st attempt: refusal of concrete and rocks @ 4' 2nd attempt: refusal of concrete and rocks @ 13' 3rd attempt: refusal of concrete and rocks @ 18'
25									

PROJECT:	**Storm Drain Modifications**	PROJECT NUMBER:	**40155BB.13**
CLIENT:	**City of Highland**	ELEVATION:	
LOR GEOTECHNICAL GROUP INC.		DATE DRILLED:	**February 28, 2020**
		EQUIPMENT:	**Mobile B-61**
		HOLE DIA.: **8"**	ENCLOSURE: **B-2**

LOG OF BORING B-3

DEPTH IN FEET	SPT BLOW COUNTS	LABORATORY TESTS	MOISTURE CONTENT (%)		DRY DENSITY (PCF)	SAMPLE TYPE	LITHOLOGY	U.S.C.S.	DESCRIPTION
	TEST DATA								
0	37		7.8		128.1			SM	@ 0 feet, FILL: SILTY SAND, approximately 10 % gravel, 15% coarse grained sand, 30% medium grained sand, 25% fine grained sand, 20% silty fines, brown, moist, loose to medium dense.
5	24		12.2		111.2				@ 3 feet, sample is of clean, medium dense to dense silty sand.
	25		7.9		122.9				Below 5.5± feet, becomes grayish-brown in color, mild organic odor.
10	13		7.1		112.4				@ 7 feet, sample has moderate petroleum odor (more like paint thinner or kerosene).
		3, 7, 11							@ 10 feet, same but milder odor, (uniform fine content grained SM below 8±' is hydraulic fill (?)), brown, moist.
15	16		9.9		114.6				@ 15 feet, very faint odor (if any), uniform soil conditions.
20	16		14.1		117.7				@ 20 feet, increase in moisture content, trace of clay.
25	25		30.6		92.5	▽			@ 25 feet, sample is wet and includes clay (at bottom).
30	29		18.4		106.8				@ 30 feet, sample disturbed (heaved up, wet soil).
35	30		28.9		99.3				@ 35 feet, thin silt layer in sampler tip, wet.
40	90		16.1		112.2				@ 40 feet, ALLUVIUM: dense silty sand.
45	54 for 6"		13.8		116.9				@ 45 feet, tip of sample is mostly medium to coarse grained sand with silt and a trace of gravel (does not appear to be with bedrock).
50									END BORING @ 45.5' due to practical refusal

8±' Fill
Groundwater @ 26±'
No bedrock

PROJECT:	Storm Drain Modifications	PROJECT NUMBER:	40155BB.13
CLIENT:	City of Highland	ELEVATION:	
LOR GEOTECHNICAL GROUP INC.		DATE DRILLED:	February 28, 2020
		EQUIPMENT:	Mobile B-61
		HOLE DIA.: 8"	ENCLOSURE: B-3

APPENDIX C

Laboratory Testing and Results

APPENDIX C
LABORATORY TESTING

General

Selected soil samples obtained from the borings were tested in our laboratory to evaluate the physical properties of the soils affecting preliminary foundation design, grading criteria, and construction procedures. The laboratory testing program performed in conjunction with our investigation included moisture content, dry density, laboratory compaction, direct shear, and soluble sulfate tests. Descriptions of the laboratory tests are presented in the following paragraphs.

Moisture-Density Tests

The moisture content and dry density information provides an indirect measure of soil consistency for each stratum, and can also provide a correlation between soils on this site. The dry unit weight and field moisture content were determined for selected soil samples, and the results are shown on the boring and trench logs, Enclosures B-1 through B-3, for convenient correlation with the soil profile.

Direct Shear Tests

Shear tests are performed with a direct shear machine at a constant rate-of-strain (usually 0.05 inches/minute). The machine is designed to test a sample partially extruded from a sample ring in single shear. Samples are tested at varying normal loads in order to evaluate the shear strength parameters, angle of internal friction and cohesion. Samples are tested in a remolded condition (90% relative compaction per ASTM 1557) and soaked, according to conditions expected in the field.

The results of the shear tests are presented in the following table.

DIRECT SHEAR TESTS				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Angle of Internal Friction (degrees)**	**Apparent Cohesion (psf)**
B-2	2-5	(SM) Silty Sand	34	200
B-3	14-17	(SM) Silty Sand	28	500

Laboratory Compaction

Selected soil samples were tested in the laboratory to determine compaction characteristics using the ASTM D 1557-91 compaction test method. The results are presented in the following table:

LABORATORY COMPACTION				
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Maximum Dry Density (pcf)**	**Optimum Moisture Content (percent)**
B-2	2-5	(SM) Silty Sand	133.0	7.5
B-3	14-17	(SM) Silty Sand	132.0	8.5

Soluble Sulfate Content Tests

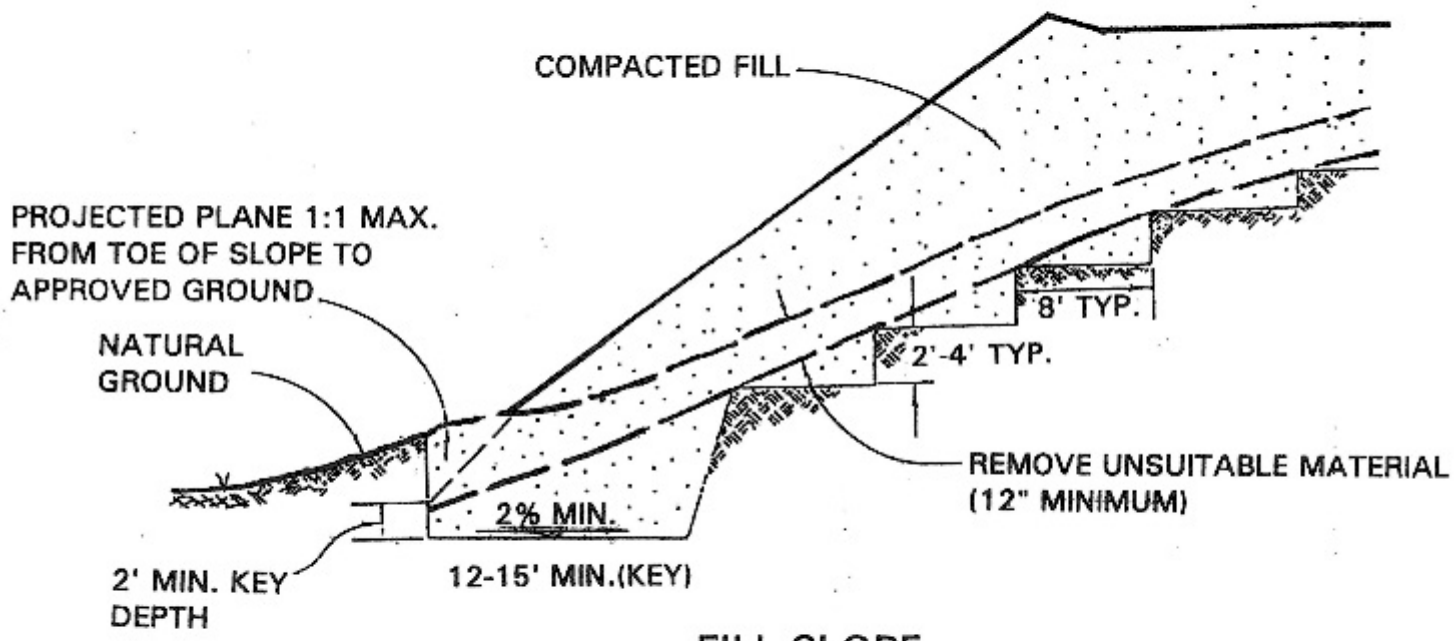
The soluble sulfate content of selected subgrade soils were evaluated. The concentration of soluble sulfates in the soils was determined by measuring the optical density of a barium sulfate precipitate. The precipitate results from a reaction of barium chloride with water extractions from the soil samples. The measured optical density is correlated with readings on precipitates of known sulfate concentrations. The test results are presented on the following table:

SOLUBLE SULFATE CONTENT TESTS			
Boring Number	**Sample Depth (feet)**	**Soil Description (U.S.C.S.)**	**Sulfate Content (percent by weight)**
B-2	2-5	(SM) Silty Sand	< 0.005
B-3	14-17	(SM) Silty Sand	< 0.005

APPENDIX D

Geotechnical Sketch

TYPICAL KEYING AND BENCHING DETAIL



FILL SLOPE

NOTES: 1) DIMENSIONS SHOWN SUBJECT TO FIELD CHANGE BASED ON ENGINEER'S JUDGEMENT

2) BENCHING REQUIRED WHEN FILLING OVER NATURAL GROUND STEEPER THAN 5H:1V

GEOTECHNICAL SKETCH

PROJECT:	BLEDSOE CREEK STORM DRAIN (LINE 'A') AND SLOPE REPAIR	**PROJECT NO.:**	40155BB.13
CLIENT:	CITY OF HIGHLAND	**ENCLOSURE:**	D-1
LOR Geotechnical Group, Inc.		**DATE:**	MARCH 2020
		SCALE:	AS SHOWN